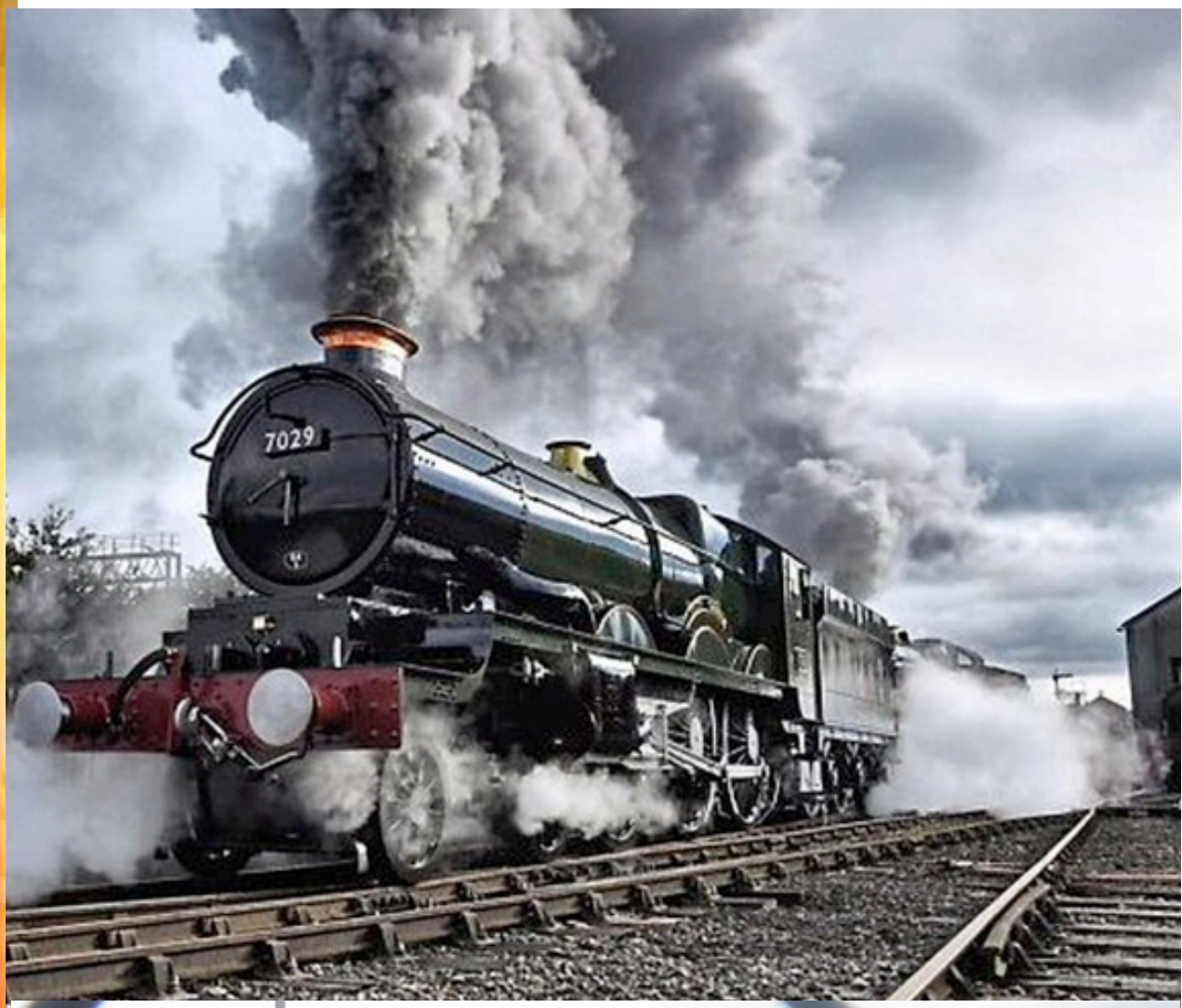
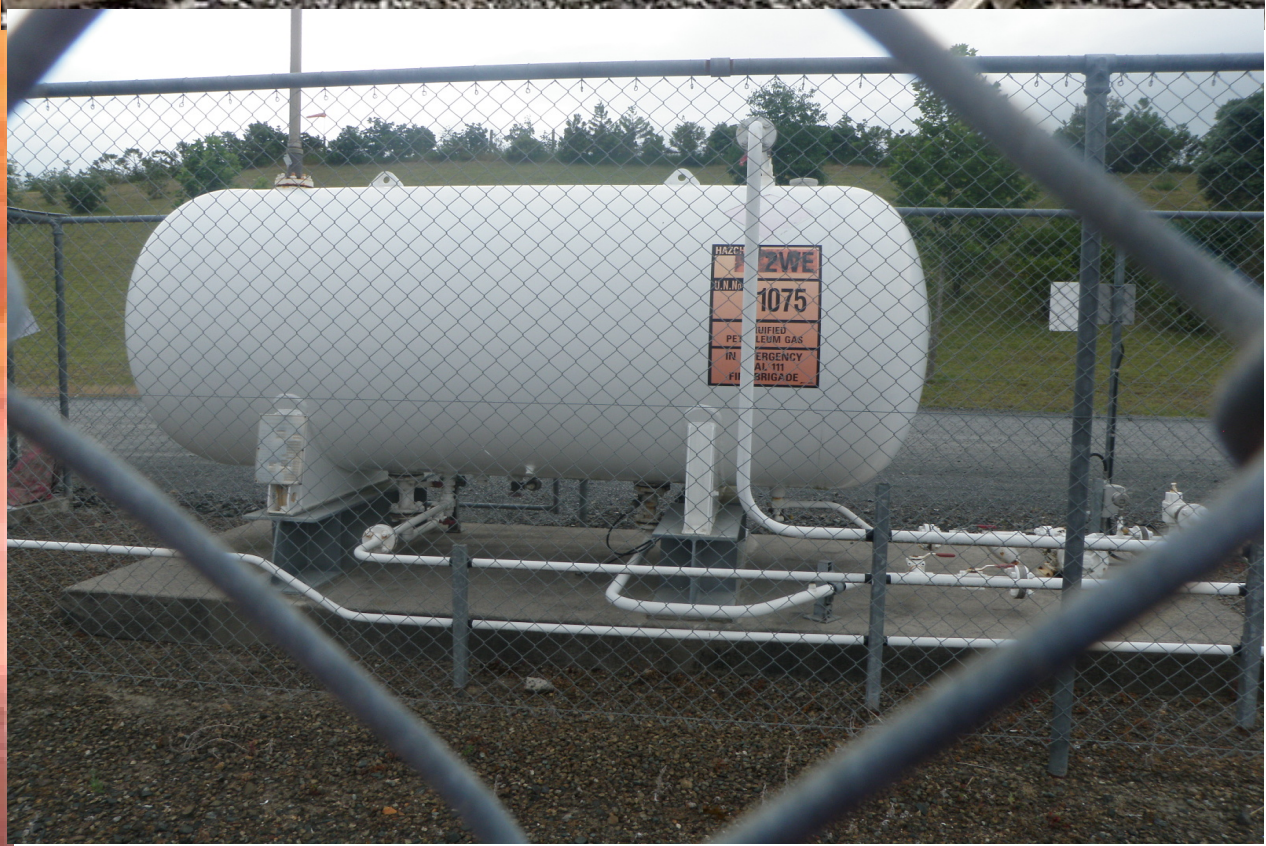
FLASHPOINT

