

# Petroleum, Geothermal and Major Hazard Facilities

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*ANNUAL REPORT 2019/20*

February 2021

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## Sector Profile

**48** Major Hazard Facilities Upper tier  
23 Type 1, 9 Type 2 and 16 Type 3

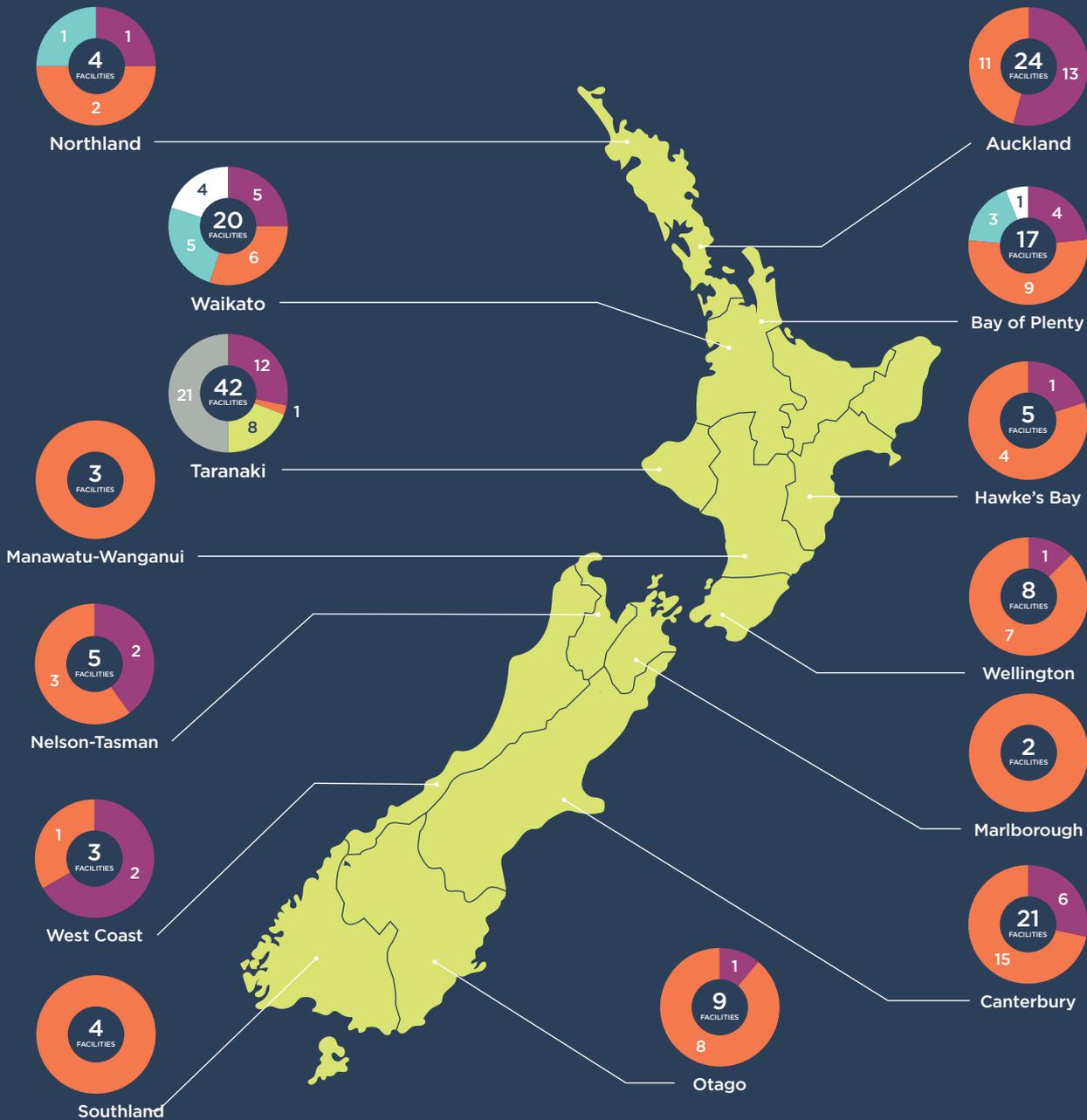
**76** Major Hazard Facilities Lower tier  
42 Type 1, 27 Type 2 and 7 Type 3

**8** Offshore Petroleum Installations  
7 Upper tier, 1 Non-production Installation

**21** Onshore Petroleum Installations  
14 Upper tier, 3 Lower tier and  
4 Non-production Installations

**9** MHF Geothermal Power Stations  
8 Upper tier, 1 Lower tier

**5** Non-MHF Geothermal  
Power Stations



● Upper tier MHF     
 ● MHF Geothermal     
 ● Offshore Petroleum  
● Lower tier MHF     
 ● non-MHF Geothermal     
 ● Onshore Petroleum

Our mission is to transform New Zealand's health and safety performance towards world-class. To achieve this requires the commitment not just of WorkSafe, but of businesses, workers and a wide range of other players in the health and safety system.

