IS1 Operational Safety (NCI 1)

Purpose

This document provides for the responsibilities of NZFS personnel regarding the safety and health of themselves, their colleagues, and other people at incidents.

Contents

Requirements for Operational Safety

Executive officers' responsibilities

The Fire Region Manager will ensure that:

- personnel are trained in and apply the principles of the Safe Person Concept
- the national/regional accident reporting system is in place and is used for reporting accidents/near misses as required by the Health and Safety (H&S) policy
- the following are in place and used:
  - regional decontamination procedure
  - Significant Hazard Exposure Protocol (SHEP)
  - reporting process
- accident investigations are conducted in accordance with the H&S policy
- all districts have a Local Procedure in accordance with this instruction

The Fire Region Manager and Chief Fire Officer are responsible to ensure that, where relevant, safety considerations form part of the content of local operational procedures

The Chief Fire Officer is responsible for producing a Local Procedure to accompany this instruction.

Local procedure

This will specifically detail the:

- local requirements for the recording of safety and health meetings (which may be a regional procedure)
- local procedure for notification of family regarding lateness off duty, injury or death.

NZFS personnel's responsibilities

NZFS personnel will follow safety directives at all times. These directives may be written or verbal, a matter of policy or ad hoc based on the situation. However, in all cases, they will follow the principals of the Safe Person Concept, common sense, sound judgement and practical application. Safety directives will generally be given by someone of senior rank.

All personnel have an obligation to maintain their own safety and not act in any way that will adversely affect the safety of others.

NZFS personnel will ensure that people who may be exposed to hazards at incidents are given clear instruction regarding:

- their role as it relates to the incident
- the nature of the hazards presented within this
- the methods by which these hazards will be managed.

Operational Responsibility

A prime responsibility of OIC Fire is to ensure the safety of personnel in their command. However, each individual has a responsibility for their own and their colleagues' safety. This is achieved by assessing and managing risk, and by adhering to operational instructions and safety procedures.

Safe and effective firefighting requires personnel to operate within crews. Crews will be under the control of an OIC Crew at all times. The OIC Crew will:

- follow operational instructions
- use the nominal roll tally procedure
- use BA entry control procedures
- establish an incident management structure
- identify hazards and communicate these to all persons on the incident ground
- evaluate priorities
- give direction
- maintain control
- monitor progress as it relates to their area of operations.

It is the duty of all NZFS personnel to bring to the attention of their OIC Crew or OIC Fire any hazard they have identified.

Use of civilians

Civilians may be utilised to assist with NZFS operations. For safety reasons, they will be under the direct supervision of NZFS personnel at all times and will be wearing the appropriate level of protective clothing and equipment for the tasks they are asked to

perform. Civilians and members of other emergency services are to be made aware of all hazards and given clear instructions as to how these hazards are to be managed and what the scope of their role is.

Note: Civilian assistance is intended to be restricted to specialist people such as members of the HSTLC, engineers at specialised or complex industrial sites, theatre nurses, prison officers, etc.

Seat Belts

All personnel travelling in NZFS vehicles will wear seat belts at all times while the vehicle is in motion.

Each individual is responsible for wearing a seatbelt. The OIC is to check that all personnel are wearing seat belts when their appliance is mobile.

Chief Fire Officers are to hold individuals accountable for compliance with this instruction and personnel not complying can expect to face disciplinary action which may lead to dismissal.

Protective clothing

All personnel are to wear the appropriate level of protective clothing for the type of incident they are attending and consequent risks likely to be present. This is to be specified by the OIC Fire. Refer to *Uniform and PPE policy (N2 POP)*.

Breathing apparatus

Breathing apparatus will be worn by all personnel working in a contaminated atmosphere, or any atmosphere suspected to be contaminated. This includes confined spaces such as tunnels, pits, closed drains, etc., unless the atmosphere is checked and monitored to ensure adequate oxygen levels.

As a minimum, Stage 1 Entry Control Procedure will be established when BA is being worn.

Safety Officer

Note: The *Command & Control Technical Manual (M1 TM)* contains updated information in section 5 relating to Incident Ground Safety Officers and needs to be read in conjunction with this instruction.

A dedicated Safety Officer(s) may be appointed at any incident of any size on the instruction of the OIC Fire, and will be appointed when:

- more than 16 persons are committed operationally at an incident
- hazardous substances are involved and a Hot Zone cordon is established
- live fire training is being undertaken
- operating in unusual/unfamiliar circumstances, e.g. silo rescue, cave rescue, cliff rescue; white water rescue, trench collapse, etc.
- the NZFS is not the lead agency and a Safety Officer is required specifically for NZFS operations.

Any member of the NZFS may be appointed as a Safety Officer at the direction of the OIC Fire or Incident Controller. Personnel appointed as Safety Officer are to be relieved of all crew responsibilities in order to carry out their role.

It is essential that persons appointed as a Safety Officer are:

- competent to identify unsafe conditions, practices and hazards, and
- have a current working knowledge of the Safe Person Concept, Operational Instructions, and appropriate Local Procedures

It is preferable that persons appointed as a Safety Officer:

- hold an officer rank
- have proven competence within the incident command structure.

The prime functions of a Safety Officer are to:

- be aware of specific objectives to be achieved and the overall plan
- identify the hazards which may lead to the injury or illness of any person
- maintain direct communications with, and make recommendations to, the OIC Fire or Incident Controller regarding actions to eliminate, isolate or minimise all identified hazards, thereby reducing the risks
- monitor the use of protective clothing and safety equipment to ensure that the best available protection is utilised
- make recommendations to the OIC Fire or Incident Controller on any matter affecting the safety or welfare of NZFS personnel or members of the public
- maintain a safety activity log, if required.

Safety Officers are to comply with all the requirements applicable to their duties and the particular incident, including:

- wearing the correct level of protective clothing
- wearing the correct identification jerkin
- following breathing apparatus entry control procedures.

Imminent danger

Where a Safety Officer discovers a situation which, in their opinion, poses an imminent risk of serious injury to NZFS personnel, or members of the public, they are empowered to:

- initiate any appropriate action, including the immediate withdrawal of personnel, if necessary
- take any action in accordance with section 28 (4) of the *Fire Service Act 1975* deemed necessary to eliminate, isolate or minimise the danger.

The power to initiate such remedial action is limited to those rare situations where the danger is so serious and imminent that failure to act immediately is likely to cause serious injury or death.

In such circumstances the Safety Officer will advise the OIC Fire and/or the Incident Controller of the actions taken as soon as practicable.

Emergency evacuation

The emergency evacuation signal is a continuous operation of all vehicle sirens.

When the emergency evacuation signal is sounded, all personnel will immediately:

- shut down firefighting deliveries at the branch
- withdraw to a place of safety
- uplift BA tallies from the Entry Control Officer, if breathing apparatus is being worn
- return to their appliance.

OIC Crews will:

- uplift nominal roll tallies
- conduct a head count
- advise the OIC Fire of the result.

Personnel working in an individual capacity as part of the command structure will report to the Incident Control Point.

Re-entry to an incident or relinquishing responsibility of the incident site

Before allowing anyone to re-enter the incident following an emergency evacuation, the OIC Fire will identify any remaining hazards resulting from the incident and advise crews being deployed accordingly.

Before handing the building back to the person responsible for the premises, the OIC Fire will notify them of any hazards that may affect people returning to the premises.

Hazard Control Officer

At any incident involving hazardous substances, the OIC Fire shall consider the appointment of a Hazard Control Officer. This decision should be based on the ability of the OIC Fire to retain direct control of the intervention team(s) working within the Hot Zone.

The principal function of the Hazard Control Officer is to control all matters of safety and operations within the Hot Zone.

This function is the responsibility of the first arriving officer until a specific appointment is made.

The Hazard Control Officer is to:

- cordon off the Hot Zone
- ensure that any person entering the Hot Zone:
  - has a good reason to do so
  - is wearing the appropriate level of protective clothing
- ensure that all persons, vehicles and equipment leaving the Hot Zone are appropriately decontaminated
- arrange for medical assistance when required
- liaise with the decontamination officer to ensure that:
  - the correct decontamination procedure is being used
  - personnel have adequate air supply to sustain decontamination
  - all records are accurately filled out
  - decontaminated people and equipment have been "tagged"
- liaise with the incident ground Safety Officer to keep them informed of the safety considerations being taken within the Hot Zone.

