



New Zealand Fire Service Research Report

ENVIRONMENTAL CRITERIA IN FIRE-FIGHTING - REVIEW AND COMPARISON OF LEGISLATIVE, POLICY AND OPERATIONAL ENVIRONMENT FOR NZFS AND OVERSEAS COUNTERPARTS

INSTITUTE OF ENVIRONMENTAL SCIENCE AND RESEARCH

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The current policy of the New Zealand Fire Service is to take all practicable steps to extinguish and prevent the spread of the fire; as mandated under the New Zealand Fire Service Act 1975. The National Rural Fire Authority are required provide fire control measures to reduce the likelihood of fires propagating and to carry out fire control measures as per the Forest and Rural Fire Act 1977. However, fire-fighting authorities around the world are beginning to acknowledge the impact of their activities on the receiving environment and the effects of both atmospheric and terrestrial pollutants from smoke and fire-ground run-off from both incident response and training activities. The environmental criteria in fire-fighting project provides a review of New Zealand position relative to similar jurisdictions; assess the impact of the new generation of 'environmentally-friendly fire-fighting foams; and assess the critical parameters that might contribute to a New Zealand specific environmentally- aware firefighting model. This report provides a legislation and literature review of the environmental aspects of fire-fighting activities in New Zealand. Overseas jurisdictions that have published policy on environmental management in fire-fighting operations are also reviewed.

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**Environmental criteria in
fire-fighting - Review and
comparison of legislative,
policy and operational
environment for NZFS
and overseas
counterparts**



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TRUTH



PREPARED FOR: New Zealand Fire Service Commission
CLIENT REPORT No: CSC 15016
PREPARED BY: Matt Ashworth
REVIEWED BY: Dr Rob Lake

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Manager



Dr. Rob Lake

[Click here to enter text.](#)

Peer reviewer



Dr. Jan Gregor

[Click here to enter text.](#)

Author



Matt Ashworth

[Click here to enter text.](#)

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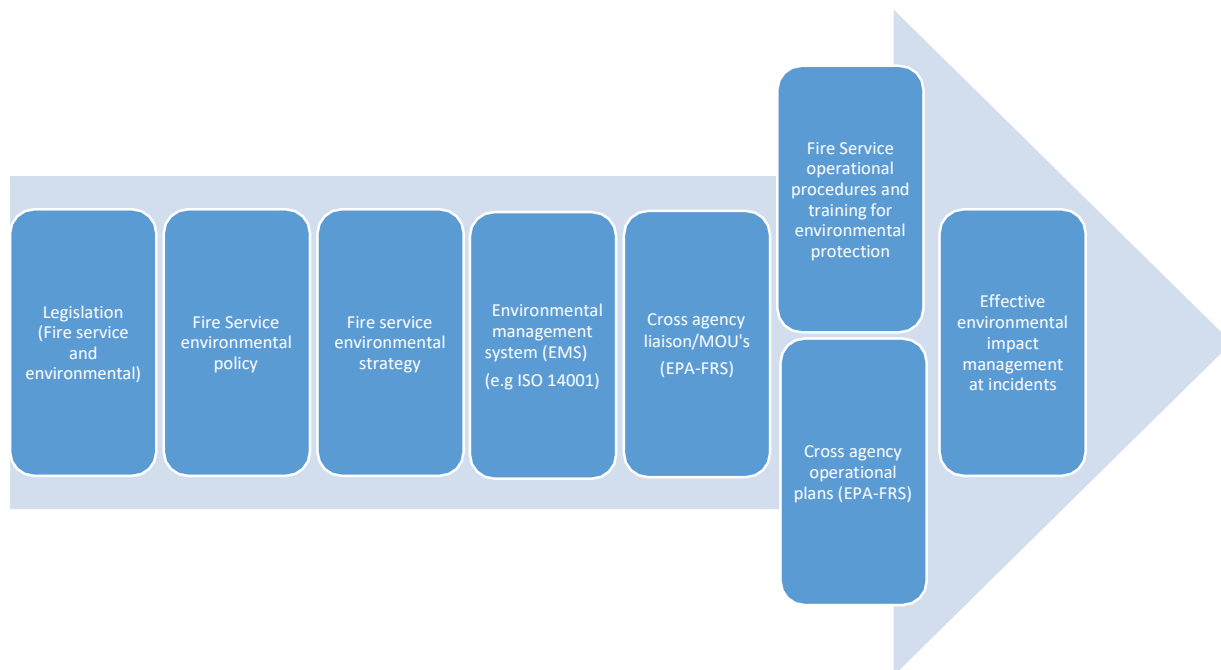
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EXECUTIVE SUMMARY

This report is intended to provide a snapshot of the current legislative, policy and operational environment that the New Zealand Fire Service Commission, the New Zealand Fire Service and the National Rural Fire Authority operate under with regard to protection of the environment during incident response, training exercises and the execution of day-to-day duties around the station and in the community.

The report goes on to provide similar snapshots for New Zealand's peer jurisdictions, England and Wales; Australia; the USA and Canada and Scotland. Comparisons of the extent of application and development of environmental criteria in fire-fighting are drawn using the England and Wales Fire and Rescue Service model as a gold standard benchmark.

The pathway to development of an effective and operationally useable environmental protection system is described based on the England and Wales Fire and Rescue services approach, with critical points along the path being the presence of environmental policy, strategy and strong and effective liaison with environmental regulators as shown below.



1. INTRODUCTION

The current policy of the New Zealand Fire Service is to take all practicable steps to extinguish and prevent the spread of the fire; as mandated under the New Zealand Fire Service Act 1975. The National Rural Fire Authority are required provide fire control measures to reduce the likelihood of fires propagating and to carry out fire control measures as per the Forest and Rural Fire Act 1977. However, fire-fighting authorities around the world are beginning to acknowledge the impact of their activities on the receiving environment and the effects of both atmospheric and terrestrial pollutants from smoke and fire-ground run-off from both incident response and training activities. The environmental criteria in fire-fighting project will provide a review of New Zealand position relative to similar jurisdictions; assess the impact of the new generation of 'environmentally-friendly fire-fighting foams; and assess the critical parameters that might contribute to a New Zealand specific environmentally-aware fire fighting model.

This report addresses Milestone 2 of the Environmental Criteria in Fire-Fighting project. It provides a legislation and literature review of the environmental aspects of fire-fighting activities in New Zealand. Overseas jurisdictions that have published policy on environmental management in fire-fighting operations are also reviewed.

The scope and sources for the review were described in the Milestone 1 report. Briefly they include:

- Legislation, regulations and guidelines from New Zealand and overseas developed countries.

This material was located via websites and personal contacts. Overarching legislation is described briefly for each jurisdiction, and available material specific to management of environmental issues is described in detail.

