

Institute of Refrigeration, Heating & Air Conditioning Engineers, responding to

MBIE DISCUSSION DOCUMENT: “Ensuring effective regulation of health & safety risks associated with toxic or flammable refrigerant gases”

dated 3 September – 14 December 2018.

MBIE seek feedback on the Health & Safety impacts associated with refrigerant gases as they adapt to the specific characteristics of low GWP refrigerants such as toxicity, flammability and high pressure, in our currently unregulated working environment. The Institute of Refrigeration, Heating, & AirConditioning Engineers (IRHACE) are pleased to provide their submission to MBIE on this issue.

About the Institute of Refrigeration, Heating and Air Conditioning Engineers (IRHACE)

A membership group, representing the independent engineers and technicians throughout the HVAC&R industry, as the Institute of Refrigeration, Heating and Air Conditioning Engineers, and comprising some 600 independent members throughout NZ and abroad.

Our main aims are to

- Promote the economic well-being and quality of life of our members and of the heating, ventilation, air conditioning and refrigeration industries and to improve the economic well-being and quality of life of every New Zealander.
- To develop a continuing development policy and framework for IRHACE members to support a more skilled and technically competent membership.

www.irhace.org.nz

Executive Summary

Our organisation IRHACE, acting on behalf of our member Technicians (and Engineers) thanks you for the opportunity to make this submission on this very important issue.

IRHACE is committed to ensuring all Technicians can demonstrate the competency to co-operate safely and effectively in all they do, encompassing every aspect of refrigeration installation and maintenance/service applications throughout New Zealand including (but not limited to) a simple heat pump installation, through to a large ammonia cool-store complex, or even an aircraft air conditioning system.

With changing refrigerants that will become mandatory for use in our industry under the Kigali Amendment to the Montreal Protocol, the resulting HFC Phasedown and introduction of low GWP refrigerants, represents a significant change to the way in which we have traditionally applied our skills, particularly in regard to Health & Safety. Upon our internal examination of the increasing risk associated with handling certain environmentally acceptable refrigerants, coupled with the very wide scope in applications using them.

We find there an obvious need to significantly lift, consolidate and coordinate our training standards, and we feel very strongly that the characteristics of all refrigerants (without exception) will need to be understood by our Technicians. In order to accomplish this, we are proposing to introduce a mandatory “Credential”. By ensuring that all individual Technicians require a current Credential in order to practice, we believe this to be the most effective way to ensure that the inherent health & safety risks are mitigated.

Acting in our role as representatives of our Technician members, IRHACE have consulted not only with these members in detail but also with our associated industry groups, such as Climate Control Companies Association of NZ and Refrigerant License NZ, who share our views. These groups will be offering their own separate submission to you and, in this instance, we enclose our submission from IRHACE which by and large concurs with the wider HVAC&R Industry as they seek your approval to provide this Credential.

In the below submission we provide feedback and recommendations to support that feedback. Where relevant, we have also provided evidence of scenarios to further justify our recommendations. We would also welcome your response to said recommendations and any questions that may arise.

Our Responses to the MBIE Discussion Document

Technicians are not required to demonstrate their competency to install, repair and maintain systems that use flammable or toxic refrigerant gases

1. Have we accurately identified the issues associated with the competence of refrigeration technicians to install, repair and maintain systems that use flammable or toxic refrigerants? Are there other issues associated with this matter?

YES

You have identified the issues in respect to competence. As to the question of accuracy however, it is important to realise that the issues involved for each of the many different refrigeration systems are complex and varied and cannot be treated in isolation with respect to the refrigerant employed in each particular situation.

The problem has been identified correctly, but accuracy as to the reasoning behind this fact is lacking, and this is probably due to the fragmentation that currently exists within our industry, as a direct result of attempts to satisfy the needs of some growth sectors with corresponding stagnation or decline in numbers of trained technicians. The simple fact of the matter is that some sectors traditionally requiring minimal qualifications will need to upgrade their basic refrigeration skills (along with an understanding of the characteristics of different refrigerants). Two examples are:

1. Split System Heat Pump Air Conditioning less than 18Kw
2. Automotive Air Conditioning

The Kigali amendment deems such sectors will need to upskill to the same standard as all other sectors simply because they will be handling the same risks in terms of the use of available refrigerants.