NZ INSTITUTE OF HAZARDOUS SUBSTANCES MANAGEMENT

Winter 2019

The Dragons are back !





Are Compliance Certifers ok?

USEFUL ORGANISATIONAL CONTACTS

NZ Institute of Hazardous Substances Management
(formerly the Dangerous Goods Inspectors Institute)
www.nzihsm.org.nz
The official home of professionals committed to the safe management of hazardous substances and dangerous goods. The NZIHSM is a 'not for profit' industry association whose goal is to protect people, communities, and the environment against the adverse effect of hazardous substances, while maintaining the benefit of these.

Responsible Care NZ
Box 5557 Wellington 6145
Responsible Care NZ works with industry partners to implement the Hazardous Substances legislation.

Worksafe (MBIE)
www.worksafe.govt.nz
Government agency formed to povide compliance advice and enforcement of hazardous substances. Responsible for hazardous substances certificates.

EPA
www.epa.govt.nz
The EPA administers the HSNO Act and supplies extensive information on working with hazardous substances.

Ministry for the Environment
www.mfe
The Ministry provides policy, publications, technical reports and consultation documents on HSNO legislation.

HAZANZ
www.hazanz.og.nz
An association of the safety organisations in New Zealand.

Local Government NZ
www.lgnz.co.nz/lg-sector/maps/
Local Authorities have responsibility for policing building controls. Some local authorities are contracted to Department of Labour to provide enforcement of hazardous substances legislation. Often a first response point with valuable local knowledge.

Government legislation
www.legislation.govt.nz

If you know of other agencies which could be useful to members, please let us know at office@nzihsm.org.nz.

President's column

Trains, toxics and test certifiers!

It is amazing how fast life seems to travel past – it is now over 1.5 years since the advent of the Hazardous Substance regulations 2017 to replace the 1996 HSNO legislation after the Pike River calamity.

Fortunately most of the scientific truths of HSNO were retained and the results for the flammable transition have been satisfactory to date and approved handlers have now converted to certified handlers for toxics only. However, on this note the Class 6 and 8 toxics are now joining flammables for the location certificates, which does make sense if the hazardous substance regulations are to cover all HS hazards and the EPA perceived benefit of 25% less hospitalisations due to hazardous substances is to be sustained.

Industry should have notified Worksafe in June 2019 if they have trigger quantities of toxic hazardous substances and be fully certified by December 2019.

On a sadder note, it is just over a year since our previous editor Anthony Lealand passed away in during complications in an operation. We have missed him, and indeed so have many others, particularly as his fireworks demonstrations lit the night sky and those around him. Perhaps it is fitting that many firework demonstrations occurred almost exactly one year since his passing as New Zealand decided to celebrate Matariki this year in an explosive manner: Anthony would have enjoyed that!

Now, for this issue of Flashpoint under our editor Dave Lascelles, we have a number of articles concerning hazardous substances and certifiers and users as follows:

(i) Incidents that could have been avoided.

(ii) Train-sense and the government resurrecting the fuel efficiencies of trains to can assist with our global-warming obligations.

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Institute President John Hickey

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If hindsight was foresight

Companies can only prosper if they manage their activities so as to give benefits to society. The delivery of these benefits is what flows through the profitability and shareholders' returns essential for the survival of the business. A commitment to workplace safety and an environmental ethos must also be a fundamental part of delivering these benefits.

The core objectives of an effective SH&E policy are generally recognised to be compliance with:

- all relevant statutory regulations and codes;
- all company-specific policies, standards and mandatory requirements;
- responsible care codes of practice.

The use of a hierarchy of controls is the usual practice for mitigating the risk of serious injuries, which is a tiered approach to minimising safety risks, through the use of tools in the following order:

- Elimination. In simple terms, this means that safety hazards should be eliminated from the workplace whenever possible. For example if employees are working at heights, businesses should evaluate whether any activities can be done on the ground instead.
- Substitution. Can a hazardous substance or piece of equipment be replaced with something less dangerous?
- Engineering controls. These controls don't get rid of the hazard, but they aim to isolate workers from the risk. These controls mitigate events that could cause harm by, for example, putting workers behind guardrails or on elevating work platforms.
- Administrative controls. These include employee training, placing warning labels on products and posting signs in work areas that alert people to possible hazards.
- Personal protective equipment. PPE includes items such as safety glasses, hard hats and respirators. This is the last point at which harm can be mitigated. The hierarchy of hazard controls should be viewed as a layered approach, rather than a menu of options.

It is informative to review some recent incident reports* against the above framework in terms of which tool(s) in the hazards controls hierarchy could have prevented the incident.
[* These reports were sourced from Worksafe's incidents data base].

1. A worker in a transport yard sustained back injuries when a freight cage he was working in fell three metres from forklift tines. An analysis of the risk mitigation options could have included using a safety harness.

2. A worker was replacing a heat probe inside an enclosed manufacturing press, when the press was switched on, engulfing him in hot steam. Engineering controls could have included a locked and tagged electrical isolation.

3. A worker had a thumb severed while cleaning a machine used to blend products. The machine was judged to have inadequate guarding.