## Overview of this report

The identification and management of risk is critical for every business in New Zealand whether it is a farm, a joinery business or a petroleum installation. WorkSafe's mandate is to ensure that this happens, and the High Hazards, Energy and Public Safety (HHE&PS) unit focuses on those operations where there is a high risk of major incidents resulting in large numbers of fatalities or serious injuries.

This report focuses on the HHE&PS unit's interactions with the petroleum, geothermal and Major Hazard Facilities (MHF) industries. It emphasises that safety in these industries has to be an integral part of how the businesses are managed and how investment is targeted to ensure the integrity of plant and equipment. In these industries, even more than others, safety must be seen as a core element of how the business is managed, it cannot be an afterthought or add on.

The petroleum and MHF regulatory regimes were established in 2013 and 2016 respectively and they require upper tier MHFs<sup>1</sup>, upper tier petroleum production and all petroleum non-production installations<sup>2</sup> to have an accepted safety case in place. Safety cases are a demonstration that the operator has the ability and means to manage major hazard risks effectively.

<sup>1</sup> Major Hazard Facilities are designated as upper or lower tier from the quantity of specified hazardous substances present at a facility, as outlined in Schedule 2 of the Health and Safety at Work (Major Hazard Facilities) Regulations 2016, and the type of facility is determined by how the specified hazardous substances are used, as outlined in Schedule 8.

<sup>2</sup> Petroleum Installations are designated as upper or lower tier from the quantity of petroleum produced and the amount of liquefied flammable gases at the installation, as outlined in section 3 (1) of the Health and Safety at Work (Petroleum Exploration and Extraction) Regulations 2016.

All upper tier MHFs now have an accepted safety case in place. This means that operators of the highest hazard sites have demonstrated that they have identified the key risks associated with the operation of their plant and have processes and procedures in place to manage those risks. Our focus now will be on verifying that the elements of the accepted safety cases are actually in place and working effectively.

Our reviews of safety cases and our general on-site inspection programme identified a number of issues requiring attention (some through formal enforcement) that all operators in these industries should note. The majority of the issues related to safety critical elements, risk control implementation, emergency response plans, operational controls and asset integrity and maintenance.

The HHE&PS unit received 289 incident notifications for petroleum, geothermal and MHF sites in the year to July 2020 - 15 of these required emergency response plans to be activated and 11 of these had the potential to cause a major incident had any of the other controls failed.

We know there is still significant under-reporting across the sector and we urge operators to take a more diligent approach to notifying the regulator of issues occurring in their facilities. That is a legal requirement and good safety practice, but it also helps the HHE&PS unit identify safety performance trends that will underpin programmes designed to address emerging issues.

During this year, our team will focus on investigation of reported incidents and ensuring that operators are carrying out their own root cause investigations and developing plans to rectify the cause and prevent reoccurrence.

We will analyse notifiable incident data this year to build an enhanced picture of where we need to focus our efforts and share insights and learnings with the sector so that together we can drive improvements that will strengthen risk management, add resilience to crucial infrastructure and ensure that industries central to New Zealand's economy can continue to operate safely.

**Donna Ellis**

Chief Inspector High Hazards





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# 1.0

## About the regulatory regime

The petroleum and MHF regulatory regimes were established in 2013 and 2016 respectively, with the introduction of the Health and Safety at Work (Petroleum Exploration and Extraction) Regulations 2016 (“the PEE regulations”) and the Health and Safety at Work (Major Hazard Facilities) Regulations 2016 (“the MHF regulations”) under the Health and Safety at Work Act 2015 (“the Act”).

The Geothermal Energy Regulations 1961 (“the Geothermal Energy regulations”) while still in effect are largely revoked, and for this reason geothermal activities are predominantly regulated under either the Act or the MHF regulations (binary plants are designated as MHFs).

At the heart of the regulatory regimes is the requirement for upper tier MHFs, upper tier petroleum production installations and non-production installations to have an accepted safety case in place. An accepted safety case is effectively a leading indicator that high hazard risks have been identified by the operator, and that processes are in place to ensure those risks are effectively managed. The integrity of the plant and structures involved in high hazard operations is fundamental to ensuring safety. Ensuring asset integrity is essential to safety, continued economic production and plant reliability. This often requires a close linkage between safety and the investment strategy of the business. Safety must be seen as an integral aspect of operating the business, it cannot be an after-thought or add-on.

Worker engagement is a key requirement of, and fundamental to the effectiveness of a safety case and the effective operation of complex plant. Both WorkSafe as the regulator and businesses need to engage effectively with workers. It's important to ensure that workers understand the instructions and training they are given about the operation of hazardous facilities and installations. Engaging with the workforce is also important because they know how work is done rather than how it is imagined by senior staff and management, and are therefore better able to identify suitable and effective controls. Effective engagement with the workforce is essential to ensure that workers are properly involved in developing work systems and that what needs to happen on site is actually being delivered in practice.