Note: All persons working within the Hot Zone will require decontamination. It is therefore prudent to keep the Hot Zone area as small as practicable and keep the number of personnel working within it to a minimum.

Decontamination record keeping

The recording keeping requirements for decontamination are available in *G7 Decontamination.*

When it has been necessary to decontaminate people, the Fire Region Manager is responsible for:

- maintaining a process for obtaining and forwarding on requests to medical specialists at any time
- informing the Regional Health and Safety Advisor of the details of the people and the incident.

Changeover of personnel

Whenever an officer or crew change their role or are relieved at any incident (including a stand-by), they will:

- brief the oncoming officer and crew of identified hazards and control measures in place or required, and
- ensure there is a hand-over of relevant documents (hazard logs, activity log, decontamination forms, etc).

Reduced crews

The requirements for reduced crews are available in *M2-2 POP Reduced crews.*

Risk management

Officers in charge will routinely use the principles of risk management at all levels of incident management to:

- define the limits of acceptable and unacceptable risks
- adjust the tactical mode, and/or the location or function of personnel at the incident accordingly
- communicate the tactics to all crews through the command structure.

In carrying out risk assessment, OIC Fires will take into account the:

- Operational Instructions
- Local Procedures
- probable outcome versus the risk
- experience and competence of personnel and crews at the incident
- Safe Person Concept.

Significant Hazard Exposure

Purpose

The purpose of this document is to ensure that personnel are aware of protocols for the management of potential or actual exposure to a range of significant hazards.

Identification of a significant hazard exposure situation

During or after an incident, exposure of personnel, (and/or contamination of equipment), to an actual or potential significant health hazard may be identified.

Examples of significant hazard exposure sources are asbestos, biological, chemical, bi-products of combustion, (including carbon monoxide), or a critical stress situation.

Incident Controllers have a responsibility to consider the potential for such exposures, especially prior to releasing resources from an incident, as early identification will assist in managing the subsequent follow-up action.

The Department of Labour Workplace Exposure Standards (WES) offer guidance on acceptable levels of workplace exposure.

Where multi gas detection and measurement equipment is available, it is to be used to accurately determine levels of contaminant. This is to be followed up by a risk assessment to identify the level of protection and personal protective clothing and equipment required.

Where multi gas detection and measurement equipment is not available, exposure time is to be minimised and all practical personal protective clothing and equipment is to be worn.

The Region Health & Safety Advisor may be consulted to:

- assist with the interpretation of the WES
- give hazard control advice,

if required.

Assessment of a significant hazard exposure

Where a significant hazard is identified, the OIC Fire will assess the potential for exposure at the time and if required ensure that follow-up action is implemented. The NZFS criteria for defining significant exposures as detailed in Annex A of this document will be used as a guide.

A senior officer is to be notified when Exposure Follow Up Actions are required to be implemented. They will specifically take responsibility for ensuring adequate resources for the follow up actions are available.

Obtaining specialist advice

The senior officer may obtain specialist advice from the Public Health Officer (PHO).

Range of follow-up options

Follow-up will always include:

- reporting, registering and filing of decontamination and exposure documentation
- provision of information to NZFS personnel,

and may include any of the following options as necessary:

- decontamination (People/PPE/plant & equipment)
- critical Incident Stress Management (CISM) assistance e.g. peer support, de-briefing.
- employee Assistance Programme (EAP) – counselling
- medical referral
- medical monitoring and/or treatment.

Management of multiple exposures or where recognition of exposure is delayed

In some situations, the senior officer may need assistance to manage the follow up process, this will especially be the case where:

- multiple NZFS personnel have been exposed
- recognition of exposure has been delayed and/or NZFS personnel have gone off duty.

Where this occurs, the senior officer, in consultation with the Regional Health & Safety Advisor will produce a Terms of Reference for the follow-up process, covering:

- urgency of follow-up
- appointment of a Tracking Co-ordinator
- what follow-up actions are required
- the order of priority of the follow-up actions
- the specifics for each follow-up action.

Tracking Co-ordinator role

The tasks of this role are to:

- notify all NZFS personnel that at incident X the potential for significant hazard exposure to source Y has been identified
- ensure follow up actions are now in progress
- identify all personnel who attended incident
- collate contact details for all these personnel
- notify/inform these personnel of follow-up process and what may be required of them
- gather information as required
- give the detail of the follow up actions required of the persons exposed

- record all completed contacts including advice given, time and date
- liaise with the Regional Health & Safety Advisor and Senior Officers as appropriate.

Information collated by the co-ordinator will be recorded on the *G7a Significant Hazard Exposure & Decontamination form FS431*.

Significant Hazard Exposure Protocols

The NZFS criteria and definitions for exposures to common significant hazards for NZFS operational personnel have been identified, and are described in the following appendices.

These hazards may occur even when the following steps are taken to manage them:

- NZFS safety procedures
- NZFS personnel training and provision
- correct wearing of the appropriate level of personal protective equipment.

Due to the potential consequences of exposures to such hazards, a specific protocol has been developed for each of the following categories:

- Airborne products of combustion -exposure related to airborne (and inhaled), products of combustion, this covers physical trauma to the lungs and airways, as opposed to any chemical effect. (Appendix 1)
- Carbon monoxide - exposure to this specific product of combustion (Appendix 2)
- Chemical (generic) - exposure to chemicals (Appendix 3)
- Biological substances – exposure to blood and body products (Appendix 4)
- Asbestos - exposure to airborne asbestos fibres (Appendix 5)
- Occupational stress - exposure in relation to workplace stress (refer to *HS3 Critical Incident Stress Management*).

Purpose

The protocols provide a consistent national standard for clear control and management following recognition of a significant exposure to an identified hazard and are designed to complement the national health surveillance programme.

By promotion of better awareness of these hazards, it is also anticipated that reporting of any significant hazard exposures will drive an improvement process to minimise the likelihood of further occurrence.

Advice to medical practitioners

Where available, a copy of the *G7a Significant Hazard Exposure & Decontamination form FS431* will be made available to the medical practitioner when a firefighter presents themselves for follow up treatment.

The Region Health & Safety Advisor may have additional medical information or guidance and may be contacted by the medical practitioner where required.

Protocol layout

Each protocol follows a similar layout containing basic information on a specific exposure hazard that includes:

- term definitions
- effects on the human body
- NZFS definition of what constitutes a significant exposure for the hazard
- practical first steps recommended to be taken following recognition that exposure may have or has occurred
- paperwork requirements
- health monitoring follow-up that may be required
- reference sources.

Appendix 1 Air-borne Products of Combustion (Respiratory System Effect) Protocol

Nature of Airborne Products of Combustion

Note: This protocol has been selected due to the high likelihood of such exposure to NZFS operational personnel.

It is primarily concerned with the bio-mechanical trauma i.e. local respiratory and pulmonary tract harm caused by inhalation of combustion products. General systemic effect is covered in the chemical exposure protocol.

Airborne products of combustion consist of a "soup" of chemicals and particulate matter produced and expelled during burning, commonly known as "smoke". Different substances are produced depending on variables such as heat available, fuel source/s, humidity, presence/amount of oxygen or other oxidants.

Particles

- particles can also act as "carriers" for other airborne products of combustion
- incomplete combustion or fuel type influences amounts of particles produced
- particles of 5 microns diameter or larger can deposit in upper airways/large lower airways and smaller particles can deposit in smaller airways such as bronchioles and alveoli (lung sacs).

Other air contaminants

Contaminant	Description
Dust	Small solid particles formed by mechanical processes such as grinding, crushing, drilling, abrading or blasting e.g. silica or stone dust
Fumes	Finely divided liquids suspended in the air. Mists are generated by liquids condensing from a vapour back to a liquid or by a liquid being broken into a dispersed state by splashing, foaming or atomising e.g. paint spraying operations
Fibres	Small solid particles whose length is several times greater than their diameter. Easily air-borne due to light weight e.g. asbestos
Gases	Formless fluids that expand to occupy their confining enclosure e.g. carbon monoxide
Vapours	Gaseous forms of substances that are normally solid or liquid state at room temperature/pressure. Formed by evaporation e.g. vapours from organic solvents such as petrol

Effects on the human body

Range from local respiratory passage and eye irritation to system disruption such as severe respiratory impairment and organ damage. Damage to internal structures may lead to development of disease processes.

