Got a fishy problem – just ASK

Submission to

Food Standards Australia and New Zealand

Proposal 1019 – Carbon Monoxide as a processing aid for fish

On behalf of CSJ Seafoods and other seafood businesses

as identified on the following page

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All Correspondence to

Alan Snow
Alan Snow Konsulting
PO Box 421
CANNON HILL Qld 4170

Phone 61 7 3390 6220
Mobile 0418 199 516
e-mail ASK@ASKonsulting.com.au
web www.askonsulting.com.au

Respondents

Name and Address	*Email*	*Contact Number*
Colin Marshall C J Seafoods PO Box 258 **BOTANY NSW 2019**	[redacted]	[redacted]
Mike Rowley Fortuna Seafood's 4/143 Shoal Bay Road **NELSON BAY NSW**	[redacted]	[redacted]
Nick Gerallis Saltwater Seafoods 1-7 Fish Market **FOOTSCRAY VIC 3043**	[redacted]	
Carmelo Comi Pacifica Trading 273 Scottsdale Dr **ROBINA QLD 4226**	[redacted]	
Cathal Farrell Upscale Seafoods 177b Orlando st **COFFS HARBOUR NSW 2540**	[redacted]	
George Costi De-Costi Seafoods 29 Bachell Ave **LIDCOMBE NSW 2141**	[redacted]	

1. Summary of Submission

This is a major decision that needs more careful thought than P1019 portrays. As such, the respondents are recommending that a conference or workshop of key stakeholders and experts be held to further discuss this issue.

The post mortem treatment of products such as Tuna with a gas mixture containing a set of gasses including Carbon Monoxide does not pose any food safety issues to the consumer as stated in P 1019.

This process has been in existence for many years and is commonly used throughout the world.

Post mortem exposure of fish to Carbon Monoxide or Tasteless Smoke is not a cure-all. Neither will turn bad fish into good. Neither will disguise nor mask decaying fish because all of the other sensory factors are unaffected.

Gas flushing through the use of a gas mixture which includes Carbon Monoxide reduces the initial bacterial load thus leading to less spoilage bacteria and extended shelf life.

Fish products exposed post mortem to Carbon Monoxide possess no more a public health risk than legally produced cold smoked scombroid products or Tasteless Smoke (or equivalent) treated Fish Products.

Australian seafood producers should have access to a processing aid (that is safe for consumers) that allows them to produce products in-line with global producers so as to not limit their ability to enter and compete effectively into export markets.

Australian Exporters and Importers should be not be forced to utilize a processing aid (Tasteless Smoke) produced by one company when that processing aid relies on Carbon Monoxide (in the gas mix) to produce products that have the same attributes (positive, negative or otherwise) as straight CO post mortem treated products.

Carbon Monoxide is presently being used in some countries to euthanize fish prior to slaughter (e.g. Tilapia in China) with the resulting products having similar or equal quality attributes as CO post mortem treated products. The use of CO for euthanizing fish is under investigation in Norway to replace the now banned Carbon Dioxide, with findings to date showing it is a more humane method to slaughter the fish and with the added fish quality attributes – improved colour in fillets and prevention of flesh fat oxidation.

2. Key Recommendations

1. A workshop (Conference) of acknowledged experts, industry, health professionals be conducted to work through all of the issues and map a strategy for the future. This should be held prior to any decision of the proposals put forward.
2. The use of a gas mixture containing Carbon Monoxide in food processing be permitted as listed in Table 3 of Standard 1.3.3 of the Food Standards Code.
3. Exposure to Carbon Monoxide & Tasteless Smoke (or equivalent) be clearly marked on all product packaging and point of sale to ensure the consumer is not deceived.

Contents

3. Background

Thank you for the opportunity to put forward a submission regarding the discussion document Proposal 1019 – Carbon Monoxide as a processing aid for fish.

The respondents accept that this is an issue that needs some clarification and as such we are in agreement with the purpose of the discussion document as outlined in the Executive Summary and again in the Introduction of P1019.

We do not, however, accept the statements contained within Proposal 1019 and the ultimate recommendations that have been put forward in the discussion document. As such, our concerns and thoughts are outlined further in this document.

On the outset, it should be noted that the discussion document P 1019 is very subjective and continually uses terms such as could, might, may, etc . It demonstrates a complete lack of supporting internationally recognised and reviewed scientific material as to the potential food safety concerns leading to conjecture rather than statements of fact that would withstand independent scientific peer review.

Proposal 1019 references only 6 documents which may not contain the most up to date scientific data due to the dates of publication and/or may not relate directly to the discussion paper (Proposal 1019), specifically

- One from the USFDA where the sale of CO treated fish is legal.
- Two (2) papers relating to testing of Carbon Monoxide (CO) in treated fish – not directly relating to food safety or quality.
- Two (2) papers relating to Carbon Monoxide and filtered wood smoke quality and bacteria (safety) one of which is 7 years old and the other is 9 years old. Given how long it takes to publish, this research was probably conducted in the early days of CO development for fish products.
- One paper referencing quality of Filtered Smoked Yellowfin Tuna and not directly related to CO tuna. This is a relatively new paper.

It should also be noted that the use of a gas mixture including Carbon Monoxide, if used properly, does not cause any food safety problems in itself to seafood products.

