HSNO Indicators

Prepared for

Ministry for the Environment

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NAVIGATUS CONSULTING in association with Inside OutWorks

HSNO Indicators

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Glossary

The following terms and abbreviations are used in this report. Some of these terms are different from the terminology used in the New Zealand hazardous substances control system. Where direct reference is made to the New Zealand system – e.g. the Hazardous Substances and New Organisms Act and / or regulations the terms used will be those of the Act or regulations and noted as such.

Term	**Definition**
Active Ingredient	Pesticide present in a formulation as described by the common name. The part of a pesticide formulation from which the biological effect is obtained (FAO. 1995).
ACVM Act	Agricultural Compounds and Veterinary Medicines Act (New Zealand).
ADG Code	Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011. *Note*: The Code is national in extent and called up by State dangerous good transport regulations. Largely derived from the UNRTDG 15th Edn.
ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road. References in the report are to the current version (January 2011). *Note*: Abbreviation derives from the French title of the original agreement: *Accord européen relatif au transport international des marchandises dangereuses par route*.
Agrichemical	Agricultural chemical used in crop and food production including pesticide, feed additive, veterinary drug and related compounds.
AS (number)	Australian Standard (followed by a number). *Note*: Australian Standards documents are frequently used as mean of compliance or compulsory solutions (e.g. requirements for design of systems components etc.) in Australian regulations.
ATEX (directive)	Two European Union directives describing what equipment and work environments are allowed in an environment with an explosive atmosphere. *Note*: Name derives from the French title of the 94/9/EC directive: *Appareils utilises à être utilises en Atmosphères Explosives*.
CAS	Chemical Abstracts Service. CAS provides a universal numbering system to uniquely identify chemicals.
Category (or Hazard Category)	The division of criteria within each hazard class, e.g. oral acute toxicity includes five hazard categories and flammable liquids includes four hazard categories. These categories compare hazard severity within a hazard class and should not be taken as a comparison of hazard categories more generally. *Note*: Definition is taken from the GHS.
CFR	"Cost and Freight" - A term of sale where the seller pays the costs and freight necessary to bring the goods to the named port of destination, but the risk of loss or damage of the goods (as well as any additional costs due to events occurring after the time the goods have been delivered on board the vessel) is transferred from the seller to the buyer when the goods pass the ship's rail in the port of shipment. The CFR term requires the seller to clear the goods for export.
Chemical	A generic term used to encompass pure chemical entities, substances (as defined by the GHS) and mixtures.
CHIP	UK Chemicals (Hazard Information and Packaging for Supply) Regulations. *Note*: These regulations are currently at version 4 so reference is frequently made to CHIP 4.
CIF	"Cost, Insurance and Freight" - A term of sale where the seller has the same obligations as under the CFR but also has to procure marine insurance against the buyer's risk of loss or damage to the goods during the carriage. The seller contracts for insurance and pays the insurance premium. The CIF term requires the seller to clear the goods for export.
Competent authority	A national body or authority designated or otherwise recognized as such in respect of enforcement, compliance inspection or (specifically in relation to the GHS) setting requirements in relation to discretionary matters within the scope of the Globally

Term	Definition
	Harmonised System.
Class (or Hazard class)	Means the nature of the physical, health or environmental hazard, e.g. flammable solid, carcinogen, oral acute toxicity; etc. *Note*: Definition is taken from the GHS. The term class is used in the HSNO regime to encompass both GHS class and category (e.g. class 6.1A). This notation is a modified form of that used by UNRTDG.
CLP	Regulation (Ec) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures. *Note*: The CLP regulation is in force or to be brought into force in 27 EU member states and so is being used as the baseline requirement for chemical hazard classification and labelling for this study.
COMAH (regulations)	Control of Major Accident Hazards Regulations (UK and Ireland). *Note*: The regulations are distinct in each jurisdiction, but both implement the so called Sevaso II directive of the European Union and so have similar effect.
Consumer Price Index	The consumer price index (CPI) measures changes over time in the general level of prices of goods and services that a reference population acquires, uses or pays for consumption.
Controls	Obligations imposed on chemical suppliers and users to manage the chemical in particular ways. Usually imposed under law or regulation but controls may also be imposed through technical documents referenced by regulation or by competent authorities. *Note:* In this report controls are divided into three types: } Obligations to provide or hold information about the hazards uses, production etc of a chemical } Obligations to provide information about chemical hazard and to package or contain the chemical to meet certain specification } Obligations to take steps to reduce likelihood or consequence of adverse effects from chemicals – called risk management controls in this report.
Data protection	Refers to intellectual property protection afforded to data provided to register a product.
Dumping	Dumping refers to the practice by firms of selling products abroad at below costs or significantly below prices in the home market. The former implies predatory pricing; the latter, price discrimination.
EC	European Commission. *Note*: The term EU is more commonly used.
Eco-toxicity	Refers to the potential for chemical stressors to affect ecosystems. *Note*: The GHS limits the scope to hazardous to the aquatic environment. However, the term is used in the broader sense in the HSNO Act and regulations.
End User Price	The End User price is the amount paid by the purchaser, excluding any deductible VAT or similar deductible tax, in order to take delivery of a unit of a good or service at the time and place required by the purchaser.
EU	European Union.
FOB	"Free on Board" - An International term of sale that means the seller fulfils his or her obligation to deliver when the goods have passed over the ship's rail at the named port of shipment. This means that the buyer has to bear all costs and risks to loss of or damage to the goods from that point. The FOB term requires the seller to clear the goods for export. *Note*: The U.S. Government sometimes uses a term "FOB Destination" to require the seller to take responsibility for delivering the goods at destination.
Formulation	An industry term for mixture – commonly used for pesticide mixtures intended for the end user. Formulations of pesticides usually contain both the active ingredient and other substances added to promote effectiveness.
GHS	Globally Harmonized System of Classification and Labelling of Chemicals. *Note*: Unless otherwise stated, references in this document are to the GHS 4th revised edition.
Gross Domestic	An aggregate measure of production equal to the sum of the gross values added of all

Term	Definition
Product	resident institutional units engaged in production (plus any taxes, and minus any subsidies, on products not included in the value of their outputs).
Group Standard	A feature of the HSNO system which oblige the user or manufacturer to obtain sufficient information about the chemical substance to determine its hazard classification and then, depending on either the most significant hazard or the area of use (or sometimes both), apply packaging, labelling datasheet and risk management controls as set out in the appropriate group standard.
Hazardous (chemical)	In this report a hazardous chemical, substance or mixture is one which has one or more hazardous properties at a greater level than as set out in the Hazardous Substances: Minimum Degrees of Hazard Regulations. *Note*: 1. These regulations copy the lowest step of hazard in the GHS classification scheme. It should be noted that this meaning is not necessarily the same in all the jurisdictions studied. 2. Broadly chemical hazards are; explosive capacity, flammability, oxidising capacity (ability to promote a fire), toxicity to humans (immediate and long term), and toxicity to populations of organisms in the environment.
HSA	The Republic of Ireland Health and Safety Authority.
HSE	(UK) Health and Safety Executive - the competent body with respect to chemical controls in the UK.
HSNO Act	Hazardous Substances and New Organisms Act 1996 as amended at 2010. *Note*: New Zealand's primary law for managing hazardous substances.
IBC	Intermediate bulk container. *Note*: Intermediate bulk containers are larger than packages (including drums), which have a maximum size of 500 litres. The maximum size of an IBC is 3000 litres.
IMO	International Maritime Organisation.
Industrial Chemical	Chemical with primarily industrial applications (as opposed to agricultural, veterinary, therapeutic uses).
Intellectual Property Rights	General term for the assignment of property rights through patents, copyrights and trademarks. These property rights allow the holder to exercise a monopoly on the use of the item for a specified period.
Jurisdiction	A place within which particular law, regulations or rules apply. In general, for this report jurisdiction is equivalent to country but there can be differences between different parts of a country – for example between England, Scotland and Northern Ireland within the United Kingdom and between states within Australia.

Term	Definition
Law of One Price	Holds that the price of an internationally traded good should be the same anywhere in the world once that price is expressed in a common currency, since people could make a riskless profit by shipping the goods from locations where the price is low to locations where the price is high (for example, by arbitraging).
List Price	The price of a product as quoted in the producer's price list, catalogue, internet site, etc. The gross price exclusive of all discounts, surcharges, rebates and the like that apply to an actual transaction.
Manifest Tracking (system)	A system either electronic or paper based which requires every handler to maintain records of the quantity and whereabouts of a chemical and (usually) to supply this information to a designated regulatory authority. *Note*: See also tracking.
Mixture	A mixture or a solution composed of two or more substances in which they do not react. *Note*: Definition is taken from the GHS.
NICNAS	(Australian) National Industrial Chemicals Notification and Assessment Scheme.
NOS	Not otherwise specified. *Note*: Term is used in assigning packing groups to chemicals which are not otherwise described in the UNRTDG (for example Environmentally hazardous substance NOS).

NSW	The Australian State of New South Wales. *Note*: This study references the legislative requirements of NSW as a representation of Australian requirements.
Performance (Regulatory Requirement)	An obligation imposed on a chemical user expressed as an end result to be achieved irrespective of method. *Example*: 'the package shall withstand a static load of not less than 1000 kg without failing and contents spilling'.
Pesticide	Substance or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm or otherwise interfering with the production, processing, storage, transport, or marketing of food, agricultural commodities, wood, wood products or animal feedstuffs, or which may be administered to animals for the control of insects, mites/spider mites or otherpests in or on their bodies. The term includes substances intended for use as a plant growth regulator, defoliant, desiccant, or agent for thinning or preventing the premature fall of fruit, and substances applied to crops either before or after harvest to protect the commodity from deterioration during storage or transport. See also agrichemical, plant protection agent. (FAO, 1986).
Pictogram	A graphical composition that may include a symbol plus other graphic elements, such as a border, background pattern or colour that is intended to convey specific information. *Note*: GHS definition.
Prescriptive (regulatory requirement)	An obligation imposed on a chemical user expressed as specific method. *Note*: Example: 'the package shall be a drum of dimensions X diameter and Y height and shall be fabricated for grade Z steel.
Price Index	A price index reflects an average of the proportionate changes in the prices of a specified set of goods and services between two periods of time. *Context:* Usually a price index is assigned a value of 100 in some selected base period and the values of the index for other periods are intended to indicate the average percentage change in prices compared with the base period.
Price Levels	Actual money values in a particular period of time.
Term	**Definition**
Pricing-to-Market	Refers to the decision of a single producer to change the relative price at which he sells his output abroad and at home in response to changes in international relative costs.
Producer Price Index	A measure of the change in the prices of goods and services either as they leave their place of production or as they enter the production process. A measure of the change in the prices received by domestic producers for their outputs or of the change in the prices paid by domestic producers for their intermediate inputs.
Purchasing Power Parity	(PPP) A price relative which measures the number of units of country B's currency that are needed in country B to purchase the same quantity of an individual good or service as 1 unit of country A's currency will purchase in country A.
Qualified person in charge (of a chemical)	A person with qualifications in respect of the chemical's properties, precautions in handling and/or the obligations imposed in controls on the chemical. *Note:* In New Zealand regulation this person is described as an approved handler as the term 'person in charge' is used for another purpose in these regulations. In other jurisdictions the obligation is described in different ways.
R & D	Research and Development by a market producer is an activity undertaken for the purpose of discovering or developing new products, including improved versions or qualities of existing products, or discovering or developing new or more efficient processes of production.
REACH	The European Community Regulation on chemicals and their safe use (EC 1907/2006). It deals with the Registration, Evaluation, Authorisation and Restriction of Chemical substances.
Residue limits	Maximum concentration of a residue that is legally permitted or recognised as acceptable in, or on, a food, agricultural commodity or animal feedstuff as set by Codex or a national regulatory authority. The term tolerance used in some countries is, in most instances, synonymous with MRL. Normally expressed as mg/kg fresh weight (after FAO. 1986).

Resource Management Act	New Zealand's main piece of legislation that sets out how we should manage our environment.
SDS	Safety data sheet (GHS term). *Note*: The term is used to distinguish GHS specifications from the US MSDS (materials safety data sheet) although the requirements are broadly similar.
Spot Price	The spot price is the selling price of a commodity (oil, soy beans, currency, etc.) for immediate rather than forward delivery.
Stringency	The amount of resource (effort, capital, staff time etc.) needed to comply with a jurisdiction's chemical management requirement.
Substance	Chemical elements and their compounds in the natural state or obtained by any production process, including any additive necessary to preserve the stability of the product and any impurities deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition. *Note*: This is the GHS. The HSNO Act defines a substance in way which includes both (GHS) substances and mixtures.
Tank wagon	A vehicle with a permanently affixed tank or container, usually for the carriage of bulk liquids.
Toxicity	The property of a substance which renders it capable of causing injury or death, to humans.
Term	**Definition**
Tracking	The obligation to record and either provide the record for inspection or notify a regulator of the amount and location of a chemical (substance or mixture). *Note*: See also 'manifest tracking'.
UK	United Kingdom (the jurisdiction consisting of England, Wales, Scotland and Northern Ireland). *Note*: Empowering laws and regulations may vary between the component countries.
UNPG (number)	United Nations Packing Group (number). *Note*: There are 3 packing groups in the UNRTDG with 1 used for the highest hazard substances and 3 for the least hazardous.
UNRTDG	United Nations Recommendations for the Transport of Dangerous Goods. *Note*: The UNRTDG document is published in two parts: Volumes 1 & 2: Model Regulations and Tests and Criteria. Reference in this report is to the current 17th Edition of the Model Regulations and the 4th Edition of Tests and Criteria.
WHS(regulation)	New South Wales Work Health and Safety Regulation 2011. *Note*: This is the primary control on hazardous chemicals in NSW, but operates alongside the Australian Dangerous Goods requirements which are derived from the UNRTDG.

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Executive Summary

1. Scope

The Ministry for the Environment (the Ministry) is the government's principal advisor on the environment in New Zealand and on international matters that affect the environment, including the oversight of the regulatory regime concerning the management of chemical risk.

The Hazardous Substances and New Organisms (HSNO) Act 1996 (the "Act") is the primary instrument for managing the risk from hazardous chemicals to people and the environment in New Zealand. The Ministry has policy oversight of the Act. The implementation of the Act and associated operational matters are undertaken by a range of agencies, including the Environmental Protection Authority, the Department of Labour and local authorities.

The Ministry has an interest in monitoring the performance of the regulatory regime to ensure that its purpose is fulfilled, that it reflects good regulatory practice, and that it provides for effective risk management without imposing undue costs or unnecessarily constraining innovation and economic growth. This report focuses on hazardous chemicals and does not attempt to address new organisms.

A significant amount of the Ministry's work, including this project, falls within the Government priority of *Building a more productive and competitive economy*. This is reflected in the Ministry's Long-term Outcome: *New Zealand's environmental management systems are strengthened and supported so that they can achieve the greatest overall environmental, economic, social and cultural benefits*. This project delivers on this outcome through assessing the impact of the HSNO legislation on the price, availability and stringency of controls for chemicals in New Zealand.

All regulation necessarily imposes some level of compliance costs. However, regulation should aim to be efficient so that compliance costs are proportional to the problem being addressed. This study was designed to assess the scale of any unnecessary regulatory burden which may arise from compliance with the HSNO Act by investigating three indicators:

Availability: *Are New Zealand chemical users unable to access, or facing noticeable delays in accessing new chemicals compared with their overseas competitors?*

Price: *Are New Zealand users paying noticeably more or less than the world price for chemicals?*

Stringency of Controls: *Do New Zealand chemical users have noticeably more stringent controls on hazardous substances imposed on them than their overseas competitors?*

2. Analysis

The availability indicator (Section 2 of this report) was assessed by analysing twelve recent applications to the EPA for approval of new hazardous substances. The analysis aimed to provide insight into the effects of the need to make HSNO applications on the availability of chemicals in the New Zealand market.

The number of chemicals chosen was intended to provide sufficient results to be representative of the general effect of the requirement to make applications under HSNO. Case studies were undertaken for four of the recent HSNO applications and a brief analysis was undertaken for the additional eight applications. This analysis included interviews with the case study applicants as well as a range of industry participants including suppliers and users.

The price and stringency of controls sections (Section 3 and Section 4) compared the following range of chemicals across New Zealand and several comparative jurisdictions, specifically comparing New Zealand with other developed jurisdictions' hazardous substances regimes as they apply to direct effects on humans and the environment, but excluding other outcomes such as food safety, animal welfare or medical efficacy.

Table 0.1 - Jurisdictions and Chemicals for Assessment

	NSW	Canada	Ireland	UK	Japan
Deltamethrin	Stringency of Controls	Stringency of Controls	Stringency of Controls	Stringency of Controls	Stringency of Controls
Dibenzoyl peroxide	Stringency of Controls	Stringency of Controls	Stringency of Controls	Stringency of Controls	Stringency of Controls
Caustic soda	Price, Stringency of Controls	Price, Stringency of Controls	Price, Stringency of Controls	Stringency of Controls	Stringency of Controls
Diesel	Price, Stringency of Controls	Price, Stringency of Controls	Price, Stringency of Controls	Stringency of Controls	Stringency of Controls
Methyl ethyl ketone	Price, Stringency of Controls	Price, Stringency of Controls	Price, Stringency of Controls	Stringency of Controls	Stringency of Controls
Glyphosate	Price, Stringency of Controls	Price, Stringency of Controls	Price, Stringency of Controls	Stringency of Controls	Stringency of Controls
Sulphuric acid	Price	Price	Price		
Chlorpyrifos	Price	Price	Price		
Chlorothalonil	Price	Price	Price		

3. Findings

3.1 Availability

The availability analysis made the following findings:

1. From the case studies where market timing information was available, chemicals became available in New Zealand market several years later than in European and North American markets. However, such delays appear to be typical of smaller or less wealthy markets
2. For those chemicals which require approval under HSNO, the main cause of the delay applications being made in New Zealand much later than in the larger wealthy markets. Comments from applicants indicate that this is mainly for financial reasons associated with the small market size in New Zealand
3. Once application is made the timeframe for HSNO approvals is relatively short compared to timeframes in other jurisdictions for those chemicals where approvals are required.
4. The range of chemicals available to users in New Zealand is most likely significantly smaller than in Australia and in other larger markets. Comments from some distributers suggest that this is mainly due to commercial reasons. The base premise of HSNO - that a hazardous substance needs specific approval before it can be introduced - is also likely to be a factor.

Some chemicals are not available in New Zealand due to the lack of demand (e.g. agrichemicals for crops not grown in New Zealand) or due to the small market size which makes this country uneconomic to service. Cost and effort of approvals under the HSNO Act is often cited as a barrier in conjunction with other issues such as approvals under the Agricultural Compounds and Veterinary Medicines (ACVM) Act. However, based on the chemicals studied and interviews conducted, the direct costs of HSNO approvals were found to be modest.

This finding is reinforced by the large number of chemicals for which use is permitted without formal approval, either because the chemical is not a hazardous substance or because of an existing approval or because formal approval is not required under the Act’s Group Standards mechanism. Group Standards are a unique feature of the New Zealand HSNO system, although some aspects of this mechanism (e.g. the self-classification provisions) are also components of other regimes.

Analysis of information supplied by agrichemical industry participants in this study shows that HSNO approval costs for agrichemicals are minor when compared to cost of acquiring local data on residue limits for approval under the ACVM Act. From discussion with these participants it is clear that the issue of greatest current concern for agrichemical distributors, and a barrier to release of new products, is “data protection”. This refers to the ability of third parties to use data submitted to the Food Safety Authority for approval of copycat substances.

In summary the range of chemicals available in New Zealand is restricted, and chemicals tend to enter the New Zealand market several years later than the largest and most wealthy markets. However, the timing of access is similar to other small markets. Case studies and feedback from chemical suppliers indicate that the main factors affecting availability and timing are market issues and effects from other, non-HSNO regulations.

3.2 Price

The analysis of price information for the chemicals and jurisdictions studied found that:

- At any one time prices of some chemicals might be higher in New Zealand than in other similar jurisdictions, but there is not a consistent pattern of generally higher chemical prices in New Zealand as would be expected if HSNO compliance costs were significant
- It is possible that higher prices may persist for some chemicals due to high concentrations of market share and the resulting lack of economies of scale for second tier suppliers. This is principally a competitive market issue and is not a direct effect of controls on the chemical imposed under the HSNO legislation
- The lack of a consistent pattern of prices is consistent with industry comment that the cost of HSNO compliance is low and is largely a background issue – at least for the major suppliers who provide most of the chemical products delivered to New Zealand users and exporters.

In summary it is concluded that, while HSNO compliance costs are likely to be significant for very small scale distributors and users, in general HSNO compliance does not have a major impact on the prices of chemicals for New Zealand industry and exporters.

3.3 Stringency of Controls

Based on the six jurisdictions and chemicals studied, the overall conclusion of this component of the assessment is that:

- New Zealand was an early leader in adopting the Globally Harmonised System for Classification and Labelling of Chemicals (GHS), but other jurisdictions have now largely caught up or are moving to do so
- While the structure of regulatory systems varies greatly between jurisdictions, and some are in transition, the levels of stringency are now remarkably uniform
- The stringency of controls in New Zealand generally falls within the range observed in other jurisdictions
- Where New Zealand controls exceed most other jurisdictions it is generally due to factors that are not significant in most other countries (such as seismic hazard) or due to the fact that New Zealand chemical controls equally weight environmental protection and human health and safety.

4. Conclusions

While some chemicals are not available in New Zealand, and some are likely to be more expensive in New Zealand at any particular time, these outcomes are most likely due to other effects such as market size and market distortions arising from non-HSNO effects.

The pricing evidence obtained is consistent with industry comment that the costs of HSNO compliance are not a significant determinant of the prices paid for chemicals in New Zealand, except perhaps for very small scale distributers and users.

As an early adopter of the Globally Harmonised System for Hazard Classification and Labelling of Chemicals, via the HSNO act, New Zealand has been a world leader on the integrated regulation of chemicals. Other jurisdictions have now largely caught up. While every country packages the controls quite differently, the New Zealand HSNO system of controls is similar in scope and stringency to chemical controls found in similar developed countries.

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1 Background

1.1 Scope

The Ministry for the Environment (the Ministry) is the government's principal advisor on the environment in New Zealand and on international matters that affect the environment, including the oversight of the regulatory regime concerning the management of chemical risk.

The Hazardous Substances and New Organisms (HSNO) Act 1996 (the "Act") is the primary instrument for managing the risk from hazardous chemicals to people and the environment in New Zealand. The Ministry has policy oversight of the Act. The implementation of the Act and associated operational matters are undertaken by a range of agencies, including the Environmental Protection Authority, the Department of Labour and local authorities.

The Ministry has an interest in monitoring the performance of the regulatory regime to ensure that its purpose is fulfilled, that it reflects good regulatory practice, and that it provides for effective risk management without imposing undue costs or unnecessarily constraining innovation and economic growth.

The majority of the Ministry's work, including this project, falls within the Government priority of *Building a more productive and competitive economy*. This is reflected in the Ministry's Long-term Outcome: *New Zealand's environmental management systems are strengthened and supported so that they can achieve the greatest overall environmental, economic, social and cultural benefits*. This project delivers on this outcome through assessing the impact of the HSNO legislation on the price, availability, price and stringency of controls for chemicals in New Zealand.

All regulation necessarily imposes some level of cost. The intention of 'good regulatory practice' is to ensure that the compliance burden imposed on society by regulation should be reasonable and fair compared to the expected regulatory benefit. In other words the regulations should be 'efficient'. The extent to which a regulation's costs are inefficient or higher than necessary is termed unnecessary regulatory burden. Some of the potential impacts of unnecessary regulatory burden include:

- Firms may face reduced profitability due to unintended administrative side effects of regulations
- Some firms may be put at a competitive disadvantage depending on their size or geographical location
- The introduction of safer or more effective chemicals could be impeded (Productivity Commission, 2008)

Some users and suppliers of hazardous chemicals in New Zealand have expressed concerns that the compliance costs associated with HSNO are unreasonable and might be reducing the competitiveness of New Zealand export industries by increasing chemical prices in New Zealand and reducing the availability of chemicals which might be considered safer or more efficient. The Ministry commissioned this study in order to identify the scale of these costs. The impact of the Act on compliance costs[1] are shown below:

- Suppliers (importers and manufacturers) of hazardous substances require an approval or must show that their chemical falls within the scope of an existing approval or a Group Standard under the Act. In common with other jurisdictions, the chemical is then subject to controls based on the chemical's hazardous properties. Obtaining an approval or showing that the chemical falls within the scope of an existing approval or a Group Standard includes the preparation of information required for hazard classification. Compliance with controls are compliance costs that are likely to be passed through to re-sellers through chemical prices (because all chemicals in New Zealand are subject to these costs) or in the form of reduced product availability
- Under the Act, re-sellers and end-users of hazardous substances are also subject to controls. Associated costs are likely to be passed through to individuals through the prices of other goods and services
- Individuals are likely to incur the costs of the required controls as they are likely to be incorporated into the prices of goods and services purchased[2].

Three indicators of compliance costs were identified and this analysis was commissioned by the Ministry to understand the scale of the effects of the compliance costs arising from the hazardous substance regime, relative to New Zealand's trade competitors. These indicators are explained below.

Indicator 1: Price

The price paid by users of chemicals in key industrial and agricultural sectors in New Zealand compared with the world price (after necessary adjustments such as transport costs and sales taxes) and, in particular, whether New Zealand users are paying noticeably more or less than the world price for chemicals. Where significant price differences are identified, analysis of the main reasons for these differences is required.

Economic and market analysis has focussed on 7 chemicals which are inputs to sectors that make a significant contribution to the New Zealand economy. In addition, the chemicals cover a spectrum of low and high hazard chemicals, as well as a range of hazard classes, such as flammability and eco-toxicity.

[1] Compliance costs are essentially used as a proxy for assessing the *impact* that HSNO regulation has on New Zealand agricultural and industrial export industries.

[2] Individuals also obtain benefits from these controls by way of reduced injuries, damage to property and reduced environmental degradation

Indicator 2: Stringency of Controls

Are New Zealand chemical users complying with noticeably more stringent controls on hazardous substances than their overseas competitors?

This part of the study involved a qualitative technical analysis of the controls imposed on 6 chemicals in New Zealand and 5 other jurisdictions. The analysis compared New Zealand's regulatory requirements against other developed countries with the comparison being focused on direct effects on human and environmental health and safety, but excluding other outcomes such as food safety, animal welfare or medical efficacy.

The analysis focused on significant points of difference between the stringency of New Zealand hazardous substance controls when compared to the stringency of controls in selected other developed countries.

Indicator 3: Availability

Are New Zealand chemical users unable to access, or facing noticeable delays in accessing new chemicals compared with their overseas competitors?

The analysis examined the range of chemicals available to users and the timing of their availability in New Zealand compared to other developed countries.

1.2 Definition of Compliance Costs

A comprehensive overview of the literature on compliance costs can be found in (Massey 2003). Since the 1950's there has been an evolving consciousness of the cost to businesses of complying with government regulations. Over this same period there was also a shift in community tolerance of non-compliance with certain types of legislation, such that protecting the environment. The result is that business owners today have an acute awareness of the cost of compliance, have more responsibility for self-regulation, and are facing an increasing level of compliance and community disapproval over non-compliance with certain pieces of legislation.

The importance of compliance costs is illustrated by the 2001 New Zealand Ministerial Panel on Compliance Costs which concluded that:

> *High compliance costs stifle innovation, hinder competitiveness, hamper investment, deter compliance, and result in firms being reluctant to expand or take on more staff.*

There is an emerging consensus on the importance of considering the *impact* of compliance, and the best ways of assessing this impact through the lens of assessing the cost to business. Typically three types of 'costs' are identified; direct, indirect and psychological. Regulatory regimes around the world use this conceptual framework for assessing the way compliance impacts on business practice and profitability.

Concepts of Compliance Costs in Taxation and Business

Much of the initial work on compliance costs has been undertaken in the context of taxation. In this context compliance costs are not considered to be the tax itself, but the costs associated with preparing and filing tax returns including internal audit costs, external advisors, and opportunity costs of staff time involved (Inland Revenue 2010).

The New Zealand Inland Revenue Department (IRD) also recognises that compliance has a psychological cost in terms of levels of stress associated with tax activities. The IRD monitors psychological stress, but to date has not monetised such costs by assigning dollar values (Inland Revenue 2010).

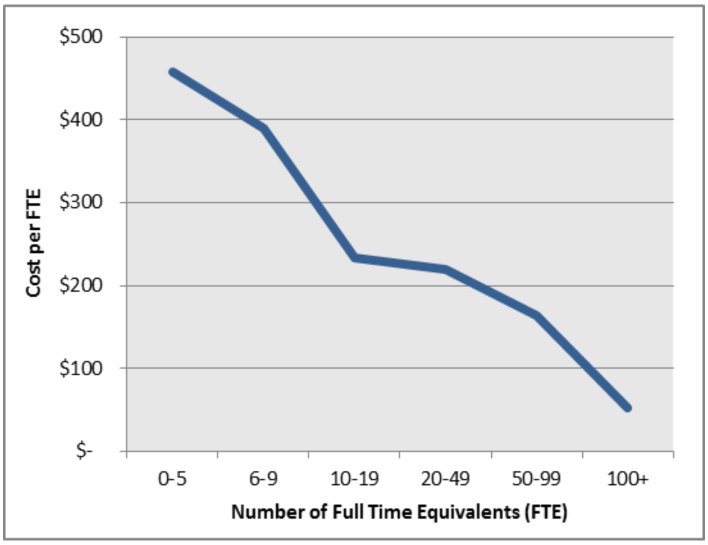
In simple terms, compliance costs in the taxation context are generally accepted to be about complying with "red tape", even if the amount of tax paid is zero.

This definition of *compliance costs* has been used in a series of surveys on compliance costs conducted by Business New Zealand in conjunction with KPMG. One of the most difficult aspects for business is coping with change. This is especially so for small and medium sized businesses (refer box).

The effects of change are illustrated by a comment in the fourth Business New Zealand compliance costs survey report, which reported an increase in HSNO compliance costs – *HSNO is adding all sorts of paperwork and compliance costs with the worst aspect being that the rules are still changing* (Business New Zealand 2006). This comment may have related to new HSNO regulations, which had just been introduced in the previous year. Over time such matters tend to become better known and recede into the background. And by 2008 HSNO was not mentioned at all in the annual compliance cost survey results (Business New Zealand 2008).

Compliance Costs for Small and Medium Sized Enterprises (SME)

Environmental Compliance Costs 2003-2008



The conventional wisdom is that compliance costs have a larger impact on small and medium sized businesses. This is supported by Business New Zealand survey results. For environmental compliance, the average reported compliance cost per employee is almost 10 times higher for businesses with 5 or fewer employees ($460), compared to enterprises with more than 100 employees ($50).

This ratio is not a reflection on the quality of environmental regulation, but rather illustrates that compliance has strong economies of scale, with the burden falling proportionally harder on small and medium sized enterprises.

Data source: Business New Zealand / KPMG

Concepts of Compliance Costs in the Chemical Industry

The European Chemicals Agency (ECHA) recently published a guide on the Calculation of Compliance Costs (ECHA 2010). This guide defines compliance cost as the difference in the price of a good between the "baseline" scenario and the price in the "restriction" scenario, multiplied by the number of units placed on the market in the "restriction" scenario. The reliance on a "baseline scenario" of no regulation makes such a definition largely theoretical in the case of New Zealand as a scenario of no regulation is not a realistic alternative to HSNO.

The main differences between this definition of *compliance costs* and the taxation usage above are that ECHA:

- Includes the substantive costs of compliance (e.g. refurbishing a chemical storage facility)
- Focusses on the change in price of the good as a measure of the net effect of such costs.

Incremental Compliance Costs of Regulation

Another concept of compliance costs concerns *additionality*, which refers to the time and expense that is over and above normal commercial practices. These additional costs might include lost opportunities or disincentives to expand the business.

The baseline might be the existing regulatory situation, which leads to the concept of *incremental compliance costs*. For instance, the Regulatory Impact Statement prepared by the Ministry for the Environment on National Environmental Standard for Sources of Human Drinking Water comments on the incremental cost (of the new standard) to consent applicants (MfE 2009).

Compliance Cost as Defined for this Study

While elements of the above definitions of compliance costs apply, none of the above fully captures compliance costs in a way that is wholly relevant to this study.

For this study, *compliance costs* are defined as the excess price (if any) that users in New Zealand pay for chemicals due to costs of compliance with HSNO being in excess of the costs of compliance in other comparable jurisdictions. This definition has several key implications:

- All costs are included in so far as they are expressed in the prices to users
- The baseline is comparable jurisdictions of a similar standard of economic development
- The comparison applies to the present day regulatory environment in New Zealand and other jurisdictions.

1.3 New Zealand Legislative Context

1.3.1 Hazardous Substances and New Organisms Act

The passing of New Zealand's Hazardous Substances and New Organisms Act in June 1996 represented one of the most significant reforms of environmental legislation since the Resource Management Act. The Act came into force in three stages. Provisions relating to new organisms took effect in July 1998. The provisions relating to hazardous substances came into force on 2 July 2001, with some additional regulations relating to compressed gasses and tank wagons being brought into force in 2003 and 2004. Transitional provisions retaining some aspects of the previous law and regulations remained in force until July 2006.

The Act established the Environmental Risk Management Authority (ERMA New Zealand) to assess and decide on applications to introduce hazardous substances or new organisms into New Zealand. Genetic modification of plants, animals and other living things is included within the scope of new organisms. In July 2011, ERMA became the Environmental Protection Authority (EPA).

1.3.2 Related Acts

A summary of HSNO linkages for the four main acts of relevance to this HSNO assessment is presented below.

Agricultural Compounds and Veterinary Medicines (ACVM) Act

The Agricultural Compounds and Veterinary Medicines (ACVM) Act overlaps with the HSNO Act because a number of the compounds used in agriculture (such as pesticides) are also hazardous substances. However, the two pieces of legislation address clearly separate outcomes.

The HSNO Act deals with the health and safety of people and the environment, whereas the Agricultural Compounds legislation is directed towards managing risks to trade in primary produce, animal welfare, and agricultural security, and making sure that the use of agricultural compounds complies with residue limits in New Zealand food standards.

Health and Safety in Employment (H&SE) Act 1992 and Regulations

There is a strong relationship between the HSNO Act and the Health and Safety in Employment (H&SE) Act 1992 because hazardous substances are often found in workplaces. The HSNO regulations allow the Environmental protection Authority (EPA) to impose exposure standards both for people working with hazardous substances in the workplace and in the wider community. Exposure standards that apply in workplaces need to be different from those that apply to members of the general public, because:

- The duration of exposure may be less due to limited time at work
- Workers may be considered less sensitive to exposure compared with the population in general, because their age structure does not include the very old or very young, and they are often in better health
- Workers may be assumed to adopt behaviours that prevent or minimise exposure (such as using protective clothing), which cannot be assumed for the public.

It is intended that the Health and Safety sector of the Department of Labour use the HSNO regulations as controls to ensure worker safety.

Resource Management Act 1991

Under the HSNO Act controls on hazardous substances apply irrespective of location. Additional controls to manage the risks at a particular site can be set under the Resource Management Act through the resource consenting process.

Where a local authority imposes conditions under the Resource Management Act, such conditions may only add to the controls imposed under the HSNO Act – they cannot be less than the minimum requirements under the HSNO legislation.

Transport Legislation

The safe operation of air, sea and land transport systems is ensured by transport legislation, including the Land Transport Rules, the Maritime Safety Rules and the Civil Aviation Rules. This legislation requires that:

- Ships, aircraft and land vehicles be designed to be safe and maintained in a safe condition
- Operators of ships, aircraft and land vehicles be trained to safely operate them
- Hazardous substances are contained or packaged to withstand the conditions of transport (e.g. loads imposed by a ship rolling at sea or the reduced pressure in an aircraft flying at altitude) and are identified so that they can be correctly managed in transport.

Figure 1.1 Tank Wagons, New Zealand

Photo: Kevin Oldham

These requirements for hazardous substances listed above and those of the HSNO Act relate as follows:

- Basic vehicle safety requirements for land transport are covered under the transport legislation requirements. Requirements specific to a hazardous substance (such as corrosion resistance of an acid tank mounted on a truck) are set in the HSNO regulations
- The HSNO regulations set chemical hazard identification requirements (e.g. labels on packages) based on an internationally standardised combination of the GHS and *UN Recommendations For the Transport of Dangerous Goods* systems, the latter being specified in New Zealand through the transport legislation
- Transport legislation requires operators to know about and comply with the appropriate requirements of the HSNO Act (e.g. hazardous substances endorsements on drivers' licenses)
- The performance required of hazardous substances packages by regulations under the HSNO Act is derived from the *UN Recommendations for the Transport of Dangerous Goods*. These meet the requirements for land transport. However, other forms of transport require additional precautions as given above, and stricter regulations under the Maritime Safety and Civil Aviation Acts apply.

1.4 Structure of NZ Chemical Industry

The history of the New Zealand chemical industry mirrors the fortunes of New Zealand industry in general. The chemical industry grew to a modest size behind protectionist tariff barriers but with the opening up of the New Zealand economy to international competition in the 1980's many product manufacturers relocated offshore or simply closed. This had impacts on the manufacturers and distributors of chemicals, leading to closures and industry consolidation.

Figure 1.2 – Hazardous Substance Signage

Source: Navigatus Consulting Ltd

Apart from some specialist products, such as resins, most chemicals used in New Zealand are now imported from major manufacturing plants overseas which have the advantage of economies of scale and in some cases cheaper capital, lower cost labour and sometimes less stringent enforcement of environmental protection. Different parts of the New Zealand chemical market show different market characteristics (Table 1.1).

Table 1.1 - New Zealand Chemical Industry - Characteristics of Market Segments

Market Segment	Characteristics
Base chemicals	Imported in bulk. High degree of market consolidation with a single major supplier and a few second tier distributors. Some chemicals such as caustic soda[3] can be readily imported as containerised dry goods and subsequently hydrated in New Zealand, thus providing a threat of competition and serving to limit price increases
Petrochemicals	Chemical products derived from petroleum – these are closely linked to fuels market and world crude oil prices
Generic Agrichemicals	Agrichemicals which are not protected by intellectual property rights. Active ingredients typically imported in intermediate bulk containers (IBC), drums or ready formulated in final packaging. No significant barriers to entry for generic chemicals, with resulting high levels of potential or actual competition
Proprietary Agrichemicals	Agrichemicals protected under Intellectual Property rights legislation (e.g. patents). Active ingredients typically imported ready formulated in final packaging. Patent protection affords owner the opportunity to recoup R&D investment for a limited time
Consumer chemicals	Chemicals generally for household or non-commercial use - range of suppliers and retailers

[3] In 2010 4,000 tonnes of caustic soda was imported in solid form, compared to 25,000 tonnes in liquid form (Source: Statistics NZ). If it is assumed that the liquid imports were mainly 50% solution then the solid form had a market share of approximately 25%.

1.5 Selection of Countries and Chemicals

1.5.1 Selection of Comparison Countries

To be of significance to New Zealand export competitiveness, the comparison jurisdictions need to be competitive producers of significant export volumes of goods that are also significant New Zealand exports[4]. Table 1.2 lists the jurisdictions which were selected for the study.

Table 1.2 - Comparison Jurisdictions

Jurisdiction	Population	GDP (NZD)	Comment	Assessed for
New Zealand	4.4m[5]	205b[6]	Primarily agricultural exports.	Price and stringency of controls
New South Wales	7.2 m	540b[7]	Similar population, export orientation and geographic location to New Zealand	Price and stringency of controls
Ireland	4.2m[8]	253b[9]	Similar to New Zealand in terms of size, agricultural production.[10]	Price and stringency of controls
Canada	34.7m[11]	1,736b[12]	Broadly similar market size and export orientation to New Zealand	Price and stringency of controls
United Kingdom	62.3m[13]	2,446b[14]	Mid-sized nation with some similarities of temperate maritime climate and is an island nation. Relatively mature chemical regulation regime as a result of a well-developed chemical industry	Stringency of controls only
Japan	127.5m[15]	9,550b[16]	Major trading partner and island nation. Japan does not compete with the New Zealand export market to the same extent as the other countries as its economy is largely complementary to New Zealand. Heavily industrialised nation with a publicly stated intention to adopt the GHS	Stringency of controls only

[4] Note that this is not the same as trading partners - as it is likely that New Zealand will have less trade with its most direct competitors than with other comparable nations
[5] Source: Dept of Statistics Population clock. http://www.stats.govt.nz/tools_and_services/tools/population_clock.aspx
[6] Nominal GDP Expenditure Basis for year to 31 Dec 2011. Source: Table 4.2: Gross Domestic Product: December 2011 Quarter - tables.xls. . Dept Statistics. http://www.stats.govt.nz
[7] Gross State Product of $420m AUD. For year ending 30 June 2011. Source: Australian Bureau of Statistics at http://www.abs.gov.au/AUSSTATs
[8] 2006 data. Source: Central Statistics Office at .http://www.cso.ie
[9] 40.1 billion euro for year ending Dec 2011. Source: Central Statistics Office at .http://www.cso.ie
[10]
[11] Source Statistics Canada.
[12] 1,374 billion Canadian dollars at market prices in year to 31 Mar 2012. Source Statistics Canada. National Economic Accounts - CANSIM table 390-002For year ending 31 March 2012.
[13] Source: "Annual Mid-year Population Estimates, 2010". Office for National Statistics. 2011. Retrieved 14 April 2012.
[14] GDP 1508 billion pounds sterling to year ending 31 Dec 2011. Source*: United Kingdom Economic Accounts Quarter 4 2011.* Office for National Statistics.
[15] USD 5,458b in 2010. Source: World Bank Country Data. http://data.worldbank.org/country/japan
[16] 2010 data. Source: World Bank Country Data. http://data.worldbank.org/country/japan

Ideally, the jurisdictions would also have similar market conditions to New Zealand with regard to factors such as market size and level of competition, which have the potential to influence price.

In most cases the comparisons are at the national level, but in some countries elements of chemical regulation are devolved to lower levels. In those cases the comparison jurisdiction is identified at the state level.

OECD membership was also used as a selection criterion as OECD countries collect and publish statistics in agreed formats that assist with international comparisons. Population size was used as a general indicator of the size of the chemical market. Language barrier and availability of data are also considered when selecting comparison jurisdictions. Island nations were preferred as there is less likelihood of market distortions arising from illegal movement of chemicals across borders.

1.5.2 Selection of Chemicals

The chemicals chosen for the study are:

- An integral requirement or input to industrial and agricultural sectors that make a significant contribution to the New Zealand economy
- Internationally traded.

In addition, the chemicals cover a spectrum of low and high hazard chemicals, as well as a range of hazard classifications, e.g. flammable and eco-toxic substances.

Figure 1.3 Bulk Storage, Port of Tauranga, New Zealand

Photo: Kevin Oldham

The following chemicals were selected for the study. The choice was partially influenced by consideration of those chemicals where HSNO effects would be most expected on price (refer Section 3.4).

Table 1.3 – Selected Chemicals Summary

Chemical	Major Uses in New Zealand	Assessed for
Sulphuric acid	Key input to the production of superphosphate fertiliser	Price and stringency of controls
Caustic soda	Often used as a Clean-in-Place (CIP) agent for processing in industries such as dairy	Price and stringency of controls
Methyl ethyl ketone	Used as a solvent in protective coatings, adhesives, printing inks, paint removers etc	Price and stringency of controls
Diesel	Fuel which is a major input to industry and agriculture in terms of transport and operation of machinery	Price and stringency of controls
Dibenzoyl peroxide	Organic peroxide (oxidizing and flammable/ explosive hazards) with applications in both industry and in medicine	Stringency of controls only
Deltamethrin	Older style of synthetic pyrethroid insecticide	Stringency of controls only
Glyphosate	Heavily used and well characterised herbicide for agricultural production	Price and stringency of controls
Chlorpyrifos	Commonly used horticultural insecticide	Price only
Chlorothalonil	Fungicide used in horticulture and also treatment of timber	Price only

While it was convenient for the study team to have the same chemicals in each part of the assessment this was not material to the assessment itself, provided that the chemicals covered a range of chemical types and hazard classes. From the outset it was intended that there would be some commonality of chemicals between the parts of the study, but that they would not completely overlap.

In the initial design the following differences in selections were made:

- The UK was included in the stringency of controls only as the study team were confident that the relevant controls information could be readily obtained. Inclusion of the UK therefore allowed the comparison of stringency of controls to be extended to an additional country for little additional effort
- Dibenzoyl peroxide was included in the stringency of controls assessment as an example of a chemical with oxidising properties so as to cover a wide range of hazardous properties. However, sulphuric acid was considered to be of more significance to New Zealand export industries and was substituted for the price evaluation.

It was recognised from the outset that there were significant risks of not being able to obtain data of adequate quality. The study methodology, as set out in the Project Plan, included a risk matrix which identified risks and proposed actions to address the risks, should they arise. Most of the risks centred on data acquisition.

In practice suitable price data from Japan could not be obtained within the limitations of the study. Such data was also expected to be of modest comparative value given the differences between the two economies. This risk had been anticipated and the methodology for the price comparison was modified to delete comparison of prices with Japan and instead was extended to a wider range of chemicals across the remaining jurisdictions.

A summary of the final matrix of chemicals and jurisdictions for price and stringency of controls is presented in the table below.

Table 1.4 - Jurisdiction and Chemical Evaluation Matrix

	NSW	Canada	Ireland	UK	Japan
Deltamethrin	Stringency of Controls	Stringency of Controls	Stringency of Controls	Stringency of Controls	Stringency of Controls
Dibenzoyl peroxide	Stringency of Controls	Stringency of Controls	Stringency of Controls	Stringency of Controls	Stringency of Controls
Caustic soda	Price, Stringency of Controls	Price, Stringency of Controls	Price, Stringency of Controls	Stringency of Controls	Stringency of Controls
Diesel	Price, Stringency of Controls	Price, Stringency of Controls	Price, Stringency of Controls	Stringency of Controls	Stringency of Controls
Methyl ethyl ketone	Price, Stringency of Controls	Price, Stringency of Controls	Price, Stringency of Controls	Stringency of Controls	Stringency of Controls
Glyphosate	Price, Stringency of Controls	Price, Stringency of Controls	Price, Stringency of Controls	Stringency of Controls	Stringency of Controls
Sulphuric acid	Price	Price	Price		
Chlorpyrifos	Price	Price	Price		
Chlorothalonil	Price	Price	Price		

1.6 Limitations

This report has been prepared by Navigatus Consulting Limited for the New Zealand Ministry for the Environment for the sole purpose of assessing the impact of complying with HSNO legislation on New Zealand suppliers and users of hazardous chemicals operating in key New Zealand export industries.

Due to commercial confidentiality only limited price data was made available by industry participants and most price data could not be independently verified. As such the comments and conclusions presented by Navigatus represent best professional judgement, based on the information available, solely for the purposes of this report.

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1.7 References

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2 Availability

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2.1 Introduction

2.1.1 Objective

The objective of this part of the study is to address the following questions:

1. Are New Zealand chemical users facing noticeable delays in accessing new chemicals compared with their overseas competitors?
2. Are New Zealand chemical users unable to access new chemicals compared with their overseas competitors?

This indicator is therefore not simply about delays in access for new chemicals, but also what chemicals are absent.

2.1.2 Background

Premise of Chemical Regulation

Controls on chemicals in New Zealand start from an opposite premise to that in most other jurisdictions - that a positive approval is required if the chemical has hazardous properties. Most other jurisdictions do not generally require positive approval for chemicals to be introduced to market.

However, although starting from opposite premises, chemical regulatory systems in OECD countries are reasonably similar in practice (Table 2.1).

Table 2.1- Chemical Regulation – Effects of Underlying Premise

Jurisdiction	New Zealand	Typical Other OECD Jurisdiction
Basic premise	Chemicals with hazardous properties are prohibited unless positively approved	Chemicals are permitted
Modified by:	Softened by: } HSNO does not apply if hazardous properties fall below thresholds } No further approvals required for substances approved prior to HSNO } Group standards } Substances only need a single approval: ie are not specific to the supplier	Tightened by: } All pesticides need specific positive approval } Escalating information to be supplied to regulatory authority as volumes of use increase } Prohibitions on certain chemicals or classes of chemical
Recently changing through:	Becoming less onerous in practice through developing more group standards which permit groups of chemicals - subject to certain controls	Becoming more onerous in practice through recent changes to more systematic reporting and submission of toxicological information to authorities, once thresholds are exceeded (e.g. European REACH system)
Resulting in:	Many chemicals are already approved, but “new” chemicals not covered by existing use or group standards need positive approval before use	Most chemicals can be marketed and used, but information such as toxicological data needs to be generated for classification and more complete chemical usage and effects information must be supplied to the regulator as quantities rise above certain thresholds

These opposite premises are not necessarily right or wrong: the New Zealand approach suits a country which primarily imports new chemicals, whereas the opposite premise is more suitable in jurisdictions where new chemicals are developed.

Delays in Access

The HSNO legislation obliges positive (i.e. before introduction) formal approval for only a proportion of new chemical introductions. Chemicals which do not require approval include:

- Chemicals which are not a hazardous substance within the meaning of the HSNO Act
- Any chemical which is already within the scope of an existing hazardous substance approval
- Any chemical that falls within the scope of a group standard under the HSNO Act.

For those chemicals which do need HSNO approval there are two main sources of delay:

- Delays due to HSNO approval processes
- Delays due to applicants holding off on making applications.

Reasons why a producer may elect to delay applying for approval in New Zealand include:

- The cost of obtaining a HSNO approval is seen as high and the supplier may firstly wish to prove the market success of the chemical in other countries, before committing resources to New Zealand approvals
- The producer has a limited budget for approvals for the type of chemical
- The producer gives priority to larger markets
- New Zealand approvals require additional information that is not required elsewhere and has to be gathered
- New Zealand approvals require that the information is presented in a unique way which requires significant inputs from senior chemists and toxicologists, who are prioritised according to market size and the amount of work involved.

2.2 Methodology

2.2.1 General Design of Methodology

The design of the methodology for this indicator seeks to address the following

1. Gaining sufficient understanding of individual HSNO applications so as to gain insight into the influence of HSNO on commercial decision making
2. Having sufficient breadth of survey so as the results are representative of the wider group of chemicals.

At first sight these objectives are not mutually compatible: the first dictates an in–depth study of a few HSNO applications, whereas the second suggests a wider survey of more applications, albeit in less depth. These two strands have been addressed by adopting a design which addressed both aspects through:

- An in depth analysis of four case studies
- A brief analysis of an additional 8 HSNO applications.

The design is also based on the approach of looking for HSNO effects where they are likely to be most prominent: which in this case is chemicals which are not covered by group standards or simple approvals, but which require a full HSNO approval process. By looking in the areas where HSNO effects are most likely to be visible it should be easier to see what the effects are, and to get an understanding of the upper bound of their impact on users in New Zealand.

2.2.2 Data Collection

The general considerations above led to the following specific requirements for the selection of chemicals in both the case studies and the chemical briefs.

Table 2.2- Sample Selection Considerations

Consideration	Comment
The chemical formulation needs to be newly introduced to the market	Existing chemicals do not require new approvals so market timing issues do not apply
The chemical formulation must require HSNO approval	As this assessment is of market access and timing issues attributable to HSNO compliance
The applications should be randomly selected	To avoid the risk of bias

A list of chemicals approved by the EPA under HSNO over the last 5 years was obtained from the Environmental Protection Authority. Hazardous substance applications are classed as A, B or C. A Category C application is required where one or more of the major hazardous components of the substance have not been previously classified and therefore a full hazard and risk evaluation is required. The sample was limited to Category C applications as those have the most extensive data requirements and were therefore most likely to provide the information required to assess the timing of market access.

A stratified sampling approach was taken, with applications being classified into agricultural and industrial chemicals (Table 2.3). The methodology called for case studies to be drawn from different applicants, so as to maximise the diversity of responses within the sample size.

Table 2.3 - Category C HSNO Approvals 2006-2011

	Industrial	Agrichemical
Number of Chemicals	12	43
Number of Applicants	10	17

Source: EPA

A random number generator was then used to select two agricultural chemicals and two industrial chemicals from different applicants (Table 2.4).

Table 2.4 - Selected Chemicals

Application No.	Applicant	Product	Comment
ERMA200367	Pfizer	PNZL-TC1310	Oral veterinary medicine for use in dogs
HSR08057	Bayer	Firebird	Herbicide containing 400g/litre flufenacet, plus 200g/litre diflufenican, in the form of a suspension concentrate
APP201112	3M	Novec™ 7500	Hydrofluoroether designed for use as a heat transfer agent and as an electronic cleaning fluid
HSR07151	EECA	B21-B99	A mixture of biodiesel fuel and diesel fuel with the proportion of biodiesel fuel in the mixture greater than 20% and less than 100%

Upon selection the relevant EPA files were inspected to identify information on timing of approvals in New Zealand and other markets. In most cases the information included in the HSNO application on approval dates in other jurisdictions was stated very generally, usually in only one or two sentences.

Further information was sought by Navigatus through email and phone consultation with the nominated contact person provided by the applicant. Navigatus also undertook independent research of online resources and notification databases in overseas jurisdictions. This information was supplemented by interviews with industry participants to provide overall context.

The level of co-operations from agrichemical suppliers was excellent. No further information could be obtained from two of the industrial chemical suppliers. The possibility of non-response had been anticipated and two additional industrial chemicals were selected in accordance with the study methodology.

In addition a further 8 applications (4 agricultural and 4 industrial) were selected for examination as chemical briefs. This was undertaken towards the end of the study to expand the information available (refer section 2.4).

The second question of this part of the study, relating to access, was explored through consultation with the above HSNO applicants and with other industry participants.

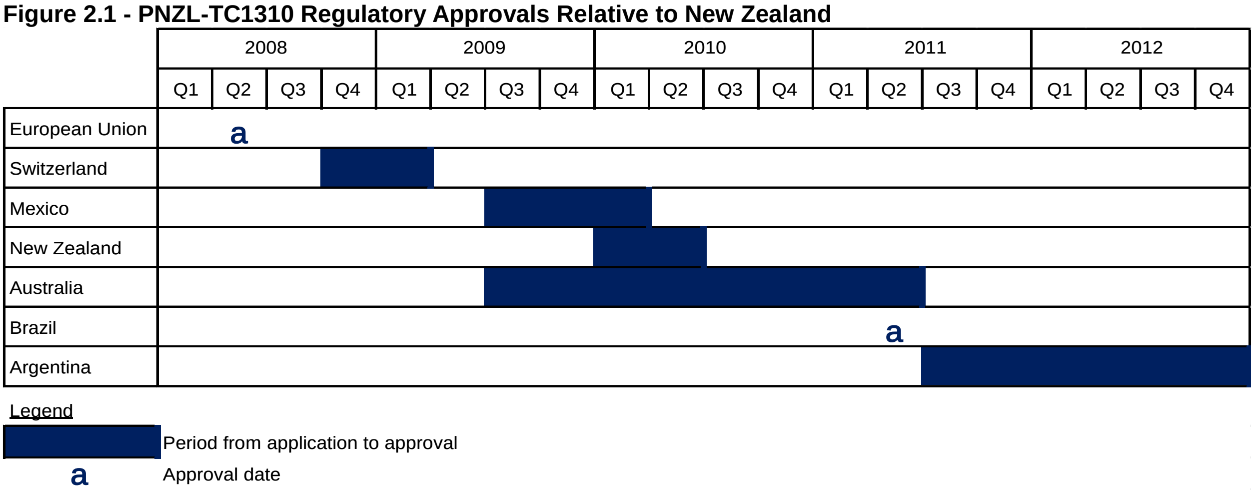
2.3 Case Studies

2.3.1 Pfizer Veterinary Medicine

This case study provides an example comparing a HSNO approval with approvals in other jurisdictions in the case where positive approvals are required by all of the jurisdictions considered. While this was a conjoint application for approval under HSNO and as an ACVM product, the following comments relate to the HSNO approvals only.

Figure 2.1 shows some of the countries where the product has been approved or where applications have been made. This is not comprehensive, but is based on the information available from the applicant. Section 5.1 of the application stated that *PNZL-TC1310 has been extensively reviewed and approved for use in non-food-producing animals (i.e. dogs) in the European Union.* The dark blue rectangles represent the period between the date the application was made and the date of regulatory approval.

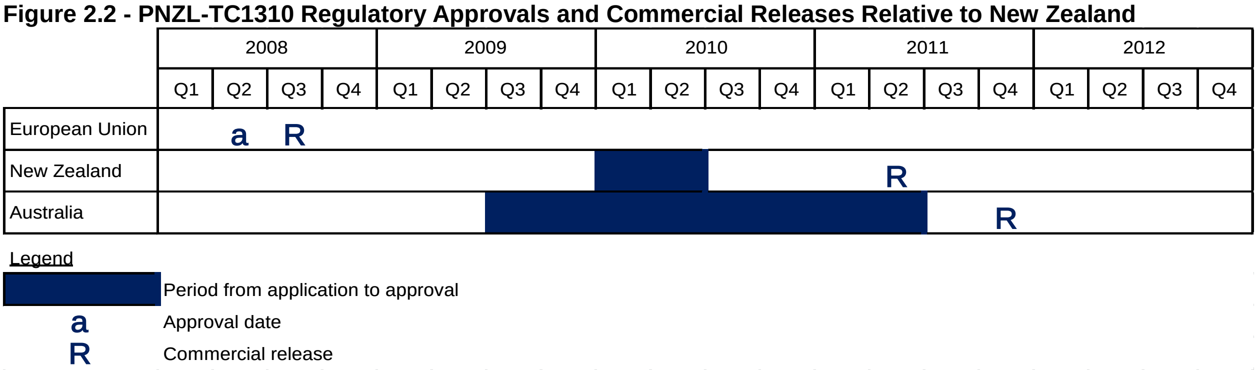
Figure 2.1 - PNZL-TC1310 Regulatory Approvals Relative to New Zealand



From the above figure it can be seen that the New Zealand regulatory approval date sits more or less in the middle of the range. The New Zealand application was made later than Switzerland, Mexico and Australia and the European Union (EU). However, once the New Zealand application was made it appears that the process progressed relatively quickly. The application date for Brazil is unknown therefore no comment can be made on the duration of the approval process. The application in Argentina was made significantly later than the other comparison countries and at the time of data collection the chemical had yet to be approved.

Figure 2.2 below shows commercial release dates for those countries where this information was available. Once the New Zealand approval was granted there was a relatively long period (approximately 10 months) until the product was actually released. Some delay between approval and product launch is to be expected while stocks are procured and a marketing campaign is arranged, but the length of this period may indicate that there were other non-HSNO reasons why New Zealand users faced delays in accessing the chemical.

Figure 2.2 - PNZL-TC1310 Regulatory Approvals and Commercial Releases Relative to New Zealand



Reasons for Delays

It is of note that the veterinary product was available in New Zealand before Australia as Australia represents a key export competitor to New Zealand, particularly in the agricultural sector. This indicates that Australia is a more attractive market and so application is made there first, but what appears to be an efficient approval process in New Zealand resulted in earlier access in New Zealand.

Although the product was available in New Zealand before some countries, it was available significantly later than in other jurisdictions such as the European Union. Reasons for such delays were explored with the applicant and the following comment was provided:

> *This product was registered and launched significantly earlier in the European Union. This was largely because the majority of the safety and efficacy trials conducted during development were performed within the European Union, and Pfizer's dialogue with the European regulatory authorities began early in the development phase. Additional information to support the registration was submitted to the European authorities over a period of time, including an extensive two-year field safety and efficacy study involving over 2000 client-owned animals. Pfizer New Zealand opted to wait until the results of this study were available before commencing registration activities locally in order to further strengthen the data package.*

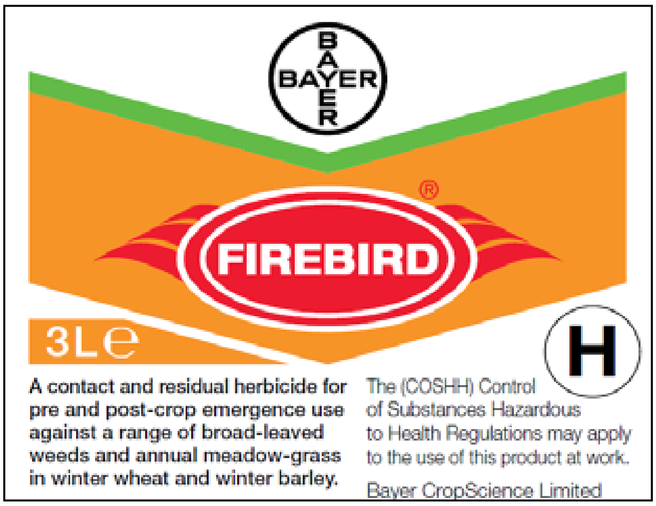
In essence, the New Zealand branch of Pfizer opted to delay making an application in order to leverage off the work done in the European Union. Industry consultation has revealed such a strategy to be common, largely as a result of New Zealand's small market size. The product development phase requires intense investment of time and resources and in order to justify such an investment there must be the potential for significant returns. Those returns are almost always going to be greatest for the largest markets, so it is rational for distributors to accord those the highest priority.

The basic European dossier was provided to the New Zealand business once the product had been approved in Europe. However, it was commented that, once European approval had been granted, additional information continued to be submitted to the European authorities, including results from an extensive two year field study. The New Zealand business chose to delay submission until the results from this study were available.

A trade-off was therefore made between submitting an earlier application and submitting a more robust application. The short processing period in New Zealand is likely to have been influenced by the robust package provided by the applicant. In addition to the decision to wait for more data to become available, the decision to delay the application was also made on commercial grounds. The sales forecasts for the New Zealand market alone were considered too small to meet minimum order requirements for manufacturing. Delaying the submission allowed for the company's Australian affiliate to submit an application to the Australian Pesticides and Veterinary Medicines Authority and allow harmonisation of labelling across both markets, thus reducing the costs of goods and allowing the demand forecasts to be combined in order to meet manufacturing thresholds.

2.3.2 Bayer – Firebird

Figure 2.3 - Part of Bayer Firebird UK Product Label

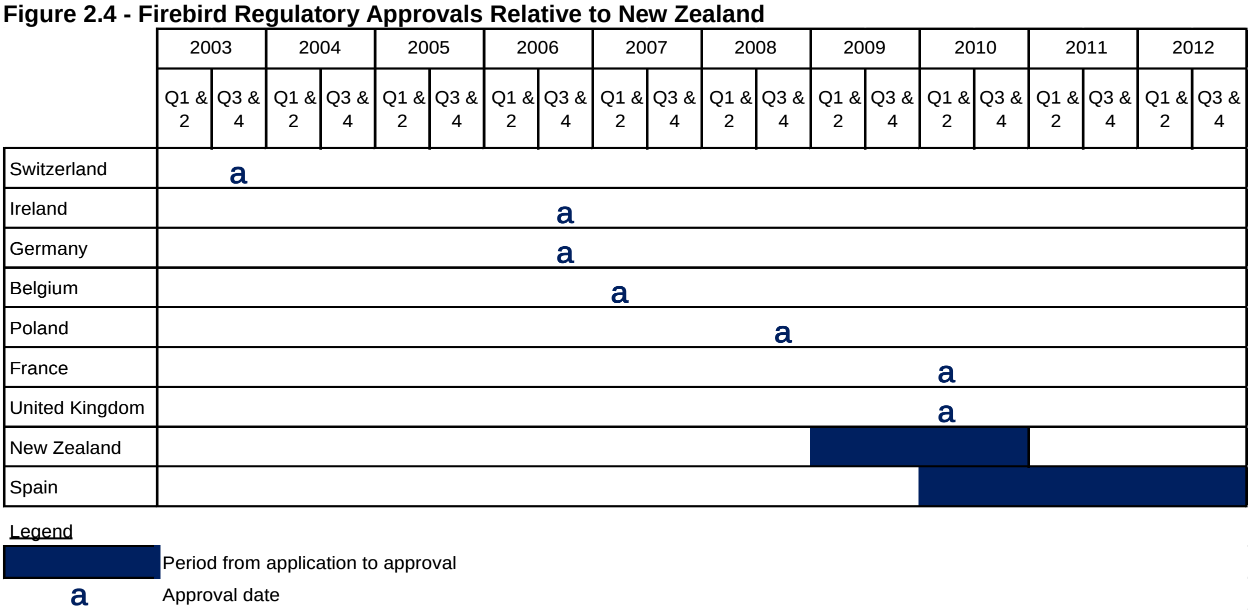


This case study provides a second example comparing a HSNO approval with approvals in other jurisdictions in the case where positive approvals are required by all of the jurisdictions considered. While this was a conjoint application for approval under HSNO and as an ACVM product, the following comments relate to the HSNO approvals only.

Application number HSR08057 was made by Bayer for the product "Firebird" which is an herbicide containing 400 g/litre flufenacet, plus 200 g/litre diflufenican, in the form of a suspension concentrate. Section 5.1 of the application stated that Firebird was already registered in Europe and the USA.

Figure 2.4 shows the Firebird approval date for New Zealand and for several European countries.

Figure 2.4 - Firebird Regulatory Approvals Relative to New Zealand



It is evident that Firebird was approved in New Zealand later than the European countries shown above, with the exception of Spain. In some cases there were significant delays in approval - of up to several years (note that approval dates for countries outside of Europe are not shown). The key reason given by the applicant for the later application in New Zealand was simply that the market opportunity was not present at that time in New Zealand or that the market was considered too small in New Zealand.

Although Bayer was granted approval in August 2010, the product was not commercially released until seven months later in March 2011. At the time of release, Bayer's marketing manager for arable crops made the following comments regarding the delay:

> *As our arable market is relatively small on a global scale manufacturers have to make increasingly hard commercial decisions whether to develop new products here, so the launch of any new arable active ingredient in New Zealand is an important event. This is especially the case when the active ingredient is as exciting as flufenacet. Flufenacet has been used over millions of hectares of arable land in Europe and has proved itself to be an extremely effective herbicide against both grass and broad-leaved weeds.*

Product launches can have a strong-flow on effect to later sales volumes of a product. The above comment suggests that a trade-off may have been made between availability of the chemical and the impact of the product launch. It indicates that market factors play a considerable role in the accessibility of chemicals and that the regulatory process is only one part of the picture when considering differences in market access.

2.3.3 3M - Novec 7500 Engineered Fluid

This case illustrates the situation where the chemical is hazardous and is not covered within another hazardous substance approval or within the scope of the currently available group standards. Application number APP201112 was made by 3M for the product Novec 7500 Engineered Fluid, a hydrofluoroether designed for use as a heat transfer agent and as an electronic cleaning fluid - Figure 2.5.

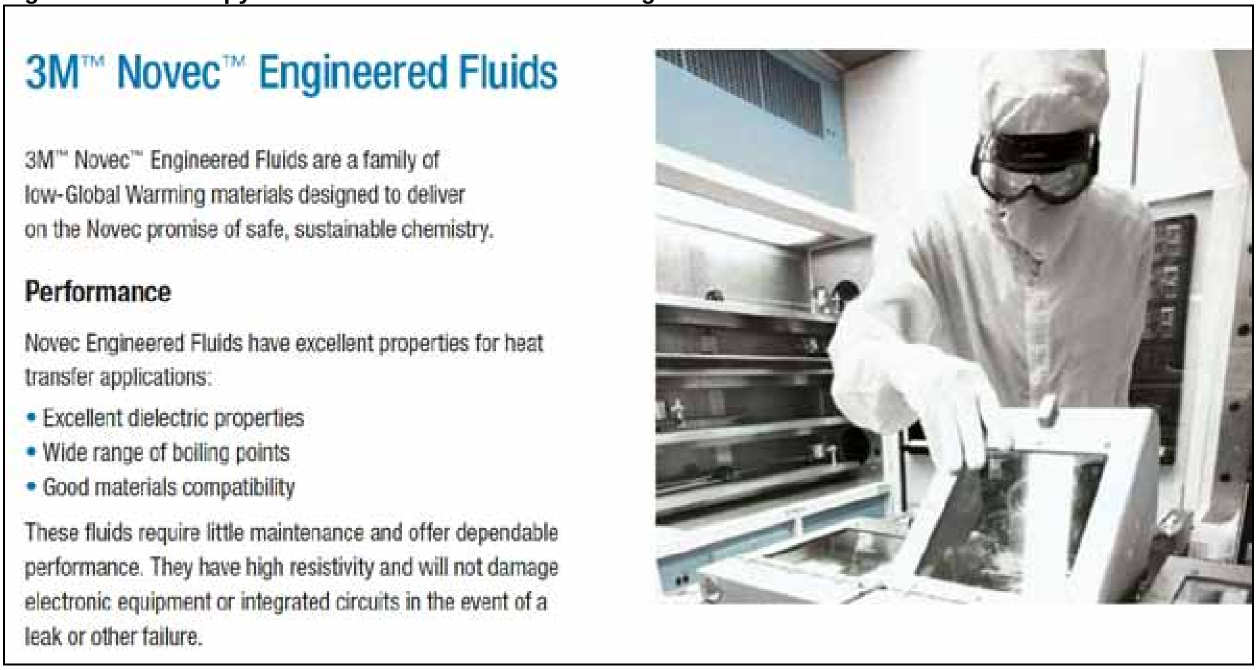
3M has developed a family of products under the Novec brand, based on proprietary segregated hydrofluoroether chemistry (Figure 2.6). Novec 7500 is just one of 17 Novec branded products with similar properties that 3M markets as *engineered fluids*[17]. The range of fluids has applications in cleaning for electronics manufacture, heat transfer, fire suppression and archival preservation. The company claims that Novec 7500 is a viable option for replacing perfluorocarbons (PFCs) in a wide array of applications. Compared to PFCs the product has a low Greenhouse Warming Potential (GWP) of around 90[18] (3M, 2008).

---

[17] 3M NZ have introduced and sell several other Novel fluids in New Zealand – these are all mixtures and were introduced under Group Standards

[18] 100-year integrated time horizon, IPCC 2001 method. For comparison the 100 yr GWP for methane is 25.

Figure 2.5 - Part Copy of Brochure for 3M Thermal Management Fluids



3M™ Novec™ Engineered Fluids

3M™ Novec™ Engineered Fluids are a family of low-Global Warming materials designed to deliver on the Novec promise of safe, sustainable chemistry.