Actions may include simple asphyxiates affecting respiratory function, foreign matter, irritants and corrosives which particularly affect the respiratory tract and lungs.

Effects can be acute (occur at or shortly after exposure) or chronic (develop over a long period.

Harm may be sustained from single or multiple exposure and is influenced by exposure intensity, duration, number, frequency of "doses" and temperature of inhaled product

Exposure routes

- Primary and most significant route is by inhalation.
- May be ingested if inadequate decontamination prior to consumption of food or smoking via unwashed hands.

"Significant Exposure to Products of Combustion" definition

Significant Exposure is defined as:

- any situation where a person has been directly exposed to air-borne products of combustion without appropriate respiratory protection, and has inhaled a quantity of these products, AND
- confirmation of any of the following acute exposure related signs/symptoms:
  - sore and inflamed throat with excessive eye irritation
  - persistent aggravated coughing
  - production of soot-stained mucous discharge
  - respiratory stridor (wheeze)
  - shortness of breath
  - soot-staining in mouth and nose
  - any other significant sign or symptoms such as evidence of carbon monoxide poisoning.

Immediate first aid and medical management

On reporting of a significant inhalation exposure, the person will:

- cease to carry out any further operational duties
- receive oxygen therapy, if available, at the scene in clear air
- receive medical advice as soon as practicable.

Recording of exposure to air-borne products of combustion

Any personnel who meet the criteria for significant hazard exposure to air-borne products of combustion are to complete:

- Work Accident Report (FS 432/432a [OSH Kiosk])
- *G7a Significant Hazard Exposure & Decontamination form FS431*

- District/Station Accident Register
- Serious Harm Notification form (to OSH) may be required if serious harm has also occurred to an affected employee at time of exposure.

On-going health monitoring and treatment

- following immediate first aid, prompt medical assessment of the affected individual is required where a significant exposure is suspected or apparent
- further confirmation of acute exposure may be by medical examination/diagnosis of the individual's physical status and which may included tests such as blood gas analysis and/or oxygen saturation levels, blood carboxyhemoglobin levels, chest X-ray and lung function testing
- the Regional Health and Safety Advisor or other designated officer, in liaison with the Regional Medical Officer (where available) will co-ordinate follow-up assessment, monitoring, treatment, health advice, and welfare support with appropriate providers as indicated. Where a Regional Medical Officer is not available, the responsibility will default to the Principal Medical Officer
- the Regional Health and Safety Advisor or the accountable line manager will inform the Principal Medical Officer of all significant hazard exposures to air-born products of combustion
- medical records are to be kept for each employee as per NZFS policy.

Reference sources

A Guide to Respiratory Protection, OSH/NZ Safety.

Air Quality Technical Report No. 22, Meeting Notes and Analysis of Reviewers Comments, Ministry for the Environment, October 2000.

Air Quality Technical Report No.12, Health Effects of Five Common Air Contaminants and Recommended Protective Ranges – Final Report, Ministry for the Environment; October 2000.

Air Quality Technical Report No.13, Health Effects of Eleven Hazardous Air Contaminants and recommended Evaluation Criteria, Ministry for the Environment, October 2000.

Air Quality Technical Report No.15, Effects of Air Contaminants on Ecosystems and Recommended Critical levels and Critical Loads – Final Report, Ministry for the Environment, October 2000.

Air Quality Technical Report No.23, Recommended Amendments to the Ambient Air Quality Guidelines 1994, Ministry for the Environment, October 2000.

Air Quality Technical Report No.55, Preliminary Assessment of Potential Human Health Indicators of Air Quality, Ministry for the Environment, June 1999.

ARC Discussion Document – Air, Land and Water, Part 2 – Air Quality, ARC, May 2001.

Hazardous Materials Response Handbook; Ch.8 - Medical monitoring, NFPA, Third Edition, 1997.

NZS/AS 1715:1991: Selection, use and maintenance of respiratory protection devices.

Protect yourself with PPE, www.safetyinfo.com

Workplace Exposure Standards, OSH, DOL, 2002.

Appendix 2 Carbon Monoxide Protocol

Nature of substance

CO is the most common domestic and industrial neurotoxin poison in the industrialised world. It is a trace constituent of the atmosphere, produced by degradation of organic matter and incomplete combustion by natural processes e.g. fossil fuel fires and volcanic activity.

The principal source is now a by-product of human innovation i.e. vehicle exhaust and portable engine emissions, fuel powered cooking/heating appliances and industrial processes e.g. foundry or steel work kilns.

It is a colourless, odourless, tasteless, un-reactive, non-irritant, highly flammable gas that is both toxic and poisonous to humans at high concentrations. It has a similar density to air.

A small amount of CO occurs naturally within the human body as a result of the normal breakdown process of haemoglobin

Term definitions

Term	Description
Ambient air	Surrounding breathable air
Hb	Haemoglobin: the blood's Oxygen (O_2) carrier protein
Ohb	Oxyhaemoglobin: blood protein carrying O_2
COHb	Carboxyhaemoglobin: blood protein carrying Carbon Monoxide (CO).
Cardiac Myoglobin	O_2 carrier protein specifically for heart muscle
WES	Workplace Exposure Standard (OSH), includes the TWA and STEL
TWA	Time Weighted Average – the average airborne concentration of a particular substance when calculated over a normal eight-hour workday, for a five day working week. May also be referred to as LTEL (Long Term Exposure Limit).
STEL	Short Term Exposure Limit (STEL). A 15 minute STEL will not be exceeded at any time during a workday even if the eight –hour TWA is within the TWA exposure standard. Exposure at the STEL will not be longer than 15 minutes and will not be repeated more than 4 x in one day, with a minimum of 60 minutes between each successive exposure at the STEL
Anaemia hypoxia mechanism	The starving of cells of O_2 due to the greater binding affinity of CO to Hb, and the subsequent reduction of available O_2
Tissue toxicity	The harmful effect of direct CO interaction with cell tissue, as opposed to harm caused by the anaemia hypoxia mechanism
CO level measurement	mg/m³ - milligrams per cubic metre (CO concentration in ambient air) ppm - parts per million (CO concentration in ambient air) COHb% - percentage of CO (CO concentration in blood)

Where carbon monoxide is routinely encountered

Excessive concentrations are present at fire incidents where CO is a common and prolific constituent of smoke.

High concentrations are found where combustion engine emissions accumulate i.e. slow moving traffic in street canyons, inside buildings adjacent to such areas, inside tunnels, car-park buildings (underground or enclosed), vehicle bays and where portable engines are used in poorly ventilated or confined spaces.

Industrial foundry and kiln emissions produce high concentrations.

NZFS exposure situations

Working without or intermittent use of Self-Contained Breathing Apparatus in any environment where CO is present e.g:

- firefighting (inside or outside).
- post-fire turnover, salvage and fire investigation, especially after initial fire knockdown and where the area is inadequately ventilated with production of CO still occurring, (possibly through the use of pp ventilation fans, portable generators or pumps).
- any work in confined spaces such ships holds, ducts, storage tanks, process vessels, silos, tunnels, utility/ service pipelines or any other underground area, particularly where conducting a search/rescue or where combustion machinery such as pumps, pp ventilation fans, generators or gas-fired equipment is operating in or adjacent.

Exposure route

CO enters the body by inhalation into the lungs when present in the ambient air.

Note: Methylene Chloride exposure can induce CO poisoning as the Liver will produce CO as a by-product when metabolising the chemical. This exposure is rare.

Nature and effect of exposure

CO is a risk to health when inhaled. Population research studies have shown association between CO levels that exceed the recommended level (2.5%) in ambient air and adverse health effects. These health effects show as higher hospital admissions and higher death rates in susceptible groups i.e. elderly, people with existing respiratory or cardiovascular disease, asthmatics, pregnant mothers and children.

In healthy adults, a moderate single exposure may cause a short-term decrease in physical and mental abilities, with a variable degree of physical discomfort.