The basic skill required to safely handle refrigerants in both sectors is still “Refrigeration”. The current level of skills required is insufficient for the above and many other sectors that handle refrigerant. We believe that the basic skills required in an environment covering all refrigerants, including low GWP refrigerants, need to be consistent and standardised.

To do this, they need to align with the current qualification framework, namely, Trade Certificate and the Approved Filler course. Other relevant topics such as an understanding of Hazardous Substances (HASNO) and how to handle spills of Hazardous substances (HAZCHEM), also need to be introduced as part of a standardised curriculum for all technicians who handle refrigerant. HASNO and HAZCHEM are the two significant compliance areas where Companies that distribute refrigerants (i.e. Refrigeration Wholesalers) will need to concentrate their expertise, simply to enable this group to communicate directly with our Technicians/Engineers in a safe manner in their day-to-day business dealings.

Certain very high-pressure refrigerants, such as CO₂, are being considered for some of the sectors of our industry (e.g. automotive). CO₂ is covered by the Pressure Vessel Regulations, however, due to the unregulated nature of our industry the regulations are not enforced and therefore not policed. We therefore strongly recommend that any Technician who may install, repair and maintain refrigeration, heat pump or air-conditioning systems using high pressure refrigerants that might be considered – have a mandatory requirement to hold a current License as part of the Credential being proposed. The level of skill attainment must align with a higher level of understanding than is currently the case.

Example

Waikato House Guttled by Fire after Bungled Heat Pump Installation

Whilst not strictly a refrigerant issue, this illustrates the need for thorough training in all aspects of refrigeration and installation for all sectors including for Heat Pump installers.

https://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=120312

2. Do you agree with these objectives? Would you suggest any others?

YES

We agree with the objectives as stated.

In addition to the stated objectives, the industry would be better served by including;

1. The alignment of the qualification standards for any technician handling any refrigerant.
2. Revising and increasing the existing qualification standards, such as Refrigeration Trade Certificate and Approved Filler courses, establishing these as the basic standard.
3. Specifying that only competent persons who install, repair or maintain refrigeration, heat pump or air conditioning systems that use high pressure refrigerants be included.

Option 1: Introduce an authorisation requirement for individual refrigeration service technicians in regulations under the HSW Act

3. Do you support the introduction of an authorisation requirement for individual refrigeration technicians in regulations under the HS&W Act?

YES

We support an authorisation for individual refrigeration Technicians, being persons who install, repair or maintain refrigeration, heat pump, or air conditioning systems that use all refrigerants, be they high pressure or otherwise, through regulation under the HS&W Act.

We propose and are currently working on a revised and upgraded qualification framework as part of a new industry 'Credential' for our Technicians/Engineers. The Credential will be comprised of two key elements;

1. An upgraded and consistently revised training regime with Trade Certificate in Refrigeration and Air conditioning (Level 4) being the initial qualification under NZQA followed by increasingly proportionate advanced steps up the NZQA ladder, plus
2. A renewable Certification:
 - a. Licenses/Certifications will be issued following the passing of both a practical and theoretical examination as verified by an Approved Industry Assessor (a newly created function for a person possessing sufficient qualifications and industry experience and who maintains a current understanding of the latest curriculum as updated by the Industry Provider such as Competenz),
 - b. Licenses/Certifications will be revalidated every 2 years and require reassessment,
 - c. Our associate entity Refrigerant License NZ will be the issuer of Licenses and maintain a register of Licensees,
 - d. Provision will be made for holders of current Trade Certificates to partially upskill to the new qualification standard at a local training provider (e.g., MIT) and then sit the two License examinations mentioned under item 2a above,
 - e. A Technician, having passed the above qualification (item1) AND who hold a current License (item 2a), will be eligible to purchase and use any refrigerant approved under current NZ Government mandate.

The HS&W Act is the appropriate legislation to put such a License under.