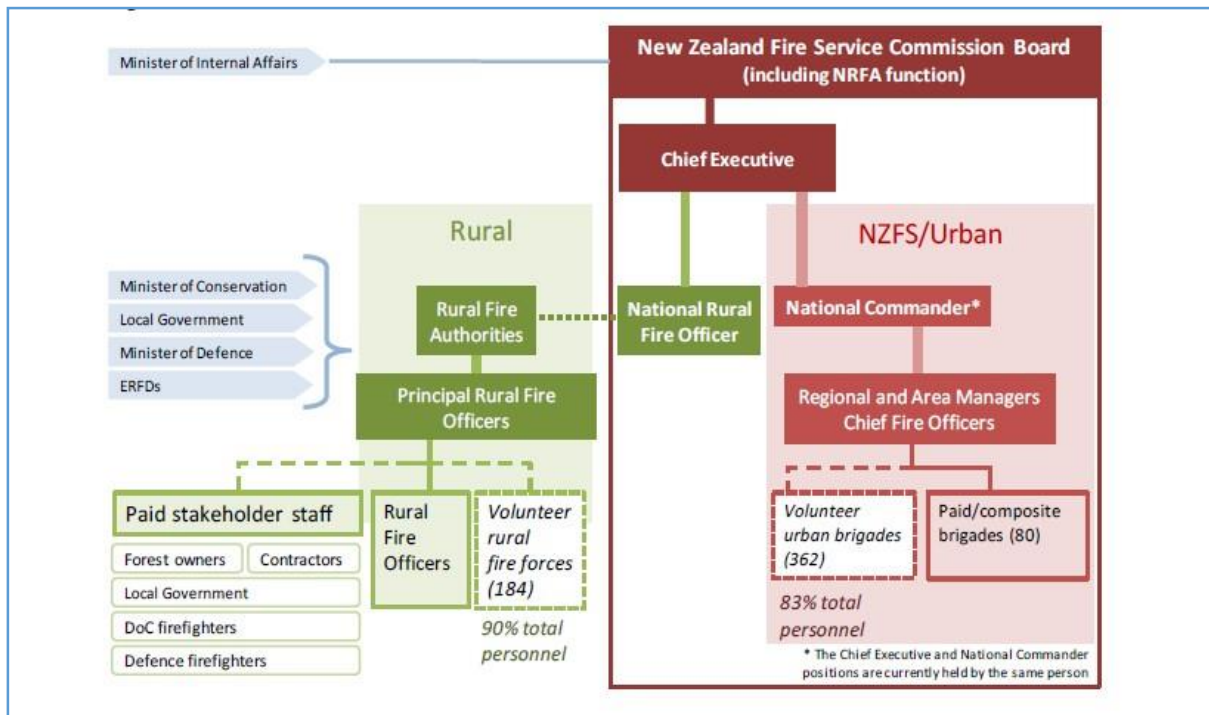
- The scientific literature using keyword searches and standard databases, as well as generalised internet searching.

The searches conducted are described, and relevant material listed.

2. NEW ZEALAND

The fire services in New Zealand are formed from three main entities, The New Zealand Fire Service Commission (NZFSC), the New Zealand Fire Service (NZFS) and the National Rural Fire Authority (NRFA) as shown in Figure 1. The NZFSC respond to the requirements from the Ministry for Internal Affairs and the NZFS and NRFA provide operational capability for fire and rescue activities throughout New Zealand.

Figure 1 Structure of Fire Services in New Zealand (2015)



2.1 FIRE SERVICE LEGISLATION

The NZFS and the NRFA statutory requirements are set out in three key pieces of legislation. These are:

- Fire Service Act (1975)¹
- Forest and Rural Fires Act (1977)²
- The Forest and Rural Fires Regulations (2005)³

Fire Service Act, 1975

The act places a duty on the NZFS and its representatives under section 28 (2) to “endeavour by all practicable means to extinguish and prevent the spread of the fire (if any), and to save lives and property in danger”. Similar duties are detailed under Section 28 (3A) to “endeavour by all practicable means to cause the stabilising or rendering safe of

¹ [Fire Service Act 1975 No 42 \(as at 05 August 2013\), Public Act Contents – New Zealand Legislation](#)

² [Forest and Rural Fires Act 1977 No 52 \(as at 01 July 2013\), Public Act Contents – New Zealand Legislation](#)

³ [Forest and Rural Fires Regulations 2005 \(SR 2005/153\) \(as at 01 July 2013\) Contents – New Zealand Legislation](#)

hazardous substances emergency, and save lives and property in danger”. The act places no duty on the Fire Service to act to preserve or protect the receiving environment from products arising from the fire-fighting or emergency response actions mandated under section 28(2) and (3A).

Forest and Rural Fire Act, 1977

The act places a duty on The NRFA and it’s staff to provide fire control measures to reduce the likelihood of fires propagating and to carry out fire control measures and provide a current fire plan for the fire area.

There is no overt provision or requirement in the act for protection of the environment from contamination arising from fire-fighting activities.

The Forest and Rural Fires Regulations, 2005

The regulations state under section 39 (s.39) that a Fire Authority must prepare a ‘Fire plan’ and that policies should be set out to demonstrate reduction (s.41), readiness (s.42), response (s.44) and recovery (46) phases. There is no explicit statement referring to protection of the environment in any of these sections, but in each section there is provision for production of policy and procedure for ‘other relevant matters (s.41.2f; s.42.2m; and 44.2f) and ‘any other recovery activities that occur after a fire has been contained’ (s.46.2e) that may allow opportunity for environmental mitigation to be included.

2.2 OTHER LEGISLATION

The Resource Management Act (RMA) (1991) ⁴

The RMA is the main piece of legislation that governs how the environment is managed in New Zealand. The RMA enables central government, through the Minister for the Environment, to prepare national policy statements and national environmental standards. National policy statements⁵ set out the requirements for councils to deal with resource management (environmental) issues; these prompt the production of regional policy statements and regional plans by regional councils⁶.

Under the RMA, the responsibility for making decisions usually lies with the local government, either regional councils or territorial authorities. Regional councils have specific responsibility for granting consents for discharges of contaminants to land, air or water; and the power to prosecute polluters is included under these responsibilities.

Under the RMA s.15 (discharge of contaminants to the environment) the following restrictions are applied

1. No person may discharge any –
 - a. Contaminant or water into water; or
 - b. Contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant) entering water;

⁴ [Resource Management Act 1991 No 69 \(as at 03 March 2015\), Public Act Contents – New Zealand Legislation](#)

⁵ [Example of National policy statement - National Policy Statement for Freshwater Management](#)

⁶ [Example Regional plan - Otago Regional Water plan 2004 \(updated 2015\)](#)

Unless the discharge is expressly allowed by a national environmental standard or other regulations, a rule in a regional plan as well as a rule in a proposed regional plan for the same region (if there is one), or as a resource consent.

2. No person may discharge a contaminant into the air, or into or onto the land, from a place or any other source, whether moveable or not, in a manner that contravenes a national environmental standard unless the discharge –
 - a. Is expressly allowed by other regulations; or
 - b. Is expressly allowed by a resource consent; or
 - c. Is an activity allowed under section 20A
- 2A No person may discharge a contaminant into the air, or into or onto the land, from a place or any other source, whether moveable or not, in a manner that contravenes a regional rule unless the discharge –
- a. Is expressly allowed by a national environmental standard or other regulations; or
 - b. Is expressly allowed by a resource consent; or
 - c. Is an activity allowed under section 20A

Section 17 the following sections apply to activities releasing environmental contaminants

1. Every person has a duty to avoid, remedy or mitigate adverse effects on the environment arising from an activity carried on by or on behalf of the person, whether or not the activity is carried in accordance with–
 - a. any of sections 10, 10A, 10B, and 20A; or
 - b. a national environmental standard, a rule , a resource consent, or a designation
2. The duty referred to in subsection (1) is not in itself enforceable against any person, and no person is liable to any other person for a breach of that duty.
3. Notwithstanding subsection (2), an enforcement order or abatement notice may be served under part 12 to–
 - a. Require a person to cease, or prohibit a person from commencing, anything that, in the opinion of the Environment Court or an enforcement officer, is or is likely to be noxious, dangerous, offensive, or objectionable to such an extent that it has or is likely to have an adverse effect on the environment; or
 - b. Require a person to do something that, in the opinion of the Environment Court or an enforcement officer' is necessary in order to avoid, remedy, or mitigate any actual or likely adverse effect on the environment caused by, or on behalf of, that person.