A heavy single exposure to may cause acute or delayed neurological deficits. The minimal level of exposure and duration sufficient to cause permanent cognitive impairment is unknown.

Chronic exposure to sub-lethal concentrations of CO has been attributed to cause:

- central nervous system harm e.g. headaches, chronic brain syndrome, mental retardation and Parkinsonian-type states, and

- cardiac muscle harm e.g. angina, damage to heart muscle and acceleration of heart disease to those at risk or predisposed.
- prolonged exposure to high concentrations of CO (e.g. >400 ppm) is not compatible with sustaining life

Mechanism of action

- CO is readily absorbed from the lungs into the bloodstream when it competes with O_2 for attachment to Hb. The most significant effect of CO is on the O_2 sensitive organs i.e. brain and heart.
- CO has an affinity over 200 times greater with Hb than O_2; thus CO quickly combines with Hb to form COHb. The Hb is unable to release the CO to carry O_2 due to this stronger bond.
- COHb also inhibits the ability of Hb to release its O_2 to the cell tissues, which further reduces available Hb for carrying O_2. These two factors reduce the amount of circulating oxygenated blood, limiting available O_2 delivery to cell tissue.
- CO also binds to Cardiac Myoglobin; O_2 is displaced exactly as it is displaced from the Hb. This loss of O_2 to heart muscle directly reduces cardiac output (pressure/volume) and further decreases the amount of circulating oxygenated blood.
- in fire situations there is also usually a higher CO_2 level present. CO_2 is a respiratory stimulant and for a person not protected by Self-Contained Breathing Apparatus, CO_2 will stimulate the breathing rate, increasing the CO uptake and level of CO exposure.
- the body compensates for presence of COHb by increasing cardiac output with an increased heart rate and release of reserve Hb cells from the Spleen.
- if the CO exposure continues and if a high level of exposure is maintained, severe hypoxia, haemodynamic collapse and death will occur.
- CO also has a direct toxic effect on cell tissue as a chemical poison in its own right. Information on this is limited.

Exposure levels

Air-quality standards are now being based not only on long exposure periods (e.g. 8 hours) but also on shorter times to control the potentially adverse effects of intense acute exposure to CO.

A single bedroom fire may produce a CO level of 5000 ppm.

Parts per million (ppm)	**Effect**
200	headaches, mental dullness and dizziness in few hours
600	identical symptoms in less than 30 minutes, unconscious in 1½ hours
4000	fatal in less than one hour

CO Workplace Exposure Standard (OSH)				
Exposure standard type	**CO level (ppm in air)**	**Maximum recommended exposure time**	**CO level (mg/m³ in air)**	**Expected % of CO in blood**
TWA	25	8 hours	12	2
STEL	50	60 minutes	30	4.8
	100	30 minutes	60	9.6
	200	15 minutes	100	16
Maximum ceiling limit is 400ppm				

Table 1: Department of Labour CO Workplace Exposure Standards and equivalencies in mg/m³ and COHb%

Note: The sum of the exposure periods during the activity (8 hour based), at a particular level will not (in total) exceed the period indicated

COHb Concentration (%)	Symptoms of CO poisoning
Less than 20%	none except slight breathlessness on exertion
20 – 30%	flushed, slight headache, some breathlessness on exertion
30 – 40 %	severe headache, vertigo, nausea, vomiting, irritability and impaired judgement
40 – 50%	symptoms as above but more severe, fainting on exertion
Greater than 60%	depression of respiratory centre leading to death

Table 2: Effects of CO exposure in healthy adults

Smoking Adults

CO is produced in normal healthy people as part of the breakdown of haemoglobin with a normal COHb range being 1 – 3%. COHb levels in average smokers (around 1 pack per day) range from 5 – 15%, depending on pattern of consumption.

Cigarette smokers can remain free of symptoms with COHb levels found in some non-smoking CO poisoned victims, but may not escape long-term harmful effects that CO may contribute towards such as cardiovascular or respiratory disease.

Signs and symptoms

History of unprotected respiratory exposure to CO in an inadequately ventilated space

Acute signs and symptoms:

- impairment in abilities requiring sustained attention and performance
- headaches, nausea and/or malaise

- dizziness, weakness and/or hypotension
- palpitations, tachycardia and/or chest pain
- disorientation, visual disturbances and/or confusion
- unconsciousness and coma
- asphyxia, apnoea and death

Note: The cherry red skin pallor is usually only seen in deceased victims.

Treatment and Achievable Reversal of Effect

Clearance of CO in an individual is influenced by:

- health status e.g. in an "at risk" group or in good health
- fitness level
- level and duration of exposure
- level of exercise during the exposure
- ventilation rate post-exposure
- whether or not O_2 is administered post-exposure.

The formation of COHb is a reversible process but takes time in clear air for the body to metabolise and eliminate the CO. The half-life of CO is 250 minutes in air which is reduced to 50 minutes with 100% O_2

Administration of 100% O_2 will rapidly improve behaviour in a CO poisoned patient. It will not prevent damage that has already occurred to cell tissue or prevent the development of any follow-on effects that may occur as a result of O_2 starvation or CO toxicity.

"Significant Exposure to CO" definition

COHb can be measured by a simple blood test that needs to be carried out as soon as possible after exposure to CO is suspected. The blood test result will confirm if exposure to CO has occurred and will give some indication of exposure severity. Determination of whether the exposure itself is "significant" is dependent upon assessment by a suitably qualified medical practitioner.

Practical control measures

Operational

- treat CO as a significant hazard present at all fires and whenever operating combustion engines in any confined space
- compliance with NCI No. 4 – Breathing Apparatus
- use Breathing Apparatus as the rule, not the exception
- ventilate smoke or exhaust contaminated structures thoroughly to maximise clean air flow-through prior to permitting NZFS personnel to remove BA

- monitor ambient CO levels to determine effectiveness of ventilation processes
- minimise worker exposure to CO in traffic congestion by improved vehicle ventilation and design
- monitor worker CO blood levels only where indicated and appropriate.

Station work areas

- eliminate accumulation of exhaust emissions in confined or poorly ventilated spaces by installation of exhaust ventilation systems
- if fixed machinery is essential and ventilation exhaust is not viable, consider replacement with electrical units
- ensure regular servicing of appliances and other engines e.g. a poorly tuned engine will emit 12 x more CO that a well tuned engine
- isolate workers and work areas from potential high level CO areas e.g. smoke stop doors
- monitor ambient CO levels where a problem is suspected.

CO monitors

CO monitors detect CO over a range of 0 to 500-1000 ppm, operate at temperatures between -15° C to +55° C and emit an audible alarm plus visual flash signal when a pre-set level of CO is reached.

The pre-set levels are configured against standard instantaneous, short term and long term exposure limits i.e. CO is continuously monitored and if the CO exposure limit for any period of time is reached, the monitor will alarm.

The monitor will instantly alarm if the CO level is 400 ppm or greater.

Industries that routinely work in confined spaces e.g. Utility service, pipeline, tank/silo service contractors etc. routinely use personal multi-gas units that monitor Oxygen, Carbon Monoxide, Hydrogen Sulphide and the Flammability range. Single gas CO monitors are also available.

Recording of CO exposure

Any personnel who have been assessed as being exposed to an abnormal level of CO need to complete:

- *NZFS Accident Report* (FS 432/432a)
- *G7a Significant Hazard Exposure & Decontamination form FS431*
- District/Station Accident Register.

On-going Health Monitoring for Long Term Effects

- individuals will be monitored in accordance with medical advice based on severity of exposure.

- the Regional Health and Safety Advisor or other designated Officer, in liaison with the Regional Medical Officer (where available) will co-ordinate follow-up assessment, monitoring, treatment, health advice, welfare and counselling support with appropriate providers as required. Where a Regional Medical Officer is not available, the responsibility will default to the Principal Medical Officer.
- the Regional Health and Safety Advisor or the accountable line manager will inform the Principal Medical Officer of all significant hazard exposures to CO.
- medical records are to be kept for each employee as per NZFS policy.

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Appendix 3 Chemical Hazards Protocol

Nature of substances

Chemicals may be in any form of solids, liquids, gases, vapours, fumes and other particulate, in any combination or mixture. Radioactive sources are also included. The complexity of chemical substances and the variations of their interaction are extremely broad.