Performance

Novec Engineered Fluids have excellent properties for heat transfer applications:

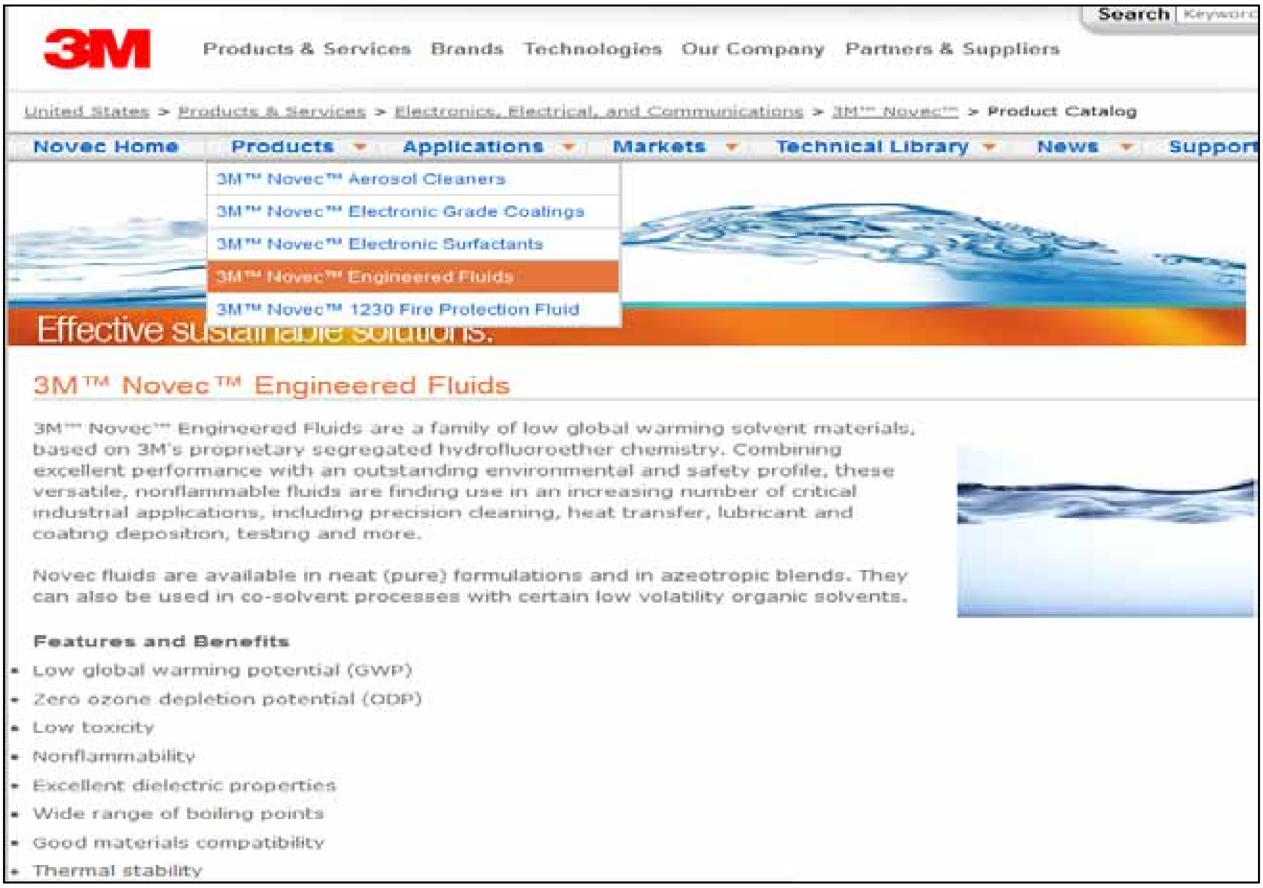
- Excellent dielectric properties
- Wide range of boiling points
- Good materials compatibility

These fluids require little maintenance and offer dependable performance. They have high resistivity and will not damage electronic equipment or integrated circuits in the event of a leak or other failure.

Source: 3M.com

The applicant advised that this is one of tens of thousands of products manufactured by 3M - all made overseas. For instance 3M markets 16 other engineered fluids under the Novec brand, which is just one of 5 Novec branded product lines from this family of chemicals. The availability of Novec 7500 was explored in the following comparative jurisdictions:

Figure 2.6 – Screenshot from 3M Novec Fluids Online Product Catalogue



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3M™ Novec™ Engineered Fluids
3M™ Novec™ 1230 Fire Protection Fluid

Effective su

3M™ Novec™ Engineered Fluids

3M™ Novec™ Engineered Fluids are a family of low global warming solvent materials, based on 3M's proprietary segregated hydrofluoroether chemistry. Combining excellent performance with an outstanding environmental and safety profile, these versatile, nonflammable fluids are finding use in an increasing number of critical industrial applications, including precision cleaning, heat transfer, lubricant and coating deposition, testing and more.

Novec fluids are available in neat (pure) formulations and in azeotropic blends. They can also be used in co-solvent processes with certain low volatility organic solvents.

Features and Benefits

- Low global warming potential (GWP)
- Zero ozone depletion potential (ODP)
- Low toxicity
- Nonflammability
- Excellent dielectric properties
- Wide range of boiling points
- Good materials compatibility
- Thermal stability

Source: 3M.com

Australia: In Australia 3M markets all 17 Novec Engineered fluids (3M, 2012). However this chemical is not listed on the Australian Inventory of Chemical Substances and thus hasn't been assessed in Australia.

United States: Novec 7500 was listed in the US in May 2000. The use of the compound depends on the definition of "Volatile Organic Compound" (VOC); however, this definition has been modified several times over the past decade or so. In November 2004 the EPA exempted this compound from the *federal* definition of VOC, meaning that its use was permitted under the Clean Air Act. In 2010 a proposal was made to have the compound exempted in the Sacramento metropolitan "Air Quality Management District", indicating that the status of the product at a State or District level is less certain (Yang, 2010).

European Union: Novec 7500 was listed on the European List of Notified Chemical Substances (ELINCS) in 2001 and by REACH in 2009

Canada: The Canadian Domestic Substances List identifies substances which are considered to be used in Canadian commerce, used for manufacturing purposes or manufactured in or imported into Canada in a quantity of 100kg or more in any year. The purpose of the list is to define what is new to Canada. In a similar way, the Non-Domestic Substances List is a list of substances believed to be in use in *international* commerce. Records from Environment Canada indicate that this chemical was on the Non-Domestic Substances List in August 2005 (Environment Canada, 2009). This means that the Novec 7500 Engineered Fluid was not necessarily in commercial use in Canada at that time; however, it was accepted to generally be in use in international commerce.

Other Jurisdictions: In addition to the above, Novec 7500 is also listed on the following inventories:

- Inventory of Existing Chemicals in China
- Korean Existing Chemical Inventory
- Philippine Inventory of Chemical and Chemical Substances
- Taiwan National Existing Chemical Substance Inventory
- Toxic Substances Control Act (US)

Approval was granted in Korea and the Philippines in 2001.

The above information is summarised in Figure 2.7 below. It can be seen that Novec 7500 was approved for use in New Zealand much later than notifications in other jurisdictions, possibly due to lack of demand. The chemical is marketed in Australia as part of the full family of Novec Engineered Fluids, but does not appear to have been notified in Australia at this time. Under the Australian NICNAS requirements notification is not required until certain volume thresholds have been exceeded.

Figure 2.7 - Novec 7500 Use and Regulatory Approval Comparison

	Pre-2003	2004		2005		2006		2007		2008		2009		2010		2011		2012	
		Q1 & 2	Q3 & 4	Q1 & 2	Q3 & 4	Q1 & 2	Q3 & 4	Q1 & 2	Q3 & 4	Q1 & 2	Q3 & 4	Q1 & 2	Q3 & 4	Q1 & 2	Q3 & 4	Q1 & 2	Q3 & 4	Q1 & 2	Q3 & 4
US	a (2000)																		
EU	a (ELINCS - 2001)											a (REACH)							
Korea	a (2001)																		
Philippines	a (2001)																		
Canada					T														
New Zealand																			

Legend

- Period from application to notification
- Several revisions have taken place during the period
- a Notification date
- T Date published on the Non-Domestic Substances list (refer text)

While NOVEC illustrates the difference between New Zealand with its positive approval requirement and other 'notification' type jurisdictions, the overall theme of the feedback from 3M was that products are introduced to New Zealand when there is an opportunity to sell or to meet specific requests from customers – and as with any new product there must be sufficient demand to offset market introduction costs, including approval costs.

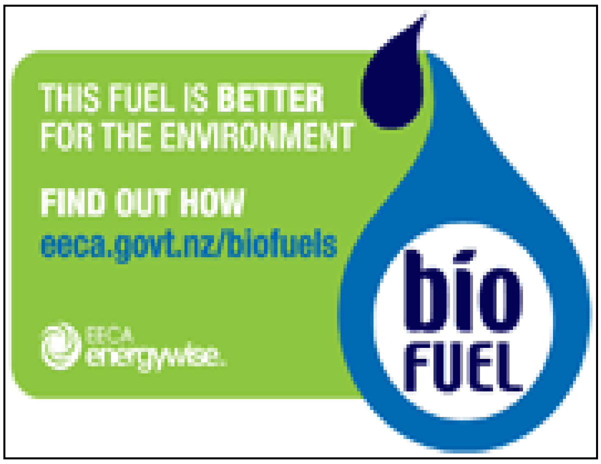
HSNO approvals are a factor in the timing of product introductions; however, the core decision about whether to introduce a chemical is driven by other factors such as the market size, demand and other costs of commercial release.

2.3.4 EECA – Biodiesel

Application number HSR07151 was made by the Energy Efficiency and Conservation Authority (EECA) for biodiesel fuel and diesel fuel blends with the proportion of biodiesel fuel in the mixture greater than 20% (known as B20) and less than 100% (B100).

Biodiesel is considered globally as one of two main renewable liquid fuel options for the transport sector, the other being ethanol. Efforts are therefore being made internationally to provide greater flexibility to use these fuel options – including extending the range of biodiesel fuel blends that are permitted.

Figure 2.8 - EECA Biofuels Label



This application differs somewhat from the other randomly selected applications as the application was made on behalf of all industry. EECA deemed the product to be beneficial to New Zealand industry overall and thus opted to undertake the application to promote the use of biodiesel blends by removing any uncertainty relating to its regulatory status.

EPA had previously confirmed B100 as a non-hazardous substance and had also approved blends of biodiesel up to and including B20. Therefore this application was to seek approval for all blends between these two positions.

Biodiesel Blends in Other Jurisdictions

Biodiesel approvals in other jurisdictions consist of three main aspects:

- Automotive fuel standards
- Biofuel mandates
- Regulatory approval of biodiesel (B100) and blends for managing the hazards to people and the environment.

It is the last of the above which is equivalent to HSNO approval, but all three are related. Over the last decade there have been initiatives in most countries to encourage the uptake of biodiesel by removing regulatory uncertainty which could be a barrier to investment in production and distribution facilities. Biodiesel manufacturers and promoters have formed lobby groups to influence legislation and manufacturers of diesel engines have been pressured to extend the warranties on their engines.[19]

Fuel Specifications

In parallel with the above, standards authorities have been setting automotive fuel standards for biodiesel. There are two competing sets of standards: ASTM standards - which are used in the US - and EU standards (Tripartite Task Force, 2007). The ASTM standards now allow for blends in general use up to 20%. The EU standard for biodiesel for general use currently allows for blends up to 7%. The EU standards are undergoing revision to achieve higher blends in modern high performance diesel engines (Delphi et al, 2009) with a next goal of 10% (CONCAWE, 2011).

Some jurisdictions allow blends up to 100%. In New Zealand automotive fuel standards are specified in the *Engine Fuel Specifications Regulations 2011*. The 2011 regulations updated the 2008 regulations, including changes to the specification for biodiesel and blends[20][21].

Regulatory Approval of Biodiesel

Regulatory approval dates for biodiesel and blends are not available for all jurisdictions. However, an indication is provided by when large scale biodiesel production facilities were established, and when fuel mandates came into effect - as it is unlikely that a commercial manufacturing operation would be established unless there was an ability to legally sell and use the product as a fuel on public roads.

United States: The first 2 biodiesel producers were registered with the USEPA in 1996 (US EPA, 2002).Biodiesel is registered with the U.S. Environmental Protection Agency (US EPA) as a motor vehicle diesel fuel and motor vehicle diesel fuel additive for use at any blend level

[19] For example refer http://www.nbb.org/about-us/history-of-biodiesel-nbb for a history of biodiesel in the US.

[20] New Zealand has a standard in place, NZS7500:2005 between 2005 and 2008 when the Engine Fuel Specifications Regulations came into force which included a specification for biodiesel.

[21] The regulations also distinguish between retail sales (diesel containing up to 5% biodiesel) and non-retail sales (all other blends).

up to B100 in highway diesel vehicles (US EPA, 2007). In the United States regulations under the Clean Air Act (40 CFR Part 79) requires that each manufacturer or importer of motor fuel have their product registered by EPA prior to its introduction into commerce (US EPA, 2007). Biofuel mandates have been operative in some individual states since 2005 (Figure 2.10).

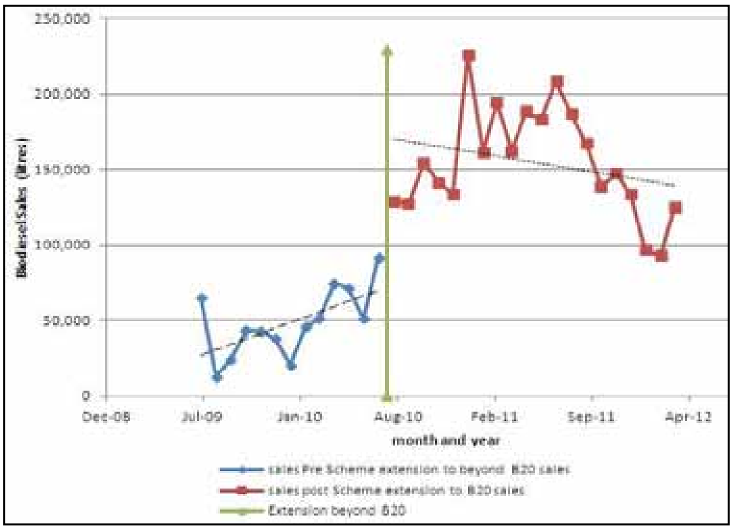
Canada: Major biodiesel plants were established in 2005, when Rothsay opened a 45 million litre per annum plant in Montreal using tallow feedstock, and Western Biodiesel opened a 20 million litre plant using various feedstocks (Canadian Renewable Fuels Association, in USDA (2011). This indicates that biodiesel has been legally approved in Canada since at least that time. In July 2011 federal regulations were enacted requiring a 2% biodiesel blend for automotive and heating fuels in most provinces. The mandate was implemented progressively over the latter half of 2011 in most territories (Biomass Hub, 2011).

Australia: Provided that it meets the relevant diesel standard B5 is considered equivalent to diesel and does not need any infrastructure changes. Blending of biodiesel with diesel can only be carried out by licensed blenders (CSIRO, 2007). Biodiesel production in Australia started in 2003/04. By 2005 there were 10 licensed producers (O'Connell, 2005). In 2009 the State of NSW amended the Biofuel Act to require a mandatory 2% blend of biodiesel, from 1 January 2010, on a volumetric basis (Biofuels NSW, 2012). The 2009 Amendment Act requires also sets out an increase the biodiesel mandate to 5% from 1 January 2012. This latter requirement has been suspended until sufficient local production is available.

Ireland: The first biodiesel production plant in Ireland commenced operation in June 2008. At the time of opening the plant the owner planned to sell the product to small distributors in Ireland and export the rest to the United Kingdom (Bevill, 2008).

New Zealand: In New Zealand biodiesel is classified a non-hazardous substance. In 2004 it was further determined that biodiesel in mixture with diesel in any proportion would be considered to be existing substances (ERMA, 2004). Handling and storage requirements are therefore the same as for mineral diesel (EPA, 2012). Production of biodiesel in New Zealand commenced in around 2007 and has increased following introduction of the Biodiesel Grants Scheme in July 2009 (Figure 2.9).

Figure 2.9 - NZ Biodiesel Sales (litres per month)

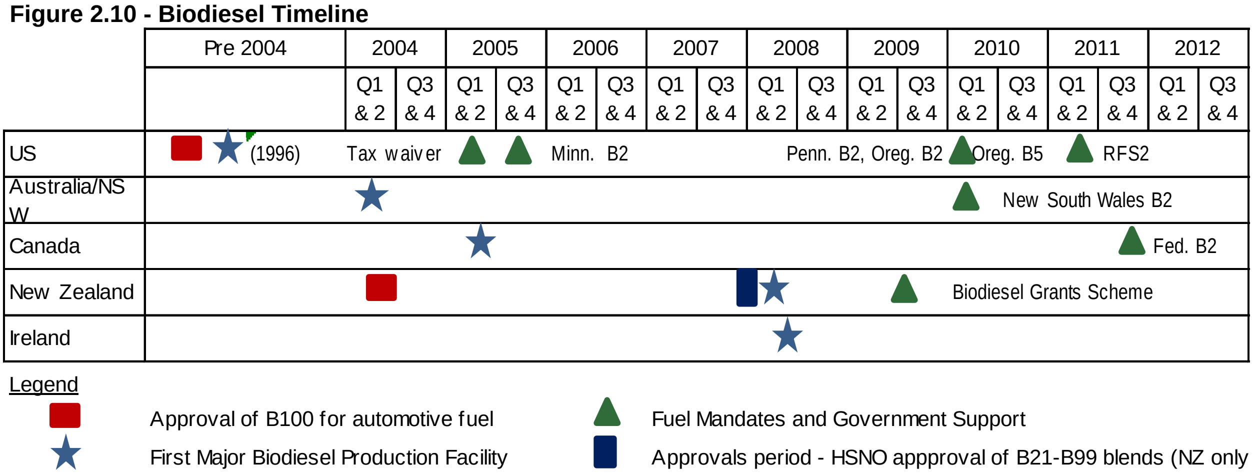


Source: bioenergy.org.nz. (EECA data)

Biodiesel Timeline

The following timeline illustrates the development of regulatory approvals, production facilities and incentives in New Zealand, the US and comparative jurisdictions.

Figure 2.10 - Biodiesel Timeline



From the timeline it can be seen that the biodiesel industry developed early in the US, which has been a leader in biodiesel production. It was almost a decade before significant production facilities started in Canada and Australia and another 3-4 years before they started in the much smaller market of New Zealand and Ireland. It is of note that the order of development is roughly in line with the relative size of each economy. This may indicate that commercial factors were important in establishing these industries.

Approvals for B21-B99 blends in New Zealand took just under 3 months. This time period is short compared to the 4 years that elapsed between ERMA determining that B100 was non-hazardous and the establishment of the first production facility.

In summary it would appear that the relatively late development of biodiesel production and use in New Zealand is most likely due to other non-HSNO factors.

2.4 Chemical Briefs

In this section 8 further chemicals are examined in brief, primarily from information submitted in the HSNO approval application. In two cases some additional information is presented based on supplementary information provided by the applicants. The chemical briefs were added towards the end of the project to get a wider understanding of:

- The timing of applications in New Zealand relative to other jurisdictions
- The duration for HSNO approval for a wider array of *Category C* substances.

Additional information was sought from applicants, but was hampered by the limited timeframe, changes in personnel in applicant organisations since the original HSNO applications were made and often low levels of knowledge of the regulatory status in other jurisdictions. These issues are to be expected as, once HSNO approval is gained, there is no need to maintain knowledge and such issues recede into the background.

Agricultural Chemicals

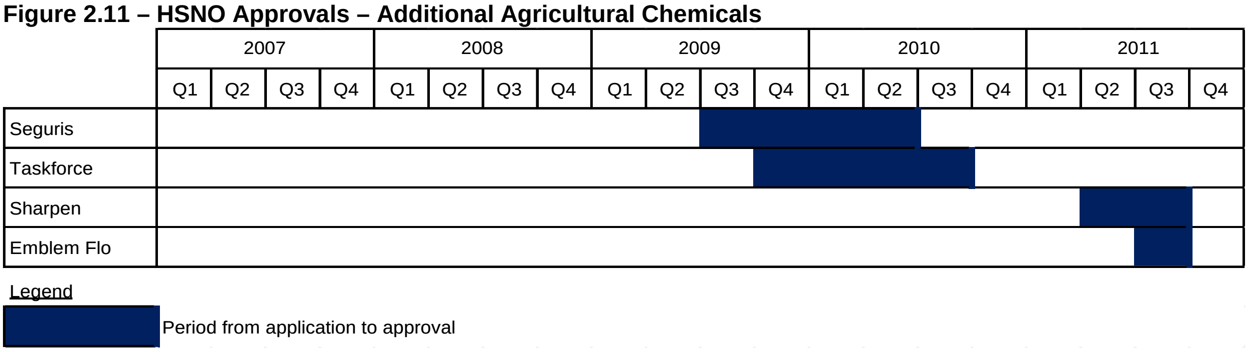
The additional HSNO applications for agricultural chemicals are shown in Table 2.5.

Table 2.5 - Additional HSNO Applications – Agricultural Chemicals

Application No.	Applicant	Short Name and Comment
ERMA200096	**Syngenta**	***Seguris*** is a fungicide for the control of foliar diseases in wheat and barely
HSR08111	**Marlborough District Council**	***Taskforce*** is a herbicide for the selective control of two invasive weeds, Chilean needle grass and Nassella tussock in pasture
ERMA200799	**BASF**	***Sharpen*** is a herbicide containing saflufenacil, to be used for post or pre-emergence control of weeds in certain orchard, crop, pre-plant burn down and non-agricultural situations
ERMA200755	**Nufarm**	***Emblem Flo*** is a selective herbicide containing bromoxynil as the butyrate ester, for the control of broadleaf weeds in maize sweetcorn and popcorn crops

Figure 2.11 shows the period from application to approval for the additional agricultural chemical applications.

Figure 2.11 – HSNO Approvals – Additional Agricultural Chemicals



The HSNO application by Syngenta Crop Protection for the Seguris fungicide was submitted for registration in Europe for use on cereals in 2008 and in New Zealand in mid-2009. HSNO approval took 8 months. At the time of the New Zealand application there was also a plan in place to submit an application in Korea for use on capsicums.

Marlborough District Council made the HSNO application to register the Taskforce herbicide in December 2009. At the time the Taskforce HSNO application was made, the product was registered with the APVMA in Australia for use in pastures and non-crop situations for control of Chilean needle grass and serrated tussock, along with other rhizomatous grass weeds. The product was approved 8 months after the HSNO application was submitted.

Sharpen was submitted for HSNO registration by BASF New Zealand in April 2011. At the time of application, the product had been approved in the US and Canada and a submission had been made in Australia. During the New Zealand evaluation and review period further information was requested of the applicant. This resulted in the application being postponed for 21 working days. The application was approved in approximately 5 months.

The HSNO application for Emblem Flo herbicide was made by Nufarm in June 2011. Figure 2.12 shows the regulatory approval dates and commercial release dates for Emblem Flo in New Zealand, the UK and the European Union.

Figure 2.12 - Emblem Flo Approval and Commercial Release Dates

	2007				2008				2009				2010				2011			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
UK	a								R											
EU									R											
New Zealand																				

Legend

	Period from application to approval
a	Approval date
R	Commercial release

The New Zealand application was some years after approval in the UK and the European Union. This is largely because the formulation was developed in Europe for the European market in order to replace the pre-existing Emblem dry product. Nufarm New Zealand was forced to switch to the new Emblem Flo version as the manufacturer planned to phase out manufacture of the dry product. As such, the decision to bring the Emblem Flo product into New Zealand was primarily supply driven.

Industrial Chemicals

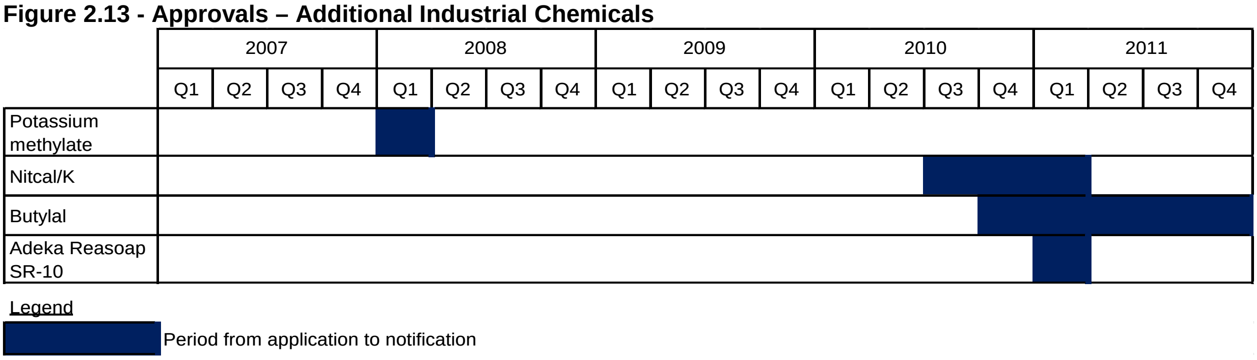
The additional HSNO applications for agricultural chemicals are shown in Table 2.6.

Table 2.6 - Additional HSNO Applications - Industrial Chemicals

Application No.	Applicant	Short Name and Comment
HSR07146	**Evonik Degussa Australia**	***Potassium methylate*** is an industrial chemical intended for use as a catalyst in biodiesel production
ERMA200510	**Yara Norge A/S**	***Nitcal/K*** is intended to be mixed into an oil based drilling fluid, as part of the formulation
ERMA200752	**Chemie-Tech**	***Butylal*** is a solvent for use in manufacturing
ERMA200734	**Nuplex Industries**	***Adeka Reasoap SR 10*** is intended for use in the manufacture of emulsion polymers for surface coating formulations

Figure 2.13 shows the period from application to approval for the additional industrial chemical applications.

Figure 2.13 - Approvals – Additional Industrial Chemicals



The Evonik Degussa application for Potassium methylate was made in January 2008 and approved in February 2008. This was a relatively quick approval likely due to the fact that the chemical was considered to be very similar to the already notified methanol, sodium salt (CAS 124-41-4). At the time of application the chemical was already listed on several overseas inventories as shown in Figure 2.14.

Figure 2.14 - Inventory status of CAS 865-33-8, Methanol, potassium salt

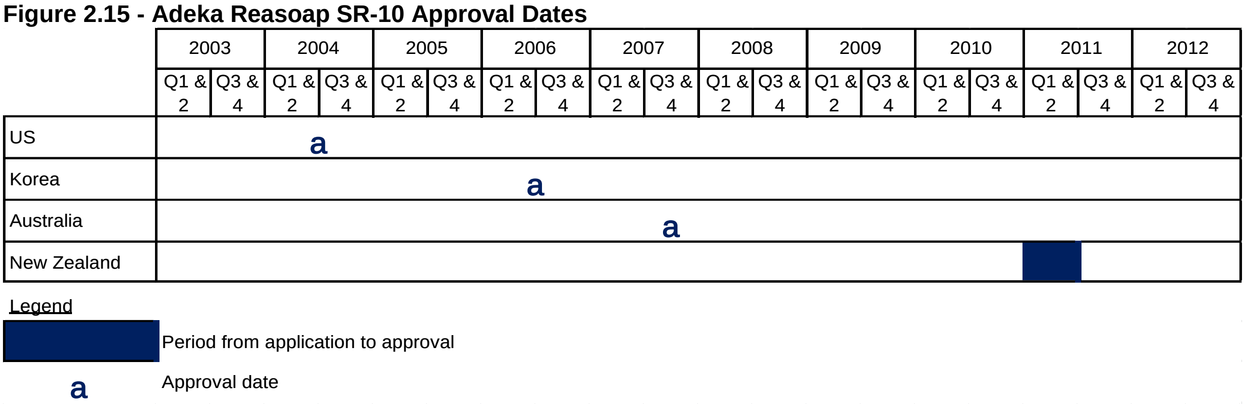
1	Australia. Industrial Chemical (Notification and Assessment) Act	AICS	01 2006	Y (positive listing)
2	Canada. Canadian Environmental Protection Act(CEPA), Non-Domestic Substances List (NDSL)	NDSL	12 2005	Y (positive listing)
3	Japan. Industrial Safety & Health Law (ISHL) List	ISHL (JP)	09 2005	Y (positive listing)
4	US. Toxic Substances Control Act	TSCA	01 2006	Y (positive listing)
5	EU. EINECS	EINECS	03 2002	Y (positive listing)
6	Korea. Toxic Chemical Control Law (TCCL) List	KECI (KR)	11 2005	Y (positive listing)
7	Philippines. The Toxic Substances and Hazardous and Nuclear Waste Control Act	PICCS (PH)	2005	Y (positive listing)
8	China. Inventory of Existing Chemical Substances	INV (CN)	2004	Y (positive listing)
9	Switzerland. Consolidated Inventory	CH INV	05 2005	Y (positive listing)

Yara Norge A/S applied to have Nitcal/K registered in 23 August 2010. At the time of application Nitcal/K had been notified in the European Union as an industrial chemical. HSNO approval was granted in January 2011.

Registration of Butylal in New Zealand was applied for in December 2010. During the assessment of the application further information was requested from the applicant and the application was subsequently postponed for 205 working days. At the time of application Butylal was already notified in the European Union. HSNO approval was granted approximately 11 months after the application was submitted.

The application to register Adeka Reasoap SR-10 was made in late January 2011 and HSNO approval was granted in March 2011. The Adeka Reasoap SR-10 approval dates for New Zealand, Australia, Korea and the US are shown in Figure 2.15.

Figure 2.15 - Adeka Reasoap SR-10 Approval Dates



It is clear from the above that the New Zealand application took place significantly later than in the US, Korea and Australia. However, once the application was made approval was granted reasonably quickly. A copy of the Australian National Industrial Chemicals notification and Assessment Scheme (NICNAS) public report regarding this chemical was appended to the New Zealand application - it is likely that the availability of such documents contributed to a short processing period.

2.5 Access

2.5.1 Overview

In addition to the above consultation regarding product delays, the selected applicants were also asked a series of questions relating to their overall chemical portfolios and the proportion of these chemicals which are sold in New Zealand. The initial question asked was simply whether the company had chemicals available to purchasers in other jurisdictions, but not in New Zealand and what were the reasons for this. Feedback from the companies is summarised in Table 2.7.

Table 2.7 - Summary of Feedback

Company	Key Reasons for Availability Overseas but not in New Zealand
Pfizer	New Zealand market is often too small to meet minimum order quantities set by manufacturing sites in relation to country-specific packaging
Bayer	Limited or no market opportunity, market size too small, lack of data protection
Nufarm	Lack of data protection for compounds in New Zealand is a disincentive to register products here
3M	Small new Zealand market, insufficient demand to make it worthwhile
EECA	No overseas operations

As with the delays to market discussed in the previous sections, the New Zealand market size is a key factor in the decision to apply for approval of chemicals for use in New Zealand. For some chemicals the New Zealand market size will be too small to be commercially viable, no matter how low the regulatory compliance costs are.

Some products are marginal: where the New Zealand market size is almost, but not quite, large enough to justify the costs of entry and of maintaining market presence. One approach employed by distributors to address marginal market size in New Zealand is to use harmonised packaging with similar markets such as Australia or the UK. This enables companies to decrease costs by "piggybacking" on production runs for the other market, which increases the potential return on investment from selling the product in New Zealand. However, such a strategy is not always possible as some products have to be repackaged or relabelled on arrival in New Zealand to meet HSNO Act regulations.

Where it is not possible to import overseas packaging for local relabelling, or to harmonise labelling with similar markets, the small market size means that the potential return from the product in New Zealand may be inadequate. In these cases the product is not commercially viable.

2.5.2 Data Protection

An additional consideration is the level of protection of proprietary information. HSNO does not of itself contain any data protection provisions and the EPA is subject to the Official Information Act (including the commercially sensitive information provisions). As a result, once a hazardous substance is approved the approval applies irrespective of supplier. Information submitted by the original applicant on factors such as hazards can be drawn on in the assessment of the substitute. This makes it much easier for substitutes to enter the market or for existing competitors to follow into new market segments. This is beneficial for price competition, but the short period of sole market access before generics arrive – reported by industry participants as typically 6 months – can be insufficient to generate the return required to apply in the first place. One outcome is that research into new uses is more difficult to justify economically, which can act as a disincentive to undertaking the research.

While there are such concerns with HSNO, data protection is much more of an issue with products that require approval under the Agricultural Compounds and Veterinary Medicines Act. ACVM approvals often require substantial research on food safety residues, which may require one or two years of field research. In many cases the research results will be available from overseas markets, but sometimes the intended usage of the chemicals in New Zealand is different due to different crops or different farming contexts. One example is the use of sheep in vineyards to strip new leaf growth from grape vines – which has implications for the sprays used on vineyards where residues may accumulate in the sheep-meat.

Industry participants state that the level of data protection in New Zealand is less than in comparable jurisdictions and prevents the recoup of large investments required to justify the investment required to bring new chemicals or uses to the New Zealand market.

Information supplied by the New Zealand Association for Animal health and Crop Protection (Agcarm) indicates that typical costs of ACVM research and approvals is an order of magnitude greater than HSNO approvals (Agcarm, 2012). While the HSNO and ACVM issues are often conflated into a single data protection concern, as there are similar issues, it is the level of data protection under the ACVM Act which is the main concern.

2.5.3 Proportion of Worldwide Portfolio

Many chemical distributers operating in New Zealand are part of multinational corporations which supply chemicals in many countries. Each country has unique and specific industrial and agricultural requirements driven by factors such as climate, dominant agricultural crops, and types of industry. As a result many products which are developed overseas are simply not relevant to the New Zealand market. For example products for the treatment of pests and diseases in crops such as rice or cotton, which are major global crops in warmer climates, are unlikely to be required in New Zealand as these crops are not grown here.

Box - Australian Productivity Commission Investigation

The Australian Productivity Commission (APC) investigated chemicals industry regulation, culminating in the report *Chemicals and Plastics Regulation* (APC, 2008). One aspect of the APC study was similar to the availability part of this study – what evidence is there that the barrier-to-entry represented by chemicals regulation slows or stops useful chemicals from being introduced.

The APC study reported that a survey of suppliers (conducted by an industry body) identified that 93% of suppliers had some chemicals available overseas, but not in Australia; 41% had reformulated chemicals to avoid assessment requirements, and 14% of the companies' worldwide portfolio was not introduced in Australia for regulatory reasons.

Industrial requirements will be driven by the types of industry present, which again is highly variable across jurisdictions. Some of the factors which are commonly taken into account when deciding whether to introduce a product in New Zealand are shown below.

Table 2.8 - Considerations for Bringing a Product to Market

Consideration	Comment
Strategic fit	How well the product fits with the existing business direction product portfolio of the company, whether the product offers the potential to leverage existing strengths in research and development, manufacturing, technical support and the like
Customer benefit	Indicators of likely demand for the product are considered, e.g. how beneficial the product would be to the customer in terms of increased production / financial gains or from an environmental, health and safety or animal welfare perspective
Attractiveness of NZ market	Market size, estimated peak sales, likely market share, profit margin and length of protection from generic competitors under data protection legislation
Technical feasibility	Technical issues in terms of providing supporting information for the application
Financial Return on Investment (ROI)	Evaluation of the projected profitability versus financial expenditure and resource investment e.g. trial work, data assessment costs, HSNO application fees and application fees for other regulatory requirements such as ACVM

Whether a distributor will choose to invest in gaining approvals and launching the new product is a commercial decision, taking into account the above and other commercial factors.

Distributors who participated in this part of the study were asked to estimate the percentage of overall chemicals profile which is available in New Zealand. Bayer Crop Science indicated that this number would likely be around 10%. This number is the inverse of the findings of the Australian Productivity Commission investigation, which found on average 14% of companies' worldwide portfolio was not introduced in Australia for regulatory reasons.

These contrasting results suggest that there are differences between the New Zealand and Australian market, but caution must be exercised in interpreting them as both results are somewhat anecdotal in nature and the New Zealand sample size is small[22]. As such, the findings regarding the range of chemicals available in New Zealand should be viewed as indicative only.

2.5.4 Reformulation of Products

None of the New Zealand companies reported having reformulated products in order to avoid certain HSNO assessment requirements[23]. It was commented, however, that when considering product options to fill potential gaps in a portfolio, it is common to compare available formulations to products that are already registered in New Zealand in order to reduce the time-to-market and associated regulatory costs. This outcome differs from the results of the Australian Productivity Commission investigation (Productivity Commission

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[22] The number of responses for the result reported by the APC is unknown.

[23] The HSNO approvals framework provides scope to reformulate products/product development with minimal regulatory compliance costs for the new developed products and their approval

2008) which found that 41% of suppliers claimed to have reformulated chemicals to avoid Australian assessment requirements.

2.6 Summary

In summary, four Category C applications for HSNO approvals (Category C being the most onerous) were examined as case studies: two industrial chemicals and two agrichemicals. The case studies looked in detail at the timing of applications and approvals for all jurisdictions.

In general the information supplied by applicants to the EPA on approvals or notifications in other jurisdictions was very brief and intensive research was required to independently research information that they were unable to provide. The degree of effort required limited the sample size and, as a result, the findings of this part of the study should be considered as indicative.

The detailed case studies found that applications in New Zealand were typically made around 5 years later than in other major markets such as Europe and North America. New Zealand approval processes were reasonably quick and, in the case of the Pfizer application, the HSNO approval process took around a quarter of the time taken in Australia. In this case, the faster approvals process in New Zealand made up for some of the delay in making the application.

A further 8 chemicals (4 industrial and 4 agrichemicals) were examined in brief, solely from the application, supplementary information supplied by the applicant, and EPA records. These chemical briefs confirmed the pattern of relatively quick approvals in New Zealand: the average approval time for the 8 approvals was less than 6 months (range 2 – 11 months).

The commercial release of the Firebird herbicide (Bayer) did not occur until 17 months after approval was granted, indicating that commercial factors can have a significant effect on when products are available on the market.

While some applicants referred to HSNO approvals as an issue for delay, most comments related to the size of market and likely financial return being determining factors. These market-related comments from applicants are consistent with observed delays in making applications (so as to benefit from research conducted by the parent company for approvals in other larger markets), and with observed delays from approvals to first sales (for example to piggy-back on production runs for markets such as Australia with similar packaging and labelling requirements, so as to reduce unit costs).

It is concluded from the sample of chemicals assessed that:

1. Chemicals tend to become available on the New Zealand market later than in other larger markets, due to New Zealand applications often being made later than in other jurisdictions. Comments from applicants indicate that this is mainly for financial reasons associated with the small market size in New Zealand
2. The timeframe for HSNO approvals is relatively short compared to timeframes in other jurisdictions for chemicals where approvals are required. Comments from industry participants suggest that commercial factors are the main reason for

delays. It is concluded that HSNO approval timeframes do not appear to be the major cause of delays in market access for chemicals

3. The range of chemicals available to users in New Zealand is most likely significantly smaller than in Australia and in other larger markets. Comments from some distributers suggest that this is mainly due to commercial reasons. The base premise of HSNO - that a chemical needs specific approval before it can be introduced - is also likely to be a factor.

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3 Price

Table of Contents

3.1 Introduction

3.1.1 Objective

This section of the report tests the hypothesis that:

> *The prices of chemicals are significantly higher in New Zealand than in comparison jurisdictions due to the requirement imposed on chemical suppliers and users by the Hazardous Substances and New Organisms Act and Regulations.*

3.1.2 Scope

In order to test the hypothesis prices have been evaluated for the following seven chemicals across four jurisdictions and (Table 3.2 and Table 3.1).

Table 3.1 - Indicator Chemicals

Industrial Chemicals	Agricultural Chemicals
Sulphuric acid	Glyphosate
Caustic soda	Chlorpyrifos
Methyl ethyl ketone	Chlorothalonil
Diesel	

Table 3.2 - Comparison Jurisdictions

Jurisdictions
New Zealand
New South Wales
Ireland
Canada

The selection of chemicals and jurisdictions was subject to a range of methodological considerations which are outlined in Section 3.4.

3.2 Factors Influencing Price

Any attempt to make international price comparisons needs to be undertaken in the context of an understanding of the factors affecting international price levels in the general sense.

Factors outside of costs which influence pricing of chemicals include:

- Demand for the chemical and/or constraints on key raw materials
- The effect of demand for products co-produced with the chemical of interest
- The influence of protections such as intellectual property rights and price controls
- Economies of scale
- Market segmentation
- Competitive forces.

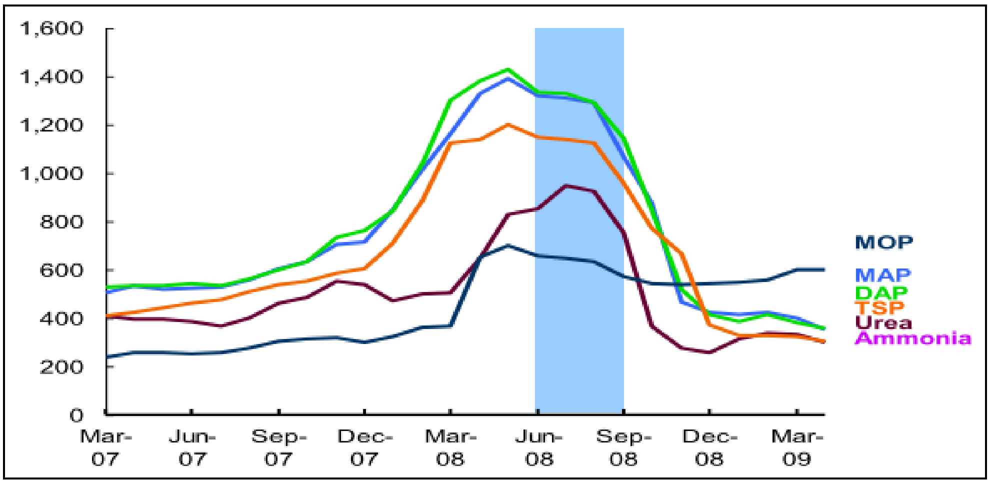
The above is not a comprehensive list, but describes some of the most commonly cited reasons for price differences to arise. Each of these factors is considered in turn below:

3.2.1 Effects of Supply and Demand

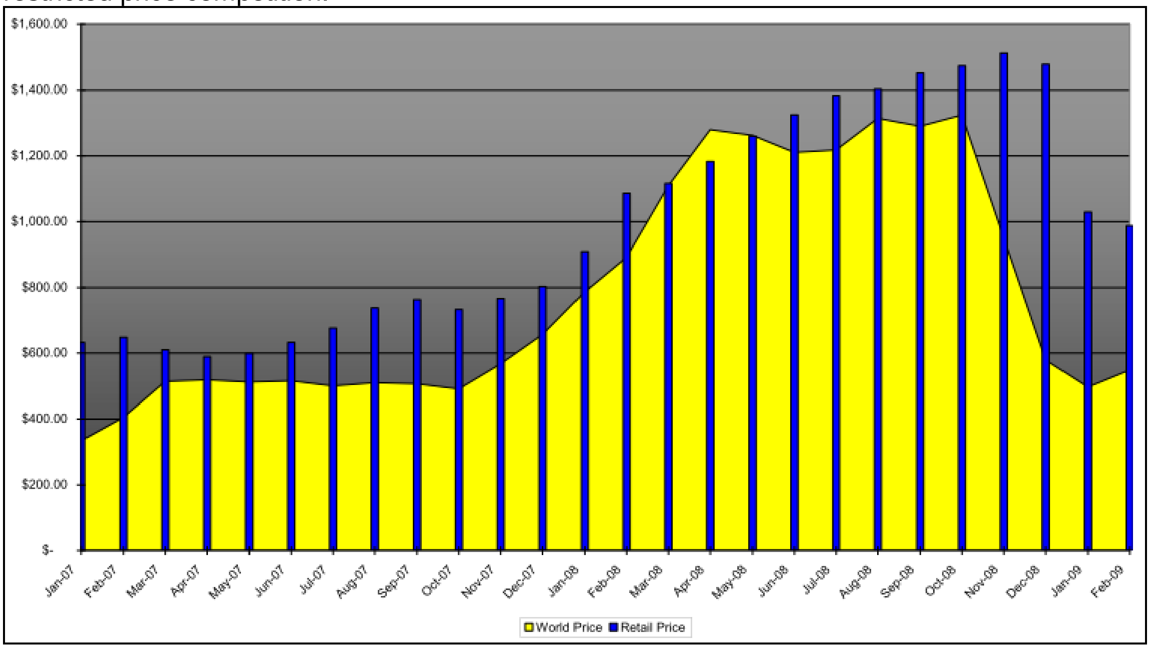
Fertiliser prices over the period 2006 to 2010 illustrate the influence on pricing due to swings in global demand and constraints on supply of raw materials. Australian fertiliser pricing and supply arrangements were investigated by the Senate Agricultural and Related Industries Select Committee (SARISC 2009), following dramatic increases in the prices of fertilisers in 2008 (Refer box).

Fertiliser Prices

The first figure below shows a rapid increase in the global nominal price of fertilisers followed by a dramatic decrease after the onset of the Global Financial Crisis.



The second figure shows the world price of di-ammonium phosphate (area chart), with the columns representing the Australian retail price over the period January 2007 to February 2009. The retail price appears to respond faster to increases in the world price than to decreases. A price ratchet effect can be seen as retail prices settle at a higher level than before, despite wholesale prices falling completely back. The difference appears as increased margins for the retailers, which could indicate restricted price competition.



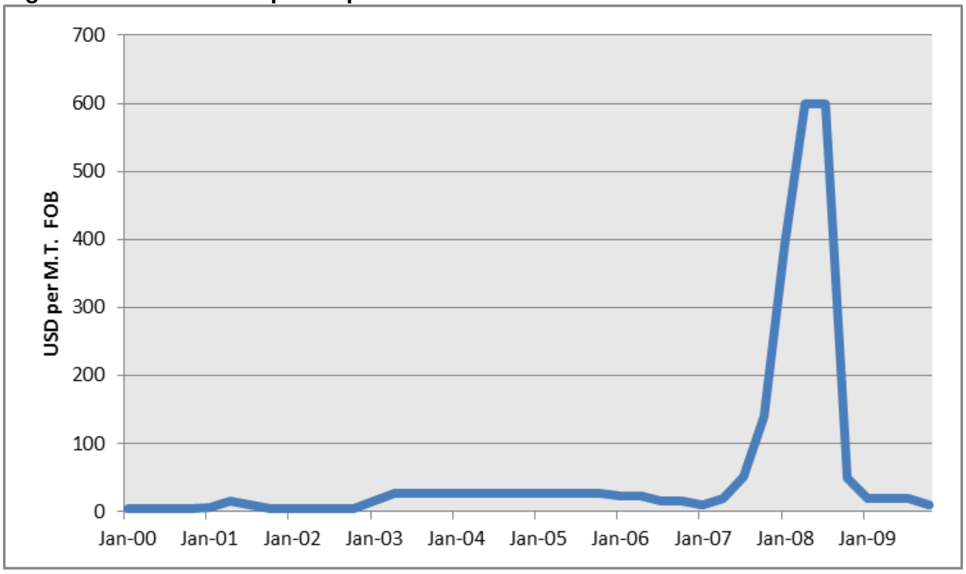
Source: (SARISC 2009)

Studies and submissions to the Senate Committee indicated that the increase was driven in part by a large increase in demand for agricultural fertiliser in both developing and developed countries. The increase in demand was unable to be met due to the limited supply of key fertiliser ingredients – nitrogen, phosphorus and potassium – and due to constraints on the speed at which the fertiliser industry is able to increase production, thus resulting in a price increase as demand outstripped supply. Other events which impacted on the price included the 2008 earthquake in Sichuan province in China, which is a major production base for fertilisers and agricultural chemicals.

3.2.2 Volatility of International Chemical Prices

International spot prices for chemicals tend to be volatile, and especially so for chemicals which are produced as a by-product of the manufacture of other, more valuable products. For instance sulphur is a by-product of oil and gas refining, so the supply of sulphur is, in large part, determined by production in these industries. If sulphur is produced in surplus the price decreases – on occasion the price can approach zero as producers need to shift the sulphur to allow their production processes to keep running. Conversely prices can increase sharply when demand rises, or if supply is constrained. For instance from late 2007 to mid-2008 the price of sulphur increased dramatically due to global forces, before crashing over the second half of 2008 (Figure 3.1).

Figure 3.1 – Alberta Sulphur Spot Prices 2000-2009



Data Source: (Inter-Chem 2011)

Caustic soda (sodium hydroxide) prices are subject to a similar dynamic given that the chemical is produced in conjunction with chlorine gas via the chlor-alkali process.

The rate at which a chlor-alkali plant will operate is set by the demand for chlorine as there is finite storage capacity for this. If the demand for chlorine is strong, then there is likely to be a surplus of caustic soda in which case the price will drop in order to increase sales. On the other hand, if the demand for chlorine drops, then the production of caustic soda will also drop with the consequent effect of prices increasing. Given that prices can move so dramatically for complex market dynamics, the potential to isolate other variables and determine causality in international prices for such products is limited.

3.2.3 Proprietary Chemicals

Several recent studies into the relative prices and availability of pharmaceuticals between countries have been undertaken (e.g. Kanavos et al. 2011; Patricia M Danzon & Furukawa 2005; U.S. Department of Commerce 2004; P. Danzon 2003; P M Danzon & Chao 2000).

Such studies have low relevance to many bulk industrial and generic agricultural chemical prices due to the different nature of pharmaceutical markets and regulatory structures. However, they are applicable to proprietary chemicals, such as some pesticides.

Many pharmaceuticals are protected by intellectual property rights, such as patents, so the prices of pharmaceuticals selected for hospital use or subsidy on prescription are often negotiated between a country's health providers and the manufacturers. Prices can be strictly regulated, often using some form of benchmarking with other countries.

Patent protection is designed to allow manufacturers to recoup original research and development costs by disallowing generic competitors and therefore allowing a higher price to be charged. An example of patent protection is glyphosate which was developed for agricultural use by Monsanto in the 1970s and sold under the trade name Roundup. Monsanto had exclusive rights to sell this product until patent expiry. Glyphosate came off patent in Canada before it came off patent in the United States (late 2000). During this period the price in Canada was reported as 40-50% less than in the US (Carlson et al. 1999).

Figure 3.2 - Aerial Spraying

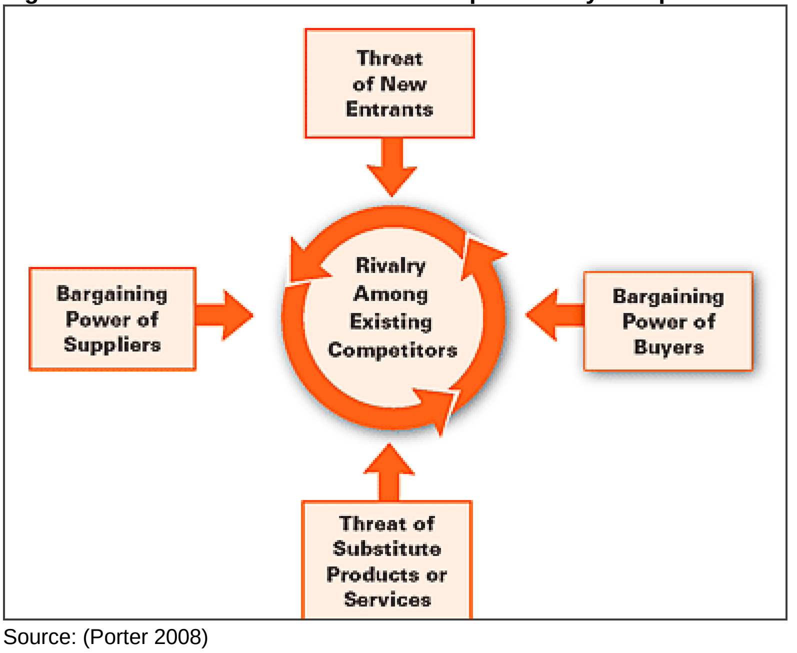
Photo: NZ Agricultural Aviation Association

3.2.4 Competitive Forces

Prices can be affected by more than just regulatory stringency and freight and labour. The degree of competition in the marketplace and how the competition takes place are important factors as well. In market segments where there is strong rivalry between existing competitors it is likely that the price will be close to that provided by efficient markets. Under these circumstances the cost of excessively stringent regulatory controls should be evident by a higher price.

Rivalry is often examined using the "5 forces" model first proposed by Michael Porter (Porter 1979).

Figure 3.3 - Porter's Five Forces that Shape Industry Competition



Source: (Porter 2008)

The degree of rivalry in a market segment depends on a range of factors (Table 3.3).

Table 3.3 - Factors Influencing Rivalry

Rivalry will be high if	Rivalry will be low if
Competitors are numerous	Competitors are few
Competitors have roughly equal size	Competitors have unequal size
Competitors have similar market share	Competitors have dissimilar market share
Industry growth is slow	Industry is fast growing
Fixed costs are low	Fixed costs are high
Products are undifferentiated	Products are well differentiated
Brand loyalty is insignificant	Brand loyalty is high
Consumer switching costs are low	Consumer switching costs are high
There is excess production capacity	There is no excess production capacity
Exit barriers are high	Exit barriers are low

Table based on Porter (1979)

Price competition is more likely when the level of rivalry is higher.

The chemical industry is not uniform, with different segments display differing levels of price competition. For instance rivalry is intense in the glyphosate market, to the extent that some Australian domestic manufacturers market have lodged claims that some overseas manufacturers are competing unfairly, "dumping" products on the Australian market, that is selling them at less than the cost price. In other segments price competition is lower, such as in animal remedies, where patents and other forms of intellectual property protection form barriers to competition. In such cases rivalry takes other forms, such as in competition to research, develop, licence and market new and improved products.

3.2.5 Economies-of-Scale

Economies-of-scale refers to the cost advantage that a firm might obtain by manufacturing or procuring on a larger scale. For instance a large store chain will likely receive volume discounts and therefore will have a lower cost per unit of a good than a small local store.

In a small market where economies of scale cannot be obtained, it would be expected that the price of a chemical would be higher. This is particularly relevant to the current study given the small population of New Zealand, which can be taken as a first-order indicator of low overall demand for chemicals.

3.2.6 Market Segmentation

Market segmentation can occur when open trade between two markets is not feasible. This could be due to reasons such as the inherent nature of the product, geographical distances or regulations. A consequence of market segmentation is that firms are able to practice price discrimination. That is, they are able to charge different prices for the same product, even though there are no differences in costs of supplying each market.

Smith & Johnson (2005) studied market segmentation along the Canada-US border and found that in many cases significant segregation exists as a result of regulation, even when there is no geographical barrier:

> *Some farmers on one side of the Alberta-Montana border are literally a stone's throw away from farmers on the other side of the border but cannot legally purchase the same agricultural chemical from the same chemical dealer. The result is a difference in prices between the two markets. An absence of regulatory barriers would allow arbitrage and almost certainly guarantee that prices in those geographically adjacent markets would exhibit similar patterns.*

The researchers argue that chemical companies generally support such regulatory segregation as it enables them to practice price discrimination. As an example of this behaviour the authors noted the assertion by the chemical industry that US producers would be confused by Canadian chemical labels because the same information was provided in both English and French (even though English speaking Canadians seemed to cope fairly well with the challenge).

Relative Prices in the US and Canada

Over the years there has been much attention dedicated to pesticide price differentials in the United States and Canada. Farmers in each country have long voiced concerns that they face consistently higher prices for pesticides than they would on the other side of the border (e.g. Smith & Johnson 2004; Short, Cameron, Freshwater 2004; Carlson et al. 1999; McEwan & Deen 1997). The long history of this cross-border examination of chemical prices provides a good outline of the methodological considerations for a valid chemical price comparison.

3.3 International Price Comparisons

3.3.1 International Price Levels

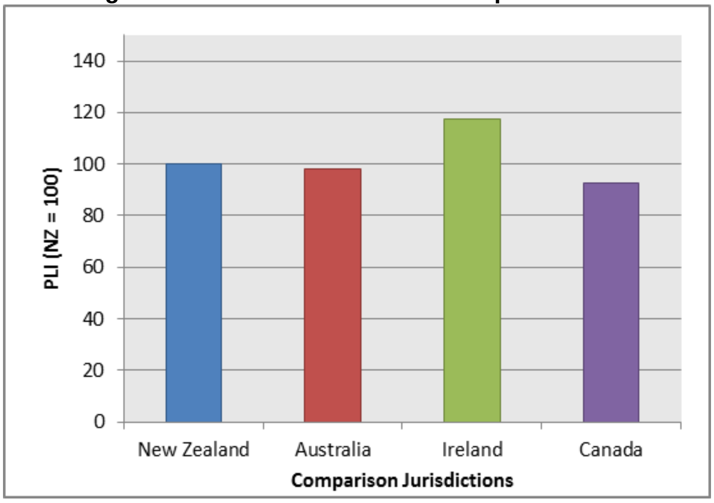
Why is NZ beer cheaper overseas?

A recent investigation by the New Zealand Herald found that Steinlager, a New Zealand beer produced by Lion Breweries, costs almost three times as much in New Zealand as in the United States or Britain. Lion external relations director Liz Read was reported as saying that it's a reflection of the different marketplace for beer pricing. "Historically, when there's been a bit of a price rise, it's stuck," Ms Read said. This counter-intuitive outcome shows how market conditions can impact price.

The World Bank coordinates the International Comparison Programme - a global statistical project which aims to compare price levels across countries throughout the world. Results from the latest round of the International Comparison Programme are not expected to be available until 2013. However, results from the previous 2005 round are available (World Bank 2007).

One statistic offered by the International Comparison Programme is the Price Level Index for each country – this aims to provide a measure of the average cost of a broad range of goods and services in one economy relative to another. It takes into account not only consumer products, but also capital and government expenditures, which together make up Gross Domestic Product.

Figure 3.4- General Price Level Comparison



Data Source: (World Bank 2007)

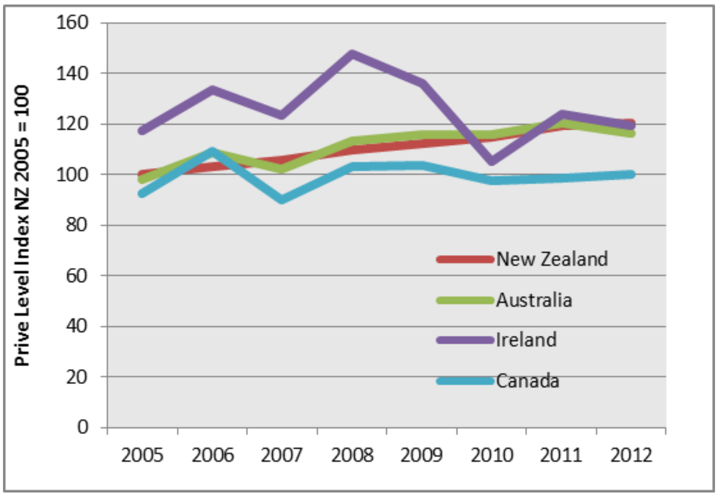


Figure 3.5 – Estimated Price Levels 2005-2012

Price Level Indices for New Zealand and the comparison jurisdictions are shown in Figure 3.4, with New Zealand set at the base level of 100. These results indicate that, in 2005, goods and services were slightly more expensive in New Zealand than in Australia and Canada, but less expensive than in Ireland.

The Price Level Index is affected by both movements in the exchange rates and by inflation in the respective countries. Since 2005 the New Zealand Consumer Price Index has increased by about 20%. This is a similar increase to Australia, although is a somewhat greater increase than Ireland and Canada whose respective Consumer Price Level Index have increased by approximately 11% and 13%.

By putting together information on exchange rate movements and consumer price inflation in each country it is possible to estimate changes in price level indices over time (Figure 3.5), in NZ dollar terms. This indicates that Irish price levels have converged to a similar level to Australian and New Zealand prices over the last 7 years, while Canadian prices have remained reasonably steady.

3.3.2 Exchange Rates and Prices

An international price comparison requires prices to be converted into a common currency. One simplistic way of doing this would be to simply use the going exchange rate on the day to convert the price of a good. Such a conversion is likely to be misleading as at any one point in time the going exchange rate is likely to be overvalued or undervalued.

Currencies are often misvalued at any one point in time because the going exchange rate fluctuates more wildly than the underlying purchasing power of the currency. The underlying purchasing power of a currency refers to the true value of a currency in terms of its ability to pay for goods and services.

The remainder of this section discusses exchange rates and the implications for the methodology of this study. Some significant implications of this discussion include:

- What market conditions are desirable for a valid comparison and therefore:
  - What countries can be selected?
  - What chemicals can be selected?
- What time period is appropriate for the comparison of prices?
- What method of currency conversion should be used?

3.3.3 Purchasing Power Parity

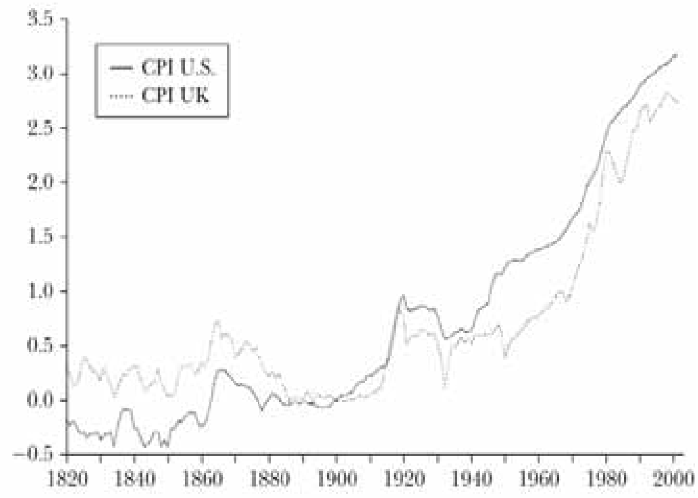
The prevailing economic rationale concerning relative pricing between countries is dominated by the concept of Purchasing Power Parity (PPP). Taylor & Taylor (2004) define the concept of PPP:

> *The general idea behind purchasing power parity is that a unit of currency should be able to buy the same basket of goods in one country as the equivalent amount of foreign currency, at the going exchange rate, can buy in a foreign country, so that there is parity in the purchasing power of the unit of currency across the two economies.*

At first glance this description does not appear to align with the above section where it was stated that currencies are often misvalued at any point in time. The fact is that very few economists consider that PPP holds in the short term. Empirical studies have time and again found significant currency deviations from PPP (for example see A. M. Taylor 2002). Despite this, the general consensus is that some form of PPP acts as an anchor for long-run real exchange rates.

Figure 3.6 shows US and UK consumer price indices expressed in US dollar terms over the last two centuries using a log scale with a base of 1900 = 0. If PPP were to hold true in its absolute form, the two lines below would overlap each other precisely. A quick glance immediately shows that this is not the case. Exchange rates do not appear to hold to PPP - at least in the short run. However, in the long run there appears to be a tendency for exchange rates to revert, at least approximately, to PPP.

Figure 3.6 – US and UK Consumer Price Indices



Source: Taylor & Taylor (2004)

The persistency of deviations from PPP can be measured by their half-life, being the period over which an initial deviation from PPP halves. Consensus estimates for the rate at which PPP deviations dampen out suggest a half-life of 3 – 5 years (Rogoff 1996). These studies have considered reversion to take place on a linear basis. More recent studies have found that such reversion may be non-linear and have indicated that reversion to PPP takes place much faster than previously thought (M. P. Taylor et al. 2001; Lucio` Sarno & Valente 2006; Norman 2010; Beckmann 2011).

The approximate time for reversion to PPP is an important concept for the methodology of this part of the study as it influences the time period for comparison of prices. The findings of Rogoff (1996) indicate that a conservative goal would be to aim for a period of at least 3 - 5 years, although recent studies (see above) suggest that a shorter period should be sufficient. The relatively recent introduction of the HSNO regime and similar regimes in competitive countries, limits the length of analysis period.

3.3.4 The Law of One Price

The Law of One Price underlies the idea of PPP. While the two concepts are often used interchangeably, they are in fact different. The Law of One Price applies to the relative price of individual goods, whereas PPP applies to the general level of prices (often measured using the Consumer Price Index or Producer Price Index of a country). The Law of One Price holds that the price of an internationally traded good should be the same anywhere in the world once the price is expressed in a common currency, since people could make a riskless profit by shipping the good from locations where the price is low to locations where the price is high.

Preconditions for such a situation include:

- Profit maximisation is prevalent in the market
- Costless transport, distribution and resale (Goldberg & Knetter 1996).

In essence, a purely "efficient" market is required. In addition to this, the Law of One Price refers to identical products. Given this information, it can be seen that the Law of One Price won't hold when:

- An effective competitive market is not present
- Transport costs are significant
- Distribution and resale costs are significant
- Chemicals from different suppliers are differentiated.

In other words the Law of One Price does not exist in the real world. Nevertheless it is a useful concept as it identifies factors that are relevant in international price comparisons.

The closer a study can come to meeting the preconditions for the Law of One Price to hold the more valid the study results will be. Some of the implications for this part of the study are:

- Comparison countries ideally exhibit a high-level of competition and free-market principles
- Transport, distribution and resale costs must be similar across all comparison countries
- Chemicals are not highly differentiated by different suppliers
- Formulation of chemical has been constant over time.

3.3.5 Pricing-to-Market

The above sections discus the various preconditions for PPP and the Law of One Price to hold. Another key reason posited for deviations from PPP and the Law of One Price is the practice known as Pricing-to-Market. This refers to the situation where an international firm strives to keep its foreign prices constant in the face of fluctuating exchange rates.

Pricing-to-Market was explored by Krugman (1986) as part of the US National Bureau of Economic Research programme. More recent analysis by Atkeson & Burstein (2008), of the Federal Reserve Bank of Minneapolis, has explored the relative pricing of goods and services by firms in different country markets. Their seminal work, *Pricing to Market, Trade Costs and International Relative Prices*, shows how large deviations from relative PPP can arise as a result of the decision of the individual firm to price-to-market.

Why Does Pricing-to-Market Occur?

Given the export-orientated nature of New Zealand's economy, most residents are aware that a high value of the New Zealand dollar relative to our key export markets is a source of concern for exporters. This is because such a high New Zealand dollar makes New Zealand exports dear in foreign currency terms and therefore less competitive in the world market, preventing exporters from gaining market share. A decrease in the value of the New Zealand has the inverse effect.

In this case the price of New Zealand goods fluctuates in foreign currency terms, depending on the exchange rate. However, many firms operating in foreign markets strive to keep their foreign prices constant in order to maintain market share in that particular country.

This occurs in part because firms have fixed costs and need market share to spread those costs over. A firm that raises foreign prices runs the risk of a downward spiral of reducing market share and spreading overheads over fewer units sold. In order to maintain stability of foreign prices, firms operating in competitive export markets tend to have a degree of elasticity in profit margins which dampens out changes in relative costs of production due to exchange rate fluctuations.

In the long run firms need margins to survive and will adjust their overheads to restore margins, or will raise prices and relinquish market share to lower cost competitors. The practical effect of these observations of dampened pricing behaviour for this study is that a time-series of prices has more discriminating power than a 'snapshot' comparison of prices on a particular date.

Implications of Pricing-to-Market

When chemicals have low differentiation the chemical from one supplier can be substituted for another. Under these conditions the market price will tend to be close to the marginal cost of production. This situation allows the marginal costs to be observed.

Where the chemicals are highly differentiated, such as highly specialised chemicals or branded consumer chemicals, then prices tend to be set by the producer, often as a constant mark-up above marginal costs. This scenario can reveal costs only if it is known that the producer has kept the mark-up constant. Otherwise price changes may simply reflect the producer's changing appetite for margin and market share. Information on mark-ups is usually commercially confidential and is seldom available. For this reason any study that includes highly specialised or branded chemicals needs to proceed with caution and firstly establish the market conditions and substitutability of the chemicals concerned.

3.3.6 Summary of Price Dynamics

Inferences from this consideration of Relative Prices for the Study Methodology are summarised in the following Table.

Table 3.4- Relative Price Considerations - Inferences for Assessment Methodology

Aspect of Methodology	Inference for Methodology	Comment
Selection of Comparison jurisdiction	Comparison jurisdictions should have floating exchange rate	Over the long run price levels are more likely to reflect rue market conditions with floating exchange rates
	Comparison jurisdictions have competitive markets	Prices are more likely to reflect compliance costs in competitive market condition
	Similar population to New Zealand	Countries with comparable populations to New Zealand are likely to have similar levels of overall market scale and activity
	Similar transport and labour costs to New Zealand	Countries with similar cost structures to New Zealand are likely to experience similar costs. Under these conditions differences in costs of compliance between jurisdictions are less likely to be masked by other factors
Selection of Indicator chemicals	Chemicals off patent	Where chemicals are off patent the presence of generic providers, or threat of completion from generics, is more like to result in prices which reflect the costs of manufacture and distribution. Under these circumstances costs of compliance are likely to be reflected in chemical prices
	Chemical markets are competitive	If the market conditions are competitive costs of compliance are likely to be reflected in chemical prices
Data availability	Ideally at least 3-5 years of chemical price data.	A single "snap shot" comparison is simplest and is often the only analysis undertaken in such studies. However, an assessment over a longer time series – where possible - enables temporal issues such as the effects of the timing of prices changes to be better evaluated. A 3-5 year time period allows time for price distortions to be eliminated by market forces, yet is short enough so that price comparisons between jurisdictions broadly reflect current regulatory practice

3.4 Methodology

The purpose of this section is the set out the methodology adopted for this assessment. The adopted methodology draws on previous studies and recommendations from the US General Accounting Office (refer box below).

Methodology Recommended by US General Accounting Office

In 1999 the United States General Accounting Office issued a letter on the Methodological Considerations for a Study of Pesticide Price Differentials (GAO 1999). A key theme was that the goals of the price study should largely determine the design and methodology of the study. Some of the methodological considerations are:

- Price data - There are several types of prices that can be used as the basis of an international comparison and the type of price used has implications for the inferences that can be drawn from the findings
- Unit of Analysis - The unit of analysis determines whether the study compares the prices of name-brand products or the prices of active ingredients found in a variety of products
- Sample Selection - The sample of chemicals can be restricted by industry, application, class or geographic region and may also be limited by availability of data
- Currency Conversion - Exchange rates vary over time and a variety of conversion methods are possible
- Limitations and Caveats - Explicit caveats and discussion of limitations in the data and/or the analysis are essential elements of any economic analysis.