There are no statutory exemptions from the requirements of the resource management act. However, possible defences in case of emergencies are identified in s.18.

Resource Management - National Environmental Standards⁷

National Environmental Standards for Air Quality

The National Environmental Standards for Air provide statements on the prohibition of several activities that would cause the release of contaminants to atmosphere. The following prohibitions contain clauses which allow exceptions for fire-fighting training exercises. Regulation 9 states:

1. The burning of wire coated with any material is prohibited.
2. Subclause (1) does not apply if the wire is–
 - b. Part of a building that is burnt for the purpose of training firefighters.

Regulation 10 states:

1. The burning of oil in the open air is prohibited.
2. Subclause (1) does not apply if–
 - b. The burning is for the purpose of training firefighters;

Regulation 9(2) and regulation 10(2b) were substituted on 6 November 2008⁸ by regulation 5 and 6 respectively of the Resource Management (National Environmental Standards Relating to Certain Air Pollutants, Dioxins and other Toxics) Amendment Regulations, 2008. The regulations quoted here reflect that substitution.

A further amendment was added in 2011⁹ under Regulation 28: More stringent rule, resource consent, or bylaw prevails; which states that 'A rule, resource consent, or bylaw that is more stringent than these regulations prevails over the regulations'. This amendment has particular significance in respect to the contents of Regional Plans required under the RMA.

2.3 NEW ZEALAND FIRE SERVICE AND NATIONAL RURAL FIRE AUTHORITY ENVIRONMENTAL POLICY AND PROCEDURE

The NZFSC National Strategic Plan 2012 – 2017¹⁰ includes two sustainability targets under strategic objective 4, these relate to reduction or prevention of greenhouse gas emissions.

Environmental protection policy is provided through the NZFS Department of Operations and Training document 'G5 Protection of the Environment 2008'. The document lays out the requirements for protection of the environment at the level of Fire Region Manager and provides additional information regarding the liaison which should be undertaken at local levels to ensure compliance with the RMA. Such liaisons may be undertaken as specifically identified meetings, but also through the attendance and relationships which may be built within the regional Hazardous Substances Technical Liaison Committees.

⁷ [National environmental standards | Ministry for the Environment](#)

⁸ [Resource Management \(National Environmental Standards Relating to Certain Air Pollutants, Dioxins, and Other Toxics\) Amendment Regulations 2008 \(SR 2008/375\) – New Zealand Legislation](#)

⁹ [Resource Management \(National Environmental Standards for Air Quality\) Amendment Regulations 2011](#)

¹⁰ [NZFS - National Strategy 2012 - 2017](#)

2.4 ENVIRONMENTAL INCIDENT REPORTING FOR FIRE SERVICE ACTIVITIES

A request for information was prepared and submitted to the pollution hotline or pollution control teams of the regional authorities in New Zealand. The request was for information regarding notification or prosecution pollution incidents (aquatic, terrestrial or atmospheric) where the NZFS or NRFA had been cited as the party causing the release of contaminants. The majority of regional authorities reported that no prosecutions had been undertaken and that there was no reporting pollution incidents attributable to incident response, training exercises or day-to-day management of operations. However, Otago Regional Council reported that several incidents had been noted as complaints received from members of the public, but none had resulted in a prosecution. The complaints received between 1998 and 2012 follow:

- Oil in harbour due to Fire Brigade pumping out bilges of overturned boats – 1 complaint
- Foam used to extinguish fire, discharge into water stream – 3 complaints
- Derelict car at fire station's back yard dripping oil – 1 complaint
- Smoke/odour from house burn during Fire Service drill, 2 complaints

Additionally a reference was located on FireNet that mentioned an incident in Auckland where foam was allowed to enter a waterway through washing foam into stormwater drains. It was noted that the event attracted the attention of Auckland Regional Council environmental pollution officers, but no further action appears to have been taken.

3. ENGLAND AND WALES

The Fire and Rescue Service (FRS) of England and Wales demonstrate a strong institutional will to undertake environmental protection practice as part of their operational duties. The drivers for this commitment come from the desire to avoid prosecution under environmental legislation and to demonstrate good stewardship of the environment. Delivery of environmental best practice is supported by strong national-level strategic direction, operational procedures and guidelines, effective training and provision of appropriate equipment to respond effectively. In addition some fire brigades at the county (regional) level have undertaken and achieved attaining and maintaining ISO 14001 environmental management accreditation¹¹ or other forms of accreditation for their environmental management systems.

3.1 FIRE SERVICE LEGISLATION

The statutory requirements for FRS are set out in the Fire and Rescue Services Act 2004. The act allows FRS to take appropriate action if an incident harms, or is likely to harm, the environment, but it does not contain any specific duty or requirement to protect the environment. However, duties are identified for fire and rescue services in five areas of environmental legislation:

- Water quality
- Sewage systems
- Land and soil
- Waste
- Nature conservation

FRS can be prosecuted and be liable for clean-up costs if their actions cause or worsen pollution; so the awareness of their duties under environmental legislation and the availability of exceptions and defences to prosecution must be understood. Where fire-fighting activities may threaten to damage areas of nature conservation (see Section 3.2) the FRS have a legal obligation to consider the effect their action may have at incidents on or near such sites.

Additional to their responsibilities under the Fire and Rescue Act 2004, the FRS must be aware of their responsibilities under other relevant legislation which considers the environment, these currently are:

- The Fire and Rescue Services (Emergencies) (England) Order 2007
- Civil Contingencies Act 2004

The Fire and Rescue Services (Emergencies) (England) Order 2007

The Order places a duty on FRS in England to have the capability to remove chemical, biological, radiological, nuclear and explosive contaminants from people at an emergency. There is also a duty to contain water used for decontamination for a reasonable time. Fire and Rescue Services must take steps to prevent or limit environmental damage when

¹¹ [ISO 14000 - Environmental management - ISO](#)

decontaminating people. Similar duties are placed upon FRS in Wales under the Fire and Rescue Services (Emergencies) (Wales) Order 2007.

Civil Contingencies Act 2004

As category 1 responders, FRS are part of multi-agency response to civil emergencies. The role of the FRS under the act is to save life, and to protect property and the environment. To be an 'environmental emergency' an incident must be one of the following:

- Contamination of land, water or air with harmful biological, chemical or radioactive substance
- Flooding
- Disruption or destruction to plant life or animal life.

3.2 OTHER LEGISLATION

Responsibility for protecting the environment in England and Wales rests with the Environment Agency in England and Natural Resources Wales. Both organisations have similar duties and powers to protect and improve the environment. The term Environment Agencies will be used to describe these organisations for this report. At a national level nature conservation bodies are the enforcing authorities for open land such as sites of special scientific interest (SSSI), specific areas of conservation and special protection areas. The respective nature conservation agencies in England and Wales are Natural England and Natural Resources Wales.