Effects on the human body

Range from local (skin irritation and eye irritation) to system disruption such as severe respiratory impairment, nerve and organ damage, increased risk of leukaemia and cancer, and death. Damage to internal structures may lead to development of disease processes.

Actions may include simple asphyxiates affecting respiratory function, chemical asphyxiates that inhibit functions of blood or other systems, irritants and corrosives particularly for lungs, and general system toxicants, with or without local effects.

Effects can be acute (occur at or shortly after exposure) or chronic (develop over a long period). Harm may be sustained from a single dose or multiple dosages and which are both influenced by exposure intensity, duration, number, and frequency.

Some substances have a threshold (a concentration below which no adverse effects are known to occur), while others have no identifiable threshold.

Some are stable and will bio-accumulate and others have a short half-life and maybe excreted or metabolised within a short period.

Exposure routes

- absorbed through the skin via direct contact
- absorbed via mucous membranes via direct contact
- inhaled via the respiratory system
- ingested through the digestive system
- radiation.

"Significant Exposure to a Chemical Substance" definition

The definition of "significant exposure to a chemical substance is:

- any situation where a person has been directly exposed to a potentially harmful or hazardous chemical substance without appropriate respiratory protection and other necessary protective clothing/equipment. This is reportable as a "Work Accident".

Until a decision has been made by the appropriately authority/practitioner qualified and competent to report otherwise, any reported exposure that meets the above criteria will be treated as a significant exposure.

It is not classifiable as a significant exposure or reportable as a work accident where a person was working in a hazardous environment but was wearing appropriate protective equipment, was appropriately decontaminated and was not in any direct physical contact with the substance(s).

Confirmation of exposure and identification of substances

- confirmation of exposure may be by medical diagnosis of the individual's state of health, blood tests and other medical tests. Even then this testing may not be conclusive of any exposure
- degree of exposure also may not be able to be accurately determined and depends greatly on the medium of exposure, the substance, and its concentration/potency
- often baseline data will not be available as it is not feasible or practical to establish baseline information for NZFS personnel due to the large variety of chemicals
- testing for some specific chemicals or groups of chemicals is available and is more for establishing that exposure has taken place rather than for determining harm or disease. Testing is limited.
- a risk assessment matrix "Test of Chemical Poisoning" is a useful diagnosis tool for medical assessment (Refer: Appendix 3A)

Recording of chemical exposure

Any personnel who meet the criteria for significant hazard exposure are to complete:

- *NZFS Accident Report Form* (FS 432/432a [OSH Kiosk]) - identify chemicals involved if possible.
- *G7a Significant Hazard Exposure & Decontamination form FS431*
- District/Station Accident Register
- *Serious Harm Notification form* (to OSH) may be required if serious harm has also occurred to an affected employee at time of exposure.

Precautionary reporting:

Recording that a member of the NZFS worked within a hazardous environment (but was adequately protected and decontaminated) may be reported in the decontamination section of *G7a Significant Hazard Exposure & Decontamination Form FS 431* and marked "Precautionary".

On-going health monitoring and treatment

- following immediate first aid action on exposure, the identification of a potential significant exposure to a hazardous substance/s flags that a prompt medical assessment of the affected individual is required as soon as practicable.
- the affected individual will be taken to the nearest appropriate medical facility for assessment and/or treatment.
- the Regional Health and Safety Manager/Advisor or other designated officer, in liaison with the Regional Medical Officer (where available) will co-ordinate follow-up assessment, monitoring, treatment, health advice, and welfare support with appropriate providers as indicated. Where a Regional Medical Officer is not available, the responsibility will default to the Principal Medical Officer.
- the Regional Health and Safety Manager or the accountable line manager will inform the Principal Medical Officer of all significant hazard exposures to chemicals.
- medical records are to be kept for each employee as per NZFS policy.

Additional chemical advice sources

- NZFS Principal Medical Officer
- NZFS Technical Liaison Officers
- Hazardous Substance Technical Liaison Committee Members
- NZFS Communications Centre for Chemdata and Poisons Centre data
- NZ National Poisons and Hazardous Chemicals Information Centre (Dunedin)
- Help Desk (03) 479-1200, Emergency (03) 474-7000 for medical advice.
- Department of Labour.
- Specific site MSDS and company Chemical Help-lines
- University Departments of Occupational Medicine

Reference sources

*Chronic Organic Solvent Neurotoxicity: Diagnostic Criteri*a, OSH, DOL, 1998.

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Preliminary assessment of potential human health indicators of air quality; Technical Paper No. 55; Ministry for the Environment, June 1999

Report on the Notifiable Occupational Disease System to June 2000, DOL, Feb 2001

The health consequences of the ICI Fire, Commission of Inquiry, 1984

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www.osh.dol.govt.nz

Appendix 3A Test for Chemical Poisoning

Introduction

The following information provides a degree of clarification as to how medical assessment and diagnosis of chemical poisoning may be reached and is reprinted from the NZ Medical Journal 13 February 1998 Vol. 111, No 1059, Pages 34-7.

This is based on the classification of a patient's symptoms and findings into major, intermediate and minor categories.

Point Allocation

The major criteria are allocated 10 points each, while the intermediate and minor criteria are allocated 5 and 2 points each, respectively (Table 1). The criteria that are applicable for a patient are identified; points are identified for each of these criteria and are summed. The points total is then used to determine the likelihood that the patient's health problems are the result of poisoning and whether they exceed arbitrary thresholds for withdrawal from chemical, active treatment and/or compensation (Table 2).

Category	Description	Points
A1	The patient has both body levels of the chemical in excess of that which has been associated with toxic effects and objective biological markers of the poisoning effect being considered and that are characteristic of the chemical	10
A2	The patient has symptoms and findings that are both characteristic of the chemical and that can either be precipitated or aggravated by the chemical, or relieved by specific antidotes to the chemical.	10
B1	The patient has had an appropriate exposure to the chemical and/or the chemical has been measured in the subject environment at levels that have been associated with toxic effects.	5
B2	The patient has either body levels of the chemical in excess of that which has been associated with toxic effects or objective biological markers of the poisoning effect being considered and that are characteristic of the chemical	5
B3	The patient has symptoms and findings that are characteristic of the chemical.	5
C1	The patient has symptoms and/or findings that have clear temporal relationship to an exposure to the chemical and that resolve within the expected time frame after the exposure ceases	2
C2	The patient has symptoms and/or findings that cannot be explained by alternative mechanisms, or alternative mechanisms that cause the same symptoms and findings have been reasonably excluded.	2
C3	The patient has symptoms and/or findings that are biologically plausible effects of the chemical.	2

Table 1 - Categories of criteria for poisoning

Number of points	Probability of chemical poisoning
2 - 4	The chemical is unlikely to be the cause of the patient's symptoms, signs or findings.
5 - 8	The chemical is possibly the cause of the patient's symptoms, signs or findings.
9 - 14	The chemical is probably the cause of the patient's symptoms, signs or findings.
15 - 20	The chemical is a highly probable cause of the patient's symptoms, signs or findings.
Greater than 20	The chemical is almost certainly the cause of the patient's symptoms, signs or findings.

Table 2 - Likelihood of health problems being due to poisoning.

Major Criteria for Chemical Poisoning

Category A1

The patient has both body levels of the chemical in excess of that which has been associated with toxic effects and objective biological markers of the poisoning effect being considered and that are characteristic of the chemical (notes 1 and 2).

Note 1: An example of these criteria would be a concurrent demonstration of raised body levels of lead and haemoglobin precursors.

Note 2: Characteristic here means typical of, rather than specific to, the chemical.

Category A2

The patient has symptoms and findings that are both characteristic of the chemical (notes 2 and 3) and that can either be precipitated or aggravated by the chemical (notes 4, 5 and 6), or relieved by specific antidotes to the chemical.

Note 3: Such as eczema or asthma.

Note 4: Such as skin patch testing, bronchial reactivity testing to specific inhaled agents or a peak flow diary that shows greater than a 20% variation with recorded flow peaks and troughs that are related appropriately in time to exposure to a chemical like formaldehyde.