4. What do you think are the main benefits and costs of this proposal? (Please quantify any impacts identified and express in dollar terms to the extent practical)

The main benefit to this proposal would be to maximise risk mitigation of not only the Technicians, but also their customers and the public. There is also no doubt that added costs to comply with a Credential will only improve the Technicians lot and raise the standard of the overall HVAC&R workforce.

IRHACE are very clear that the word ‘authorisation’ in this context equates to Technicians holding a mandatory industry Credential (including a License, as defined above) and this will only be achieved through a form of regulation such as the HS&W Act, to give it weight and credibility.

Clearly, there will be added costs. For many, this will be viewed as a cost of doing business and improving the quality of safe delivery for our industry. Others may not share that view. Regardless, a mandatory Credential will raise the quality and professionalism in the industry – both being necessary prerequisites for improving accountability in terms of safety in the use of refrigerants both for the Technicians and the public in general.

Whilst we have a view as to cost implications, we see that the final cost of a Credential is best determined following the finalisation of the government’s direction. In order to provide guidance in response to MBIE’s question regarding costs we make the following points:

- The goal is to upgrade the existing level 3 Trade Certificate to include required training around low-GWP refrigerants. It is paramount to ensure that we do not devalue the Trade Certificate and what apprentices have achieved. The content, however, must be revised to reflect the changing refrigerants and to ensure Health & Safety implications are understood for all refrigerants.
- We point out there is already a cost to qualifying for the Trade Certificate (currently borne as part of the Apprenticeship scheme) and this is unlikely to change substantially.
- We envisage that meeting this revised criterion will require a small amount of additional training for all who have already graduated with the Trade Cert, however:
There are some current Technicians and Engineers who currently hold many of the additional qualifications required, others potentially none (or few), therefore some will be able to comply faster than others and therefore at less cost.
- You will note in the RLNZ submission (Appendix A) we also make a distinction between the qualification required to comply as solely a Heat Pump or Automotive Air Conditioning Technician and the qualification required to meet the standard as a Refrigeration Technician working on equipment over 18kg, or an Ammonia Plant operator.
- To make this distinction between these qualifications ensures that Technicians cannot seamlessly transfer between levels, and therefore would understand that to do so would require additional training (this is currently not the case)

The RLNZ submission provides more detail on how the HVAC&R industry wish to implement a training framework and compliance regime

IRHACE/CCCCANZ /RLNZ have done a significant amount of work on how that Credential should look and how it would be enforced, and are confident they can provide a comprehensive framework to ensure those standards are reinforced.

This Credential will include, but not be limited to:

- Enhancement of existing Trade Certificate qualifications.
- Additional training for existing Technicians.
- A form of grandfathering of all existing Technicians at the outset.
- A method of Capstone and/or Prior Recognition of Learning for some in the industry, be they older Technicians, or those looking to immigrate.

- Use of Continuous Professional Development (CPD) to incentivise upskilling on an ongoing basis.
- As refrigerants are likely to change markedly in future years, there is a need to regularly revisit the Technician knowledge and training.
- Any changes to the regulatory framework introduced now must be suitably robust enough to accommodate knowledge when increased pressure, flammability, or toxicity of refrigerants becomes more prevalent, the norm even.
- Requiring the individual to demonstrate competency when installing, repairing, or maintaining these systems will provide a much higher level of certainty than other options available.
- An industry licensing or registration model is also being proposed to further reinforce that process and assessment procedure. It is envisaged that, for practicality's sake, a managed register would align to other similar registers within the construction industry and wider built environment, however, would be managed jointly by a body common to our industry associations such as RLNZ.

There will also be a cost to compliance and we have investigated costs and assumptions regarding an industry managed Registration body, which is further explained in the RLNZ submission.

5. Do you agree that technicians who only work on automotive air conditioning systems should be excluded from the proposed requirement to hold an authorisation? If no, why?

Definitely **NO**.

This answer is **no** because of the magnitude of risk to life (their life and others). Whilst we don't have day to day contact with the practices and procedures currently employed in the automotive industry, the risks are similar.

We point out, given parts of the automotive manufacturing industry have opted for the widespread use of high-pressure refrigerant CO₂, we believe those Technicians who service or maintain such equipment must be required to hold this industry Credential if the risks to consumers or third parties are to be mitigated.