An innovation of the adopted methodology is the use of a "signals" approach with the objective of identifying weak signals within a "noisy" environment of price volatility and change.

3.4.1 Selection of Chemicals

When undertaking a study of this nature there is a trade-off between the numbers of chemicals included in the study and the practicality of the assignment.

A relatively small number of chemicals have been selected covering a number of key areas in the New Zealand economy including agriculture, transport, and processing industries. Consideration was also given to different types of chemical hazard in the selection, with the intent of illustrating as much of the impact of different aspects of HSNO regulations. If it were found that there was no impact (or limited impact) on the prices of these chemicals, then it could be reasonably inferred that the impact on other chemicals would also be low.

Chemicals can be classed in many ways according to various functional or structural properties. The OECD Report on the Chemicals Sector (Kiriyama 2010) discusses chemicals on the basis of the following economic schema:

- Basic
- Specialty
- Fine
- Consumer.

Basic industrial chemicals compete mainly on cost as there is limited opportunity for innovation of new products or for marketing to have an impact - such factors tend to have influence further down the supply chain. Product innovation is key for specialty and fine chemicals whose customers' needs are often rapidly evolving. The consumer chemical market is largely driven by the introduction of new chemicals and marketing approaches.

Basic chemicals are often subject to relatively strict storage and distribution regulations and specialty chemicals tend to be subject to greater regulatory approval and packaging/labelling requirements. Overall it was considered that basic and specialty chemicals were the chemical types which were most likely to be affected by HSNO and would therefore benefit most from further analysis. This approach provides the greatest discrimination and will allow the reasons for price differences to be explored. If the effects are found to be small in such critical segments of the chemical market, then it can reasonably be inferred that the effects will be small in other segments. Table 3.5 shows the chemicals which were chosen for this part of the study based on the above information.

Table 3.5 – Selected Chemicals Summary

Chemical	Major Uses in New Zealand
Sulphuric acid	Key input to the production of phosphate fertiliser
Caustic soda	Often used as a Clean-in-Place agent in dairy processing
MEK	Has a number of industrial applications including as a solvent in protective coatings, adhesives, printing inks, paint removers etc
Diesel	Fuel which has major implications for industry and agriculture in terms of transport and operation of machinery
Glyphosate	Highly used herbicide for agricultural production
Chlorpyrifos	Commonly used horticultural insecticide
Chlorothalonil	Fungicide used in horticulture and also treatment of timber

Substitution of Deltamethrin

As noted above, a factor in chemical selection was the need to illustrate as broad as possible selection of the impacts of the HSNO regime. For this reason some chemicals were chosen in common with those used for the Stringency of Controls part of this study. Originally Deltamethrin, a synthetic pyrethroid insecticide, was originally selected as the pesticide.

While there is good data to base comparisons of regulatory stringency on for this chemical, industry consultation revealed that usage of product has significantly declined in New Zealand and in other countries and is becoming less widespread. Deltamethrin was therefore substituted with chlorpyrifos and chlorothalonil as these chemicals are in more current use and so could be expected to have better pricing data available.

3.4.2 Selection of Jurisdictions

Comparison jurisdictions were selected on the basis that they were competitive producers of significant export volumes of products that are also significant New Zealand exports[24]. Jurisdictions were also selected on the basis of similar market conditions to New Zealand

[24] Note that this is not the same as trading partners - as it is likely that New Zealand will have less trade with its most direct competitors than with other comparable nations

with regard to factors such as market size and level of competition which have the potential to influence price.

OECD membership was used as a criterion as OECD countries collect and publish statistics in agreed formats that assist with international comparisons. Population size was used as a general indicator of the size of the chemical market. Language barrier and availability of data are also considerations which were made when considering comparison jurisdictions. The selected jurisdictions along with the factors considered are set out in Table 3.6.

Table 3.6 - Comparison Jurisdiction Summary

Jurisdiction	Comment
New South Wales	Similar population, export orientation and geographic location to New Zealand
Ireland	Similar to New Zealand in terms of size, agricultural production and is an island nation
Canada	Broadly similar market size and export orientation to New Zealand

Japan was initially selected as one of the comparison jurisdictions based on discussion with the Ministry. The limited availability of data from Japan meant the decision was made to exclude Japan from the study. Additionally, Japan does not compete with the New Zealand export market to the same extent as the other countries as its economy is largely complementary to New Zealand's.

Prioritisation of Jurisdictions

The aim when selecting comparison jurisdictions has been to choose jurisdictions which are similar in market size and structure. This has been done on the basis that the more similar the market conditions between countries, the more valid the results will be. Any differences are more likely to be the result of regulatory burden rather than, for example, economies of scale.

The prioritisation of jurisdictions was therefore undertaken with these factors in mind. The purpose of the study calls for comparison against competitors, which are countries that produce a similar range of goods to New Zealand (services are excluded as hazardous substances are less directly related to services). The other key considerations are market size and geographical proximity to sources of the chemicals concerned. While the market size for each country will be different for each chemical, population is used as a first order estimate of market size. Finally, island nations are preferred as border controls are likely to be as strong as they are in New Zealand. This is a reason for selecting Ireland instead of Denmark, which is a similar European economy.

A simple scoring system based on the above considerations was used to assess the similarity of jurisdictions to New Zealand Table 3.7.

Table 3.7 – Similarity of Comparison Jurisdictions to New Zealand

	Similarity to New Zealand in terms of…				
Jurisdiction	**Exports**[25]	**Market Size**[26]	**Proximity**[27]	**Accessibility**[28]	**Total Score**
New South Wales	3	3	3	2	**11**
Ireland	3	3[29]	1	3	**10**
Canada	2	2	1	1	**6**

Notes: 3 = very similar to New Zealand
2 = somewhat similar to New Zealand
1 = dissimilar to New Zealand

Table 3.7 indicates that New South Wales and Ireland have a higher degree of similarity to New Zealand than Canada. New South Wales is similar to New Zealand in all aspects, although slightly less in terms of accessibility as the jurisdiction can be accessed over land from the other Australian States. Ireland also has a high level of similarity in all of the above areas except for proximity to major international suppliers given its geographic closeness to the UK and other European Countries. Canada's proximity to major international suppliers and its accessibility must be taken into account when interpreting results. The above suggests that greater weight should be given to comparison to NSW and Ireland when drawing conclusions from this part of the study.

3.4.3 Which Price Type?

The percept of chemical "price" is simple. However, there are many types of prices and the appropriate price must be selected based on data availability and the goals of the study. Some price "candidates" are discussed in Table 3.8 below.

Table 3.8 - Price Types

Price	Comment
Bulk Spot Price	The international spot price for bulk quantity purchases, usually quoted loaded on a ship at the point of origin. The spot price is often used as the best indication of current marginal price on international markets as it responds to changing balance of supply and demand at that point in time. For this reason the international spot price tends to be volatile
Bulk Contract Price	Bulk contract prices are usually based on spot prices This provides certainty to the seller and buyer, and results in smaller price swings
Retail List Price	The price list typically seen by a user
User Price	This may be more than the list price due to freight costs, or may be less than the list price for larger users due to discounting and rebates

In general the price paid by users was preferred for this part of the study as it is further down the supply chain and allows the greatest opportunity for the effects of regulations to affect price.

[25] Export competitor to New Zealand
[26] Population used as first order estimate
[27] Geographic proximity to major international suppliers
[28] For example, island nations are preferred
[29] Ireland has some of the characteristics of a larger market. It has proximity to the UK and is sometimes treated as part of the UK market by suppliers, is a member of the EU, and falls under the EU REACH system.

Each of the selected chemicals was considered individually when deciding on the appropriate price to use, as different chemicals are typically supplied in different quantities (e.g. by the tonne or by the container).

Also the appropriate price type representing user prices in one country may not be the appropriate price type in another country. For example, most of the sulphur in New Zealand comes from Vancouver, Canada. However, the Free on Board (FOB) Vancouver international spot price would not be an appropriate measure of HSNO effects as it would not reflect any price effects on New Zealand users arising from regulation.

On the other hand, the FOB Vancouver spot price for sulphur would be appropriate for certain areas in Canada as it is a close representation of what the primary users would pay. Most of the sulphur in Canada is produced at sour natural gas wells or oil sand plants in Alberta and has to be transported approximately 1000 kilometres to Vancouver. For these reasons the cost to the large scale users (e.g. pulp mills) in Ontario and Quebec is therefore much the same as the international spot price (Camford Information 2012).

3.4.4 Time Period for Comparison

Selecting the time period over which to compare prices is a decision which is subject to data availability as well as two constraints:

1. The time should ideally be long enough to allow for prices which have diverged from Purchasing Power Parity (PPP) to revert (refer Section 3.3.2)
2. The time should be short enough so that the comparison made is between regulatory controls which are current in each jurisdiction.

As discussed in Section 3.3.2 the half-life of deviations from PPP is conservatively around 3-5 years. This suggests that the period for analysis should be at least 3-5 years (one half-life) and ideally more. The second criterion requires a relatively short period of comparison as the regulations controlling hazardous substances in other jurisdictions have changed over recent years as global harmonisation initiatives have been implemented.

From the above considerations it was decided that, where data availability permits, prices will be analysed over the period from 2005 to 2011.

3.4.5 Unit of Analysis

Chemicals come in a range of formulations, packaging and brand names. To make meaningful comparisons it is necessary to compare equivalent products delivered to end users in similar packaging units. Table 3.9 shows the unit of analysis for each chemical.

Table 3.9 - Unit of Analysis

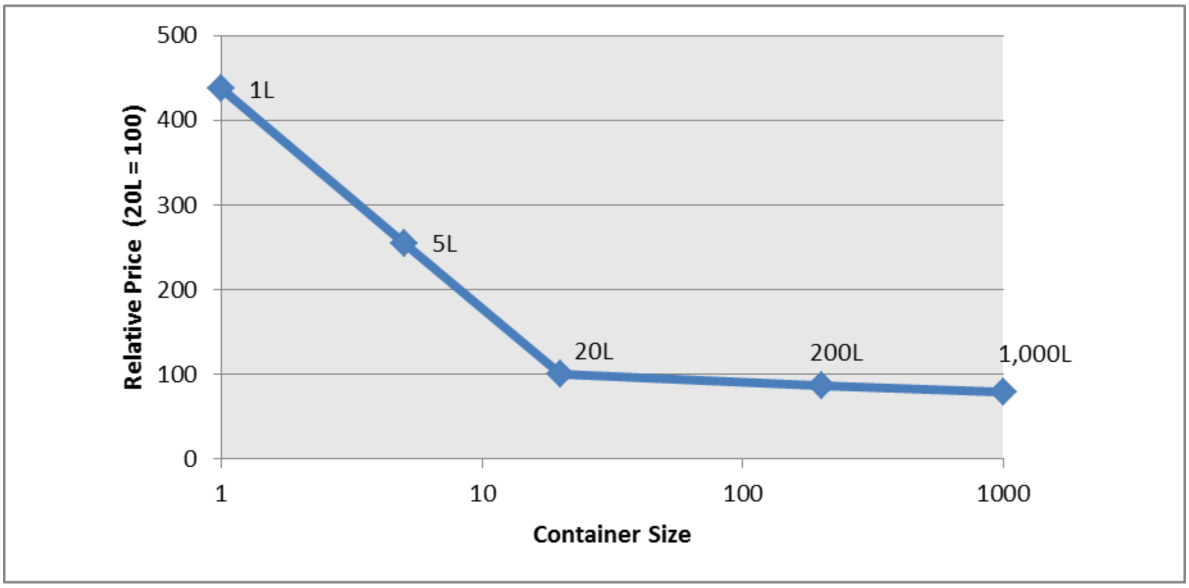
Chemical	Unit	Concentration
Sulphuric acid	NZD$/tonne, Bulk	93-98%, priced on 98% basis
Caustic soda	NZD $/tonne, Bulk	50-70%, priced on 100% basis
MEK	NZD $/kilogram, 150-200L Drum	100%
Diesel	NZD $/litre, Retail Pump	100%
Glyphosate	NZD $/kilogram Active Ingredient, 20L Containers - Retail	360-540 g/L Active Ingredient
Chlorpyrifos	NZD $/kilogram Active Ingredient, 10-20L Containers - Retail	480-500 g/L Active Ingredient
Chlorothalonil	NZD $/kilogram Active Ingredient, 10-20L Containers - Retail	720 g/L Active Ingredient

The unit of analysis selected for the industrial chemicals was the unit most commonly sold to end users for which there was suitable price data.

Agricultural chemicals often come in a range of formulations, with different proportions of the active ingredient, which is usually the most expensive part. For the agricultural chemicals the selected unit of analysis is done on the basis of active ingredient. This is a common approach and is the one used by the US Department of Agriculture (USDA 2010).

Effect of Container Size on Price

The figure below shows the relative price per kilogram of glyphosate (active ingredient) for different container sizes (data acquired from New Zealand agrichemical supplier price lists). This illustrates a clear distinction between the pricing dynamics for low volume users and high volume users. At first, the price per kilogram decreases dramatically as the container size increases from 1L to 20L. For container sizes of 20L and over, the price per kilogram decreases only slightly.



In the case of glyphosate, 20L containers are the most commonly purchased. Regular agricultural users are unlikely to require glyphosate herbicide in lower volumes, although may require larger volumes depending on the type of operation. This study has focused on the container/unit sizes which are most relevant for regular users of the indicator chemicals. The relevant unit size will vary for each chemical. For example, chlorpyrifos and chlorothalonil are usually purchased in lower volumes than glyphosate, whereas industrial chemicals are typically purchased in much higher volumes.

The New Zealand HSNO regime imposes controls on chemicals, and therefore obligations on suppliers, on the basis of the hazardous properties of the chemical using, as a basis, the Globally Harmonized System of Classification and Labelling of Chemicals (GHS). The hazards of chemicals can vary depending on other components they are mixed with, whether these are hazardous or not. Using user prices therefore requires consideration of formulations or mixtures, especially for agrichemicals.

Because of differences in formulation between jurisdictions, Section C (comparing regulatory stringency) uses pure chemicals or substances as defined under the GHS for comparison. There is therefore no one-to-one alignment between the chemical formulations assessed in this study for regulatory stringency and user price, although in general the same type of hazard is regulated in each case. This is not considered to be material to the conclusions of this study as the alignment between assessments, while convenient, is not important to the methodology.

3.4.6 Transport Costs

Domestic Freight

Where possible, prices including the cost of domestic freight were obtained, as the focus of this study is the price paid by end users of chemicals. Most regulatory regimes deal with the transport of hazardous substances and therefore it is expected that there will be some costs of compliance involved in transporting chemicals.

However, many factors interact to determine freight rates, including distance, route, the actual service being offered, intra-industry and intermodal competition, and the regulatory environment facing operators.

The New Zealand trucking market has been described as highly competitive with low barriers to entry (Booz Allen Hamilton 2005). A review of road freight costs in New Zealand, and comparison with Australian States, was undertaken by Pearson (2007). In this study, freight costs were categorised as:

- Capital – depreciation, interest
- Fuel – diesel fuel costs including all relevant taxes and charges
- Driver – wages, equipment, superannuation, payroll tax, leave coverage
- Repairs & Maintenance – includes tire and oil costs
- Other – road user charges, registration charges, licensing, ACC charges, vehicle insurance, overheads and profit.

Jurisdictions have been selected where the above factors a likely to be similar as a method of “controlling” for these factors. The proposition is that differences in freight costs due to chemical industry regulation are more likely to be apparent when comparing chemical prices across similar jurisdictions.

International Freight

Prices of chemicals imported into New Zealand are affected by the distance they must travel from major international chemical suppliers. However, international freight costs are complex. The published freight rate is only a starting point and bunker fuel adjustment factors and currency adjustment factors now surpass the base freight rate (Koedyk 2012).

Given the complexity of international freight costs, no attempt was made to quantify these. Rather jurisdictions were prioritised based on similarities to New Zealand conditions, including factors such as accessibility and distance from major international supply hubs and a greater weight was given to results from comparison jurisdictions which would be likely to share similar freight costs.

3.4.7 Basket of Prices

The choice of method used to assess price differences depends not only on the goals of the study but on the nature of the price data. One approach is to simply compare chemical prices one-by-one across countries. Another method is to construct a price index that determines the average price of a "basket" of chemicals. Such a basket price index could be the arithmetic average of prices (i.e. sum and divide by the number of chemicals) or could be a weighted index, where prices are assigned weights depending on certain criteria such as total consumption within New Zealand. Such a method requires a high level of consistency of data type across all chemicals and jurisdictions and, as this was not available, it is more appropriate for this study to use the individual price comparison technique to compare prices. Results were then aggregated using a method discussed in Section 3.4.10 and qualitatively assessed.

3.4.8 Currency Conversion

Price comparisons between countries are not straightforward due to the volatility of exchange rates. In the long run, currency movements reflect the terms of trade of each country and its internal inflation rate. In practice the relative values of currencies are affected by factors such as perceptions of likely future movements in interest rates and general market sentiment (e.g. so called "risk on" or "risk off"). This volatility means that a simple "snapshot" comparison through converting a price using the nominal exchange rate at one point in time is likely to be misleading.

International price comparisons often use a weekly, monthly, quarterly or yearly average exchange rate to convert prices to a common currency. Average exchange rates are used rather than the prevailing rate at a particular point in time to reduce the effect of random fluctuations in exchange rate. This study has elected to convert prices based on the average exchange rate over the time period being considered (usually one calendar year).

Ireland differs from the other comparison jurisdictions as it shares the euro with other nations. This means that the exchange rate is more likely to represent the purchasing power of the euro in the European Union as a whole, rather than specifically in Ireland. This is a limitation which must be taken into account when considering the outputs of the analysis where prices are compared across jurisdictions.

3.4.9 Inflation Adjustment

Inflation refers to the increase in the general level of prices in an economy. The Consumer Price Index (CPI) of each country was used to adjust prices, where needed, for inflation. Inflation adjustments were made on a yearly basis as this matches the level of granularity at which price data was collected.

3.4.10 Price Signals

As discussed in Section 3.2 and 3.3, market size, pricing dynamics and the number of suppliers – as well as a range of other more random variables (such as market sentiment) influence relative prices between jurisdictions. Random fluctuations are bound to be a large factor in any international price comparison.

For this study a set of expected price signals have been identified. When evaluated together, these signals act as a guide that can indicate, in general terms, the likelihood that HSNO regulations are causing a higher chemical prices in New Zealand when compared to the chosen comparator jurisdictions.

If New Zealand prices of chemicals are higher due to HSNO regulations being excessively stringent compared to the comparator countries then, all other factors remaining constant, the "Price Signals" outlined in Table 3.10 would be expected.

Table 3.10 - Expected Price Signals

Price Signal	Description	Comment
Price Signal 1: Price Levels	Price levels of selected chemicals in New Zealand are high compared to other countries when converted to a common currency	Analysed on a per chemical basis. Tests the basic premise of whether NZ prices are higher than overseas
Price Signal 2: Price Change	Inflation-adjusted prices of chemicals in New Zealand have risen more than in comparator countries following HSNO introduction	Analysed on a per chemical basis. Indicates whether HSNO could potentially be a driver of any price difference observed
Price Signal 3: Price Levels by Hazard	Price of highly hazardous chemicals in NZ will be relatively dear compared to the same chemicals in other countries	Analysed on an overall basis across all chemicals

3.4.11 Evaluating the Price Signals

Each price signal was qualitatively assessed on the basis of the strength of the signal, the years of available data, the number of jurisdictions for which comparable data was available and how similar those jurisdictions are to New Zealand. The signals were then rated as below (Table 3.11):

Table 3.11 – Qualitative Price Signal Rating System

Rating	Description
Strong Pass	Strong price signal with robust data availability
Weak Pass	Price signal with adequate data availability
Undetermined	Issues such as data availability not allowing conclusion to be drawn
Weak Fail	No price signal observed, adequate data availability
Strong Fail	No price signal observed, robust data availability

The number of price signals "passed" indicates the likelihood that HSNO regulations are causing high costs of compliance. The results of the price signals were interpreted in conjunction with information gathered through research and industry consultation in order to assess whether there is sufficient evidence to conclude that HSNO is having a significant effect on the prices paid for chemicals by New Zealand users. The expected form of each of the expected price signals is outlined below.

Price Signal 1

Price levels of selected chemicals in New Zealand are high compared to other countries after Price Level Index adjustment

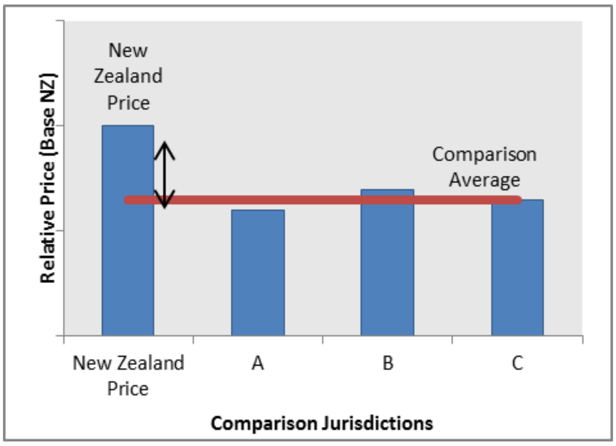
This is a straightforward comparison of price levels. Depending on the price data available the comparison may be for a single year, or averaged for multiple years.

More weight is attributed to this signal where price data is available for several years and for multiple jurisdictions.

As discussed in Section 3.3.2, longer data records enable more robust comparisons.

Analysis of this price signal followed the steps below:

Figure 3.7 – Expected Form of Price Signal 1

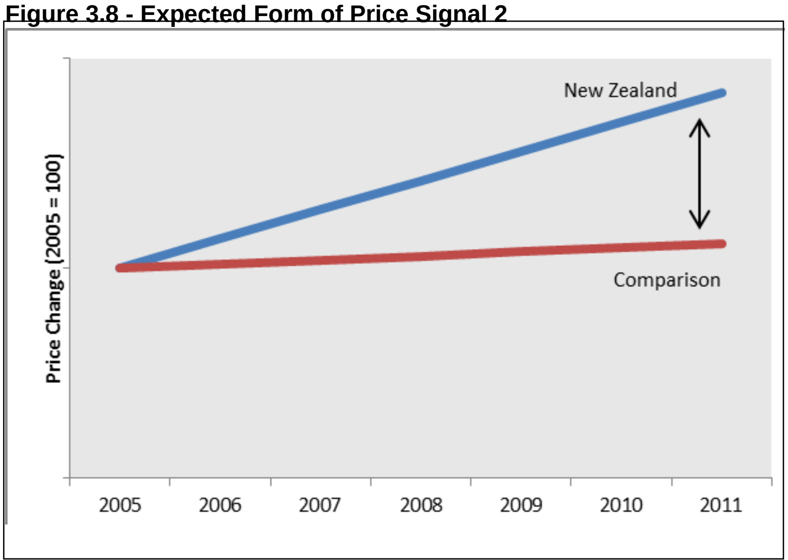


1. The average price from 2005-2011 for each jurisdiction was converted to New Zealand dollars using the average exchange rate for the period of comparison
2. A strong price signal would be found if the New Zealand price is significantly higher than the average price of the comparison jurisdictions.

Price Signal 2

Inflation-adjusted prices of chemicals in New Zealand have risen more than in comparator jurisdictions following HSNO introduction

Figure 3.8 - Expected Form of Price Signal 2



This price signal explores whether chemical prices have increased more in New Zealand than in overseas jurisdictions in recent years. It is possible that chemical prices across all comparator countries have increased due to global circumstances and this could be given as a reason for an observed increase in chemical prices in New Zealand. This price signal is therefore used to indicate whether there is a New Zealand specific factor at play.

If chemical prices have risen by a greater percentage (once the effects of inflation have been adjusted for) in New Zealand than in other countries then this would indicate that a general change in global circumstances is not solely responsible for the increase in price. A possible explanation of such a scenario is that the HSNO legislation has imposed higher costs on chemical suppliers than equivalent legislation in other countries.

The analysis of this expected price signal follows the steps below:

1. Prices from 2005-2011 are adjusted for inflation to 2005 levels using each country's Consumer Price Index (CPI)

2. A positive price signal would be found if the percentage increase in New Zealand price is significantly greater than the increase in the average increase in the comparator countries.

Price Signal 3
Price of highly hazardous chemicals in NZ will be relatively dear compared to the same chemicals in other countries.

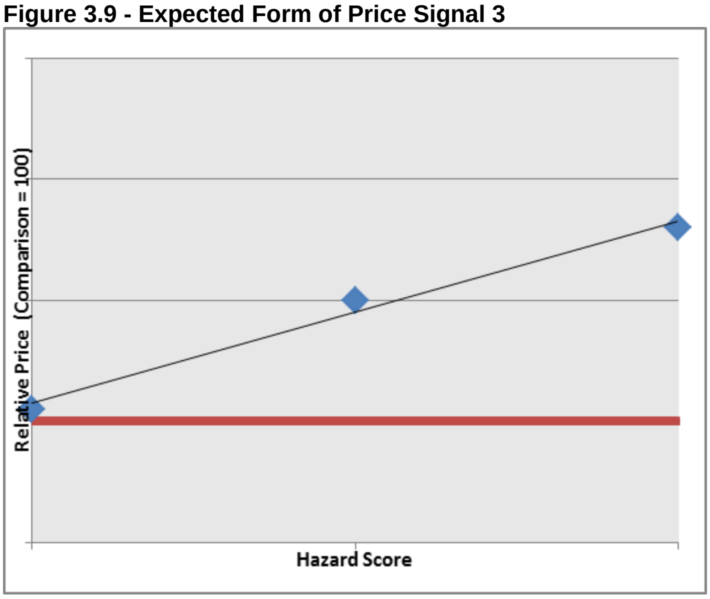
It is expected that, if HSNO has a significant effect on chemical prices, then the effect should be strongest in the price of high hazard chemicals, as these are subject to more onerous (and therefore more costly for suppliers) controls under most regulatory regimes. For this signal to apply, it is expected that the price of high hazard chemicals will be relatively higher in New Zealand than in overseas jurisdictions.

For instance it might be found that low hazard chemicals might be slightly more expensive in New Zealand than in other jurisdictions in percentage terms, but that high hazard chemicals are much more expensive in New Zealand.

While it is obvious that chemicals have differing degrees of hazard, there is no internationally agreed system to produce an overall assessment of chemical hazard across hazard classes. For instance is a corrosive chemical more hazardous than a flammable one?

The existing classification systems focus on identifying and classifying each of the hazardous properties of a chemical so that appropriate precautions can be taken. In that context an overall assessment of degree of hazard of Chemical A versus Chemical B is not useful, and is not done. While assessment and classification routinely takes place within each hazard class (e.g. highly flammable versus moderately flammable) the authors are not aware of any previous attempt to arrive at a generic assessment of hazard, that takes account of all hazard classes.

Figure 3.9 - Expected Form of Price Signal 3



In order to score the indicator chemicals by hazard, a hazard score was developed based on the Global Harmonisation System classification of chemical hazards. The GHS system has the advantage of being internationally agreed and therefore less influenced by local factors, such as social perceptions of hazards which vary from jurisdiction to jurisdiction.

This hazard assessment methodology can be seen as a logical extension of the GHS classification system, but contains a number of implicit assumptions. Chief amongst those is the implicit assumption that the number of hazard classes is a proxy for importance. For example a finely graded hazardous property with 5 subdivision classes has the potential to generate a score of 5, whereas another property with only 2 divisions can score a maximum of 2. This is considered to be a reasonable premise for developing a scoring system for overall hazard, but is otherwise unproven.

The analysis of this expected price signal followed the procedure below:

1. Assess hazard score for each selected chemical
2. Assess NZ prices relative to the average across other selected jurisdictions
3. Plot results by relative price and hazard score.

A positive price signal is found if the line of best fit is positively sloping, indicating that high hazard chemicals are relatively more expensive in New Zealand.

The scoring system and its application to the selected chemicals are presented in Appendix A, while the results of the analysis for Price Signal 3 are presented in Section 3.5.

3.4.12 Limitations of Data

Clarity regarding data limitations is an important consideration in any price comparison study. This study aimed to compare time-series data for 7 chemicals across 4 distributions. While there is ample data on spot prices for bulk chemicals, this is not useful for reasons already outlined. Data on the actual prices paid by users over time and across a series of jurisdictions is hard to find, and for such reasons is not available from the few studies on international price comparisons for chemicals which exist in the literature.

A key challenge to obtaining price data is commercial confidentiality. This resulted in many businesses being unable to provide data on the prices paid or received for chemicals. Key limitations in the data acquired are below:

- Suitable time series data was not always available meaning that in some cases “snap shot” comparisons were used instead of averaged prices over the last 3–5 years
- Suitable data was not available for all chemicals in each jurisdiction meaning that some comparisons were drawn only between New Zealand and the jurisdictions where data was available
- In most cases data was only available from a single source for each chemical in each jurisdiction so verification was not possible.

The above limitations were taken into account when interpreting the results. To assist with understanding the limitations of the data, sources of data are presented in the following sections for each chemical, and any significant limitations arising from the data are discussed.

3.5 Price Analysis

In this section price data is presented for each of the selected chemicals, along with an evaluation for the following two price signals:

- Price Signal 1: Price Level in NZ compared to other jurisdictions
- Price Signal 2: Price Change in NZ over time.

3.5.1 Sulphuric Acid

Market profile

Sulphuric acid has many applications and is heavily used in the chemical industry. Sulphuric acid is manufactured in New Zealand from sulphur, most of which is imported in solid form. Sulphuric acid is also imported directly. The sulphuric acid market in NZ is around 600-700,000 tonnes per annum with most being used in fertiliser manufacture and around 40,000 tonnes in industrial applications (Orica Chemnet 2012).

Superphosphate

Superphosphate is the fertiliser most commonly used in New Zealand. It is manufactured from the reaction between Sulphuric acid and phosphate rock (NZIC 1998).

There are three sites manufacturing sulphuric acid in NZ; Balance Mt Maunganui, Ravensdown Awatoto and Ravensdown Christchurch. Balance also imports sulphuric acid to its Invercargill/Bluff fertiliser works (Koedyk 2012).

Outside of fertiliser manufacturers, the biggest sulphuric acid users are Fonterra and Carter Holt, using approximately 10,000 tonnes per year. These major customers purchase either directly from the New Zealand manufacturers or import themselves.

In addition, the major manufacturers supply sulphuric acid to chemical distributors who distribute to other industries. Orica Chemnet is the major distributor of sulphuric acid in New Zealand. Other distributors are listed in Table 3.12 below.

Table 3.12 - Sulphuric Acid Manufacturers and Distributors

Manufacturer	Distributors
Balance	Orica Chemnet Jasol
Ravensdown	Orica Chemnet Damar Industries

Similarly to New Zealand, the biggest consumers of sulphuric acid in Canada are the phosphate fertiliser producers, which are located in Alberta and generate acid on site from the sulphur that is readily available in Alberta. The wholesale market in Ontario and Quebec consists mainly of acid produced as a result of scrubbing sulphur compounds from stack gases and by base metal smelting operations in the northern parts of those provinces and Manitoba (Camford Information 2012).

Price Information

Sulphuric acid is a globally traded commodity and world prices tend to be volatile. It is often prepared as a by-product from mining operations. Many metal ores are sulphides and smelting operations eliminate sulphur in the form of sulphur dioxide gas. The sulphur dioxide gas is recovered, cleaned and converted into sulphuric acid.

The primary data sources pursued for sulphuric acid are shown in Table 3.13.

Table 3.13 - Sulphuric Acid Price Data Sources

Jurisdiction	Data Sources	Comment
New Zealand	Chemical distributor list prices and import price data from NZ Customs	Import data obtained from Statistics New Zealand
New South Wales	Industry expert	
Ireland	Industry expert	
Canada	Camford Information	Chemical price information service provider

There are several grades of sulphuric acid and the strength determines the price. Large users often require a 98% concentration, whereas small local users tend to purchase at lower strengths, around the 50% level. The data obtained is shown below in Table 3.14.

Table 3.14 - Sulphuric Acid Unit of Analysis

Jurisdiction	Unit	Grade	Comment
New Zealand	\$/MT Bulk	98%	Distributor list price - includes freight up to 250km
New South Wales	\$/MT Bulk	98%	Includes delivery to Sydney area, NSW
Canada	\$/MT Bulk	93%	Terminal price - includes freight from Manitoba of the northern parts of Ontario and Quebec to either Toronto of Montreal

The data received for Canada was for a slightly lower grade than for the other jurisdictions. To account for the variation Canadian prices were converted to and analysed on a 98% basis. Significant price differences would be expected between low concentration sulphuric acid and high. However, all of the grades listed above are high concentrations and therefore such a conversion was seen as appropriate for this study. New Zealand, New South Wales and Canadian prices all include domestic freight and this makes the comparison relevant for the investigation of regulatory burden.

Evaluation

Effectively sulphur and sulphuric acid are by-products arising from the production of other desirable products. Production is mainly driven by demand for the other products and little influenced by the price which could be received for the by-product. This contributes greatly to the volatility of sulphuric acid prices on world markets - as illustrated by the price spike in 2008 Figure 3.10.

It can be seen that the spot price for both sulphur and sulphuric acid spiked in 2008 then fell just as quickly again. Sulphuric acid landed in New Zealand is most likely to originate in the Asia- Pacific area. The market in this area is strongly influenced by sulphur production from Canada, which is also the origin of most of the solid sulphur imported to New Zealand. The New Zealand landed prices for sulphuric acid appear to follow the Vancouver solid sulphur prices but with some evidence of lag and smoothing, presumably due to the effects of longer term supply agreements.

Figure 3.10 - Sulphuric Acid Price Track 2003-2009[30]

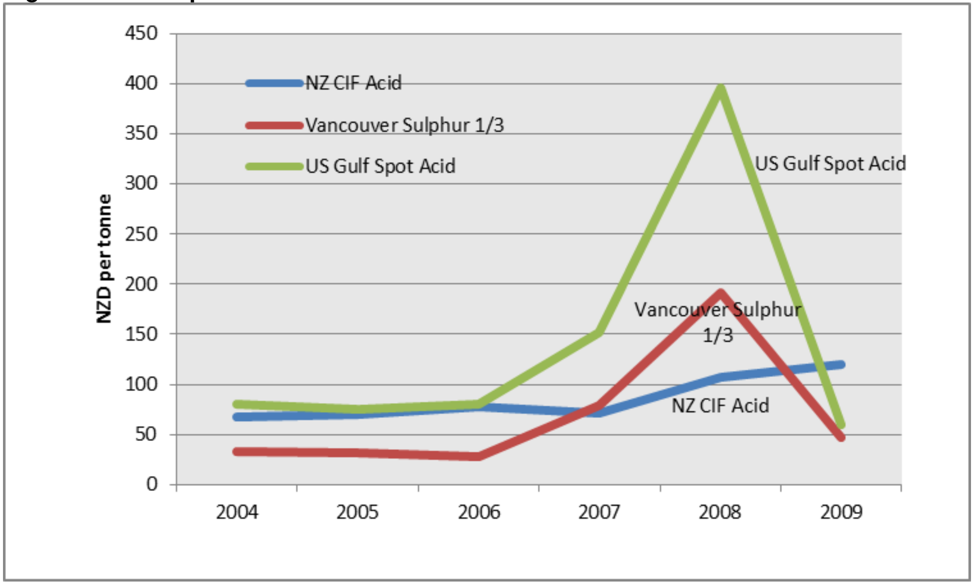
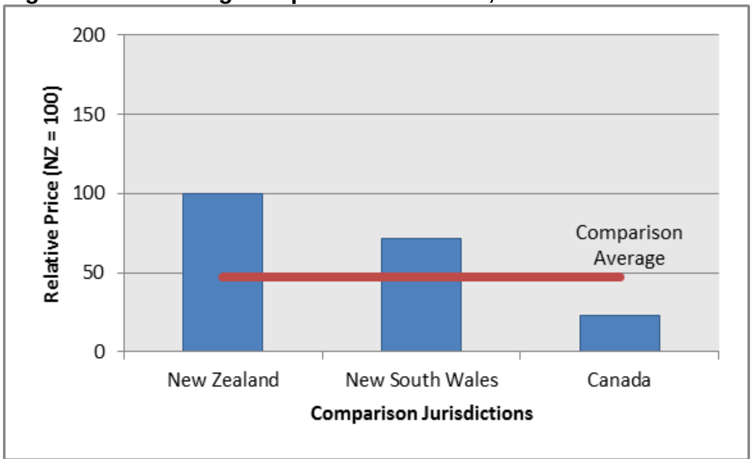


Figure 3.11 shows 2012 sulphuric acid price across the comparison jurisdictions, relative to the New Zealand price.

Figure 3.11 - Average Sulphuric Acid Price, 2012



New Zealand prices for sulphuric acid appear to be significantly higher than in the comparison jurisdictions. Of most relevance is the comparison against NSW prices. Canadian prices would be expected to be low as much of the sulphur supply for the Asia Pacific region comes from Canada.

There are several possible explanations for the higher prices observed in New Zealand compared to NSW:

1. HSNO is having a significant effect on prices in New Zealand
2. The comparison is misleading as the actual price paid by large scale users in New Zealand is much lower due to heavy use of discounts and confidential rebates to the largest users
3. Freight costs to New Zealand are higher than for other jurisdictions

[30] Price presented for sulphur is for one third of tonne equivalent units, as one tonne of sulphur forms 3 tonnes of sulphuric acid.

4. New Zealand customers value price consistency and are prepared to pay a higher margin at times in return for stable prices
5. New Zealand distributors have larger margins on sulphuric acid.

Interviews with major users have revealed that heavy discounts and rebates are provided to the biggest users, but major users are often bound by confidentiality agreements so actual prices paid by the largest users were not observed in this study. This suggests that the second factor listed above could be influential. However, as the extent of price discounting is not known this price difference may be due to HSNO effects and Price Signal 1 is therefore assessed as a Weak Pass.

Taking all of the above into account the assessment of sulphuric acid against the price signals is presented in Table 3.15.

Table 3.15 – Summary of Sulphuric Acid Outcomes

Price Signal	Outcome	Comment
Price Signal 1: Price Levels	Weak Pass	Includes all jurisdictions, but snapshot of 2012 prices only
Price Signal 2: Price Change	Undetermined	Insufficient data

3.5.2 Caustic Soda

Market Profile

Caustic soda (sodium hydroxide) is a fundamental building-block chemical and is a globally traded commodity. It is produced in conjunction with chlorine gas via the chlor-alkali process, so availability and price are therefore impacted significantly by the global balance of demand between chlorine and caustic soda.

Caustic soda is commonly used as a Clean-in-Place (CIP) agent, often in the food and beverages industry. The largest users of caustic soda are Fonterra, Carter Holt and Winstone who combined take about 70-80% of imports.

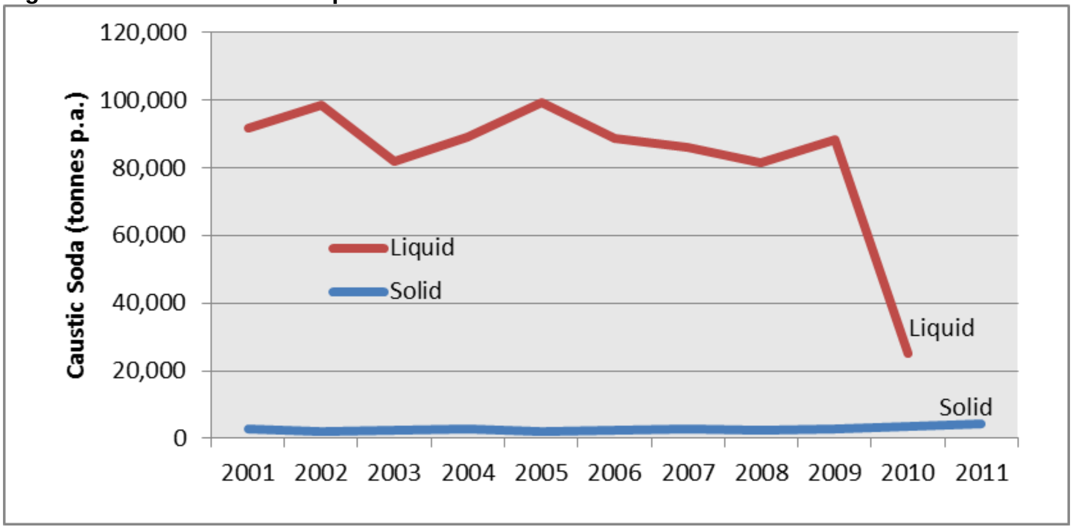
Caustic soda is primarily imported into New Zealand in bulk liquid shipments. However, solid caustic soda is also imported in conventional shipping containers and dissolved locally. In 2010 4,000 tonnes of caustic soda was imported in solid form, compared to 25,000 tonnes in liquid form (Source: Statistics NZ). It is considered that the ease of competition via this mechanism serves as a cap on the price of liquid caustic soda (Koedyk 2012).

If it is assumed that the liquid imports were mainly 50% solution, then NZ Custom's data indicates that the solid form leapt from a persistent 4-6% market share over the decade ending in 2009 to a 25% market share in 2010. The jump in market share for the solid form of caustic soda in 2010 was partly due to an 18% increase in solid caustic soda imports, but was mainly due to a

Photo: Kevin Oldham

72% plunge in liquid imports (Figure 3.13). These changes indicate that competition from solid imports is succeeding in taking market share of caustic soda imports.

Figure 3.13- Caustic Soda Imports



Price Information

As mentioned above, caustic soda is produced as a by-product of chlorine gas manufacture in a chlor-alkali plant. The rate at which a chlor-alkali plant will operate is set by the demand for chlorine as storage of chlorine gas is relatively costly, so capacity is limited. If the demand for chlorine is strong, then there may well be a surplus of caustic soda produced in which case the price will drop in order to increase sales. On the other hand, if the demand for chlorine drops, then the production of caustic soda will also drop with the consequent effect of prices increasing.

The price data obtained for caustic soda was obtained from the sources shown in

Table 3.16. Data was obtained primarily for bulk purchases of 50% solution, and with freight included (Table 3.17). All prices were converted to and analysed on a 100% basis.

Table 3.16 - Caustic Soda Price Data Sources

Jurisdiction	Data Sources	Comment
New Zealand	Chemical distributor list prices and NZ Customs import price data	Customs data obtained via Statistics NZ
New South Wales	Industry experts	
Ireland	Industry experts	
Canada	Camford Information	Chemical price information service provider

Table 3.17 – Caustic Soda Unit of Analysis

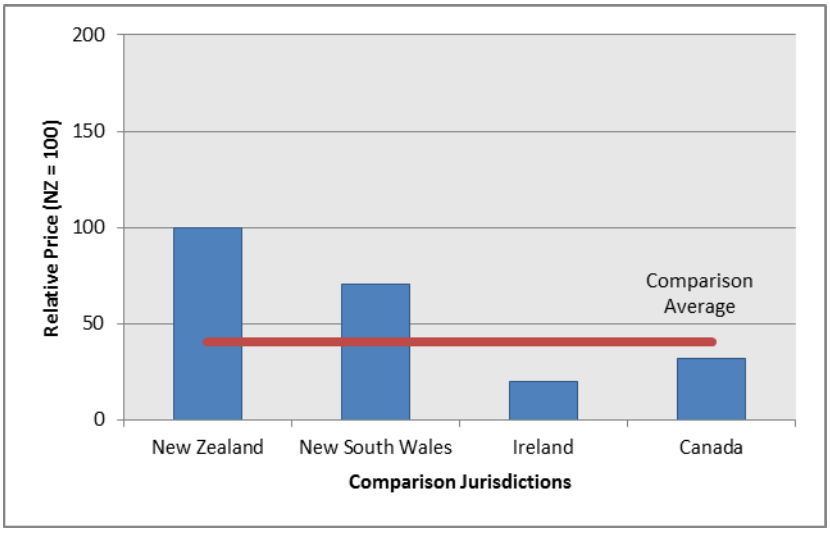
Jurisdiction	Unit	Grade	Comment
New Zealand	$/MT Bulk	50%	Includes freight up to 250km
New South Wales	$/MT Bulk	50%	Includes delivery to Sydney area, NSW
Ireland	$/MT Bulk	50%	CFR European port
Canada	$/MT Bulk	50-70%	FOB price to distribution terminal in Concord, ON (approx. 400-500km)

The Canadian price is the Freight on Board (FOB) price to the distribution terminal in Concord, Ontario – just northwest of Toronto. Caustic soda for eastern Canada is manufactured in Quebec, approximately 400-500km east of Toronto. Therefore the Concord FOB price should include most of the transportation cost.

Evaluation

Figure 3.14 shows 2012 caustic soda price across all the comparison jurisdictions, relative to the New Zealand price.

Figure 3.14 - Average Caustic Soda Price, 2012

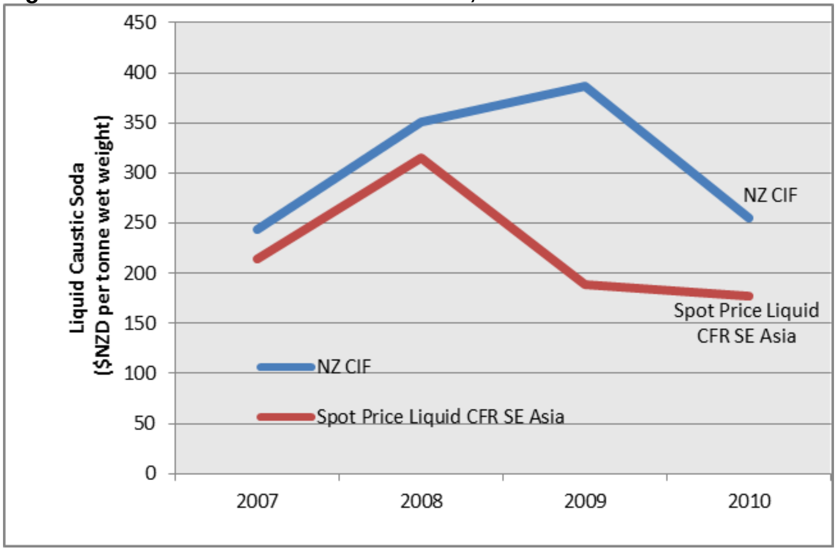


The New Zealand price appears to be significantly higher. The largest supplier of caustic soda in New Zealand declined to provide pricing information and therefore the price shown is for secondary suppliers who deal with significantly lower quantities of caustic soda. Economies-of-scale could be one explanation for why the NZ price is much higher.

One major user of caustic soda, with operations in both New Zealand and Australia, reportedly pays 10% more for bulk liquid caustic soda in New Zealand. A quarter of this 10% price difference was attributed to ocean freight costs and the balance was due to higher local port handling and bulk storage costs (Koedyk 2012).

The price track of landed costs of liquid caustic soda imports for the period 2007 to 2012 is shown in Figure 3.15 alongside the SE Asia spot price. The price tracks are close in 2007 and 2008, with declared landed prices being within $50 of the spot price. The landed price shows strong lag effects, with landed prices continuing to rise in 2009 while spot prices fell away, widening the difference to almost $200. This is most likely due to the effects of longer term supply contracts which serve to dampen price swings: in periods of rising prices, such as 2007 and 2008 the price difference narrows due to the benefit of prices set for long term contracts based on the prior period of lower prices. In 2009 the opposite effect occurred. The 2010 year is likely to be the most representative of steady state conditions, with a price difference of around $NZD 80. Most of this would be accounted for by freight and insurance.

Figure 3.15 - Price Track of Caustic Soda, 2007-2012



Taking all of the information into account, the assessment of caustic soda against the signals criteria is presented in Table 3.18.

Table 3.18 - Summary of Caustic Soda Outcomes

Price Signal	Outcome	Comment
Price Signal 1: Price Levels	Weak Pass	Includes all jurisdictions, snapshot of 2012 prices only
Price Signal 2: Price Change	Undetermined	Insufficient user data due to commercial confidentiality reasons

While the price differential is significant this has been rated as a weak as the comparison data was limited to a snapshot of 2012 prices, which may be misleading.

3.5.3 Methyl Ethyl Ketone (MEK)

Market Profile

Over half of global demand for MEK comes from the paints and coatings industry. Other uses include rubber-based industrial cements, low temperature bonding agents and as a separation solvent for printing inks (ICIS 2011).

Z Energy (previously Greenstone Energy) and the Australian Solvents & Chemicals Company (ASCC) are two major suppliers in the New Zealand market.

MEK Global Volatility

The great East Japan Earthquake in March 2011 dealt a severe blow to Japan's chemical industry. Major MEK production facilities at Maruzen Petrochemical's Chiba Plant were shut down and not scheduled to restart until at least a year later. Maruzen was the largest MEK producer in Japan and one of the largest in Asia, with a capacity of 170,000 tonnes per year. The plant's shutdown had severe implications for printing, newspaper and paint manufacturing industries (ICIS 2011a) and caused CRF NE Asian MEK prices to surge by USD 80-150 per tonne (ICIS 2011b).

Price Information

MEK price is often subject to supply constraints which in recent years have caused price spikes in Europe and Asia. MEK is usually sold in New Zealand with a relatively low margin (Koedyk 2012). Sources of data for MEK are shown below (Table 3.19 and Table 3.20).

The MEK prices below include charges for packaging into drums, but not delivery. MEK distributors maintain warehouses in all major centres, so only local delivery charges (if any) would have to be added.

Table 3.19 - MEK Price Data Sources

Jurisdiction	Data Sources
New Zealand	Chemical distributor list prices
New South Wales	Consultation with industry experts
Canada	Chemical price information service provider

Table 3.20 - MEK Unit of Analysis

Jurisdiction	Unit	Comment
New Zealand	150kg Drum	Distributor list price, freight to user not included
New South Wales	1 Metric Tonne	Sydney selling price for MEK imported in 20' full load container
Canada	150kg Drum	Distributor list price, freight to user not included

Evaluation

Figure 3.16 shows the average MEK prices in Canada from the period 2006-2012, relative to the New Zealand price over the same period. Canadian prices were converted to New Zealand dollars using the average exchange rate over the comparison period.

Figure 3.16 - Average MEK Price 2006-2012

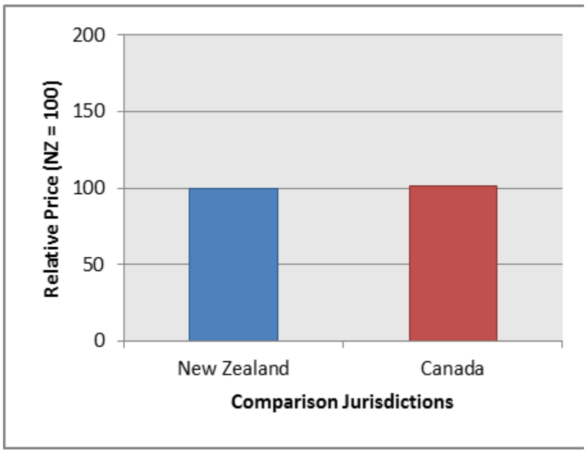


Figure 3.17 - MEK Price Track, 2006-2012

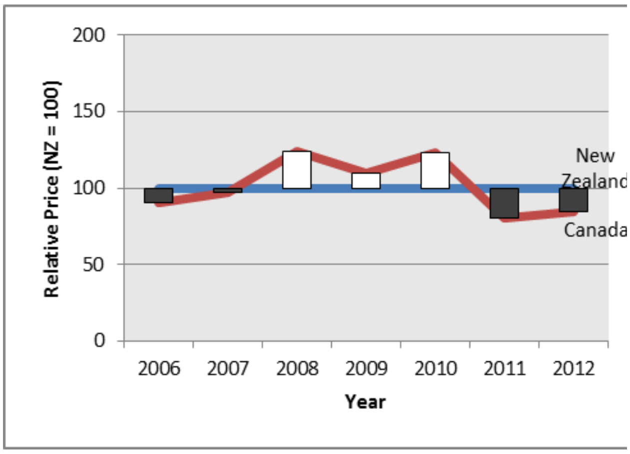
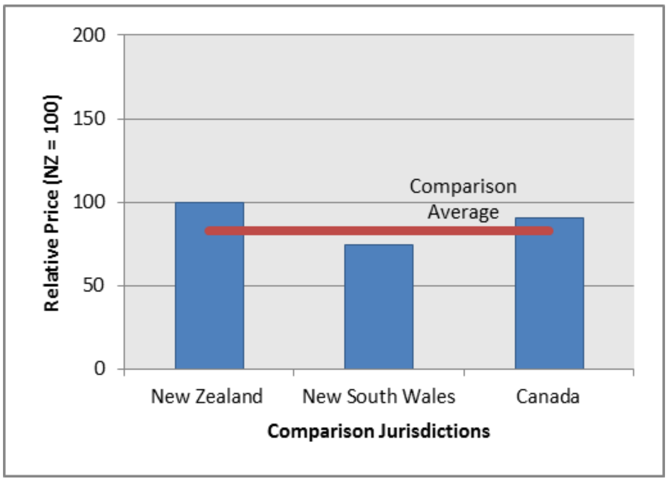


Figure 3.18 - Average MEK Price, 2012

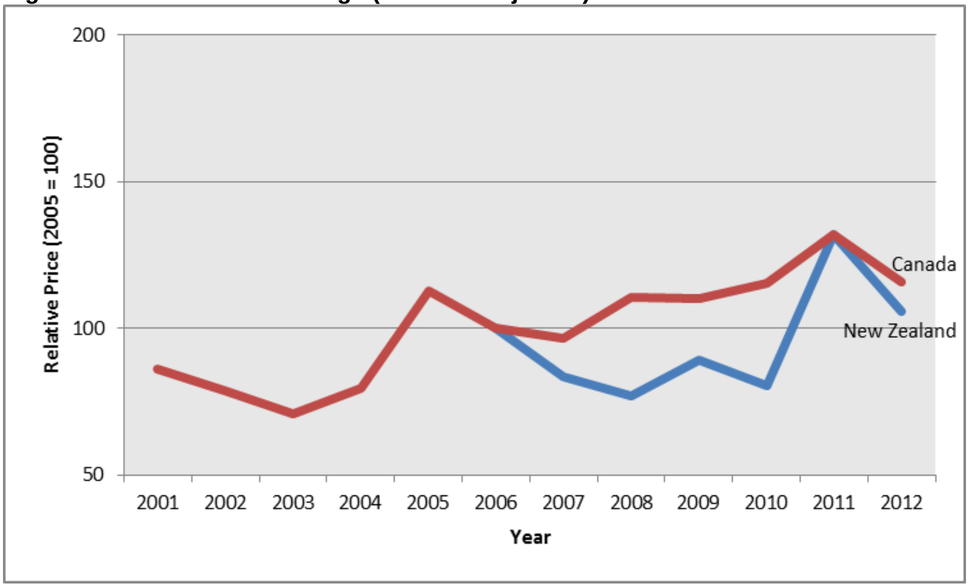


It can be seen from the comparison that, on average, MEK prices are very similar between New Zealand and Canada over the comparison period. When the historical price track is considered (Figure 3.17) it is apparent that, despite this high degree of convergence on average, relative prices between the countries tend to fluctuate from year to year – on occasion by up to 20%. Figure 3.18 shows a snapshot of 2012 MEK prices across New Zealand, New South Wales and

Canada. This indicates that, at this time, NSW prices for MEK are significantly lower than in both New Zealand and Canada.

Figure 3.19 shows the evaluation of Price Signal 2 – how the price of MEK has changed relative to the 2006 price in each country. Prices have been adjusted for inflation using the CPI for each country and are expressed in 2006 dollars. Canadian data was available from 2001 and as such has been shown from this period, still with reference to 2006 prices - this pre-2006 data is shown to solely provide context and does not influence the evaluation.

Figure 3.19 - MEK Price Change (Inflation Adjusted) 2001 – 2012



Note: Pre-2006 NZ prices not shown

After 2006 the price tracks diverged, with the New Zealand price decreasing for several years, while the Canadian price increased. In 2011 the New Zealand price rapidly increased and the prices between the two countries converged. Taking account of all the above, the overall assessment for MEK is presented in Table 3.21.

Table 3.21 - Summary of MEK Outcomes

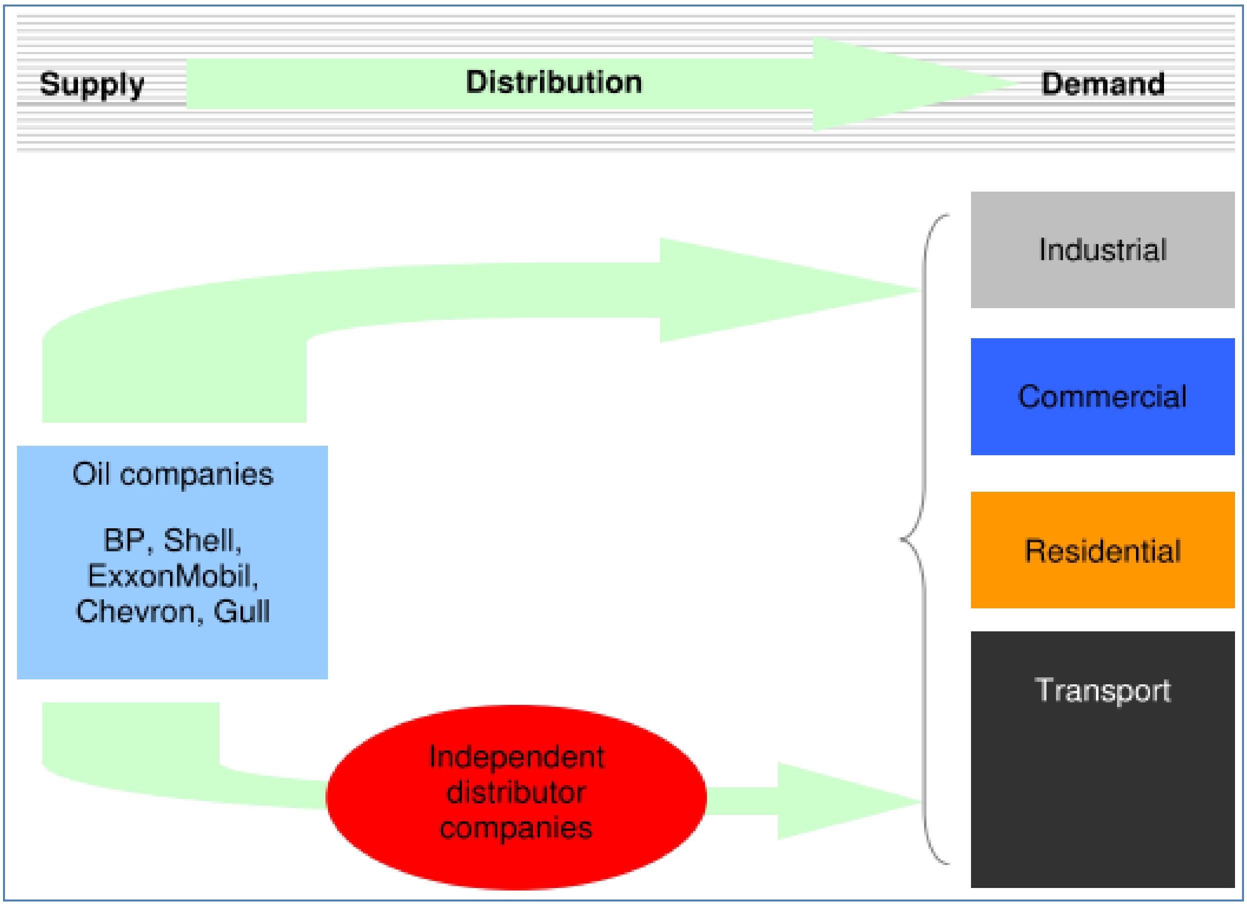
Price Signal	Outcome	Comment
Price Signal 1: Price Levels	**Strong Fail**	Comparison against Canada, 5 years of comparable data
Price Signal 2: Price Change	**Strong Fail**	Comparison against Canada, 5 years of comparable data

This signal is considered to be a strong fail as a multi-year comparison against Canadian data found no lasting price differential.

3.5.4 Diesel

Market Profile

Figure 3.20 - Liquid Fuel Supply Chain in New Zealand after Market Deregulation in 1988



Source: (Field 2010)

Diesel is important for New Zealand exports as it is used by all industries as a transport fuel. A study by Field showed that in 2008 18% of New Zealand's domestic diesel (i.e. around 519 million litres) was delivered by independent fuel distribution companies (Field 2010). The primary recipients of these diesel deliveries were:

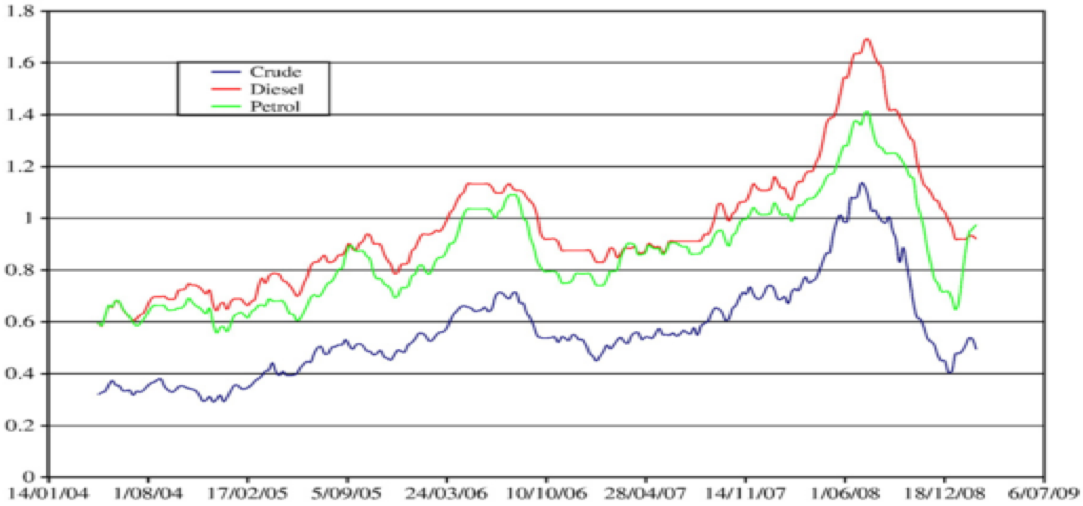
- Agricultural businesses (43%)
- Forestry and mining operations (11%)
- Building and construction businesses (10%)
- Service stations and fuel stops (14%).

Price Information

Diesel is recognised as a key input to industrial economies and the price is much-studied. In New Zealand and other countries price data is collected and published, and allegations of market distortions and anti-competitive behaviour appear regularly. In short the sector comes under close scrutiny, especially when prices are rising. The results of a recent analysis of the timing of price rises and falls in the New Zealand market are presented in the following box.

Diesel and Crude Oil Prices

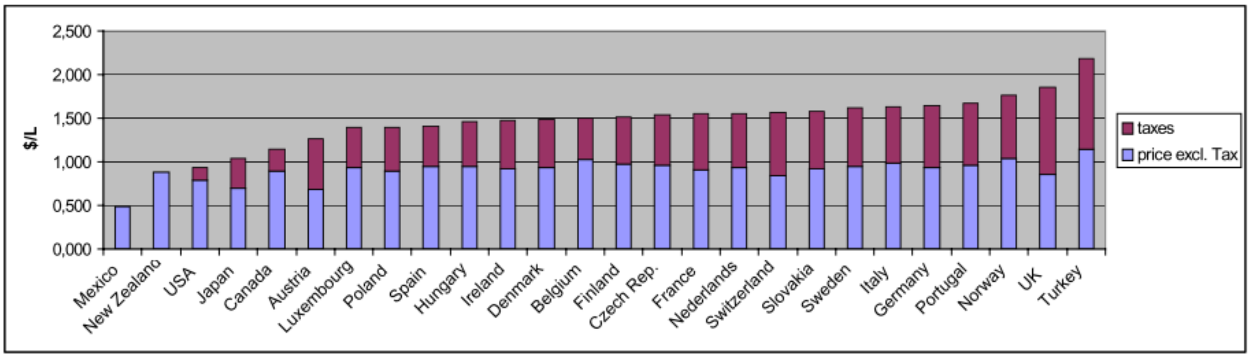
A recent study by Liu et al. (2010) investigated how pre-tax petrol and diesel prices in New Zealand respond to changes in crude oil prices. The study found that oil companies in New Zealand tend to adjust diesel prices upwards faster than they adjust them downwards and that the difference is statistically significant. Such a difference was not found with the price of petrol, suggesting that diesel price is relatively less competitive. A large proportion of diesel consumption is by commercial customers whereas most petrol users are individual motorists. An implication of the study is that commercial customers are not as price sensitive as petrol users and that oil companies are able to exploit this relatively inelastic demand to increase profits.



Source: (Liu et al. 2010)

In 2008 the Institut Français des Relations Internationales (Ifri) published the results of an investigation of diesel prices in OECD countries (Davoust 2008). In New Zealand enterprises that use diesel as an input pay Goods and Services Tax (GST) on the diesel they buy, but can offset that against GST collected on Goods and services that are sold. Thus the net GST rate on diesel purchases (or any other GST liable input) is effectively zero. Allowing for this, and for similar regimes in other jurisdictions, Davoust found that the effective price for diesel in New Zealand as an input to industry is amongst the lowest in the sample of OECD (Figure 3.21). Diesel input prices are typically 50% more than in New Zealand, mainly due to the effect of non-recoverable taxes in the other OECD countries.

Figure 3.21 - Diesel Prices (Davoust 2008)



Data sources and unit of analysis are shown in (Table 3.22 and Table 3.23).

Table 3.22 - Diesel Price Data Sources

Jurisdiction	Data Sources	Notes
New Zealand	NZ Ministry of Economic Development	Average weekly prices
New South Wales	Australian Petroleum Institute	Average yearly prices
Ireland	Ireland Automobile Association	Field work carried out in week 2 of each month
Canada	Ontario Ministry of Energy	Average weekly prices

Table 3.23 - Diesel Unit of Analysis

Jurisdiction	Unit	Notes
New Zealand	$/L	Retail pump price – tax exclusive
New South Wales	$/L	Retail pump price – tax exclusive
Ireland	$/L	Retail pump price – tax exclusive
Canada	$/L	Retail pump price – tax exclusive

Evaluation

Figure 3.22 shows the average relative price of diesel across all jurisdictions for the period from 2007 – 2001. Figure 3.22 shows the prices id diesel in each year, relative to New Zealand.

Figure 3.22 - Average Diesel Price, 2007-2011

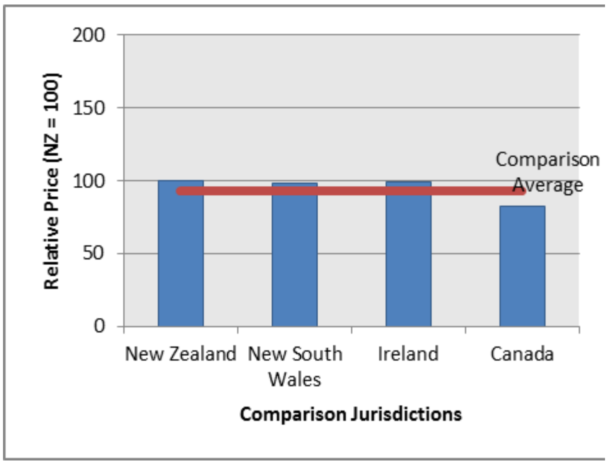
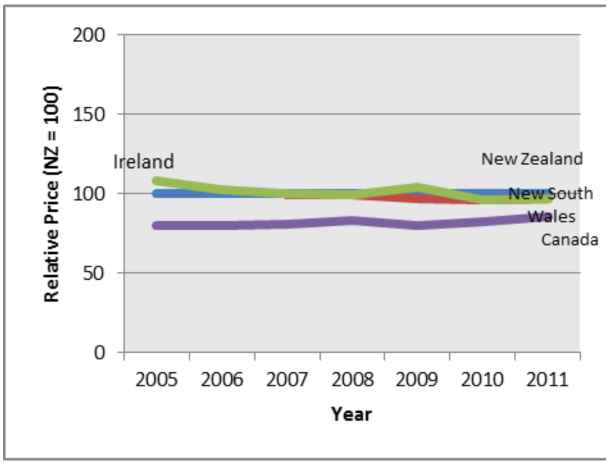


Figure 3.23 - Diesel Price Track, 2005-2011



Note: Pre-2007 NSW prices not shown

The tax-exclusive price of diesel in New Zealand is similar to Ireland, slightly higher than NSW and somewhat higher than Canada. While the actual price levels have changed, price relativity between the jurisdictions has remained fairly constant in recent years (Figure 3.24). Over this period most jurisdictions have undergone revisions to chemical regulations, but these do not appear to have affected the relative level diesel prices. This could indicate that such controls have only a minor effect on prices, but a more likely explanation is that any such changes in controls have been relatively minor in respect of diesel.

Figure 3.24 - Diesel Price Change (Inflation Adjusted), 2005-2011

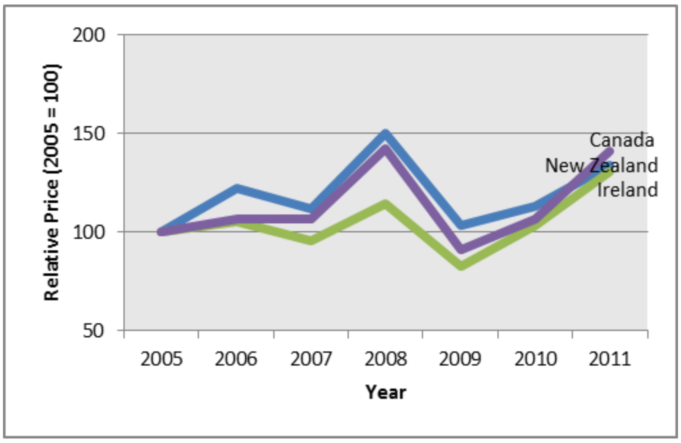


Figure 3.24 shows how the price of diesel has increased in New Zealand, Ireland and Canada relative to 2005 prices (when adjusted for inflation using each country's CPI). There is a high level of volatility in the comparison period but on average the New Zealand price has not increased significantly more than the other jurisdictions. Table 3.24 summarises the outcomes of the diesel price evaluation.