Note 5: Bronchial reactivity testing in this context refers specifically to a reaction to the chemical concerned and not to agents such as hypertonic saline, methacholine and histamine. It is noteworthy that the latter two agents have a false positive rate of about 20%.

Note 6: A peak flow diary that shows greater than a 20% variation with recorded flow peaks and troughs that are related appropriately in time to exposure is appropriate for a type A2 major criterion. In contrast, a peak flow diary that shows greater than a 20% variation with recorded peaks and troughs, but where there is no clear or consistent relationship to exposure is only appropriate for a type B3 intermediate criterion

Intermediate Criteria for Chemical Poisoning

Category B1

The patient has had an appropriate (Note 7) exposure the chemical and/or the chemical has been measured in the subject environment at levels associated with toxic effects (Note 8).

Note 7: The exposure needs to be assessed in the context of the chemical involved and the reported effect. For example, a history of repeated exposures to levels of solvents well in excess of modern workplace exposure standards is necessary to substantiate a direct neural injury. Alternatively, a single 20-minute exposure to 1% carbon monoxide can be accepted as the origin of a chronic encephalopathy. Finally, a repeated exposure to low concentrations of isocyanates can be accepted as the basis of sensitisation and subsequent asthma. Consideration will be given to cross-sensitisation after an exposure to a chemically very similar compound.

Note 8: The environmental levels of the chemical need to be measured under conditions that are analogous to the reported exposure for the patient. This assessment may take the form of measuring a surrogate agent (for which assays exist) as a test of the adequacy of ventilation and general environmental status. For example, levels of nitrous oxide measured in an operating theatre can be used as a surrogate for other similarly employed anaesthetics. Surrogates will need to be carefully chosen to match factors such as relative volatility.

Category B2

The patient has either body levels of the chemical in excess of that which has been associated with toxic effects or biological markers of the poisoning effect being considered and that are characteristic of the chemical (Note 1, 2 and 9).

Note 9: A patient cannot be assessed as satisfying both criteria A2 and B2. If criterion A2 is met, then B2 cannot be considered.

Category B3

The patient has symptoms and findings (Note 10) that are characteristic of the chemical (Notes 6, 11 and 12).

Note 10: These do not include biological markers such as haemoglobin pre-cursors in a patient poisoned by lead.

Note 11: Such as a pattern of psychometric test performance that indicates recent brain injury to carbon monoxide a month previously or a peak flow diary that shows greater than a 20% variation with recorded flow peaks and troughs in a patient who is exposed to chemical like formaldehyde.

Note 12: A patient cannot be assessed as satisfying both criteria B3 and C3. If a criterion B3 is met, then C3 cannot be considered.

Minor Criteria for Chemical Poisoning

Category C1

The patient has symptoms and/or findings that have a clear temporal relationship to an exposure to the chemical and that resolve within the expected time after the exposure ceases (note 13).

Note 13: Such as irritation of eyes, noses and upper airways during, and immediately after, an exposure to solvent vapour.

Category C2

The patient has symptoms and/or findings that cannot be explained by alternative mechanisms, or alternative mechanisms that can cause the same symptoms and findings have been reasonably excluded (note 14).

Note 14: Such as excluding diabetes in a patient with a peripheral neuropathy.

Category C3

The patient has symptoms and/or findings (note 10) that are biologically plausible effects of the chemical (note 15).

Note 15: Such as a several year delay from exposure to an established carcinogen like cadmium and renal cancer development or an encephalopathy, five days after an exposure to a known neurotoxin like hydrogen sulphide.

Appendix 4 Biological Substances Protocol

Occupational exposure to biological substances

NZFS operational personnel may be exposed to biological substances such as blood borne pathogens and other communicable diseases during the normal course of their work.

There are many different blood-borne pathogens that potentially may be transmitted via penetrating injury or mucous membrane exposure, with the most significant being Hepatitis B Virus, Hepatitis C Virus and Human Immuno-deficiency Virus.

Other diseases not found in human blood may be carried in fluids such as human faeces (e.g. Hep A) or animal blood and fluids.

Term definitions

Term	Definition
Affected person	Person exposed to blood or body fluids
Source individual	Person whose blood or body fluid is source of exposure.
Blood-borne pathogen	Micro-organism that exists in human blood and other body fluids. When body fluids that are infectious enter the bloodstream of another person they can cause disease.
HBV	Hepatitis B virus.
HCV	Hepatitis C virus.
HIV	Human Immuno-deficiency virus – virus causing AIDS
Universal precautions	Risk management strategy of treating all blood and body fluids as if infectious, regardless of source
Zoonoses	Diseases that may be transferred to humans from animals e.g. Leptospirosis, Salmonella. These are not primarily human infections

Exposure sources

- all human body fluids and secretions, especially any fluid with visible blood
- microbial cultures and packaged human blood products for hospital use
- body parts, organs, corpses and any other human material
- medical, clinical, laboratory equipment/work surfaces, hospital linen and waste
- animal blood, fluid and waste.

Potential exposure situations

- casualty extrication/ first aid provision at an accident or medical assist incident
- physical recovery of a body or body parts

- handling of blood/body fluid contaminated objects e.g. needles
- police assist rescue calls e.g. disturbed person threatening self-harm
- at an incident at a hospital, veterinary clinic, medical or research lab
- at an incident involving aggressive/ trapped/ sick/ injured or dead animals
- at an incident involving contact with sewage.

Exposure routes

- punctures or cuts from sharp objects contaminated with blood/fluid
- spill of blood/fluid onto mucous membranes of eye, mouth and/or nose
- spill of blood/fluid onto skin that may or may not be intact
- laceration and contamination with blood/fluid from a bite.

Exposure levels

High Risk:

- deep puncture wound caused by object contaminated with blood/body fluid or other non-clean substance
- puncture wound with hollow-bore needle used in vein/artery of another individual
- cut with sharp instrument visibly contaminated with blood/body fluid or other non-clean substance
- massive contamination with blood/body fluid/sewage to intact skin
- accidental inhalation of blood/body fluid/sewage

Medium Risk:

- splash of blood/body fluid/sewage onto mucous membrane i.e. in eyes, in mouth or up nose
- contact of blood/body fluid/sewage onto broken skin e.g. patch of dermatitis
- prolonged contact with blood/body fluid/sewage on a large exposure of intact skin
- animal or human bite breaking skin integrity.

Low Risk:

- small amount of blood/body fluid/sewage on intact skin.

Risk statistical data (summary only)

Hepatitis B:

- virtually no risk of infection if previously immunised with Hepatitis B vaccine and have developed immunity
- if affected individual is unvaccinated, the infection risk is 30%.

Hepatitis C:

- penetrating injury has an infection risk of 3%
- splash to mucous membrane infection risk is less than 1.8%.

Human Immuno-deficiency virus:

- penetrating injury has an infection risk of 0.3%
- splash to mucous membrane (eye, nose, mouth) has an infection risk of 0.1%
- splash to intact skin has an infection risk of less than 0.1%.

"Significant Exposure to Biological Substance" definition

The NZFS definition of "significant exposure to a biological substance" is when exposure level of person exposed meets either high or medium risk criteria as listed earlier in this document under the heading - "Exposure levels".

Universal precautions

Appropriate risk management practices include:

- treat all persons or contact as if infectious
- cover all cuts or abrasions with a waterproof plaster or dressing when on duty
- wearing appropriate Personal Protective Equipment (PPE) for the task
- careful handling or care with high risk or contaminated objects
- supply and use of washing facilities following completion of task
- cleaning schedule for high risk or contaminated equipment
- appropriate disposal of disposable PPE and/or equipment
- maintain good hygiene practices before, during and after task.

Note: Universal Precautions is the most effective method of protection for the emergency service worker in a biological substance exposure situation. If these guidelines are followed the risk of infection can be significantly minimised.

Immediate action at scene following exposure

Report accident and initiate immediate first aid precautions as follows:

Open wound

- encourage wound to bleed, thoroughly wash with water for 15 minutes and dress
- do not attempt to use a caustic solution to clean
- seek medical advice as soon as possible.

Splash to mucous membrane

- flush splashes to nose, mouth or eyes thoroughly with water for 15 minutes
- if splash in mouth, spit out and thoroughly rinse out with water for 15 minutes
- if splash in eyes irrigate with the eyes open
- seek medical advice as soon as possible.