Local Authorities have responsibility for environmental quality in relation to factors such as impact of smoke from fires and vehicle emissions and complaints relating to noise, litter and odour for sites not regulated by environment agencies.

3.2.1 Environmental Legislation

There are three pieces of legislation that relate to protection of the environment that the FRS must respond to in the execution of their duties:

- The Environmental Permitting (England and Wales) Regulations 2010 (EPR, 2010)
- Environmental Damage Regulations 2009
- Water Industry Act 1999

The Environmental Permitting (England and Wales) Regulations 2010.

Under the regulation it is an offence to cause or knowingly permit the release of pollution to ground or surface waters. This is unless the release is allowed by an environmental permit or exemption.

Under the regulation, 'to cause' is defined such that it must involve an active operation or the failure to take action. To 'knowingly permit' involves failing to prevent pollution where there is knowledge of it occurring.

The regulations do allow a defence where FRS actions cause pollution, but the following three criteria must be met:

- A discharge is made in an emergency to avoid danger to human health
- All reasonably practicable steps were taken to minimise pollution
- The relevant environment agency is informed of the incident as soon as possible.

Environmental Damage Regulations 2009.

Under the regulations FRS must take steps to prevent or reduce damage to the environment. They must notify the appropriate regulator of:

- Damage to a site of special scientific interest
- Damage to species and habitats outside SSSIs that are protected by EU legislation
- Serious long-term damage to ground water or surface water that results in decline of water status under the Water Framework Directive
- Contamination of the land by substances or organisms that cause significant risk to human health.

Under normal circumstances there is no defence against a breach of the regulations. However there is exemption for defined exceptional circumstances:

- Acts of terrorism
- Exceptional natural phenomena, if the operator has taken all reasonable precautions to prevent them
- Activities which have the sole purpose of protecting against natural disasters, and activities which have the main purpose of serving national defence or international security.

Water industry Act 1999

It is an offence to release polluting material into a sewer without having consent from the sewerage company. Sewerage companies must be informed when accidental releases occur.

3.3 OPERATIONAL PROCEDURES AND GUIDANCE

3.3.1 National level procedures and guidance

Fire and Rescue Authorities (FRA) are required by the National Framework¹² to produce local integrated risk management plans (IRMP) that set out the strategy, in collaboration with other agencies, for reducing commercial, economic and social impact of fires and other emergency incidents. The specific detail of how this should be achieved is reported through the IRMP Steering Group policy guidance for environmental protection¹³. The fulfilment of this requirement is achieved in part through the provision of an operational procedures handbook.

The FRS in partnership with the Environment Agencies first produced the 'Environmental Handbook for the Fire and Rescue Service' in 2008. It has recently undergone its first revision¹⁴ to ensure that lessons that have been learned in the last six years can be incorporated into the environmental management of the FRS in England and Wales. The aim of the guidance is 'to protect the environment at operational incidents, during training events and as part of the day-to-day management of FRS premises and activities' [1]. An

¹² [Department for Communities and Local Government - Fire and rescue national framework for England, July 2012.](#)

¹³ [IRMP Steering Group Integrated Risk Management: Policy Guidance - Environmental Protection](#)

¹⁴ [Link to 'Environmental Handbook for the Fire and Rescue Service' 2014 revision.](#)

abbreviated table of contents for the handbook is reproduced to demonstrate the scope of the document in Appendix A.

The handbook is supported in part with the supplementary publication ‘Environmental Protection new guidance catalogue’¹⁵ [2], from the National Operational Guidance Programme. The catalogue provides quick reference to areas of change or addition in the revised version of the Handbook; and quick access aide-memoires for operational fire-fighting. The concept of ‘hazard and control statements’ is used to provide a concise tabulated digest of hazards that may reasonably be expected to be present at a fire-ground. The table is reproduced below to demonstrate its utility:

Table 1 Example of ‘hazard and control statements’ for England and Wales FRS.

| Hazard | Control measures |
|----------------------------|--|
| Fire water run-off | Controlled burn Containment Recycling Reduction Disposal Operational risk information plan |
| Fire-fighting with foam | Containment Substitution Reduction Disposal |
| Smoke plumes | Controlled burn Extinguish Removal or separation Use of Air Quality Cell or appropriate function Operational risk information plan |
| Polluting materials | Access to specialist advice Containment Dilution Absorption Transportation Aeration Treatment Disposal Decontamination |
| Physical damage | Defined paths and tracks in protected areas Liaison with conservation bodies Operational risk information plan |
| High pressure oil pipeline | Containment Diversion Operational risk information plan |
| Wildfires | Containment Fire-fighting foam and chemicals Access to specialist advice High volume pumps Operational risk information plan |

¹⁵ [Environmental Protection guidance catalogue \(McGlashan, 2014\).](#)

The guidance catalogue then goes on to identify the appropriateness of individual control measures and the criteria that should be considered as part of the risk assessment when deciding appropriate strategy for managing the incident. An example of this is the table that is produced in the document that details when a ‘controlled burn’ is appropriate and factors which make it inappropriate; the table is reproduced below:

Table 2 examples of factors influencing the decision to use controlled burning as a pollutant control measure

| Controlled burn considered | Controlled burn inappropriate |
|---|---|
| Life of health is not at risk or a controlled burn will reduce risk to people | Life or health is at immediate risk or a controlled burn will increase risk to people |
| There is little chance of extinguishing the fire | There is a high chance of extinguishing the fire with minimal health or environmental impacts |
| Fighting the fire with other techniques could cause significant risks to firefighters | The fire is likely to spread widely or to high hazard areas |
| Property is beyond salvage | Important or valuable buildings are involved |
| Fire conditions, weather conditions and/or the local landscape are appropriate for minimising air quality impacts | Fire conditions, weather conditions and/or the local landscape are inappropriate |
| Fire water run-off could damage an area of high environmental sensitivity or value | Drainage from the site leads to an area of low environmental sensitivity or fire water is not polluting |
| Fire water run-off could affect drinking water sources or affect sewage treatment works | Fire water can be contained on site or off-site |

3.3.2 Regional and local procedures and guidelines

The FRS in England and Wales is managed at the county or regional level by the local Fire Authority. Each of the Fire Authorities are responsible for the provision of fire and rescue services in their area. The environmental management policy and procedure is also provided by each of these Fire Authorities to comply with their legal obligations. Environmental management systems (EMS) are widely used to coordinate, to a greater or lesser extent, the requirements for environmental protection during operational incidents and training, with more business-oriented sustainability processes. Examples of these are those of Merseyside FRS¹⁶, Greater Manchester FRS¹⁷ and West Midlands FRS¹⁸. In addition to providing these statements of intent, the Fire Authorities also report on the delivery of their goals against a series of metrics which are reported in Fire Authority Annual Reports or through similar feedback mechanisms such as sustainable development annual reports¹⁹.