Table 3.24 - Summary of Diesel Outcomes

Price Signal	Outcome	Comment
Price Signal 1: Price Levels	Strong Fail	Comparison across all jurisdictions, 5 years of comparable data
Price Signal 2: Price Change	Strong Fail	Comparison against Ireland and Canada, 5 years of comparable data

3.5.5 Glyphosate

Market Profile

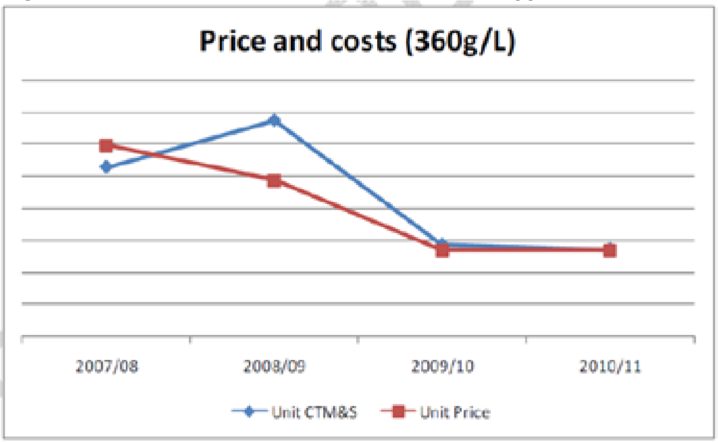
Glyphosate is a herbicide developed by the Monsanto Company in the early 1970s. The herbicide is no longer protected by patent and is reportedly the largest-selling herbicide in the world.

Many major manufacturers of glyphosate are located in China, and it has recently been alleged that Chinese exporters have been dumping glyphosate in Australia. Information submitted in support of the dumping allegation states that imports of formulated glyphosate have contributed to a 20 per cent reduction in Australian glyphosate production volumes in the 2010/2011 financial year, whilst imports have increased nearly 400% (Australian Customs 2012b).

Price Information

Prices of glyphosate in Australia have declined which has been partly attributed to the alleged dumping. Figure 3.25 is taken from the Australian Customs public record of the allegations and shows the trend in Australian glyphosate prices over recent years. Data sources and the selected unit of analysis are shown in Table 3.25 and Table 3.26.

Figure 3.25 - Price and Costs of Australian Glyphosate



Source: (Australian Customs 2012a)

Table 3.25 - Glyphosate Price Data Sources

Jurisdiction	Data Sources	Notes
New Zealand	Retail suppliers, users	Via personal visits, email and phone surveys
New South Wales/Australia[31]	HerbiGuide (pesticide information providers) and retail suppliers	Via email and phone surveys
Ireland	Irish Farmers Journal retail price survey	
Canada	Government and University retail price Surveys	

Table 3.26 - Glyphosate Unit of Analysis

Jurisdiction	Unit	Notes
New Zealand	$/kg AI	20L Retail Price, 1000L Intermediate Bulk Container – freight included
New South Wales/Australia	$/kg AI	20L Retail Price
Ireland	$/kg AI	20L Retail Price
Canada	$/kg AI	10-20L 20L Retail Price

Glyphosate based herbicides are sold in a range of formulations, containing differing levels of the active ingredient glyphosate. In most cases the formulation includes additional ingredients which increase the effectiveness of the product (e.g. surfactants, penetrants and the like). Glyphosate products can differ across jurisdictions; however, formulations containing similar ingredients have been selected for comparison.

Prices were analysed on the basis of NZD per kilogram of active ingredient to account for the differing concentrations of formulations.

[31] Pre-2012 prices were actually surveyed in Western Australia, although they were supplied by nation-wide distributors who have similar prices across Australia.

Evaluation

Figure 3.26 shows the 2012 relative glyphosate prices between New Zealand and New South Wales. Figure 3.27 shows changes in New Zealand, Australian and Canadian prices from 2005 (adjusted for inflation using each county's CPI). Figure 3.27 shows data from before 2005. However, this data is shown solely to provide context and does not influence the evaluation. These charts indicate that:

- New Zealand glyphosate prices are currently very similar to those in NSW
- New Zealand glyphosate prices have fallen earlier than prices in Canada and Australia, but follow similar trends overall.

Figure 3.26 - Average Glyphosate Price, 2012

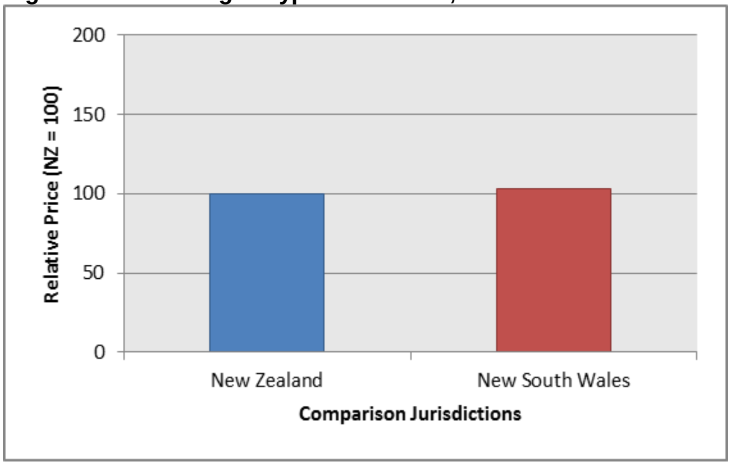


Figure 3.27 - Glyphosate Price Change (Inflation Adjusted), 2002-2011

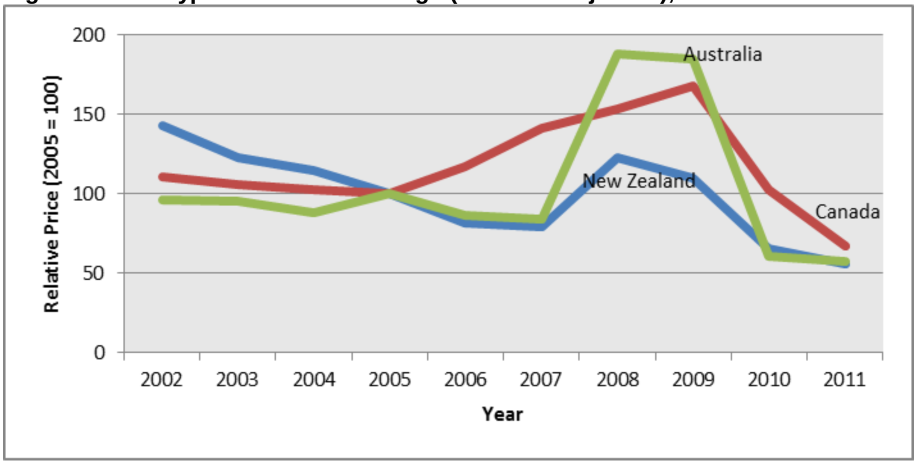


Table 3.27 - Summary of Glyphosate Outcomes

Price Signal	Outcome	Comment
Price Signal 1: Price Levels	Weak Fail	Comparison against NSW - snapshot of 2012 prices only. No significant difference found
Price Signal 2: Price Change	**Strong Fail**	Comparison against Canada, 5 years of comparable data. NZ prices have fallen faster since 2005 than those in Canada

The dumping allegations for glyphosate give cause for a caveat. Dumping of a product has a market distorting effect and can decrease prices in a jurisdiction significantly. This must be taken into account when evaluating the above information. If it is found that such dumping is taking place in one country but not another then this affects price differences.

Taking into account all of the above information and the current status of the dumping allegations, the price evidence does not indicate significant effects of HSNO on glyphosate prices in New Zealand and therefore price Signal 1 is assessed as a weak fail. Price signal 2 is assessed as a strong fail given the long time series of comparable data and the lack of any discernible HSNO impact.

3.5.6 Chlorpyrifos

Market Profile

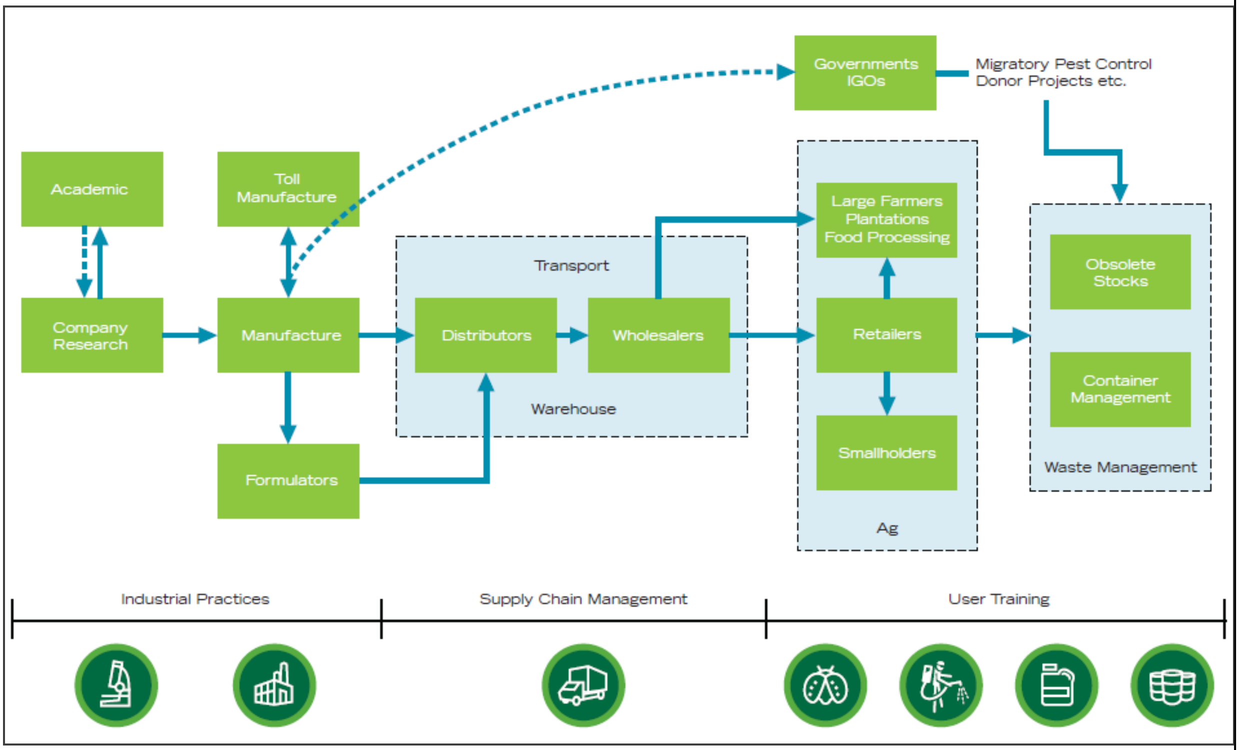
Chlorpyrifos is an insecticide, being one of a class of pesticides known as organophosphates – these are the dominant class of insecticides in New Zealand.

In 2004, total insecticide use in New Zealand was around 400 tonnes of active ingredient per annum (Walker 2004). Further breakdown of usage is not available in New Zealand as customs data does not classify pesticides to an adequate level for identifying active ingredients. In Ireland chlorpyrifos accounted for 13% of insecticide usage in the same year (Department of Agriculture & Food 2004). If the market share of chlorpyrifos is similar in New Zealand then the market size would be around 50 tonnes per annum.

Movement of a Product through the Value Chain

A recent report by the industry advocacy group CropLife International presented the following diagram illustrating the movement of a crop protection product through the value chain. Research and development is the first step and this often represents a period of significant investment of both time and resources for chemical manufacturers.

Once a chemical is approved and in production it is common for the pure substance to be manufactured separately and passed on to formulators. The product is then handled by distributors and wholesalers who sell directly to major users or on to retailers.



Source: (CropLife International 2011)

Price Information

Data sources for chlorpyrifos prices and the selected unit of analysis are presented in Table 3.17 and Table 3.18.

Table 3.28 - Chlorpyrifos Price Data Sources

Jurisdiction	Data Sources	Comment
New Zealand	Retail suppliers	
New South Wales	Retail suppliers	
Ireland	Irish Farmers Journal retail price survey	

Table 3.29 - Chlorpyrifos Unit of Analysis

Jurisdiction	Unit	Comment
New Zealand	$/kg AI	20L Retail Price, 1000L IBC – freight included
New South Wales	$/kg AI	20L Retail Price
Ireland	$/kg AI	20L Retail Price

Evaluation

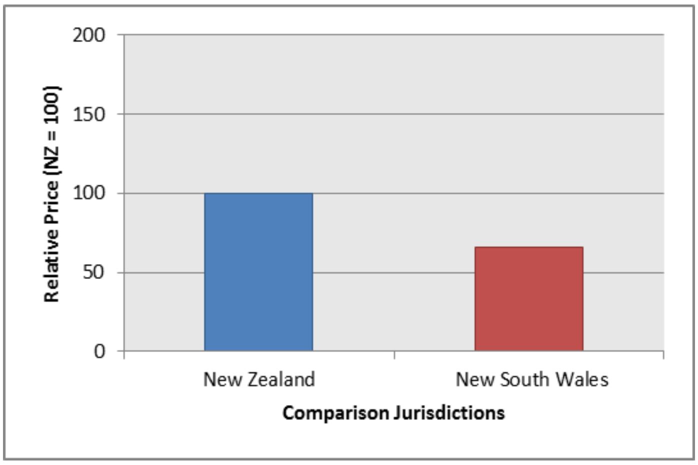


Figure 3.28 - Average Chlorpyrifos Price, 2012

A comparison against current prices in NSW is presented in Figure 3.28. This comparison indicates that current chlorpyrifos prices in New Zealand are significantly higher than in NSW. Accordingly, Price Signal 1 is a pass. However, because the data set is limited the price signal is classified as weak, resulting in an overall classification of "Weak Pass". No determination was made for Price Signal 2 due to insufficient data.

Table 3.30 - Summary of Chlorpyrifos Outcomes

Price Signal	Outcome	Comment
Price Signal 1: Price Levels	Weak Pass	Comparison against NSW only and snapshot of 2012 prices only
Price Signal 2: Price Change	Undetermined	Insufficient data

In summary the data for chlorpyrifos is limited, but the data shows that NZ prices were higher in 2012 than in NSW. One of the possible explanations for the difference is that it is due to the compliance costs of HSNO so Price Signal 1 is accorded a pass. Although the price difference is significant, because the data set is small the signal is classified as weak.

3.5.7 Chlorothalonil

Market Profile

Chlorothalonil is one of the most commonly used fungicides in New Zealand. There is a market of around 60,000L per year for formulated chlorothalonil with a value of approximately NZD 1 million (Syngenta 2012). Ninety per cent of the market consists of applications to potatoes, grapes and vegetable brassicas, with grapes being the primary product used in export markets.

Chlorothalonil is commonly imported from Asia as a pure substance and is formulated in New Zealand. Alternatively it is imported to Australia where it is formulated, packed and labelled and subsequently sent to New Zealand. The primary form of distribution in New Zealand is through ‘rural supplies’ distribution outlets. Interviews with industry participants suggest that the market for chlorothalonil is highly competitive.

Price Information

Large increases in world price of the pure substance reportedly occurred in 2008 - these were partly attributed by industry participants to the temporary closure of major plants in China in preparation for the Beijing Olympics. The price surges were also likely subject to other international forces as similar price increases across many chemicals can be observed during this period. Suppliers around the world tend to follow the market price up or down irrespective of their cost structure or production capacity (Koedyk 2012).

New Zealand prices of basic chlorothalonil formulations have reduced significantly over the last few years in large part due to the increasing levels of competition. New Zealand prices for more advanced formulations have remained relatively constant (Figure 3.31). Data sources and unit of analysis are shown below (Table 3.31 and Table 3.32).

Table 3.31 - Chlorothalonil Price Data Sources

Jurisdiction	Data Sources
New Zealand	Retail suppliers
New South Wales[32]/Australia	HerbiGuide (pesticide information provider) and retail suppliers
Ireland	Irish Farmers Journal retail price survey
Canada	Government and University retail price surveys

[32] Price data for New South Wales was actually collected in Western Australia; however prices are from major nation-wide distributors who have similar prices across Australia - the prices are therefore representative of the New South Wales price.

Table 3.32 - Chlorothalonil Unit of Analysis

Jurisdiction	Unit	Comment
New Zealand	NZD $/kg of active Ingredient (AI)	10-20 Litre Retail Price
New South Wales/Australia	NZD $/kg of active Ingredient (AI)	20 Litre Retail Price
Ireland	NZD $/kg of active Ingredient (AI)	20 Litre Retail Price
Canada	NZD $/kg of active Ingredient (AI)	10-20 Litre Retail Price

Evaluation

Price data collected suggests that chlorothalonil is significantly more expensive in New Zealand than Australia and Ireland (Figure 3.29 and Figure 3.30). Figure 3.31 shows the price track of the New South Wales price relative to the New Zealand price (prices from before 2005 are shown only to provide context and do not influence the evaluation). The New Zealand price has been consistently higher up until 2011 when the Australian price increased to above the New Zealand level. Taking account of the full period of analysis Price Signal 1 is classified as a Strong Pass.

Figure 3.29 - Average Price, 2005-2012

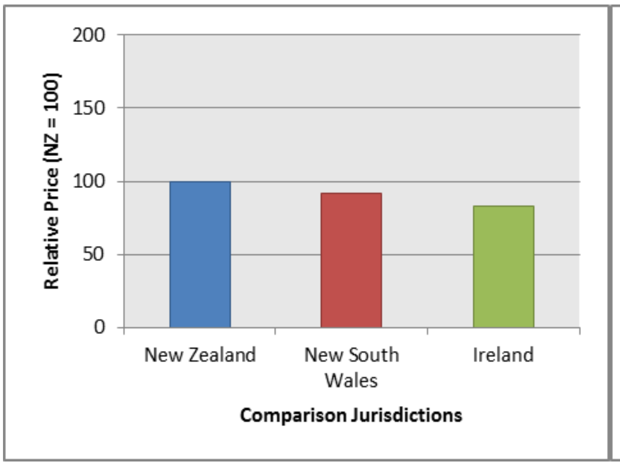


Figure 3.30 - Average Chlorothalonil Price, 2009

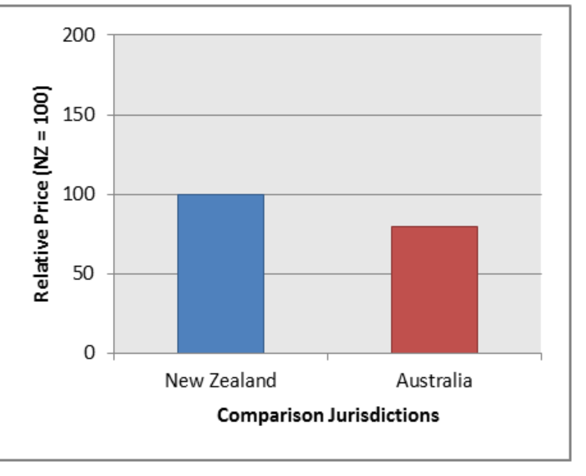


Figure 3.31 - Chlorothalonil Price Track, 2003-2012

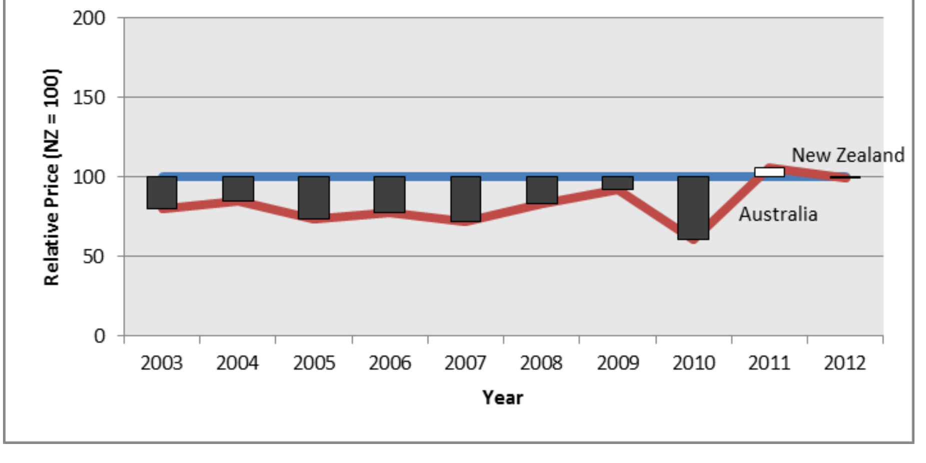


Figure 3.32 shows the inflation adjusted price of chlorothalonil, expressed in 2005 dollars (prices from before 2005 are shown only to provide context and do not influence the evaluation). The New Zealand price has decreased since 2005 and therefore Price Signal 2 is rated as a Strong Fail.

Figure 3.32 - Chlorothalonil Price Change (Inflation Adjusted), 2003-2012

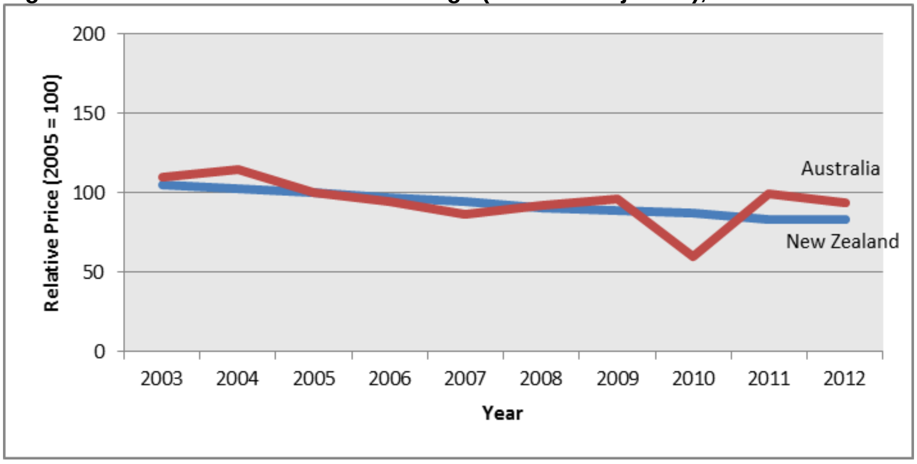


Table 3.33 - Summary of Chlorothalonil Outcomes

Price Signal	Outcome	Comment
Price Signal 1	Strong Pass	Comparison against NSW, full time series of prices – New Zealand prices have matched NSW prices since 2011
Price Signal 2	Strong Fail	Comparison against NSW, full time series of prices

3.5.8 Evaluation of Price Signal 3

Price Signal 3 – Price Level by Hazard Score – is derived from the logic that, if HSNO is having a significant effect on prices of chemicals in New Zealand, the prices of more hazardous chemicals should be more affected than less hazardous chemicals.

It is intuitive that some chemicals are more hazardous than others and there are different levels of hazard classification associated with properties such as flammability. However, there is no accepted system of making an overall assessment of hazard rating. One of the issue is that this involves a degree of value judgement: for instance how to compare a substance which is explosive (with mainly human potential consequences) with one which is eco-toxic. So, for the purposes of this study the level of hazard was assessed based on the international GHS hazard rating. The methodology is outlined in 3.4.10 and the hazard scores arising from that analysis are presented in Table 3.3.

Table 3.34 - Hazard Ratings of Selected Chemicals

Chemical	Hazard Score	
Glyphosate	5	Aquatic eco-toxicity, eye irritant, acute toxicity
Diesel	6	Aquatic eco-toxicity, flammable liquid, acute toxicity, skin irritant, carcinogen
Caustic Soda	7	Acute toxicity, skin corrosive, metallic corrosive, eye corrosive, aquatic eco-toxicity
MEK	7	Flammable liquid, acute toxicity, skin irritant, eye irritant, target organ toxicity
Sulphuric Acid	12	Acute toxicity, carcinogen, target organ toxicity, skin corrosive, aquatic eco-toxicity, metallic corrosive, eye corrosive
Chlorpyrifos	12	Acute toxicity, aquatic eco-toxicity, target organ toxicity, eye irritant, skin irritant
Chlorothalonil	12	Acute toxicity, sensitiser, suspect carcinogen, target organ toxicity, eye corrosive, aquatic eco-toxicity

This hazard scoring system is a novel one, developed specifically for this assessment. While it is considered to be based on a reasonable premise, and to produce results which seem appropriate, the scoring system is not proven. As such any results of Price Signal 3 should be qualified accordingly.

The second component of Price Signal 3 is to compare the New Zealand price for each chemical against the "world user price" for the same chemical, where in this case the world user price is the arithmetic average of prices across the jurisdictions for the period of comparison.

Spot market prices for bulk shipments can be purchased for most chemicals, but that data is not relevant for two main reasons:

- User prices are required, to allow the effects of regulatory controls to be expressed in the end user price
- While the spot price eventually influences supply price, there is often a substantial lag: so comparing spot prices with end user prices at any particular point in time is likely to be misleading whenever spot prices are volatile - which they often are.

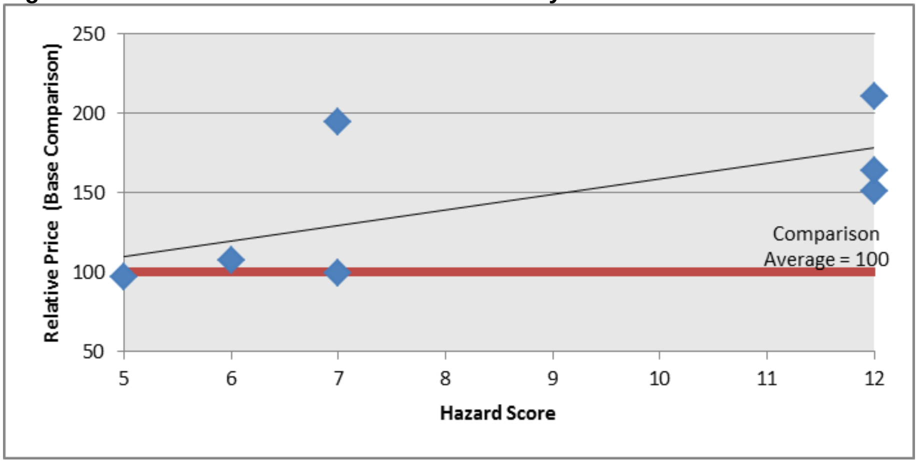
Time series of end user prices are difficult to obtain. For these reasons most studies on international price comparisons consist solely of "snapshots", studying present day prices. For this study an extensive search was undertaken for data, including commissioning time series information from overseas providers. Ideally each chemical would have 6 years of data from 2006 to 2011 for each jurisdiction, but in some cases this was limited by data availability. The data sources and data obtained for each chemical are discussed in 3.5.

The prices obtained were for equivalent units of analysis, which refers to the chemical purity and size of container. In some cases, where chemicals are typically consumed in different levels of concentration in different jurisdictions, then adjustments were made on the basis of concentration of active ingredient to enable valid price comparisons to be made. The units of analysis and any adjustments are discussed for each chemical in Section 3.5. Historical prices were converted to New Zealand dollars using the average exchange rate for the calendar year concerned.

An index value for the New Zealand prices was then calculated for each chemical, taking the world user price (as defined for this study) as the base, with the base level set at a value of 100. For instance if the world user price for Chemical A was $100 per unit of analysis, and the New Zealand price was $110 then the NZ relative price index would be 110. Likewise if the world user price for Chemical B was $50 per unit and the New Zealand price was $55 then the price level index would also be 110.

The level of hazard was then plotted against the hazard rating (Figure 3.33). In this figure the size of the diamond represents the quality of the data: the largest diamonds are for chemicals where a full set of suitable price data was available across most jurisdictions for the full 6 year comparison period, 2005 to 2011 inclusive.

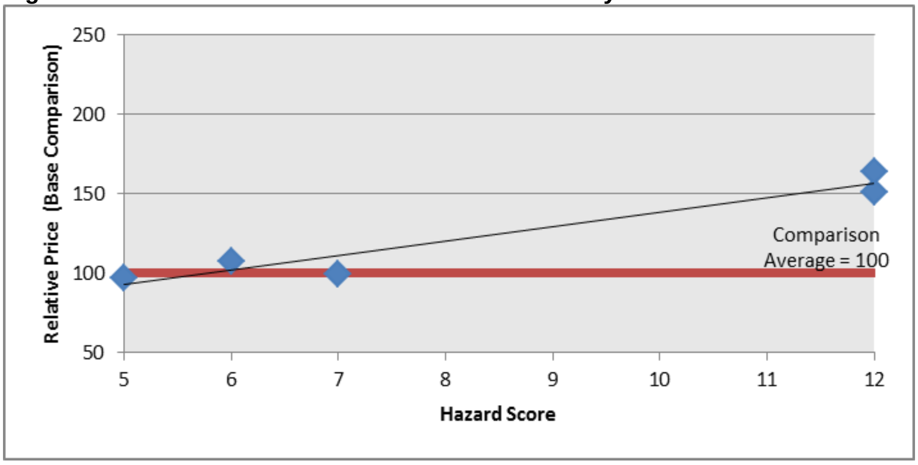
Figure 3.33 - Selected Chemicals - Price Index by Hazard Score



This analysis indicates that chemicals with low hazard ratings are similar in price to the comparison jurisdictions whereas the more hazardous chemicals are relatively more expensive in New Zealand. As such this is a positive price signal: that is that there could be a price effect due to HSNO.

The trend line in the figure above treats all data points as being of equal validity and so could be misleading. This is especially the case when the two chemicals with the highest relative prices are also those with the least data. There are also grounds to suspect that the New Zealand prices for these two chemicals are overstated due to the sales practices in this area of the industry which is characterised by confidential discounts and rebates for large scale users. For these reasons another analysis was undertaken excluding these two chemicals (Figure 3.34). The trend line is almost identical in slope to that shown above, albeit displaced downwards. This suggests that the price signal is reasonably robust.

Figure 3.34 - Five Selected Chemicals - Price Index by Hazard Score



Taking account increase in costs for the high-scoring chemicals the Signal is rated as a pass. Due to the qualifications discussed above regarding the novel nature of the hazard scoring system, Price Signal 3 is rated as a Weak Pass.

3.6 Price Discussion

The Price Signals for each chemical are presented in Table 3.35 below.

Table 3.35 - Summary of Price Signal 1 and 2 Evaluation

Chemical	Price Signal 1: Price Levels	Price Signal 2: Price Change
Sulphuric acid	Weak Pass	Undetermined
Caustic soda	Weak Pass	Undetermined
Methyl ethyl ketone	**Strong Fail**	**Strong Fail**
Diesel	**Strong Fail**	**Strong Fail**
Glyphosate	Weak Fail	**Strong Fail**
Chlorpyrifos	Weak Pass	Undetermined
Chlorothalonil	**Strong Pass**	**Strong Fail**
Overall Evaluation	**Inconsistent**	**Strong Fail**

For Price Signal 1 (Price Levels), no consistent pattern was found, with Price Signals ranging from a Strong Pass (1) to Weak Pass (3) through to Weak Fail (1) and Strong Fail (2). Accordingly the overall finding is that Price Signal 1 was inconsistent.

The data was of sufficient quality to determine Price Signal 2 for 3 of the 7 chemicals, all of which were Strong Fails. Accordingly Price Signal 3 is classified as a Strong Fail overall.

Price Signal 3 was classified as a weak pass as per the analysis in Section 3.5.

Table 3.36 - Overall Evaluation of Price Signals

Signal	Outcome
Price Signal 1	Inconsistent
Price Signal 2	**Strong Fail**
Price Signal 3	Weak Pass
Overall Summary	*Low likelihood of significant HSNO price effect*

The overall evaluation of the price signals indicates that there is a low likelihood that HSNO is having a significant effect on the prices paid by New Zealand chemical users in agricultural and industrial export industries. If HSNO were having a significant effect, then passes would be expected for the majority of chemicals evaluated across a range of price signals.

This finding is in line with industry participant's comments that it is highly unlikely that any significant HSNO price signal exists that could be detected in end user prices. In essence, the marketplace sets the price and so any costs associated with HSNO regulations are seen as just part of the cost of doing business.

These findings are consistent with the comments made by industry participants advising this study. Similar requirements are in place in most countries. The costs associated with HSNO product assessments and approved handler certificates are not seen as onerous by major distributors. Concerns arise regarding the costs of bringing storage infrastructure up to new standards under HSNO, but such concerns tend to recede once the upgrade has been made.

HSNO regulation does have significant implications for capital spending programmes. Investments driven by compliance will always take priority over other investment categories, but there is only a limited amount of capital that any company can invest in its business at any time if it is to remain viable and meet shareholder expectations. Therefore businesses operating in New Zealand (with its smaller market size compared to Australia and the rest of the world) will often be faced with the decision to delay or forgo investments that improve productivity and profitability in favour of making investments to become compliant with new regulations. It could be argued that storage infrastructure has a finite lifetime so its replacement was inevitable, but it is the forced timeframe of investments and the impact on other investment priorities that is the issue.

In total dollar terms the cost of compliance with HSNO is greatest for the largest importers and users. For such operators costs can arise in relatively large lumps when infrastructure has to be upgraded to meet new HSNO requirements. But after such changes have been made there are few significant on-going costs. One large-scale distributor advises that capital costs to meet HSNO requirements average out at around $20 per tonne of chemical handled. In addition there are on-going costs to meet HSNO requirements of around $1 per tonne.

It can be argued as to what element of this is an excessive impost, if any, as without HSNO there would be some form of control, which would have compliance costs. Additional considerations are that older, noncomplying, facilities are likely to need substantial refurbishment and that construction of newer facilities creates opportunities to add features with other advantages - such as improved efficiency of operations, reduced manpower and the like. On the other hand the above are direct costs only and do not allow for the opportunity cost of management time and effort spent on compliance. It is not possible within the scope of this study to tease all these factors out, and they will in any case differ from facility to facility, but the low levels of cost per tonne suggests that the excess cost of HSNO, if any, is likely to be small for large scale distributors and users.

As seen in earlier sections of this report relative prices can deviate at times or persistently due to market forces. However, this is not necessarily an indication of a stringent or high cost regulatory regime.

Average Price Paid by Watercare for Chemicals

Watercare Services Limited is the Auckland Council organisation responsible for the delivery of fresh water and the treatment of wastewater in the Auckland Region. As the owner and operator of water supply and wastewater treatment plants serving over 1.3 million people, Watercare is major user of chemicals. Each year Watercare prepares and issues a comprehensive Annual Report and Supplementary Information.

Photo: Watercare

The 2011 Supplementary Information (Watercare 2011) reports that 13 chemicals were used in water treatment through the region and 20 chemicals in wastewater treatment.

In total approximately 8600 tonnes of chemicals were used for water supply and 8000 tonnes for wastewater treatment in 2010/11. Over the same period Watercare spent \$9.3m on chemicals. Assuming that there was no change in the total value of chemicals stockpiled by Watercare between the start and end of the accounting period, the average cost of chemicals purchased by Watercare in 2011 was \$560 per tonne.

In absolute terms the costs of complying with any regulatory regime are likely to be greatest for the dominant distributor as that company will usually have the largest amount of infrastructure, most staff and largest fleet of delivery vehicles. However, a dominant supplier should achieve economies-of-scale so that the effect per tonne of product is small. The costs of compliance on a unit basis are usually higher for the smaller secondary suppliers. The costs quoted above are therefore likely to be a lower bound of the costs for other suppliers, but even at 10 times this, the compliance costs per unit of throughput is not likely to be significant given that the prices of bulk chemicals typically range between \$500 and \$1000 per tonne (as illustrated in the Watercare box).

This suggests that the costs of complying with the HSNO regime do not have a significant effect on prices. Under these circumstances any analysis of Price Signals would expect to find nothing consistent, just random fluctuations and other non-HSNO variations. This is what was found from the price signals and on this basis the price analysis is found to be consistent with industry comments which indicate that HSNO compliance does not have a significant effect on prices of chemicals in New Zealand.

3.7 Conclusions

The analysis of price information found that:

- At any one time prices of some chemicals might be higher in New Zealand than in other similar jurisdictions, but there is not a consistent pattern of generally higher chemical prices in New Zealand - as would be expected if HSNO compliance costs were significant
- It is possible that higher prices may persist for some chemicals due to high concentrations of market share and the resulting lack of economy of scale for second tier suppliers, but this is principally a competitive market issue and is not a direct effect of controls on the chemical imposed under the HSNO legislation
- The lack of a consistent pattern of prices is consistent with industry comment that the cost of HSNO compliance is low and is largely a background issue – at least for the major suppliers who provide most of the chemical products delivered to New Zealand users and exporters.

In summary it is concluded that, while HSNO compliance costs are likely to be significant for very small scale distributors and users, in general HSNO compliance does not have a major impact on the prices of chemicals for New Zealand industry and exporters.

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4 Stringency of Controls

Table of Contents

4.1 Summary

This section of the report provides a qualitative response to the question:

> *Are New Zealand chemical users complying with noticeably more stringent controls on hazardous substances than their overseas competitors?*

The assessment considers basic (for human and environmental health and safety only) controls, and divides these into the following three main subsections, scoring the controls for stringency against a defined 'norm' value:

- Requirements for hazard data for classification
- Information (labelling and safety data sheets) and requirements for packages and large transportable containers
- Direct risk management controls including; exposure limits (human and environmental), prevention of accidental fire and explosion (physical hazard initiation), emergency preparedness requirements, tracking, obligations for qualified persons to be in charge of a chemical, obligations for disposing of unwanted chemicals, and specific requirements for bulk containers fixed to vehicles and in a particular location.

From the above 3 main subsections a total of 16 separate areas of regulatory control were assessed and each area scored on a 3 point scale as follows:

1 – Less stringent than the norm
2 – Equivalent stringency to the norm
3 – More stringent than the norm.

Stringency is based on the amount of resource (effort, capital, staff time etc.) needed to comply with the requirement and was not related to the conservativeness of the controls where possible internationally agreed standards of regulation were chosen as norms. Where such agreed standards do not exist, the norm chosen was the current level of control on the indicator chemicals imposed in New Zealand.

Six chemicals were chosen, and comparisons were made between the stringency of controls imposed on these chemicals. The chemicals chosen were 5 substances (as defined under the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) and one mixture (diesel fuel).

The chemicals chosen were intended to:

- Represent a reasonable range of end uses important in the New Zealand economy including fuel, pesticides, industrial solvents, and cleaning agents
- Illustrate as many of the classes of chemical hazard regulated in most systems as possible

The chemicals chosen were:

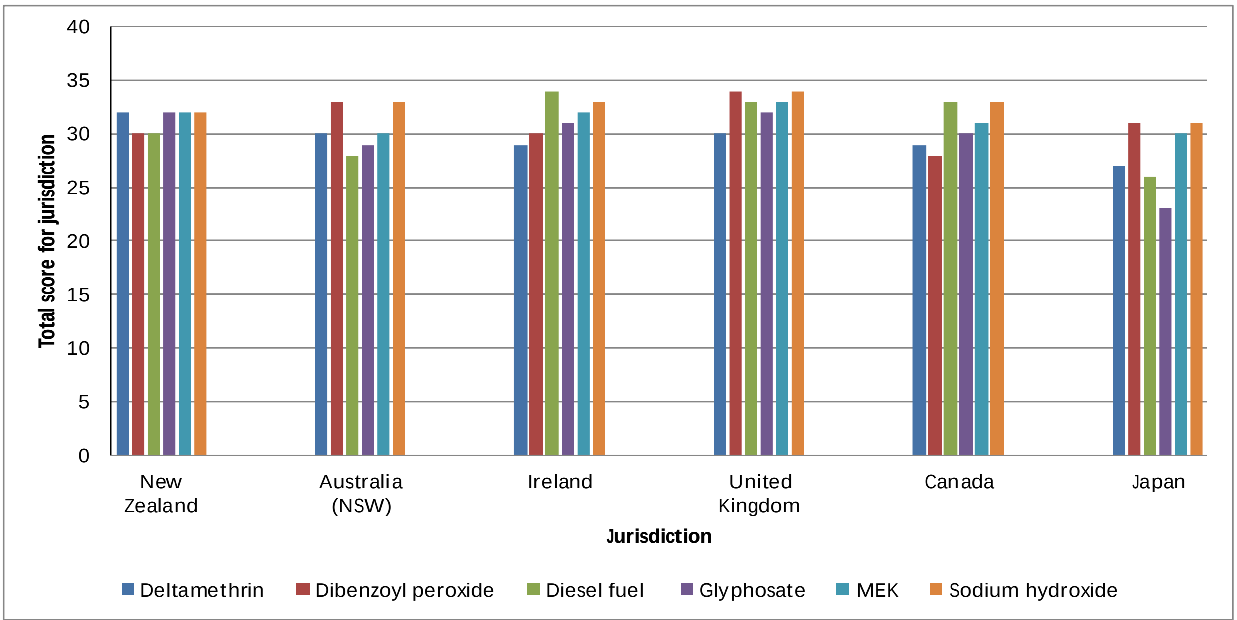
- Deltamethrin – a well-established active ingredient in insecticides
- Dibenzoyl peroxide - an organic peroxide with applications in both pharmaceutical use and glass reinforced plastic fabrication
- Diesel fuel - a very widely used fuel for road vehicles, boats, ships, agricultural machinery etc
- Glyphosate – a well-established active ingredient in herbicides
- Methyl ethyl ketone - a widely used organic solvent
- Sodium hydroxide - a base chemical with application in clean in place systems.

The jurisdictions chosen for comparison with New Zealand were:

a) Australia (represented by the State of New South Wales)
b) Canada (a mixed federal and provincial regulatory system)
c) Ireland (an EU country with some economic similarities to New Zealand)
d) Japan (a trading partner with a significant chemical industry)
e) The United Kingdom (an EU country with a well-established industrial economy).

The study showed that the comparison jurisdictions impose broadly similar levels of obligation on chemical suppliers and users with respect to stringency of controls. Put another way, the effort required to comply with legislative obligations to control chemicals to minimise harm to people and the environment is, in aggregate, similar across all the jurisdictions considered. The scores found are summarised in figure 1, noting that the scoring for Japan is done using summaries provided by the expert contact from Japan and not by comparing the actual legislation, which was not available in translation.

Figure 4.1 – Regulatory Requirement Scores by Jurisdiction



Within this overall result, there are differences between the expenditure and resources involved in complying with controls in particular areas.

There are differences in the data required for assessment of hazards and/or approval for use. While some jurisdictions require chemical hazard data only (usually using the GHS hazard classification as a basis) others require more detailed information about use patterns, production volumes, etc. Depending on whether group standards apply to a given chemical, both requirements apply in New Zealand, although missing information can be tolerated and may attract stricter control (a form of precautionary principle).

There are relatively few differences between jurisdictions in requirements for information (labels and safety data sheets) and for packaging, including large packages or intermediate bulk containers. Those differences which do occur appear to be a result of historical or transitional issues or the exercise of allowable discretion by competent authorities under international agreements.

In the third group (direct risk management controls) there are differences between jurisdictions, many of which result from differences in regulatory design or philosophy. These differences include:

- More or fewer chemicals with occupational exposure limits imposed
- Complexities in some regimes due to the imposition of a mix of general duties to achieve chemical safety and specific technical standards given the force of regulation or given evidential standing
- Remnants of older prescriptive requirements in some regimes which limit certain types of operation (e.g. in respect of petroleum storage and handling)
- Obligations to provide detailed plans to regulatory authorities and to provide public information in the case of large quantities of the chemical in some regimes (e.g. in implementing the EU Seveso II directive)
- Differences between approaches to disposal of unwanted chemicals. Systems used included hazard reduction requirements before or at disposal of chemicals (in the NZ system) and treating unwanted chemicals as hazardous waste with consequent tracking and facility licensing requirements (e.g. in Ireland, UK and Australia)
- Obligations to comply with seismic loading requirements layered on international design standards for large bulk storage tanks in the case of Japan and New Zealand, but not the other jurisdictions studied.

The effect of regulatory requirements on the operation of business is also compounded by the level and type of enforcement used. While the information obtained in this area was not complete, it appears that (with few exceptions e.g. large facilities in Ireland) chemical safety is subject to very low rates of compliance checking and enforcement in most of the jurisdictions studied. Compliance inspections are often part of general workplace safety inspections using inspectors with little specialised training.

Many jurisdictions have attempted to overcome this limitation by requiring certification of complex systems (e.g. tankwagons and bulk storage systems) by qualified persons. While a useful mechanism it is not, however, clear to what extent these certificates are being used in compliance checking.

Overall, this component of the assessment concludes that:

1. While the structure of regulatory systems varies greatly between jurisdictions, and some are in transition, the aggregate levels of stringency are remarkably uniform
2. The stringency of controls in New Zealand generally falls within the range observed in other jurisdictions. Where New Zealand controls exceed most other jurisdictions it is generally due to factors that are not significant in most other countries (such as higher levels of seismic hazard) or due to the greater emphasis that New Zealand controls place on environmental protection
3. There are differences in stringency for specific controls on chemicals and these are largely the result of specific local conditions or differences in regulatory framework design or philosophy.

4.2 Method

4.2.1 Basis for Comparison

The purpose of this part of the HSNO Indicators project is to address the question posed by Indicator 2:

> *Are New Zealand chemical users complying with noticeably more stringent controls on hazardous substances than their overseas competitors?*

This part therefore compares the primary instrument for managing chemical risks in New Zealand, the Hazardous Substances and New Organisms (HSNO) Act and its related machinery, with as far as possible equivalent[33] regimes in the selected jurisdictions and for the selected chemical entities.

This has several important consequences for the comparison:

a) The comparison is limited to the purposes set out in the HSNO Act. Simply stated these purposes are protecting the environment and the health and safety of people and communities. In practice the scope is limited to direct exposure to the chemical or, in the case of chemicals with physical hazards (fire, explosion and oxidative effects), the direct consequence of the hazard being initiated

b) Controls imposed for other purposes are therefore excluded from this comparison. For example, controls imposed for purposes such as those of the Agricultural Compounds and Veterinary Medicines Act, the Medicines Act, and the Food Act are excluded from the comparison of stringency

c) Controls imposed on a chemical at a site are only considered insofar as they are generic (i.e. apply at any site). Controls which are imposed on a specific site are excluded from the comparison. These site specific controls are generally imposed through land use planning law (in New Zealand the Resource Management Act).

Figure 4.2 – Chemical Store in Rural Setting

Navigatus

[33] Not all jurisdictions have single law based chemical safety regimes so exact equivalency is not possible with all regimes.

4.2.2 Jurisdictions and Chemicals Used

The following jurisdictions were used to compare regulatory stringency:

- New Zealand as the basis for comparison (see section 4.2.5 below)
- Australia – using the State of New South Wales as the comparator jurisdiction[34]
- Japan
- The Republic of Ireland
- The United Kingdom[35]
- Canada[36].

Six chemicals were chosen with the objective of exploring the effect of a broad range of chemical hazard classes with respect to each regulatory system. The chemicals chosen were:

- Deltamethrin – a well-established active ingredient in insecticides
- Dibenzoyl peroxide - an organic peroxide with both pharmaceutical and glass reinforced plastic applications
- Diesel fuel - a very widely used fuel for road vehicles, boats, ships, agricultural machinery etc
- Glyphosate – a well-established active ingredient in herbicides
- Methyl ethyl ketone - a widely used organic solvent
- Sodium hydroxide - a base chemical with application in clean in place systems.

The reasoning behind the selection of these particular chemicals and jurisdictions is provided in Section 1.5.2 of this report.

The chemicals chosen were evaluated as substances (as defined under the GHS) i.e. effectively the pure chemical or pure chemical with any required stabiliser. The exception to this is diesel fuel which is a well-defined mixture, although some jurisdictions use different formulations depending on temperature which may be time of year dependent. These seasonal variations in diesel composition formulation do not appear to have any noticeable effect on the stringency of controls.

The reason for this choice was to provide the best possible 'like with like' comparison across the jurisdictions chosen. Formulation of mixtures, even when the mixture is with another chemical not classified as hazardous, can significantly alter the resulting mixture's hazardous properties, sometimes with very small changes in mixture formulation leading to significant changes in properties and so the controls imposed. The GHS substance

[34] In the Australian 'commonwealth' system each state and territory has the power to make different laws and regulations although these are becoming increasingly harmonised.

[35] Different legislation exists for England, Scotland and Wales in some areas of chemical control although the effect of these differences is generally small.

[36] Canada uses a 'federal and provincial' jurisdiction model with some data requirements, information and transport (packaging and transportable containers) requirements imposed at federal and risk management controls generally imposed at provincial level. Canada's most populous and industrialised province, Ontario, was used as an exemplar for this study.

definition[37] provides a convenient basis to remove this confounding issue from the comparison.

For ease of international comparison chemicals were defined by their CAS number.

Readers of this report are reminded to note that this use of largely 'pure' chemicals basis is different from indicator 1 for this work where chemical formulations were used to compare prices.

4.2.3 Defining Stringency

Given that stringency means a number of different things in different contexts, it is important to be clear about what is intended by this term for this project. The objective of this section of the project is to examine the stringency of controls as these relate to the cost of complying with hazardous substances management regimes in NZ and elsewhere. Stringency in this context therefore describes impositions under the regime (and the selected comparator regimes) which impose costs on chemical suppliers and users. These costs may be direct (e.g. the obligation to purchase and provide certain equipment or data) or indirect (e.g. the obligation to provide certain expertise, or undertake certain actions - such as recordkeeping).

For this project stringency is therefore not taken to mean actions imposed on chemical suppliers and users which are intrinsically of a 'high standard'. For example; if ensuring that a substance which has high aquatic ecotoxicity does not enter water bodies is something which imposes little cost on either the supplier or the user, then this is not seen as being highly stringent in the context of this project.

On the other hand, an obligation to maintain chemical substances in the direct control of a qualified person may well be stringent since the supplier and user must both bear the cost of this person's qualification and of the fact that the person's duties are limited by the need to supervise or undertake handling of the chemical themselves.

4.2.4 Practical Aspects of Stringency

This report evaluates stringency of controls in relation to:

- Data required for approvals
- Packaging and information (labels and safety data sheets)
- Risk management.

Data required for approvals

The obligations imposed by regulators on those seeking to have chemicals approved or classified for regulatory purposes. These obligations focus on the requirement to provide or hold for inspection data about the hazards of the chemical, but may also include requirements to provide information such as production volumes, end uses, etc. These requirements impose costs on the supplier (and indirectly on the user) by:

[37] The formal GHS definition of substance is: 'chemical elements and their compounds in the natural state or obtained by any production process, including any additive necessary to preserve the stability of the product and any impurities deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition'

i. Requiring the supplier to expend resources acquiring the data
ii. Requiring the supplier to present this in specified ways and to a specified level of certainty to the regulator.

These expenditures then flow through as costs which would be recovered in the prices paid by users of the substance.

Packaging and Information: *Requirements for packaging, data sheets and labelling of chemicals*
These requirements are often internationalised as a result of uptake of international schemes such as the Globally Harmonized System of Classification and Labelling of Chemicals (GHS), the UN Recommendations for the Transport of Dangerous Goods (UNRTDG), International Maritime Organisation (IMO) codes etc. Jurisdictions which have different requirements (e.g. extra label information or different packaging) may impose costs as a result of repackaging or relabeling to meet a required standard.

Risk Management
Specific risk management controls for chemicals such as those requiring preparation to deal with emergencies, supervision by competent persons etc. These controls often require either the direct expenditure of resources (for example the purchase of fire extinguishing equipment) or the use of specialised skills (e.g. in preparing plans to deal with emergencies or in training staff to a specific standard).

Many jurisdictions also have specialised obligations which may not fit neatly into these three areas. For example there may be a requirement to notify the regulator of the import or use of a quantity of specific chemical but no other tracking requirements. Where possible these specific requirements are tied to one the above categories, but if this is not practicable specific comment is made on the requirement in Sections 4.5.1 and 4.5.2.

4.2.5 A Scale for Stringency

Calculating and comparing the absolute costs that stringency of controls imposes on suppliers and users of chemicals is not considered workable as the many assumptions required are likely to result in any calculated costs not being meaningfully comparable. This is best illustrated by some examples:

- The costs attributable to a requirement to have workers with given skills ‘in charge’ of certain hazardous substances would need to be separated from the costs of training that worker to do a job presumably associated with the substance. (Explosives handlers need to know enough to use the explosive for the desired effect, pesticides applicators need to understand how to apply the material at correct levels to achieve efficient pest control) Further, the cost of any training would depend on factors such as prior knowledge and experience, the skills of the trainer etc
- Separating the requirement to supply particular information in a particular format on a label from the cost of the label itself would require a series of assumptions. The cost would, for example, depend on how the label is manufactured and/or applied to any container, something likely to vary as much between methods as between elements on the label.

Accordingly, quantification of the cost of compliance is not practical. It is, however, possible to make a qualitative assessment of stringency by comparing the controls across different jurisdictions and to assess if the rules are more stringent in one compared to another, or are much the same.

The following 3 step qualitative scale for stringency has therefore been adopted:

Table 4.1 - Stringency Scale

Numerical ranking	Level	Description
3	High	Requirements of the jurisdiction are more extensive or require more action (e.g. equipment in place, training, and planning) than international norms where these exist or than the controls on the substance in the HSNO regime where these do not
2	Medium	Requirements of the jurisdiction are the same as international norms where these exist or as the controls on the substance in the HSNO regime where these do not
1	Low	Requirements of the jurisdiction are less extensive or require less action than international norms where these exist or than the HSNO requirements for these substances where such norms do not exist

Using this scale, a larger numerical rating will mean a higher level of stringency for a given jurisdiction with respect to a given chemical.

This three step scale reflects the level of judgement inherent in comparisons of systems which are not completely similar and embedded in different frameworks and expectations with the jurisdictions compared.

The following international norms are used as the basis for the 3 step comparison:

a) Label requirements – GHS label (see GHS 4th Edition [United Nations 2011[i]] Chapter 1.4 and related annexes)
b) Data sheet requirements – GHS SDS (see GHS 4th Edition Chapter 1.5 and related annexes)
c) Packaging – performance requirements as set out in the UNRTDG 17th Edition Model Regulations [United Nations 2011[ii]] Chapter 6.1
d) Intermediate bulk containers (IBC) – performance requirements as set out in the UNRTDG 17th Edition Model regulations Chapter 6.5.

Other requirements are compared to the corresponding controls on the specified indicator chemical provided under the HSNO Act. These are:

a) Exposure limits including environmental exposure limits where provided
b) Controls to prevent initiation of hazard (physical hazard)
c) Physical hazard exposure limit (heat, blast)[38]
d) Requirements to be prepared for emergencies involving the chemical
e) Tracking requirements where applicable

[38] New Zealand is unusual in having explicit exposure limits for heat, blast etc. Most jurisdictions imply these with safety distances.

f) Requirements for persons in charge of the substance (*approved handler* in the HSNO regime) where applicable
g) Disposal requirements
h) Requirements for tankwagons and fixed bulk containers.

The types of controls listed in the previous paragraph frequently do not apply. For example controls to prevent initiation of a physical hazard do not apply in relation to hazardous substances without physical hazard properties (i.e. are not flammable explosive etc as defined under the GHS). In these cases controls do not apply in New Zealand and the scoring is in relation to no control being imposed in NZ. So a score of 2 would apply to both jurisdictions if both another jurisdiction and New Zealand did not impose tracking requirements on a chemical.

In addition to these controls most systems require data on the intrinsic hazards of the chemical as this forms the basis for imposing controls on it. This area contains some complexities when considering existing and in use chemicals.

4.2.6 Stringency of Data Requirements

Assessing stringency of data requirements using existing (and so already in use) chemicals presents some complications. Existing chemicals have established permitted use(s) and controls based on historical data from various sources and various times in the past. The data requirements for such 'existing chemicals' could therefore be considered zero, rendering any comparison meaningless. This is in spite of the fact that at the time the different jurisdictions, in considering chemical substances, may require, or have required, that different amounts of data on hazards be produced or at least made available on demand.

Some jurisdictions require that, even with chemicals which are currently permitted for use, data is 'filled in' to a certain standard. An example of this approach is the EU REACH (European Union Registration, Evaluation, Authorisation and Restriction of Chemicals) requirements where more or less extensive data sets are required depending on factors such as production volume. These requirements are irrespective of past approvals or use patterns, but are dependent on the volumes of the substance produced or imported into the EU as a whole.

Other jurisdictions do not in the absolute sense 'require' data but deal with missing information or information of lesser quality in ways depending on stated precautionary policies. An example of this is the New Zealand system under which decisions permitting or restricting a chemical substance are controlled by a published methodology with regulatory force.

Jurisdictions which have implemented the GHS *self-classification principle*[39] require suppliers of chemicals to have sufficient chemical hazard information to allow the chemical

[39] Within the GHS, the self-classification principle is further qualified by the principle that the GHS does not of itself require the testing of the chemical to generate data about hazards not already to hand. However, jurisdictions implementing the GHS generally require that specific data is measured or calculated (e.g. for mixtures) by one of the methods set out in the GHS document. Some jurisdictions also allow for data to be missing or of poor quality by providing precautionary rules which can lead to the imposition of stricter controls in these cases.

to be labelled and to produce data sheets complying with their specifications. This is often extended to packaging, using internationally agreed specifications such as those in the UNRTDG. An example of this is the EU CLP (classification, labelling and packaging of substances and mixtures) regulation which has the effect of obliging suppliers and users to both acquire and examine the scientific validity of chemical hazard information which is then used to classify the chemical. Classification is then used for labelling, provision of data sheets and packaging.

New Zealand extends this further by the use of *group standards*. Group standards oblige the user or manufacturer to obtain sufficient information about the chemical substance to determine its hazard classification and then, depending on either the most significant hazard or the area of use (or sometimes both), apply packaging, labelling datasheet and risk management controls as set out in the appropriate group standard. Most group standards have been developed by the Environmental Risk Management Authority (now Environmental Protection Authority) through a process which includes consultation with chemical suppliers and users.

Considering these factors suggests two possible approaches to dealing with the 'data requirement' component of stringency:

a) Treat the indicator substances as if they were 'new' and examine the data requirements for the specific substances to be permitted for their current use in the jurisdiction
b) Compare the systems generically – i.e. by comparing the data requirements for any new substance between systems.

While both options have limitations, the first maintains consistency with the other aspects of the stringency comparison and so has been selected.

There do not appear to be any formal international norms about the amount, type and quality of data required for assessment and permitting use. The best approximation appears to be the requirements for data to classify (and hence set label/ data sheet and packaging requirements) of the EU CLP, since this is a common standard agreed by the 27 member states. This is therefore proposed as the midpoint for data requirements – i.e. as the international norm for comparison purposes.

Alternatively the data requirements of the REACH system could be used as these are subject to the same agreement. However, it is understood that the required data set for chemicals under REACH is in reality the most comprehensive in current use. Using REACH requirements would therefore be setting a midpoint at the most stringent level available, inappropriate for a 3 point stringency scale.

4.2.7 Missing and Incomplete Information

To reduce the likelihood of bias from missing information any control where information is completely absent is assigned a midpoint score and the lack of information commented on in reporting results.

In the case of incomplete information, professional judgement was used to assign a score to the control for the substance and jurisdiction. A comment on the judgement is included in the appropriate part of the data table (see section 4.2.8 below).

Both of the above situations are distinguished from information showing that a requirement or control is absent. Absent controls or requirements are scored as 1 (low stringency) as they do not impose costs on the supplier or user because there is no obligation to comply with anything.

4.2.8 Data Assembly

The regulatory requirements for a given jurisdiction are in some cases quite complex. To provide a manageable and traceable means of referencing this information, the regulatory requirements for each jurisdiction are summarised in tables in Appendix B. The general form of these tables is shown below.

Each summary of the regulatory requirement provided in Appendix B with a footnoted hyperlink to the actual law, regulation, or other statutory requirement where this is available on the Web. As there are assumptions inherent in any comparisons with the chosen norms, the hyperlinks provide readers with the opportunity to view the actual requirement for themselves.

With one exception, the data tables were completed by the same personnel on the team using references supplied by persons with local expertise in each jurisdiction. This approach was taken to ensure that, as far possible, interpretation of each jurisdiction's requirement was done on a consistent basis.

The exception to this was the data for Japan. Japanese law, regulation and similar requirements are generally not available in English translation and so the data tables were completed by our local expert in that country (Prof. Hiroshi Jonai, Professor of Medical and Welfare Engineering, Graduate School of Science and Technology- Nihon University, Tokyo), and his descriptions were then used in Appendix B. Points of clarification derived from discussions with Prof. Jonai and assumptions made in deriving scores from the summaries provided were then added to the tables.

4.2.9 General Form of Data Tables

The data tables setting out the requirements found for each jurisdiction are provided in Appendix B. These are of the following general form and based on the assumptions given in the table below.

Table 4.2 - General Form of Data Tables with Description of Controls and Assumptions

Jurisdiction: [Jurisdiction name]

Substance: [Chemical name and CAS number]

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	Information which must be presented for approval or available for compliance inspection in order to either approve the chemical or show that it has been correctly classified		Evaluation based on the information required for classification or approval of a 'new' example of the indicator chemical	
Labelling	Information required on a label including any required words, phrases or pictograms and any layout rules			
Data sheet	Information required on a safety data sheet – e.g. for workplace use			
Packaging	The strength, durability and other requirements for a package into which the chemical may be put. Requirements are at the 'basic' level i.e. without regard to a particular transport mode. Package as defined by the UNRTDG 17th Edn			
IBC	The strength, durability and other requirements for an intermediate bulk container as defined by the UNRTDG 17th Edn			
Exposure limit (tox.)	Limits (usually air concentration) on the concentration to which humans may be exposed for a specified time. Exposure limits are often set only for workplaces so these figures were referenced where available		Not applicable if the chemical is not toxic as defined by the GHS i.e. as specified in the HSNO Act Hazardous substances (threshold) regulations	
Exposure limit (ecotox.)	Limits (usually water concentration) on the concentration of the chemical in the open environment		Not applicable if the chemical is not hazardous to the aquatic environment as defined by the GHS – i.e. as specified in the HSNO Act Hazardous substances (threshold) regulations	

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Physical hazard (initiation)	Controls imposed on a chemical with physical hazards (explosiveness, flammability, oxidising capacity etc.) to prevent this physical hazard being manifested. Usually some combination of separating initiation energy (e.g. electrical spark) oxygen or fuel from the chemical		Not applicable if the chemical cannot be classified with physical hazards as defined by the GHS – i.e. as specified in the HSNO Act Hazardous substances (threshold) regulations	
Exposure limit heat/ blast	Controls, if any, imposed on a chemical with physical hazards (explosiveness, flammability, oxidising capacity etc.) to prevent injury to persons or damage to property from heat or blast as a result of these effects being initiated unintentionally		Not applicable if the chemical cannot be classified with physical hazards as defined by the GHS – i.e. as specified in the HSNO Act Hazardous substances (threshold) regulations	
Emergency preparedness	Obligations imposed on the handling (including storage) of a chemical to make preparations to deal with emergencies. May include; fire fighting equipment, emergency plans, first aid instructions/equipment/materials, and/or secondary containment (for liquids)		May be quantity dependent, but site specific requirements are excluded	
Tracking	Obligations to record and/or report to an authority the quantity and whereabouts of a chemical during all or part of its lifecycle		Does not include tracking systems which apply in some jurisdictions when the chemical is declared as a waste	
Qualified Person in charge	Requirement to have a specifically qualified person supervise and/or handle the chemical when it is not secured		Only considered if there is a chemical specific requirement over and above the general obligation for workers to be fully trained and/or supervised which is contained in most modern occupation health and safety legislation	
Disposal	Obligations to be met when disposing of a chemical which is unwanted		Includes both performance type obligations (e.g. reduce hazardous properties by a specified amount) and process type obligations (e.g. tracking and treatment in a licensed facility) provided these obligations apply generally - i.e. do not apply only to a specific location	

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Tankwagon	Strength, durability, contents resistance etc requirements for containers permanently affixed to vehicles		Not applicable if the chemical as assessed is a solid	
Fixed bulk storage container	Strength, durability, contents resistance etc requirements for containers larger than IBC and permanently at a fixed location.		Not applicable if the chemical as assessed is a solid. Includes only obligations which apply generally and not those which are location specific – e.g. as a result of land use planning law.	

4.2.10 Presentation of Results

Using the method outlined in Section 4.2, results of the comparison of the requirements were compiled in tables;

- For each chemical by jurisdiction (to obtain a picture of the overall level of impost on users in the jurisdiction) – Section 4.3
- For each type of control by jurisdiction to show the effects of each jurisdiction's approach to each control area – Section 4.4

These results are presented in the following sections, with tables colour coded to highlight variations from the international norm or baseline comparator of the New Zealand system. Higher than comparator, or norm scores are shaded as red, while lower than comparator or norm scores are shown as blue.

4.3 Jurisdiction Comparison by Chemical

The following sections provide a comparison of each jurisdiction's requirement, considering each chemical individually. As each chemical has a unique combination of hazardous properties as well as specific use patterns, this comparison might be expected to show biases in relation to these factors for the jurisdictions chosen.

The scoring system used and the number of separate regulatory controls considered means that it is possible for scores to vary from a high of 48 to a low of 16 for each jurisdiction, although the selection of New Zealand as the norm for comparison for 10 requirements limits the lowest possible score for New Zealand to 26.

4.3.1 Deltamethrin CAS# 52918-63-5

Deltamethrin is a solid with a number of human toxic properties including acute toxicity, specific target organ toxicity and irritancy. It is also internationally classified in the most severe environmental hazard (ecotoxicity) category using the GHS. This substance does not exhibit any physical hazards as defined under the GHS.

The scores for regulation of deltamethrin in each jurisdiction, derived as described above, are as follows:

Table 4.3 - Stringency Comparison by Jurisdiction - Deltamethrin

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Assessment/ approval data	3	3	3	3	3	1
Labelling	3	2	2	3	3	3
Data sheet	2	2	2	2	1	2
Packaging	2	2	2	2	2	2
IBC	2	2	2	2	2	2
Exposure limit (tox.)	2	2	2	2	2	2
Exposure limit (ecotox.)	2	2	2	2	2	2
Physical hazard (initiation)	2	2	2	2	2	2
Exposure limit heat/ blast	2	2	2	2	2	2
Emergency preparedness	2	2	1	1	1	1
Tracking	2	1	1	1	1	1
Person in charge	2	1	1	1	1	2
Disposal	2	3	3	3	3	1
Tankwagon	2	2	2	2	2	2
Fixed bulk storage container	2	2	2	2	2	2
Jurisdiction score	**32**	**30**	**29**	**30**	**29**	**27**

As can be seen from table 4.3.1, the jurisdictions considered show very similar overall scores for controls imposed on this substance. As might be expected of a pesticide ‘active’ ingredient, most jurisdictions require substantial amounts of data for approval, and it is likely that those which do not would require a similar large amount of information for formulated mixtures for end use under specific pesticides legislation.

When compared with NZ requirements, other jurisdictions do not impose as many requirements in relation to emergency preparedness, tracking and control by competent persons. This would appear to the result of basic chemical requirements imposed through occupational safety laws/ regulation. Such regulation does not usually include protection of the environment as a purpose.

4.3.2 Dibenzoyl Peroxide: CAS # 94-36-0

Dibenzoyl peroxide was assessed for this exercise as UN number 3104 (26% - 77% water stabilised). This still falls within the definition of “substance” under the GHS and provides an approximately mid-point classification as an organic peroxide (type C). Dibenzoyl peroxide also has irritancy and sensitising properties.

As considered in this study, the substance is a solid and package size is limited under UN rules to reduce the likelihood of explosion from self-accelerated decomposition. As a result IBC, tankwagon and bulk storage specific requirements have no practical effect.

The scores for regulation of dibenzoyl peroxide in each jurisdiction, derived as described above, are as follows:

Table 4.4 - Stringency Comparison by Jurisdiction - Dibenzoyl Peroxide

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Assessment/ approval data	1	3	3	3	3	3
Labelling	3	3	2	3	3	3
Data sheet	2	2	2	2	1	2
Packaging	2	2	2	2	2	2
IBC	2	2	2	2	2	2
Exposure limit (tox.)	2	3	3	3	2	2
Exposure limit (ecotox.)	2	2	2	2	2	2
Physical hazard (initiation)	2	2	1	2	1	2
Exposure limit heat/ blast	2	2	1	2	1	2
Emergency preparedness	2	2	2	3	1	1
Tracking	2	2	2	2	2	2
Person in charge	2	1	1	1	1	2
Disposal	2	3	3	3	3	2
Tankwagon	2	2	2	2	2	2
Fixed bulk storage container	2	2	2	2	2	2
Jurisdiction score	**30**	**33**	**30**	**34**	**28**	**31**

Scores across all jurisdictions are remarkably uniform with individual jurisdiction's requirements largely balancing out over the complete set of controls considered. In spite of the complexities in handling this substance, and organic peroxides in general, only New Zealand and Japan require personnel with specific training to be in charge of the substance although Canada does impose a general obligation to train workers to handle chemicals, which would apply to dibenzoyl peroxide. It is also interesting to note that most jurisdictions other than NZ and Japan impose (workplace) exposure limits on this substance.

4.3.3 Diesel fuel: CAS# 68476-34-6

Diesel fuel is one of the highest production volume chemicals in the world and is the only example of a mixture (by the GHS definition) in the set of indicator substances used. Diesel was historically not regarded as a flammable liquid as, when tested, diesel gave a higher flashpoint than the cut-off for flammable liquids used by the earlier versions of the UNRTDG.

Some jurisdictions have used a specific class of combustible liquid to handle such chemicals. Further, much of the historical control on diesel fuel disregarded hazardous properties other than combustibility. However, diesel fuel displays some toxic hazards including irritancy and some long term toxic effects. In addition, diesel fuel displays significant aquatic environmental toxicity. As a result, more recently revised control systems account for these other hazards whereas systems which retain older control elements do not, and may provide controls in relation to the older combustible liquid classification in respect of flammability. Some of these differences are evident in the jurisdiction scores in the following table.