Example

The Tamahere Cool store fire in 2008 is an example of just why not to allow segmentation or for a loophole in the industry. The contractor at fault at Tamahere was a mobile air-conditioning technician familiar with automotive work. He was not trained to handle such a project, but able to do so all the same, with tragic consequences.

<https://www.parliament.nz/resource/0000145544>

Our industry does and can work in a mix of disciplines and must be trained for the optimum outcome and safety for all.

IMPORTANT ADDITIONAL NOTES (Regarding Question 5)!

1. The argument about volume of refrigerant contained in each system (or vehicle) should not apply because refrigerant (to service these vehicles) can be supplied in bulk – the technician can be dealing with larger volumes during service procedures.
2. The question of how NZ is going to handle imported vehicles (both new and used) in this regard is very important.

3. Notes 1) & 2) above apply equally to imported packaged equipment (e.g. heat pumps).
4. The NZ government must look at existing border controls of all sources of refrigerant entering (& leaving) NZ.

6. Do you agree that technicians should not be required to hold an authorisation for any work on a refrigeration system, heat pump or air conditioning system that uses non-toxic or non-inflammable refrigerants? If no, why?

We **DO NOT AGREE** with your statement.

Every Technician should be required to hold an authorisation (Credential) independently. No-one should be exempt. Otherwise there is risk of loopholes being found.

One reason IRHACE propose this is that Kigali approves CO₂ (as a non-toxic and non-inflammable refrigerant); however, this is a very high-pressure refrigerant and we are concerned that currently there are no controls on the design and service of systems employing this refrigerant. The use of CO₂ is currently increasing markedly, particularly in sub or trans-critical supermarket applications.

Currently, we have no way of telling if any single refrigerant is going to become the 'refrigerant of choice' for refrigeration, heat pump or automobiles, but one can safely say that CO₂ will be a consideration.

To introduce a Credential for Technicians yet leave a 'loop-hole' to circumvent the safe use of any refrigerant, would be contrary to the HS&W Act in a regulated governance structure advocated for in our Credential proposal.

The HVAC&R Credential includes a tiered Certificate of Competence structure with increasing grades of eligibility within, to cater for safe handling of all refrigerants. That is, all Technicians must sit a practical and theoretical examination and be graded according to competency level. This applies equally to every Technician wishing to handle or purchase any refrigerant.

7. Should the proposed authorisation requirement apply (or not apply) to technicians who work on refrigeration or air conditioning systems in aircraft, vessels, transportable containers and mobile (truck or van) refrigeration units? Why?

YES, it must apply.

The key is the refrigerant type – not the system type or size.

Accordingly, our opinion is that the proposed authorisation should indeed apply to all Technicians working with any refrigerant.

Regardless, this must apply to:

- **all** refrigerants
- **all** categories
- **all** Technicians/Engineers

8. Do you agree with the proposed categories for the refrigeration technician authorisation?
If no, why?

NO, as explained in our answers to items 5 through 7 above.

Regardless of the situation, this must apply to:

- **all** refrigerants
- **all** categories
- **all** Technicians/Engineers

9. Do you agree with the proposed high-level criteria to be met before a technician authorisation will be issued?

YES, we do agree.

There cannot be any exceptions. Any Technician working with any refrigerant should be trained and acknowledged via authorisation (i.e., Credential).

10. Are there any other high-level criteria that should be met before a refrigeration technician authorisation will be issued?

YES

We believe there are shortcomings and that our industry can introduce a better training regime. The Credential will include training under Pressure Hazards, HASCHEM and HASNO, and in brief below:

1. A practical test to demonstrate understanding for the grade they wish to practice,
2. A test to demonstrate knowledge of related legislation, such as HASNO & HAZCHEM signage and clean-up procedures,
3. Training to understand refrigerant Safety Standard 5149,
4. Along with training to ensure competency in differing levels and sectors of the industry who handle these refrigerants.

Option 2: Introduce an authorisation requirement for refrigeration service businesses in regulations under the HSW Act

11. Do you support the introduction of an authorisation requirement for refrigeration service businesses in regulations under the HSW Act? If no, why?