The Environment Agency, Local Government Association and the Welsh Local Government Association produced ‘Working Better Together Protocol Series, Protocol 8, Fire and Rescue Service Issues’²⁰. The purpose of the protocol is to ensure the effective cooperation and communication between the FRS and the Environment Agency in dealing with emergency incidents. The protocol provides a framework for use by Fire Authorities and the local environment agency for mutual support at incidents in the delivery of effective management

¹⁶ [Merseyside FRS - Environmental Management Strategy](#)

¹⁷ [Greater Manchester Fire and Rescue Service - Sustainability](#)

¹⁸ [West Midlands FRS - Environmental Strategy](#)

¹⁹ [London Fire Brigade Sustainable Development Annual Report 2013 - 2014](#)

²⁰ [Working Better Together Protocol 8, Fire and Rescue Service Issues.](#)

of environmental impact. The protocol identifies areas of mutual interest and shared environmental outcomes as shown below:

Table 3 Areas of mutual interest for Environment Agency and FRS under the 'Working better together - Protocol 8'

| Area of mutual interest | Target to be achieved |
|--|--|
| Emergency planning and integrated risk management plans/risk reduction plans | Any integrated risk management plans/risk reduction plans which have either direct or indirect impact on the safety of the community through environmental protection (pollution control), flooding and controlled burn strategies will be developed in partnership with the Environment Agency. |
| Pollution incident management | All FRS will be equipped with grab-packs and specialist environmental protection equipment. |
| Training exercising and pollution prevention | All courses offered by the Fire Service College to be reviewed by the National Fire and Rescue Service Strategic Liaison Working Group and relevant environmental information incorporated into the course syllabus. |
| Information exchange | Local agreements signed between appropriate Environment Agency Regions and FRS. |
| Flood risk management | Completion of flood risk management annex supported by appropriate procedures and guidance. |

4. AUSTRALIA

The federal system of government in Australia gives the constitutional responsibility for emergency response with the states and territories. This includes preparedness for and mitigation of potential emergencies as well as response and recovery actions. State and territorial governments have to institute appropriate regulatory arrangements to protect life, property and the environment; as well as having primary responsibility for delivering emergency services to the community. They are also responsible for developing built environment fire safety codes, undertaking fire-related research, formulation of policy and providing advice on fire safety.

As such each state or territory has its own fire and rescue service and rural fire service; each of which produces their own policy and strategy for management of operations, including environmental management and stewardship.

The states of New South Wales and Victoria operate a model where urban and rural fire services are independent entities although in both cases urban and rural fire services are administered by the respective Minister for Police and Emergency Services.

Table 4 Jurisdiction and legislation covering urban and rural fire services in NSW and Victoria

| JURISDICTION | URBAN | RURAL |
|-----------------|--|--|
| New South Wales | NSW Fire and Rescue provides service to Greater Sydney area and regional centres. Legislation - Fire Brigades Act, 1989 | NSW Rural Fire Service, area covers 90% of NSW and is responsible for coordination of all agencies in a major bush-fire Legislation - Rural Fires Act 1997 |
| Victoria | The Metropolitan Fire and Emergency Service Board (MFB) provides urban fire services from Melbourne CBD to middle and outer suburbs. Legislation - Metropolitan Fire Brigades Act, 1958 | Country Fire Authority (CFA) is responsible for rural and urban fire suppression for outer Melbourne, regional centres and 'country Victoria'. Legislation - Country Fire Authority Act, 1958; Forests Act, 1958. |

Australian Capital Territory (ACT), Queensland, South Australia and Tasmania have urban and rural fire services under a single structure

Table 5 Jurisdiction and legislation for single agency urban and rural fire services

| JURISDICTION | CONTROLLING AGENCY | STRUCTURE |
|--------------|--|--|
| ACT | Emergency Service Agency, part of the Justice and Community Safety Directorate | ACT Fire and Rescue and ACT Rural Fire Service Legislation – Emergencies Act, 2004 |
| Queensland | Department of Community and Safety | The Queensland Fire and Rescue Service Legislation - Queensland Fire and Rescue Service Act, 2005 |

| | | |
|-----------------|----------------------------------|---|
| South Australia | SA Fire and Emergency Commission | Metropolitan Fire Service Brigade and Country Fire Service Legislation – Fire and Emergency Services Act, 2005 |
| Tasmania | The State Fire Commission | The Tasmania Fire Service Legislation – Fire Service Act, 1979 |

This report will take the state of Victoria as a case study; this is due to the active environmental strategy and policy that the jurisdiction has pursued.

4.1 FIRE SERVICE LEGISLATION (VICTORIA CASE STUDY)

The Metropolitan Fire Brigades Act (1958) is the principal legislation directing the activities of the Metropolitan Fire and Emergency Service Board (MFB). The act is similar to the New Zealand Fire Service Act (1975) in placing emphasis on protection of life, property and environment from fire or other incidents and mandates the Fire Authority to endeavour to extinguish fire by all practicable means. There is no overt statement or requirement placed on protection of the environment from contaminants arising from fire-fighting or other incident response activities.

The Country Fire Authority Act (1958) is one of the principal Acts directing the activities of Country Fire Authority (CFA). The Act places emphasis on protection of life, property and environment from fire or other incidents, and mandates the Fire Authority to endeavour to extinguish fire by all practicable means. As with the MFB there is no overt statement or requirement placed on protection of the environment from contaminants arising from fire-fighting or other incident response activities. The Forests Act (1958) is the second principal Act to which the CFA responds. Sections 62 – 72 identify the activities around regulation and prevention of fire in forest areas; they do not address fire-fighting activities.

4.2 OTHER LEGISLATION

In addition to these principal acts the MFB and CFA are subject to the Environmental Protection Act (1970) and its subsequent amendments. The Act requires licensing of activities resulting in the release of contaminants to the environment, and the Fire Services are subject to these requirements. The Act then states that with respect to water, air and soil (compartments) that discharges should be in accordance with State environmental protection policy; and that no person should pollute these compartments so that:

...the physical, chemical or biological condition is changed as to make or reasonably be expected to make the 'compartment' unclean, noxious, poisonous, or impure, detrimental to the health, welfare, safety of property of human beings, poisonous or harmful to animals, birds, wildlife, fish or other aquatic life, or plants or so as to be detrimental to any beneficial use of the environment.

4.3 FIRE SERVICE ENVIRONMENTAL POLICY AND STRATEGY

4.3.1 Country Fire Authority

The CFA produced a comprehensive environment strategy document in 2003²¹, which contains the CFA environment policy statement. The policy statement identifies

²¹ [CFA environment strategy 2003](#)

environmental action plans (EAP) for the main types of incidents and training events attended by the service. The EAP includes identification of the incident type, the likely environmental effects, the minimisation goals, and key actions to enable minimisation goals. EAP's are intended as a reference to document actions that will help the CFA improve environmental management performance over time. An example from the policy is given in Figure 2:

Figure 2 Example of environment action plan promulgated by CFA

| |
|--|
| <p>Environment Action Plan: Structural fire</p> <p><u>Effects</u></p> <ul style="list-style-type: none"> • High volumes of water. • Fire water run-off including combustion products and fire-fighting foam. • Smoke. <p><u>Goals</u></p> <ul style="list-style-type: none"> - Minimise impacts on the environment and maximise benefits. <p><u>Key Actions</u></p> <ul style="list-style-type: none"> - Minimise pollution and resource use and further develop strategies for fire water run-off, foam use and smoke management. - Maximise planning and preparedness. - Continue to maximise prevention through: <ul style="list-style-type: none"> - Developing guidelines for advice to industry, and - Encouraging appropriate fire water management practices for business premises. |
|--|

The CFA environmental strategy report then identifies key activities that impact on the environment and assesses the benefits or risks posed by each activity. The rating that each activity receives under the reporting matrix is used to prioritise the order in which they are addressed.