4. An uncontrolled LPG release on an industrial site allowed approximately 140 litres of LPG to be unexpectedly discharged from a trailer mounted calibrating unit. One worker was taken to hospital after receiving cold burns to the leg and another person suffered a knock to the head after the leak engulfed all the personnel and vehicles present at the vehicle loading bay site. The burns suffered by one worker suggest that PPE gear had not been considered as essential to the operation.

While if hindsight was foresight, all such incidents as those above would not occur, it benefits us all to take all practical steps to eliminate their possibility.

Trains:

Back to the future?

What is all this train-sense?

In its latest 'Wellbeing budget' the Government announced it was investing in the New Zealand Rail system and reducing the expenditure into upgrading roads. Is this sensible and why would the Government want to promote a transport system of the past?

Just over 100 years ago the world was ruled by rail, the mechanical horses propelled mankind into the Industrial Age. Big and beautiful, snorting steam and smoke, the dragons of their time!

They carried people and freight, freight and people, backwards and forwards from one end of the country to the other. From 1830 the first public railway, which used only steam locomotives, all the time, was the Liverpool and Manchester railway and commercial trains grew from there.

Steam power continued to be the dominant power system in railways around the world for more than a century until oil-based locomotives (such as diesel) took over. Railways were so much stronger and faster than animal-drawn carriages and throughout the Americas and Western world railways were developed, spreading their tracks and freight throughout the world.

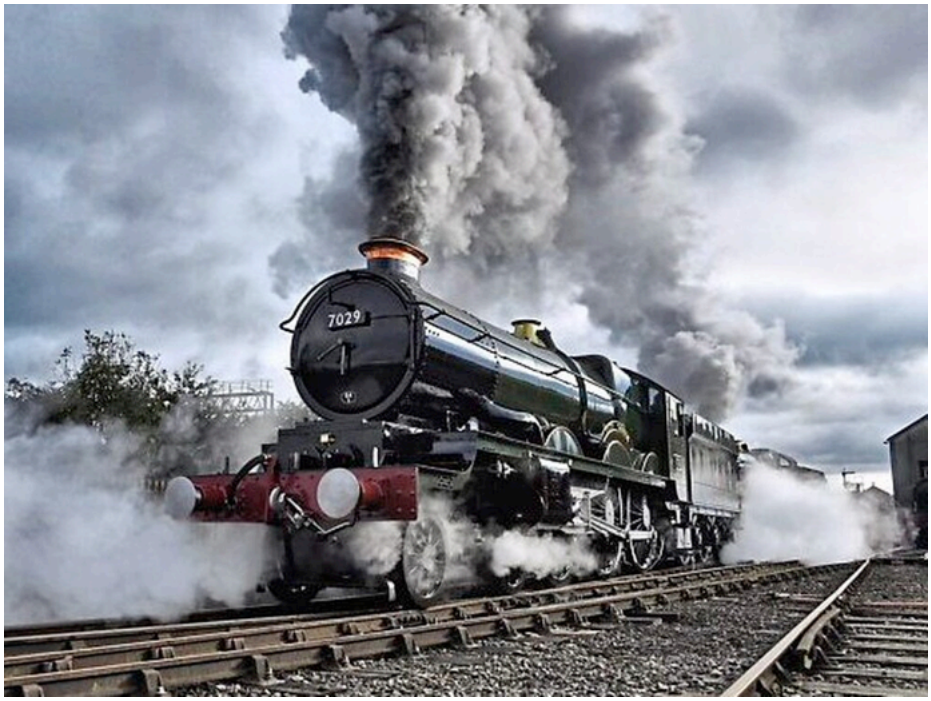
But in 1886 German inventor Karl Benz introduced his Benz Motorwagen– a horseless carriage, powered by oil, running on rubber wheels where railway tracks were not required.

They started slowly but then oil-powered automobiles became widely available in the early 20th century with one of the first cars accessible to the masses being was the 1908 Model T Ford.

The world of cars and automobiles dominated travel from the 1920s to the present day with the carriage of persons and freight being assisted by the advent of commercial airlines from the early 1950s. Freight and transport was now international and the mighty railway became a poor relation to their oil and wheel-based cousins and many felt that the age of Rail was past. But NO, the mighty railways still had a secret advantage, a fuel efficiency over its mechanised cousins in an age where fuel emissions are becoming significant.

The Coalition Government is to revitalise rail, with a substantial investment in KiwiRail, regional rail and the Auckland City Rail Link.

Budget 2019 and the Provincial Growth Fund provides $1 billion to support the redevelopment of KiwiRail. This includes $375 million for new wagons and locomotives, $331 million to invest in track and other supporting infrastructure and $35 million to begin the process of replacing current ferries that are nearing the end of



Steam raiiway --t he dragons of their time.

their lives. $300 million is also being provided from the PGF for investment in regional rail initiatives.

The Transport Minister said: "Rail makes a vital contribution to urban public transport. Moving more freight by rail is economically efficient, and reduces carbon emissions as well as deaths and serious injuries on our roads.

Rail has moved a long way from its steam roots with extremely high-speed electric transportation.

Or in the words of Winston Peters: "After 155 years of rail in New Zealand, the historic misstep of privatisation and the managed decline of the past decade, securing these assets for the future is especially gratifying."

But is this correct and how does this compare with offshore findings?

Efficiency of rail versus road

In New Zealand an Ernst & Young "Value of Rail Report" noted that rail prevents at least 271 accidents per year by reducing the number of trucks on the road, which may be a trifle optimistic. However, it also found that a tonne of freight moved by rail delivers a 66% reduction in carbon emissions compared with trucks. Similarly, an Association of American Railroads 2016 report found that moving freight by rail is four times more fuel efficient than moving freight on the highway. Trains can move a ton of freight over 470 miles on a single gallon of fuel. Efficient use of fuel means fewer greenhouse gas emissions for our planet.

A University of Canterbury study in 1984 on "The use of Energy in Tourism", during a previous ' Oil crisis', found similar results for the New Zealand condition.

In addition to this the US EPA estimates, when it is allowed to, that moving freight by rail, instead of highway transportation, lowers greenhouse gas emissions by 75%. They indicated that shifting 10% of long-haul freight from the highway to rail in the USA would reduce annual greenhouse gas emissions by approximately 18 million tons. The EPA found that Railroads are the most environmentally friendly way to move freight across land.