Splash to skin

- at scene, wash thoroughly with soap and water
- seek medical advice as soon as possible if medium/high risk exposure.

Check clothing, PPE and other equipment

- avoid re-contamination and remove any contaminated article
- wash hands after removal and cleaning, bagging or disposal of any contaminated article, object or item of equipment.

Decontamination

- contaminated clothing to be securely bagged and labelled "Blood contaminated clothing – wash separately" and forwarded to the appropriate laundry
- residual bloodstains may contain viruses, which remain active for some time
- equipment and working surfaces will be cleaned after any use by rinsing in water, (the effectiveness of disinfectant is reduced by organic matter, so ensure that dirt is well cleaned off first), scrubbing if necessary to remove particulate material such as soil, faeces etc. Then to ensure an adequate cleaning, soak or wash all surfaces a 0.5% Sodium Hypochlorite solution (follow manufacturers recommendations or use 9 parts water to 1 part bleach [i.e. bleach with a 0.5% Sodium Hypochlorite solution] or a granular chlorine compound), and leave in contact for 5 - 10 minutes. Then drain and rinse well with potable water and dry thoroughly.

Note: A '10% Sodium Hypochlorite solution' bleach is a double strength household bleach.

Disposal

Contaminated disposable equipment and disposable PPE to be securely bagged and appropriately disposed in the correct refuse collection/container.

If unsure on correct procedure seek advice from qualified personnel, e.g. Hospital (Infection Control), Ambulance, GP, Nursing staff at local A&E etc.

Recording of exposure to a biological substance

Any personnel who meet the criteria for significant hazard exposure are to complete:

- *NZFS Accident Report Form*(FS 432/432a OSH Kiosk) - identify source or source individual if possible
- *G7a Significant Hazard Exposure & Decontamination Form FS431* (If low risk category, complete form and mark "Precautionary"
- District/Station Accident Register.

Ongoing health monitoring requirements

- the Regional Health and Safety Manager/Advisor, or other designated officer, in liaison with the Regional Medical Officer (where available) will co-ordinate follow-up assessment, monitoring, treatment, health advice, welfare and counselling support with appropriate providers as required. Where a Regional Medical Officer is not available, the responsibility will default to the Principal Medical Officer.
- all such employees will undergo, as soon after the incident as is practicable, (within 12-24 hours), blood tests for baseline monitoring of appropriate pathogens (i.e. to ensure the person did not have the infection before the exposure). Baseline testing usually includes HepB antigen testing, HBV, HCV and HIV antibody levels.
- the Regional Health and Safety Manager or the accountable line manager will inform the Principal Medical Officer of all significant hazard exposures to a biological substance
- medical records are to be kept for each employee as per NZFS policy.

Risk infection assessment

Most exposures do not result in an infection. Risk of infection varies and depends on:

- source, type and level of exposure
- if a pathogen is involved and its level in/on source item/individual
- status of affected individual's immune system.

Where the source is known, most employees can be quickly reassured by obtaining antibody levels (HBV, HCV, and HIV) from the source or donor person. Negative levels eliminate the risk except in some special circumstances, which the medical officer will determine.

Exposure where source item or individual cannot be identified

In this situation, a risk assessment will be carried out by the medical practitioner at time of consultation re the likelihood of a source being positive for a blood-borne pathogen in order to assist in the decision regarding treatment and follow-up for the affected individual.

Source assessment factors (in addition to the above):

- location and circumstances of exposure
- prevalence of HepB, HepC or HIV in the area/community where:
  - the source item or individual is from
  - exposure occurred
- any additional information on use of the source item or lifestyle of source individual e.g. IV drug user.

Note: Appropriate follow-up will also be determined for the risk of tetanus depending on the circumstance of exposure.

Ongoing medical management (summary only)

Hepatitis B

- post-exposure check of immune status
- hepatitis B vaccination is effective in preventing infection post-exposure for those who do not have immunity at the time of exposure
- post-exposure treatment to begin as soon as possible, preferably within 24 hours and no longer than 10 days. The first of the safe and effective HBV vaccine will be given at the same time. Can be given to pregnant women
- if exposed to HBV and receive treatment, it is very unlikely that infection will occur and that it may be passed onto someone else
- no precautions recommended for other person contact.

Hepatitis C

- no vaccine or immediate post-exposure prophylactic treatment is available.
- baseline HCV antibodies test, PCR for HCV and Liver function test will be carried out and repeated monthly for three months.
- it is very unlikely that infection will occur and that it may pass onto someone else.
- no precautions recommended for other person contact.

Human Immuno-deficiency virus

- no vaccine for HIV. Anti-viral treatments are available.
- anti-viral prophylactic treatment will be initiated within 2 hours of exposure and continue for at least four weeks and up to six weeks.
- HIV Antibody test as soon as possible post-exposure and at six weeks and 3, 6, 9 and 12 months.
- during follow-up period (especially the first 6 – 12 weeks when most infected persons are expected to show signs of infection, individual recommended to follow guidelines for prevention of transmission of HIV as follows:
- do not donate blood, semen or organs.
- refrain from unprotected sexual intercourse.
- if choose to have sexual intercourse, using a condom consistently and correctly may reduce the risk of HIV transmission.
- breast-feeding women will consider not breast-feeding to prevent potential exposure of their infants to HIV in breast milk.
- ongoing medical counselling as required.

Reference sources

AK Region H&S Note 01/2001 Significant Hazard Exposure/Specialist Advice

AK Region H&S Note 1/99 Blood Pathogen Exposure Decontamination

Infection Risk; National Occupational Health & Safety Commission; www.worksafe.gov.au

Needle-stick Injuries; OSHA; www.osha-slc.gov

Public Health Service Guidelines for the management of Health Care Worker Exposures to HIV and Recommendations for Post-Exposure Prophylaxis; www.cdc.gov

Blood-borne pathogen; OSHA Regulations;

Recommendations for Prevention of HIV Transmission in Health-care Settings; US Dept of Health and Human Services; www.cdc.gov

National Code of Practice for Health Care Workers and Other People at Risk of the Transmissions of Human Immuno-deficiency Virus and Hepatitis B in the Work-place; NOHSC; www.worksafe.gov.au

Forcing compliance with OSHA's Blood-borne Pathogen Standard; www.afscme.org

Needle-stick Injuries-OSHA Compliance; www.osha-slc.gov

Blood Related Accident Policy; Healthcare Otago; November 2000

Exposure to Blood; US Department of Health and Human Services; www.cdc.gov

Blood-borne Pathogens; OSHA Fact Sheet; www.osha.slc.gov

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Hepatitis and HIV/AIDS: Guide to the Fire Service, CFO Letter No. 10, Home Office, UK, 1995

Appendix 5 Asbestos Fibres Protocol

Nature of substance

Asbestos is a naturally occurring fibrous mineral. Its substance is made up of many microscopic hair-like fibres that vary in length and diameter according to the type of asbestos. The material has binding strength, insulation and heat resistant properties. All asbestos types are potentially hazardous to health.

Where asbestos is found

Vehicle brake and clutch linings and discontinued building products which include asbestos cement cladding, sprayed-on textured ceiling coatings, acoustic insulation, thermal (lagging) insulation on pipes, ducts, furnaces and boilers, fire protective linings on structural steel, floor coverings and some roofing and fencing products, particularly pre –1980.

Exposure route

Asbestos fibres, suspended in breathable air, enter the body through inhalation.

Passive fall-out occurs where asbestos becomes dry/ friable due to age and fibres "fall out" into breathable atmosphere, especially where there is a long-term exposure to heat and vibration.

Active fall-out occurs due to extreme deterioration or disturbance of material that releases high concentrations of fibres into the air. e.g.:

- accessing concealed spaces e.g. roof void, sub-floor, around plant and equipment, utility service areas, ducts, etc.
- using any cutting/abrasive tool on asbestos cement or other bonded product containing asbestos or dry sanding of floor covering backings containing asbestos
- venting fire conditions involving asbestos product
- post-fire salvage, ventilation, turnover or fire investigation work, particularly where asbestos product has been subjected to fire conditions.

Note: Asbestos washed into a waterway may wash up, dry out and permit fibres to become airborne and become a hazard to others. This risk to health is considered to be very minor unless it involves bulk quantities.