The adoption of this strategy has led to the integration of environmental management policies into the operational activities of the CFA. An example of this is the 'Fire Ecology – Guide to environmentally sustainable bush fire management in rural Victoria'²². The guide provides information for operational staff around decision making for preparedness and prevention activities as well as fire-fighting operations; that will provide the best outcomes with regard to protection of the environment. The guide also serves to demonstrate how environmental and ecological needs have become part of the institutional thinking at state and CFA level. Excerpts that demonstrate this are shown in Figure 3.

Figure 3 Policy statement excerpts from CFA 'Fire Ecology Guide'

| |
|--|
| <p>The Living with fire strategy (Government of Victoria 2008) provides directions for achieving this vision, including better integration of ecological needs in fire management planning to promote ecosystem health and resilience.</p> <p>The CFA environmental care policy states: "CFA aims to deliver its services in a safe, efficient and effective manner while protecting the environment wherever possible for future generations" (CFA 2003).</p> |
|--|

²² [Sustainable Fire Management - Country Fire Authority](#)

The CFA Chief Officer's Standing Order 16: Environmental care states: "In any activity, CFA members shall consider the effects of their activities on the environment and where practical take steps to minimise negative effects and maximise benefits" (CFA 2005a).

The CFA Chief Officer's SOP 9-28: Strategy and tactics states: "Consider the environment in developing your control strategies and in your operations. Seek specialist advice where required to help you with these issues. Include environmental precautions in briefings. Be aware of water and debris runoff. If your operations are likely to cause disturbance requiring rehabilitation, notify the appropriate agencies to help a smooth transition to the recovery phase" (CFA 2005b).

Environmental notes in the CFA Chief Officer's SOP: Prescribed burning (CFA 2009a) state:

- "The planning of a prescribed burn will be consistent with environmental management standards and practices as outlined in the CFA Environmental care policy and Chief Officer's Standing Order 16 – Environmental care.
- "The planner must seek advice on matters of conservation significance, which need to be addressed in a prescribed burn operation, including threatened flora and fauna. This includes ideal fire intervals identified in ecological burning strategies.
- "Plan any use of class A foam in accordance with CFA procedures and avoid its use near watercourses and certified organic farms.
- "The prescribed burn must be planned to manage the impact of smoke on the community. Appropriate notifications should be made in advance.
- "Plan control lines to minimise soil disturbance, and plan for rehabilitation of control lines where necessary after the burn has been declared safe."

Environmental strategy is now maintained as part of routine strategic refreshes and is included as part of CFA annual plans under the 'Community Risk' heading.

4.3.2 Metropolitan Fire and Emergency Service Board

MFB environment policy was provided to ESR by e-mail as the online link to the service was broken. The most recent version was authorised by the Board of MFB in 2014²³. The environment policy undergoes annual review to ensure that it remains current. The policy provides confirmation of its universal scope of application within MFB, and identifies the roles and responsibilities of all staff and executives in delivery of the following stated environmental outcomes:

- Comply with applicable legislation and other requirements that MFB has committed to;
- Actions to reduce the environmental impact of our operations;
- Actions to minimise pollution;
- Minimise consumption, the amount of waste production onsite and maximise recycling;
- Utilise sustainable purchasing principles when purchasing products and services and encourage our suppliers and contractors to meet high standards of environmental management and performance;

²³ [Environment - Metropolitan Fire and Emergency Services Board](#)

- Embed ecological sustainable design (ESD) in station and building works, including consideration to research innovative technologies;
- Providing environmental training to operational firefighters, corporate staff and contractors;
- Build partnerships and share knowledge within the emergency services sector and the community;
- Set targets, measures and actions to deliver our policy commitments;
- Annually report on our environmental performance internally and externally;
- Undergo periodic independent EMS audits and other benchmarking tools.

5. USA AND CANADA

The United States Environment Protection Agency (USEPA) administers key national legislation that directs protection of the environment, the principal acts are:

- The Clean Air Act (1970)²⁴
- Clean Water Act (1972)²⁵
- Pollution Prevention Act (1990)²⁶, and
- Emergency Planning and Community Right To Know Act (1986)²⁷

These acts require that pollution be prevented from entering the environment and are broadly similar in application to environmental legislation detailed for other jurisdictions.

National level coordination of fire and emergency services is undertaken through the Federal Emergency Management Authority (FEMA) and it's subordinate organisation the US Fire Administration.

Maintenance and development of fire and rescue services is carried out by Fire Departments that are funded at local or county government level; there are also a number of privately funded fire departments.

Through reference to strategic plans of a number of Fire Departments²⁸ it is apparent that the predominant approach to environmental management is through adoption of environmental sustainability targets such as greenhouse gas emission reduction; reduced consumption of materials, fleet renewal and sustainable building practice. They do not address issues surrounding environmental management and protection during fire-fighting or other incident response. The author has been unable to identify any Fire Departments who have referenced protection of the environment from fire-fighting and incident response activities

Canada operates a similar system to the USA with Federal laws serving the requirement of Federal constitutional powers. The Provincial laws are based on the provincial constitutional requirements; and each province has its own environmental statutes. The principal of 'Polluter pays' is enshrined in Federal and Provincial law.

Fire Departments in Canada are funded through local government and, in general, appear to be part of the municipal service provision. During the course of the research for this report the author was unable to find specific detail regarding the use of environmental management systems or environmental sustainability strategies by fire departments. However, as already detailed, fire departments appear to operate as a municipal service, so local government strategies may be in force with regard to goal setting for the fire departments. It is likely that fire departments would be working towards environmental sustainability targets as in the USA as opposed to managing the impact of fire-fighting operations on the environment.

²⁴ [Summary of the Clean Air Act | Laws & Regulations | US EPA](#)

²⁵ [Summary of the Clean Water Act | Laws & Regulations | US EPA](#)

²⁶ [Summary of the Pollution Prevention Act | Laws & Regulations | US EPA](#)

²⁷ [Summary of the Emergency Planning & Community Right-to-Know Act | Laws & Regulations | US EPA](#)

²⁸ [Los Angeles Fire Department strategic plan 2015-2017](#), [Alameda County Fire Department Strategic Plan 201 - 2017](#), [Los Angeles County Fire Department Strategic Action Plan 2012 - 2017](#), [Manhattan Beach Fire Department - Green Team](#), [Town of Cary Fire Department Sustainability Research paper](#).

6. SCOTLAND

The Scottish Fire and Rescue Service (SFRS) is a relatively new organisation, having been formed in 2013 by amalgamation of the previous eight fire and rescue services. The SFRS environmental strategy 2014 – 2017²⁹ is the first as a unified national body. The strategy includes a strong environmental policy statement that leverages off the need to adhere to a recent Scottish Government publication “the Fire and Rescue Framework for Scotland (2013)”. The framework presents, amongst the other requirements on the SFRS, environmental performance objectives and expectations around both sustainability targets and reduction of environmental impacts from operational and training activities. The environmental policy identifies the development of an EMS as a tool to assist in achieving their commitments.