Rail sense

So overall in this age where following recent 'global warming agreements' the government is trying to reduce their carbon impact, the Railways do actually make sense in that it is far more fuel and carbon efficient per tonne of freight transferred than its road and airline alternatives.

So perhaps once again the increased use of rail for freight and passenger transport between large population centres and cities, along with a little 'carbon-absorbing' technology does indeed make sense.

Electric car idea freewheeling into impossibility

by David Lascelles

While it is wonderful to have new technologies, and electric cars are certainly an exciting technology, like with all technologies one must consider the WHOLE process flow and consider items like "Where does the electricity come from?"

A recent article on the electric car scene in New South Wales puts the likely uptake rate for electric cars in any country into some perspective – a political party in New South Wales is proposing an all-electric car plan by 2030! Its impossibie and most certainly will send Australia to the wall.

The monthly average domestic household energy need is 880 kilowatts or 10,560 kilowatts a year.

There are over 18,000,000 (eighteen million) vehicles registered in New South Wales of which 12,000,000 are cars.

Let's say that the lowest minimum horsepower for cars is 100 - most are between 150 to 350. One hundred horsepower (100 hp) equals 73.7 kilowatts. 73.7 kilowatts multiplied by twelve million is 882,000,000 kilowatts, and that will be every day.That's 322 billion kilowatts a year.

So, where is all the power coming from just to charge vehicles? NSW only produces 71,860,000,000 (i.e. 71.86 billion) kilowatts a year. It's an impossibility.

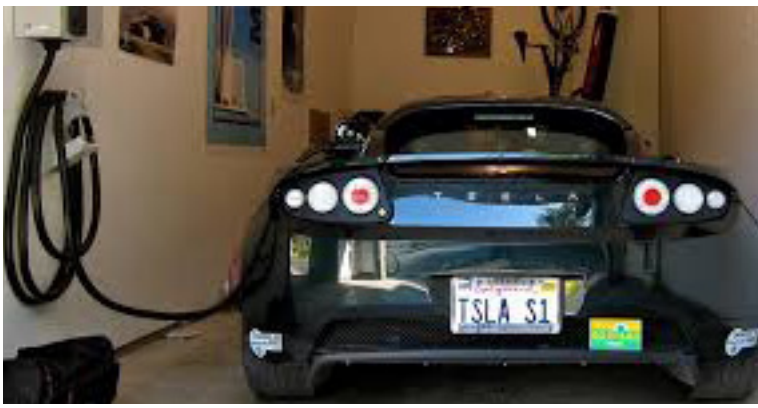
At the moment it takes 16 hours to fully charge an electric car and on a special 'quick' charge the time is (allegedly) two hours. It doesn't take much imagination to picture the frustration, delays and confusion at refill stations (wherever they'll be located) during peak hour and during holiday periods.

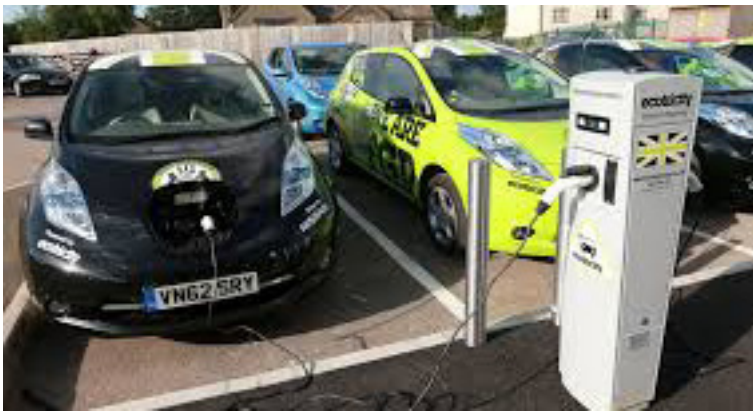
Even at the quickest rate of two hours, queues will be 30km long whole of NSW would become gridlocked. Imagine too if an electric car in peak time on a major motorway experienced a flat battery? No jerry cans in the boot to save the day there.

The politicians are leading us all into a living nightmare. In the older suburbs where there is only off-street parking, how will those car owners go about charging their vehicles?

Moreover, message to all the grey nomads – sell your caravans now because an electric-powered car hasn't been invented yet that can tow a van, and if one could, the cost to run it would be prohibitive.

And all the above says nothing of the time and cost to put a nation-wide re-charging infrastructure into place (or example, at every petrol station).





Yes, the electric cars are a great innovation, but one must consider the WHOLE PROCESS before jumping at the latest bright bauble, as without the overall process consideration and solutions, there is a real risk that we may create a bigger problem than the petrol problem that we are trying to solve.

Are certifiers worth it?

In 2018 the NZIHSM President and Administrator were invited to a meeting with the government's Workplace Minister to discuss the benefits of and issues surrounding the Hazardous Substances Compliance certification regime and specific issues that were evident with the transfer to the Hazardous Substance 2017 regulations from the previous HSNO legislation. This article summarises the issues discussed.

The NZIHSM was founded in 2002 from Dangerous Goods Inspectors, Designers and Users with the goal to, "Protect the Environment and Health and Safety of People and Communities by preventing or managing the adverse effects of Hazardous Substances, while maintaining the benefit of these". The NZIHSM works alongside other organisations such as HSPNZ, IChemE and Engineering NZ involved in the use of chemicals in industry and the Workplace to maintain the Health and Safety of all.

The hazardous substance issue discussions:
In line with our goal, the NZIHSM team discussed four main issues as follows:

1. NZIHSM believes that the HSNO regime practice of having industry experienced, non-government enforcement, independent Compliance certifiers is important and has demonstrated benefits for Industry and Society since its inception in 2006.
2. Class 9 (Environment toxins) are now only included (for information only) in the new Hazardous Substance Regulations Dec 2017. NZIHSM believes that they are very important to our environment and as per the previous HSNO Act should always be checked and considered as part of certification.
3. Training for all workers, compliance certifiers and enforcement should be consistent with science and certification requirements.
4. Should environmental toxins include consideration of global warming effects?

What are the benefits of hazardous substance compliance certifiers?