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## 2.0

# Review of the past year

## 2.1 Safety cases

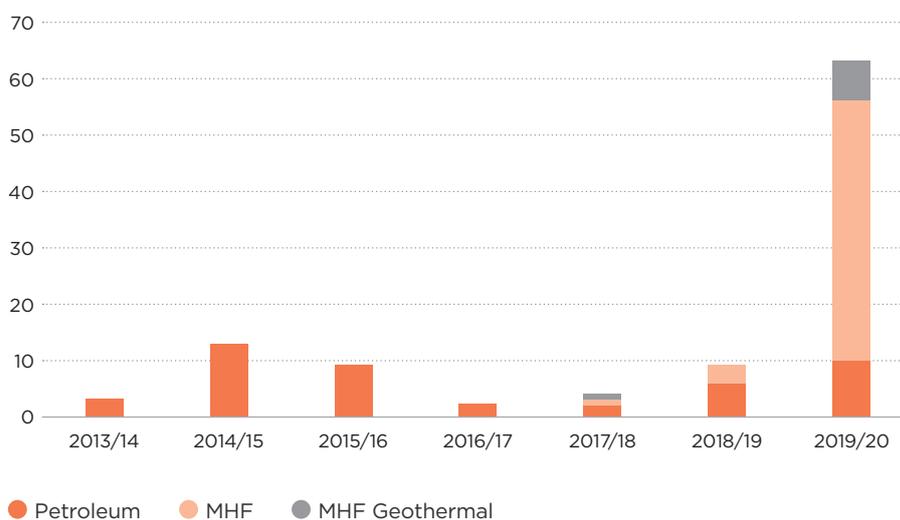
Upper tier MHFs are in their first five-year cycle of safety cases, with all existing facilities required to have an accepted safety case in place by April 2021.

To operate, any upper tier MHF must have an accepted safety case. The High Hazards team at WorkSafe has been focussed on assessing MHF safety cases in the past year. Requests for further information were made to many of the operators to ensure that appropriate processes were in place to manage high hazard risks at each site. Nine geothermal power stations with binary plant were designated as MHFs and required safety cases.

Petroleum installations are into their second five-year safety case cycle, and inspectors are reviewing the revised safety cases in 2020 and 2021 as they are submitted.

The numbers of safety cases accepted annually for Petroleum, MHF and Geothermal MHF sites since the beginning of the petroleum regime are shown in Figure 1, highlighting the large volume of safety cases assessed and accepted in the past year.

SAFETY CASES



**FIGURE 1:**  
Safety cases accepted each year for Petroleum, MHF and Geothermal MHF sites

Through the review of safety cases for MHF, geothermal MHF and petroleum sites, several key areas were identified across a number of sites that required improvements to the management system at the facility or installation, or were recorded as future inspection topics to be further explored by inspectors during site inspections.

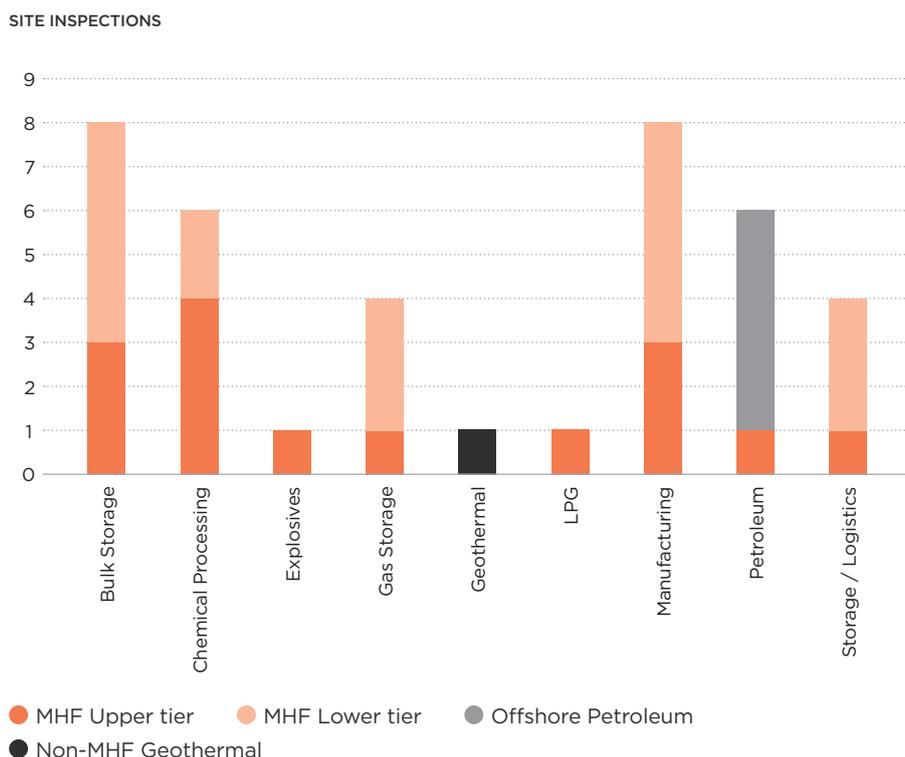
We will focus our inspections on emergency response plans, safety assessments - ensuring effective identification of all relevant potential major incident scenarios, monitoring the performance of control measures and worker engagement.