Prior to the inception of the unified SFRS, the Scottish Environment Protection Agency (SEPA) and the Chief Fire Officer Association (Scotland) representing the Scottish Fire and Rescue Services entered into:

1. a Strategic Memorandum of Understanding³⁰ (MOU), and
2. a Memorandum of Understanding (Operational Protocols)³¹

The strategic MOU identifies areas of common interest between the two groups and where, when and how coordination of action and operational support will be undertaken to protect the environment. The MOU (Operational Protocols) identifies:

1. The composition of a tactical level working group with representatives from SEPA and SFRS to develop joint operational procedures.
2. The roles and responsibilities, in particular empowering SRFS incident commander to make tactical decisions allowing reasonable practicable steps for reduction or minimisation of environmental pollution to be superseded by best fire-fighting and rescue practice.
3. That through liaison with SEPA, and where reasonably practicable, the SRFS will adopt operational procedures which will prevent, reduce or minimise pollution of the environment.
4. Agreement on 10 Joint Operational Protocols (run-off from fire-fighting activities; controlled burns; use of fire-fighting foams; end of life vehicles; chemical incidents; waste from road traffic

The MOU (Operational Procedures) also provides a suggested layout for an environment protection ‘incident card’, which provides generic guidance to SRFS when dealing with certain types of incidents and illustrates when SEPA should be contacted. The CFOA (Scotland) then assist with the implementation and support of the identified actions and procedures through production of fire service operational procedures and training opportunities.

²⁹ [SFRS environmental strategy 2014 - 2017](#)

³⁰ [SEPA-CFOA \(Scotland\) MOU 28-04-05](#)

³¹ [SEPA-CFOA \(Scotland\) MOU Operational Protocols 28-04-05](#)

7. OTHER JURISDICTIONS

South Korea and Japan were originally intended to be part of the review, however the language barrier and relatively small volume of material available in English meant that it has not been possible to assess those national systems to an extent that would be valuable to the report.

8. SCIENTIFIC LITERATURE REVIEW

Searches were made of scientific literature databases and the internet to locate material relevant to environmental effects and management of fire-fighting activities. The searches performed and records reviewed are described in Appendix B. Records were reviewed by title. A total of 28 potentially useful published papers and reports were located by this searching. Most of the relevant records were reports on the toxicology or ecotoxicology of chemicals used in fire-fighting. The others mostly concerned recovery of vegetation after fires.

All potentially relevant records were added to an EndNote citation database. Seven other articles found via Google links were saved.

Below is a brief description of the small amount of relevant material located.

8.1 CASE STUDY

Collateral Damage: The Environmental Effects of Fire-fighting (Ingalsbee, 2004, available from: http://www.fire-ecology.org/research/biscuit_suppression.html accessed 14 October 2015)

This article describes experience and lessons learnt from a major wildfire in Oregon in 2002. The environmental effects described include:

- Direct Environmental Effects:
 - Fireline construction
 - Tree felling
 - Chemical use
 - Water use
 - Suppression firing operations
- Indirect environmental effects
 - Off-highway vehicle use
 - Road reconstruction
 - Spread of noxious and invasive weeds
 - Post fire logging

Under chemical use, the article describes the use of fire retardants, which are mixtures of chemicals and water which cling to organic matter and make biomass difficult to burn for a limited time. Retardants are mixtures of 80% water, 10% fertiliser, and 10% chemical additives. Popular retardants are PhosChek which breaks down to ammonia and phosphoric acid at temperatures above 200 degrees, and Fire-Trol which degrades to cyanide which maybe toxic to wildlife. The fertiliser may also have longer term effects in weed growth. The article comments that rapid intervention by fire fighters after application of retardant is essential to take advantage of the temporary effect.

Water use may have unintended consequences in the spread of contaminants (e.g. plant pathogens) from the water source. Measures to control this, such as chlorination of the water, may also have unintended consequences after application.

One of the recommendations of the article is to advocate for “firefighter training, performance measures, and new research and development in minimum impact suppression tactics”.

8.2 TOXICOLOGY AND ECOTOXICOLOGY

The articles identified in this section relate primarily to the toxicological effects of fire-fighting chemicals on specific species within ecosystems or that are used in standard ecotoxicology tests. These types of data can be used when preparing advice to be included in guidance literature for operators.

Haloalkanes [3] (obsolete)

Fire retardant and suppressant effects on rainbow trout [4]

Eco-Toxicological Evaluation of Fire-Fighting Foams in Small-Sized Aquatic and Semi-Aquatic Biotopes [5]

Perfluorinated Surfactants and the Environmental Implications of Their Use in Fire-Fighting Foams [6]

Neurotoxic effects of perfluoroalkylated compounds: mechanisms of action and environmental relevance [7]

Acute toxicity of fire control chemicals to *Daphnia magna* (Straus) and *Selenastrum capricornutum* (Printz) [8]

Acute toxicity of fire-retardant and foam-suppressant chemicals to *Hyaella azteca* (Saussure) [9]

8.3 BIODEGRADATION AND MONITORING

The articles identified below relate to the environmental persistence and analysis of fire-fighting chemicals in varying environmental compartments. They provide an example of the type of data that can be accessed to determine the appropriateness of a chemical for application in particular incident scenarios.

Fluorinated fire-fighting foams [10]

Environmental levels and distribution of structural isomers of perfluoroalkyl acids after aqueous fire-fighting foam [11]

Determination of perfluorocarboxylates in groundwater impacted by fire-fighting activity [12]

Perfluorinated surfactants and the environmental implications of their use in fire-fighting foams [6]

Monitoring perfluorinated surfactants in biota and surface water samples following an accidental release of fire-fighting foam into Etobicoke Creek [13]

9. DISCUSSION

The range of approaches and level of engagement in environmental management and sustainability reported across the jurisdictions has been highly variable. The most comprehensive approach appears to be that of the England and Wales Fire and Rescue Services. A brief summary of the development stage that the reported jurisdictions have reached with regard to environmental criteria for fire-fighting is provided in Table 6. The England and Wales FRS framework, the elements of which are summarised in the left-hand column, will be used as a gold standard benchmark. The other jurisdictions will be compared against this benchmark by indicating whether or not an element is present in their existing systems.

Table 6 Comparison of the reviewed jurisdictions against England and Wales FRS bench mark.

| Criteria contributing to effective delivery of environmental protection systems for fire and rescue incident response | England & Wales | Australia (Victoria) | USA and Canada | Scotland | New Zealand |
|---|-----------------|----------------------|----------------|----------|-------------|
| Legislation (fire service and environmental) | ✓ | ✓ | ✓ | ✓ | ✓ |
| Fire Service Environmental Policy | ✓ | ✓ | – | ✓ | ✓ |
| Fire Service Environmental Strategy | ✓ | ✓ | – | ✓ | ✓ |
| Environmental Management System | ✓ | ✓ | ✗ | – | ✗ |
| Cross Agency Liaison | ✓ | ✓ | – | ✓ | – |
| Memoranda of Understanding (EPA-FRS) | ✓ | – | ✗ | ✓ | ✗ |
| Fire Service operational procedures for environmental protection | ✓ | – | ✗ | – | ✓ |
| Cross-agency Operational plans (EPA-FRS) | ✓ | – | ✗ | ✓ | – |

Key to table: ✓ criteria present; – tentative; ✗ criteria absent

* Presence of a policy is not consistent across Fire Departments

The system in place in England and Wales leverages off environmental legislation that is relatively recent (1999, 2009, 2010), this means that the FRS are responding to a more current interpretation and understanding of the importance of the environment than many of the other jurisdictions, with the exception of Scotland. The requirement to include environmental protection in operational situations is due to the liability that the FRS are faced with should a release occur. Additionally, the Fire Service legislation is also relatively new (2004) and so is also aligned with current thinking on the importance of the environment. These factors contribute to the England and Wales FRS producing strong environmental policy and strategy which both drives and supports the achievement of the lower tier criteria.