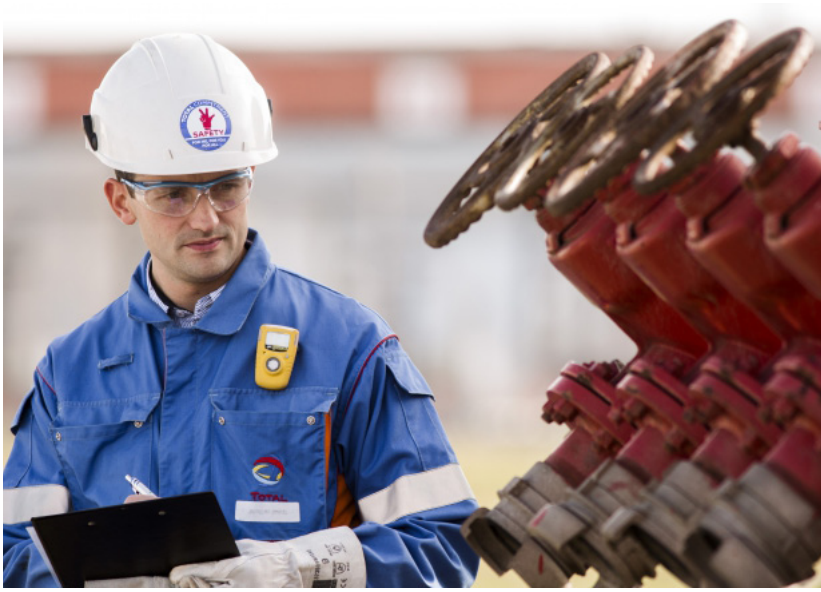
The NZIHSM experience to-date has been that an independent compliance certifier have visited sites and as a benefit to industry can provide 'general advice' on the safe hazardous substance handling requirements for compliance to industry.

This has been a mutual collaboration between government, certifiers and industry that has been beneficial to all parties in that:

For industry – they can obtain general 'hazsub' compliance advice from industry-experienced professionals without the immediate threat of an enforcement action while they remedy any 'minor and technical' issues. When compliant, industry also benefit from a compliance certificate which is considerably 'cheaper' than a court-instigated process.

For government – the certifiers have represented a 'minimal or no cost' resource through the hazardous substance industries, by industry-trained certifiers, without the potential conflict between issuing compliance certificates where possible enforcement activity is required later if an incident occurs.

An additional benefit of an independent compliance certifier has allowed government to indirectly convey compliance advice with an annual site visit without the need for immediate enforcement or direct conflict should a later incident occur.



For the certifiers – the benefit of being able to liaise with industry to provide general compliance advice, with some government support and protection against direct legal court action, has allowed the independent test certifier regime to be successful.

Are these benefits proven?

While it is difficult to statistically prove that accidents did not occur (ie: fence at top of cliff worked), some support for this can be found in the EPA article (page 4, Flashpoint Summer 2018) where the EPA survey found that that:

"The data included a 25% decrease in the total number hospitalised (due to hazardous substances) over 10 years (433 in 2015 compared with 578 in 2006, despite an 11% increase in New Zealand's population)". This decrease in hospitalisation almost directly lines up with the time that the independent compliance test certifier regime has been operating.

Should ecotoxins be checked as part of location certification?

Contrary to the previous HSNO Act, the Class 9 (Environment toxins) are included (for information only) in the new Hazardous Substance Regulations Dec 2017. NZIHSM believes that ecotoxics are very important to our environment and should be considered in its own right when considering hazardous substance so that its value is recognised and not just as a possible side effect from other items.

NZIHSM believes it is very important that the environmental toxic nature of chemicals (Class 9) are still considered and checked as part of the compliance certification location certificate process in addition to those just considered significantly toxic to humans (Class 6). This is because many substances can adversely affect the environment at significantly lower concentrations than they become directly hazardous to humans, which in effect, allows greater environmental exposure to these ecotoxins if Class 9 ecotoxins are not included.

Some examples –

a. ***Diesel***

Diesel fuel had HSNO Classes 3.1D, 6.1E, 6.3B, 6.7B, 9.1B where secondary containment is required for 3.1D at 10,000 litres, but 9.1B at 1000 litres storage. This would imply that if 9.1B is not considered, the trigger quantity for diesel bunding compliance checking will increase to 10,000 l under HSAW (HS) from 1000 l under HSNO)

This may be significant given that diesel spills contribute to some of the more noticeable incidents within NZ.

b. ***Chlorine (liquid)***

Liquid chlorine had HSNO Classes 5.1.1B, 6.1D, 8.1A, 8.2C, 8.3A, 9.1A, 9.2A, 9.3A where secondary containment is required for 9.1A at 100kg (half a drum) under the HSAW hazsub Regs from Dec 2017. This is now risen to the human toxic under Schedule 16 of 1000kg. This is a significant increase and unless containment is checked from 100kg significant damage to the environment could ensure for smaller life forms. (ie: should a key component of mustard gas be released at higher quantities?)

Training for all workers and compliance certifiers and enforcement should be consistent with science and certification requirements?

Delivering training does cost time, resource and money.

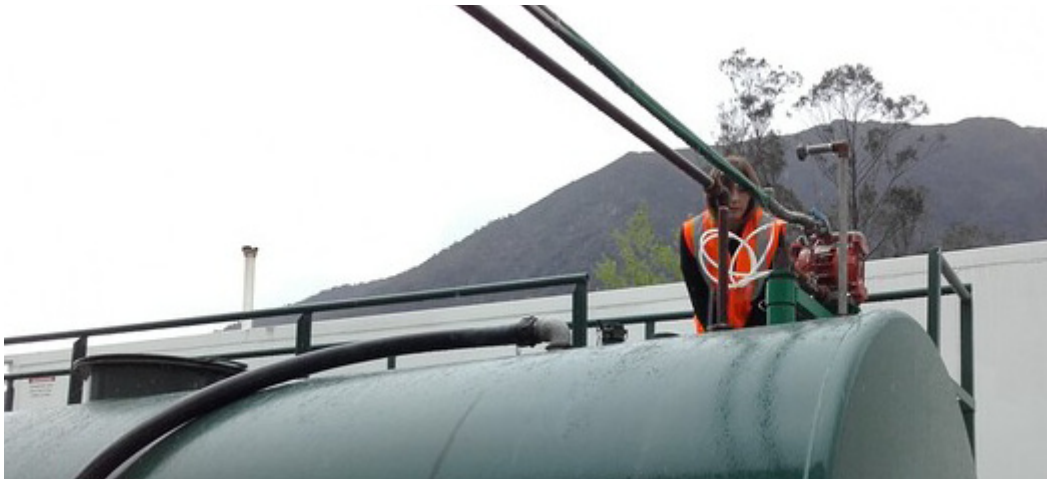
(a) Compliance certifiers and enforcement officers initial training.