NO.

The IRHACE preference remains for **Option 1** as outlined above, because it is the closest control point for mitigating the risk. To further explain this:

- We have no confidence that an authorisation requirement such as we have proposed in our Credential (for a Technician) would guarantee that all employers (PCBU's) would invest in staff to ensure they are qualified and compliant.
- Currently each PCBU is covered under the HS&W Act, under which there is sufficient compliance for their work scope.

- How can a PCBU have sufficient control over employees? (i.e., the man in a van who is working remotely, say 50km from base). How will he know the quality of the work and, what is more, sign off on it?
- There are potentially 2 PCBU involved on any given job, one being the building owner, the other the employer of the Technician who goes to sites. There is a strong likelihood that the building owner would take on the cheapest contractor and potentially not know to check on or understand his responsibilities over the Technician who comes on site. The site owner is also unlikely to have the knowledge or expertise to assess the standard of the job or whether Health & Safety obligations are being met by the Contractor or Technician.

We also point out that, the PCBU will be a stronger business by having satisfactorily trained and qualified staff, in turn, lifting the value of their business.

Example

The Electrical regulations require *individual Electricians* to hold the necessary qualification and License for similar reasons. The PCBU does not take the responsibility to sign off their work remotely. Similarly, each individual Electrician issues a “Certificate of Compliance” for their own work. We see a direct parallel with this and our proposed Credential.

Questions 12 thru 19

Not applicable

Option 3: Build on the current approach to industry self-regulation supported by WorkSafe effort to improve awareness, understanding, and compliance with current regulatory requirements.

20. Do you support building on the current approach to industry self-regulation supported by WorkSafe improving awareness, understanding and compliance with current regulatory requirements? If no, why?

NO

Due to the Kigali amendment and, as an entity representing our industry, IRHACE no longer supports this particular approach. There needs to be a change.

We support a more direct approach for 2 reasons:

1. Option 1, as outlined above, is the closest control point for mitigating the risk.
2. Our industry has become fragmented in terms of skill levels. We either exclude some sectors from using Kigali gases altogether **OR** standardise on an upgraded level of competency and, in this way, consolidate the industry to control the risk points (by authorization/licensing) more effectively. It is the latter direction that we are advocating.

21. What do you think are the main benefits and costs of this proposal? (Please quantify any impacts identified and express in dollar terms to the extent practical)

There are no benefits to this proposal. There is only the inherent risk with our industry standing still, which is the option offered here.

No large or small amount of money spent on training would have any value under this option. In fact, there is a likelihood of an escalation of issues with low GWP refrigerants, as consistently mentioned throughout our response.

Compliance with the joint Australian/New Zealand Standard for commercial refrigeration systems is not mandatory for systems using anhydrous ammonia.

22. Have we accurately identified the gaps in the current regulatory requirements for ammonia refrigeration systems? Are there any other issues associated with this matter?

YES

The problem has been identified correctly. This subject is another example of an anomaly present in our standards of training and regulation for Refrigeration Technicians. The current discussion, along with ratification of the Kigali Amendment, provides the motivation to correct this situation in the same way that we have described for other lower level attainment areas of our industry.

The basic skill required to safely handle all refrigerants (including anhydrous ammonia, which is being utilised more and more as A1 refrigerants become less available) is still “Refrigeration”. The safe handling of anhydrous ammonia needs to align with the current qualification framework.

Anhydrous ammonia is simply another refrigerant and has its own particular dangerous characteristics in relation to safe handling.

23. Do you agree that there is a case for requiring operators of ammonia systems to comply with the joint Australian/New Zealand Standard for commercial refrigeration systems?

YES

However, this answer is reserved for anyone operating Plants employing ammonia refrigerant; it does not change the IRHACE belief regarding Technicians and their qualifications, which need to have a wider focus encompassing all Kigali refrigerants.

Specialised training to handle ammonia has only developed in a declining market due to insufficient numbers of qualified Technicians. This market is reversing now and the need for more trained Technicians will increase as high GWP refrigerants become more costly and scarce.