The success of the England and Wales FRS system appears to be the close working relationship that has been developed with the key environmental stakeholders. The relationship between the Environment Agency and the CFOA/FRS has matured to a point where it appears that a high degree of cooperation is enabled, leading to the development of more readily deliverable operational outcomes. An indicator of the quality of the relationship

that has come through the liaison is the provision of the Environmental Handbook for the Fire and Rescue Service, 2008 (revised 2014). The varying EMS used across the regional FRS also appear to be functional and provide the evidence to show compliance from sustainability efforts all the way through to pollution management.

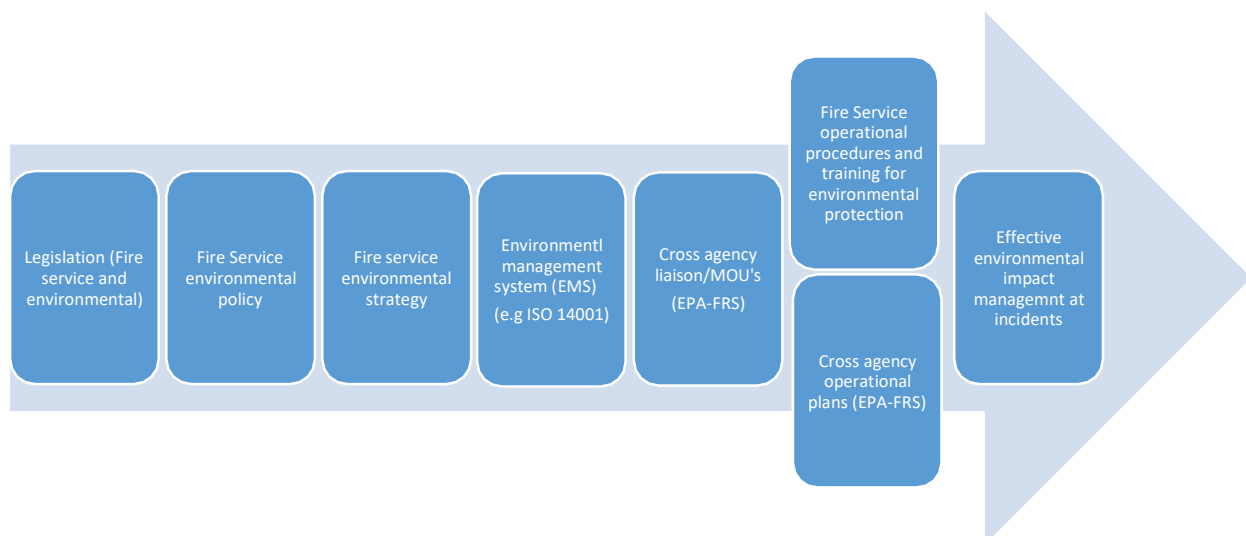
The Scottish model is also a valuable one to learn from, and appears to be on a similar trajectory to the England and Wales model. The absence of an EMS and an equivalent document to the Environmental Handbook for the Fire and Rescue Service may be due to the time it takes to create such documents and the short period that the amalgamated SFRS has been in operation. As with the England and Wales model, a significant factor in the development of the system in Scotland appears to be the positive engagement that is undertaken with the environmental regulator, SEPA.

The New Zealand position is less advanced, the older Fire Acts (1975 and 1977) do not place emphasis on minimisation of pollution. Although clauses referring to protecting the environment are present, the intent seems to be to protect the environment from fire/hazardous materials. The relatively recent RMA (1991) identifies a number of prohibitions for release of pollutants to the environment and provides no statutory exemption for fire services. Additionally the role of regional authorities as environmental regulator and for production of regional plans for protection of the environment adds a further tier of compliance that must be achieved. The liaison with the regional authorities with regard to prevention of pollution arising from fire-fighting or incident management is not formalised, but appear to be underway in some regions through the Hazardous Substances Technical Liaison Committees.

From the survey of the regional authorities undertaken for this report, there appear to be relatively few complaints recorded, and no convictions for release of pollutants to the environment from fire-fighting activities.

A factor that may be pertinent but at present is difficult to determine the impact of, is the organisational balance of the liaising parties and the impact that it has on the quality of the relationship. In the England and Wales model, the Environment Agency is a single National entity with regional branches representing the collective interest; and the FRS are regional or county-based organisations. The dynamic in Scotland, since the amalgamation of the eight FRS into the SFRS is different, with both SFRS and SEPA being large national-level organisations.

Figure 4 An indicative pathway to providing effective environmental pollution management at incidents.





10. APPENDIX A

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11. APPENDIX B

11.1 ENVIRONMENTAL FIRE-FIGHTING LITERATURE SEARCHING

Web of Science (no date restrictions)

New Zealand fire-fighting: 2 records – neither relevant

New Zealand fire-fighting environmental impact: no records

New Zealand fire-fighting environmental management: no records

New Zealand fire-fighting sustainability: no records

New Zealand fire-fighting pollution: no records

New Zealand fire-fighting prosecution AND RMA OR Resource Management Act: 6286 records – reviewed first 50 records – none relevant (including the word “management” spreads a very wide net)

New Zealand fire environmental: 79 records – none relevant

New Zealand fire: 606 records – 11 potentially relevant

Environment fire-fighting: 279 records – 11 potentially relevant

PubMed

New Zealand fire: 261 records – 2 relevant

Google

Environment fire-fighting: reviewed first 100 links – 12 potentially relevant, 7 retrieved

Specific journals:

Fire Safety Journal (searched via Science Direct):

Environmental fire-fighting: 83 records – 4 relevant

Fire Ecology (<http://fireecologyjournal.org/journal-archive/>)

Fire-fighting environmental: 53 results – none relevant



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**INSTITUTE OF ENVIRONMENTAL
SCIENCE AND RESEARCH LIMITED**

- ▀ **Kenepuru Science Centre**
34 Kenepuru Drive, Kenepuru, Porirua 5022
PO Box 50348, Porirua 5240
New Zealand
T: +64 4 914 0700 F: +64 4 914 0770

- ▀ **Mt Albert Science Centre**
120 Mt Albert Road, Sandringham, Auckland 1025
Private Bag 92021, Auckland 1142
New Zealand
T: +64 9 815 3670 F: +64 9 849 6046

- ▀ **NCBID – Wallaceville**
66 Ward Street, Wallaceville, Upper Hutt 5018
PO Box 40158, Upper Hutt 5140
New Zealand
T: +64 4 529 0600 F: +64 4 529 0601

- ▀ **Christchurch Science Centre**
27 Creyke Road, Ilam, Christchurch 8041
PO Box 29181, Christchurch 8540
New Zealand
T: +64 3 351 6019 F: +64 3 351 0010

www.esr.cri.nz