Initial training of new legislation should be carried out by Worksafe to ensure that compliance certifiers and enforcement are receiving consistent interpretation of the legislation. It is suggested that Worksafe carry out at least one annual joint training of certifiers and enforcement and where possible Industry covering relevant issues per year.

(b) For training for ALL and certifiers CPD

The Approved handler training under HSNO has been replaced by Training for ALL handlers under Hazsub Regs 17, Section 4.5.

It is of interest, however, to note that many compliance certifiers have found that in spite of this call for increased training for ALL, because specific approved handlers are no longer required for each HS site that hazardous substance Training numbers have actually decreased across industry. This should be monitored over time to see if this pattern continues.



Should environmental toxins be broadened to include for global warming.

There seems to be consensus that while the carbon age, and chemicals thereof, has been of great benefit to the human race we may not have considered the full process.

There is significant evidence that our planet may be absorbing more of the suns rays in the recent past, effectively warming our plant.

A major cause of this appears to be an increase in carbon dioxide in our atmosphere which continues to allow shorter wave ultraviolet radiation to pass through and be absorbed by the earth but blocks some longer wave heat radiation from being reemitted – 'the greenhouse effect'.

NZIHSM believes that the benefits of carbon-based products should be continued to be enjoyed, but that much of the carbon dioxide byproduct of the combustion reaction should also be cleaned at source and waste carbon products recycled so that the planetary effect is minimised. (Note: Global warming can lead to sea level rise as land ice melts and more intense rain and storms as more sun energy and water vapour is available from a warmer atmosphere).

Current issues

There is some concern that the number of compliance certifiers appears to be decreasing with discussion amongst certifiers appearing to indicate that the increased non-chargeable compliance requirements for certifiers is increasing the certifier's work burden per site certificate, but industry is not always able to pay increased costs to match this burden.

This, along with the age profile of experienced certifiers, has resulted in a decrease in numbers.

To quantify this, in November 2013 the EPA hazardous substance test certifier list numbered around 230 ,whereas in June 2018 the it was 78. This would appear to indicate that the number of available certifiers has decreased by almost two-thirds over the past five years.

Should we be concerned with this reduction and what are the benefits of having a government independent hazardous substance compliance certifier regime?

While this is of concern, and it would be good if more science graduates could be recruited into this hazardous substance (chemicals) profession, this decrease in the number of qualified certifiers is somewhat offset by the increased use by certifiers of trainee and experienced assistants due to the time and difficulties involved in new certifiers being approved.

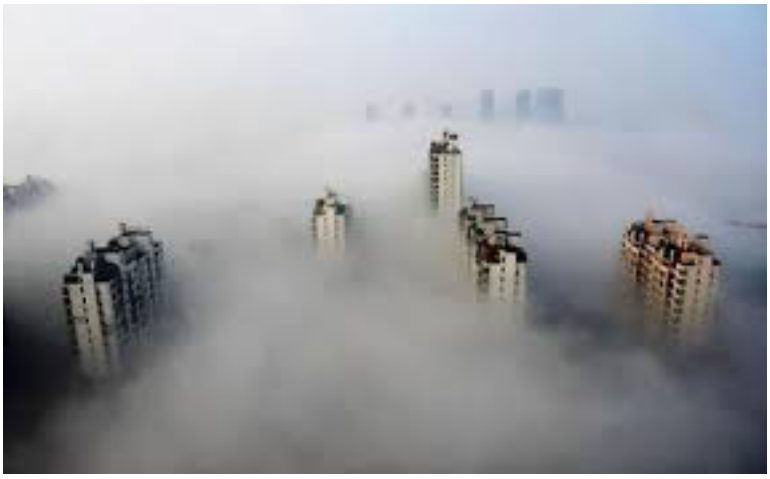
Summary

In summary, it is believed that the experienced compliance certifier system is still of significant benefit to ALL in that at least once per year knowledgeable visits where hazardous substances are used, does continue to promote ongoing safe use of hazardous substances within New Zealand.

But is this difficult job as 'guardians' of HS safety for industry, the Government and the people, worth it? On consideration of all the factors, it would appear that in our land of 'He Tangata', even one Kiwi is worth it, but we appear to have done far better than this.

This numerical benefit was also demonstrated by the 25% decrease in hospitalisation due to hazardous substances in the initial 10 years of the hazardous substance certification regime!

Smogacalypse persists



by David Lascelles

China's air quality has been an issue for many years – the word "smogocalypse" has been coined for China's pollution woes.

The effects of air pollution in China include an estimated one million premature deaths each year and lost food production of 20 million tonnes per annum through reduced crops of maize, rice and soybean. Major pollutants include airborne particulates, carbon & nitrogen oxides, ozone, and volatile organic compounds.

The primary contributors to pollution include coal-based power generation, coal-based industries, and transport emissions. The residential and commercial sector are all big sources of pollution, due to the amount of dirty coal still being burned for heating in winter in parts of the country.

The consumption of coal in China has increased ten-fold since around the year 2000. Recent attempts to curb the use of coal as an energy source have gone some way to alleviate China's pollution problems, but there is a long way left to go. Airborne particulate pollution in the major Chinese cities is more than double that of the city average world-wide.

The power generation sector is the primary source of ozone pollution. Ozone reduces photosynthesis in plants, stunting growth or weakening them. The economic loss due this effect alone is put at 1% of GDP. Monitoring has shown that in some regions of China, average annual ozone concentrations increased by 16% year-on-year to hit a six-year high last year.

Clear blue skies, clouds with clear edges and bright sunsets are still a rarity. A reduction in pollution across the north of China was noticed between 2013 and 2016. While this may be in part due to improving pollution controls, this reduction coincided with a sharp dip in economic growth during that time; and pollution levels began to climb again as the economy recovered.