With all upper tier MHF sites now having an accepted safety case, the focus for inspectors shifts to the on-site verification that all elements of the safety case are actually in place on site and working effectively, and following up on future inspection topics in those key areas and other areas identified in safety case assessments.

## 2.2 Site inspections

Sites are prioritised for inspection on the basis of our assessment of the quality of the safety case, the number of future inspection topics, the time since the last inspection, and reported incidents or complaints.

Last year, 39 high hazard site inspections were undertaken across a range of industries (Figure 2). There were no site inspections to geothermal MHF or onshore petroleum installations. The number of site inspections was lower than typical due to the focus on assessing safety cases, and the impact of COVID-19 on travel and face-to-face interactions.



Site inspections in 2019/20 by high hazard site type

14

MHF Upper tier

19

MHF Lower tier

5

Offshore Petroleum

1

Non-MHF Geothermal

**FIGURE 2:** Site Inspections undertaken in 2019/20 by industry sector

## 2.3 Enforcement measures

Where inspectors identify health and safety issues, a range of enforcement measures are available for use. Enforcement measures include prohibition, improvement and non-disturbance notices, sustained compliance and directive letters. Recommendations may also be made but these are not legally enforceable. Inspectors are guided as to the appropriate level of enforcement by our Enforcement Decision-making Model (EDM).

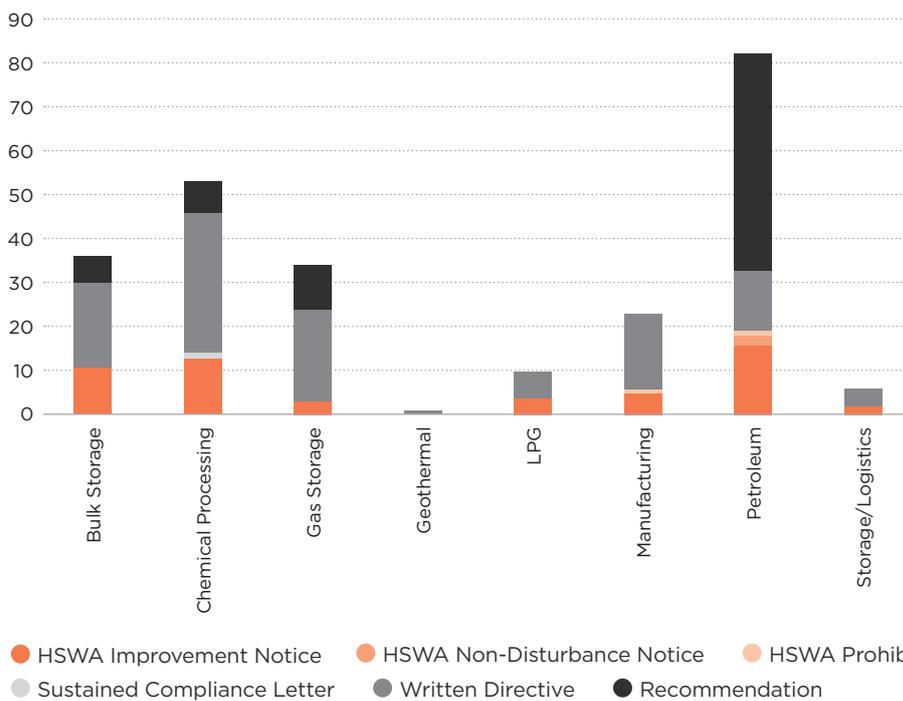
Table 1 shows the number of enforcement measures taken in 2019/20 by enforcement type and by industry sector. Last year, a total of 245 enforcement measures were taken at high hazard sites across a range of industries (Figure 3). The majority of the enforcement measures were taken at lower tier MHF (62%), upper tier MHF (17%) and offshore petroleum (20%) sites.

ENFORCEMENT MEASURE	MHF UPPER TIER	MHF LOWER TIER	OFFSHORE PETROLEUM	ONSHORE PETROLEUM	MHF GEOTHERMAL
Prohibition Notice		2			
Improvement Notice	22	30	1	1	
Sustained Compliance Letter	1				
Non-Disturbance Notice		2			
Directive Letter	16	95	2		1
Recommendations	3	23	46		

**TABLE 1:** Enforcement measures taken and recommendations made in 2019/20 by high hazard site type

We are putting processes in place to ensure we systematically follow up on all issues to ensure necessary controls are implemented in a timely manner.