Table 4.5 - Stringency Comparison by Jurisdiction - Diesel Fuel

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Assessment/ approval data	1	2	3	3	3	3
Labelling	3	3	2	3	3	2
Data sheet	2	2	2	2	1	1
Packaging	2	1	2	2	2	1
IBC	2	1	2	2	2	2
Exposure limit (tox.)	2	2	3	2	2	2
Exposure limit (ecotox.)	2	2	2	2	2	2
Physical hazard (initiation)	2	2	2	2	2	1
Exposure limit heat/ blast	2	2	3	2	3	1
Emergency preparedness	2	1	3	3	2	2
Tracking	2	2	2	2	2	2
Person in charge	2	2	2	2	3	2
Disposal	2	3	3	3	3	1
Tankwagon	2	2	2	2	2	2
Fixed bulk storage container	2	1	1	1	1	2
Jurisdiction score	**30**	**28**	**34**	**33**	**33**	**26**

Diesel is one of two liquids in the study so controls in respect of tankwagons and bulk storage containers have practical effect for diesel. As this table shows, New Zealand, although weighting environmental hazards equally with other types of hazard, scores near the midpoint of both the possible scale and of the jurisdictions considered.

4.3.4 Glyphosate: CAS# 1071-83-6

The substance glyphosate is also solid, rendering those controls specific to liquids not relevant. Glyphosate is a purpose designed herbicide active ingredient and so provides an example of a substance with largely environmental hazard, being classified with an intermediate level aquatic ecotoxicity, and in addition eye irritancy and a low level of acute toxicity in the New Zealand implementation of the GHS. The substance does not classify with any physical hazards.

Given this, it might be expected that absolute scores for controls on this substance would be relatively low. However, as shown in the following table, this is not the case. For example in most systems comprehensive data sheet requirements are retained, even though the major use of these is in workplaces, and workplace law often excludes environmental considerations. Packaging and labelling requirements also feature, showing that these now largely equally weight environmental effects with other types of hazard, although this is not the case in Canada where these requirements appear to be based solely on human health hazards.

The following table does show a noticeably lower score for Japan.

Table 4.6 - Stringency Comparison by Jurisdiction – Glyphosate

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Assessment/ approval data	3	3	3	3	3	1
Labelling	3	2	2	3	3	1
Data sheet	2	2	2	2	1	1
Packaging	2	1	2	2	1	1
IBC	2	1	2	2	1	1
Exposure limit (tox.)	2	2	2	2	2	2
Exposure limit (ecotox.)	2	2	2	2	2	2
Physical hazard (initiation)	2	2	2	2	2	2
Exposure limit heat/ blast	2	2	2	2	2	2
Emergency preparedness	2	1	1	1	1	1
Tracking	2	2	2	2	2	2
Person in charge	2	2	2	2	3	2
Disposal	2	3	3	3	3	1
Tankwagon	2	2	2	2	2	2
Fixed bulk storage container	2	2	2	2	2	2
Jurisdiction score	**32**	**29**	**31**	**32**	**30**	**23**

The underlying reasons for the apparently low levels of stringency were raised with our Japanese expert who pointed to legislation which does require data on hazards to be provided for chemicals manufactured or imported into Japan. However, from his comments such legislation appears to be list based, and glyphosate has not been listed. This suggests that the Japanese system relies on the regulator expertise and resources to determine whether to include chemicals on lists, rather than this being a responsibility of the manufacturer or distributer to determine, based on hazards.

4.3.5 Methyl Ethyl Ketone: CAS# 78-93-3

Methyl ethyl ketone is an organic liquid widely used as a solvent. It is highly flammable (second highest classification as a flammable liquid in the GHS) as well classifying with skin irritancy, and some human toxicity, including specific target organ toxicity.

As one of two liquids selected, there is practical application of the controls for tankwagons and fixed bulk storage for this chemical. The chemical also illustrates the effect of requirements in relation to secondary containment. Methyl ethyl ketone is not a single use substance so regulation is not dominated by a specific end use, as is the case for many of the other indicator substances chosen. The scoring for controls is shown in the following table:

Table 4.7 - Stringency Comparison by Jurisdiction - Methyl Ethyl Ketone

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Assessment/ approval data	3	3	3	3	3	3
Labelling	3	2	2	3	3	3
Data sheet	2	2	2	2	1	2
Packaging	2	2	2	2	2	2
IBC	2	2	2	2	2	2
Exposure limit (tox.)	2	2	2	2	2	2
Exposure limit (ecotox.)	2	2	2	2	2	2
Physical hazard (initiation)	2	2	3	3	2	1
Exposure limit heat/ blast	2	2	2	2	3	2
Emergency preparedness	2	2	3	3	2	1
Tracking	2	2	2	2	2	2
Person in charge	2	1	1	1	1	2
Disposal	2	3	3	3	3	2
Tankwagon	2	2	2	2	2	2
Fixed bulk storage container	2	1	1	1	1	2
Jurisdiction score	**32**	**30**	**32**	**33**	**31**	**30**

Again, total scores for each jurisdiction are remarkably uniform. As for diesel fuel, jurisdictions other than New Zealand and Japan have less stringent requirements for the performance and integrity of the fixed bulk storage vessels and equipment. The difference appear to be related to higher levels of seismic activity in these two jurisdictions, both of which impose specific seismic loading factors on otherwise similar international code based requirements.

4.3.6 Sodium Hydroxide: CAS# 1310-73-2

The substance sodium hydroxide is a white crystalline solid and finds application both as an intermediate product in the manufacture of other chemicals, and as an industrial cleaning agent. It is most obviously a corrosive (both skin and metallic corrosion) but is also acutely toxic and displays some aquatic ecotoxicity.

The scores for each jurisdiction for this chemical, derived as described above, are as follows:

Table 4.8 - Stringency Comparison by Jurisdiction - Sodium Hydroxide

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Assessment/ approval data	3	3	3	3	3	1
Labelling	3	2	2	3	3	3
Data sheet	2	2	2	2	1	2
Packaging	3	2	2	2	2	2
IBC	1	2	2	2	2	2
Exposure limit (tox.)	2	3	3	3	3	2
Exposure limit (ecotox.)	2	2	2	2	2	2
Physical hazard (initiation)	2	2	2	2	2	2
Exposure limit heat/ blast	2	2	2	2	2	2
Emergency preparedness	2	2	2	2	1	2
Tracking	2	2	2	2	2	2
Person in charge	2	2	2	2	3	3
Disposal	2	3	3	3	3	2
Tankwagon	2	2	2	2	2	2
Fixed bulk storage container	2	2	2	2	2	2
Jurisdiction score	**32**	**33**	**33**	**34**	**33**	**31**

Again the aggregate scores are remarkably similar with some of the differences for other chemicals also being evident here. These include more specific human (workplace) exposure limits being set for a majority of jurisdictions, the greater use of specifically qualified persons as a control in the case of Japan, and more complex disposal requirement for those countries with disposal controlled through separate waste management legislation – see also section on disposal below.

4.4 Comparison by Type of Control

The other perspective to compare stringency between jurisdictions from is to consider each type of control. This section therefore provides a comparison of each jurisdiction's requirement for all chemicals, considering each of the types of control outlined in section 0 individually. As each chemical has a unique combination of hazardous properties as well as specific use patterns, this comparison should show whether the jurisdictions chosen place greater obligations (from the point of view of the work required of the chemical's supplier or user) in respect of a particular type of control.

The scoring system used, and the number of separate regulatory controls considered means that it is possible for scores to vary from a high of 18 to a low of 6 for each jurisdiction, although for risk management type controls the use of the New Zealand system as the norm for comparison means that the score for New Zealand in these areas of control is automatically 12.

This comparison has proven to be quite useful to illustrate the particular areas of difference between jurisdictions. However, many scores are near the midpoint of the possible range, indicating that use of international norms and risk management controls (in aggregate) are similar to those used in New Zealand.

4.4.1 Data Required for Assessment/Approval

As previously noted, all of the chemicals used in the study were existing 'approved' chemicals, making the 'as of today' data requirements effectively zero. Notwithstanding this, it could be argued that the EU REACH requirements would require new data to be acquired for some of the indicator chemicals. REACH requires that over time all chemicals have the same amount of data available about them within the EU system. The amount of data is dependent on the production volume of the chemical, but the indicator chemicals are all in the high volume area of the scheme.

Given this, to provide a meaningful basis for comparison of all systems, comparisons were done assuming the bringing to market of a new chemical with the same properties as the selected chemicals.

Table 4.9 - Stringency Comparison - Data Requirement

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Deltamethrin	3	3	3	3	3	1
Dibenzoyl peroxide	1	3	3	3	3	3
Diesel fuel	1	3	3	3	3	3
Glyphosate	3	3	3	3	3	1
MEK	3	3	3	3	3	3
Sodium hydroxide	3	3	3	3	3	1
Total for jurisdiction	**14**	**18**	**18**	**18**	**18**	**12**

Using this approach, there are clear differences between the jurisdictions considered. In the New Zealand case, the existence of group standards (e.g. the organic peroxide group standard applicable to dibenzoyl peroxide) results in a relatively low data requirement. For such cases, advice obtained from staff at the NZ Environmental Protection Authority is that the group standard requirement for 'sufficient information to allow third party verification' would be met by evidence of classification from other jurisdictions – a less stringent requirement than that provided in the EU CLP. In other cases the obligation to produce data for a full HSNO Act assessment of 'risks, costs and benefits' does impose significant obligations on those seeking approval of the chemical.

On the other hand, Ireland and the United Kingdom, as EU members, would require all of the information expected for higher production volume chemicals within the EU REACH system. It is important to note that this requirement is time staged (not all information is required immediately) and is common for all 27 EU member countries, so data must only be provided once to satisfy all 27 countries' requirements. The information required immediately is that specified in the EU CLP regulation, the chosen norm for this requirement.

The Australian Commonwealth wide National Industrial Chemicals Notification Scheme (NICNAS) imposes data requirements with similarities to both REACH and the New Zealand full approval requirement, and greater than chosen norm. Canada imposes a similar requirement through its federal level New Substances Notification regulations, with the data required again being related to production volumes.

The more limited information available about the Japanese system suggests a regime in transition from a set of older and country specific requirements to an internationalised system. Given Japan's stated intention to implement the GHS a set of requirements similar to those of the EU appears to be the likely endpoint of this process.

4.4.2 Labelling

One of the major components of the developments of the GHS (the chosen norm for this study) was to establish an internationally consistent system for basic information contained on a chemical container label. The GHS has achieved this in large measure and there are specific and quite prescriptive requirements stated in section 1.4 of the 4th Edition of the GHS. There is also provision for integration between transport and GHS label requirements – see Annex 7 GHS 4th Edn.

The assessment of labelling requirements given by this study illustrates the extent to which these requirements have been adopted internationally and areas where variations still occur.

Table 4.10 - Stringency Comparison - Labelling

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Deltamethrin	3	2	2	3	3	3
Dibenzoyl peroxide	3	3	2	3	3	3
Diesel fuel	3	3	2	3	3	2
Glyphosate	3	2	2	3	3	1
MEK	3	2	2	3	3	3
Sodium hydroxide	3	2	2	3	3	3
Total for jurisdiction	**18**	**14**	**12**	**18**	**18**	**15**

New Zealand's performance based system (designed before the prescriptive detail of labelling in the GHS was completed) is actually closer to this international norm than the above table might suggest. New Zealand labelling requirements only score a 'more stringent than norm' rating as a result of an emergency management obligation to provide contact details for emergency assistance immediately with the substance (and so effectively on the label). By comparison, the GHS requirement is only to provide supplier contact details.

Australian requirements oblige the naming of all components in mixtures, irrespective of circumstance whereas the GHS is more qualified, requiring only components with certain toxic hazards. The GHS does, however, provide for competent authority discretion in this area, so the higher stringency scores for Australia in the cases of mixtures are again relatively minor deviations from the international norm.

Ireland's system simply adopts the EU CLP while in the case of the UK the empowering legislation still specifically prescribes the pre-CLP so called *R-phrases* to warn of hazards. This difference would require separate UK labels until the specific regulation is updated. Canadian requirements also impose some unique obligations, including the use of non-GHS hazard pictograms and not using some GHS pictograms. In addition the Canadian federal system requires a specific notice on the label stating that a safety data sheet must be available.

The more limited information available about the Japanese system indicates a mix of country specific requirements and more internationalised elements.

4.4.3 Safety Data Sheet

As shown by the summary table below, requirements for safety data sheets (sometimes called material safety data sheets or MSDS) are nearly universal in the jurisdictions reviewed. The content and form required for these data sheets almost universally follows the specifications set out in the GHS. The only exceptions are found in the Japanese and Canadian systems. In Japan's case there are no apparent requirements for diesel fuel and glyphosate – possibly for historical reasons although the apparent 'chemical list' basis of Japanese legislation (see comment in respect of glyphosate in the Japanese context above) may also affect this area of control.

In the case of Canada the safety data sheet requirements are firmly founded on human health considerations so the requirements include no obligation for environmental hazard information or transport requirements – both elements of the GHS format.

Table 4.11 - Stringency Comparison - Safety Data Sheet Requirement

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Deltamethrin	2	2	2	2	1	2
Dibenzoyl peroxide	2	2	2	2	1	2
Diesel fuel	2	2	2	2	1	1
Glyphosate	2	2	2	2	1	1
MEK	2	2	2	2	1	2
Sodium hydroxide	2	2	2	2	1	2
Total for jurisdiction	**12**	**12**	**12**	**12**	**6**	**10**

4.4.4 Packaging

As for safety data sheets, the requirements for packages are generally uniform and compliant with the chosen international norm (the UNRTDG 17th Edn) across all the jurisdictions considered. There are again exceptions in respect of Japan where the use of transport requirements as a 'basic' packaging requirement combined with what appears to be a list based approach to chemical regulation creates some anomalies. There is a similar exception in the case of Canada where glyphosate is not listed in the appropriate transport regulation so not attracting basic packaging requirements which are imposed through federal level transport regulation.

There is also an anomaly in respect of NZ requirements, as sodium hydroxide falls into a class which attracts, as a default, requirements for child proof closures on smaller packages. These requirements are not part of the basic UN system specifications.

Table 4.12 - Stringency Comparison - Packaging

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Deltamethrin	2	2	2	2	2	2
Dibenzoyl peroxide	2	2	2	2	2	2
Diesel fuel	2	1	2	2	2	1
Glyphosate	2	1	2	2	1	1
MEK	2	2	2	2	2	2
Sodium hydroxide	3	2	2	2	2	2
Total for jurisdiction	**13**	**10**	**12**	**12**	**11**	**10**

4.4.5 Intermediate Bulk Container

Requirements for intermediate bulk containers (IBC) are also generally uniform across all the jurisdictions reviewed. Again there are some limited expectations which appear to be largely the result of historical use of the UN system classification of the chemicals concerned. An interesting exception is NZ controls on sodium hydroxide for which no requirements for sodium hydroxide can be found in the HSNO regulations. This omission is likely to be of little practical consequence as NZ transport law would require that UN IBC requirements be met.

Table 4.13 - Stringency Comparison - IBC

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Deltamethrin	2	2	2	2	2	2
Dibenzoyl peroxide	2	2	2	2	2	2
Diesel fuel	2	1	2	2	2	2
Glyphosate	2	1	2	2	1	1
MEK	2	2	2	2	2	2
Sodium hydroxide	1	2	2	2	2	2
Total for jurisdiction	**11**	**10**	**12**	**12**	**11**	**11**

4.4.6 Exposure Limit – Human Toxicity

Commonly, exposure limits are set as air concentrations of the chemical and are often set only for workplaces, and hence enforced through occupational safety legislation. Some regimes (including New Zealand) do provide for general exposure limits but these are relatively rare. For this control, the baseline is the New Zealand requirement. For the indicator chemicals, the NZ system imposes exposure limits only for MEK. The red boxes in the results table therefore indicate jurisdictions where (generally workplace) exposure limits are imposed.

These more comprehensive controls in the case of Ireland, the UK and Australia are thought to be the result of additively adopting all available limits from those countries with larger chemical industries.

Table 4.14 - Stringency Comparison - Exposure Limit Human Toxicity

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Deltamethrin	2	2	2	2	2	2
Dibenzoyl peroxide	2	3	3	3	2	2
Diesel fuel	2	2	3	2	2	2
Glyphosate	2	2	2	2	2	2
MEK	2	2	2	2	2	2
Sodium hydroxide	2	3	3	3	3	2
Total for jurisdiction	**12**	**14**	**15**	**14**	**13**	**12**

4.4.7 Exposure Limit – Ecotoxicity

The New Zealand regulatory system makes provision for the setting of environmental exposure limits, although only a limited number of values have been set. None of the chemicals used in this study have exposure limits set and no similar limits were found in basic chemical control system of the other jurisdictions in the study.

Table 4.15 - Stringency Comparison - Exposure Limit Ecotoxicity

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Deltamethrin	2	2	2	2	2	2
Dibenzoyl peroxide	2	2	2	2	2	2
Diesel fuel	2	2	2	2	2	2
Glyphosate	2	2	2	2	2	2
MEK	2	2	2	2	2	2
Sodium hydroxide	2	2	2	2	2	2
Total for jurisdiction	**12**	**12**	**12**	**12**	**12**	**12**

4.4.8 Physical Hazard: Initiation

A significant issue in control the hazards from flammable, explosive and oxidising chemicals is preventing fire or explosion from occurring unless this is wanted (e.g. use of explosives in construction or combustion of fuels to produce heat).

These 'prevention of initiation' requirements generally oblige users to control or remove some combination of energy (either as heat or as a spark such as from electrical equipment), oxidising agents (air or oxygen), and/or fuel (in the case of oxidising substances). Approaches to this range from;

- Performance based controls, often with cited approved methods of meeting the requirement, (the New Zealand approach) through;
- General obligations to prevent fire, explosion etc with evidential reference to technical standards or similar documents (characteristic of the Australian approach), and to;
- Enforceable citing of agreed technical standards such as used in European countries.

In terms of chemical management, such controls apply only to those substances or mixtures which are classified for physical hazards (explosives, flammable liquids, gases and solids, and oxidising substances). Three of the six chemicals chosen have these properties; dibenzoyl peroxide, diesel fuel and methyl ethyl ketone.

As shown in the following table, the net effect of the stringency of these controls is broadly similar. However, there are some exceptions: In the cases of Ireland and Canada for the organic peroxide dibenzoyl peroxide, no chemical specific controls were found, suggesting that these regimes rely entirely on general obligations to manage hazards in workplaces.

Such an approach can be regarded as either highly stringent (requiring considerable work by those managing the chemical) or of low stringency (requiring no special management for this chemical in this regard). As the focus of this study is on chemical specific regulation, the latter assessment has been chosen. (A similar situation may occur for MEK in Japan, although because of the summarised nature of the information available this is unclear.)

Table 4.16 - Stringency Comparison - Physical Hazard Initiation Controls

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Deltamethrin	2	2	2	2	2	2
Dibenzoyl peroxide	2	2	1	2	1	2
Diesel fuel	2	2	2	2	2	1
Glyphosate	2	2	2	2	2	2
MEK	2	2	3	3	2	1
Sodium hydroxide	2	2	2	2	2	2
Total for jurisdiction	**12**	**12**	**12**	**13**	**11**	**10**

The regulatory requirements in both Ireland and the UK for MEK (a highly flammable liquid) include both general duties on those in charge (generally of workplaces) and making enforceable complex technical requirements from Europe wide technical documents. This mix has been judged as requiring considerably more effort than other approaches and scored accordingly.

4.4.9 Exposure Limit: Heat and Blast Effects

In a similar way to the regulations controlling initiation of physical effects from chemicals liable to burn, promote fires or detonate, most systems either directly or indirectly specify limits to protect people, and sometimes property, from the effects fire or explosion. Often these specifications are stated as minimum distance between storage or manufacturing locations and boundaries of the facility or other parts of the facility such as offices. They may also be stated as an obligation to install barriers such as fire resistant walls. For example the New Zealand system provides a mix of requirements for distance, fire rated walls and limits of the amount of heat or blast over pressure that spaces accessible by the public may be subjected to.

As shown in the table below, most of the jurisdictions in the study require means to protect people and surroundings with broadly similar requirements for action, structures etc.

A few exceptions were found however:

- On the one hand Irish regulation appears to rely on general workplace safety obligations in respect of dibenzoyl peroxide, which is scored as less stringent from the perspective of this study (see previous section for the full rationale)
- On the other, diesel fuel is included in the scope of specific regulations for petroleum products in Ireland and as a combustible liquid with controls under the regulatory Fire Code of the province of Ontario in the case of Canada. These regulations are very prescriptive and detailed about the requirements on places handling petroleum products (including diesel), placing significant restrictions on the design and siting of these types of facility
- In the case of the province of Ontario the requirements for protection at flammable liquid storage and handling locations (e.g. as fire rated walls) are significantly larger than the corresponding New Zealand requirement

Table 4.17 - Stringency Comparison - Heat and Blast Limits

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Deltamethrin	2	2	2	2	2	2
Dibenzoyl peroxide	2	2	1	2	1	2
Diesel fuel	2	2	3	2	3	1
Glyphosate	2	2	2	2	2	2
MEK	2	2	2	2	3	2
Sodium hydroxide	2	2	2	2	2	2
Total for jurisdiction	**12**	**12**	**12**	**12**	**13**	**11**

4.4.10 Emergency Preparedness

Chemical specific emergency preparedness requirements generally consist of some combination of; first aid instructions and/or materials, obligations to provide emergency plans, secondary containment requirements (generally for liquids), and requirements for particular equipment such as fire extinguishers.

As already described, the basis for comparison here is the New Zealand system which contains all of these elements (some being quantity dependent).

Table 4.18 - Stringency Comparison - Emergency Preparedness Requirements

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Deltamethrin	2	2	1	1	1	1
Dibenzoyl peroxide	2	2	2	3	1	1
Diesel fuel	2	1	3	3	2	2
Glyphosate	2	1	1	1	1	1
MEK	2	2	3	3	2	1
Sodium hydroxide	2	2	2	2	1	2
Total for jurisdiction	**12**	**10**	**12**	**13**	**8**	**8**

The jurisdictions which scored less than New Zealand therefore often had some element of the above missing. For example, the NSW/Australian controls for gylphosate are found in occupational safety regulation, so contain no requirements to be prepared to deal with effects on the environment in the event of spills. In the same system, deltamethrin controls do not have this limitation because of its human health hazard.

In other jurisdictions, the multi-level nature of requirements was judged to be more complex than equivalent New Zealand requirements. For example the UK and Ireland have both implemented the so called Seveso II directive of the EU in their own regulations, overlaying the general duties specific to chemicals in health and safety regulation with more complex requirements for larger facilities. These more complex requirements include public reporting and provision of emergency management plans to competent authorities – although often with larger trigger quantities than the NZ system.

By contrast Japan appears to have relatively limited chemical specific requirements for emergency preparedness and may rely on more general obligations in its emergency services legislation.

This paucity of chemical specific requirements for emergency preparedness is also characteristic of the Canadian system where, in the case of the exemplar province of Ontario, only a power for an inspector to require emergency planning (as part of other documentation) could be found. This power would have to be exercised before such steps became an obligation.

4.4.11 Tracking

Tracking is the obligation to retain records for inspection and/or supply to a regulator about the whereabouts of a chemical over some or all of its lifecycle. Several of the jurisdictions reviewed required manifest tracking of hazardous wastes, a requirement which captures most of the chemicals considered in this study. This requirement has been included in the section on disposal, as it is integral to the way in which those jurisdictions deal with chemical wastes. It is therefore not considered in this section. Again the basis for comparison is the New Zealand system.

Table 4.19 - Stringency Comparison - Tracking Requirements

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Deltamethrin	2	1	1	1	1	1
Dibenzoyl peroxide	2	2	2	2	2	2
Diesel fuel	2	2	2	2	2	2
Glyphosate	2	2	2	2	2	2
MEK	2	2	2	2	2	2
Sodium hydroxide	2	2	2	2	2	2
Total for jurisdiction	**12**	**11**	**11**	**11**	**11**	**11**

Only one substance, deltamethrin, requires tracking in the New Zealand system. However, this requirement is not mirrored by the other systems reviewed, leading to lower scores than NZ for those systems. This may be the result of the NZ system equally weighting environmental hazards with other types of hazard, something not found in all other systems.

4.4.12 Qualified Person in Charge

Qualified person in charge requirements in chemical control regimes those specific to the chemical (or in some cases chemical class – e.g. explosives are commonly required to be in the control of a competent person or secured). For the purposes of this study these requirements are only considered if there are chemical specific obligations which require the person to have expertise in relation to that chemical and/or its controls. These requirements are different from (and often in addition to) general requirements in many systems of workplace regulation which impose general duties (usually on an employer) to show that workers are fully trained or supervised for the job to be done.

As shown in the table below, with the New Zealand system as the basis, for two of the indicator chemicals, dibenzoyl peroxide and methyl ethyl ketone New Zealand does require qualified persons in charge, and in both cases the requirement is quantity dependent. Of the other jurisdictions, only Japan makes similar use of this qualified person approach to chemicals management. In fact Japan extends the requirement to other chemicals studied, including for larger quantities of sodium hydroxide. Australia, Ireland, and the UK appear to rely largely on general obligations in workplace safety law of the type already described.

Canada provides a somewhat unusual 'half way house' in this regard. The federal level chemical data and identification requirements appear to be reflected in complementary provincial legislation (often regulations under provincial occupational safety law). In the exemplar case studied (the province of Ontario) this law also requires basic training specific to the chemical for all persons handling it. The requirements are generic in extent but significantly less than the certificated approved handler approach used in New Zealand regulation.

Table 4.20 - Stringency Comparison - Requirements for Qualified Person in Charge

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Deltamethrin	2	2	2	2	1	2
Dibenzoyl peroxide	2	1	1	1	1	2
Diesel fuel	2	2	2	2	3	2
Glyphosate	2	2	2	2	3	2
MEK	2	1	1	1	1	2
Sodium hydroxide	2	2	2	2	3	3
Total for jurisdiction	**12**	**10**	**10**	**10**	**12**	**13**

4.4.13 Disposal

This study finds that disposal requirements imposed specifically on chemicals are of two general types:

- Chemical specific or hazard class specific requirements to be met when disposing of any unwanted quantities of the chemical, and
- Systems which treat chemicals as hazardous wastes, so imposing all or most of the controls via waste management legislation.

As New Zealand re-wrote all of its chemical control legislation at one time, it has adopted the former approach, treating disposal as simply the last stage in the lifecycle of a chemical on which controls are imposed. Most of the other jurisdictions studied adopt the latter approach, treating chemicals as a special class of waste and imposing procedures on the management of that waste.

As shown in the table below Australia/NSW, Ireland, Canada and the UK all use variants of the latter approach. Ingredients of this approach, mostly common to all systems, include (usually manifest) tracking of the waste through any transport and storage system, with this tracking ending only when the chemical is treated in a facility with a specific permit, including conditions set on any discharges to the environment. The level of record keeping and the need to ensure that the treatment operations' permit conditions are current and complied with is judged as a more complex imposition than the New Zealand obligation to meeting specific (usually hazardous property reduction) conditions when disposing of unwanted chemicals.

The exception appears to be Japan, where it is understood that there is a mix of obligations specific to chemicals (somewhat similar to the New Zealand approach) and situations where there is little direct control on the chemical itself. It is speculated that in the latter case site specific controls on waste treatment facilities and/or processing plants may be used to manage the chemical hazards.

Table 4.21 - Stringency Comparison by Jurisdiction - Disposal Requirements

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Deltamethrin	2	3	3	3	3	1
Dibenzoyl peroxide	2	3	3	3	3	2
Diesel fuel	2	3	3	3	3	1
Glyphosate	2	3	3	3	3	1
MEK	2	3	3	3	3	2
Sodium hydroxide	2	3	3	3	3	2
Total for jurisdiction	**12**	**18**	**18**	**18**	**18**	**9**

4.4.14 Tankwagon

Requirements for tankwagons (containers for chemicals permanently fixed to a vehicle) were found to be stated either as performance requirements or engineering specifications. For each approach the requirements specify strength, durability and resistance to contents of the vessel and its attachments to the vehicle. For road vehicles these requirements may extend to protection for the driver, emergency management (e.g. fire fighting) systems, and vessel size limits. Practically, the requirements are only applied to liquids or gases.

In this study only two chemicals are liquids (diesel fuel and MEK) and the requirements divide into two types; performance requirements (the NZ system) and reference to detailed engineering design specifications for the other jurisdictions studied.

While there are some differences in the detail of requirements in each jurisdiction (with Ireland and the UK referencing common EU wide engineering standards), from the stringency standpoint there is little difference between the requirements of each jurisdiction. All jurisdictions require tankwagons to be designed and manufactured to meet engineering specifications or performance requirements. They also all require that the vehicle is periodically inspected and certified as meeting the specified requirements.

As shown in the table below, while the individual requirements may be different between jurisdictions, the effort and resources required is judged as equivalent.

Table 4.22 - Stringency Comparison - Tankwagon

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Deltamethrin	2	2	2	2	2	2
Dibenzoyl peroxide	2	2	2	2	2	2
Diesel fuel	2	2	2	2	2	2
Glyphosate	2	2	2	2	2	2
MEK	2	2	2	2	2	2
Sodium hydroxide	2	2	2	2	2	2
Total for jurisdiction	**12**	**12**	**12**	**12**	**12**	**12**

4.4.15 Fixed Bulk Container

The term fixed bulk container refers to bulk storage tanks, often seen in tanks farms or adjacent to facilities where chemicals are handled or used. As with tankwagons, chemical regulation requirements for fixed bulk containers are only relevant for liquids and gases. The two chemicals which are liquids in this study are, as previously noted, diesel fuel and methyl ethyl ketone.

In general, fixed bulk storage vessels are regulated by requiring adherence to an engineering design standard, building the tanks to meet that standard and periodically inspecting them. In New Zealand's case, unlike other aspects of the regulatory system, fixed bulk tanks are required to conform to one of a number of engineering specifications. These specifications (generally developed in either North America or Europe) are overlaid with requirements for the vessel to comply with local requirements for wind and seismic loading.

Figure 4.3 - Tank Farm

Photo: Steve Vaughan

It is understood that a similar set of requirements apply in Japan, which would be expected given the seismically active nature of both countries.

The situation in the other jurisdictions reviewed is somewhat similar although the approach taken is different. In each case the regulatory requirement is for the structure to conform to an accepted (engineering) design standard and to be subject to inspection and certification.

However, in each of these other jurisdictions no requirement to overlay local requirements for seismic loading could be found. In our view, this would make meeting the regulatory obligation simpler and the jurisdictions are scored accordingly – see table below, specifically considering the rows in the table for diesel and MEK. Other chemicals are all scored as 2 (equivalent to New Zealand), as no jurisdiction imposes requirements for solids.

Table 4.23 - Stringency Requirements - Fixed Bulk Container

	New Zealand	Australia (NSW)	Ireland	United Kingdom	Canada	Japan
Deltamethrin	2	2	2	2	2	2
Dibenzoyl peroxide	2	2	2	2	2	2
Diesel fuel	2	1	1	1	1	2
Glyphosate	2	2	2	2	2	2
MEK	2	1	1	1	1	2
Sodium hydroxide	2	2	2	2	2	2
Total for jurisdiction	**12**	**10**	**10**	**10**	**10**	**12**

4.5 Other Factors

While the control elements already described are those which either identify or seek to reduce the hazards of the chemicals used in the study, in practice these are often overlaid by a further set of requirements which place obligations on chemical users. These requirements can be thought of as falling in to two classes:

- Requirements to take some action to aid in assuring compliance
- Obligations to provide information about the activities where chemicals are managed which is available to the wider public.

In addition to this, the actions taken to enforce or check for compliance with controls can also impose costs on the user or supplier of a chemical. These actions impose costs in two ways:

- A visit from an inspector checking that requirements are being complied with can of itself impose costs. Inspectors must generally be accompanied by staff able to answer questions, provide information which the inspector may wish to see, and/or enable the inspector to access those locations which they wish to inspect
- An inspector may discover a matter which is not in compliance with the requirements. This will generally mean the organisation being inspected will need to take action to come back into compliance within some (usually limited) timeframe. While it could be argued that that the organisation should already be in compliance, chemical users can complain, with some justification, that these actions can unevenly impose costs – especially when inspection rates are low.

Each of these matters is discussed in the following sections.

4.5.1 Assuring Compliance

The jurisdictions examined in this study employ a variety of compliance assurance mechanism imposed within the chemical controls frameworks they use. These include certificates issued by qualified persons and licenses or official certificates issued by an inspectorate.

Certificates Issued by Qualified Persons

Many of the systems reviewed include obligations to have a component or system inspected by a qualified person at fixed intervals, usually with the qualified person issuing a certificate or similar document stating that the inspected item meets certain requirements. In the New Zealand system these are called *test certificates* and are used extensively for both complex engineering systems (e.g. tankwagons, bulk storage tanks etc.) and for qualifications of persons in charge of specified chemicals. The UK, Ireland, Canada and Australia make use of similar system to assure the integrity of engineering systems, but do not appear to do so for personal qualifications. It is understood that the Japanese system makes considerable use of qualified persons, but it is not clear if this uses a certificate system which must be kept up to date.

In these cases the qualified persons (typically engineers with a particular specialty) charge for the service, imposing costs on the chemical user.

Licenses or Official Certificates

Where regulations require licenses, the obligation is to obtain a certificate for location(s) where (generally larger amounts) of chemicals are stored or handled. These site certificates or licenses are usually issued directly by inspectors or compliance officers and a fee is normally levied for the license, which must be renewed at fixed intervals. This type of requirement was part of the New Zealand system but was replaced by test certificates, largely as a result of recognising that it is difficult to maintain the required expertise among inspectors in a small country.

Licenses appear to have also been largely discontinued in the Australian system, at least in New South Wales, amid concerns that the license implies that the facility, location or item is approved. This appears to have led to operators using the presence of a license as a defence when prosecuted as a result of an incident [Laycock, 2012[iii]].

Within the scope of the chemicals used as indicators in the study, the Irish system retains licensing for facilities storing and handling petroleum products (see Section 1.4.4 of Appendix B for detail of the relevant regulations). There do not appear to be similar requirements in the UK or Canadian systems.

Reporting to Competent Authorities

Several of the regulatory systems examined require specific reporting to particular competent authorities. These obligations vary from requirements to report the amount of a substance at a location to the relevant enforcement agency once a trigger quantity is exceeded, through to obligations to provide quite complex safety reports to these authorities under the UK and Irish Control of Major Accident Hazard (COMAH) regulations. While it can be argued that these requirements simply require providing the authority with information which is otherwise available in normal practice or required by another part of a regulation, the act of reporting does require further expenditure of effort or resource.

4.5.2 Providing Public Information about Chemical Related Activities

A feature of the legislation in those EU countries which have implemented the so called Seveso II directive [EU Council, 1996[iv]] is that a requirement is placed on operators of the 'major accident hazard' facilities designated in the directive to provide information to the public about the nature of the hazards and various related matters. The information is often provided through the website of a competent authority, but the specifications are quite detailed and so the effort involved may be considerable.

It should be noted that other jurisdictions may require similar information as part of the land use consenting of a site, but as these requirements are site specific, they are beyond the scope of the study.

The quantities of the chemical required to trigger this requirement depend on the chemical involved, but are generally quite large. More detailed information for specific chemicals can be found in the 'emergency management' sections of the data tables for specific chemicals and the cases of UK and Ireland in Appendix B.

4.5.3 Enforcement and Compliance Checking

As noted in the introduction to this section, the nature, frequency, and scope of enforcement or compliance inspection activities can impose costs on chemical suppliers and users. Most agencies with compliance checking and/or enforcement functions must also balance the amount of activity they undertake with available resources and the obligation to ensure acceptable levels of compliance.

Assessment of levels of compliance checking and enforcement was not part of the scope of this study, but enforcement activity has influence on how stringent the controls are in practice. So the local experts in each jurisdiction who advised on the nature of the controls were also asked to provide additional comment on the nature and extent of enforcement in those jurisdictions. These expert contacts were chosen (or in some cases selected by authorities contacted) for their knowledge of the controls frameworks in that jurisdiction, and not specifically for expertise or experience in enforcement and enforcement policies. As a result these contacts only provide a single and at times limited viewpoint so the information obtained was variable. The following comments should therefore be taken as indicative only.

New Zealand

In NZ the largest single amount of compliance checking in relation to hazardous substances is inspections by the Department of Labour's Health and Safety Inspectors. Most inspectors are generalists (e.g. trained to look for mechanical hazards etc. as well as some basic hazardous substances training). The Department of Labour website [Department of Labour 2012[v]] states that "Each year health and safety inspectors visit about 5,000 workplaces". However, latest Statistics New Zealand figures show approximately 470,000 distinct business enterprises [Statistics New Zealand, 2012[vi]]. Using this as a surrogate for number of workplaces suggests an inspection rate for all workplace health and safety matters of slightly more than 1% per annum - not all of which will use hazardous substances.

Other agencies are responsible for inspections in other areas including the transport agencies and Police, the Ministry of Health and local authorities.

When incidents occur, and particularly if people are injured or killed, the charges brought tend to be generic charges under our Health and Safety in Employment law. So far only two prosecutions have been undertaken directly under the HSNO Act, in 2009.

Many of the more complex requirements are subject to test certificates (see previous section). When the HSNO compliance arrangement were originally developed it was intended that inspectors ask to see these certificates as a way of simplified compliance checking, but there is no public information available about the extent to which this is currently happening. It has been observed that some premises - which might be expected to display test certificates – still display licenses from the pre-HSNO regime. [Vaughan, 2011[vii]]

It is understood that the Environmental Protection Authority is conducting, or is about to conduct, surveys of the level of compliance with hazardous substance regulations, which should help to fill this gap in current understanding on current levels of compliance with the test certificate requirements.

Australia

Compliance arrangements vary from state to state in Australia so the following observations relate largely to the state of New South Wales. As with New Zealand, most compliance checking activities are undertaken by the occupational safety inspectorate of the NSW Workcover Authority.

It has not been possible to determine any information about either general or hazardous substances related inspection rates.

Our local expert in NSW did, however, observe that the changes in occupational safety law which occurred in 2011 seem to have resulted in some confusion both about the specific standards against which inspections should be carried out and about acceptable practices procedures or design standards. This appears to be in part due to the shift from a licensing regime to the current workplace safety and related laws which rely heavily on general duties to provide safe workplaces backed up by evidential reference to Australian Standards documents.

Generically, the NSW Workcover Authority website states workplace enforcement activities are governed by the Agency's published Compliance and Prosecution Guidelines [NSW Workcover Authority 2012[viii]]

Ireland

In Ireland chemicals related legislation is primarily enforced by specialist Health and Safety Inspectors in the Chemical Business Services Division of the country's Health and Safety Authority (HSA).

The general inspectorate is expected to check how chemicals are being used in a workplace (e.g. labelling and occupational hygiene), as well as covering mechanical hazards and the like. If an inspector had significant concerns they would normally call in a specialist inspector to investigate [Pratt, 2012[ix]].

Within the Chemical Business Services Division is a Supply and Transport section that is responsible for Transport of Dangerous Substances by Road (e.g. compliance with ADR etc) and enforces legislation on tankwagons and other packaged dangerous goods. Checks are carried out in conjunction with the police, as the latter are the only ones who have the powers to stop vehicles, but once stopped, they hand over to the HSA, and thereafter HSA can take cases for non-compliance with the legislation, without police involvement.

Within the same division, Chemical Producers and Storage inspectors cover the major accident hazards premises (under the Irish version of COMAH regulations). The stated aim is to inspect each company at least once a year (about 30 companies in total).

Other sections in Chemical Business Services Division deal with compliance with REACH, CLP and the like, and do little active enforcement in workplaces.

Most prosecutions would be taken under the Health, Safety and Welfare Act and the specific legislation on Dangerous Substances, ranging from fatalities or serious injuries to serious non-compliances with the relevant legislation.

The number of inspectors in the Supply and Transport and COMAH sections is small, so compliance checks are limited in number.

No data on inspection rates for other than COMAH facilities is available.

United Kingdom

In the UK the primary inspection agency is the Health and Safety Executive which again has in effect two divisions, a general workplace inspectorate and specialist inspectors in relation to areas such as high hazard industries (e.g. those covered by the COMAH regulations) and in respect of REACH.

Some information on inspections is published on the websites of relevant agencies, such as an operating plan of the Hazardous Industries Directorate of the Health and Safety Executive [Hazardous Industries Directorate, undated[x]]. Unfortunately, the most recent plan is for the period 2004- 2008. Further, the plan covers areas as diverse as offshore oil and gas, biological activities including genetic modification, diving operations and mining, as well as chemicals related (larger) industries. As a result it is not possible to separate out activities related to chemicals management.

In respect of environmental legislation (e.g. waste management requirements including for hazardous waste) the UK has separate national (English, Scottish etc.) environment agencies responsible for compliance inspection. By way of example, the Environment Agency (covering England and Wales) states on its website that it 'use(s) a 'risk-based' approach to target our resources at poor performers and illegal operators who pose the highest risk to the environment.' [Environment Agency Website[xi]] However, there is no specific indication of inspection rates.

Japan

As already noted, limited information was available from Japan in order to compile this report as a result of the fact that Japanese law and policies are not generally available in translation. It was not possible to assess levels of compliance and enforcement action from the information available.

Canada

Information about the Canadian chemicals management system was obtained via the National Office of the Workplace Hazardous Materials Information System, a federal body whose major roles are oversight of labelling of containers, the provision of material safety data sheets and worker education and training programs. The office was therefore not able to provide specific detail on inspection activities, which appear to be largely at provincial level and controlled through provincial policies.

The Office does provide a national compliance policy document [Intergovernmental WHMIS Coordinating Committee, 2002[xii]] for the functions listed, but the document is very much at a principle level and provides little indication of actual inspection rates.

As the province of Ontario was used as an exemplar for provincial level chemicals related activity, a search was made for information about this province's enforcement policies and activities. Statistics published on the Ontario Ministry of Labour website showed that for the last year which data is available (2009 – 10) some 46,000 field visits were made to industrial sites [Ontario Ministry of Labour website[xiii]]. However, we were not able to determine an absolute number of industrial sites in the province, nor were we able to obtain sufficient information about the nature of 'industrial sites' to make any estimate of the extent to which chemicals would form part of these visits. Further the Ministry's website states that

- Field visits include inspections, investigations and consultations
- Priority for inspections is based on data from the province's workplace insurance scheme (presumably claims for lost time incidents or injuries).

This limited information does not suggest that inspection for compliance with chemical controls is a large part of the provincial Ministry's inspection workload.

4.6 Conclusions on Regulatory Stringency

Considering the main areas of hazardous substance control as outlined in section 4.2.4, relatively little overall difference in stringency between the selected jurisdictions was observed. The scoring scale used could have resulted in scores for a jurisdiction as high as 48 and as low as 16, but in fact the scores for each jurisdiction vary from a single low value of 23 to a highest value of 34, with most scores falling into a range from 29 to 33.

This indicates that these jurisdictions impose broadly similar levels of obligation on chemical suppliers and users with respect to stringency of controls. Put another way, the effort required to comply with legislative obligations to control chemicals to minimise harm to people and the environment, is broadly similar across all the jurisdictions considered.

Within this, there are differences between the expenditure and resources involved in complying with controls in particular areas. It is most useful to consider these in terms of each of the three areas of controls which form the basis for this study.

4.6.1 Hazard Data Requirements

Hazard data requirements are a significant component of stringency because, while some tests are relatively inexpensive (e.g. the closed cup test to determine flashpoint for classifying flammable liquids), others require extensive testing on laboratory animals and substantial scientific analysis.

Using the EU wide CLP regulation as a comparison point, there are three basic variations on requirements for hazard data to classify the chemical's hazards. This classification has flow on effects into other areas as it is a major basis on which the level of controls imposed is specified.

The first variation is meeting the data requirements of the CLP, enabling initial or introduction access for the chemical in EU countries (represented in this study by Ireland and the UK). However, these jurisdictions also use a more stringent requirement under the REACH regulation. This regulation imposes requirements to establish much more information about the chemical (including information on end uses, production volumes etc) over a period of time and depending on production volumes. It is important to note that the REACH requirement must only be met once for all 27 EU jurisdictions as the information supplied is automatically available to all these jurisdictions through the European Chemical Agency.

New Zealand has similar requirements to the REACH in that the process for full approval of a hazardous substance in New Zealand requires the necessary information to establish 'risks, costs and benefits' arising from the chemical. These requirements are tempered by a system which allows for information not to be provided, but with the possibility of more precautionary (and potentially more stringent) controls.

The combination of Australian Commonwealth level NICNAS requirements and the requirements of the NSW state system impose data requirements with some similarities to REACH, and clearly greater than the chosen norm of the EU CLP. As already noted, Canada's two part system imposes a requirement with some similarities to the Australian one.

The third basic variation is also found in the New Zealand system and applies in the event that a *group standard* is in place to cover the chemical. Only two chemicals in the study were covered by group standards but this probably not a representative sample, especially as the number of group standards continues to expand. Where chemicals are covered by *group standards*, the obligation is to provide 'sufficient information to allow third party verification' a requirement which it is understood would be met by evidence of classification from other jurisdictions – a less stringent requirement than that provided in the EU CLP.

As noted in the results section, Japan's obligations for data appear to be list based, relying on chemicals being listed before data is required. Japan states that it remains in transition to implementing the GHS [UN Economic Commission for Europe[xiv]] so this situation may change.

4.6.2 Information (Label and Safety Data Sheet) and Packages

This area of control largely affects chemical suppliers. With a few exceptions, some of which may be historical, requirements in this area are largely uniform across the jurisdictions considered.

Most jurisdictions accept a GHS specification (or GHS plus transport specification) label. The exceptions appear to be mostly the result of transitions still in progress (e.g. the UK requirement for pre-GHS R-phrases) and potentially some exceptions in Japan.

There are three 'modern' standout areas in this regard, although one (Canada) may still be in transition to the GHS.

The Australian system extends the requirement to list components of a mixture on a label from only components contributing to certain toxic effects to a general obligation. The NZ requirements include an obligation to provide contact details for emergency assistance in the event of an incident (e.g. a poisoning in the case of toxic properties) on a label. (The actual requirement is a performance one which is most easily achieved by adding the information to a label.)

Both of these obligations are 'GHS consistent' in that the GHS provides for other information as specified by the competent authority.

The Canadian variations are more complex as the Canadian labelling system use two different pictograms from the GHS and do not use 3 of the internationalised pictograms of the GHS.

Safety data sheet requirements are almost completely uniform across the chosen jurisdictions with only some limited exceptions in the case of Japan and Canada. These exceptions are less stringent than the norm.

Package and large transportable container requirements are similarly almost uniform across the jurisdictions studied, with the few exceptions appearing to be regulatory omissions, although the New Zealand requirement for corrosive chemicals (represented in this study by sodium hydroxide) to be in packages with child-proof closures does provide one example of a higher level of stringency.

4.6.3 Risk Management Type Controls

Controls which suppliers and users must implement is this area include; exposure limits and limits to control initiating physical hazards (largely fire, heat, and or explosion), obligations to provide preparations for emergencies, specific requirements for persons with chemical and regulatory expertise to be in charge of the chemical, tracking, and disposal requirements. The standards of strength, chemical resistance and the like for tankwagons and fixed bulk storage vessels are also included here, although these could also be regarded as extensions of packaging requirements.

Controls in this area generally achieve similar results (or standards of risk reduction) although the regulatory design philosophies do show some differences. These differences can lead to greater or lesser stringency from the chemical user and supplier perspective.

These difference can best be summarised in tabular form, remembering that all comparisons are with New Zealand's HSNO regime.

Table 4.24 - Stringency Comparison for Risk Management Controls

Regulatory requirement	Higher stringency	Lower stringency
Exposure limits (human toxicity)	UK, Ireland, and Australia appear to have large lists of workplace exposure limits obtained by accumulating listings from major industrial jurisdictions	
Exposure limits (aquatic ecotoxicity)		
Physical hazard - initiation prevention	UK and Ireland's combination of general duties for safety and technical specifications from European documents provides a relatively complex regulatory environment	
Physical hazard – preventing exposure to heat fire or explosion	Highly detailed prescriptions in Irish regulation for petroleum – including diesel fuel	Japanese system appears not to require separation, fire- resistant walls etc for diesel (possibly a historical anomaly)
Preparation for emergencies	UK and Ireland's implementation of the Seveso II directive leads to complex requirements for locations where there are large quantities of the chemical	Few chemical specific requirements found in the case of both Canada and Japan
Tracking		Tracking is not used in most jurisdictions although New Zealand does so for deltamethrin making other jurisdictions comparatively less stringent

Regulatory requirement	Higher stringency	Lower stringency
Qualified person in charge	Japan appears to make extensive use of requiring chemical specific qualifications. Canada requires chemical specific training for workers for federally defined Controlled products – a lesser requirement than formal certification	UK, Ireland, and Australia rely on general (i.e. non- chemical specific) obligations for workers to be trained and/or supervised
Disposal	UK, Ireland, Canada and Australia treat disposal of chemicals as hazardous waste management, triggering tracking and licensing of facility requirements	Japan appears to have few chemical specific disposal requirements
Fixed bulk storage vessels		UK, Ireland, Canada and Australia do not have the additional requirement for seismic loading resistance found in NZ and Japan

4.6.4 Chemical Regulation System Design

New Zealand is unique of the countries studied in having a single basic chemicals regulation legislative and administrative package (i.e. law, regulations and administrative structure). This basic system provides hazard assessment, baseline requirements on packaging, hazard communication and risk management controls which apply regardless of sector or circumstance.

This is not to say that other legislation does not affect the control of chemicals in New Zealand. For example transport law imposes requirements on the transport of dangerous goods, most of which are chemicals. Separate laws controlling agricultural compounds, food safety and land use also affect how chemicals are managed. However, these other obligations are for the most part either complementary (e.g. land transport packaging requirements are for all practical purposes equivalent to the HSNO basic packaging obligations) or additive. For example agricultural compounds requirements for pesticides add on to basic HSNO requirements, as do site specific requirements for chemical storage and handling facilities under the Resource Management Act.

Other jurisdictions studied do not have this type of system ‘architecture’ but do have some similarities with each other.

Most of the jurisdictions studied have national or supranational (i.e. EU wide) notification and assessment systems. These are largely if not entirely data repositories for chemical hazard and supporting (e.g. production volumes, end uses etc.) information. They impose stringency on chemical suppliers and users through obliging this data to be supplied to the relevant authority.

Below this, most of the jurisdictions studied impose obligations along sector lines. Most have components of transport regulation which specify packaging and bulk containers (on vehicles), labelling, some documentation and in some cases specific knowledge in handling chemicals. Most also have sections of workplace safety legislation which specifies packaging, labelling, chemical handling data (safety data sheets or equivalent) the control of exposure to workers, sometime specific expertise of handlers, controls to prevent fires and/or explosions, and emergency preparedness.

Most of the non-New Zealand regimes studied also impose some environmental chemicals management obligations on suppliers and users. These obligations generally relate to providing hazard information, containment (packages and large containers), the setting of exposure limits, and emergency preparedness.

A review of these sector based listings of obligations does show the potential for duplication and so possible conflict both in terms of requirements imposed on users and of agencies involved.

Notwithstanding this, the qualitative results from this study do not show major differences in the overall stringency or level of effort imposed the chemical supplier or user between the systems studied.

4.7 References

i Globally Harmonised System of Classification and Labelling of Chemicals 4th Revised Edition United Nations (New York and Geneva) 2011

ii Recommendations on the Transport of Dangerous Goods 17th Revised Edition United Nations (New York and Geneva) 2011

iii Craig Laycock CMSS Pty Ltd. Pers Comm 2012

iv Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances

v Department of Labour Website: Workplace visits. http://www.osh.dol.govt.nz/services/work-visits.shtml

vi Statistic New Zealand Website: New Zealand Business Demography Statistics: At February 2011 http://www.stats.govt.nz/browse_for_stats/businesses/business_characteristics/BusinessDemographyStatistics_HOTPFeb11.aspx

vii Vaughan: Personal observations during 2010 and 2011

viii NSW Workcover Authority. Compliance Policy and Prosecution Guidelines 2012. May be downloaded at http://www.workcover.nsw.gov.au/formspublications/publications/Pages/compliancepolicyprosecutionguidelines.aspx

ix Iona Pratt. Pers. Comm. 2012

x Hazardous Industries Directorate: Operating plan 2004 -2008 May be obtained here: http://www.hse.gov.uk/hid/operatingplan/operating.pdf

xi (UK) Environment Agency Website: Assessing compliance. http://www.environment-agency.gov.uk/business/regulation/31823.aspx

xii National Compliance Policy for the Workplace Hazardous Materials Information System. Intergovernmental WHMIS Coordinating Committee, 2002. Obtainable from: http://www.hc-sc.gc.ca/ewh-semt/occup-travail/whmis-simdut/compliance_policy-politique_conformite-1-eng.php

xiii Ontario Ministry of Labour website – enforcement statistics http://www.labour.gov.on.ca/english/hs/pubs/enforcement/index.php

xiv UN Economic Commission for Europe, GHS Implementation Webpage (entry for Japan) http://www.unece.org/trans/danger/publi/ghs/implementation_e.html

5 Conclusions

While some chemicals are not available in New Zealand, and some are likely to be more expensive in New Zealand at any particular time, these outcomes are most likely due to other effects such as market size and due to market distortions arising from non-HSNO effects.

The pricing evidence is consistent with industry comment that the costs of HSNO compliance are not a significant determinant of the prices paid for chemicals in New Zealand, except perhaps for very small scale distributers and users.

As an early adopter of the Globally Harmonised System for Hazard Classification and Communication for chemicals, via the HSNO act, New Zealand has been a world leader on the integrated regulation of chemicals. Other jurisdictions have now largely caught up. While every country packages the controls quite differently, the New Zealand HSNO system of controls is similar in scope and stringency to chemical controls found in similar developed countries.

Appendix A: Hazard Scoring System

This appendix outlines the scoring system which was developed as the simplified scale for degree of hazard used in Section 3 as part of the evaluation of price signal 3. The system is based on the GHS classification scheme for hazards and so is largely independent of jurisdictions. The hazard classes and categories of the GHS are shown in the attached diagrams at the end of this appendix.

The Hazard Scoring System is as follows:

1. Each class of hazard is weighted equally – eg human toxicity is assumed to carry the same weighting as eco-toxicity.
2. The difference between the number of each hazard category within the class and the number of the lowest (least hazardous) category in the class plus 1 is used to describe the degree of that hazard (plus 1 to prevent 0 scores for internationally classified hazards).
3. Scale subdivisions are ignored (ie in scales with 1A and 1B these are treated as 1)

The overall degree of hazard of a given chemical is represented by the sum of the category numbers for the given chemical.

This scale has the following features:

- It uses only the internationally agreed degree of hazard – no account is taken of social perceptions, which will vary from jurisdiction to jurisdiction
- A more finely subdivided class (i.e. more categories) allows for a higher score
- Those categories for which the GHS uses letters not numbers are assigned numbers with the first letter being assigned 1, the second 2 and so on.
- A larger the score for the chemical means a higher 'degree of hazard'

Using this scheme, the indicator chemicals used for the chemical price comparison have the following 'scores.' These scores were derived from NZ classifications, which do not differentiate between chronic and acute aquatic hazard. The additional NZ classes for eco-toxicity (soil, terrestrial vertebrate and terrestrial invertebrate) are not included as these elements were not adopted in the GHS.

Chemical	CAS No.	GHS classifications	Number of categories for class	Surrogate score for class	Total surrogate score for chemical;
Sodium hydroxide	1310-73-2	Acute tox Cat 4	5	2	**7**
		Metallic corrosive Cat 1	1	1	
		Skin corrosive Cat 2	3	2	
		Eye corrosive Cat 1	1	1	
		Aquatic ecotox Cat 4	4	1	

Chemical	CAS No.	GHS classifications	Number of categories for class	Surrogate score for class	Total surrogate score for chemical;
Dibenzoyl Peroxide	94-36-0	Organic peroxide Cat C	7	5	**8**
		Eye irritant Cat 1	1	1	
		Sensitizer Cat 2	2	1	
		Aquatic ecotox Cat 4	4	1	
Methyl ethyl ketone	78-93-3	Flammable liquid Cat 2	4	3	**7**
		Acute toxic Cat 5	5	1	
		Skin Irritant Cat 2	2	1	
		Eye irritant Cat 1	1	1	
		Target organ tox. Cat 2	2	1	
Diesel fuel	68476-34-6	Flammable liquid Cat 4	4	1	**6**
		Acute toxic Cat 5	5	1	
		Skin irritant Cat 2	2	1	
		Carcinogen Cat 2	2	1	
		Aquatic ecotox Cat 2	4	2	
Glyphosate	1071-83-6	Acute tox Cat 5	5	1	**5**
		Eye irritant Cat 1	1	1	
		Aquatic ecotox Cat 2	4	3	
Deltamethrin	52918-63-5	Acute toxic Cat 2	5	4	**13**
		Skin irritant Cat2	2	1	
		Eye irritant Cat 1	1	1	
		Target organ Cat 1	3	3	
		Aquatic ecotox Cat 1	4	4	
Sulphur	7704-34-9	Flammable solid Cat 2	2	1	**2**
		Eye irritant Cat 1	1	1	
Chlorpyrifos	2921-88-2	Acute toxic Cat 2	5	4	**12**

Chemical	CAS No.	GHS classifications	Number of categories for class	Surrogate score for class	Total surrogate score for chemical;
		Skin Irritant Cat 2	2	1	
		Eye irritant Cat 1	1	1	
		Target organ toxicity Cat 1	2	2	
		Aquatic ecotox Cat 1	4	4	
Chlorothalonil	1897-45-6	Acute toxic Cat 2	5	4	**12**
		Sensitiser Cat 2	2	1	
		Carcinogen Cat 2	2	1	
		Target organ toxicity Cat 2	2	1	
		Eye corrosive Cat 1	1	1	
		Aquatic ecotox Cat 1	4	4	
Sulphuric acid*	7664-93-9	Acute toxic Cat 4	5	2	**12**
		Carcinogen Cat 1	2	2	
		Target Organ toxicity Cat 1	2	2	
		Metallic corrosive Cat 1	1	1	
		Skin Corrosive Cat 2	3	2	
		Eye corrosive Cat 1	1	1	
		Aquatic ecotox Cat 3	4	2	

* Assumed to be concentrated sulphuric acid and not fuming sulphuric acid which is a solution of sulphur trioxide in sulphuric acid

GHS hazard classification diagrams:

Physical Hazards

Hazard Class	Hazard Category							
Explosives	Unstable Explosives	Div 1.1		Div 1.2	Div 1.3	Div 1.4	Div 1.5	Div 1.6
Flammable Gases (including chemically unstable gases)	1	1A	1B	2	2A	2B		
Aerosols	1	2	3					
Oxidising Gases	1							
Gases Under Pressure Compressed Gases Liquefied Gases Refrigerated Liquefied Gases Dissolved Gases	1							
Flammable Liquids	1	2		3	4			
Flammable Solids	1	2						
Self-reactive Substances	Type A	Type B		Type C	Type D	Type E	Type F	Type G
Pyrophoric Liquids	1							
Pyrophoric Solids	1							
Self-heating Substances and Mixtures	1	2						
Substances and mixtures which, in contact with water, emit flammable gases	1	2		3				
Oxidising Liquids	1	2		3				
Oxidising Solids	1	2		3				
Organic Peroxides	Type A	Type B		Type C	Type D	Type E	Type F	Type G
Corrosive to Metals	1							

Health Hazards

Hazard Class	Hazard Category				
Acute Toxicity Acute Toxicity: Oral Acute Toxicity: Dermal Acute Toxicity: Inhalation	1	2	3	4	5
Skin Corrosion/Irritation	1A	1B	1C	2	3
Serious Eye Damage/Eye Irritation	1	2A	2B		
Respiratory or Skin Sensitisation	1	1A	1B		
Germ Cell Mutagenicity	1A	1B	2		
Carcinogenicity	1A	1B	2		
Reproductive Toxicity - Fertility	1A	1B	2	Lactation	
Specific Target Organ Toxicity - Single Exposure	1	2	3		
Specific Target Organ Toxicity - Repeated Exposure	1	2			
Aspiration hazard	1	2			

Environmental hazards

Hazard Class	Hazard Category			
Aquatic toxicity, acute	1	2	3	
Aquatic toxicity, chronic	1	2	3	4
Hazardous to the ozone layer	1			

Appendix B: Stringency Data Tables

This appendix lists and scores the controls imposed on each indicator chemical in each of the chosen jurisdictions. Listings are grouped by chemical with the table providing information for each jurisdiction in the same order with New Zealand listed first in each section. Hazard classifications are provided using the notation of the New Zealand implementation of the GHS for the New Zealand table.

Contents

1.1 General form and layout of the data tables.

This appendix consists of 36 tables which summarise the controls on the indicator chemicals used in this study, provide references to the legislative instruments used to impose those controls in each of the jurisdictions studied, and score those controls for stringency using the method set out in Section 4 of the report itself. In the case of the tables describing New Zealand controls the hazard classification for the chemicals concerned is also provided at the start of the table. This is in effect the GHS classification for the chemical although the notation system of the HSNO Act is used.

The legislative instruments, codes and other controls referenced in the tables are, wherever possible, provided with endnote cross references placed at the end of each table which give hyperlinks to the actual regulation where this is available on the web. These hyperlinks were correct that the time of completion of this work but, as those responsible for maintenance of the referenced websites alter their sites, these hyperlinks may no longer be correct as time passes.

The following outline provides an explanation of the content of each table including any assumptions used in their construction.

Jurisdiction: **[Jurisdiction name]**

Substance: **[Chemical name and CAS number]**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	*Information which must be presented for approval of available for compliance inspection in order to either approve the chemical or show that it has been correctly classified*		Evaluation based on the information required for classification or approval of a 'new' example of the chemical.	
Labelling	*Information required on a label including any required words, phrases or pictograms and any layout rules*			
Data sheet	*Information required on a safety data sheet – e.g. for workplace use*			

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Packaging	*The strength, durability and other requirements for a package into which the chemical may be put. Requirements are at the 'basic' level i.e. without regard to a particular transport mode. Package as defined by the UNRRTDG 17th Edn*			
IBC	*The strength, durability and other requirements for an intermediate bulk container as defined by the UNRTDG 17th Edn.*			
Exposure limit (tox.)	*Limits (usually air concentration) on the concentration to which humans may be exposed for a specified time. Exposure limits are often set only for workplaces so these figures were referenced where available.*		Not applicable if the chemical is not toxic as defined by the GHS – i.e. as specified in the HSNO Act Hazardous substances (threshold) regulations.	
Exposure limit (ecotox.)	*Limits (usually water concentration) on the concentration of the chemical in the open environment.*		Not applicable if the chemical is not hazardous to the aquatic environment as defined by the GHS – i.e. as specified in the HSNO Act Hazardous substances (threshold) regulations.	
Physical hazard (initiation)	*Controls imposed on a chemical with physical hazards (explosiveness, flammability, oxidising capacity etc.) to prevent this physical hazard being manifested. Usually some combination of separating initiation energy (e.g. electrical spark) oxygen or fuel from the chemical.*		Not applicable if the chemical cannot be classified with physical hazards as defined by the GHS – i.e. as specified in the HSNO Act Hazardous substances (threshold) regulations.	

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Exposure limit heat/ blast	*Controls, if any, imposed on a chemical with physical hazards (explosiveness, flammability, oxidising capacity etc.) to prevent injury to persons or damage to property from heat or blast.*		Not applicable if the chemical cannot be classified with physical hazards as defined by the GHS – i.e. as specified in the HSNO Act Hazardous substances (threshold) regulations.	
Emergency preparedness	*Obligations imposed on the handling (including storage) of a chemical to make preparations to deal with emergencies. May include; fire fighting equipment, emergency plans, first aid instructions/equipment/materials, and/or secondary containment (for liquids)*		May be quantity dependent but site specific requirements are excluded.	
Tracking	*Obligations to record and/or report to an authority the quantity and whereabouts of a chemical during all or part of its lifecycle.*		Does not include tracking systems which apply in some jurisdictions when the chemical is declared as a waste.	
Qualified person in charge	*Requirement to have a specifically qualified person supervise and/or handle the chemical when not it is not secured.*		Only considered if there is a chemical specific requirement over and above the general obligation for workers to be fully trained and/or supervised which is contained in most modern occupation health and safety legislation.	
Disposal	*Obligations to be met when disposing of a chemical which is unwanted.*		Includes both performance type obligations (e.g. reduce hazardous properties by a specified amount) and process type obligations (e.g. tracking and treatment in a licensed facility) provided these obligations apply generally - i.e. do not apply only to a specific location.	

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Tankwagon	*Strength, durability, contents resistance etc. requirements for containers permanently affixed to vehicles.*		Not applicable if the chemical as considered is a solid.	
Fixed bulk storage container	*Strength, durability, contents resistance etc. requirements for containers larger than IBC and permanently at a fixed location.*		Not applicable if the chemical as considered is a solid. Includes only obligations which apply generally and not those which are location specific – e.g. as a result of land use planning law.	