This same link between rising coal consumption and CO_2 emissions and improved economic activity, was last seen when the government introduced a stimulus campaign to bolster the economy after the global financial crisis. Spikes of NO_2 from coal-burning plants contributed to huge plumes of pollution within the industrial centres of China. A recent similar rise in NOx levels from power plants has been noted as China's economy recovers.

Recent attempts to reduce pollution have included shifting coal-dependent manufacture away from the winter months; and a campaign for the removal of residential coal burners, which failed as it left many literally 'out in the cold' without any home heating. China is also investing heavily in hydroelectric power to reduce its dependence on coal. Other solutions include investing in high-tech industries such as electric cars and solar panels. These and many other initiatives will be required to fully address China's bourgeoning emissions problems.

Of note, rising emissions have also been recorded more

recently in India's industrialised areas. India's pollution rose steeply during the years pollution in China abated, and kept rising even as Chinese pollution returned in the past 18 months. It seems no coincidence that smog, a sore topic in China for many years, has become a hot topic in India over the past year.

[*Author's note: This article references the* South China Morning Post *for some of its content].*

from page one

on the benefits of compliance certifiers.

(iv) Smogacopalypse as the effect of air pollution persists in China as cars are used by the billion people.

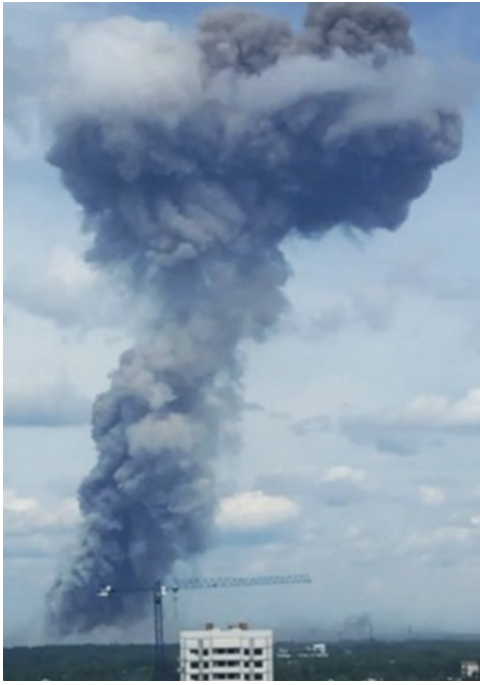
(v) Continue on our sources of alternative energy, this time looking at hydrogen.

This all demonstrates that progress is continuing to happen, and it was especially good to be present at a recent hazardous substance seminar on LPG where all of the users, Worksafe and enforcers and certifiers were ALL present to ALL work together towards workable safe solutions for concerned as we ALL seek to enjoy our beautiful planet together.

Another positive item is the recent government announcement that it is funding $40m towards finding recycling options for plastics (and other ground extracted products?) so we humans can reuse and enjoy what we already have while maintaining harmony with our planet!

I hope we are all successful.

Explosions destroy refinery, arms factory



Another USA refinery explosion and the decimation of a Russian arms factory throw up many questions about the on-going adherence to safety rules and proceedures.

The massive explosion (pictured below) at Philidephia's 150-year-old Energy Solutions complex could put 1000 people out of work and mean a hike in local petrol pricing. Apparently a fire in a vat of butane triggered the major blast. The company only emerged from bankruptcy a year ago and this will probably put the company under for good as the refinery will remain closed.

The U.S. Chemical Safety and Hazard Investigation Board's lead investigator said the refinery was a pile of twisted metal and it would be some time before it is deemed safe to enter. Thankfully there were no casualties.

The Russiam arms factory at Dzerzhinsk left a mushroom cloud hanging over the area and injured 79 people. Many secondary explosions followed the main blast that destroyed the processing facility. Most of the people who were hurt were cut by flying glass from the explosion, which also caused a shockwave that smashed windows in homes and other factories in the city.

Last August three people died in another factory blast in Dzerzhinsk, in central Russia, which is believed to be one of the world's most polluted cities.

Where will our energy come from: Hydrogen?

Society relies on energy! We use it to cook our food, heat our homes, provide our transport, power our machines, run our communications and allow us to fly and talk around the planet.

A good energy source needs to be reliable in that it must be readily available, easily stored and obtainable, and be able to be transported to its use site to provide ready energy with minimal side effects whenever it is required.

The New Zealand Government has reduced the number of allowable hydrocarbon searching permits and the search for alternative energy technologies is gaining traction such as wind, hydro, solar and hydrogen.

This article looks at hydrogen: describes some of the manufacturing and delivery options, the factors that can influence the choice, and some of the associated challenges.

The Sun

On earth our sun is the largest energy source as it burns its hydrogen. This great furnace in the sky allows our plants to grow and in many ways contributes most of the energy on our planet. The trick is, however, how can we harness and store this energy so that we can use it as we need?

Hydrogen the fuel

Hydrogen is gathering support as a potential replacement for fossil-based fuels such as coal, oil, and natural gas. In theory, and for most applications, this is an attractive option: a relatively plenteous material whose use causes only a small environmental disturbance compared to, for instance, airborne emissions of carbon dioxide or particulate materials.

Unlike fossil-based fuels, hydrogen needs to be processed out of something else and delivered to the point of use.

But for any of us older observers who can remember the Zeppelin, and we are not talking Led Zeppelin here, misuse of this product can be explosive indeed.

Manufacturing hydrogen

Hydrogen as part of compounds is common on earth: it is in water, fossil fuels and most living things. Yet, it rarely exists in its pure form in nature. Instead, it has to be extracted from water or from hydrocarbons.

Nearly half the hydrogen produced in the world today is derived from natural gas via a steam reforming process. The natural gas reacts with steam in a catalytic converter. The process strips away the hydrogen atoms, leaving carbon dioxide as the by-product (and, unfortunately, releasing it to the atmosphere as a global warming gas).

Coal gasoline or methanol can also be reformed through gasification to produce hydrogen, but this is more

The* Hindenburg *disaster -the airship exploded while docking on he USA. Not all airships ended as fireballs – one of Hindenberg's sister ships did 1.6 million km before being retired.

expensive than using natural gas and also releases CO_2, which scientists hope to keep earthbound through a process called 'carbon sequestration' or re-burying it under the earth.