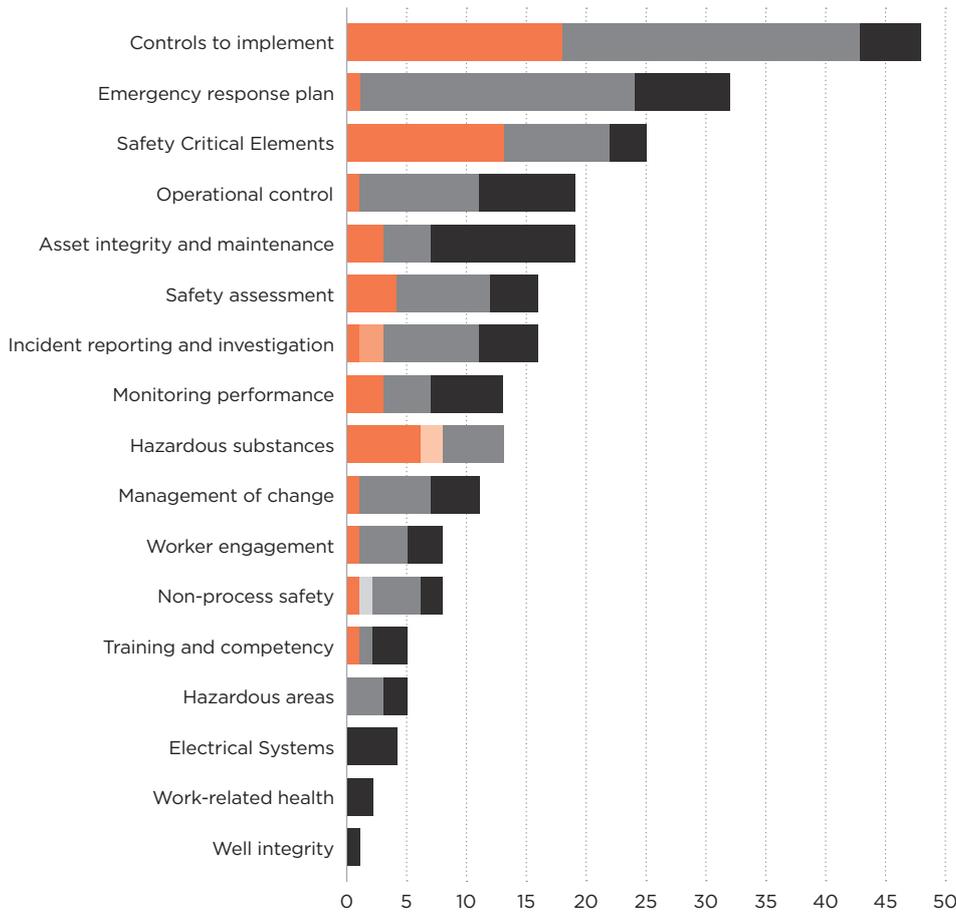
**ENFORCEMENT MEASURES AND RECOMMENDATIONS 2019/20**



**FIGURE 3:** Enforcement measures taken in 2019/20 by industry sector

Figure 4 shows the number of enforcement measures issued in 2019/20 by category, and provides an indication of the key areas of concern to our inspectors. Last year, the majority of enforcement measures were issued for health and safety issues relating to controls to implement (20%), emergency response plans (16%), safety critical elements (13%), operational controls (10%) and asset integrity and maintenance (10%).

ENFORCEMENT MEASURES AND RECOMMENDATIONS 2019/20



**FIGURE 4:**  
Enforcement measures taken in 2019/20 by category

- HSWA Improvement Notice    ● HSWA Non-Disturbance Notice    ● HSWA Prohibition Notice
- Sustained Compliance Letter    ● Written Directive    ● Recommendation

**Case study**

**Using our levers to drive change in the high hazards sector**

Used together in the right way, our levers of engagement, education and enforcement are powerful drivers for effecting health and safety change. WorkSafe targets our interventions to make a measurable difference, while holding those who do not meet their obligations to account. This year, this was demonstrated through our work with Lawter (NZ) Limited (Lawter); a chemical plant operator in Mount Maunganui.

Lawter was first designated as a lower tier MHF in 2017. As a result of our initial inspection of their process and plant, a gap analysis report was ordered. Our Inspectors began working with Lawter to improve existing health and safety practice and process.

In December 2019, Lawter suffered a plant failure involving a flammable liquid, resulting in a loss of containment. This event further highlighted why identified improvements were needed.

WorkSafe’s engagement prior to the event had already prompted Lawter to identify \$40m of capital and operational health and safety improvements. Even though they were already working with us, WorkSafe still had to decide the best approach to take in response to the event. To help, the MHF team relied on our enforcement decision-making model.

Andrew Hanson, a Specialist Health and Safety Inspector in the MHF team reflected, “At the conclusion of our inquiries and investigative work, and with consideration of previous operator commitments, a decision was made to focus on using WorkSafe’s levers of engagement and education to obtain the best outcome, rather than to prosecute”.

“The WorkSafe High Hazards team is always looking for the best outcome for workers, contractors, businesses, other persons and society as a whole, especially when considering the potential for uncontrolled events at major hazard facilities and installations that could expose multiple persons to risks to their health and safety, including a risk of death,” Andrew commented.