1.2 Deltamethrin CAS# 52918-63-5

1.2.1 Jurisdiction: New Zealand

(Hazard classification as shown in NZ system- provided to assist referencing NZ regulations and standards only:

6.1B acute toxic class B

6.3B Skin irritant class B

6.4A Eye irritant class A

6.9A Target organ toxicant class A

9.1A Aquatic ecotox Class A

9.2C Soil ecotox class C

9.3A Terrestrial vertebrate ecotox Class A

9.4A Terrestrial invertebrate ecotox class A)

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Assessment data	Deltamethrin has an existing approval (#HSR003288) so no further data is required. However deltamethrin generically does not appear to be covered by any of the HSNO group standards, so if the approval did not exist, data on both the physical properties and hazardous properties would be required and submitted to the EPA. In addition sufficient information to complete the risks costs and benefits section of a release application would be required.	EPA NZ Website: HSNO Controls for Deltamethrin[1]	As all the chemicals in the study are already approved in the NZ regime this exercise considers the data required if a new 'deltamethrin' came on to the NZ market. Score is on this basis	**3**
Labelling	Labelling requirements are performance version of GHS (i.e. GHS label would comply) but regulation also explicitly permits use of UNRTDG label as complying. However regulation 18(c) of the HSNO Hazardous Substances Identification Regulations requires information about possible changes which might cause the substance to become more hazardous in a closed container. Emergency management regulations also apply and require information on the first aid for exposure to the substance on the label along with emergency service contact.	EPA NZ Website: HSNO Controls for Deltamethrin1 Hazardous substances (Identification) regulations (2001)[2] Hazardous substances (Emergency Management) Regulations 2001[3]	No known self reactions in container to form new substance hazards. First aid and emergency contact are in addition to GHS basic requirement. GHS does contain power for competent authority to require additional information but this will increase costs over jurisdictions where this is not required.	**3**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Data sheet	Requirements set out in Hazardous substances Identification Regulations, reference sections similar to those in the GHS SDS specification and include specific requirements in respect of information about ecotoxicity and toxicity.	EPA NZ Website: HSNO Controls for Deltamethrin1 Hazardous substances (Identification) regulations 20012 Globally Harmonized System of Classification and Labelling of Chemicals (GHS) Fourth revised edition United Nations, 2011[4]	GHS compliant datasheet (in English) would comply with requirements. It is assumed that the specific wording of the regulation is equivalent to the relevant sections of the GHS requirement.	**2**
Packaging	Requirements set out in the Hazardous Substances (Packaging) Regulations – these are a performance translation of the UNRTDG 14th Edn Packaging requirements. NB includes requirements which translate the 'Dangerous Goods in limited quantity' requirements of this edition of the UNRTDG.	EPA NZ Website: HSNO Controls for Deltamethrin1 Hazardous Substances (Packaging) Regulations 2001[5]	UNRTDG packaging would comply with these requirements	**2**
IBC	Deltamethrin may be stored/transported in transportable containers meeting the requirements of UNRDTG model regulations for intermediate bulk containers or portable tanks	EPA NZ Website: HSNO Controls for Deltamethrin1 Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004 – Part 6[6]		**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Exposure limit (tox.)	No entry in exposure limits table or Dept of Labour WES table	EPA NZ Website: Substance exposure limit register[7]		**2**
Exposure limit (ecotox.)	No entry in exposure limits table	EPA NZ Website: Substance exposure limit register7		**2**
Physical hazard (initiation)	Not applicable			**2**
Exposure limit heat/ blast	Not applicable			**2**
Emergency preparedness	Quantities of deltamethrin in excess of 100kg attract requirements for • Pre-prepared and tested emergency management plans • (for quantities in excess of 250kg) Signage setting out actions to be taken in the event of an emergency.	EPA NZ Website: HSNO Controls for Deltamethrin1 Hazardous substances (Emergency Management) Regulations 2001[8]		**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Tracking	Record of application required if used in a public place or if the substance may enter air or water and leave the place of application. Record to be kept at each place where the substance is or has been including; identity of approved handler, location, quantity, quantity transferred to another place and date transferred, disposal date and means if applicable.	EPA NZ Website: HSNO Controls for Deltamethrin1 Hazardous Substances (Classes 6, 8, and 9 Controls) Regulations 2001[9] Hazardous Substances (Tracking) Regulations 2001[10]		**2**
Qualified person in charge	Deltamethrin must be either secured (lock and key test) or under the direct control of a person with certified knowledge of properties and controls on substance unless being transported in which case dangerous good transport requirements apply.	EPA NZ Website: HSNO Controls for Deltamethrin1 Hazardous Substances (Tracking) Regulations 2001[10]		**2**
Disposal	Disposal includes either • Export as waste (in compliance with Basel etc) • Treatment to remove hazardous properties • Treatment Includes landfill or other treatment facility Obligation on importer, manufacturer or supplier to provide information about disposal method with substance for quantities above 100g.	EPA NZ Website: HSNO Controls for Deltamethrin1 Hazardous Substances (Disposal) Regulations 2001[11]		**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Tankwagon	Not applicable – substance is a solid			**2**
Fixed bulk storage container	Not applicable – substance is a solid			**2**
Score deltamethrin New Zealand				**32**

[1] http://www.epa.govt.nz/search-databases/Pages/controls-details.aspx?SubstanceID=4194&AppID=3287
[2] May be obtained here: http://www.legislation.govt.nz/regulation/public/2001/0124/latest/link.aspx?search=ts_regulation_hazardous+substances_resel&p=1
[3] May be obtained here: http://www.legislation.govt.nz/regulation/public/2001/0123/latest/DLM43173.html?search=ts_regulation_Hazardous+substances_resel&p=1&sr=1
[4] May be obtained here: http://www.unece.org/trans/danger/publi/ghs/ghs_rev04/04files_e.html
[5] May be obtained here: http://www.legislation.govt.nz/regulation/public/2001/0118/latest/DLM40764.html?search=ts_regulation_hazardous+substances_resel&p=1&sr=1
[6] May be obtained here: http://www.legislation.govt.nz/regulation/public/2004/0046/latest/DLM245670.html?search=ts_regulation_hazardous+substances_resel&p=1&sr=1
[7] http://www.epa.govt.nz/search-databases/Pages/substance-exposure-limit-register.aspx#tel-table
[8] May be obtained here: http://www.legislation.govt.nz/regulation/public/2001/0123/latest/DLM43173.html?search=ts_regulation_Hazardous+substances_resel&p=1&sr=1
[9] May be obtained here: http://www.legislation.govt.nz/regulation/public/2001/0117/latest/DLM39614.html?search=ts_regulation_hazardous+substances_resel&p=1&sr=1
[10] May be obtained here: http://www.legislation.govt.nz/regulation/public/2001/0120/latest/DLM42424.html?search=ts_regulation_hazardous+substances_resel&p=1&sr=1
[11] May be obtained here: http://www.legislation.govt.nz/regulation/public/2001/0119/latest/DLM41657.html?search=ts_regulation_hazardous+substances_resel&p=1&sr=1

1.2.2 Jurisdiction: Australia/NSW

Substance: Deltamethrin CAS# 52918-63-5

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Assessment data	NSW requirements are overlaid by the Commonwealth level NICNAS requirements, which require information about hazardous properties production volumes, uses locations etc Dangerous goods for transport: toxic class data required in accordance with the tests cited in the ADG Code. These criteria are copied from the UNRTDG 15th Edn which in turn cross refer to the UNRTDG 'Tests and Criteria' Volumes. Hazardous substances (workplace) Work Health and Safety regulation direct cites GHS for classification and place obligation of importer or manufacturer to classify.	Industrial Chemicals (Notification and Assessment) Act[1] NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3] NSW Work Health and Safety Regulation 2011[4]	As deltamethrin has an existing approval in most systems, this study focuses for the data required for approval of a new 'deltamethrin'. The requirements for data in the NSW system reference either the UNRTDG Tests and Criteria or the GHS but are overlaid by the NICNAS requirements. The NSW plus Australian chemical notification requirements require information with similarities to REACH	3

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Labelling	Transport (dangerous goods) label requires UN number and proper shipping name as well as UN specified pictogram. Hazardous substance label requirement matches GHS unless the substance is a scheduled drug or poison but also requires identity of ingredients for mixtures.	NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3] NSW Work Health and Safety Regulation 2011[4] Globally Harmonized System of Classification and Labelling of Chemicals (GHS) Fourth revised edition United Nations, 2011[5]	Requirements are consistent with GHS, but only because this is a GHS substance (pure chemical). Identity of ingredients required by NSW Work Health and Safety Regulation is not required on the label under the GHS 4th Edn. The substance deltamethrin is not listed in the 2011 Federal poisons schedule. NB Attention is drawn to the GHS combined transport and a GHS labelling requirement (Chapter 1.4 & Annex 7 GHS 4th Edn)	**2**
Data sheet	Data sheet requirements match those of the GHS although some detail is omitted and the GHS building block principle is used (e.g. Acute toxic category 5 not used)	NSW Work Health and Safety Regulation 2011[4]	GHS compliant data sheet would be acceptable noting that • There are obligations to update at fixed intervals • GHS means of dealing with commercial in confidence information is interpreted locally	**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Packaging	Packaging requirements are UNRTDG 15th Edn copied into the Australian Code for the Transport of Dangerous Goods Workplace requirements are generic only – no specific performance	NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3]	Minimal difference between URTDG 15th and 17th Edn for packaging performance.	**2**
IBC	IBC requirements are UNRTDG 15th Edn copied into the Australian Code for the Transport of Dangerous Goods	Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3]	Minimal difference between URTDG 15th and 17th Edn for IBC performance.	**2**
Exposure limit (tox.)	None found			**2**
Exposure limit (ecotox.)	None found			**2**
Physical hazard (initiation)	Not applicable – no physical hazard classification			**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Exposure limit heat/ blast	Not applicable – no physical hazard classification			**2**
Emergency preparedness	Emergency plan required if 'manifest quantity' exceeded (2500 kg) As the substance deltamethrin is not a liquid secondary containment provisions not applicable	NSW Work Health and Safety Regulation 20114	Some differences in detail from NZ requirements (although detail is sparse in NSW regulation) Regarded as equivalent for practical purposes	**2**
Tracking	No requirement found for tracking of the substance			**1**
Qualified person in charge	No specific obligation found for a qualified person in charge of deltamethrin	NSW Work Health and Safety Regulation 20114	NSW Work health and safety legislation does include a general obligation for workers to be properly trained or supervised. This generic requirement is seen as equivalent to NZ Health and Safety in Employment law and so not specific to the substance or part of the chemicals control regime.	**1**
Disposal	While not specifically controlled under the Environmentally Hazardous Chemicals Act, deltamethrin disposal is likely to be captured as a scheduled process under the Protection of the Environment Operations Act. These operations are subject to site by site licensing designed to reduce emissions.	NSW Environmentally Hazardous Chemicals Act 1985[6] NSW Protection of the Environment Operations Act 1997[7]	The controls described do not provide the same level of specification as the NZ requirements for disposal but the effect is in most cases likely to be roughly equivalent. However the complexity of steps required is higher (e.g. requiring manifest tracking of the waste) so this requirement is scored as 3.	**3**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Tankwagon	Substance is a solid – not applicable			**2**
Fixed bulk storage container	Substance is a solid – not applicable			**2**
Score deltamethrin Australia/ NSW				**30**

[1] May be viewed here: http://www.comlaw.gov.au/Details/C2012C00082/Html/Text#_Toc313881260
[2] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+124+2009+cd+0+N
[3] May be obtained here: http://www.ntc.gov.au/filemedia/Publications/ADG7October2011.pdf
[4] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+674+2011+cd+0+N
[5] May be obtained here: http://www.unece.org/trans/danger/publi/ghs/ghs_rev04/04files_e.html
[6] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/act+14+1985+cd+0+N
[7] May be viewed here: http://www.legislation.nsw.gov.au/viewtop/inforce/act+156+1997+ch.1-sec.1+0+N

1.2.3 Jurisdiction: Canada

Substance: Deltamethrin CAS# 52918-63-5

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Assessment data	Deltamethrin is covered as a dangerous good in Transport of dangerous goods regulations and is covered by the Controlled products regulations under the Hazardous Products Act as it would be captured by its toxic properties. The New Substances Notification Regulations which are Federal in extent require both environmental hazard data and (based on volume produced or imported) data about uses, likely exposure routes, and sources of discharge into the environment.	(Federal) Hazardous Products Act[1] (Federal) Controlled Products Regulations[2] (Federal) Transport of Dangerous Goods regulations[3] (Federal) New Substances Notification Regulations (Chemicals and Polymers) (SOR/2005-247)[4]	Deltamethrin is separately controlled in pesticides formulations under the Canadian pesticides legislation but the 'pure' active does not appear to be. Deltamethrin has an existing approval in most systems, so this study focuses for the data required for approval of a new 'deltamethrin'. Under the Hazardous Products Act and Controlled products Regulations the classification criteria in the regulations have fewer categories than the EU CLP in respect of some toxic effects and no criteria for environmental effects. They also permit data from 'similar' chemicals. However further data is required under the New Substances Notification Regulations.	3

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Labelling	Labelling requirements at the federal level use different symbols from those specified under the GHS, including two symbols not specified by the GHS and excluding three GHS symbols. The label also requires a statement to the effect that a safety data sheet is available. The labels also require the pre-GHS R-phrases of the former EU system	Federal) Hazardous Products Act[1] (Federal) Controlled Products Regulations[2]	Requirements differ from those of the GHS including different symbols for toxic effect and no obligation for an environmental hazard symbol. But there is an additional requirement for notice of a safety data sheet and for pre-GHS R-phrases.	**3**
Data sheet	Data sheet requirements listed are less than those for the standard GHS datasheet as environmental hazards and transport requirements are not specified.	Federal) Hazardous Products Act[1] (Federal) Controlled Products Regulations[2]		**1**
Packaging	The Transport of Dangerous Goods regulations require packaging which complies with prescriptions in a Canadian Standard. From those parts of the standard visible to us, it appears that this standard essentially mirrors the packaging requirements of the UNRTDG, although it may be an earlier than 17th Edn.	(Federal) Transport of Dangerous Goods regulations[3]		**2**
IBC	The Transport of Dangerous Goods regulations require use of IBC which comply with prescriptions in a Canadian Standard. From the FAQ available on the Transport Canada website these requirements appear to match those of the UNRTDG.	(Federal) Transport of Dangerous Goods regulations[3] Transport Canada FAQ re IBC[5]		**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Exposure limit (tox.)	Workplace exposure limits are set in provincial legislation in Canada and Ontario legislation is used as an exemplar for these provincial requirements. This legislation does not set an exposure limit for deltamethrin.	(Province of Ontario) R.R.O. 1990, Regulation 833 Control Of Exposure To Biological or Chemical Agents[6]	A table of threshold values published by the Ontario Ministry of Labour does not include an entry for deltamethrin[7].	**2**
Exposure limit (ecotox.)	No limit found			**2**
Physical hazard (initiation)	Not classified for physical hazards – not applicable			**2**
Exposure limit heat/ blast	Not classified for physical hazards – not applicable			**2**
Emergency preparedness	No chemical or chemical class specific requirements found other than the basic information required in safety data sheets. - i.e. no chemical specific emergency plan requirements	(Province of Ontario) Occupational Health and Safety Act[8]	The province of Ontario, used as the exemplar for provincial level Canadian requirements, does empower inspectors to require written plans in respect of, among other things, the emergency process for dealing with 'chemical, biological and physical agents. However as written the obligation is a power of inspectors not a legal requirement, and is not chemical or chemical class specific.	**1**
Tracking	None found			**1**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Qualified person in charge	Deltamethrin is a controlled product under the federal Controlled Products Regulations which obliges employers in Ontario to provide training for workers handling this chemical	Ontario Occupational Health and Safety Act: Regulation 860, Workplace Hazardous Materials Information System (WHMIS)[9]	These requirements are less strict than the NZ 'approved handler' requirements.	**1**
Disposal	Ontario regulation used as the exemplar requires hazardous waste to be manifest tracked and treated in licensed facilities. The definition of hazardous waste includes wastes with toxic properties. , although test used are not entirely clear.	(Ontario) R.R.O. 1990, Regulation 347 General — Waste Management[10] Registration Guidance Manual For Generators Of Liquid Industrial And Hazardous Waste (Replaces 0195e) December 2009[11]	Manifest tracking and disposal through licensed facilities is regarded as more complex than the New Zealand requirement	**3**
Tankwagon	Substance is a solid - not applicable			**2**
Fixed bulk storage container	Substance is a solid - not applicable			**2**
Score deltamethrin Canada				**29**

[1] May be viewed here: http://laws-lois.justice.gc.ca/eng/acts/H-3/FullText.html
[2] May be viewed here: http://www.canlii.org/en/ca/laws/regu/sor-88-66/latest/sor-88-66.html
[3] May be viewed here: http://www.tc.gc.ca/eng/tdg/clear-tofc-211.htm
[4] May be viewed here: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-247/index.html
[5] May be viewed here: http://www.tc.gc.ca/eng/tdg/moc-ibc-faqunstandardizedibcs-246.html#when

[6] May be viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900833_e.htm
[7] http://www.labour.gov.on.ca/english/hs/pubs/oel_table.php
[8] May be viewed here: http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90o01_e.htm
[9] May viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900860_e.htm#BK5
[10] May be viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900347_e.htm#BK27
[11] May be obtained here: http://www.ene.gov.on.ca/environment/en/resources/STD01_076193.html

1.2.4 Jurisdiction: Ireland

Substance: Deltamethrin CAS# 52918-63-5

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Assessment data	Ireland's laws directly put in place the CLP regulations – Chemicals Amendment Act as cited at left, so requirements are as for the CLP.	Chemicals (Amendment) Act 2010[1] European Communities (Authorization, Placing on The Market, Use and Control of Biocidal Products) Regulations, 2001[2] Regulation (EC) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP)[3] Regulation (EC) No 1907/2006 Of The European Parliament And Of The Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended)[4]	Deltamethrin is already approved in the Irish regime. However this exercise considers the data required if a new 'deltamethrin' came in to the Irish market. CLP regulations apply. However a 'new' deltamethrin would be caught by REACH requirements leading to requirements for data more extensive than those of the CLP NB the cited European Communities (Authorization, Placing on The Market...) regulation also references the CLP. Biocidal action is generally control under separate rules but the chemicals controlled are mixtures and not the substance deltamethrin	**3**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Labelling	Irish law directly puts in place CLP requirements – Chemicals Amendment Act as cited at left So requirements are as for the CLP.	Chemicals (Amendment) Act 2010[1] Regulation (EC) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP)[3]	See note concerning biocidal mixtures above which must also follow CLP requirements	**2**
Data sheet	Datasheet requirement under the Chemicals Act calls up REACH SDS (safety data sheet) requirements	Chemicals (Amendment) Act 2010[1] Regulation (EC) No 1907/2006 Of The European Parliament And Of The Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended)[4]		**2**
Packaging	Irish law directly puts in place CLP requirements – Chemicals Amendment Act as cited at left So requirements are as for the CLP.	Chemicals (Amendment) Act 2010[1] Regulation (EC) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP)[3]		**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
IBC	Regulations cited reference ADR for IBC	European Communities (Carriage of Dangerous Goods by Road and Use of Transportable Pressure Equipment) Regulations 2011[4] European Agreement concerning the International Carriage of Dangerous Goods by Road webpage[5]		**2**
Exposure limit (tox.)	No workplace exposure limit found			**2**
Exposure limit (ecotox.)	None found			**2**
Physical hazard (initiation)	Not applicable – not classified for physical hazards			**2**
Exposure limit heat/ blast	Not applicable – not classified for physical hazards			**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Emergency preparedness	There are general obligations in respect of worker safety to undertake risk assessments and prepare emergency plans under the Safety, health and welfare at work ... regulations as cited at right. However these are generic to chemical hazards of any kind and only in respect to worker safety. Deltamethrin is captured by the European Communities Control of major accident hazard... regulations as a result of its ecotoxicity. Specific emergency plans are therefore required for quantities exceeding 100 tonnes	Safety, Health and Welfare at Work (General Application) Regulations 2007[6] European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2006[7]	Apart from the generic requirements to protect worker safety (not chemical specific) the limits for specific chemical related emergency plans are very much larger than NZ.	**1**
Tracking	No specific requirement			**1**
Qualified person in charge	No requirements specific to the substance found			**1**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Disposal	Deltamethrin is covered by the second schedule part III of the Waste Management Act. The Act provides a regime controlling the handling of hazardous waste and requires its sending to treatment facilities and landfills subject to permitting under the Act. Individual permits under the permitting provisions set site specific limits on emissions.	Waste Management Act, 1996[8] (and as subsequently amended)	The controls described do not provide the same level of specification as the NZ requirements for disposal but the effect is in most cases likely to be roughly equivalent. However the complexity of steps required is higher so this requirement is scored as 3	**3**
Tankwagon	Not applicable – substance is a solid			**2**
Fixed bulk storage container	Not applicable – substance is a solid			**2**
Score deltamethrin Ireland				**29**

[1] May be obtained here: http://www.hsa.ie/eng/Legislation/Acts/Chemicals_Acts_2008_and_2010_and_the_Guide/Chemicals_Act_No_32_of_2010_pdf.pdf
[2] May be viewed here: http://www.irishstatutebook.ie/2001/en/si/0625.html
[3] May be obtained here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:353:0001:1355:en:PDF
[4] May be obtained here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1907:20111210:EN:PDF
[5] http://www.unece.org/trans/danger/publi/adr/adr2011/11ContentsE.html
[6] May be viewed here: http://www.irishstatutebook.ie/2007/en/si/0299.html
[7] May be viewed here: http://www.irishstatutebook.ie/2006/en/si/0074.html#sched1-partii
[8] May be viewed here: http://www.irishstatutebook.ie/1996/en/act/pub/0010/index.html

1.2.5 Jurisdiction: Japan

Substance: Deltamethrin CAS# 52918-63-5

NB: Descriptions as supplied by Prof. Hiroshi Jonai, Professor of Medical and Welfare Engineering, Graduate School of Science and Technology - Nihon University, Tokyo. All Japanese law and regulations are available only in Japanese so the descriptions below are referenced to the translated titles of the relevant legislation only (references supplied by Prof. Jonai). Scoring is based on our judgements from the information provided by Jonai.

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Assessment data	Assessment or self classification data not required Deltamethrin is on the list of Acts concerned as acute toxic or corrosive substance. Poisonous and Deleterious Substances Control Act, does not require assessment or self classification data. Jonai observes that some other Acts do, but his comments suggest data requirements are less than would be required under the CLP	Poisonous and Deleterious Substances Control Act	Deltamethrin is approved (& listed) in the Japanese regime, however this exercise considers the data required if a new 'deltamethrin' came on to the Japanese market. On the basis of Jonai's comments data requirements are less than the CLP	**1**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Labelling	Specific terms are required on the label in Japanese characters (Kanji) and these terms are different from the GHS terms translated into Japanese	Poisonous and Deleterious Substances Control Act	A specific label will be required for Japan making this control more stringent than the GHS	**3**
Data sheet	Japan's SDS requirements are equivalent to the GHS (in Japanese)	Poisonous and Deleterious Substances Control Act		**2**
Packaging	Requirements are equivalent to the UNRTDG 16^{th} Edn	Civil Aeronautics Act Ship Safety Act		**2**
IBC	Requirements are equivalent to the UNRTDG 16th Edn	Civil Aeronautics Act Ship Safety Act	IBC are by definition multi-modal although carriage of IBC by air would generally be unusual	**2**
Exposure limit (tox.)	No entry			**2**
Exposure limit (ecotox.)	No entry			**2**
Physical hazard (initiation)	Not applicable no physical hazard classification			**2**
Exposure limit heat/ blast	Not applicable no physical hazard classification			**2**
Emergency preparedness	No requirements reported by Jonai			**1**
Tracking	No requirements			**1**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Qualified person in charge	Require hazardous materials officer qualified by a national examination Knowledge needed: laws concerned, chemistry, toxicity, treatment and storage	Poisonous and Deleterious Substances Control Act		**2**
Disposal	Specified disposal requirements not detailed by Jonai: Export as waste is permitted subject to Basel convention	Act on Control of Export, Import and Others of Specified Hazardous Wastes and Other Wastes	Jonai reports reference in waste management law to limits on concentration of cyanide with respect to deltamethrin. The reference is unclear as there is no documented breakdown path for this substance than generates cyanide. No reference to reducing hazardous properties before disposal found so scored as less stringent than NZ	**1**
Tankwagon	Not applicable – substance is a solid			**2**
Fixed bulk storage container	Not applicable – substance is a solid			**2**
Score deltamethrin Japan				**27**

1.2.6 Jurisdiction: United Kingdom

Substance: Deltamethrin CAS# 52918-63-5

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Assessment data	Deltamethrin is a dangerous substances under the CHIP 4 regulations (by reference to the CLP in those regulations) The CHIP 4 regulations require a person supplying such substances to make 'themselves aware of all relevant and accessible data that may exist' in relation to the substance.	Information and Packaging for Supply) Regulations 2009 [UK regulation][1] Regulation (EC) No 1907/2006 Of The European Parliament And Of The Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended)[2]	Deltamethrin is already approved in the UK regime. However this exercise considers the data required if a new 'deltamethrin' came on to the UK market. CHIP regulation is interpreted as equivalent the self classification requirement of the CLP. However a 'new' deltamethrin would be caught by REACH requirements leading to requirements for data more extensive than those of the CLP	3

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Labelling	Labelling requirements contained in the CHIP 4 regulations still require the Pre-GHS R and S phrases of the 1967 EC directive. Symbols and other information required are annexed in the regulation and are also not consistent with the GHS 'label' requirements. Some additional information required (e.g. EC number – see regulation 7) and exemptions for small packages	The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 [UK regulation]1 Globally Harmonized System of Classification and Labelling of Chemicals (GHS) Fourth revised edition United Nations, 2011[3]	The CHIP 4 regulation requirements are different from those of the GHS and so a different label (from GHS or Transport/GHS) would be required for the UK. NB there are additional requirements to be met in respect of biocidal use of deltamethrin. This is seen as equivalent to the NZ ACVM Act requirements and outside the scope of this study.	**3**
Data sheet	Datasheet required for dangerous substances – form of required information is consistent with GHS.	CHIP 4 Webpage describes requirement as the same as that under REACH [4] (empowering legislation is not clear) Further detail on HSE REACH pages[5]	REACH data sheet requirement is equivalent to GHS	**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Packaging	CHIP 4 regulations cross refer to Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007, which in turn cross refer to European RID ADR document for package requirements. These appear to be a more chemical specific version of the UNRTDG requirements using largely the same performance level. Dangerous good in limited quantity also provided for. Packages specifically meeting maritime and air transport requirements are also permitted.	The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 [UK regulation]1 Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007[6] European Agreement concerning the International Carriage of Dangerous Goods by Road webpage[7]	The UK regulations do not appear to provide 'basic' packaging requirements but rather simply permit packages which are acceptable for any transport mode.	**2**
IBC	The UK Carriage of Dangerous Goods ... regulations reference ADR for IBC	Dangerous Goods and Use of Transportable Pressure Equipment Regulations 20076 European Agreement concerning the International Carriage of Dangerous Goods by Road webpage5	ADR (European Agreement concerning the International Carriage of Dangerous Goods by Road) appears to be consistent with UNRTDG for IBC	**2**
Exposure limit (tox.)	None found			**2**
Exposure limit (ecotox.)	None found			**2**
Physical hazard (initiation)	Not applicable – no physical hazard classification			**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Exposure limit heat/ blast	Not applicable – no physical hazard classification			**2**
Emergency preparedness	Deltamethrin is captured as a scheduled substance in the Control of major accident hazard (COMAH) regulations as a result of toxic and ecotoxic properties. Accordingly there are requirements for emergency plans where quantities on a site exceed 50 tonnes For smaller quantities the Management of Health and Safety at work regulations impose general duties to assess risks to workers health and safety and provide necessary means to manage.	Management of Health and Safety at Work Regulations 1999[8] Control of Major Accident Hazards Regulations 1999 as amended [9]	The lower limit for the requirement for formal emergency plans (under the COMAH regulations) is much larger than that for NZ - 50 tonnes V 100kg. Smaller quantities only attract requirements for worker (not environmental) emergency preparedness.	**1**
Tracking	No requirement found		NZ obliges recording of application etc so UK system less stringent	**1**
Qualified person in charge	UK Management of Health and Safety at work regulations require employers to appoint a person with health and safety knowledge	Management of Health and Safety at Work Regulations 19999	Regulations similar to general requirements in the NZ Health and Safety in employment regulations and not chemical specific. N requires person with defined knowledge in charge or substance to be secured.	**1**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Disposal	Deltamethrin is covered by Annex III of the Hazardous Waste regulations and the Scottish Special Waste Regulations. These regulations control handling of hazardous waste and require its sending to treatment facilities and landfills subject to the Environmental Permitting (England and Wales) Regulations. These regulations implement the EU's Integrated Pollution Prevention and Control (IPPC) Directive. Individual permits under the permitting regulations set site specific limits on emissions.	Hazardous Waste (England and Wales)Regulations 2005 (amended 2009)[10] The Environmental Permitting (England and Wales) Regulations 2007[11] Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control[12].	The controls described do not provide the same level of specification as the NZ requirements for disposal but the effect is in most cases likely to be roughly equivalent. However the complexity of steps required is higher so this requirement is scored as 3	**3**
Tankwagon	Not applicable – substance is a solid			**2**
Fixed bulk storage container	Not applicable – substance is a solid			**2**
Score deltamethrin United Kingdom				**30**

[1] May be viewed here: http://www.legislation.gov.uk/uksi/2009/716/contents/made
[2] May be obtained here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1907:20111210:EN:PDF
[3] May be obtained here: http://www.unece.org/trans/danger/publi/ghs/ghs_rev04/04files_e.html
[4] http://www.hse.gov.uk/chip/law.htm
[5] http://www.hse.gov.uk/reach/resources/reachsds.pdf
[6] May be viewed here http://www.legislation.gov.uk/uksi/2007/1573/regulation/51/made
[7] http://www.unece.org/trans/danger/publi/adr/adr2011/11ContentsE.html
[8] May be viewed here: http://www.legislation.gov.uk/uksi/1999/3242/contents/made
[9] May be viewed here: http://www.legislation.gov.uk/uksi/1999/743/schedule/1/made

[10] May be viewed here: http://www.legislation.gov.uk/uksi/2005/894/contents/made
[11] May be viewed here: http://www.legislation.gov.uk/uksi/2007/3538/contents/made
[12] May be viewed here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008L0001:EN:NOT

1.3 Dibenzoyl peroxide CAS # 94-36-0

1.3.1 Jurisdiction: New Zealand

HSNO hazard classification: (assumed for consistency 26- 77% water stabilised equivalent – i.e. UN # 3104)

5.2C Organic peroxides: type C

6.4A Irritating to the eye

6.5B Contact sensitiser

9.1D Slightly harmful in the aquatic environment or otherwise designed for biocidal action

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	HSNO Group standard is available so sufficient data is required to assign the substance to the group standard. Requirement is "sufficient information to allow for third party verification" of the hazardous properties. Record to be kept of assessment and available for inspection	Organic Peroxides Group Standard 2006. HSR002629[1]	NZ EPA staff advise that 'sufficient information to allow third party verification' would normally be less than EU CLP prescribes. (e.g. R phrases and verifiable US hazard descriptions would be accepted).	1

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Labelling	Required information includes: • Common or chemical name • Pictograms for organic peroxide (GHS or UNRTDG) – other pictograms as required by the GHS • Signal word 'danger' and hazard statement 'heating may cause fire' • Precautionary statements as required by the GHS • general precaution statement required 'read label before use' • Emergency telephone number required in addition to manufacturer contact details	Organic Peroxides Group Standard 2006. HSR002629[1]	Basic label requirements equivalent to the GHS but general precaution statement, and emergency telephone number is in addition	**3**
Data sheet	Data sheet requirements are equivalent to the GHS (includes requirement for approval reference and date etc as provided for by the GHS)	Organic Peroxides Group Standard 2006. HSR002629[1]	Data sheet requirements are equivalent to the GHS	**2**
Packaging	Package (< 400kg, 450 l) shall meet the requirements of UNRTDG Packing group II as set out in 14th Edn. Specific requirement for the package to prevent compression at < $0^{O}C$ and preventing trapping of substance in closure. NB package size for class 5.2C restricted by UNRTDG. Also specific small package requirements which mirror the dangerous goods in excepted quantities provisions of the UNRTDG	Organic Peroxides Group Standard 2006. HSR002629[1]	Performance requirements would be met by use of UNRTDG compliant packaging	**2**
IBC	Refers to HSNO Tankwagons and transportable containers regulations – part 6 cross refers to UNRTDG. However quantities for transport will be limited by UNRTDG limits implemented in NZ by transport legislation.	Organic Peroxides Group Standard 2006. HSR002629[1]	No practical application for IBC for this substance given UNRTDG package size limit.	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Exposure limit (tox.)	No entry in the EPA register of exposure limits or WES	Organic Peroxides Group Standard 2006. HSR002629[1] NZ EPA Website: Substance Exposure limit register[2]		**2**
Exposure limit (ecotox.)	No entry in the EPA exposure limit table	Organic Peroxides Group Standard 2006. HSR002629[1] NZ EPA Website: Substance Exposure limit register[2]		**2**
Physical hazard (initiation)	Requirements to separate from incompatible substances, ignition sources, and control temperature to below 50^{O}C or SADT as specified in Class 1-5 Regulations (Reference is 'site and storage' portion of Group Standard)	Organic Peroxides Group Standard 2006. HSR002629[1]	SADT is approximately 80^{O}C so control is not onerous	**2**
Exposure limit heat/ blast	Separation distances or firewalls at fixed location (Reference is 'site and storage' portion of Group Standard)	Organic Peroxides Group Standard 2006. HSR002629[1]	These are surrogates for the effect of a (fire) hazard if manifested	**2**
Emergency preparedness	Fire extinguisher as specified in HSNO regulations for quantities above 10kg Emergency response plan and secondary containment where quantity above 25kg	Organic Peroxides Group Standard 2006. HSR002629[1]		**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Tracking	No tracking requirement	Organic Peroxides Group Standard 2006. HSR002629[1]		**2**
Qualified person in charge	Quantities over 10kg require approved handler (supervision or direct control) certified in respect of class 5.2 substances. Alternately substance must be kept secured (lock and key test).	Organic Peroxides Group Standard 2006. HSR002629[1]		**2**
Disposal	Specified disposal requirements: Export as waste, treatment so no longer a hazardous substance, placement in landfill so as not initiate fire or explosion	Organic Peroxides Group Standard 2006. HSR002629[1]		**2**
Tankwagon	Substance as specified is a solid – tankwagon requirements do not apply (also transport is limited by maximum package size as set out in UNRTDG)	Organic Peroxides Group Standard 2006. HSR002629[1]		**2**
Fixed bulk storage container	Substance is a solid	Organic Peroxides Group Standard 2006. HSR002629[1]		**2**
Score dibenzoyl peroxide New Zealand				**30**

[1]May be obtained here: http://www.epa.govt.nz/Publications/gs-organic-peroxides.pdf
[2] http://www.epa.govt.nz/search-databases/Pages/substance-exposure-limit-register.aspx#tel-table

1.3.2 Jurisdiction: NSW/Australia

Substance: Dibenzoyl peroxide CAS # 94-36-0

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	NSW requirements are overlaid by the Commonwealth level NICNAS requirements, which require information about hazardous properties production volumes, uses locations etc For transport purposes the NSW Dangerous Goods transport regulation calls up the ADG code. This copies UNRTDG 15th Edn so data requirements will be equivalent to CLP. Hazardous substances (workplace) Work Health and Safety regulation direct cites GHS for classification and place obligation of importer or manufacturer to classify.	Industrial Chemicals (Notification and Assessment) Act[1] NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3] NSW Work Health and Safety Regulation 2011[4]	As dibenzoyl peroxide has an existing approval in most systems, this study focuses for the data required for approval of a new ‘dibenzoyl peroxide’. The requirements for data in the NSW system reference either the UNRTDG Tests and Criteria or the GHS. The NSW plus Australian chemical notification requirements require information with similarities to REACH	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Labelling	Transport (dangerous goods) label requires UN number and proper shipping name. Hazardous substance label requirement matches GHS unless the substance is a scheduled drug or poison but also requires identity of ingredients.	NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3] NSW Work Health and Safety Regulation 2011[4]	Requirements not consistent with GHS because hazardous substance label requirement includes obligation to describe components (dibenzoyl peroxide is water stabilised).	**3**
Data sheet	Data sheet requirements match those of the GHS although some detail is omitted and the GHS building block principle is used (e.g. Acute toxic category 5 not used)	NSW Work Health and Safety Regulation 2011[4]	GHS compliant data sheet would be acceptable noting that • There are obligations to update at fixed intervals • GHS means of dealing with commercial in confidence information is interpreted locally	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Packaging	Packaging requirements are UNRTDG 15th Edn copied into the Australian Code for the Transport of Dangerous Goods Workplace requirements are generic only	NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3]	Minimal difference between URTDG 15th and 17th Edn for packaging performance.	**2**
IBC	IBC not permitted by UNRTDG requirements (organic peroxides have limited package size smaller than IBC)	NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3]	No practical application for IBC for this substance given UNRTDG package size limit.	**2**
Exposure limit (tox.)	Workplace exposure limit set for air for dibenzoyl peroxide in Australian workplace exposure standards (called up by Work Health and Safety regulation)	NSW Work Health and Safety Regulation 2011[4] Safework Australia: Workplace Exposure Standards for Airborne Contaminants Dec 2011[5]	Scoring is in comparison with NZ where no limit set	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Exposure limit (ecotox.)	None found			**2**
Physical hazard (initiation)	Legislative requirements are not specific to either dibenzoyl peroxide or organic peroxides generally. Instead relevant regulation (workplace safety) requires a risk assessment and the putting in place of steps to minimise risks.	NSW Work Health and Safety Regulation 2011[4] Storage and Handling of Dangerous Goods Code of Practice 2005 WorkCover NSW[6]	General practices in conducting such risk assessments and putting in place controls are to reference codes of practice (which in the case of NSW appear to no longer have statutory force) and Australian Standards. These standards contain a considerable number of 'cascade' references to other documents. Reference to primary code shown at left. In practice the obligations imposed will be similar to the NZ system but the acceptable standard is less clear – e.g. following particular codes is 'evidential' rather than an absolute defence as in the NZ system.	**2**
Exposure limit heat/ blast	Legislative requirements are not specific to either dibenzoyl peroxide or organic peroxides generally. Instead relevant regulation (workplace safety) requires a risk assessment and the putting in place of steps to minimise risks.	NSW Work Health and Safety Regulation 2011[4] Storage and Handling of Dangerous Goods Code of Practice 2005 WorkCover NSW[6]	General practices in conducting such risk assessments and putting in place controls are to reference codes of practice (which in the case of NSW appear to no longer have statutory force) and Australian Standards. These standards contain a considerable number of 'cascade' references to other documents. Reference to primary code shown at left. In practice the obligations imposed will be similar to the NZ system but the acceptable standard is less clear – e.g. following particular codes is 'evidential' rather than an absolute defence as in the NZ system.	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Emergency preparedness	The regulations contain general obligations to be prepared for emergencies include having in place fire fighting equipment and containing spills. Also emergency plan required if 'manifest quantity' exceeded (2500 kg). As the substance of dibenzoyl peroxide is not a liquid, secondary containment provisions not applicable. No requirements found in respect of the environmental hazards of dibenzoyl peroxide.	NSW Work Health and Safety Regulation 2011[4] NSW Environmentally Hazardous Chemicals Act 1985[7]	Some differences in detail from NZ requirements (although detail is sparse in NSW regulation) Regarded as equivalent for practical purposes.	**2**
Tracking	No requirement found within direct control on substance regulatory framework.			**2**
Qualified person in charge	No specific obligation found for a qualified person in charge of dibenzoyl peroxide.	NSW Work Health and Safety Regulation 2011[4]	NZ requires approved handler for quantities over 10kg. (NB: Australian Work health and safety legislation does include a general obligation for workers to be properly trained or supervised. This generic requirement is seen as equivalent to NZ Health and Safety in Employment law and so not specific to the substance or part of the chemicals control regime.)	**1**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Disposal	While not specifically controlled under the Environmentally Hazardous Chemicals Act, dibenzoyl peroxide disposal is likely to be captured as a scheduled process under the Protection of the Environment Operations Act. These operations are subject to site by site licensing designed to reduce emissions.	NSW Environmentally Hazardous Chemicals Act 1985[8] NSW Protection of the Environment Operations Act 1997[9]	The controls described do not provide the same level of specification as the NZ requirements for disposal but the effect is in most cases likely to be roughly equivalent. However the complexity of steps required is higher (e.g. requiring manifest tracking of the waste) so this requirement is scored as 3.	**3**
Tankwagon	Substance is a solid and package size limited – not applicable			**2**
Fixed bulk storage container	Substance is a solid and package size limited – not applicable			**2**
Score dibenzoyl peroxide Australia/NSW				**32**

[1] May be viewed here: http://www.comlaw.gov.au/Details/C2012C00082/Html/Text#_Toc313881260
[2] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+124+2009+cd+0+N
[3] May be obtained here: http://www.ntc.gov.au/filemedia/Publications/ADG7October2011.pdf
[4] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+674+2011+cd+0+N
[5] May be obtained here: http://safeworkaustralia.gov.au/AboutSafeWorkAustralia/WhatWeDo/Publications/Pages/Exposure-Standards-Airborne-Contaminants.aspx
[6] May be obtained here: http://www.workcover.nsw.gov.au/formspublications/publications/Pages/storageandhandlingofdangerousgoods.aspx
[7] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/act+14+1985+cd+0+N
[8] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/act+14+1985+cd+0+N
[9] May be viewed here: http://www.legislation.nsw.gov.au/viewtop/inforce/act+156+1997+ch.1-sec.1+0+N

1.3.3 Jurisdiction: Canada

Substance: Dibenzoyl peroxide CAS # 94-36-0

(Assumed for consistency 26- 77% water stabilised equivalent – i.e. UN # 3104)

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	Dibenzoyl peroxide is listed as a dangerous good in Transport of dangerous goods regulations and is covered by the Controlled products regulations under the Hazardous Products Act as it would be captured by its oxidising and toxic properties. The New Substances Notification Regulations which are Federal in extent require both environmental hazard data and (based on volume produced or imported) data about uses, likely exposure routes, and sources of discharge into the environment.	Federal) Hazardous Products Act[1] (Federal) Controlled Products Regulations[2] (Federal) Transport of Dangerous Goods regulations[3] (Federal) New Substances Notification Regulations (Chemicals and Polymers) (SOR/2005-247)[4]	Notwithstanding that this chemical is regarded as a substance under the GHS, dibenzoyl peroxide UN # 3104 is regarded as a mixture under the Controlled Products regulations. As dibenzoyl peroxide has an existing approval in most systems, this study focuses for the data required for approval of a new 'dibenzoyl peroxide'. Dibenzoyl peroxide as defined has properties which mean a 'new' dibenzoyl peroxide would meet the test criteria of the Transport of Dangerous Good s regulations. It would also be captured as an organic peroxide (oxidiser) mixture under the Hazardous Products Act and Controlled products Regulations. The classification criteria in the regulations have fewer categories than the EU CLP in respect of some toxic effects and no criteria for environmental effects. They also permit data from 'similar' chemicals. However further data is required under the New Substances Notification Regulations.	3

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Labelling	Labelling requirements at the federal level use different symbols from those specified under the GHS, including two symbols not specified by the GHS and excluding three GHS symbols. The label also requires a statement to the effect that a safety data sheet is available. The labels also require the pre-GHS R-phrases of the former EU system	Federal) Hazardous Products Act[1] (Federal) Controlled Products Regulations[2]	Requirements are significantly different from the GHS	**3**
Data sheet	Data sheet requirements listed are less than those for the standard GHS datasheet as environmental hazards and transport requirements are not specified.	(Federal) Hazardous Products Act[1] (Federal) Controlled Products Regulations[2]		**1**
Packaging	The Transport of Dangerous Goods regulations require packaging which complies with prescriptions in a Canadian Standard. From those parts of the standard visible to us, it appears that this standard essentially mirrors the packaging requirements of the UNRTDG, although it may be an earlier than 17th Edn.	(Federal) Transport of Dangerous Goods regulations[3]	On the basis of information available packaging requirement are assumed to be equivalent to the UNRTDG.	**2**
IBC	The Transport of Dangerous Goods regulations require use of IBC which comply with prescriptions in a Canadian Standard. From the FAQ available on the Transport Canada website these requirements appear to match those of the UNRTDG	(Federal) Transport of Dangerous Goods regulations[3] Transport Canada FAQ re IBC[5]		**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Exposure limit (tox.)	Workplace exposure limits are set in provincial legislation in Canada and Ontario legislation is used as an exemplar for these provincial requirements. . Neither of the two relevant regulations considered provide a workplace exposure limit for dibenzoyl peroxide.	(Province of Ontario) R.R.O. 1990, Regulation 833 Control Of Exposure To Biological or Chemical Agents[6] Ontario Regulation 490/09 Designated Substances[7]	These regulations also refer to values contained in a handbook published by the American Conference of Governmental Industrial Hygienists. We can find no reference to a value for diesel fuel from this organisation so it has been assumed that a value is not set. Further a table of threshold values published by the Ontario Ministry of Labour does not provide a value for dibenzoyl peroxide[8].	**2**
Exposure limit (ecotox.)	No requirement found		Assumed that no requirement set.	**2**
Physical hazard (initiation)	Requirements for managing physical hazards appear are set in provincial legislation in Canada and Ontario legislation is used as an exemplar for these provincial requirements. The Industrial establishment regulations do not impose chemical or chemical class specific requirements on organic peroxides. However, in reference to spray coating, the Ontario Fire Code does impose requirements to keep away from incompatible materials but not for temperature control.	(Province of Ontario) R.R.O. 1990, Regulation 851 Industrial Establishments[9] Ontario Regulation 213/07 -The Ontario Fire Code[10]	Requirements to prevent initiation of fire/ explosion for organic peroxides do not appear as complete as those in NZ. This finding checks with interest by Canadian officials in NZ control of this class of chemical and concerns raised by our local expert (federal level) contact.	**1**
Exposure limit heat/ blast	No requirement found specific to chemical or chemical class		NZ requires separation with fire rated walls	**1**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Emergency preparedness	No requirement for emergency response assistance plan under the (Federal) transport of dangerous good regulations No chemical or hazard class requirements found for this chemical.	(Federal) Transport of Dangerous Goods regulations[3]		**1**
Tracking	None found			**2**
Qualified person in charge	As dibenzoyl peroxide is a controlled product under the federal Controlled Products Regulations employers in Ontario are obliged to provide specific training for workers handling this chemical	Ontario Occupational Health and Safety Act: Regulation 860, Workplace Hazardous Materials Information System (WHMIS)[11]	Dibenzoyl peroxide in New Zealand has specified 'qualified person in charge' requirements. There are some differences in trigger quantities and scope of the knowledge to be provided, the requirements are judged as less than the NZ requirement for a specifically certificated person.	**1**
Disposal	Ontario regulation used as the exemplar requires hazardous waste to be manifest tracked and treated in licensed facilities. The definition of hazardous waste includes reactive waste so is presumed to include dibenzoyl peroxide. Guidance on the system is provided in the referenced Guidance manual.	(Ontario) R.R.O. 1990, Regulation 347 General — Waste Management[12] Registration Guidance Manual For Generators Of Liquid Industrial And Hazardous Waste (Replaces 0195e) December 2009[13]	Manifest tracking and disposal through licensed facilities is regarded as more complex than the New Zealand requirement	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Tankwagon	Dibenzoyl peroxide is a solid – not applicable (Also transport containers limited by size limits in the UNRTDG designed to reduce likelihood of self accelerated decomposition.)			**2**
Fixed bulk storage container	Substance is a solid – not applicable (Also transport containers limited by size limits in the UNRTDG designed to reduce likelihood of self accelerated decomposition.)			**2**
Score dibenzoyl peroxide Canada				**28**

[1] May be viewed here: http://laws-lois.justice.gc.ca/eng/acts/H-3/FullText.html
[2] May be viewed here: http://www.canlii.org/en/ca/laws/regu/sor-88-66/latest/sor-88-66.html#SCHEDULE_I__123238
[3] May be viewed here: http://www.tc.gc.ca/eng/tdg/clear-tofc-211.htm
[4] May be viewed here: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-247/index.html
[5] May be viewed here: http://www.tc.gc.ca/eng/tdg/moc-ibc-faqunstandardizedibcs-246.html#when
[6] May be viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900833_e.htm
[7] Maybe viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_090490_e.htm
[8] http://www.labour.gov.on.ca/english/hs/pubs/oel_table.php
[9] May be viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900851_e.htm#BK12
[10] May be viewed here: http://www.e-laws.gov.on.ca/html/source/regs/english/2007/elaws_src_regs_r07213_e.htm
[11] May viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900860_e.htm#BK5
[12] May be viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900347_e.htm#BK27
[13] May be obtained here: http://www.ene.gov.on.ca/environment/en/resources/STD01_076193.html

1.3.4 Jurisdiction: Ireland

Substance: Dibenzoyl peroxide CAS # 94-36-0

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	Ireland's laws directly put in place the CLP regulations – Chemicals Amendment Act as cited at left So requirements are as for the CLP.	Chemicals (Amendment) Act 2010[1] Regulation (EC) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP)[2] Regulation (EC) No 1907/2006 Of The European Parliament And Of The Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended)[3]	Dibenzoyl peroxide is already approved in the Irish regime. However this exercise considers the data required if a new 'dibenzoyl peroxide' came in to the Irish market. CLP regulations apply. However a 'new' dibenzoyl peroxide would be caught by REACH requirements leading to requirements for data more extensive than those of the CLP	3

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Labelling	Irish law directly puts in place CLP requirements – Chemicals Amendment Act as cited at left So requirements are as for the CLP.	Chemicals (Amendment) Act 2010[1] Regulation (EC) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP)[3]	CLP regulations apply through Irish law	**2**
Data sheet	Datasheet requirement under the Chemicals Act calls up REACH SDS (safety data sheet requirements)	Chemicals (Amendment) Act 2010[1] Regulation (EC) No 1907/2006 Of The European Parliament And Of The Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended)[4]	REACH data sheet requirement is equivalent to GHS	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Packaging	Irish law directly puts in place CLP requirements – Chemicals Amendment Act as cited at left So requirements are as for the CLP.	Chemicals (Amendment) Act 2010[1] Regulation (EC) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP)[3]		**2**
IBC	Regulations cited reference ADR for IBC	European Communities (Carriage of Dangerous Goods by Road and Use of Transportable Pressure Equipment) Regulations 2011[4] European Agreement concerning the International Carriage of Dangerous Goods by Road webpage[4]	ADR (European Agreement concerning the International Carriage of Dangerous Goods by Road) appears to be consistent with UNRTDG for IBCs	**2**
Exposure limit (tox.)	8 hour occupational exposure limit provided in the cited regulation and code	Safety, Health and Welfare At Work (Chemical Agents) Regulations, 2001[5] Code of Practice for the Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001[6]	No exposure limit set in NZ requirements so Irish legislation is more stringent	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Exposure limit (ecotox.)	No limit found for dibenzoyl peroxide in the regulations	European Communities Environmental Objectives (Surface Waters) Regulations 2009[7]		**2**
Physical hazard (initiation)	No specific requirements to manage either dibenzoyl peroxide or organic peroxides generally were found.	Safety, Health and Welfare At Work Act, 1989[8]	The Safety Health and Welfare at Work Act contains general duties to identify and take steps to reduce hazards in the workplace. However these are seen as equivalent to general obligations in other workplace law (e.g. the NZ Health and Safety in Employment Act) and so not chemical specific	**1**
Exposure limit heat/ blast	No specific requirements were found			**1**
Emergency preparedness	Requirements include • Adequate numbers of fire extinguishers • Emergency plans for larger quantities through the European Communities (Control of Major Accident Hazards...) regulations [The European Communities (Control of Major Accident Hazards...) regulations appear to replicate the EU COMAH or Seveso II directive]	Safety, Health and Welfare at Work (General Application) Regulations 2007[9] European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2006[10]	This assessment assumes that dibenzoyl peroxide is captured under the cited control of major accident hazards regulation because of its oxidising and flammable properties. The combination of general duties and specific requirements (for quantities above 50 tonnes) are approximately equivalent to NZ requirements although less specific.	**2**
Tracking	No specific requirement found			**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Qualified person in charge	No specific requirement found			**1**
Disposal	Dibenzoyl peroxide is captured as a hazardous waste by reason of its flammability and oxidising effect (second Schedule part III) in the Waste Management Act. The Act provides a regime controlling the handling of hazardous waste and requires its sending to treatment facilities and landfills subject to permitting under the Act. Individual permits under the permitting provisions set site specific limits on emissions.	Waste Management Act, 1996 (as amended)[11]	The controls described do not provide the same level of specification as the NZ requirements for disposal but the effect is in most cases likely to be roughly equivalent. However the complexity of steps required is higher so this requirement is scored as 3	**3**
Tankwagon	Substance is a solid – not applicable			**2**
Fixed bulk storage container	Substance is a solid – not applicable			**2**
		Score dibenzoyl peroxide Ireland		**30**

[1] May be obtained here: http://www.hsa.ie/eng/Legislation/Acts/Chemicals_Acts_2008_and_2010_and_the_Guide/Chemicals_Act_No_32_of_2010_pdf.pdf
[2] May be obtained here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:353:0001:1355:en:PDF
[3] May be obtained here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1907:20111210:EN:PDF
[4] http://www.unece.org/trans/danger/publi/adr/adr2011/11ContentsE.html
[5] May be viewed here: http://www.irishstatutebook.ie/2001/en/si/0619.html

[6] May be obtained here:
http://www.hsa.ie/eng/Publications_and_Forms/Publications/Chemical_and_Hazardous_Substances/Code_of_Practice_Chemical_Agent_Regulations_2011.pdf
[7] May be obtained here: http://www.environ.ie/en/Legislation/Environment/Water/FileDownLoad,20824,en.pdf
[8] May be viewed here: http://www.irishstatutebook.ie/1989/en/act/pub/0007/index.html
[9] May be viewed here: http://www.irishstatutebook.ie/2007/en/si/0299.html
[10] May be viewed here: http://www.irishstatutebook.ie/2006/en/si/0074.html#sched1-partii
[11] May be viewed here : http://www.irishstatutebook.ie/1996/en/act/pub/0010/print.html

1.3.5 Jurisdiction: Japan

Substance: Dibenzoyl peroxide CAS # 94-36-0

Assumed for consistency 26- 77% water stabilised equivalent – i.e. UN # 3104

NB: Descriptions as supplied by Prof. Hiroshi Jonai, Professor of Medical and Welfare Engineering, Graduate School of Science and Technology- Nihon University, Tokyo. All Japanese law and regulations are available only in Japanese so the descriptions below are referenced to the translated titles of the relevant legislation only (references supplied by Prof. Jonai). Scoring is based on our judgements from the information provided by Jonai.

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	Jonai advises that data is generally required for peroxide solid or liquid to classify hazards by tests defined by Fire and Disaster Management Act. The tests required are different from UNRTDG Tests and Criteria manual No requirements for classification with respect to toxicity	Fire and Disaster Management Act	Jonai advises that assessment or self classification data not required for dibenzoyl peroxides as it is already listed in the relevant legislation. However, this exercise considers the data required if a new 'dibenzoyl peroxide' came on to the market. Score is on the basis that the test indicated would be required and UNRTDG Tests and criteria tests would not be accepted.	**3**
Labelling	Label requirements are different from the GHS As specific terms in Kanji (Japanese/ Chinese characters) are required The required terms are different from the GHS words translated into Japanese.	Fire and Disaster Management Act	A specific label will be required for Japan making this control more stringent than the GHS	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Data sheet	Japan's SDS requirements are equivalent to the GHS	Industrial Safety and Health Act		**2**
Packaging	Requirements are equivalent to the UNRTDG 16th Edn, however there are specific requirements for carriage of goods in tunnels under water (special legislation)	Civil Aeronautics Act Ship Safety Act Road Act	The special legislation for carriage in tunnels under water is regarded as special requirements over and above basic packaging requirements (e.g. comparable to special restrictions on carriage of certain dangerous good by air) Scored as equivalent to UNRTDG.	**2**
IBC	Not applicable. UNRTDG limits package size to 50 kg as a result of the properties of this type of organic peroxide			**2**
Exposure limit (tox.)	No entry			**2**
Exposure limit (ecotox.)	No entry			**2**
Physical hazard (initiation)	Requirements to separate from incompatible substances, ignition sources and control temperature to below 55^{O}C	Fire and Disaster Management Act	For practical purposes equivalent to NZ controls	**2**
Exposure limit heat/ blast	Requirements for separation distances and fire resistant walls in relevant of a building at the storage location	Fire and Disaster Management Act	For practical purposes equivalent to NZ controls	**2**
Emergency preparedness	Quantities equal to or more than 10kg require fire fighting equipment at storage location	Fire and Disaster Management Act	No information about emergency response plans so on the basis of available information less stringent than NZ controls	**1**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Tracking	No requirement			**2**
Qualified person in charge	Quantities equal to or more than 10kg require hazardous materials officer qualified by a national examination Knowledge needed: laws concerned, physics and chemistry, hazard, fire prevention and extinguishing measures	Fire and Disaster Management Act		**2**
Disposal	Required to be separated from other waste and ignition sources.	Waste Management and Public Cleansing Act		**2**
Tankwagon	Not applicable. UNRTDG limits package size to 50 kg as a result of the properties of this type of organic peroxide			**2**
Fixed bulk storage container	Substance is a solid – not applicable			**2**
Score dibenzoyl peroxide Japan				**31**

1.3.6 Jurisdiction: United Kingdom

Substance: Dibenzoyl peroxide CAS # 94-36-0

(Assumed for consistency 26- 77% water stabilised equivalent – i.e. UN # 3104)

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	Dibenzoyl peroxide (as described – i.e. UN#3104) is a dangerous substances under the CHIP 4 regulations and requires a person supplying such substances to make 'themselves aware of all relevant and accessible data that may exist' in relation to the substance.	The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 [UK regulation][1] Regulation (EC) No 1907/2006 Of The European Parliament And Of The Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended)[2]	Dibenzoyl peroxide is already approved in the UK regime. However this exercise considers the data required if a new 'dibenzoyl peroxide' came on to the UK market. CHIP regulation is interpreted as equivalent the self classification requirement of the CLP. However a 'new' dibenzoyl peroxide would be caught by REACH requirements leading to requirements for data more extensive than those of the CLP.	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Labelling	Labelling requirements contained in the CHIP 4 regulations still require the Pre-GHS R and S phrases of the 1967 EC directive. Symbols and other information required are annexed in the regulation and are also not consistent with the GHS 'label' requirements. Some additional information required (e.g. EC number – see regulation 7) and exemptions for small packages	The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 [UK regulation][1] Globally Harmonized System of Classification and Labelling of Chemicals (GHS) Fourth revised edition United Nations, 2011[3]	The CHIP 4 regulation requirements are different from those of the GHS and so a different label (from GHS or Transport/GHS) would be required for the UK.	**3**
Data sheet	Datasheet required for dangerous substances – form of required information is consistent with GHS.	CHIP 4 Webpage describes requirement as the same as that under REACH [4] (empowering legislation is not clear) Further detail on HSE REACH pages[5]	REACH data sheet requirement is equivalent to GHS	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Packaging	CHIP 4 regulations cross refer to Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007 which in turn cross refer to European RID ADR document for package requirements. These appear to be a more chemical specific version of the UNRTDG requirements using largely the same performance level. Dangerous good in limited quantity also provided for. Packages specifically meeting maritime and air transport requirements are also permitted.	The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 [UK regulation][1] Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007[6] European Agreement concerning the International Carriage of Dangerous Goods by Road webpage[7]	The UK regulations do not appear to provide 'basic' packaging requirements but rather simply permit packages which are acceptable for any transport mode.	**2**
IBC	Not applicable. UNRTDG limits package size to 50 kg as a result of the properties of this type of organic peroxide			**2**
Exposure limit (tox.)	Workplace exposure limit (long term exposure) set under	The Control of Substances Hazardous to Health Regulations 2002[8] EH40/2005 Workplace exposure limits[9]	No exposure limits set in the NZ framework	**3**
Exposure limit (ecotox.)	Only reference available appears to be to law for permitting certain types of facilities. No reference found to exposure limits as such for dibenzoyl peroxide	The Environmental Permitting (England and Wales) Regulations 2010[10]	From the information available assumed equivalent to NZ (no limit set)	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Physical hazard (initiation)	The Dangerous Substances and Explosive Atmospheres regulations require a risk assessment and the taking of a hierarchy of actions for all dangerous substances (including organic peroxides) Reference is made to control of ignition sources and segregation of incompatible substances	(UK)Dangerous Substances and Explosive Atmospheres Regulations 2002[11]	The controls imposed are framed as duties on the operator and are a mix of performance and prescription. The effect of the controls is generally equivalent to the controls in the NZ (HSNO) system although references are less specific	**2**
Exposure limit heat/ blast	None found specific to dibenzoyl peroxide	(UK)Dangerous Substances and Explosive Atmospheres Regulations 2002[11] The Regulatory Reform (Fire Safety) Order 2005[12]	Obligations placed in the 'Fire Safety Order' are generic and relate largely to providing means of escape from fires	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Emergency preparedness	Dibenzoyl peroxide is classified as 'oxidising' for the purposes of the Control of major accident hazard (COMAH) regulations. General duties to control accidents apply for quantities above 50 tonnes and specific requirements for emergency plans apply for quantities above 200 tonnes. For smaller quantities the Management of Health and Safety at work regulations also apply, these impose general duties to assess risks to workers health and safety and provide necessary means to manage.	Control of Major Accident Hazards Regulations 1999 as amended [13] Management of Health and Safety at Work Regulations 1999[14]	The combination of general duties and specific requirements for large quantities has the effect of making the requirements more stringent but less specific than NZ controls – e.g. NZ control specify what is required whereas UK regulations require processes to meet general duties. Quantity limits are larger than for NZ regulations.	**3**
Tracking	No tracking requirements found			**2**
Qualified person in charge	UK Management of Health and Safety at work regulations require employers to appoint a person with health and safety knowledge	Management of Health and Safety at Work Regulations 1999[8]	Regulations similar to general requirements in the NZ Health and Safety in employment regulations and not chemical specific. Less stringent than NZ which requires specific expertise for handling even fairly modest quantities (greater than 10kg)	**1**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Disposal	The hazardous properties of dibenzoyl peroxide (e.g. oxidising nature) make it a hazardous waste in the Hazardous Waste regulations and the Scottish Special Waste Regulations. These regulations control handling of hazardous waste and require its sending to treatment facilities and landfills subject to the Environmental Permitting (England and Wales) Regulations. These regulations implement the EU's Integrated Pollution Prevention and Control (IPPC) Directive. Individual permits under the permitting regulations set site specific limits on emissions	Hazardous Waste (England and Wales)Regulations 2005 (amended 2009)[15] The Environmental Permitting (England and Wales) Regulations 2007[16] Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control[17].	The controls described do not provide the same level of specification as the NZ requirements for disposal but the effect is in most cases likely to be roughly equivalent. However the complexity of steps required is higher so this requirement is scored as 3	**3**
Tankwagon	Not applicable – the substance is a solid and in any case quantities in a single container are limited to 50 kg by the UNRTDG			**2**
Fixed bulk storage container	Not applicable – the substance is a solid and in any case quantities in a single container are limited to 50 kg by the UNRTDG			**2**
	Score dibenzoyl peroxide United Kingdom			**34**

[1] May be viewed here: http://www.legislation.gov.uk/uksi/2009/716/contents/made
[2] May be obtained here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1907:20111210:EN:PDF
[3] May be obtained here: http://www.unece.org/trans/danger/publi/ghs/ghs_rev04/04files_e.html

[4] http://www.hse.gov.uk/chip/law.htm
[5] http://www.hse.gov.uk/reach/resources/reachsds.pdf
[6] May be viewed here http://www.legislation.gov.uk/uksi/2007/1573/regulation/51/made
[7] http://www.unece.org/trans/danger/publi/adr/adr2011/11ContentsE.html
[8] May be viewed here: http://www.legislation.gov.uk/uksi/2002/2677/contents/made
[9] May be obtained here: http://www.hse.gov.uk/pubns/books/eh40.htm
[10] May be viewed here: http://www.legislation.gov.uk/ukdsi/2010/9780111491423/contents.
[11] May be viewed here: http://www.legislation.gov.uk/uksi/2002/2776/contents/made
[12] May be obtained here: http://www.legislation.gov.uk/uksi/2005/1541/pdfs/uksi_20051541_en.pdf
[13] May be viewed here: http://www.legislation.gov.uk/uksi/1999/743/schedule/1/made
[14] May be viewed here: http://www.legislation.gov.uk/uksi/1999/3242/contents/made
[15] May be viewed here: http://www.legislation.gov.uk/uksi/2005/894/contents/made
[16] May be viewed here: http://www.legislation.gov.uk/uksi/2007/3538/contents/made
[17] May be viewed here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008L0001:EN:NOT

1.4 Diesel fuel CAS# 68476-34-6

1.4.1 Jurisdiction: New Zealand

(Hazard classification as shown in NZ system- provided to assist referencing NZ regulations and standards only:

3.1D Flammable liquid class D

6.1E acute toxic class E

6.3B Skin irritant class B

6.7B carcinogen class B

9.1B aquatic ecotoxic class B)

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Assessment data	Diesel fuel (listed as 'Diesel fuel (automotive gas oil and marine diesel fuel)') has an existing approval (#HSR001441) so no further data is required. The listing for this substance in the NZIOC states 'Fuels, diesel, no. 2 (68476-34-6) may be used as a single component chemical under an appropriate group standard'. This suggests that were a 'new' diesel fuel to be introduced there would be an applicable group standard – allowing self classification. However which of the current groups standards would apply is not obvious from the titles of group standards on the EPA website.	EPA Database – controls for approved hazardous substances Diesel fuel (automotive gas oil and marine diesel fuel)[1] NZ Inventory of Chemicals – NZ EPA website – entry for CAS# 68476-34-6[2]	NZIOC entry taken at face value so score assigned as 1	**1**
Labelling	Labelling requirements are performance version of GHS (i.e. GHS label would comply) but regulation also explicitly permits use of UNRTDG label as complying. However regulation 18(c) of the HSNO Hazardous substances identification regulations requires information about possible changes which might cause the substance to become more hazardous in a closed container. Emergency management regulations also apply and require information on the first aid for exposure to the substance on the label along with emergency service contact.	EPA Database – controls for approved hazardous substances Diesel fuel (automotive gas oil and marine diesel fuel)1 Hazardous substances Identification regulations 2001[3] Hazardous substances (Emergency Management) Regulations 2001[4]	No known self reactions in container to form new substance hazards. First aid and emergency contact are in addition to GHS basic requirement. GHS does contain power for competent authority to require additional information but this will increase costs or jurisdictions where this is not required.	**3**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Data sheet	Requirements set out in Hazardous substances Identification regulations, includes specified requirements for information about ecotoxicity and toxicity.	EPA Database – controls for approved hazardous substances Diesel fuel (automotive gas oil and marine diesel fuel)[1] Hazardous substances Identification regulations 2001[3]	GHS compliant datasheet (in English) would comply with requirements. It is assumed that the specific wording of the regulation is equivalent to the relevant sections of the GHS requirement.	**2**
Packaging	Requirements set out in the Hazardous Substances (Packaging) Regulations – these are a performance translation of the UNRTDG 14th Edn Packaging requirements (UNPGIII requirements). NB: includes requirements which translate the ‘Dangerous Goods in limited quantity’ requirements of this edition of the UNRTDG	EPA Database – controls for approved hazardous substances Diesel fuel (automotive gas oil and marine diesel fuel)[1] Substances (Packaging) Regulations 2001[5]	UNRTDG 17th Edn assigns packaging group III to diesel fuel (see dangerous goods list in UNRDTDG 17th Edn) so NZ requirements are equivalent to UNRTDG with the possible exception of dangerous goods in limited quantity provisions which are not seen as relevant for diesel fuel.	**2**
IBC	Requirements for transportable containers are set out in the Hazardous Substances (Tankwagons and Transportable Containers) regulations Part 6	EPA Database – controls for approved hazardous substances Diesel fuel (automotive gas oil and marine diesel fuel)[1] Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004[6]	The referenced regulations directly refer to UNRTDG 14th Edn	**2**
Exposure limit (tox.)	No requirement set and no WES listed	EPA Database – controls for approved hazardous substances Diesel fuel (automotive gas oil and marine diesel fuel)[1]		**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Exposure limit (ecotox.)	No requirement set	EPA Database – controls for approved hazardous substances Diesel fuel (automotive gas oil and marine diesel fuel)1		**2**
Physical hazard (initiation)	Regulations require: controls which provide for various combinations of • Controlling vapour limits to outside upper and lower explosive limits (including where modified by different oxygen concentrations • Exclusion of ignition sources • Earthing of equipment capable of conducting electricity • Establishment of hazardous atmosphere zones to delimit the places where controls and equipment must meet certain conditions Except where ignition is intended	EPA Database – controls for approved hazardous substances Diesel fuel (automotive gas oil and marine diesel fuel)1 Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001[7]	Hazardous substance regulations are performance based and cross refer to various standards and prescriptive requirements in other regulations etc as accepted means of compliance. The regulations allow for • Increased and reduced oxygen atmospheres • Specification of ignition energies for individual substances ...so are unusually thorough in providing for unusual circumstances without reference to secondary risk analyses etc.	**2**
Exposure limit heat/ blast	No requirement stated	EPA Database – controls for approved hazardous substances Diesel fuel (automotive gas oil and marine diesel fuel)1		**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Emergency preparedness	Fire extinguisher required for storage of more than 250l Secondary containment systems required for quantities in excess of 10,000l Emergency response plan required where quantity greater than 10,000l Signage specifying the actions to be taken in an emergency required if quantity greater than 10,000l	EPA Database – controls for approved hazardous substances Diesel fuel (automotive gas oil and marine diesel fuel)[1] Hazardous substances (Emergency Management) Regulations 2001[4]		**2**
Tracking	Tracking not required	EPA Database – controls for approved hazardous substances Diesel fuel (automotive gas oil and marine diesel fuel)[1]		**2**
Qualified person in charge	No requirement for qualified qualified person in charge	EPA Database – controls for approved hazardous substances Diesel fuel (automotive gas oil and marine diesel fuel)[1]		**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Disposal	Disposal requires either • Export as waste in compliance with Basel etc conventions; • Treating to make no longer a hazardous substance Notes Discharge to landfill not permitted Treating by combustion is subject to limits on exposure to heat radiation	EPA Database – controls for approved hazardous substances Diesel fuel (automotive gas oil and marine diesel fuel)1 Hazardous Substances (Disposal) Regulations 2001[8]		**2**
Tankwagon	Diesel must carried in bulk in tankwagons which meet specified conditions of strength, corrosion resistance, impact resistance, stability, protection of load and operator from fire, and protection from collision with other vehicles. Tankwagons must be certified as meeting requirements. (Test certificate)	EPA Database – controls for approved hazardous substances Diesel fuel (automotive gas oil and marine diesel fuel)1 Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004[9]		**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Fixed bulk storage container	No requirements listed for fixed bulk storage in HSNO website controls database. However the transfer notice used for diesel lists specific prescriptive requirements for bulk storage for liquids of the class(es) into which diesel falls. In general these requirements reference API and some BSI standards for tank design. New Zealand standards are referenced for seismic and wind loading.	EPA Database – controls for approved hazardous substances Diesel fuel (automotive gas oil and marine diesel fuel)1 Summary of Approvals of Substances transferred under the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (As Amended)[10]	In general the requirements for fixed bulk storage are internationalised by reference to API and BSI standards (and some others as alternates) However the requirements include New Zealand specific obligations for wind loadings and seismic loadings	**2**
Score diesel fuel New Zealand				**30**

[1] http://www.epa.govt.nz/search-databases/Pages/controls-details.aspx?SubstanceID=3187&AppID=3279
[2] http://www.epa.govt.nz/search-databases/Pages/nzioc-details.aspx?SubstanceID=8568
[3] May be obtained here: http://www.legislation.govt.nz/regulation/public/2001/0124/latest/link.aspx?search=ts_regulation_hazardous+substances_resel&p=1
[4] May be found here: http://www.legislation.govt.nz/regulation/public/2001/0123/latest/whole.html?search=ts_regulation_hazardous+substances_resel&p=1#dlm43173
[5] May be obtained here http://www.legislation.govt.nz/regulation/public/2001/0118/latest/whole.html?search=ts_regulation_hazardous+substances_resel&p=1#dlm40764
[6] May be obtained here: http://www.legislation.govt.nz/regulation/public/2004/0046/latest/whole.html?search=ts_regulation_hazardous+substances_resel&p=1#DLM247045
[7] May be obtained here: http://www.legislation.govt.nz/regulation/public/2001/0116/latest/whole.html?search=ts_regulation_Hazardous+substances_resel&p=1#DLM37395
[8] May be obtained here: http://www.legislation.govt.nz/regulation/public/2001/0119/latest/whole.html?search=ts_regulation_hazardous+substances_resel&p=1#DLM41692

[9] May be obtained here:
http://www.legislation.govt.nz/regulation/public/2004/0046/latest/DLM245670.html?search=ts_regulation_Hazardous+substances_resel&p=1&sr=1