Another method to produce hydrogen without using fossil fuels in the process is to use renewable sources of energy such as solar, wind, hydro, geothermal and biomass, which can be harnessed to produce electricity. The electricity, in turn, can be used, in a process called electrolysis, to split water into hydrogen and oxygen."

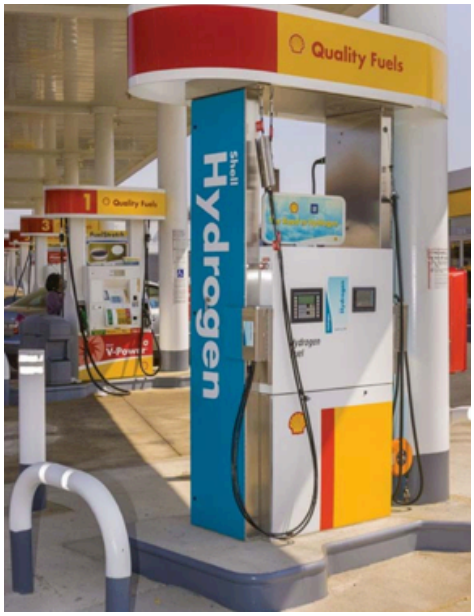
Transporting hydrogen

For most applications, hydrogen will be used as a gas, but that does not mean that it is always transported as a gas. The Zeppelin balloon mostly used hydrogen gas as lighter than air, but lost favour after a couple of spectacular explosions.

Nowadays the majority of the hydrogen moved around has been in steel cylinders, or in specially-designed and refrigerated tube trailers. With the increasing possibility of there being more hydrogen cars, there is the need for methods to store hydrogen that are both lightweight and safe.

Delivering high purity and very high purity hydrogen in cylinders has been commonplace for decades, and this is likely to remain a market for some time into the future but because of its significantly higher cost per energy unit (kj) than carbon-based fuels, it is not widely used in New Zealand, but more available overseas.

Proposals to replace some or all of the natural gas with



Hydrogen at the pump.

hydrogen open up new opportunities for hydrogen, and if 'slightly impure' hydrogen can be delivered, for instance, to heat or domestic customers at a lower cost than the high purity grades, without affecting the quality of the product, it will improve the chances of a more widespread uptake.

Summary

High purity hydrogen can be used as a 'non carbon-based fuel' and has been transported in cylinders for a long time. However, developing applications, like fuel cell vehicles have served to stimulate innovation to overcome perceived obstacles.

The transition to a hydrogen-based economy will require bulk transport: this is not without its difficulties, but can draw significantly on the custom and practice of the natural gas industries.

It is very probable that pure hydrogen, introduced into pipes previously used for natural gas (repurposing) will, at the required levels in the ppmv (parts per million by volume) range, pick up sufficient impurities to require pre-treatment before use in a fuel cell anyway. Hence pipeline transportation of bulk hydrogen becomes a distinct possibility, even using existing infrastructure. Still more so if hydrogen is present together with natural gas at low (eg 20 vol%) levels.

Hydrogen is a compressible gas, but because of the small molecular mass, centrifugal designs are not ideal, as they need to operate at tip speeds three times faster than that of natural gas compressors to achieve the same compression ratio. Because of hydrogen's small molecule size, axial compressors are not very efficient either, as there is significant inter-stage leakage.

Hence positive displacement (reciprocating) compressors are often preferred, also Ionic compressors are available today at the capacities and pressures required at hydrogen fuelling stations (>700 bar)

So hydrogen as a transport fuel is possible and can be used to replace hydro-carbon fuels. However, because we cannot just dig up stable hydrogen from underground it will require more expensive processing and hence cost than simple hydrocarbon deposits.

But this additional cost will be offset by the simple production of water only from the hydrogen combustion reaction, which should be more favourable for continuing use on our beautiful water planet.

Uncle Archie

Kia ora HS Practitioners!
Archie has been away for a while but is now back looking at safety in New Zealand.

The toxics are here!

While some eco-toxic observations have declined, the serious 'human' toxics and corrosives (Class 6.1, 8.1A) are having greater scrutiny and are requiring certification from December 2019 and indeed should be specially controlled by industry since June 2019. This is heartening, but it is a bit early to tell the benefits of this to date.

The king of signs?

We all agree that signs are important for safety! But which is the most useful sign? A major contender would have to be "Nosmo King" which is so important that it is 'etched into a prominent place in the metal of oil tankers'! Yes, 'No Smoking' is very wise on the deck of an oil container-ship. *(See photo Oil tanker catches fire near Hong Kong Jan 2019)*

Paper bag recycling?

As indicated in this magazine, we should all recognise the risks of using 'non-recyclable' plastic bags! We note that non-recycleable plastic bags are now banned!
However, is it wise, as some shops are doing, to replace longer lived recyclable plastic bags with more expensive single use paper bags? Not only do 'paper bags' cause our carbon absorbing trees to be cut down, but they are hopeless in the rain and can only be recycled once though the fireplace!

Recycling availability?

Many would agree that rather than continue to 'dig up' new oil products, we should be re-using those carbon treasures (eg: plastics) that we already have at our disposal.
Of course, the adjunct to this is that we must find items to replace these such as solar power or plastic recycling facilities. With China now reducing its recycling availability, where are the NZ recycling alternatives? A great opportunity here?

If you want to send your comment, you can send it to archie@NZIHSM.org.nz.
The ideas expressed in this column are not necessarily the views of the NZIHSM or Flashpoint and in some cases the NZIHSM frankly does not approve!

Mining your Cellphone!

There are 0.034 grams of gold in each cell phone, according to the U.S. Geological Survey. That's the equivalent of 0.001 troy ounces, worth about $1.82 at today's prices. There are also 16 grams of copper, worth about 12 cents, 0.35 grams of silver, worth 36 cents, and 0.00034 grams of platinum, valued at 2 cents.In bulk, that's a ton of precious metal. In fact, ReCellular said it recycled enough gold last year to make 1500 wedding bands and enough copper to make two Statues of Liberty. The trade-in companies all send parts to one of just two smelters in the United States, so that tiny amount of value becomes a treasure trove of bling.

Technologies are evolving to recover these precious metals on a large scale. For the gold only, in very rough numbers, there are 10 troy ounces of gold (or about three-fifths of a pound) per ton of smartphones. Ten thousand phones weigh one ton. [With gold selling for about $1580 per ounce, that would yield $15,800.]

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