The participation of workers in the Lawter response was an important part of the change and improvement process; a tripartite process driven by WorkSafe, Lawter and its staff. Lawter commented that, “we believe Lawter staff are ideally placed to recognise areas in which procedures can be improved, and allowing them to have a voice and be part of the decision making process adds value to their jobs and allows them to play an active role in shaping the future of the company”.

Our decision to work with Lawter, rather than prosecute, does not mean that they were not held to account. All of our enforcement measures place obligations on duty holders. WorkSafe used prohibition notices (1), improvement notices (9), written directives (21), and non-disturbance notices (2), and made recommendations (3) to address the root causes of the issues identified at Lawter; in total 36 matters were raised. But, in their own words, “focusing on solutions and improvements, rather than facing prosecution, offered us a positive way to move forward and ultimately resulted in a safer environment”.

Lawter shared their experience of the incident and engagement with WorkSafe with other operators through the 2020 MHF forum. This helped the MHF community in New Zealand become more aware of the incident and investigation results, and how MHF operators can work to ensure they are meeting their own health and safety obligations.

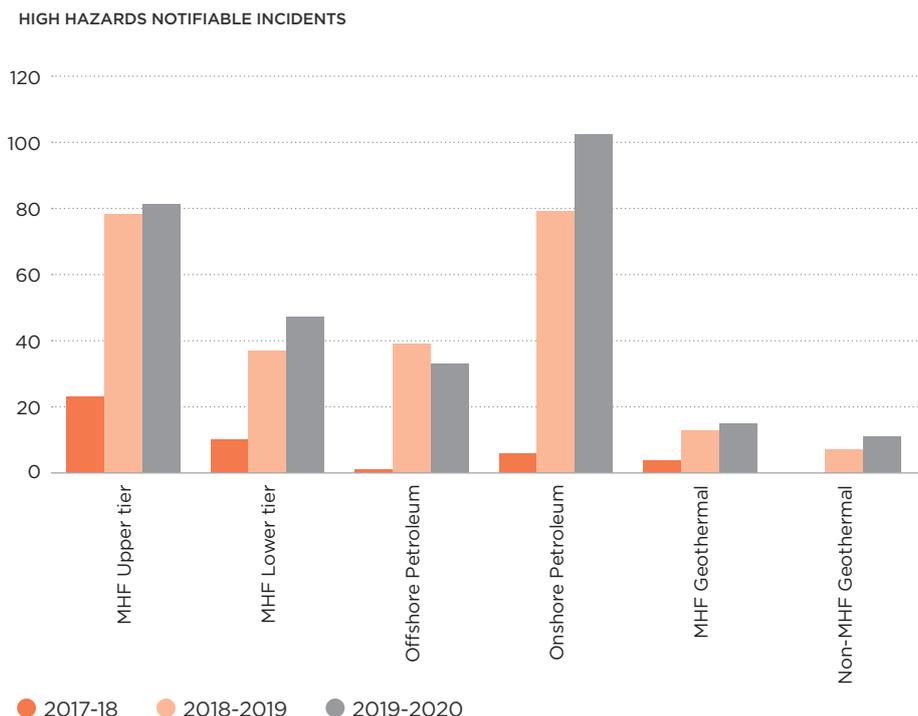
## 2.4 Notifiable incidents

Notifiable incidents, known to high hazard industries as ‘near-misses’ or ‘precursor events’ must be reported to WorkSafe under section 24(1) of the Act, regulation 70 of the PEE regulations, regulation 33 of the MHF regulations, and regulation 35A of the Geothermal Energy regulations.

Figure 5 shows the number of notifiable incidents at high hazard sites between July 2017 and June 2020. The number of notifiable incidents has increased over time as expected, due to improved understanding by operators to notify as per their legislative requirements. However, there is still significant under-reporting of incidents across the sector.

In the past 12 months (July 2019 – July 2020), only a third of MHF’s, compared with 76% of petroleum sites and 57% of geothermal sites reported notifiable incidents. In the past two years combined (July 2018 – July 2020), 48% of MHF sites 79% of petroleum sites and 86% of geothermal sites reported notifiable incidents.