[10] http://www.epa.govt.nz/Publications/Transfer-Notice-35-2004.pdf

1.4.2 Jurisdiction: Australia/NSW

Substance: Diesel fuel CAS# 68476-34-6

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Assessment data	NSW Requirements in two parts: • Diesel is regarded as a combustible liquid and so covered by the Australian Dangerous Goods code (which is called up by NSW law) so data required to ascertain flammability as per UNRTDG Manual of Tests and criteria • Other hazardous properties, including biological hazards, where classification matches that of the GHS and requirement is to determine if the substance is a hazardous chemical and what class/ category it falls in to. NSW requirements are overlaid by the Commonwealth level NICNAS requirements, which require information about hazardous properties production volumes, uses locations etc	Industrial Chemicals (Notification and Assessment) Act[1] NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3] NSW Work Health and Safety Regulation 2011[4]	As diesel has an existing approval in most systems, this study focuses for the data required for approval of a new 'diesel fuel'. The requirements for data in the NSW system reference either the UNRTDG Tests and Criteria or the GHS. As the GHS itself references the UNRTDG for criteria with respect to physical hazards, the NSW system is regarded as equivalent to the CLP. However The NSW plus Australian chemical notification requirements require information with similarities to REACH	**3**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Labelling	No Label requirements as a result of physical hazards as the flash point is in excess of 60^{O}C. Work health and safety (hazardous substances) Label requirement matches GHS unless the substance is a scheduled drug or poison but also requires identity of ingredients	NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] NSW Work Health and Safety Regulation 2011[4]	Requirement more stringent than GHS label because of obligation to list ingredient in mixture (diesel fuel is a mixture)	**3**
Data sheet	Data sheet requirements match those of the GHS although some detail is omitted and the GHS building block principle is used (e.g. Acute toxic category 5 not used)	NSW Work Health and Safety Regulation 2011[4]	GHS compliant data sheet would be acceptable noting that • There are obligations to update at fixed intervals • GHS means of dealing with commercial in confidence information is interpreted locally	**2**
Packaging	No dangerous goods for transport requirement – see description under labelling (not classified as flammable liquid) Workplace requirements are generic only	NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] NSW Work Health and Safety Regulation 2011[4]	UNRTDG 17th does not specify packaging requirements for substances with flash point above 60^{O}C. But UNRTDG 17th Edn dangerous good list lists diesel fuel as PGIII, so the NSW control less stringent than UNRTDG	**1**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
IBC	No dangerous goods for transport requirement – see description under labelling (not classified as flammable liquid) Workplace regulations make generic reference to IBC as specified in the ADR but no clear if this compels ADR specification IBC	NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] NSW Work Health and Safety Regulation 2011[4]	Since IBC are multimodal and UNRTDG 17th Edn lists IBC requirements in dangerous goods list for diesel the transport requirement (and potentially the workplace requirement) are less stringent than the UNRTDG	**1**
Exposure limit (tox.)	No listing found			**2**
Exposure limit (ecotox.)	No listing found			**2**
Physical hazard (initiation)	Legislative requirements are not specific to either diesel or flammable liquids. Instead relevant regulation (workplace safety) requires a risk assessment and the putting in place of steps to minimise risks. Hazardous atmospheres are mentioned as a specific type of risk.	NSW Work Health and Safety Regulation 2011[4] Storage and Handling of Dangerous Goods Code of Practice 2005 WorkCover NSW[5] AS 1940 - 2004 Storage and handling of flammable and combustible liquids[6]	General practices in conducting such risk assessments and putting in place controls are to reference codes of practice (which in the case of NSW appear to no longer have statutory force) and Australian Standards. These standards contain a considerable number of 'cascade' references to other documents. References to some primary standards and documents are shown at left. In practice the obligations imposed will be similar to the NZ system but the acceptable standard is less clear – e.g. following particular codes is 'evidential' rather than an absolute defence as in the NZ system.	**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Exposure limit heat/ blast	Legislative requirements are not specific to either diesel or flammable liquids. Instead relevant regulation (workplace safety) requires a risk assessment and the putting in place of steps to minimise risks. No specific mention is made of heat or blast effects in regard to flammable or combustible liquids.	NSW Work Health and Safety Regulation 2011[4] Storage and Handling of Dangerous Goods Code of Practice 2005 WorkCover NSW[6]	General practices in conducting such risk assessments and putting in place controls are to reference codes of practice (which in the case of NSW appear to no longer have statutory force) and Australian Standards. These standards contain a considerable number of 'cascade' references to other documents. References to some primary standards and documents are shown at left. In practice the obligations imposed will be similar to the NZ system but the acceptable standard is less clear.	**2**
Emergency preparedness	The regulations contain general obligations to be prepared for emergencies and include having in place fire fighting equipment and containing spills. As diesel is not within the limits of flammability or toxicity specified for hazardous chemicals there is no specific obligation of emergency plans regardless of quantity. No requirements found in respect of the environmental hazards of diesel.	NSW Work Health and Safety Regulation 2011[4] NSW Environmentally Hazardous Chemicals Act 1985[7]	The absence of a requirement for emergency plans makes the NSW system less stringent than the NZ system.	**1**
Tracking	No general tracking requirement for diesel			**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Qualified person in charge	No specific obligation found for a qualified person in charge of diesel	NSW Work Health and Safety Regulation 2011[4]	Australian Work health and safety legislation does include a general obligation for workers to be properly trained or supervised. This generic requirement is seen as equivalent to NZ Health and Safety in Employment law and so not specific to the substance or part of the chemicals control regime.	**2**
Disposal	While not specifically controlled under the Environmentally Hazardous Chemicals Act, diesel fuel disposal is likely to be captured as a scheduled process under the Protection of the Environment Operations Act. These operations are subject to site by site licensing designed to reduce emissions.	NSW Environmentally Hazardous Chemicals Act 1985[7] NSW Protection of the Environment Operations Act 1997[8]	The controls described do not provide the same level of specification as the NZ requirements for disposal but the effect is in most cases likely to be roughly equivalent. However the complexity of steps required is higher (e.g. requiring manifest tracking of the waste) so this requirement is scored as 3.	**3**
Tankwagon	Under the Dangerous Good regulations tankwagons (called tank vehicles in the regulations) must comply with the Australian Dangerous Goods Code. The Good then calls up AS 2809.1 & 2 for specific requirements.	NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3] Approval of a dangerous goods road tank vehicle design- webpage[9]	While we do not have access to full copies of the two AS cited, review of preview portions of these documents and of the compliance report templates provided on the 'approval of dangerous goods road tank vehicle…' web page indicates the requirements are prescriptive and similar to the performance requirements of the NZ regulations.	**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Fixed bulk storage container	Legislative requirements are not specific to either diesel or flammable liquids. Instead relevant regulation (workplace safety) requires a risk assessment and the putting in place of steps to minimise risks. No specific references to atmospheric bulk storage tanks can be found.	NSW Work Health and Safety Regulation 2011[4] AS 1940 The Storage and Handling of Combustible and Flammable liquids[6]	General practices in conducting such risk assessments and putting in place controls are to reference codes of practice (which in the case of NSW appear to no longer have statutory force) and Australian Standards. These standards contain a considerable number of 'cascade' references to other documents. References to some primary standards and documents are shown at left. From the references within AS1940 it would appear that controls do not specifically add seismic and wind loading requirements to the cited design standards which are assumed equivalent to those cited in NZ requirements. Because of this control are regarded as less stringent than NZ	**1**
Score diesel fuel Australia/ NSW				**29**

[1] May be viewed here: http://www.comlaw.gov.au/Details/C2012C00082/Html/Text#_Toc313881260
[2] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+124+2009+cd+0+N
[3] May be obtained here: http://www.ntc.gov.au/filemedia/Publications/ADG7October2011.pdf
[4] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+674+2011+cd+0+N
[5] May be obtained here: http://www.workcover.nsw.gov.au/formspublications/publications/Pages/storageandhandlingofdangerousgoods.aspx
[6] May be obtained here: http://infostore.saiglobal.com/store/Details.aspx?ProductID=253546
[7] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/act+14+1985+cd+0+N
[8] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N
[9] http://www.environment.nsw.gov.au/dangerousgoods/tankdesign.htm

1.4.3 Jurisdiction: Canada

Substance: Diesel fuel CAS# 68476-34-6

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Assessment data	Diesel fuel is listed as a dangerous good in Transport of dangerous goods regulations and is covered by the Controlled products regulations as a result of by its flammability and toxic properties. The New Substances Notification Regulations which are Federal in extent require both environmental hazard data and (based on volume produced or imported) data about uses, likely exposure routes, and sources of discharge into the environment.	(Federal) Hazardous Products Act[1] (Federal) Controlled Products Regulations[2] (Federal) Transport of Dangerous Goods regulations[3] (Federal) New Substances Notification Regulations (Chemicals and Polymers) (SOR/2005-247)[4]	As diesel has an existing approval in most systems, this study focuses for the data required for approval of a new 'diesel fuel'. Diesel fuel's properties mean a 'new diesel' would not meet the test criteria of the Transport of Dangerous Good s regulations but would be captured as a combustible liquid under the Hazardous Products Act and Controlled products Regulations. The classification criteria in the regulations have fewer categories than the EU CLP in respect of some toxic effects and no criteria for environmental effects. They also permit data from 'similar' chemicals. However, further data is required under the New Substances Notification Regulations.	**3**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Labelling	Labelling requirements at the federal level use different symbols from those specified under the GHS, including two symbols not specified by the GHS and excluding three GHS symbols. The label also requires a statement to the effect that a safety data sheet is available and requires the use of pre-GHS R-phrases of the former EU system	(Federal) Hazardous Products Act[1] (Federal) Controlled Products Regulations[2]	Requirements are significantly different from the GHS	**3**
Data sheet	Data sheet requirements listed are less than those for the standard GHS datasheet as environmental hazards and transport requirements are not specified.	(Federal) Hazardous Products Act[1] (Federal) Controlled Products Regulations[2]		**1**
Packaging	The Transport of Dangerous Goods regulations require packaging which complies with prescriptions in a Canadian Standard. From those parts of the standard visible to us, it appears that this standard essentially mirrors the packaging requirements of the UNRTDG, although it may be an earlier than 17th Edn.	(Federal) Transport of Dangerous Goods regulations[3]	On the basis of information available packaging requirement are assumed to be equivalent to the UNRTDG.	**2**
IBC	The Transport of Dangerous Goods regulations require use of IBC which comply with prescriptions in a Canadian Standard. From the FAQ available on the Transport Canada website these requirements appear to match those of the UNRTDG	(Federal) Transport of Dangerous Goods regulations[3] Transport Canada FAQ re IBC[5]		**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Exposure limit (tox.)	Workplace exposure limits are set in provincial legislation in Canada and Ontario legislation is used as an exemplar for these provincial requirements. Neither of the two relevant regulations considered provide a workplace exposure limit for diesel fuel.	(Province of Ontario) R.R.O. 1990, Regulation 833 Control Of Exposure To Biological or Chemical Agents[6] Ontario Regulation 490/09 Designated Substances[7]	These regulations also refer to values contained in a handbook published by the American Conference of Governmental Industrial Hygienists. We can find no reference to a value for diesel fuel from this organisation so it has been assumed that a value is not set. Further a table of threshold values published by the Ontario Ministry of Labour does not provide a value for diesel fuel[8].	**2**
Exposure limit (ecotox.)	No requirement found		Assumed that no requirement is set.	**2**
Physical hazard (initiation)	Requirements for managing physical hazards appear are set in provincial legislation in Canada and Ontario legislation is used as an exemplar for these provincial requirements. The Industrial establishment regulations contain general requirements for ventilation and exclusion of ignition sources for handling flammable liquids but do not refer to either specific technical requirements or performance standards. The Ontario Fire Code does require specific types of electrical equipment for places where combustible liquids (including diesel) are and cross refers to the province's electrical regulations.	(Province of Ontario) R.R.O. 1990, Regulation 851 Industrial Establishments[9] Ontario Regulation 213/07 -The Ontario Fire Code[10]	Guidance referenced on the Ontario Ministry of Labour website references hazardous zones which appear to cross refer to electrical regulations. Total requirements are distributed but seen as similar in effect to NZ requirements	**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Exposure limit heat/ blast	Requirements appear to be at provincial level and using Ontario as the exemplar, generic requires for flammables are set out in the Ontario Fire Code – largely as specifications for fire rated walls.	Ontario Regulation 213/07 -The Ontario Fire Code[10]	Fire rating is generally greater than for equivalent NZ requirements which would translate to higher construction costs.	**3**
Emergency preparedness	Part 7 of the Transport of Dangerous Goods Regulations require the consigner to provide an Emergency response assistance plan where very large quantities (effectively whole train loads) of diesel fuel are consigned. Federal regulations for petroleum storage tanks specify secondary containment requirements for bulk storage tanks (but not apparently large scale storage in drums or other packages) which are similar to New Zealand. Requirements by reference to joint provincial code of practice. At provincial level, using the province of Ontario as the exemplar, requirements are contained in the Ontario Fire Code and include obligations to provide fire extinguishers, spill control and provision of fire safety plans.	(Federal) Transport of Dangerous Goods regulations[3] (federal regulation) Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations SOR/2008-197[11] Canadian Council of Ministers of the Environment's Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products[12] Ontario Regulation 213/07 -The Ontario Fire Code[10]	Secondary containment requirements found at the federal level appear to apply only to bulk storage tanks. The requirements of the Ontario fire code are highly prescriptive but the overall level of obligation is similar to that required for large volumes under the NZ requirements.	**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Tracking	No requirement found			**2**
Qualified person in charge	Diesel is a controlled product under the federal Controlled Products Regulations which obliges employers in Ontario to provide training for workers handling this chemical	Ontario Occupational Health and Safety Act: Regulation 860, Workplace Hazardous Materials Information System (WHMIS)[13]	These requirements are more stringent than the NZ case where occupational safety law has only have general provisions for training and supervision of workers but less strict than the NZ 'approved handler' requirements.	**3**
Disposal	Ontario regulation used as the exemplar requires hazardous waste to be manifest tracked and treated in licensed facilities. The definition of hazardous waste includes ignitable waste so is presumed to include diesel fuel. Guidance on the system is provided in the referenced Guidance manual.	(Ontario) R.R.O. 1990, Regulation 347 General — Waste Management[14] Registration Guidance Manual For Generators Of Liquid Industrial And Hazardous Waste (Replaces 0195e) December 2009[15]	Manifest tracking and disposal through licensed facilities is regarded as more complex than the New Zealand requirement	**3**
Tankwagon	Federal regulations require tankwagons (called highway tanks) and rail tankwagons to be built and periodically tested for compliance with Canadian standards (e.g. CSA B6621 for highway tanks). We are not able to access these documents or even generic descriptions of then from public sources.	(Federal) Transport of Dangerous Goods regulations[3]	The cited standards are likely to be similar to other international standards for such vehicles with possibly some local small variations. Stringency assumed to be equivalent to NZ requirements.	**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Fixed bulk storage container	At the federal level, diesel storage tanks are subject to regulation under specific regulations made under Canadian Environmental Protection Act. These regulations are limited to facilities under federal control or on federal land. Regulations cross refer to a code of practice which calls up various design codes including both Canadian and API codes. At provincial level, using the province of Ontario as the exemplar, requirement are contained in the Ontario Fire Code and make specific reference to both API and Canadian design standards without specific further obligation to provide for seismic factors.	(federal regulation) Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations SOR/2008-197**Error! Bookmark not defined.Error! Bookmark not defined.** Canadian Council of Ministers of the Environment's Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products[12] Ontario Regulation 213/07 -The Ontario Fire Code[10]	Canadian codes are not readily accessible but are assumed equivalent to API codes. No mention found of additional factors over and above code design such as seismic, wind loading, extreme climate etc so assessed as less stringent than NZ. NB: the absence of additive factors in relation to seismic loading is reasonable given that the cited codes are designs for North American conditions.	**1**
Score diesel fuel Canada				**33**

[1] May be viewed here: http://laws-lois.justice.gc.ca/eng/acts/H-3/FullText.html
[2] May be viewed here: http://www.canlii.org/en/ca/laws/regu/sor-88-66/latest/sor-88-66.html
[3] May be viewed here: http://www.tc.gc.ca/eng/tdg/clear-tofc-211.htm

[4] May be viewed here: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-247/index.html
[5] May be viewed here: http://www.tc.gc.ca/eng/tdg/moc-ibc-faqunstandardizedibcs-246.html#when
[6] May be viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900833_e.htm
[7] Maybe viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_090490_e.htm
[8] http://www.labour.gov.on.ca/english/hs/pubs/oel_table.php
[9] May be viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900851_e.htm#BK10
[10] May be viewed here: http://www.e-laws.gov.on.ca/html/source/regs/english/2007/elaws_src_regs_r07213_e.htm
[11] May be viewed here: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2008-197/index.html
[12] May be obtained here: http://www.ccme.ca/assets/pdf/pn_1326_eng.pdf
[13] May viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900860_e.htm#BK5
[14] May be viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900347_e.htm#BK27
[15] May be obtained here: http://www.ene.gov.on.ca/environment/en/resources/STD01_076193.html

1.4.4 Jurisdiction: Ireland

Substance: Diesel fuel CAS# 68476-34-6

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Assessment data	Ireland laws directly put in place the CLP regulations – Chemicals Amendment Act as cited at left So requirements are as for the CLP.	Chemicals (Amendment) Act 2010[1] Regulation (EC) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP)[2] REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended)[3]	Diesel fuel is already approved in the Irish regime. However this exercise considers the data required if a new 'diesel fuel' came in to the Irish market. CLP regulations apply. However a 'new' diesel fuel would be caught by REACH requirements leading to requirements for data more extensive than those of the CLP	**3**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Labelling	Irish law directly puts in place CLP requirements – Chemicals Amendment Act as cited at left So requirements are as for the CLP.	Chemicals (Amendment) Act 2010[1] Regulation (EC) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP)[3]	CLP regulations apply	**2**
Data sheet	Datasheet requirement under the Chemicals Act calls up REACH SDS (safety datasheet requirements)	Chemicals (Amendment) Act 2010[1] Regulation (EC) No 1907/2006 Of The European Parliament And Of The Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended)[4]	REACH data sheet requirement is equivalent to GHS	**2**
Packaging	European Communities (Carriage of Dangerous Goods by Road...) regulations refer to European ADR document for package requirements. These appear to be a more chemical specific version of the UNRTDG requirements using largely the same performance level.	European Communities (Carriage of Dangerous Goods by Road and Use of Transportable Pressure Equipment) Regulations 2011[4] European Agreement concerning the International Carriage of Dangerous Goods by Road webpage[5]	As with the UK these requirements are not 'basic' but simply providing that packages meeting road transport requirements are acceptable.	**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
IBC	Regulations cited reference ADR for IBCs	European Communities (Carriage of Dangerous Goods by Road and Use of Transportable Pressure Equipment) Regulations 2011[4] European Agreement concerning the International Carriage of Dangerous Goods by Road webpage[5]	ADR (European Agreement concerning the International Carriage of Dangerous Goods by Road) appears to be consistent with UNRTDG for IBCs	**2**
Exposure limit (tox.)	8hr occupational exposure limit provided in a code of practice under the regulations specified	Safety, Health and Welfare At Work (Chemical Agents) Regulations, 2001[6] Code of Practice for the Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001[7]	Exposure limit is higher level of stringency than NZ	**3**
Exposure limit (ecotox.)	No limit found for diesel in the regulations	European Communities Environmental Objectives (Surface Waters) Regulations 2009[8]		**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Physical hazard (initiation)	The cited 'dangerous substances' regulations encompass diesel as 'petroleum spirit class III'. These regulations provide detailed technical prescriptions to control ignition sources. Similar requirements (possibly duplicating the 'dangerous substances' regulations can also be found in the "safety Health and Welfare at work ...' regulations	Dangerous Substances (Petroleum Bulk Stores) Regulations, 1979[9] Dangerous Substances (Retail and Private Petroleum Stores) Regulations, 1979[10] Safety, Health and Welfare at Work (General Application) Regulations 2007[11]	The prescriptions appear similar to the performance requirements of the NZ HSNO system	**2**
Exposure limit heat/ blast	Implicit exposure limits are provided in the cited regulations as distances from the boundary of the facility regulated and certain operations.	Dangerous Substances (Petroleum Bulk Stores) Regulations, 1979[9] Dangerous Substances (Retail and Private Petroleum Stores) Regulations, 1979[10]	More stringent than the NZ requirements which do not provide any limits specific to diesel	**3**
Emergency preparedness	Requirements include (for larger quantities): • Bunding (described as 'retaining enclosures') for fixed storage facilities • Adequate numbers of fire extinguishers • Emergency plans for larger quantities	Dangerous Substances (Petroleum Bulk Stores) Regulations, 1979[9] Safety, Health and Welfare at Work (General Application) Regulations 2007[6]	While the prescriptions appear in many respects similar to the performance requirements of the NZ HSNO system, the regulations (for larger storage facilities) contain more detailed requirements to provide current site plans (specifying, scale number and content of plans) and so are judged more stringent	**3**
Tracking	No requirement			**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Qualified person in charge	No requirement found for specifically trained qualified person in charge for diesel fuel.		The Safety, Health and Welfare at Work (General Application) Regulations already noted do provide general obligations on employers to train workers for the workplaces they are working. This is regarded as equivalent to the duties in the NZ Health and Safety IN Employment law.	**2**
Disposal	Diesel is captured by the definition of hazardous waste in the Waste Management Act. The Act provides a regime controlling the handling of hazardous waste and requires its sending to treatment facilities and landfills subject to permitting under the Act. Individual permits under the permitting provisions set site specific limits on emissions.	Waste Management Act, 1996 (as amended)[12]	The controls described do not provide the same level of specification as the NZ requirements for disposal but the effect is in most cases likely to be roughly equivalent. However the complexity of steps required is higher so this requirement is scored as 3	**3**
Tankwagon	Tankwagon specifications in the Republic of Ireland are as set out in the relevant sections of the ADR. This section is in reality a detailed design code for the design (and subsequent construction and in service testing) of these tank vehicles. Periodic testing and recertification is required for these vehicles.	European Communities (Carriage of Dangerous Goods by Road and Use of Transportable Pressure Equipment) Regulations 2011[13]	Section 6.8 of the ADR appears to have all the ingredients that the requirements for tankwagons in New Zealand have but in much more prescriptive form. From a regulatory stringency point of view there is little to choose between the two approaches, provided design code approaches are kept updated to match new technologies. (ADR is updated approximately annually.)	**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Fixed bulk storage container	The regulations provide specific requirements for horizontal storage tanks (in a schedule) and call up one British Standard (BS 2654) for vertical tanks. There appear to be no specified additional requirements for wind or seismic loading.	Dangerous Substances (Petroleum Bulk Stores) Regulations, 1979[9]	As NZ requirements include additional obligations (over and above the basic integrity of the tank and fittings) for wind and seismic loading NZ controls are judged as more stringent	**1**
		Score diesel fuel Ireland		**34**

[1] May be obtained here: http://www.hsa.ie/eng/Legislation/Acts/Chemicals_Acts_2008_and_2010_and_the_Guide/Chemicals_Act_No_32_of_2010_pdf.pdf
[2] May be obtained here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:353:0001:1355:en:PDF
[3] May be obtained here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1907:20111210:EN:PDF
[4] May be viewed here: http://www.irishstatutebook.ie/2011/en/si/0349.html
[5] http://www.unece.org/trans/danger/publi/adr/adr2011/11ContentsE.html
[6] May be viewed here: http://www.irishstatutebook.ie/2001/en/si/0619.html
[7] May be obtained here: http://www.hsa.ie/eng/Publications_and_Forms/Publications/Chemical_and_Hazardous_Substances/Code_of_Practice_Chemical_Agent_Regulations_2011.pdf
[8] May be obtained here: http://www.environ.ie/en/Legislation/Environment/Water/FileDownLoad,20824,en.pdf
[9] May be viewed here: http://www.irishstatutebook.ie/1979/en/si/0313.html#zzsi313y1979a66
[10] May be viewed here: http://www.irishstatutebook.ie/1979/en/si/0311.html
[11] May be viewed here: http://www.irishstatutebook.ie/2007/en/si/0299.html
[12] May be viewed here : http://www.irishstatutebook.ie/1996/en/act/pub/0010/print.html
[13] May be viewed here: http://www.irishstatutebook.ie/2011/en/si/0349.html

1.4.5 Jurisdiction: Japan

Substance: Diesel fuel CAS# 68476-34-6

NB: Descriptions as supplied by Prof. Hiroshi Jonai, Professor of Medical and Welfare Engineering, Graduate School of Science and Technology- Nihon University, Tokyo. All Japanese law and regulations are available only in Japanese so the descriptions below are referenced to the translated titles of the relevant legislation only (references supplied by Prof. Jonai). Scoring is based on our judgements from the information provided by Jonai.

	Description of requirement	Source/ Reference (name translated from Japanese)	Comments & assumptions	Score
Assessment data	Data is generally required for flammable solid or liquid to classify hazards by tests defined by Fire and Disaster Management Act. These tests are different from those of the UNRTDG Tests and Criteria No requirement for information to classify with respect to toxicity	Fire and Disaster Management Act[1] Civil Aeronautics Act Ship Safety Act	Jonai advises that assessment or self classification data not required for Diesel fuel as it is already listed in the relevant legislation. However, this exercise considers the data required if a new ‘diesel’ came on to the market. Score is on the basis that the test indicated would be required and UNRTDG Tests and criteria tests would not be accepted.	**3**

	Description of requirement	Source/ Reference (name translated from Japanese)	Comments & assumptions	Score
Labelling	Requirements are equivalent to those of the UNRTDG 16th Edn	Civil Aeronautics Act Ship Safety Act	UN Transport labels differ from those of the GHS although the use Transport and GHS labels together are mandated by both systems. Assuming that GHS labels are not prohibited by Japan the labelling requirements are regarded as of equal stringency	**2**
Data sheet	No requirement for data sheet found			**1**
Packaging	Transport by water or air : requirements are equivalent to the UNRTDG 16th Edn Transport by road: no requirement	Civil Aeronautics Act Ship Safety Act	Packaging for transport by air or water are regarded (as for the NZ system) as in addition to the 'basic' requirement As no basic requirement is indicated score is 1	**1**
IBC	Transport by water or air: requirements are equivalent to the UNRTDG 16th Edn	Civil Aeronautics Act Ship Safety Act	IBC are by definition multi-modal so requirement is equivalent to UNRTDG	**2**
Exposure limit (tox.)	No entry found		Equivalent to NZ	**2**
Exposure limit (ecotox.)	No entry found		Equivalent to NZ	**2**
Physical hazard (initiation)	No requirements found		It can be speculated that this is because of the use of the UNRTDG classification which (pre GHS) did not classify diesel as flammable	**1**

	Description of requirement	Source/ Reference (name translated from Japanese)	Comments & assumptions	Score
Exposure limit heat/ blast	No requirements found		It can be speculated that this is because of the use of the UNRTDG classification which (pre GHS) did not classify diesel as flammable	**1**
Emergency preparedness	Requirements described as including obligation for fire extinguishers at sites with large quantities, 'facilities to prevent leak or scatter' (interpreted as secondary containment requirement'	Fire and Disaster Management Act	Unclear if the details are more or less strict than NZ – assumed equivalent based on information provided	**2**
Tracking	No requirements found		Equivalent to NZ	**2**
Qualified person in charge	No requirements found		Equivalent to NZ	**2**
Disposal	No requirements found		See speculation about use of earlier UNRTDG classification above Also may be site specific controls imposed through pollution control laws?	**1**
Tankwagon	Requirements for tankwagon materials: for example specific type of steel Maximum tank volume 30000 litres, partitioned into smaller sections equal to or less than 4000. Other requirements described as 'similar to NZ'	Fire and Disaster Management Act	Requirements as stated are regarded as sufficiently similar to NZ to score as equivalent	**2**

	Description of requirement	Source/ Reference (name translated from Japanese)	Comments & assumptions	Score
Fixed bulk storage container	When presented with a summary description of NZ requirements (as contained in the relevant transfer order) Jonai described requirements in Japan as similar – including earthquake resistance. (Requirements may be more prescriptive and reference was made in Jonai's comments to minimum wall thickness for specified steel.)	Fire and Disaster Management Act	On the basis of stated requirements regarded as sufficiently similar to NZ to score as equivalent	**2**
Score diesel fuel Japan				**26**

[1] This law appears to be also described in translation as the Fire Service Act. (Act No. 186 of July 24, 1948). The translation makes references to Cabinet orders for much of the detailed controls in the hazardous materials section of the translated law. The apparent translation can be obtained here: 125.60.26.41/download.do?file_id=7268

1.4.6 Jurisdiction: United Kingdom

Substance: Diesel fuel CAS# 68476-34-6

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Assessment data	Diesel fuel is a dangerous substances under the CHIP 4 regulations and requires a person supplying such substances to make 'themselves aware of all relevant and accessible data that may exist' in relation to the substance.	The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 [UK regulation][1] Regulation (EC) No 1907/2006 Of The European Parliament And Of The Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended)[2]	Diesel fuel is already approved in the UK regime. However this exercise considers the data required if a new 'diesel fuel' came on to the UK market. CHIP regulation is interpreted as equivalent the self classification requirement of the CLP. However a 'new' diesel fuel would be caught by REACH requirements leading to requirements for data more extensive than those of the CLP	**3**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Labelling	Labelling requirements contained in the CHIP 4 regulations still require the Pre-GHS R and S phrases of the 1967 EC directive. Symbols and other information required are annexed in the regulation and are also not consistent with the GHS 'label' requirements. Some additional information required (e.g. EC number – see regulation 7) and exemptions for small packages	The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 [UK regulation][1] Globally Harmonized System of Classification and Labelling of Chemicals (GHS) Fourth revised edition United Nations, 2011[3]	The CHIP 4 regulation requirements are different from those of the GHS and so a different label (from GHS or Transport/GHS) would be required for the UK	**3**
Data sheet	Datasheet required for dangerous preparations – form of required information is consistent with GHS.	CHIP 4 Webpage describes requirement as the same as that under REACH [4] (empowering legislation is not clear) Further detail on HSE REACH pages[5]	REACH data sheet requirement is equivalent to GHS	**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Packaging	CHIP 4 regulations cross refer to Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007 which in turn cross refer to European ADR document for package requirements. These appear to be a more chemical specific version of the UNRTDG requirements using largely the same performance level. Dangerous good in limited quantity also provided for. Packages specifically meeting maritime and air transport requirements are also permitted.	The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 [UK regulation][1] Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007[6] European Agreement concerning the International Carriage of Dangerous Goods by Road webpage[7]	The UK regulations do not appear to provide 'basic' packaging requirements but rather simply permit packages which are acceptable for any transport mode.	**2**
IBC	The UK Carriage of Dangerous Goods ... regulations reference ADR for IBCs	Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007[6] European Agreement concerning the International Carriage of Dangerous Goods by Road webpage[5]	ADR (European Agreement concerning the International Carriage of Dangerous Goods by Road) appears to be consistent with UNRTDG for IBCs	**2**
Exposure limit (tox.)	None provided in the workplace exposure limits document referenced by the Control of Substances Hazardous to Health Regulations 2002	The Control of Substances Hazardous to Health Regulations 2002[8] EH40/2005 Workplace exposure limits[9]	Equivalent to NZ requirements (no exposure limit set)	**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Exposure limit (ecotox.)	Only reference available appears to be to law for permitting certain types of facilities. No reference found to exposure limits as such for diesel.	The Environmental Permitting (England and Wales) Regulations 2010[10]	From the information available assumed equivalent to NZ (no limit set)	**2**
Physical hazard (initiation)	Regulations require • Definition of hazardous atmosphere zones • (by cross reference with The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations) the installation of specified types of equipment in such zone to reduce the risk of fire or explosion • A specified hierarchy of actions to reduce the likelihood of fire or explosion. Cross reference is made to the 'ATEX directive' which provides further specification of equipment for use in hazardous atmosphere zones.	(UK)Dangerous Substances and Explosive Atmospheres Regulations 2002[11] (UK) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 1996[12] 'ATEX' Directive 94/9/EC of the European Parliament and the Council on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres[13]	The controls imposed are framed as duties on the operator and are a mix of performance and prescription. The effect of the controls is generally equivalent to the controls in the NZ (HSNO) system although • Provides more prescription and so less ability to provide different solutions but potentially more defined requirements • Because of cross references made, are inherently complex to follow	**2**
Exposure limit heat/ blast	None found specific to diesel	(UK)Dangerous Substances and Explosive Atmospheres Regulations 2002[11] The Regulatory Reform (Fire Safety) Order 2005[14]	Obligations placed in the 'Fire Safety Order' are generic and relate largely to providing means of escape from fires	**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Emergency preparedness	Diesel is regarded as a 'petroleum product' for the Control of major accident hazard (COMAH) regulations. General duties to control accidents apply for quantities above 5,000 tonnes and specific requirements for emergency plans apply for quantities above 50,000 tonnes. For smaller quantities the Management of Health and Safety at work regulations also apply, these impose general duties to assess risks to workers health and safety and provide necessary means to manage. The Control of Pollution (Oil Storage) (England) Regulations 2001 contain requirements for secondary containment	Management of Health and Safety at Work Regulations 1999[15] Control of Major Accident Hazards Regulations 1999 as amended [16] The Control of Pollution (Oil Storage) (England) Regulations 2001[17] (Equivalent regulations in Scotland and Northern Ireland)	The combination of general duties and specific requirements for large quantities (larger than NZ HSNO for emergency plans) has the effect of making the requirements more stringent but less specific than NZ controls – e.g. NZ control specify what is required whereas UK regulations require processes to meet general duties Secondary containment requirements are also provided which are similar to New Zealand requirements.	**3**
Tracking	No tracking requirements found			**2**
Qualified person in charge	UK Management of Health and Safety at work regulations require employers to appoint a person with health and safety knowledge	Management of Health and Safety at Work Regulations 1999[8]	Regulations similar to general requirements in the NZ Health and Safety in employment regulations and not chemical specific	**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Disposal	Diesel is listed as a hazardous waste in the Hazardous Waste regulations and the Scottish Special Waste Regulations. These regulations control handling of hazardous waste and require its sending to treatment facilities and landfills subject to the Environmental Permitting (England and Wales) Regulations. These regulations implement the EU's Integrated Pollution Prevention and Control (IPPC) Directive. Individual permits under the permitting regulations set site specific limits on emissions	Hazardous Waste (England and Wales)Regulations 2005 (amended 2009)[18] The Environmental Permitting (England and Wales) Regulations 2007[19] Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control[20].	The controls described do not provide the same level of specification as the NZ requirements for disposal but the effect is in most cases likely to be roughly equivalent. However the complexity of steps required is higher so this requirement is scored as 3	**3**
Tankwagon	Tankwagon specifications in the UK are as set out in section 6.8 0f the ADR. This section is in reality a detailed design code for the design (and subsequent construction and in service testing of these tank vehicles. Periodic testing and recertification is required for these vehicles.	The Carriage of Dangerous Goods (Classification, Packaging and Labelling) and Use of Transportable Pressure Receptacles Regulations 1996 (as amended)[21] European Agreement concerning the International Carriage of Dangerous Goods by Road webpage[5]	Section 6.8 appears to have all the ingredients that the requirements for tankwagons in New Zealand have but in much more prescriptive form. From a regulatory stringency point of view there is little to choose between the two approaches, provided design code approaches are kept updated to match new technologies. (ADR is updated approximately annually.)	**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Fixed bulk storage container	While fixed bulk storage vessels are impacted by a number of requirements the obligations directly on the storage vessel/ facility which are not location specific are in the referenced regulations. These regulations impose general duties which require interpretation. The UK DEFRA has issued guidance (referenced) which indicated some standard for design and construction which are regarded as complying with these duties. The documents found do not contain specific seismic and wind loading requirements equivalent to those in NZ.	The Control of Pollution (Oil Storage) (England) Regulations 2001[17] (Equivalent regulations in Scotland and Northern Ireland) Control of Major Accident Hazards Regulations 1999[9] Guidance note for the Control of Pollution (Oil Storage)(England) Regulations 2001[22]	As NZ requirements include additional obligations (over and above the basic integrity of the tank and fittings) for wind and seismic loading NZ controls are judged as more stringent	**1**
Score diesel fuel United Kingdom				**33**

[1] May be viewed here: http://www.legislation.gov.uk/uksi/2009/716/contents/made
[2] May be obtained here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1907:20111210:EN:PDF
[3] May be obtained here: http://www.unece.org/trans/danger/publi/ghs/ghs_rev04/04files_e.html
[4] http://www.hse.gov.uk/chip/law.htm
[5] http://www.hse.gov.uk/reach/resources/reachsds.pdf
[6] May be viewed here http://www.legislation.gov.uk/uksi/2007/1573/regulation/51/made
[7] http://www.unece.org/trans/danger/publi/adr/adr2011/11ContentsE.html
[8] May be viewed here: http://www.legislation.gov.uk/uksi/2002/2677/contents/made
[9] May be obtained here: http://www.hse.gov.uk/pubns/books/eh40.htm
[10] May be viewed here: http://www.legislation.gov.uk/ukdsi/2010/9780111491423/contents.
[11] May be viewed here: http://www.legislation.gov.uk/uksi/2002/2776/contents/made
[12] May be viewed here: http://www.legislation.gov.uk/uksi/1996/192/contents/made
[13] May be viewed here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31994L0009:en:NOT

[14] May be obtained here: http://www.legislation.gov.uk/uksi/2005/1541/pdfs/uksi_20051541_en.pdf
[15] May be viewed here: http://www.legislation.gov.uk/uksi/1999/3242/contents/made
[16] May be viewed here: http://www.legislation.gov.uk/uksi/1999/743/schedule/1/made
[17] May be viewed here: http://www.legislation.gov.uk/uksi/2001/2954/contents/made
[18] May be viewed here: http://www.legislation.gov.uk/uksi/2005/894/contents/made
[19] May be viewed here: http://www.legislation.gov.uk/uksi/2007/3538/contents/made
[20] May be viewed here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008L0001:EN:NOT
[21] May be viewed here: http://www.legislation.gov.uk/uksi/1996/2092/contents/made
[22] May be obtained here: http://archive.defra.gov.uk/environment/quality/water/waterquality/oilstore/documents/oil_store.pdf

1.5 Glyphosate CAS# 1071-83-6

1.5.1 Jurisdiction: New Zealand

(Hazard classification as shown in NZ system- provided to assist referencing NZ regulations and standards only:

6.1E Acute toxic class E

6.4A Eye irritant class A

9.1B Aquatic ecotox class B)

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Assessment data	Glyphosate has an existing approval (#HSR003192) so no further data is required. However glyphosate generically does not appear to be covered by any of the HSNO group standards, so if the approval did not exist, data on both the physical properties and hazardous properties would be required and submitted to the EPA. In addition sufficient information to complete the risks costs and benefits section of a release application would be required.	EPA NZ Website: HSNO Controls for Glyphosate[1]	As all the chemicals in the study are already approved in the NZ regime this exercise considers the data required if a new 'glyphosate' came on to the NZ market. Score is on this basis	**3**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Labelling	Labelling requirements are performance version of GHS (i.e. GHS label would comply) but regulation also explicitly permits use of UNRTDG label as complying. However regulation 18(c) of the HSNO Hazardous substances identification regulations requires information about possible changes which might cause the substance to become more hazardous in a closed container. Emergency management regulations also apply and require information on the first aid for exposure to the substance on the label along with emergency service contact.	EPA NZ Website: HSNO Controls for Glyphosate[1] Hazardous substances (Identification) regulations (2001)[2] Hazardous substances (Emergency Management) Regulations 2001[3]	No known self reactions in container to form new substance hazards. First aid and emergency contact are in addition to GHS basic requirement. GHS does contain power for competent authority to require additional information but this will increase costs over jurisdictions where this is not required.	**3**
Data sheet	Requirements set out in Hazardous substances Identification regulations, reference sections similar to those in the GHS SDS specification and include specific requirements in respect of information about ecotoxicity and toxicity	EPA NZ Website: HSNO Controls for Glyphosate[1] Hazardous substances (Identification) regulations (2001)[2] Globally Harmonized System of Classification and Labelling of Chemicals (GHS) Fourth revised edition United Nations, 2011[4]	GHS compliant datasheet (in English) would comply with requirements. It is assumed that the specific wording of the regulation is equivalent to the relevant sections of the GHS requirement.	**2**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Packaging	Requirements set out in the Hazardous Substances (Packaging) Regulations – these are a performance translation of the UNRTDG 14th Edn Packing group III requirements. NB includes requirements which translate the 'Dangerous Goods in limited quantity' requirements of this edition of the UNRTDG.	EPA NZ Website: HSNO Controls for Glyphosate[1] Hazardous Substances (Packaging) Regulations 2001[5]		**2**
IBC	Glyphosate may be stored/transported in transportable containers meeting the requirements of UNRDTG model regulations for intermediate bulk containers or portable tanks	EPA NZ Website: HSNO Controls for Glyphosate[1] Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004 – Part 6[6]		**2**
Exposure limit (tox.)	No entry in exposure limits table or Dept of Labour WES table	EPA NZ Website: Substance exposure limit register[7]		**2**
Exposure limit (ecotox.)	No entry in exposure limits table	EPA NZ Website: Substance exposure limit register[7]		**2**
Physical hazard (initiation)	Not applicable			**2**
Exposure limit heat/ blast	Not applicable			**2**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Emergency preparedness	Quantities of glyphosate in excess of 10,000kg attract requirements for pre-prepared and tested emergency management plans Quantities in excess of 1000 kg require signage setting out actions to be taken in the event of an emergency.	EPA NZ Website: HSNO Controls for Glyphosate[1] Hazardous Substances (Emergency Management) Regulations 2001[3]		**2**
Tracking	No requirements for tracking although there is a special requirement for providing specific information about composition (i.e. impurities) and source of the chemical to the Authority	EPA NZ Website: HSNO Controls for Glyphosate[1]		**2**
Qualified person in charge	No requirement for a qualified person to be in control of this substance	EPA NZ Website: HSNO Controls for Glyphosate[1]		**2**
Disposal	Disposal includes either • Export as waste (in compliance with Basel etc) • Treatment to remove hazardous properties • Treatment Includes landfill or other treatment facility Obligation on importer, manufacturer or supplier to provide information about disposal method with substance for quantities above 200g.	EPA NZ Website: HSNO Controls for Glyphosate[1] Hazardous Substances (Disposal) Regulations 2001[8]		**2**

	Description of requirement	Source/ Reference	Comments & assumptions	Score
Tankwagon	Not applicable – substance is a solid			**2**
Fixed bulk storage container	Not applicable – substance is a solid			**2**
Score glyphosate New Zealand				**32**

[1] http://www.epa.govt.nz/search-databases/Pages/controls-details.aspx?SubstanceID=3208&AppID=3287
[2] May be obtained here: http://www.legislation.govt.nz/regulation/public/2001/0124/latest/link.aspx?search=ts_regulation_hazardous+substances_resel&p=1
[3] May be obtained here: http://www.legislation.govt.nz/regulation/public/2001/0123/latest/DLM43173.html?search=ts_regulation_Hazardous+substances_resel&p=1&sr=1
[4] May be obtained here: http://www.unece.org/trans/danger/publi/ghs/ghs_rev04/04files_e.html
[5] May be obtained here: http://www.legislation.govt.nz/regulation/public/2001/0118/latest/DLM40764.html?search=ts_regulation_hazardous+substances_resel&p=1&sr=1
[6] May be obtained here: http://www.legislation.govt.nz/regulation/public/2004/0046/latest/DLM245670.html?search=ts_regulation_hazardous+substances_resel&p=1&sr=1
[7] http://www.epa.govt.nz/search-databases/Pages/substance-exposure-limit-register.aspx#tel-table
[8] May be obtained here: http://www.legislation.govt.nz/regulation/public/2001/0119/latest/DLM41657.html?search=ts_regulation_hazardous+substances_resel&p=1&sr=1

1.5.2 Jurisdiction: Australia/NSW

Substance: Glyphosate CAS# 1071-83-6

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Assessment data	NSW requirements are overlaid by the Commonwealth level NICNAS requirements, which require information about hazardous properties production volumes, uses locations etc. Glyphosate does not have hazards which make it subject to Australian Dangerous Goods rules. Classification under NSW WHS regulations follows the GHS.	Industrial Chemicals (Notification and Assessment) Act[1] Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3] NSW Work Health and Safety Regulation 2011[4]	As glyphosate has an existing approval in most systems, this study focuses for the data required for approval of a new 'glyphosate'. (This includes data required to exclude the substance from regulation under for example the Australian dangerous goods rules. The requirements for data in the NSW system reference either the UNRTDG Tests and Criteria or the GHS. NSW requirements are overlaid by the Commonwealth level NICNAS requirements, which require information about hazardous properties production volumes, uses locations etc	**3**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Labelling	Hazardous substance label requirement matches GHS unless the substance is a scheduled drug or poison but also requires identity of ingredients for mixtures. Glyphosate is listed as a scheduled poison which attracts very prescriptive label requirements.	NSW Work Health and Safety Regulation 2011[4] (Australian) Standard for the Uniform Scheduling of Medicines and Poisons(2011)[5]	The deference to the labelling requirements of the poison schedule holds only if the chemical is a 'consumer product' The substance glyphosate would not be supplied as a consumer product, as consumer products are always mixture containing glyphosate and other substances.	**2**
Data sheet	Data sheet requirements match those of the GHS although some detail is omitted and the GHS building block principle is used (e.g. Acute toxic category 5 not used)	NSW Work Health and Safety Regulation 2011[4]	GHS compliant data sheet would be acceptable noting that • There are obligations to update at fixed intervals • GHS means of dealing with commercial in confidence information is interpreted locally	**2**
Packaging	No packaging requirements derived from Transport regulation as glyphosate is not a dangerous good for transport. Workplace packaging requirements are generic only	NSW Work Health and Safety Regulation 2011[4]	Under the 17th Edn, UNRTDG Glyphosate would be classified as 3077 Environmentally hazardous substance solid NOS, and attract requirements for Packing group III. Australian controls therefore less stringent than the benchmark.	**1**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
IBC	No IBC requirements derived from Transport regulation as glyphosate is not a dangerous good for transport.		Under the 17th Edn, UNRTDG Glyphosate would be classified as 3077 Environmentally hazardous substance solid NOS, and attract corresponding requirements for IBC. Australian controls therefore less stringent than the benchmark.	**1**
Exposure limit (tox.)	None found			**2**
Exposure limit (ecotox.)	None found			**2**
Physical hazard (initiation)	No applicable – no physical hazard			**2**
Exposure limit heat/ blast	No applicable – no physical hazard			**2**
Emergency preparedness	No chemical specific obligations found to provide emergency plans or secondary containment systems	NSW Work Health and Safety Regulation 2011[4]		**1**
Tracking	No chemical specific obligations for tracking found			**2**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Qualified person in charge	No specific obligation found for a qualified person in charge of glyphosate	NSW Work Health and Safety Regulation 2011[4]	NSW Work health and safety legislation does include a general obligation for workers to be properly trained or supervised. This generic requirement is seen as equivalent to NZ Health and Safety in Employment law and so not specific to the substance or part of the chemicals control regime.	**2**
Disposal	While not specifically controlled under the Environmentally Hazardous Chemicals Act, glyphosate disposal is likely to be captured as a scheduled process under the Protection of the Environment Operations Act. These operations are subject to site by site licensing designed to reduce emissions.	NSW Environmentally Hazardous Chemicals Act 1985[6] NSW Protection of the Environment Operations Act 1997[7]	The controls described do not provide the same level of specification as the NZ requirements for disposal but the effect is in most cases likely to be roughly equivalent. However the complexity of steps required is higher (e.g. requiring manifest tracking of the waste) so this requirement is scored as 3.	**3**
Tankwagon	Substance is a solid – not applicable			**2**
Fixed bulk storage container	Substance is a solid – not applicable			**2**
Score glyphosate Australia/ NSW				**29**

[1] May be viewed here: http://www.comlaw.gov.au/Details/C2012C00082/Html/Text#_Toc313881260
[2] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+124+2009+cd+0+N
[3] May be obtained here: http://www.ntc.gov.au/filemedia/Publications/ADG7October2011.pdf

[4] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+674+2011+cd+0+N
[5] May be viewed here: http://www.comlaw.gov.au/Details/F2011L01612
[6] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/act+14+1985+cd+0+N
[7] May be viewed here: http://www.legislation.nsw.gov.au/viewtop/inforce/act+156+1997+ch.1-sec.1+0+N

1.5.3 Jurisdiction: Canada

Substance: Glyphosate CAS# 1071-83-6

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Assessment data	Glyphosate is covered by the Controlled products regulations under the Hazardous Products Act as it would be captured by it s eye irritancy. The New Substances Notification Regulations which are Federal in extent require both environmental hazard data and (based on volume produced or imported) data about uses, likely exposure routes, and sources of discharge into the environment.	(Federal) Hazardous Products Act[1] (Federal) Controlled Products Regulations[2] (Federal) New Substances Notification Regulations (Chemicals and Polymers) (SOR/2005-247)[3]	Glyphosate is separately controlled in pesticides formulations under the Canadian pesticides legislation but the 'pure' active does not appear to be. Glyphosate has an existing approval in most systems; this study focuses for the data required for approval of a new 'glyphosate'. The classification criteria in the Controlled products Regulations have fewer categories than the EU CLP in respect of some toxic effects and no criteria for environmental effects. They also permit data from 'similar' chemicals. However further data is required under the New Substances Notification Regulations.	**3**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Labelling	Labelling requirements at the federal level use different symbols from those specified under the GHS, including two symbols not specified by the GHS and excluding three GHS symbols. The label also requires a statement to the effect that a safety data sheet is available. The labels also require the pre-GHS R-phrases of the former EU system	Federal) Hazardous Products Act[1] (Federal) Controlled Products Regulations[2]	No symbols used for glyphosate are different from the GHS but: • the pre- GHS R-phrases are required • the environmental hazard symbol is not required; and • a statement about availability of safety data sheets is required So leading to a separate label requirement for Canada from the chosen norm.	**3**
Data sheet	Data sheet requirements listed are less than those for the standard GHS datasheet as environmental hazards and transport requirements are not specified.	(Federal) Controlled Products Regulations[2]		**1**
Packaging	No federal level packaging requirements found as the substance is not capture under the Transport Canada classification requirements.	(Federal) Transport of Dangerous Goods regulations[4]	Glyphosate is not named in the transport Canada list of 'class 9' chemicals	**1**
IBC	No federal level IBC requirements found as the substance is not captured under the Transport Canada classification requirements.	Federal) Transport of Dangerous Goods regulations[3]	Glyphosate is not named in the transport Canada list of 'class 9' chemicals	**1**
Exposure limit (tox.)	Workplace exposure limits are set in provincial legislation in Canada and Ontario legislation is used as an exemplar for these provincial requirements. This legislation does not set an exposure limit for glyphosate.	(Province of Ontario) R.R.O. 1990, Regulation 833 Control Of Exposure To Biological or Chemical Agents[5]	A table of threshold values published by the Ontario Ministry of Labour does not include an entry for glyphosate[6].	**2**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Exposure limit (ecotox.)	While guidelines are provided for drinking water for glyphosate, the regulatory effect of these is unclear. No limits were found for receiving waters.	Guidelines For Canadian Drinking Water Quality - Supporting Documents - Glyphosate[7]		**2**
Physical hazard (initiation)	Does not show any physical hazard – not applicable			**2**
Exposure limit heat/ blast	Does not show any physical hazard – not applicable			**2**
Emergency preparedness	No chemical or chemical class specific requirements found other than the basic information required in safety data sheets. - i.e. no chemical specific emergency plan requirements	(Province of Ontario) Occupational Health and Safety Act[8]	The province of Ontario, used as the exemplar for provincial level Canadian requirements, does empower inspectors to require written plans in respect of, among other things, the emergency process for dealing with 'chemical, biological and physical agents. However as written the obligation is a power of inspectors not a legal requirement, and is not chemical or chemical class specific.	**1**
Tracking	No requirement found			**2**
Qualified person in charge	The substance glyphosate would be a controlled product under the federal Controlled Products Regulations which obliges employers in Ontario to provide training for workers handling this chemical.	Ontario Occupational Health and Safety Act: Regulation 860, Workplace Hazardous Materials Information System (WHMIS)[9]	These requirements are more stringent than the NZ case where occupational safety law has only have general provisions for training and supervision of workers but less strict than the NZ 'approved handler' requirements.	**3**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Disposal	Ontario regulation used as the exemplar requires hazardous waste to be manifest tracked and treated in licensed facilities. The definition of hazardous waste includes substances in schedules of the regulation, including glyphosate, so it is presumed to be covered. Guidance on the system is provided in the referenced Guidance manual.	(Ontario) R.R.O. 1990, Regulation 347 General — Waste Management[10] Registration Guidance Manual For Generators Of Liquid Industrial And Hazardous Waste (Replaces 0195e) December 2009[11]	Manifest tracking and disposal through licensed facilities is regarded as more complex than the New Zealand requirement	**3**
Tankwagon	Substance is a solid – not applicable			**2**
Fixed bulk storage container	Substance is a solid – not applicable			**2**
Score glyphosate Canada				**30**

1 May be viewed here: http://laws-lois.justice.gc.ca/eng/acts/H-3/FullText.html
2 May be viewed here: http://www.canlii.org/en/ca/laws/regu/sor-88-66/latest/sor-88-66.html
3 May be viewed here: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-247/index.html
4 May be viewed here: http://www.tc.gc.ca/eng/tdg/clear-tofc-211.htm
5 May be viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900833_e.htm
6 http://www.labour.gov.on.ca/english/hs/pubs/oel_table.php
7 May be obtained here: http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/glyphosate/index-eng.php
8 May be viewed here: http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90o01_e.htm
9 May viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900860_e.htm#BK5
10 May be viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900347_e.htm#BK27
11 May be obtained here: http://www.ene.gov.on.ca/environment/en/resources/STD01_076193.html

1.5.4 Jurisdiction: Ireland

Substance: Glyphosate CAS# 1071-83-6

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Assessment data	Ireland's laws directly put in place the CLP regulations – Chemicals Amendment Act as cited at left So requirements are as for the CLP.	Chemicals (Amendment) Act 2010[1] European Communities (Authorization, Placing on The Market, Use and Control of Biocidal Products) Regulations, 2001[2] Regulation (EC) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP)[3] Regulation (EC) No 1907/2006 Of The European Parliament And Of The Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended)[4]	Glyphosate is already approved in the Irish regime. However this exercise considers the data required if a new 'gylphosate' came in to the Irish market. CLP regulations apply. However a 'new' glyphosate would be caught by REACH requirements leading to requirements for data more extensive than those of the CLP NB the cited European Communities (Authorization, Placing on The Market...) regulation also references the CLP. Biocidal action is generally control under separate rules but the chemicals controlled are mixtures and not the substance glyphosate	**3**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Labelling	Irish law directly puts in place CLP requirements – Chemicals Amendment Act as cited at left So requirements are as for the CLP.	Chemicals (Amendment) Act 20101 Regulation (EC) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP)[3]	See note concerning biocidal mixtures above which must also follow CLP requirements	**2**
Data sheet	Datasheet requirement under the Chemicals Act calls up REACH SDS (safety datasheet requirements)	Chemicals (Amendment) Act 20101 Regulation (EC) No 1907/2006 Of The European Parliament And Of The Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended)[4]		**2**
Packaging	Irish law directly puts in place CLP requirements – Chemicals Amendment Act as cited at left So requirements are as for the CLP.	Chemicals (Amendment) Act 20101 Regulation (EC) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP)[3]		**2**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
IBC	Regulations cited reference ADR for IBC	European Communities (Carriage of Dangerous Goods by Road and Use of Transportable Pressure Equipment) Regulations 2011[4] European Agreement concerning the International Carriage of Dangerous Goods by Road webpage[5]		**2**
Exposure limit (tox.)	No Workplace exposure limit found		Not surprising given that the substance has very low acute toxicity and only eye irritation otherwise	**2**
Exposure limit (ecotox.)	None found			**2**
Physical hazard (initiation)	Not applicable – not classified for physical hazards			**2**
Exposure limit heat/ blast	Not applicable – not classified for physical hazards			**2**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Emergency preparedness	There are general obligations in respect of worker safety to undertake risk assessments and prepare emergency plans under the Safety, health and welfare at work ... regulations as cited at right. However these are generic to chemical hazards of any kind and only in respect to worker safety. Glyphosate is captured by the European Communities Control of major accident hazard... regulations as a result of its ecotoxicity. Specific emergency plans are therefore required for quantities exceeding 200 tonnes	Safety, Health and Welfare at Work (General Application) Regulations 2007[6] European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2006[7]	Apart from the generic requirements to protect worker safety (not chemical specific) the limits for specific chemical related emergency plans are very much larger than NZ.	**1**
Tracking	No specific requirement found			**2**
Qualified person in charge	No requirements specific to the substance found			**2**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Disposal	Glyphosate is covered by the second schedule part III of the Waste Management Act. The Act provides a regime controlling the handling of hazardous waste and requires its sending to treatment facilities and landfills subject to permitting under the Act. Individual permits under the permitting provisions set site specific limits on emissions.	Waste Management Act, 1996[8] (and as subsequently amended)	The controls described do not provide the same level of specification as the NZ requirements for disposal but the effect is in most cases likely to be roughly equivalent. However the complexity of steps required is higher so this requirement is scored as 3	**3**
Tankwagon	Not applicable – substance is a solid			**2**
Fixed bulk storage container	Not applicable – substance is a solid			**2**
		Score glyphosate Ireland		**31**

[1] May be obtained here: http://www.hsa.ie/eng/Legislation/Acts/Chemicals_Acts_2008_and_2010_and_the_Guide/Chemicals_Act_No_32_of_2010_pdf.pdf
[2] May be viewed here: http://www.irishstatutebook.ie/2001/en/si/0625.html
[3] May be obtained here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:353:0001:1355:en:PDF
[4] May be obtained here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1907:20111210:EN:PDF
[5] http://www.unece.org/trans/danger/publi/adr/adr2011/11ContentsE.html
[6] May be viewed here: http://www.irishstatutebook.ie/2007/en/si/0299.html
[7] May be viewed here: http://www.irishstatutebook.ie/2006/en/si/0074.html#sched1-partii
[8] May be viewed here: http://www.irishstatutebook.ie/1996/en/act/pub/0010/index.html

1.5.5 Jurisdiction: Japan

Substance: Glyphosate CAS# 1071-83-6

NB: Descriptions as supplied by Prof. Hiroshi Jonai, Professor of Medical and Welfare Engineering, Graduate School of Science and Technology - Nihon University, Tokyo. All Japanese law and regulations are available only in Japanese so the descriptions below are referenced to the translated titles of the relevant legislation only (references supplied by Prof. Jonai). Scoring is based on our judgements from the information provided by Jonai.

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Assessment data	No requirement for data found	Act on the Evaluation of Chemical Substances and Regulation of Their Manufacture, etc	Jonai advises that this legislation is list based so if the chemical is not on the list its requirements do not apply. Glyphosate is not on the list, however if it was, Jonai advises that data on both human and environmental toxicity would be required.	**1**
Labelling	No requirement	Act on the Evaluation of Chemical Substances and Regulation of Their Manufacture, etc	Jonai advises that the named Act has no requirements for labelling	**1**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Data sheet	No requirement	Act on the Evaluation of Chemical Substances and Regulation of Their Manufacture, etc	Jonai advises that the named Act has no requirements for safety data sheets.	**1**
Packaging	No requirement		Based on Jonai's advice, Japan appears not to require UNPG III for glyphosate.	**1**
IBC	No requirement			**1**
Exposure limit (tox.)	None found			**2**
Exposure limit (ecotox.)	None found			**2**
Physical hazard (initiation)	Not applicable – not physical hazard classification			**2**
Exposure limit heat/ blast	Not applicable – not physical hazard classification			**2**
Emergency preparedness	No requirement			**1**
Tracking	No requirement			**2**
Qualified person in charge	No requirement			**2**
Disposal	Limitations on discharge to the sea – not further specified	Act on Prevention of Marine Pollution and Maritime Disaster	Regarded as less comprehensive and so less stringent than NZ	**1**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Tankwagon	Not applicable – substance is a solid			**2**
Fixed bulk storage container	Not applicable – substance is a solid			**2**
Score glyphosate Japan				**21**

1.5.6 Jurisdiction: United Kingdom

Substance: Glyphosate CAS# 1071-83-6

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Assessment data	Glyphosate is a dangerous substances under the CHIP 4 regulations (by reference to the CLP in those regulations) The CHIP 4 regulations require a person supplying such substances to make 'themselves aware of all relevant and accessible data that may exist' in relation to the substance.	The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 [UK regulation][1] Regulation (EC) No 1907/2006 Of The European Parliament And Of The Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended)[2]	Glyphosate is already approved in the UK regime. However this exercise considers the data required if a new 'glyphosate' came on to the UK market. CHIP regulation is interpreted as equivalent the self classification requirement of the CLP. However a 'new' glyphosate would be caught by REACH requirements leading to requirements for data more extensive than those of the CLP	**3**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Labelling	Labelling requirements contained in the CHIP 4 regulations still require the Pre-GHS R and S phrases of the 1967 EC directive. Symbols and other information required are annexed in the regulation and are also not consistent with the GHS 'label' requirements. Some additional information required (e.g. EC number – see regulation 7) and exemptions for small packages	The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 [UK regulation][1] Globally Harmonized System of Classification and Labelling of Chemicals (GHS) Fourth revised edition United Nations, 2011[3]	The CHIP 4 regulation requirements are different from those of the GHS and so a different label (from GHS or Transport/GHS) would be required for the UK. NB there are additional requirements to be met in respect of biocidal use of glyphosate. This is seen as equivalent to the NZ ACVM Act requirements and outside the scope of this study.	**3**
Data sheet	Datasheet required for dangerous substances – form of required information is consistent with GHS.	CHIP 4 Webpage describes requirement as the same as that under REACH [4] (empowering legislation is not clear) Further detail on HSE REACH pages[5]	REACH data sheet requirement is equivalent to GHS	**2**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Packaging	CHIP 4 regulations cross refer to Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007 which in turn cross refer to European RID ADR document for package requirements. These appear to be a more chemical specific version of the UNRTDG requirements using largely the same performance level. Dangerous good in limited quantity also provided for. Packages specifically meeting maritime and air transport requirements are also permitted.	The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 [UK regulation][1] Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007[6] European Agreement concerning the International Carriage of Dangerous Goods by Road webpage[7]	The UK regulations do not appear to provide 'basic' packaging requirements but rather simply permit packages which are acceptable for any transport mode.	**2**
IBC	The UK Carriage of Dangerous Goods ... regulations reference ADR for IBCs	Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007[6] European Agreement concerning the International Carriage of Dangerous Goods by Road webpage[5]	ADR (European Agreement concerning the International Carriage of Dangerous Goods by Road) appears to be consistent with UNRTDG for IBCs	**2**
Exposure limit (tox.)	None found			**2**
Exposure limit (ecotox.)	None found			**2**
Physical hazard (initiation)	Not applicable – no physical hazard classification			**2**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Exposure limit heat/ blast	Not applicable – no physical hazard classification			**2**
Emergency preparedness	Glyphosate is not captured as a scheduled substance in the Control of major accident hazard (COMAH) regulations. So there are no specific requirements in relation to these (i.e. for emergency preparedness where larger quantities held). The Management of Health and Safety at work regulations therefore provide the main requirements imposing general duties to assess risks to workers health and safety and provide necessary means to manage.	Management of Health and Safety at Work Regulations 1999[8] Control of Major Accident Hazards Regulations 1999 as amended [9]	The requirements are less specific than the NZ. No specific requirement to develop an emergency plan and the obligation to assess risks and provide appropriate steps is only in respect of worker safety. Scored as less stringent than NZ	**1**
Tracking	No requirement found			**2**
Qualified person in charge	No requirement found			**2**

	Description of requirement	Source/ Reference	Comments &assumptions	Score
Disposal	Glyphosate is covered by Annex III of the Hazardous Waste regulations and the Scottish Special Waste Regulations. These regulations control handling of hazardous waste and require its sending to treatment facilities and landfills subject to the Environmental Permitting (England and Wales) Regulations. These regulations implement the EU's Integrated Pollution Prevention and Control (IPPC) Directive. Individual permits under the permitting regulations set site specific limits on emissions.	Hazardous Waste (England and Wales)Regulations 2005 (amended 2009)[10] The Environmental Permitting (England and Wales) Regulations 2007[11] Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control[12].	The controls described do not provide the same level of specification as the NZ requirements for disposal but the effect is in most cases likely to be roughly equivalent. However the complexity of steps required is higher so this requirement is scored as 3	**3**
Tankwagon	Not applicable – substance is a solid			**2**
Fixed bulk storage container	Not applicable – substance is a solid			**2**
	Score glyphosate United Kingdom			**32**

[1] May be viewed here: http://www.legislation.gov.uk/uksi/2009/716/contents/made
[2] May be obtained here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1907:20111210:EN:PDF
[3] May be obtained here: http://www.unece.org/trans/danger/publi/ghs/ghs_rev04/04files_e.html
[4] http://www.hse.gov.uk/chip/law.htm
[5] http://www.hse.gov.uk/reach/resources/reachsds.pdf
[6] May be viewed here http://www.legislation.gov.uk/uksi/2007/1573/regulation/51/made
[7] http://www.unece.org/trans/danger/publi/adr/adr2011/11ContentsE.html
[8] May be viewed here: http://www.legislation.gov.uk/uksi/1999/3242/contents/made

[9] May be viewed here: http://www.legislation.gov.uk/uksi/1999/743/schedule/1/made
[10] May be viewed here: http://www.legislation.gov.uk/uksi/2005/894/contents/made
[11] May be viewed here: http://www.legislation.gov.uk/uksi/2007/3538/contents/made
[12] May be viewed here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008L0001:EN:NOT

1.6 Methyl ethyl ketone (MEK) CAS# 78-93-3

1.6.1 Jurisdiction: New Zealand

(Hazard classification as shown in NZ system- provided to assist referencing NZ regulations and standards only:

3.1B flammable liquid class B

6.1E Acute toxic class E

6.3B Skin irritant class B

6.4A Eye irritant class A,

6.9B Target Organ toxicant class B)

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	MEK has an existing approval (#HSR001190) so no further data is required. However MEK generically does not appear to be covered by any of the HSNO group standards, so if the approval did not exist, data on both the physical properties and hazardous properties would be required and submitted to the EPA. In addition sufficient information would be required to complete the risks costs and benefits section of a release application would be required. If the application was for MEK as a solvent only (the most common use for MEK) then the Solvents (Flammable) Group Standard 2006 would apply along with the self classification provisions of the group standard	1. EPA NZ Website: HSNO Controls for 2-Butanone[1] 2. Solvents (Flammable) Group Standard 2006 (HSR002650)[2]	All the chemicals in the study are already approved in the NZ regime. This exercise considers the data required if a new 'Methyl ethyl ketone' came on to the NZ market. Score is on this basis	**3**
Labelling	Labelling requirements are performance version of GHS (i.e. GHS label would comply) but regulation also explicitly permits use of UNRTDG label as complying. However regulation 18(c) of the HSNO Hazardous substances identification regulations requires information about possible changes which might cause the substance to become more hazardous in a closed container. Emergency management regulations also apply and require information on the first aid for exposure to the substance on the label along with emergency contact	EPA NZ Website: HSNO Controls for 2-Butanone[1] Hazardous Substance (Identification) Regulations 2001[3] Hazardous substances (Emergency Management) Regulations 2001[4]	First aid and emergency contact are in addition to GHS basic requirement. GHS contains power for competent authority to require additional information but this will increase costs	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Data sheet	Requirements set out in Hazardous substances Identification regulations[5]	EPA NZ Website: HSNO Controls for 2-Butanone[1] Hazardous Substance (Identification) Regulations 2001[3]	GHS compliant datasheet (in English) would comply with requirements	**2**
Packaging	Requirements set out in the Hazardous Substances (Packaging) Regulations – these are a performance translation of the UNRTDG 14th Edn Packaging requirements.	EPA NZ Website: HSNO Controls for 2-Butanone[1] Hazardous Substances (Packaging) Regulations[6]	To check – whether MEK is can be packed in small containers under UNRTDG.	**2**
IBC	MEK may be stored/transported in transportable containers meeting the requirements of UNRDTG model regulations for intermediate bulk containers or portable tanks	EPA NZ Website: HSNO Controls for 2-Butanone[1] Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004[7]		**2**
Exposure limit (tox.)	The EPA cross refers to Dept of Labour OSH WES for this substance which does provide an air exposure limit.	EPA NZ Website: HSNO Controls for 2-Butanone[1] EPA NZ Website: Exposure limit register[8]		**2**
Exposure limit (ecotox.)	No entry in exposure limit register	EPA NZ Website: Exposure limit register[8]		**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Physical hazard (initiation)	Regulations require: controls which provide for various combinations of • Controlling vapour limits to outside upper and lower explosive limits (including where modified by different oxygen concentrations • Exclusion of ignition sources • Earthing of equipment capable of conducting electricity • Establishment of hazardous atmosphere zones to delimit the places where controls and equipment must meet certain conditions Except where ignition is intended	EPA NZ Website: HSNO Controls for 2-Butanone[1] Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001[9]	Hazardous substance regulations are performance based and cross refer to various standards and prescriptive requirements in other regulations etc as accepted means of compliance. The regulations allow for • Increased and reduced oxygen atmospheres • Specification of ignition energies for individual substances ...so are unusually thorough in providing for unusual circumstances without reference to secondary risk analyses etc.	**2**
Exposure limit heat/ blast	Generic formula based requirement limiting exposure to heat V time have been revoked	EPA NZ Website: HSNO Controls for 2-Butanone[1] Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001[9]	The revocation appears to mean that there are no specific controls in relation to heat/ blast for MEK	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Emergency preparedness	Larger quantities of MEK attract requirements for • Fire extinguishers • Secondary containment • Pre-prepared and tested emergency management plans • Signage setting out actions to be taken in the event of an emergency	EPA NZ Website: HSNO Controls for 2-Butanone[1] Hazardous Substances (Emergency Management) Regulations 2001[4]	Requirements generally irrespective of whether MEK is stored in bulk or in large numbers of packages, IBC etc	**2**
Tracking	No tracking requirements for MEK	EPA NZ Website: HSNO Controls for 2-Butanone[1]		**2**
Qualified person in charge	Qualified person who can explain the controls and the properties of the substance must be in charge where quantity exceeds 250l	EPA NZ Website: HSNO Controls for 2-Butanone[1] Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001[9]	Substance to be secured when person not in direct control	**2**
Disposal	Permitted disposal includes: export as waste, treatment so that the substance is no longer hazardous, discharge to environment after treatment including via landfill or treatment facility	EPA NZ Website: HSNO Controls for 2-Butanone[1] Hazardous Substances (Disposal) Regulations 2001[10]	Disposal by burning must not expose persons to heat or blast above prescribe limits	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Tankwagon	MEK must carried in bulk in tankwagons which meet specified conditions of strength, corrosion resistance, impact resistance, stability, protection of load and operator from fire, and protection from collision with other vehicles. Tankwagons must be certified as meeting requirements. (Test certificate)	EPA NZ Website: HSNO Controls for 2-Butanone[1] Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004[11]		**2**
Fixed bulk storage container	No requirements listed for fixed bulk storage in HSNO website controls database. However the transfer notice used for MEK lists specific prescriptive requirements for bulk storage for liquids of the class(es) into which MEK falls. In general these requirements reference API and some BSI standards for tank design. New Zealand standards are referenced for seismic and wind loading.	EPA NZ Website: HSNO Controls for 2-Butanone[1] Summary of Approvals of Substances transferred under the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (As Amended)[12]	In general the requirements for fixed bulk storage are internationalised by reference to API and BSI standards (and some others as alternates) However the requirements include New Zealand specific obligations for wind loadings and seismic loadings	**2**
Score MEK New Zealand				**32**

[1] http://www.epa.govt.nz/search-databases/Pages/controls-details.aspx?SubstanceID=1613&AppID=3279
[2] May be obtained here: http://www.epa.govt.nz/Publications/gs-solvents-flammable.pdf
[3] May be obtained here: http://www.legislation.govt.nz/regulation/public/2001/0124/latest/whole.html?search=ts_regulation_Hazardous+substances_resel&p=1#DLM45328
[4] May be obtained here: http://www.legislation.govt.nz/regulation/public/2001/0123/latest/DLM43173.html?search=ts_regulation_Hazardous+substances_resel&p=1&sr=1
[5] May be found here: http://www.legislation.govt.nz/regulation/public/2001/0124/latest/link.aspx?search=ts_regulation_hazardous+substances_resel&p=1