IRHACE believe that anyone handling anhydrous ammonia should have a similar level of standardised training and regulation as anyone handling any refrigerants. As mentioned in our answer to question

1 above, as the level of use of ammonia increases, additional trained Technicians will be required even if they eventually operate a single plant (i.e., become a plant operator).

To summarise, the reasons for the current “fragmentation” of operators possessing ammonia skills is twofold:

1. A historical declining need that is *now reversing*, and
2. A lack of qualified technician numbers (in ammonia refrigeration skills) as a trained source of Plant Engineers.

24. Do you agree with the proposed change to regulation 10.10 of the Hazardous Substance Regulations? If no, why?

YES

We agree noting that this is a standard applicable to each site using anhydrous ammonia. It should not be confused with our clear advice in this submission that the industry Credential should also include the necessary knowledge to handle ammonia, the HASNO (storage and handling regulations) and HAZCHEM (signage) that are fundamentally applicable to the associated level of risk.

25. Do you agree with the proposed transitional arrangements? If no, why?

YES

We believe this to be a practical step for existing ammonia plants and the Technicians.

26. What do you think are the main benefits and costs of this proposal? (Please quantify any impacts identified and express in dollar terms to the extent practical)

The main benefit of the proposal is to establish a common basis of understanding between Plant Owners, Plant Operators and external service providers (i.e., Technicians).

Costs will be similar, as explained in item 4; however, some specialised training would come at additional cost. These are unlikely to be greater than the costs incurred for current additional plant operator training.

The Credential, for all Technicians, including Plant Operators, will also assist in “defragmenting” training, providing additional career paths for Technicians towards becoming a Plant Operator.

We also anticipate the Registration body mentioned in item 4 and further explained in the RLNZ submission will satisfactorily manage compliance for anhydrous ammonia.

In Conclusion

Our submission has been created to reinforce our industry concerns that, in developing a Credential there is only one option, for a mandatory credential that will include all refrigerants for use in all circumstances and industry sectors. We see the current regulatory framework to be deficient and are advocating for the new mandatory Credential to mitigate any Health & Safety concerns.

We have consulted at length with our membership and the wider HVAC&R industry and have, in conjunction with CCCANZ and RLNZ, developed a framework for both the Credential and the Licensing/Registration body to ensure full compliance by all practitioners. This will ensure the industry meets their Health & Safety obligations and reduce risk to workers and the public as the more flammable, higher pressure and toxic refrigerants become more prevalent.

Ultimately, we see the industry Credential to be an essential element in customer protection and this certification would act as an added value for technicians to prove their competence and proficiency and raise the standard of this essential industry.

Feel free to contact Christine Johnston (details below) should you wish to discuss any of the initiatives or recommendations we have provided here.

Please find attached a list of referenced concerns and incidents that have occurred around the world within our industry as Appendix 1 to our submission – These support the need in NZ to make changes to how we function as an industry in order to minimise such events.

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Appendix 1 (Links)

Worldwide Refrigerant Related Health & Safety Concerns/Incidents

If you are unable to open links, please copy and paste into your browser to access.

Australia, June 2018

Cold storage company fined for ammonia accident – H&S failure: workers were in vicinity of ammonia and not aware of risks

<https://www.coolingpost.com/world-news/ammonia-accident-leads-to-fine/>

Czech Republic, June 2018

Automotive company fined for recovery failure of R134a

<https://www.coolingpost.com/world-news/auto-firm-fined-e3500-for-f-gas-breach/>

Sweden, May 2018

Swedish EPA expect HVAC industry to toe the line regarding conversion to alternative low GWP refrigerants

<https://www.coolingpost.com/world-news/sweden-rejects-f-gas-exemption-request/>

Waikato-NZ, April 2018

Botched heat pump installation burns house to the ground.

https://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=12031254

Germany, April 2018

Federal Motor Transport Authority violated European law by allowing Daimler to continue use of R134a in car air-con systems after a European MAC directive banned the use after 1 Jan 2011.

<https://www.coolingpost.com/world-news/germany-faces-fine-r134a-dispute/>

Auckland, March 2018

Worksafe, Enforceable Undertaking

<https://worksafe.govt.nz/laws-and-regulations/enforceable-undertakings/accepted-enforceable-undertakings/airtech-limited/>

USA, March 2018

Fine settlement from a death caused by ammonia leak in 2012.