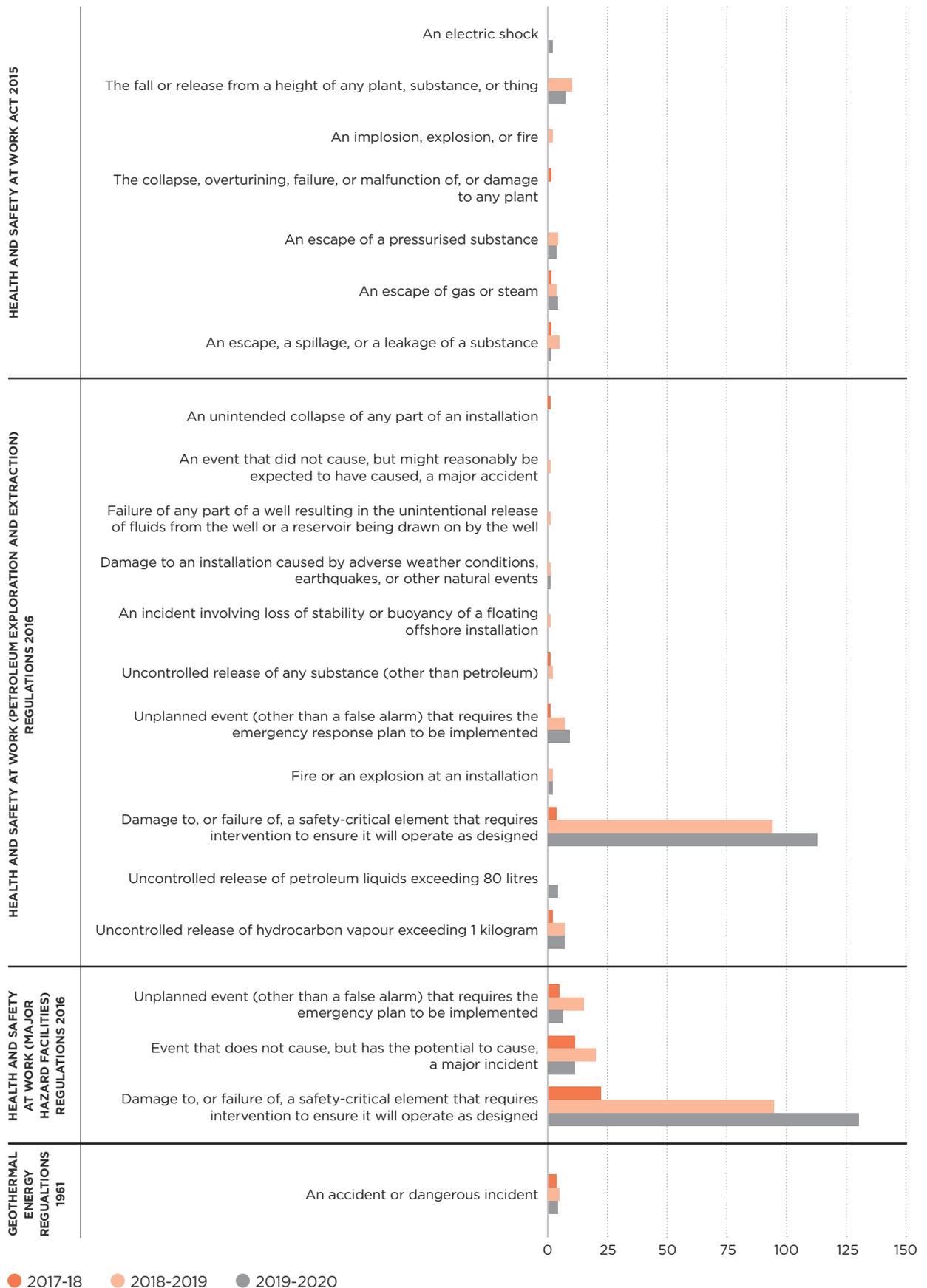
Inspectors will review reporting arrangements as part of our inspection approach. It is essential that operators monitor their processes for notifiable incidents as these are important indicators of failures in risk management. Having identified and reported incidents, operators should also investigate the causes of the incident, and take action to rectify failures and prevent their reoccurrence. We will increase our emphasis on the investigation of notified incidents in 2021, see page 18.



**FIGURE 5:**  
Notifiable incidents reported by high hazard site type between July 2017 and June 2020

Figure 6 shows the legislative categories for notifiable incidents reported to WorkSafe for the three years between July 2017 and June 2019. The data shows that in the 2019-20 year, 83% of notifiable incidents involved damage to, or failure of, a safety-critical element that required intervention to ensure it will operate as designed. A total of 15 unplanned incidents (other than false alarms) requiring emergency plans to be implemented occurred and 11 incidents that did not cause, but had the potential to cause a major incident occurred. There were seven incidents involving an uncontrolled release of hydrocarbon vapour (exceeding 1kg) and four incidents involving an uncontrolled release of petroleum liquids (exceeding 80L). In different circumstances, any of these incidents could have given rise to a major incident.

HIGH HAZARDS NOTIFIABLE EVENT LEGISLATIVE CATEGORIES 2018-19 AND 2019-20



**FIGURE 6.** Legislative categories for notifiable incidents reported by high hazard sites between July 2017 and June 2020

### Case study

#### **Improving safety at fuel storage depots – Implementing the Buncefield Recommendations**

Buncefield in the UK was the site of a major explosion and fire at a fuel storage facility. The explosion was a stark reminder of the risks associated with an apparently benign terminal.

The Health and Safety Executive (HSE) described the circumstances where in the early hours of Sunday 11th December 2005, a number of explosions occurred at Buncefield Oil Storage Depot, Hemel Hempstead, Hertfordshire. At least one of the initial explosions was of massive proportions and there was a large fire, which engulfed a high proportion of the site. Over 40 people were injured; fortunately there were no fatalities. Significant damage occurred to both commercial and residential properties in the vicinity and a large area around the site was evacuated on emergency service advice. The fire burned for several days, destroying most of the site and emitting large clouds of black smoke into the atmosphere.