Nature of hazard

Asbestos is a risk to health only when inhaled. Exposure to significant levels of asbestos fibres over a significant period of time presents a health hazard.

The risk of contracting an asbestos-related disease is higher as the dose increases. A high dose over a short period is comparable to a low dose over a long period.

Asbestos exposure is defined as a significant hazard, but harm (asbestos related disease) does not usually occur, or is usually not detectable, until a significant time after exposure.

Risk of developing asbestos related disease depends on four factors:

- Type/size of asbestos fibre inhaled
- Number of asbestos fibres inhaled
- Length of times in which asbestos fibres were inhaled
- Individual factors, e.g. history of smoking

Target organs are the lungs. Potential health effects (all long term) consist of:

- asbestosis - scarring of lung tissue, usually caused by high dose over a long period (very slow development of 30 plus years)
- lung cancer - cellular dysfunction, increased risk for smokers
- mesothelioma - rare cancer in coverings of lungs and abdomen linked to blue and brown asbestos exposure
- pleural damage - usually in the form of "plaques" (small, firm scars) on the coverings of the lungs.

Exposure limits

Brief exposure to low concentrations is unlikely to be a major health risk (MoH 1996), however there is no known "safe" specific threshold of exposure.

"Significant Exposure to Asbestos" definition

The NZFS definition of "significant exposure to asbestos" is:

- any situation where a person is considered to have been exposed to an asbestos fibre/dust contaminated atmosphere and was not protected by the wearing of appropriate respiratory protection and other necessary personal protective equipment at the time of the exposure

Such exposure is reportable as a work accident.

It is not classifiable as significant exposure or reportable as a work accident where a person has been exposed to an asbestos fibre/dust contaminated atmosphere but has worn appropriate respiratory protection and other necessary personal protection throughout, and the person, their protective clothing and equipment has been appropriately decontaminated.

Regulatory controls in place

Asbestos is not now commonly used as a building product with the NZBC, clause F2 – Hazardous Building Materials setting rules for its use as a building material.

Work with existing in-place asbestos products is controlled by the *Health and Safety in Employment (Asbestos) Regulations 1998*.

Confirmation of Asbestos Presence at an Incident

Where asbestos is suspected, especially if the building was constructed pre-1985, the following procedure is to be followed:

- treat the building as if asbestos presence is confirmed until results of laboratory analysis prove otherwise
- notify the building owner of the situation. The building owner is responsible for arranging the testing for asbestos. Once samples have been collected, results of laboratory analysis will usually be available within 48 hours
- the local OSH branch will be contacted if asbestos is found in a workplace and advice sought, if/where required. If asbestos is found in a residential situation, the Ministry of Health - Public Protection Officer will be advised

Practical Control Measures

- treat as a significant hazard where asbestos is present or suspected
- all persons in area will wear appropriate protective clothing and breathing apparatus until all NZFS work is completed
- where the task is likely to be of a prolonged period, the use of Level 3 or Level 4 protective clothing will be considered for ease of post incident operations and decontamination
- water spray is a very effective medium for controlling asbestos fibres
- appropriate decontamination of equipment and clothing will take place.

Correctly worn Self-Contained Breathing Apparatus will provide total respiratory protection against asbestos.

Implement local dust level control measures:

- saturate contaminated area during clean-up/investigation
- continue to wet down with a fine spray on a regular basis
- do not use high-pressure water jets on bound asbestos products e.g. asbestos sheeting
- do not allow surfaces to dry, as asbestos fibres can then become air-borne
- minimise draught/airflow/heating through contaminated area
- minimise any cutting, grinding or other work that excessively disturbs fibres/dust.

Decontamination

- persons carrying out decontamination will wear eye protection, respiratory protection, disposable gloves and overalls
- all clothing worn for decontamination will be disposed or cleaned as appropriate
- most effective scene decontamination for clothing and equipment is high-pressure water wash-down

- personnel that have been exposed to asbestos will remain wearing BA and will not remove their protective clothing until they have been thoroughly soaked with water. Level 2 clothing will then be securely bagged, identified "Asbestos Contaminated – wash separately" and appropriately laundered. Clothing heavily contaminated with asbestos fibre will require assessment, as washing may not be effective in removing fibres
- breathing apparatus – wash thoroughly with water and detergent whilst charged

Containment and disposal

- any asbestos material or clothing to be disposed will be placed in sealed containers that suppress release of asbestos fibre/dust.
- containers will be clearly marked in letters at least 25mm high "Asbestos Hazard-wear respirator & protective clothing while handling contents"
- will be disposed of in a place approved by the territorial authority

Notification of asbestos-related incident

Workplaces: At an incident involving a workplace, the local OSH branch is to be notified.

Private dwellings: At an incident involving a private dwelling, the Ministry of Health – Public Health Protection Officer is to be notified.

Recording of exposure

Any personnel who meet the criteria for significant hazard exposure are to undergo full decontamination, and complete:

- *NZFS Accident Report Form* (FS 432/432a [OSH Kiosk])
- *G7a Significant Hazard Exposure & Decontamination Form FS431*
- District/Station Accident Register.

The Regional Health and Safety Advisor will contact affected individuals and seek consent to forward their exposure details onto the Asbestos Register. Repeat exposures do not require registering.

On-going health monitoring

- individuals will be monitored in accordance with the Asbestos Regulations 1998 and Medical Monitoring Schedules as published by OSH
- the Regional Health and Safety Advisor or other designated Officer, in liaison with the Regional Medical Officer (where available) will co-ordinate follow-up assessment, monitoring, treatment, health advice, welfare and counselling support with appropriate providers as required. Where a Regional Medical Officer is not available, the responsibility will default to the Principal Medical Officer
- the Regional Health and Safety Advisor or the accountable line manager will inform the Principal Medical Officer of all significant hazard exposures to asbestos

- any employee who leaves the FS will be advised if there is a need to continue with any recommended medical examinations
- the NZFS bears the responsibility and cost of further investigations, where in the opinion of a medical practitioner (with specialist qualifications in occupational or respiratory medicine and experience in asbestos related diseases and conditions), such future investigations are warranted
- medical records are to be kept for each employee as per NZFS policy.

Asbestos register

The asbestos register is for monitoring people who have been exposed to asbestos and consists of two parts:

Part 1 Exposure Register - Those reported as having been exposed to asbestos.

Part 2 Disease register - Those reported as having asbestos related disease.

Notifications to Part 1 can be made by those individuals who felt they had been exposed to asbestos, or by people acting on their behalf (and following consultation/consent), such as a medical practitioner, employer, union official, relative or friend.

Specific points of inquiry

- local OSH Branch
- the Registrar

  Asbestos Disease and Exposure Registers

  P.O. Box 3705

  WELLINGTON

  Ph: (04) 915-4466
- The Asbestos Disease Association of NZ (Inc.)

  P.O. Box 20035, Glen Eden

  WAITAKERE CITY

  Ph: (09) 827-4912

Reference Sources

A Deadly Dust: 50 years of asbestos use in NZ, Safeguard magazine, Dec 1991

A review of the asbestos situation (1990 – 2000), Asbestos Diseases Association, Grootegoed & Syret.

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Asbestos exposure in NZ, Glass, B; New Ethicals Journal, August 2001

Asbestos NZ 2001, Asbestos Diseases Association, Grootegoed & Syret

Guidelines for the Management and Removal of Asbestos, January 1999

Health and Safety in Employment (Asbestos) Regulations 1998

National Asbestos Register

NSW Fire Brigades, Safety Bulletin 2002/2 - Asbestos

OSH (DOL) "Asbestos – a deadly dust", 1999

OSH (DOL) "Asbestos exposure and disease" - Notes for the Medical Practitioner, July 2000

OSH (DOL) "Workplace Exposure Standards, 2002

OSH (DOL) Guide to the Asbestos Regulations 1998. December 1998

www.osh.dol.govt.nz

Record of amendments

Date	Brief description of amendment
Jan 2012	Changed code from RD1 to IS1
Sept 2013	Minor typo corrected. Some references to other operational documents updated.
Feb 2014	Amended to make the appointment of a Hazard Control Officer discretionary (i.e. consistent with other NZFS documents).