<https://www.winesandvines.com/news/article/196998/Final-Settlement-on-Winery-Ammonia-Death>

<https://www.coolingpost.com/world-news/330k-fine-fatal-ammonia-release/>

USA, March 2018

Man with automotive business illegally brought in R22 from China.

<https://www.coolingpost.com/world-news/r22-importer-faces-10-years-jail/>

New Plymouth – NZ, February 2018

Near miss, ammonia leak.

<https://www.stuff.co.nz/national/100512872/workers-evacuated-after-ammonia-leak>

France, Feb 2018

IIR reviewing refrigeration safety due to new flammable refrigerants on the market

<https://www.coolingpost.com/world-news/iir-group-look-refrigeration-safety/>

Australia, Feb 2018

Automotive business fined for imported vehicles with charged with R134a

<https://www.vasa.org.au/business-fined-for-unlicensed-import-of-vehicles-containing-refrigerant/>

Whanganui – NZ, January 2018

Three injured after ammonia leak.

<https://www.stuff.co.nz/national/100512872/workers-evacuated-after-ammonia-leak>

Australia, December 2017

Ammonia leak harms two, incurs fine.

<https://www.coolingpost.com/world-news/meat-processor-fined-ammonia-leak/>

USA, November 2017

Ammonia leak injures one, incurs fine.

<https://www.coolingpost.com/world-news/10000-fine-ammonia-leak/>

Canada, October 2017

Ammonia leak kills three.

<https://www.theglobeandmail.com/news/british-columbia/three-killed-at-fernie-bc-arena-were-doing-maintenance-work/article36645031/>

Netherlands, October 2017

Five injured in cylinder explosion.

<https://www.coolingpost.com/world-news/ammonia-cylinder-explodes-gea-factory/>

Gisborne -NZ, September 2017

Ammonia leak.

<http://gisborneherald.co.nz/localnews/2993900-135/firefighters-turn-out-to-leaking-ammonia>

Germany, July 2017

Improper procedure causes explosion at a refrigeration plant. Injures eight.

<https://www.coolingpost.com/world-news/mystery-surrounds-refrigeration-explosion/>

USA, July 2017

Ammonia explosion injures two and causes water main leak.

<http://www.chicagotribune.com/news/local/breaking/ct-elk-grove-village-explosion-20170707-story.html>

USA, June 2017

Violation of ammonia regulations incurs fine.

<https://www.epa.gov/newsreleases/us-epa-commits-sanger-calif-poultry-processor-protect-workers-local-community-risk>

Thailand, June 2017

Freon leak affects 20 crew.

<https://www.bangkokpost.com/news/general/1261299/crew-hospitalised-after-gas-leak-on-foreign-fishing-vessel>

Northland – NZ, May 2017

Major leak at a meat works plant.

https://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=11854906

Bluff-NZ, April 2016

Fire enables ammonia leak at a coolstore.

<http://www.newstalkzb.co.nz/news/emergency/fire-service-attempts-to-control-ammonia-leak-on-wharf-at-bluff/>

USA, March 2016

Ammonia leak causes one death.

<https://www.boston.com/news/local-news/2016/03/23/firefighters-respond-to-ammonia-leak-in-seaport-district>

January 2016

Beca questions ammonia safety procedures in NZ

<https://www.becca.com/ignite-your-thinking/ignite-your-thinking/january-2016/have-you-reviewed-your-ammonia-safety>

Invercargill – NZ, March 2015

Ammonia leak

<http://www.newstalkzb.co.nz/news/emergency/fire-service-attempts-to-control-ammonia-leak-on-wharf-at-bluff/>

Australia, June 2014

Hydrocarbon refrigeration explosion kills two.

<https://www.vasa.org.au/fatal-pub-fire-blamed-on-use-of-automotive-hc-refrigerant/>

China, September 2013

Ammonia leak kills 15.

<http://www.abc.net.au/news/2013-09-02/an-china-ammonia-deaths-caused-by-detached-cap/4928574>