The HSE and the Environment Agency investigated the incident and secured convictions against five companies who were ordered to pay almost £10m (\$20m) in combined fines and costs.

The findings of the investigation into the fire contained lessons for every operator of a high hazard facility. In particular the report drew attention to the need for:

- Systematic assessment of safety integrity level requirements
- Protection against loss of primary containment using high integrity systems
- Engineering against escalation of loss of primary containment
- Engineering against loss of secondary and tertiary containment
- Operating with high reliability organisations
- Delivering high performance through culture and leadership.

The New Zealand petroleum and MHF regulatory regimes requires that risks be controlled 'so far as is reasonably practicable' (SFAIRP). Demonstrating compliance with the Buncefield recommendations has been accepted as controlling the risks at fuel storage depots SFAIRP. This has provided clarity to the sector about how they can meet their obligations and demonstrate that risks are being managed.

The safety case assessment process and, where necessary, formal enforcement measures, have secured progress towards full adoption of the Buncefield recommendations at fuel storage depots. Controls including the installation of automatic overfill prevention systems, leak detection systems, fire protection systems, and closed circuit television have, or are now being, installed at fuel depots across New Zealand.

The introduction of these controls has been critical to ensuring that the risk of a major incident such as a fire, explosion, or large release of a toxic vapour is being appropriately managed at major hazard facilities across New Zealand. Ensuring that these critical precautions are fully implemented and maintained will remain a key issue for high hazard inspectors.

Detailed information is available at [www.hse.gov.uk/comah/buncefield/index.htm](http://www.hse.gov.uk/comah/buncefield/index.htm)

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# 3.0

## Our focus for the year ahead



### 3.1 Inspections

We plan to inspect every high hazard site at least once every two years. This year, we expect to undertake at least 100 inspections. At each inspection, we will ensure that we engage with the most senior person on site to explain the purpose of our visit and before we leave, we will discuss our findings, planned actions and secure their commitment to ensuring necessary improvements are made. Our formal correspondence will include senior personnel from the organisation and may include the organisation's Chief Executive Officer, General Managers, Country Manager, and Directors.

Our site inspections at sites with an accepted safety case in place will focus on verifying the topics identified for inspection during the safety case assessment and topics identified through previous site inspections to determine they are now working effectively. We will also consider inspections as a result of a notifiable event review.

Inspections will particularly focus on emergency response plans, safety assessments - ensuring effective identification of all relevant potential major incidents, monitoring the performance of control measures, worker engagement, asset integrity and maintenance, and incident reporting and investigation.

### 3.2 Investigation and analysis of notifiable incidents

We will place a greater emphasis on our investigation of reported incidents and ensuring that when incidents are reported, operators are carrying out their own thorough investigations to identify root causes and take appropriate remedial action. Analysis of data from these sources will be a significant element in future reports to identify trends and focus areas for WorkSafe as a regulator, and for improvement for the sector.

### 3.3 Major incidents and emergency plans

Over the next year, we will work with operators and emergency services to ensure expectations regarding an emergency response are realistic, and that emergency plans clearly identify the roles and responsibilities of those involved in a response (including plans at multiple or adjacent sites, level of training and capability, and access to specialist equipment).

The team is taking a proactive approach and working with local government regarding land-use planning to ensure that encroachment around high hazard sites does not occur, which could place members of the public at risk in a fire, explosion or toxic release. In September 2020, the Environment Court made a precedent-setting decision regarding setback distances around petroleum installations. The Environment Court has imposed changes to the South Taranaki District Plan to include setback distances of 250m for well heads and 650m for production stations. This decision has implications for authorities to consider separation between MHF's with potential off-site risk and nearby developments.

Where operators are unable to contain the impact of a major incident to their site boundaries, the risk of fatalities or serious injuries needs to be considered in future land use planning decisions around sensitive areas including residences and public access areas. The team will provide input on this issue in the reform of the Resource Management Act 1991.

### **3.4 Approach to high hazard sites below the threshold for 'Major Hazard Facility' designation**

We will be strengthening our oversight of high hazard facilities that fall below the threshold to be designated as 'Major Hazard Facilities' by creating an additional team of inspectors dedicated to this area. The team will link in with the work of the compliance certifiers and ensure that site standards are implemented and maintained.

### **3.5 Continue to build strategic relationships with other regulators in New Zealand and internationally**

To ensure that we remain abreast with international standards and learnings, we will maintain and develop our relationships with other regulators both in New Zealand and internationally, including International Offshore Regulators Forum, Health and Safety Executive (Great Britain), NOPSEMA, OECD, and the European Seveso inspectors.

### **3.6 Feedback**

This is our first report. We are keen to know what you think and how we can provide better or more useful data next time. Please send any feedback you have to [hhu.mhf@worksafe.govt.nz](mailto:hhu.mhf@worksafe.govt.nz)



### **Disclaimer**

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