[6] May be obtained here:
http://www.legislation.govt.nz/regulation/public/2001/0118/latest/whole.html?search=ts_regulation_hazardous+substances_resel&p=1#dlm40764
[7] May be obtained here:
http://www.legislation.govt.nz/regulation/public/2004/0046/latest/DLM245670.html?search=ts_regulation_Hazardous+substances_resel&p=1&sr=1
[8] http://www.epa.govt.nz/search-databases/Pages/substance-exposure-limit-register.aspx#tel-table
[9] May be obtained here:
http://www.legislation.govt.nz/regulation/public/2001/0116/latest/whole.html?search=ts_regulation_Hazardous+substances_resel&p=1#DLM37395
[10] May be obtained here:
http://www.legislation.govt.nz/regulation/public/2001/0119/latest/whole.html?search=ts_regulation_Hazardous+substances_resel&p=1#dlm41692
[11] May be obtained here:
http://www.legislation.govt.nz/regulation/public/2004/0046/latest/DLM245670.html?search=ts_regulation_Hazardous+substances_resel&p=1&sr=1
[12] http://www.epa.govt.nz/Publications/Transfer-Notice-35-2004.pdf

1.6.2 Jurisdiction: NSW/Australia

Substance: Methyl ethyl ketone (MEK) CAS# 78-93-3

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	NSW requirements are overlaid by the Commonwealth level NICNAS requirements, which require information about hazardous properties production volumes, uses locations etc NSW Classification is required under 2 basic regulatory systems: dangerous goods and hazardous substances. Dangerous good classification is for transport and uses the Australian Code for the Transport of Dangerous Goods by Road & Rail and is based on primary hazard (flammable liquid). Classified using UNRTDG information requirements from Tests and Criteria. Hazardous substance classification, as referred to in the NSW Work Health and Safety Regulation, uses GHS methodology and would require similar information to that specified in the CLP.	Industrial Chemicals (Notification and Assessment) Act[1] NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3] NSW Work Health and Safety Regulation 2011[4]	As MEK has an existing approval in most systems, this study focuses for the data required for approval of a new 'Methyl ethyl ketone'. The requirements for data in the NSW system reference either the UNRTDG Tests and Criteria or the GHS. The NSW plus Australian chemical notification requirements require information with similarities to REACH.	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Labelling	Transport (dangerous goods) label requires UN number and proper shipping name as well as UN specified pictogram. Hazardous substance label requirement matches GHS unless the substance is a scheduled drug or poison but also requires identity of ingredients for mixtures.	NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3] NSW Work Health and Safety Regulation 2011[4]	Requirements consistent with GHS – but only because this is a GHS substance (pure chemical) – identity of ingredients not required on the label under the GHS 4th Edn	**2**
Data sheet	Data sheet requirements match those of the GHS although some detail is omitted and the GHS building block principle is used (e.g. Acute toxic category 5 not used)	NSW Work Health and Safety Regulation 2011[4]	GHS compliant data sheet would be acceptable noting that • There are obligations to update at fixed intervals • GHS means of dealing with commercial in confidence information is interpreted locally	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Packaging	Packaging requirements are UNRTDG 15th Edn copied into the Australian Code for the Transport of Dangerous Goods Workplace requirements are generic only	NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3] NSW Work Health and Safety Regulation 2011[4]	Minimal difference between URTDG 15th and 17th Edn for packaging performance.	**2**
IBC	IBC requirements are UNRTDG 15th Edn copied into the Australian Code for the Transport of Dangerous Goods	NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3]	Minimal difference between URTDG 15th and 17th Edn for IBC performance.	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Exposure limit (tox.)	Workplace exposure limit set for air for MEK in Australian workplace exposure standards (called up by Work Health and Safety regulation)	NSW Work Health and Safety Regulation 2011[4] Safework Australia: Workplace Exposure Standards for Airborne Contaminants Dec 2011[5]	There is also a workplace exposure limit for MEK in the NZ requirements	**2**
Exposure limit (ecotox.)	None found			**2**
Physical hazard (initiation)	Legislative requirements are not specific to either MEK or flammable liquids. Instead relevant regulation (workplace safety) requires a risk assessment and the putting in place of steps to minimise risks. Hazardous atmospheres are mentioned as a specific type of risk.	NSW Work Health and Safety Regulation 2011[4] Storage and Handling of Dangerous Goods Code of Practice 2005 WorkCover NSW[6] AS 1940 - 2004 Storage and handling of flammable and combustible liquids[7]	General practices in conducting such risk assessments and putting in place controls are to reference codes of practice (which in the case of NSW appear to no longer have statutory force) and Australian Standards. These standards contain a considerable number of ‘cascade’ references to other documents. References to some primary standards and documents are shown at left. In practice the obligations imposed will be similar to the NZ system but the acceptable standard is less clear – e.g. following particular codes is ‘evidential’ rather than an absolute defence as in the NZ system.	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Exposure limit heat/ blast	Legislative requirements are not specific to either MEK or flammable liquids. Instead relevant regulation (workplace safety) requires a risk assessment and the putting in place of steps to minimise risks. Hazardous atmospheres are mentioned as a specific type of risk.	NSW Work Health and Safety Regulation 20114 Storage and Handling of Dangerous Goods Code of Practice 2005 WorkCover NSW[6] AS 1940 - 2004 Storage and handling of flammable and combustible liquids[6]	General practices in conducting such risk assessments and putting in place controls are to reference codes of practice (which in the case of NSW appear to no longer have statutory force) and Australian Standards. These standards contain a considerable number of 'cascade' references to other documents. References to some primary standards and documents are shown at left. In practice the obligations imposed will be similar to the NZ system but the acceptable standard is less clear – e.g. following particular codes is 'evidential' rather than an absolute defence as in the NZ system.	**2**
Emergency preparedness	The regulations contain general obligations to be prepared for emergencies and include having in place fire fighting equipment and containing spills. Emergency plan required if 'manifest quantity' exceeded (2500 litres)	NSW Work Health and Safety Regulation 20114	Some differences in detail from NZ requirements (although detail is sparse in NSW regulation) Regarded as equivalent for practical purposes	**2**
Tracking	None found			**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Qualified person in charge	No obligations specific to substance found	NSW Work Health and Safety Regulation 20114	Australian Work health and safety legislation does include a general obligation for workers to be properly trained or supervised. This generic requirement is seen as equivalent to NZ Health and Safety in Employment law and so not specific to the substance or part of the chemicals control regime. Requirement is regarded as less stringent than NZ which requires qualified person in charge with specific knowledge above threshold amount.	**1**
Disposal	While not specifically controlled under the Environmentally Hazardous Chemicals Act, MEK disposal is likely to be captured as a scheduled process under the Protection of the Environment Operations Act. These operations are subject to site by site licensing designed to reduce emissions.	NSW Environmentally Hazardous Chemicals Act 1985[7] NSW Protection of the Environment Operations Act 1997[8]	The controls described do not provide the same level of specification as the NZ requirements for disposal but the effect is in most cases likely to be roughly equivalent. However the complexity of steps required is higher (e.g. requiring manifest tracking of the waste) so this requirement is scored as 3.	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Tankwagon	Under the Dangerous Good regulations tankwagons (called tank vehicles in the regulations) must comply with the Australian Dangerous Goods Code. The Good then calls up AS 2809.1 & 2 for specific requirements.	NSW Dangerous Goods (Road and Rail Transport) Regulation 20092 Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)3 Approval of a dangerous goods road tank vehicle design- webpage[9]	While we do not have access to full copies of the two AS cited, review of preview portions of these documents and of the compliance report templates provided on the 'approval of dangerous goods road tank vehicle...' web page indicates the requirements are prescriptive and similar to the performance requirements of the NZ regulations.	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Fixed bulk storage container	Legislative requirements are not specific to either MEK or flammable (or other hazard) liquids. Instead relevant regulation (workplace safety) requires a risk assessment and the putting in place of steps to minimise risks. No specific references to atmospheric bulk storage tanks can be found.	NSW Work Health and Safety Regulation 20114 AS 1940 - 2004 Storage and handling of flammable and combustible liquids[6]	General practices in conducting such risk assessments and putting in place controls are to reference codes of practice (which in the case of NSW appear to no longer have statutory force) and Australian Standards. These standards contain a considerable number of 'cascade' references to other documents. References to some primary standards and documents are shown at left. From the references within AS1940 it would appear that controls do not specifically add seismic and wind loading requirements to the cited design standards which are assumed equivalent to those cited in NZ requirements. Because of this control are regarded as less stringent than NZ	**1**
Score MEK Australia/NSW				**30**

[1] May be viewed here: http://www.comlaw.gov.au/Details/C2012C00082/Html/Text#_Toc313881260
[2] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+124+2009+cd+0+N
[3] May be obtained here: http://www.ntc.gov.au/filemedia/Publications/ADG7October2011.pdf
[4] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+674+2011+cd+0+N
[5] May be obtained here: http://safeworkaustralia.gov.au/AboutSafeWorkAustralia/WhatWeDo/Publications/Pages/Exposure-Standards-Airborne-Contaminants.aspx
[6] May be obtained here: http://www.workcover.nsw.gov.au/formspublications/publications/Pages/storageandhandlingofdangerousgoods.aspx
[7] May be obtained here: http://infostore.saiglobal.com/store/Details.aspx?ProductID=253546
[8] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N
[9] http://www.environment.nsw.gov.au/dangerousgoods/tankdesign.htm

1.6.3 Jurisdiction: Canada

Substance: Methyl ethyl ketone (MEK) CAS# 78-93-3

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	MEK is covered as a dangerous good in Transport of dangerous goods regulations and is covered by the Controlled products regulations as by reason of its flammability and toxic properties. The New Substances Notification Regulations which are Federal in extent require both environmental hazard data and (based on volume produced or imported) data about uses, likely exposure routes, and sources of discharge into the environment.	(Federal) Hazardous Products Act[1] (Federal) Controlled Products Regulations[2] (Federal) Transport of Dangerous Goods regulations[3] (Federal) New Substances Notification Regulations (Chemicals and Polymers) (SOR/2005-247)[4]	As MEK has an existing approval in most systems, this study focuses for the data required for approval of a new 'methyl ethyl ketone'. MEK's properties mean a new 'MEK' would meet the test criteria of the Transport of Dangerous Good s regulations and would be captured as a flammable liquid under the Hazardous Products Act and Controlled products Regulations. The classification criteria in the regulations have fewer categories than the EU CLP in respect of some toxic effects and no criteria for environmental effects. They also permit data from 'similar' chemicals. However further data is required under the New Substances Notification Regulations.	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Labelling	Labelling requirements at the federal level use different symbols from those specified under the GHS, including two symbols not specified by the GHS and excluding three GHS symbols. The label also requires a statement to the effect that a safety data sheet is available. The labels also require the pre-GHS R-phrases of the former EU system	(Federal) Hazardous Products Act1 (Federal) Controlled Products Regulations2	Requirements are significantly different from the GHS	**3**
Data sheet	Data sheet requirements listed are less than those for the standard GHS datasheet as environmental hazards and transport requirements are not specified.	(Federal) Hazardous Products Act1 (Federal) Controlled Products Regulations2		**1**
Packaging	The Transport of Dangerous Goods regulations require packaging which complies with prescriptions in a Canadian Standard. From those parts of the standard visible to us, it appears that this standard essentially mirrors the packaging requirements of the UNRTDG, although it may be an earlier than 17th Edn.	(Federal) Transport of Dangerous Goods regulations3	On the basis of information available packaging requirement are assumed to be equivalent to the UNRTDG.	**2**
IBC	The Transport of Dangerous Goods regulations require use of IBC which comply with prescriptions in a Canadian Standard. From the FAQ available on the Transport Canada website these requirements appear to match those of the UNRTDG	(Federal) Transport of Dangerous Goods regulations3 Transport Canada FAQ re IBC[5]		**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Exposure limit (tox.)	Workplace exposure limits are set in provincial legislation in Canada and Ontario legislation is used as an exemplar for these provincial requirements. This legislation does set an exposure limit for MEK.	(Province of Ontario) R.R.O. 1990, Regulation 833 Control Of Exposure To Biological or Chemical Agents[6]	A table of threshold values published by the Ontario Ministry of Labour specifies a time weighted average limit for MEK[7].	**2**
Exposure limit (ecotox.)	No requirement found		Assumed that no requirement has been set	**2**
Physical hazard (initiation)	Requirements for managing physical hazards appear are set in provincial legislation in Canada and Ontario legislation is used as an exemplar for these provincial requirements. The Industrial establishment regulations contain general requirements for ventilation and exclusion of ignition sources for handling flammable liquids but do not refer to either specific technical requirements or performance standards. The Ontario Fire Code also requires specific types of electrical equipment for places where flammable liquids) are and cross refers to the province's electrical regulations.	(Province of Ontario) R.R.O. 1990, Regulation 851 Industrial Establishments[8] Ontario Regulation 213/07 -The Ontario Fire Code[9]	Guidance referenced on the Ontario Ministry of Labour website references hazardous zones which appear to cross refer to electrical regulations. Total requirements are distributed but are estimated to be approximately equivalent to NZ requirements in practice.	**2**
Exposure limit heat/ blast	Requirements appear to be at provincial level and using Ontario as the exemplar, generic requires for flammables are set out in the Ontario Fire Code – largely as specifications for fire rated walls.	Ontario Regulation 213/07 -The Ontario Fire Code[9]	Fire rating requirement is generally greater than for equivalent NZ requirements which would translate to higher construction costs.	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Emergency preparedness	No transport Canada emergency plan requirements in the transport regulations. Emergency preparedness requirements for flammable liquids are at provincial level and using Ontario as an exemplar, these are provided in the Ontario Fire Code. The Code obliges the provision of fire extinguishers, spill control and provision of fire safety plans.	Federal) Transport of Dangerous Goods regulations3 Ontario Regulation 213/07 -The Ontario Fire Code[10]	The requirements of the Ontario fire code are highly prescriptive but the overall level of obligation is similar to that required for large volumes under the NZ requirements.	**2**
Tracking	No requirement found			**2**
Qualified person in charge	As MEK is a controlled product under the federal Controlled Products Regulations employers in Ontario are obliged to provide specific training for workers handling this chemical	Ontario Occupational Health and Safety Act: Regulation 860, Workplace Hazardous Materials Information System (WHMIS)[10]	MEK in New Zealand has specified 'qualified person in charge' requirements. There are some differences in trigger quantities and scope of the knowledge to be provided, the requirements are judged as less than the NZ requirement for a specifically certificated person.	**1**
Disposal	Ontario regulation used as the exemplar requires hazardous waste to be manifest tracked and treated in licensed facilities. The definition of hazardous waste includes flammable waste so is presumed to include MEK.	(Ontario) R.R.O. 1990, Regulation 347 General — Waste Management[11] Registration Guidance Manual For Generators Of Liquid Industrial And Hazardous Waste (Replaces 0195e) December 2009[12]	Manifest tracking and disposal through licensed facilities is regarded as more complex than the New Zealand requirement	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Tankwagon	Federal regulations require road tankwagons (called highway tanks) and rail tankwagons to be built and periodically tested for compliance with Canadian standards (e.g. CSA B6621 for highway tanks). We are not able to access these documents or even generic descriptions of then from public sources.	(Federal) Transport of Dangerous Goods regulations3	The cited standards are likely to be similar to other international standards for such vehicles with possibly some local small variations. Stringency assumed to be equivalent to NZ requirements.	**2**
Fixed bulk storage container	Storage requirements for non-petroleum flammable liquids are at provincial level. Using the province of Ontario as the exemplar, requirement are contained in the Ontario Fire Code and make specific reference to both API and Canadian design standards without specific further obligation to provide for seismic factors.	Ontario Regulation 213/07 -The Ontario Fire Code**Error! Bookmark not defined.Error! Bookmark not defined.**	Canadian codes are not readily accessible but are assumed equivalent to API codes. No mention found of additional factors over and above code design such as seismic, wind loading, extreme climate etc so assessed as less stringent than NZ. NB: the absence of additive factors in relation to seismic loading is reasonable given that the cited codes are for North American conditions.	**1**
		Score MEK Canada		**31**

[1] May be viewed here: http://laws-lois.justice.gc.ca/eng/acts/H-3/FullText.html
[2] May be viewed here: http://www.canlii.org/en/ca/laws/regu/sor-88-66/latest/sor-88-66.html
[3] May be viewed here: http://www.tc.gc.ca/eng/tdg/clear-tofc-211.htm
[4] May be viewed here: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-247/index.html
[5] May be viewed here: http://www.tc.gc.ca/eng/tdg/moc-ibc-faqunstandardizedibcs-246.html#when
[6] May be viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900833_e.htm
[7] http://www.labour.gov.on.ca/english/hs/pubs/oel_table.php
[8] May be viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900851_e.htm#BK12
[9] May be viewed here: http://www.e-laws.gov.on.ca/html/source/regs/english/2007/elaws_src_regs_r07213_e.htm
[10] May viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900860_e.htm#BK5
[11] May be viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900347_e.htm#BK27
[12] May be obtained here: http://www.ene.gov.on.ca/environment/en/resources/STD01_076193.html

1.6.4 Jurisdiction: Ireland

Substance: Methyl ethyl ketone CAS# 78-93-3

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	Ireland's laws directly put in place the CLP regulations – Chemicals Amendment Act as cited at left So requirements are as for the CLP.	Chemicals (Amendment) Act 2010[1] Regulation (EC) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP)[2] Regulation (EC) No 1907/2006 Of The European Parliament And Of The Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended)[3]	MEK is already approved in the Irish regime. However this exercise considers the data required if a new 'MEK' came in to the Irish market. CLP regulations apply. However a 'new' MEK would be caught by REACH requirements leading to requirements for data more extensive than those of the CLP	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Labelling	Irish law directly puts in place CLP requirements – Chemicals Amendment Act as cited at left So requirements are as for the CLP.	Chemicals (Amendment) Act 2010[1] Regulation (EC) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP)[3]	CLP regulations apply	**2**
Data sheet	Datasheet requirement under the Chemicals Act calls up REACH SDS (safety datasheet requirements)	Chemicals (Amendment) Act 2010[1] Regulation (EC) No 1907/2006 Of The European Parliament And Of The Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended)[4]	REACH data sheet requirement is equivalent to GHS	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Packaging	Irish law directly puts in place CLP requirements – Chemicals Amendment Act as cited at left So requirements are as for the CLP.	Chemicals (Amendment) Act 20101 Regulation (EC) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP)[3]		**2**
IBC	Regulations cited reference ADR for IBC	European Communities (Carriage of Dangerous Goods by Road and Use of Transportable Pressure Equipment) Regulations 20114 European Agreement concerning the International Carriage of Dangerous Goods by Road webpage[4]	ADR (European Agreement concerning the International Carriage of Dangerous Goods by Road) appears to be consistent with UNRTDG for IBCs	**2**
Exposure limit (tox.)	Exposure limits set using the indicated regulation which refers to the cited Code of Practice	Safety, Health and Welfare At Work (Chemical Agents) Regulations, 2001[5] Code of Practice for the Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001[6]	Both Ireland and NZ set workplace exposure limits	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Exposure limit (ecotox.)	No limit found for MEK in the regulations	European Communities Environmental Objectives (Surface Waters) Regulations 2009[7]		**2**
Physical hazard (initiation)	The regulations cited at right require the definition of areas of hazardous atmosphere zones. The European communities (equipment and protective systems ...) regulations then call up the ATEX directive for specific protective equipment for use in these zones.	Safety, Health and Welfare At Work (Explosive Atmospheres) Regulations 2003[8] European Communities (Equipment and Protective Systems Intended For Use in Potentially Explosive Atmospheres) Regulations, 1999.[9] 'ATEX' Directive 94/9/EC of the European Parliament and the Council on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres[10]	The controls imposed are framed as duties on the operator and are a mix of performance and prescription. The effect of the controls is generally equivalent to the controls in the NZ (HSNO) system although they provide more prescription and so less ability to provide different solutions but potentially more defined requirements Because of cross references made, are inherently complex to follow	**3**
Exposure limit heat/ blast	None found specific to MEK			**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Emergency preparedness	Requirements include • Adequate numbers of fire extinguishers • Emergency plans for larger quantities through the European Communities (Control of Major Accident Hazards...) regulations [The European Communities (Control of Major Accident Hazards...) regulations appear to replicate the EU COMAH or Seveso II directive] Requirements for bunding etc are imposed on sites under the Protection of Environment Act – see the Guidance note cited at right	Safety, Health and Welfare at Work (General Application) Regulations 2007[11] European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2006[12] Protection of the Environment Act 2003[13] IPC Guidance Note on Storage and Transfer of Materials for Scheduled Activities[14]	Emergency preparedness requirements appear to come from several different sources in the Irish system and it is not very clear when requirements become site specific. This complexity of requirements leads to the given score	**3**
Tracking	No requirement found			**2**
Qualified person in charge	No requirement found specific to MEK			**2**
Disposal	MEK is captured as a hazardous waste by reason of its flammability (second Schedule part III) in the Waste Management Act. The Act provides a regime controlling the handling of hazardous waste and requires its sending to treatment facilities and landfills subject to permitting under the Act. Individual permits under the permitting provisions set site specific limits on emissions.	Waste Management Act, 1996 (as amended)[15]	The controls described do not provide the same level of specification as the NZ requirements for disposal but the effect is in most cases likely to be roughly equivalent. However the complexity of steps required is higher so this requirement is scored as 3	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Tankwagon	Tankwagon specifications in the Republic of Ireland are as set out in the relevant sections of the ADR. This section is in reality a detailed design code for the design (and subsequent construction and in service testing) of these tank vehicles. Periodic testing and recertification is required for these vehicles.	European Communities (Carriage of Dangerous Goods by Road and Use of Transportable Pressure Equipment) Regulations 2011[16]	Section 6.8 of the ADR appears to have all the ingredients that the requirements for tankwagons in New Zealand have but in much more prescriptive form. From a regulatory stringency point of view there is little to choose between the two approaches, provided design code approaches are kept updated to match new technologies. (ADR is updated approximately annually.)	**2**
Fixed bulk storage container	For bulk storage of chemicals other than petroleum the major controls appear to be those imposed by Ireland's Environmental Protection Agency under the Protection of Environment Act. While the Agency appears to have considerable discretion in the actual application of the Act, it's guidance lists requirements for bulk storage tanks including above and below ground structures including design and construction in accordance with a 'recognised engineering code'. The obligations to meet certain requirements all stem from a requirement to undertake a risk assessment for the site, however a reading of the guidance suggests many of the obligations are standardised.	Protection of the Environment Act 2003[13] IPC Guidance Note on Storage and Transfer of Materials for Scheduled Activities[14]	As the requirements set out in the 'guidance note' appear not to include the additional requirements (over and above the basic integrity of the tank and fittings) for wind and seismic loading, NZ controls are judged as more stringent.	**1**
		Score MEK Ireland		**33**

[1] May be obtained here:
http://www.hsa.ie/eng/Legislation/Acts/Chemicals_Acts_2008_and_2010_and_the_Guide/Chemicals_Act_No_32_of_2010_pdf.pdf
[2] May be obtained here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:353:0001:1355:en:PDF
[3] May be obtained here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1907:20111210:EN:PDF
[4] http://www.unece.org/trans/danger/publi/adr/adr2011/11ContentsE.html
[5] May be viewed here: http://www.irishstatutebook.ie/2001/en/si/0619.html
[6] May be obtained here:
http://www.hsa.ie/eng/Publications_and_Forms/Publications/Chemical_and_Hazardous_Substances/Code_of_Practice_Chemical_Agent_Regulations_2011.pdf
[7] May be obtained here: http://www.environ.ie/en/Legislation/Environment/Water/FileDownLoad,20824,en.pdf
[8] May be viewed here: http://www.irishstatutebook.ie/2003/en/si/0258.html
[9] May be viewed here: http://www.irishstatutebook.ie/1999/en/si/0083.html
[10] May be viewed here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31994L0009:en:NOT
[11] May be viewed here: http://www.irishstatutebook.ie/2007/en/si/0299.html
[12] May be viewed here: http://www.irishstatutebook.ie/2006/en/si/0074.html#sched1-partii
[13] May be viewed here: http://www.irishstatutebook.ie/2003/en/act/pub/0027/index.html
[14] May be obtained here: http://www.epa.ie/downloads/advice/general/materials%20storage.pdf
[15] May be viewed here : http://www.irishstatutebook.ie/1996/en/act/pub/0010/print.html
[16] May be viewed here: http://www.irishstatutebook.ie/2011/en/si/0349.html

1.6.5 Jurisdiction: Japan

Substance: Methyl ethyl ketone (MEK) CAS# 78-93-3

NB: Descriptions as supplied by Prof. Hiroshi Jonai, Professor of Medical and Welfare Engineering, Graduate School of Science and Technology- Nihon University, Tokyo. All Japanese law and regulations are available only in Japanese so the descriptions below are referenced to the translated titles of the relevant legislation only (references supplied by Prof. Jonai). Scoring is based on our judgements from the information provided by Jonai.

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	Data is generally required for flammable solid or liquid to classify hazards by tests defined by Fire and Disaster Management Act The tests are different from UNRTDG Tests and Criteria Manual	Fire and Disaster Management Act Industrial Safety and Health Act	Jonai advises that assessment or self classification data not required for MEK as it is already listed in the relevant legislation. However, this exercise considers the data required if a new 'Methyl Ethyl ketone' came on to the market. Score is on the basis that the test indicated would be required and UNRTDG Tests and criteria tests would not be accepted.	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Labelling	Label requirements are different from the GHS, specific terms in Kanji required These terms are different from the GHS words (translated into Japanese)	Fire and Disaster Management Act Poisonous and Deleterious Substances Control Act	Jonai notes that, notwithstanding the requirements under the Fire and Disaster Management Act, the Industrial Safety and Health Act does require equivalents to the GHS (in Japanese). This complexity is judged greater than the GHS	**3**
Data sheet	Jonai advises that Japanese SDS requirements are equivalent to the GHS	Industrial Safety and Health Act Poisonous and Deleterious Substances Control Act		**2**
Packaging	Jonai advises that Transport by water or air requirements are equivalent to the UNRTDG 16th Edn. however there are specific requirements for carriage of goods in tunnels under water (special legislation)	Civil Aeronautics Act Ship Safety Act Road Act	The special legislation for carriage in tunnels under water are regarded as special requirements over and above basic packaging requirements (e.g. comparable to special restrictions on carriage of certain dangerous good by air) Scored as equivalent to UNRTDG	**2**
IBC	Requirements are equivalent to the UNRTDG 16th Edn	Civil Aeronautics Act Ship Safety Act	IBC are by definition multi-modal although carriage of IBC by air would generally be unusual	**2**
Exposure limit (tox.)	Exposure limit set of 200 ppm (assumed to be workplace exposure limit)	Industrial Safety and Health Act	Equivalent to NZ which also sets workplace exposure limit	**2**
Exposure limit (ecotox.)	None found			**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Physical hazard (initiation)	Jonai advises that there are requirements to separate from ignition sources, control temperature to below 55^{O}C and prevent vaporization	Fire and Disaster Management Act	Unclear from the advice provided if these are equivalent to the 'flammable atmospheres type controls found in other jurisdiction's legislation. Assumed equivalent effect to NZ law but from information provided less effort may be required to comply	**1**
Exposure limit heat/ blast	Requirements for separation distances and fire resistant walls for a building at the storage location	Fire and Disaster Management Act	Judged as equivalent to NZ requirements	**2**
Emergency preparedness	Quantities more than 200L require fire fighting equipment at storage location	Fire and Disaster Management Act	Unclear if other elements required (e.g. emergency plans) from the information available	**1**
Tracking	No requirement advised by Jonai			**2**
Qualified person in charge	Quantities more than 200 l require hazardous materials officer qualified by a national examination (Knowledge needed: laws concerned, physics and chemistry, hazard, fire prevention and extinguishing measures)	Fire and Disaster Management Act	Requirements equivalent to NZ although trigger quantity slightly different	**2**
Disposal	Jonai advises that disposed of MEK must be separated from other waste and ignition sources.	Waste Management and Public Cleansing Act	Appears similar to NZ requirement on available information	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Tankwagon	Requirements for tankwagon materials: for example specific type of steel Maximum tank volume 30000 litres, partitioned into smaller sections equal to or less than 4000. Other requirements described as 'similar to NZ'	Fire and Disaster Management Act	Requirements as stated are regarded as sufficiently similar to NZ to score as equivalent	**2**
Fixed bulk storage container	When presented with a summary description of NZ requirements (as contained in the relevant transfer order) Jonai described requirements in Japan as similar – including earthquake resistance. (Requirements may be more prescriptive and reference was made in Jonai's comments to minimum wall thickness for specified steel.)	Fire and Disaster Management Act	Requirements as stated are regarded as sufficiently similar to NZ to score as equivalent	**2**
Score MEK Japan				**30**

1.6.6 Jurisdiction: United Kingdom

Substance: Methyl ethyl ketone (MEK) CAS# 78-93-3

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	MEK is a dangerous substances under the CHIP 4 regulations and requires a person supplying such substances to make 'themselves aware of all relevant and accessible data that may exist' in relation to the substance.	The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 [UK regulation][1] Regulation (EC) No 1907/2006 Of The European Parliament And Of The Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended)[2]	MEK is already approved in the UK regime. However this exercise considers the data required if a new 'MEK' came on to the UK market. CHIP regulation is interpreted as equivalent the self classification requirement of the CLP. However a 'new' MEK would be caught by REACH requirements leading to requirements for data more extensive than those of the CLP.	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Labelling	Labelling requirements contained in the CHIP 4 regulations still require the Pre-GHS R and S phrases of the 1967 EC directive. Symbols and other information required are annexed in the regulation and are also not consistent with the GHS 'label' requirements. Some additional information required (e.g. EC number – see regulation 7) and exemptions for small packages	The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 [UK regulation]1 Globally Harmonized System of Classification and Labelling of Chemicals (GHS) Fourth revised edition United Nations, 2011[3]	The CHIP 4 regulation requirements are different from those of the GHS and so a different label (from GHS or Transport/GHS) would be required for the UK.	**3**
Data sheet	Datasheet required for dangerous substances – form of required information is consistent with GHS.	CHIP 4 Webpage describes requirement as the same as that under REACH [4] (empowering legislation is not clear) Further detail on HSE REACH pages[5]	REACH data sheet requirement is equivalent to GHS	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Packaging	CHIP 4 regulations cross refer to Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007 which in turn cross refer to European RID ADR document for package requirements. These appear to be a more chemical specific version of the UNRTDG requirements using largely the same performance level. Dangerous good in limited quantity also provided for. Packages specifically meeting maritime and air transport requirements are also permitted.	The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 [UK regulation][1] Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007[6] European Agreement concerning the International Carriage of Dangerous Goods by Road webpage[7]	The UK regulations do not appear to provide 'basic' packaging requirements but rather simply permit packages which are acceptable for any transport mode.	**2**
IBC	The UK Carriage of Dangerous Goods ... regulations reference ADR for IBC	Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007[6] European Agreement concerning the International Carriage of Dangerous Goods by Road webpage[5]	ADR (European Agreement concerning the International Carriage of Dangerous Goods by Road) appears to be consistent with UNRTDG for IBCs	**2**
Exposure limit (tox.)	Short and long term workplace exposure limits are set	The Control of Substances Hazardous to Health Regulations 2002[8] EH40/2005 Workplace exposure limits[9]	Regarded as equivalent to NZ.	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Exposure limit (ecotox.)	Only reference available appears to be to law for permitting certain types of facilities. No reference found to exposure limits as such for MEK	The Environmental Permitting (England and Wales) Regulations 2010[10]	From the information available assumed equivalent to NZ (no limit set)	**2**
Physical hazard (initiation)	Regulations require • Definition of hazardous atmosphere zones • (by cross reference with The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations) the installation of specified types of equipment in such zone to reduce the risk of fire or explosion • A specified hierarchy of actions to reduce the likelihood of fire or explosion. Cross reference is made to the 'ATEX directive' which provides further specification of equipment for use in hazardous atmosphere zones.	(UK)Dangerous Substances and Explosive Atmospheres Regulations 2002[11] (UK) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 1996[12] 'ATEX' Directive 94/9/EC of the European Parliament and the Council on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres[13]	The controls imposed are framed as duties on the operator and are a mix of performance and prescription. The effect of the controls is generally equivalent to the controls in the NZ (HSNO) system although • Provides more prescription and so less ability to provide different solutions but potentially more defined requirements Because of cross references made, are inherently complex to follow	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Exposure limit heat/ blast	None found specific to MEK	(UK)Dangerous Substances and Explosive Atmospheres Regulations 2002[11] The Regulatory Reform (Fire Safety) Order 2005[14]	Obligations placed in the 'Fire Safety Order' are generic and relate largely to providing means of escape from fires	**2**
Emergency preparedness	MEK is classified as 'highly flammable' for the purposes of the Control of major accident hazard (COMAH) regulations. General duties to control accidents apply for quantities above 50 tonnes and specific requirements for emergency plans apply for quantities above 200 tonnes. For smaller quantities the Management of Health and Safety at work regulations also apply, these impose general duties to assess risks to workers health and safety and provide necessary means to manage.	Control of Major Accident Hazards Regulations 1999 as amended [15] Management of Health and Safety at Work Regulations 1999[16]		**3**
Tracking	No tracking requirements found			**2**
Qualified person in charge	UK Management of Health and Safety at work regulations require employers to appoint a person with health and safety knowledge	Management of Health and Safety at Work Regulations 19998	Regulations similar to general requirements in the NZ Health and Safety in employment regulations and not chemical specific. Less stringent than NZ which requires specific expertise for handling larger quantities	**1**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Disposal	The hazardous properties of MEK (e.g. flammability) make it a hazardous waste in the Hazardous Waste regulations and the Scottish Special Waste Regulations. These regulations control handling of hazardous waste and require its sending to treatment facilities and landfills subject to the Environmental Permitting (England and Wales) Regulations. These regulations implement the EU's Integrated Pollution Prevention and Control (IPPC) Directive. Individual permits under the permitting regulations set site specific limits on emissions	Hazardous Waste (England and Wales)Regulations 2005 (amended 2009)[17] The Environmental Permitting (England and Wales) Regulations 2007[18] Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control[19].	The controls described do not provide the same level of specification as the NZ requirements for disposal but the effect is in most cases likely to be roughly equivalent. However the complexity of steps required is higher so this requirement is scored as 3	**3**
Tankwagon	Tankwagon specifications in the UK are as set out in section 6.8 0f the ADR. This section is in reality a detailed design code for the design (and subsequent construction and in service testing of these tank vehicles. Periodic testing and recertification is required for these vehicles.	The Carriage of Dangerous Goods (Classification, Packaging and Labelling) and Use of Transportable Pressure Receptacles Regulations 1996 (as amended)[20] European Agreement concerning the International Carriage of Dangerous Goods by Road webpage5	Section 6.8 appears to have all the ingredients that the requirements for tankwagons in New Zealand have but in much more prescriptive form. From a regulatory stringency point of view there is little to choose between the two approaches, provided design code approaches are kept updated to match new technologies. (ADR is updated approximately annually.)	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Fixed bulk storage container	It appears that fixed bulk storage tanks must meet general duties under various regulations, the coverage of some of which is not clear (e.g. the control of pollution (oil storage) regulations refer to 'any kind of oil including petrol') These general duties which require interpretation. For example, the UK Health and Safety Executive has issued guidance for inspection of bulk storage tanks but with little if any reference to requiring compliance with specific standards. The documents found do not contain specific seismic and wind loading requirements equivalent to those in NZ.	The Control of Pollution (Oil Storage) (England) Regulations 2001[21] (Equivalent regulations in Scotland and Northern Ireland) Control of Major Accident Hazards Regulations 1999[13] UK HSE technical circular: Integrity of atmospheric storage tanks SPC/Tech/Gen/35[22]	As NZ requirements include additional obligations (over and above the basic integrity of the tank and fittings) for wind and seismic loading NZ controls are judged as more stringent. Although we would observe that obtaining information about acceptable standards for tanks is difficult to do.	**1**
Score MEK United Kingdom				**33**

[1] May be viewed here: http://www.legislation.gov.uk/uksi/2009/716/contents/made
[2] May be obtained here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1907:20111210:EN:PDF
[3] May be obtained here: http://www.unece.org/trans/danger/publi/ghs/ghs_rev04/04files_e.html
[4] http://www.hse.gov.uk/chip/law.htm
[5] http://www.hse.gov.uk/reach/resources/reachsds.pdf
[6] May be viewed here http://www.legislation.gov.uk/uksi/2007/1573/regulation/51/made
[7] http://www.unece.org/trans/danger/publi/adr/adr2011/11ContentsE.html
[8] May be viewed here: http://www.legislation.gov.uk/uksi/2002/2677/contents/made
[9] May be obtained here: http://www.hse.gov.uk/pubns/books/eh40.htm
[10] May be viewed here: http://www.legislation.gov.uk/ukdsi/2010/9780111491423/contents.
[11] May be viewed here: http://www.legislation.gov.uk/uksi/2002/2776/contents/made
[12] May be viewed here: http://www.legislation.gov.uk/uksi/1996/192/contents/made

[13] May be viewed here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31994L0009:en:NOT
[14] May be obtained here: http://www.legislation.gov.uk/uksi/2005/1541/pdfs/uksi_20051541_en.pdf
[15] May be viewed here: http://www.legislation.gov.uk/uksi/1999/743/schedule/1/made
[16] May be viewed here: http://www.legislation.gov.uk/uksi/1999/3242/contents/made
[17] May be viewed here: http://www.legislation.gov.uk/uksi/2005/894/contents/made
[18] May be viewed here: http://www.legislation.gov.uk/uksi/2007/3538/contents/made
[19] May be viewed here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008L0001:EN:NOT
[20] May be viewed here: http://www.legislation.gov.uk/uksi/1996/2092/contents/made
[21] May be viewed here: http://www.legislation.gov.uk/uksi/2001/2954/contents/made
[22] May be viewed here: http://www.hse.gov.uk/foi/internalops/hid/spc/spctg35.htm

1.7 Sodium hydroxide CAS# 1310-73-2

1.7.1 Jurisdiction: New Zealand

(Hazard classification as shown in NZ system- provided to assist referencing NZ regulations and standards only:

6.1D: acute toxicity class D (GHS cat4)

8.1A Metallic corrosive class A

8.2B Skin corrosive class B

8.3A Eye corrosive class A

9.1D Aquatic ecotox class D

9.3C Terrestrial vertebrate ecotox class D)

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	Sodium hydroxide has an existing approval (#HSR001547) so no further data is required. However sodium hydroxide generically does not appear to be covered by any of the HSNO group standards, so if the approval did not exist, data on both the physical properties and hazardous properties would be required and submitted to the EPA. In addition sufficient information would be required to complete the risks costs and benefits section of a release application would be required. If the application was for NaOH as a cleaning product only then the cleaning products (corrosive) group standard would apply along with the self classification provisions of the group standard.	EPA website – approval to import or manufacture hazardous substance[1] Cleaning products group standard corrosive HSR002526[2]	While all the chemicals in the study are already approved in the NZ regime, this exercise considers the data required if a new 'sodium hydroxide' came on to the NZ market. Score is on this basis	**3**
Labelling	Labelling requirements are performance version of GHS (i.e. GHS label would comply) but regulation also explicitly permits use of UNRTDG label as complying. However regulation 18(c) of the HSNO Hazardous substances identification regulations requires information about possible changes which might cause the substance to become more hazardous in a closed container. Emergency management regulations also apply and require information on the first aid for exposure to the substance on the label along with emergency service contact.	EPA website – controls for hazardous substances database – Sodium hydroxide[3] Hazardous substances Identification regulations 2001[4] Hazardous substances (Emergency Management) Regulations2001[5]	No known self reactions in container to form new substance hazards. First aid and emergency contact are in addition to GHS basic requirement. GHS does contain power for competent authority to require additional information but this will increase costs over jurisdictions where this is not required.	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Data sheet	Requirements set out in Hazardous substances Identification regulations, reference sections similar to those in the GHS SDS specification and include specific requirements in respect of information about corrosiveness and toxicity.	EPA website – controls for hazardous substances database – Sodium hydroxide3 Hazardous substances Identification regulations4 Globally Harmonized System of Classification and Labelling of Chemicals (GHS) Fourth revised edition United Nations, 2011[6]	GHS compliant datasheet (in English) would comply with requirements. It is assumed that the specific wording of the regulation is equivalent to the relevant sections of the GHS requirement.	**2**
Packaging	Requirements set out in the Hazardous Substances (Packaging) Regulations – these are a performance translation of the UNRTDG 14th Edn Packaging requirements. NB includes requirements which translate the 'Dangerous Goods in limited quantity' requirements of this edition of the UNRTDG. Child resistant closures required for small quantities	EPA website – controls for hazardous substances database – Sodium hydroxide3 Hazardous Substances (Packaging) Regulations[7]	UNRTDG packaging would comply with this with the exception of: requirement for small containers (<2.5l) unless for workplace use to have child resistant closures	**3**
IBC	No requirements for IBCs listed	EPA website – controls for hazardous substances database – Sodium hydroxide3		**1**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Exposure limit (tox.)	No exposure limits set but requirement for protective clothing and equipment	EPA website – controls for hazardous substances database – Sodium hydroxide3		**2**
Exposure limit (ecotox.)	No environmental exposure limits set	EPA website – controls for hazardous substances database – Sodium hydroxide3		**2**
Physical hazard (initiation)	Not applicable			**2**
Exposure limit heat/ blast	Not applicable			**2**
Emergency preparedness	Large quantities require emergency response plans	EPA website – controls for hazardous substances database – Sodium hydroxide3 Hazardous substances (Emergency Management) Regulations20015		**2**
Tracking	No requirement for tracking			**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Qualified person in charge	No requirement for a qualified qualified person in charge of the chemical	EPA website – controls for hazardous substances database – Sodium hydroxide[8]		**2**
Disposal	Permitted disposal includes: export as waste, treatment so that the substance is no longer hazardous, discharge to environment after treatment including via landfill or treatment facility	EPA website – controls for hazardous substances database – Sodium hydroxide[9] Hazardous substances disposal regulations[10]		**2**
Tankwagon	Pure substance is a solid so tankwagon requirements do not apply			**2**
Fixed bulk storage container	Pure substance is a solid so fixed bulk container requirements do not apply			**2**
Score sodium hydroxide New Zealand				**32**

[1] http://www.epa.govt.nz/hazardous-substances/approvals/Pages/Release-approvals.aspx#Publicly
[2] http://www.epa.govt.nz/Publications/gs-cleaning-corrosive.pdf
[3] http://www.epa.govt.nz/search-databases/Pages/controls-details.aspx?SubstanceID=671&AppID=3280
[4] May be obtained here: http://www.legislation.govt.nz/regulation/public/2001/0124/latest/link.aspx?search=ts_regulation_hazardous+substances_resel&p=1
[5] May be obtained here: http://www.legislation.govt.nz/regulation/public/2001/0123/latest/whole.html?search=ts_regulation_hazardous+substances_resel&p=1#dlm43173
[6] May be obtained here: http://www.unece.org/trans/danger/publi/ghs/ghs_rev04/04files_e.html

[7] May be obtained here
http://www.legislation.govt.nz/regulation/public/2001/0118/latest/whole.html?search=ts_regulation_hazardous+substances_resel&p=1#dlm40764
[8] http://www.epa.govt.nz/search-databases/Pages/controls-details.aspx?SubstanceID=671&AppID=3280
[9] http://www.epa.govt.nz/search-databases/Pages/controls-details.aspx?SubstanceID=671&AppID=3280
[10] May be obtained here:
http://www.legislation.govt.nz/regulation/public/2001/0119/latest/whole.html?search=ts_regulation_hazardous+substances_resel&p=1#dlm41657

1.7.2 Jurisdiction: NSW/ Australia

Substance: Sodium hydroxide CAS# 1310-73-2

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	NSW requirements are overlaid by the Commonwealth level NICNAS requirements, which require information about hazardous properties production volumes, uses, locations etc Dangerous goods for transport: corrosive data in accordance with the tests cited in the ADG Code. These criteria are copied from the UNRTDG 15th Edn which in turn cross refer to the UNRTDG 'Tests and Criteria' Volumes. Hazardous substances (workplace) Work Health and Safety regulation direct cites GHS for classification and place obligation of importer or manufacturer to classify.	Industrial Chemicals (Notification and Assessment) Act[1] NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3] NSW Work Health and Safety Regulation 2011[4]	As sodium hydroxide has an existing approval in most systems, this study focuses for the data required for approval of a new 'sodium hydroxide'. The requirements for data in the NSW system reference either the UNRTDG Tests and Criteria or the GHS. The NSW plus Australian chemical notification requirements require information with similarities to REACH	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Labelling	Transport (dangerous goods) label requires UN number and proper shipping name as well as UN specified pictogram. Hazardous substance label requirement matches GHS unless the substance is a scheduled drug or poison but also requires identity of ingredients for mixtures.	NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3] NSW Work Health and Safety Regulation 2011[4]	Requirements consistent with GHS – but only because this is a GHS substance (pure chemical) – identity of ingredients not required on the label under the GHS 4th Edn	**2**
Data sheet	Data sheet requirements match those of the GHS although some detail is omitted and the GHS building block principle is used (e.g. Acute toxic category 5 not used)	NSW Work Health and Safety Regulation 2011[4]	GHS compliant data sheet would be acceptable noting that • There are obligations to update at fixed intervals • GHS means of dealing with commercial in confidence information is interpreted locally	**2**
Packaging	Packaging requirements are UNRTDG 15th Edn copied into the Australian Code for the Transport of Dangerous Goods Workplace requirements are generic only	NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3]	Minimal difference between URTDG 15th and 17th Edn for packaging performance.	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
IBC	IBC requirements are UNRTDG 15^{th} Edn copied into the Australian Code for the Transport of Dangerous Goods	NSW Dangerous Goods (Road and Rail Transport) Regulation 2009[2] Australian Code for the Transport of Dangerous Goods by Road & Rail (7th Edn) 2011 (called up by above regulation)[3]	Minimal difference between URTDG 15^{th} and 17^{th} Edn for IBC performance.	**2**
Exposure limit (tox.)	Workplace exposure limit set for air for sodium hydroxide in Australian workplace exposure standards (called up by Work Health and Safety regulation)	NSW Work Health and Safety Regulation 2011[4] Safework Australia: Workplace Exposure Standards for Airborne Contaminants Dec 2011[5]	Scoring is in comparison with NZ where no limit set	**3**
Exposure limit (ecotox.)	None found			**2**
Physical hazard (initiation)	Not applicable			**2**
Exposure limit heat/ blast	Not applicable			**2**
Emergency preparedness	Emergency plan required if 'manifest quantity' exceeded (2500 kg) As the substance sodium hydroxide is not a liquid secondary containment provisions not applicable	NSW Work Health and Safety Regulation 2011[4]	Some differences in detail from NZ requirements (although detail is sparse in NSW regulation) Regarded as equivalent for practical purposes	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Tracking	No requirement found for tracking of the substance			**2**
Qualified person in charge	No specific obligation found for a qualified person in charge of sodium hydroxide	NSW Work Health and Safety Regulation 2011[4]	NSW Work health and safety legislation does include a general obligation for workers to be properly trained or supervised. This generic requirement is seen as equivalent to NZ Health and Safety in Employment law and so not specific to the substance or part of the chemicals control regime.	**2**
Disposal	While not specifically controlled under the Environmentally Hazardous Chemicals Act, sodium hydroxide disposal is likely to be captured as a scheduled process under the Protection of the Environment Operations Act. These operations are subject to site by site licensing designed to reduce emissions.	NSW Environmentally Hazardous Chemicals Act 1985[6] NSW Protection of the Environment Operations Act 1997[7]	The controls described do not provide the same level of specification as the NZ requirements for disposal but the effect is in most cases likely to be roughly equivalent. However the complexity of steps required is higher (e.g. requiring manifest tracking of the waste) so this requirement is scored as 3.	**3**
Tankwagon	Substance is a solid – not applicable			**2**
Fixed bulk storage container	Substance is a solid – not applicable			**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Score sodium hydroxide Australia/NSW				**33**

[1] May be viewed here: http://www.comlaw.gov.au/Details/C2012C00082/Html/Text#_Toc313881260
[2] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+124+2009+cd+0+N
[3] May be obtained here: http://www.ntc.gov.au/filemedia/Publications/ADG7October2011.pdf
[4] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+674+2011+cd+0+N
[5] May be obtained here: http://safeworkaustralia.gov.au/AboutSafeWorkAustralia/WhatWeDo/Publications/Pages/Exposure-Standards-Airborne-Contaminants.aspx
[6] May be viewed here: http://www.legislation.nsw.gov.au/maintop/view/inforce/act+14+1985+cd+0+N
[7] May be viewed here: http://www.legislation.nsw.gov.au/viewtop/inforce/act+156+1997+ch.1-sec.1+0+N

1.7.3 Jurisdiction: Canada

Substance: Sodium hydroxide CAS# 1310-73-2

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	Sodium hydroxide is covered as a dangerous good in Transport of dangerous goods regulations and is covered by the Controlled products regulations under the Hazardous Products Act as it would be captured by its skin corrosive properties. The New Substances Notification Regulations which are Federal in extent require both environmental hazard data and (based on volume produced or imported) data about uses, likely exposure routes, and sources of discharge into the environment.	(Federal) Hazardous Products Act[1] (Federal) Controlled Products Regulations[2] (Federal) Transport of Dangerous Goods regulations[3] (Federal) New Substances Notification Regulations (Chemicals and Polymers) (SOR/2005-247)[4]	Sodium hydroxide has an existing approval in most systems, so this study focuses for the data required for approval of a new 'sodium hydroxide'. Under the Controlled products Regulations the classification criteria in the regulations have fewer categories than the EU CLP in respect of some toxic effects and no criteria for environmental effects. They also permit data from 'similar' chemicals. However further data is required under the New Substances Notification Regulations which go beyond what is required by the CLP, although data requirements are stepped with more information as production/ import volumes become large.	3

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Labelling	Labelling requirements at the federal level use different symbols from those specified under the GHS, including two symbols not specified by the GHS and excluding three GHS symbols. The label also requires a statement to the effect that a safety data sheet is available. The labels also require the pre-GHS R-phrases of the former EU system	Federal) Hazardous Products Act[1] (Federal) Controlled Products Regulations[2]	No different symbols from those used by the GHS are required under the Canadian system but there is an additional requirement for notice of a safety data sheet and for pre-GHS R-phrases.	**3**
Data sheet	Data sheet requirements listed are less than those for the standard GHS datasheet as environmental hazards and transport requirements are not specified.	Federal) Hazardous Products Act[1] (Federal) Controlled Products Regulations[2]		**1**
Packaging	The Transport of Dangerous Goods regulations require packaging which complies with prescriptions in a Canadian Standard. From those parts of the standard visible to us, it appears that this standard essentially mirrors the packaging requirements of the UNRTDG, although it may be an earlier than 17th Edn.	(Federal) Transport of Dangerous Goods regulations[3]		**2**
IBC	The Transport of Dangerous Goods regulations require use of IBC which comply with prescriptions in a Canadian Standard. From the FAQ available on the Transport Canada website these requirements appear to match those of the UNRTDG.	(Federal) Transport of Dangerous Goods regulations[3] Transport Canada FAQ re IBC[5]		**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Exposure limit (tox.)	Workplace exposure limits are set in provincial legislation in Canada and Ontario legislation is used as an exemplar for these provincial requirements. This legislation does set an exposure limit sodium hydroxide	(Province of Ontario) R.R.O. 1990, Regulation 833 Control Of Exposure To Biological or Chemical Agents[6]	A table of threshold values published by the Ontario Ministry of Labour does include an entry for sodium hydroxide[7].	**3**
Exposure limit (ecotox.)	No limit found			**2**
Physical hazard (initiation)	Substance is not classified with an physical hazard - not applicable			**2**
Exposure limit heat/ blast	Substance is not classified with an physical hazard - not applicable			**2**
Emergency preparedness	No emergency response assistance plan required under Federal transport of dangerous goods regulations No chemical or chemical class specific requirements found other than the basic information required in safety data sheets. - i.e. no chemical specific emergency plan requirements	Federal) Transport of Dangerous Goods regulations[3] Province of Ontario) Occupational Health and Safety Act[8]	The province of Ontario, used as the exemplar for provincial level Canadian requirements, does empower inspectors to require written plans in respect of, among other things, the emergency process for dealing with 'chemical, biological and physical agents. However as written the obligation is a power of inspectors not a legal requirement, and is not chemical or chemical class specific.	**1**
Tracking	No requirement found			**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Qualified person in charge	Sodium hydroxide is a controlled product under the federal Controlled Products Regulations which obliges employers in Ontario to provide training for workers handling this chemical	Ontario Occupational Health and Safety Act: Regulation 860, Workplace Hazardous Materials Information System (WHMIS)[9]	These requirements are more stringent than the NZ case where occupational safety law has only have general provisions for training and supervision of workers but less strict than the NZ 'approved handler' requirements.	**3**
Disposal	Ontario regulation used as the exemplar requires hazardous waste to be manifest tracked and treated in licensed facilities. The definition of hazardous waste includes corrosive waste. Guidance on the system is provided in the referenced Guidance manual.	(Ontario) R.R.O. 1990, Regulation 347 General — Waste Management[10] Registration Guidance Manual For Generators Of Liquid Industrial And Hazardous Waste (Replaces 0195e) December 2009[11]	Manifest tracking and disposal through licensed facilities is regarded as more complex than the New Zealand requirement	**3**
Tankwagon	Substance is a solid – not applicable			**2**
Fixed bulk storage container	Substance is a solid – not applicable			**2**
Score sodium hydroxide Canada				**33**

[1] May be viewed here: http://laws-lois.justice.gc.ca/eng/acts/H-3/FullText.html
[2] May be viewed here: http://www.canlii.org/en/ca/laws/regu/sor-88-66/latest/sor-88-66.html
[3] May be viewed here: http://www.tc.gc.ca/eng/tdg/clear-tofc-211.htm
[4] May be viewed here: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-247/index.html
[5] May be viewed here: http://www.tc.gc.ca/eng/tdg/moc-ibc-faqunstandardizedibcs-246.html#when

[6] May be viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900833_e.htm
[7] http://www.labour.gov.on.ca/english/hs/pubs/oel_table.php
[8] May be viewed here: http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90o01_e.htm
[9] May viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900860_e.htm#BK5
[10] May be viewed here: http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900347_e.htm#BK27
[11] May be obtained here: http://www.ene.gov.on.ca/environment/en/resources/STD01_076193.html

1.7.4 Jurisdiction: Ireland

Substance: Sodium hydroxide CAS# 1310-73-2

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	Ireland's laws directly put in place the CLP regulations – Chemicals Amendment Act as cited at left So requirements are as for the CLP.	Chemicals (Amendment) Act 2010[1] Regulation (EC) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP)[2] Regulation (EC) No 1907/2006 Of The European Parliament And Of The Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended)[3]	Sodium hydroxide is already approved in the Irish regime. However this exercise considers the data required if a new 'sodium hydroxide' came in to the Irish market. CLP regulations apply. However a 'new' sodium hydroxide would be caught by REACH requirements leading to requirements for data more extensive than those of the CLP	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Labelling	Irish law directly puts in place CLP requirements – Chemicals Amendment Act as cited at left So requirements are as for the CLP.	Chemicals (Amendment) Act 2010[1] Regulation (EC) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP)[3]	CLP regulations apply	**2**
Data sheet	Datasheet requirement under the Chemicals Act calls up REACH SDS (safety datasheet requirements)	Chemicals (Amendment) Act 2010[1] Regulation (EC) No 1907/2006 Of The European Parliament And Of The Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended)[4]	REACH data sheet requirement is equivalent to GHS	**2**
Packaging	Irish law directly puts in place CLP requirements – Chemicals Amendment Act as cited at left So requirements are as for the CLP.	Chemicals (Amendment) Act 2010[1] Regulation (EC) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP)[3]		**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
IBC	Regulations cited reference ADR for IBC	European Communities (Carriage of Dangerous Goods by Road and Use of Transportable Pressure Equipment) Regulations 2011[4] European Agreement concerning the International Carriage of Dangerous Goods by Road webpage[4]	ADR (European Agreement concerning the International Carriage of Dangerous Goods by Road) appears to be consistent with UNRTDG for IBCs	**2**
Exposure limit (tox.)	15min occupational exposure limit provided in a code of practice under the regulations specified	Safety, Health and Welfare At Work (Chemical Agents) Regulations, 2001[5] Code of Practice for the Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001[6]	Exposure limit is higher level of stringency than NZ	**3**
Exposure limit (ecotox.)	No limit found for sodium hydroxide in the regulations	European Communities Environmental Objectives (Surface Waters) Regulations 2009[7]		**2**
Physical hazard (initiation)	Not applicable – not classified for physical hazard			**2**
Exposure limit heat/ blast	Not applicable – not classified for physical hazard			**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Emergency preparedness	Sodium hydroxide is not listed as a scheduled substance in the European Communities Control of major accident hazard... regulations. So there are no specific requirements in relation to these (i.e. for emergency preparedness where larger quantities held). There are general obligations in respect of worker safety to undertake risk assessments and prepare emergency plans under the Safety, health and welfare at work ... regulations as cited at right. However these are generic to chemical hazards of any kind and only in respect to worker safety.	European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2006[8] Safety, Health and Welfare At Work (Chemical Agents) Regulations, 2001[9]	The requirements are less specific than the NZ. No specific requirement to develop an emergency plan, but the obligation to assess risks and provide appropriate steps is considered at least as stringent as NZ requirements.	**2**
Tracking	No requirements found			**2**
Qualified person in charge	No requirements found			**2**
Disposal	Sodium hydroxide is covered by the second schedule part III of the Waste Management Act. The Act provides a regime controlling the handling of hazardous waste and requires its sending to treatment facilities and landfills subject to permitting under the Act. Individual permits under the permitting provisions set site specific limits on emissions.	Waste Management Act, 1996[10] (and as subsequently amended)	The controls described do not provide the same level of specification as the NZ requirements for disposal but the effect is in most cases likely to be roughly equivalent. However the complexity of steps required is higher so this requirement is scored as 3	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Tankwagon	Not applicable – the substance is a solid			**2**
Fixed bulk storage container	Not applicable – the substance is a solid			**2**
Score sodium hydroxide Ireland				**33**

[1] May be obtained here: http://www.hsa.ie/eng/Legislation/Acts/Chemicals_Acts_2008_and_2010_and_the_Guide/Chemicals_Act_No_32_of_2010_pdf.pdf
[2] May be obtained here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:353:0001:1355:en:PDF
[3] May be obtained here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1907:20111210:EN:PDF
[4] http://www.unece.org/trans/danger/publi/adr/adr2011/11ContentsE.html
[5] May be viewed here: http://www.irishstatutebook.ie/2001/en/si/0619.html
[6] May be obtained here: http://www.hsa.ie/eng/Publications_and_Forms/Publications/Chemical_and_Hazardous_Substances/Code_of_Practice_Chemical_Agent_Regulations_2011.pdf
[7] May be obtained here: http://www.environ.ie/en/Legislation/Environment/Water/FileDownLoad,20824,en.pdf
[8] May be viewed here: http://www.irishstatutebook.ie/2006/en/si/0074.html#sched1-partii
[9] May be viewed here: http://www.irishstatutebook.ie/2001/en/si/0619.html#article8
[10] May be viewed here: http://www.irishstatutebook.ie/1996/en/act/pub/0010/index.html

1.7.5 Jurisdiction: Japan

Substance: Sodium hydroxide CAS# 1310-73-2

NB: Descriptions as supplied by Prof. Hiroshi Jonai, Professor of Medical and Welfare Engineering, Graduate School of Science and Technology-Nihon University, Tokyo. All Japanese law and regulations are available only in Japanese so the descriptions below are referenced to the translated titles of the relevant legislation only (references supplied by Prof. Jonai). Scoring is based on our judgements from the information provided by Jonai.

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	Assessment or self classification data not required Sodium hydroxide is on the list of Acts concerned as acute toxic or corrosive substance. Poisonous and Deleterious Substances Control Act, does not require assessment or self classification data. Jonai observes that some other Acts do but his comments suggest data requirements are less than would be required under the CLP	Industrial Safety and Health Act Poisonous and Deleterious Substances Control Act	Sodium hydroxide is approved (& listed) in the Japanese regime, however this exercise considers the data required if a new 'sodium hydroxide' came on to the Japanese market. On the basis of Jonai's comments data requirements are less than the CLP	**1**
Labelling	Specific terms are required on the label in Japanese characters (Kanji) and these terms are different from the GHS terms translated into Japanese	Poisonous and Deleterious Substances Control Act	A specific label will be required for Japan making this control more stringent than the GHS	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Data sheet	Japan's SDS requirements are equivalent to the GHS (in Japanese)	Industrial Safety and Health Act Poisonous and Deleterious Substances Control Act		**2**
Packaging	Requirements are equivalent to the UNRTDG 16th Edn, however there are specific requirements for carriage of goods in tunnels under water (special legislation)	Civil Aeronautics Act Ship Safety Act Road Act	The special legislation for carriage in tunnels under water are regarded as special requirements over and above basic packaging requirements (e.g. comparable to special restrictions on carriage of certain dangerous good by air) Scored as equivalent to UNRTDG	**2**
IBC	Requirements are equivalent to the UNRTDG 16th Edn	Civil Aeronautics Act Ship Safety Act	IBC are by definition multi-modal although carriage of IBC by air would generally be unusual	**2**
Exposure limit (tox.)	No entry			**2**
Exposure limit (ecotox.)	No entry			**2**
Physical hazard (initiation)	Not applicable			**2**
Exposure limit heat/ blast	Not applicable			**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Emergency preparedness	Facilities handling larger quantities require 'structural facilities to prevent leak, scatter or penetrate at storage location' (interpreted as equivalent to secondary containment requirements)	Poisonous and Deleterious Substances Control Act	Unclear if there is a requirement for emergency plans. Scoring with limited information approximately equivalent to NZ system	**2**
Tracking	No requirement			**2**
Qualified person in charge	Requires control by hazardous materials officer qualified by a national examination. Knowledge needed: laws concerned, chemistry, toxicity, treatment and storage	Poisonous and Deleterious Substances Control Act[1]	Unclear if this is quantity related. However requirement for hazardous materials officer more stringent than NZ requirement	**3**
Disposal	pH of waste equal to or less than 8.6 and Requirements for waste when discharged to the sea	Water Pollution Control Act Act on Prevention of Marine Pollution and Maritime Disaster	Limited information suggest approximate equivalence to NZ requirement to treat until not hazardous	**2**
Tankwagon	Requirements for tankwagon materials: for example specific type of steel Maximum tank volume 30000 litres, partitioned into smaller sections equal to or less than 4000. Other requirements described as 'similar to NZ'	Poisonous and Deleterious Substances Control Act	In fact tankwagon controls are only relevant to sodium hydroxide solution but controls are based on GHS definition of substance which for sodium hydroxide means a solid. Equivalence to NZ assumed.	**2**
Fixed bulk storage container	General requirement on structural facilities to prevent leak, scatter or penetrate at storage location	Poisonous and Deleterious Substances Control Act	In fact fixed bulk storage controls generally only relevant for liquids and as assessed Sodium hydroxide will be a solid	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Score sodium hydroxide Japan				**31**

[1] Web based English language notes on the Act (refer: http://www8.cao.go.jp/kisei-kaikaku/oto/otodb/english/houseido/hou/lh_05020.html) state that the Act requires registration of the business handling poisons and deleterious substances which further reinforces requirements in this area.

1.7.6 Jurisdiction: United Kingdom

Substance: Sodium hydroxide CAS# 1310-73-2

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Assessment data	Sodium hydroxide is a dangerous substances under the CHIP 4 regulations and requires a person supplying such substances to make 'themselves aware of all relevant and accessible data that may exist' in relation to the substance.	The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 [UK regulation][1] Regulation (EC) No 1907/2006 Of The European Parliament And Of The Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended)[2]	Sodium hydroxide is already approved in the UK regime. However this exercise considers the data required if a new 'sodium hydroxide' came on to the UK market. CHIP regulation is interpreted as equivalent the self classification requirement of the CLP. However a 'new' sodium hydroxide would be caught by REACH requirements leading to requirements for data more extensive than those of the CLP	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Labelling	Labelling requirements contained in the CHIP 4 regulations still require the Pre-GHS R and S phrases of the 1967 EC directive. Symbols and other information required are annexed in the regulation and are also not consistent with the GHS 'label' requirements. Some additional information required (e.g. EC number – see regulation 7) and exemptions for small packages	The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 [UK regulation]1 Globally Harmonized System of Classification and Labelling of Chemicals (GHS) Fourth revised edition United Nations, 2011[3]	The CHIP 4 regulation requirements are different from those of the GHS and so a different label (from GHS or Transport/GHS) would be required for the UK	**3**
Data sheet	Datasheet required for dangerous substances – form of required information is consistent with GHS.	CHIP 4 Webpage describes requirement as the same as that under REACH [4] (empowering legislation is not clear) Further detail on HSE REACH pages[5]	REACH data sheet requirement is equivalent to GHS	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Packaging	CHIP 4 regulations cross refer to Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007 which in turn cross refer to European RID ADR document for package requirements. These appear to be a more chemical specific version of the UNRTDG requirements using largely the same performance level. Dangerous good in limited quantity also provided for. Packages specifically meeting maritime and air transport requirements are also permitted.	The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 [UK regulation][1] Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007[6] European Agreement concerning the International Carriage of Dangerous Goods by Road webpage[7]	The UK regulations do not appear to provide 'basic' packaging requirements but rather simply permit packages which are acceptable for any transport mode.	**2**
IBC	The UK Carriage of Dangerous Goods ... regulations reference ADR for IBCs	Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007[6] European Agreement concerning the International Carriage of Dangerous Goods by Road webpage[5]	ADR (European Agreement concerning the International Carriage of Dangerous Goods by Road) appears to be consistent with UNRTDG for IBCs	**2**
Exposure limit (tox.)	Short term exposure limit provided in the workplace exposure limits document referenced by the Control of Substances Hazardous to Health Regulations 2002	The Control of Substances Hazardous to Health Regulations 2002[8] EH40/2005 Workplace exposure limits[9]	More stringent requirement than NZ which provides no exposure limit	**3**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Exposure limit (ecotox.)	Only reference available appears to be to law for permitting certain types of facilities. No reference found to exposure limits as such for sodium hydroxide	The Environmental Permitting (England and Wales) Regulations 2010[10]	From the information available assumed equivalent to NZ (no limit set)	**2**
Physical hazard (initiation)	Not applicable – no physical hazard			**2**
Exposure limit heat/ blast	Not applicable – no physical hazard			**2**
Emergency preparedness	Sodium hydroxide is not listed as a scheduled substance in the Control of major accident hazard (COMAH) regulations. So there are no specific requirements in relation to these (i.e. for emergency preparedness where larger quantities held). The Management of Health and Safety at work regulations therefore provide the main requirements imposing general duties to assess risks to workers health and safety and provide necessary means to manage.	Management of Health and Safety at Work Regulations 1999[11] Control of Major Accident Hazards Regulations 1999 as amended [12]	The requirements are less specific than the NZ. No specific requirement to develop an emergency plan, but the obligation to assess risks and provide appropriate steps is considered at least a stringent as NZ requirements.	**2**
Tracking	No requirement found			**2**
Qualified person in charge	UK Management of Health and Safety at work regulations require employers to appoint a person with health and safety knowledge	Management of Health and Safety at Work Regulations 1999[8]	Regulations similar to general requirements in the NZ Health and Safety in employment regulations and not chemical specific	**2**

	Description of requirement	Source/ Reference	Comments and assumptions	Score
Disposal	Sodium hydroxide is covered by Annex II of the Hazardous Waste regulations and the Scottish Special Waste Regulations. These regulations control handling of hazardous waste and require its sending to treatment facilities and landfills subject to the Environmental Permitting (England and Wales) Regulations. These regulations implement the EU's Integrated Pollution Prevention and Control (IPPC) Directive. Individual permits under the permitting regulations set site specific limits on emissions.	Hazardous Waste (England and Wales)Regulations 2005 (amended 2009)[13] The Environmental Permitting (England and Wales) Regulations 2007[14] Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control[15].	The controls described do not provide the same level of specification as the NZ requirements for disposal but the effect is in most cases likely to be roughly equivalent. However the complexity of steps required is higher (e.g. requiring manifest tracking of the waste) so this requirement is scored as 3.	**3**
Tankwagon	Substance is a solid – not applicable			**2**
Fixed bulk storage container	Substance is a solid – not applicable			**2**
Score sodium hydroxide United Kingdom				**34**

[1] May be viewed here: http://www.legislation.gov.uk/uksi/2009/716/contents/made
[2] May be obtained here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1907:20111210:EN:PDF
[3] May be obtained here: http://www.unece.org/trans/danger/publi/ghs/ghs_rev04/04files_e.html
[4] http://www.hse.gov.uk/chip/law.htm
[5] http://www.hse.gov.uk/reach/resources/reachsds.pdf
[6] May be viewed here http://www.legislation.gov.uk/uksi/2007/1573/regulation/51/made
[7] http://www.unece.org/trans/danger/publi/adr/adr2011/11ContentsE.html
[8] May be viewed here: http://www.legislation.gov.uk/uksi/2002/2677/contents/made

[9] May be obtained here: http://www.hse.gov.uk/pubns/books/eh40.htm
[10] May be viewed here: http://www.legislation.gov.uk/ukdsi/2010/9780111491423/contents.
[11] May be viewed here: http://www.legislation.gov.uk/uksi/1999/3242/contents/made
[12] May be viewed here: http://www.legislation.gov.uk/uksi/1999/743/schedule/1/made
[13] May be viewed here: http://www.legislation.gov.uk/uksi/2005/894/contents/made
[14] May be viewed here: http://www.legislation.gov.uk/uksi/2007/3538/contents/made
[15] May be viewed here: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008L0001:EN:NOT