This was recognized from the 1990's in the USA and again in many subsequent reviews since and also in 2001 by a study conducted by the European Commission which concluded that CO is a safe product for food production. The EU only banned the use as they believed most consumers were not ready to accept the technology.

Carbon Monoxide can help to reduce the bacterial load of product due to the inhibition of spoiling bacteria. Food spoiling bacteria have no or limited impact on colour degradation. Therefore, colour alone is not a good indicator of freshness and should only be used in conjunction with other sensory attributes such as smell, slime etc when considering the age of processed fish.

Histamine manifests itself in the fish product via temperature abuse and is generally associated with Scombroid fish however; salmon, pilchards, herrings and sardines are also linked to scombroid (histamine) poisoning.

4. The use of Carbon Monoxide in a Gas Mixture

Carbon Monoxide is commonly used

- in isolation; and
- in conjunction with other gasses

for gas flushing as part of the process of the Modified Atmosphere Packaging process (MAP) or Controlled Atmosphere Packaging (CAP).

Common gasses used in MAP or CAP include Hydrogen, Oxygen, Nitrogen, Carbon Dioxide, Carbon Monoxide.

A mixture of 85% Nitrogen and 15% Carbon Monoxide has been shown to reduce the bacterial load in product quite substantially.

Carbon Monoxide performs the function of stabilizing colour. The product can be frozen and the colour preserved. Nitrogen is used to prevent oxidization The frozen product presents good appearance when defrosted or sold frozen in vacuum packs.

Carbon Monoxide as a component of the gas mixture used in Controlled Atmosphere Packaged (CAP) product extends shelf life by inhibiting various spoilage bacteria.

A disadvantage with vacuum packing or anaerobic MAP for fresh meat is the change in meat colour. A mixture of CO_2 and oxygen is usually used in MAP to avoid this change.

CO_2 is used for its inhibitory effect on the gram-negative spoilage flora and oxygen as a stabilizer of the red colour. The shelf life during this storage is not as predominant compared to anaerobic storage in CO_2. As such, it is possible for the colour of product such as Tuna to appear brown and off when it is not. (Food Science Network).

Fish muscle quality declines soon after harvest and continues once the fish has been processed. Primary contributors to fish muscle-quality decline are microorganisms, oxygen, lipids, heme proteins, and enzymes. Heme proteins in fish muscle are primarily responsible for lipid oxidation and color deterioration. Oxidation of the heme proteins hemoglobin and myoglobin occurs rapidly after processing and during storage, giving the red muscle of fish an undesirable brown appearance.

The oxidized heme proteins are also known to promote lipid oxidation, leading to rancidity development in fish muscle. The use of carbon monoxide (CO) or extensively filtered smoke (FS) that contains carbon monoxide has been shown to prevent the undesirable brown color formation of fish muscle. (Garner, 2004)

5. Tuna Processing

Tuna is generally caught by long liners and processed at land based establishments. As such, the supply of tuna can be variable and, as is the case for most seafood, a considerable quantity is frozen to even out the supply chain.

The problem with freezing tuna is that there are major colour changes to the flesh of the product during frozen storage, unless the product is frozen at cryogenic conditions (< -60^{o}C). The flesh darkens and is unattractive on thawing.

To prevent this, tuna products are commonly treated post mortem and prior to freezing with a gas mixture containing Carbon Monoxide as outlined above.

6. Why use Carbon Monoxide

The use of Carbon Monoxide to maintain colour is not new and, as stated in the discussion document, has been a practice for many years, initially emanating from the meat industry.

The science as to why is well documented and what is stated in the discussion document is technically correct.

Essentially, fish muscle and in particular Tuna, is full of myoglobin (an oxygen carrying pigment in muscle). When the tuna is cut up, oxygen comes into contact with myoglobin in the exposed meat surface to form a bright red pigment (oxymyoygobin) which brings on the red colour.

However, over time and continued exposure to oxygen, the red colour of the meat gradually changes into various shades of brown due (known as Chocolate Tuna) to oxidation and conversion of the oxymyoglobin to a brown pigment (metmyoglobin). Carbon monoxide reacts with the myoglobin to form a very stable complex, carboxymyoglobin and assists in maintaining the fresh cut appearance allowing the product to access distant markets in a natural appearance

The discussion paper states that the consumer "could" be deceived because of the colour. Colour is only one attribute or indicator of shelf life that a consumer would use and indicators such as taste, odour, Use By or Best By date etc are unaffected by exposure to Carbon Monoxide.

In fact it has been found that colour is not the best attribute to assess freshness as bacteria that spoil products are not associated directly with colour loss. So a piece of tuna with the natural fresh cut appearance could be spoiled or not spoiled just as a piece of Chocolate Tuna could be spoiled or not spoiled.

If the only indicator that a consumer was to use was colour, how would a consumer determine if a white flesh fish was "off" as the colour remains similar over the spoilage period and so the other sensory attributes must be utilised.

There is already guidelines/legislation in place to help with quality control through the supply chain and ultimately provide the consumer with the confidence to select safe, quality product. The management and control of these processes would be of greater use to consumer than the banning of a particular process that has been shown globally to not pose a direct health risk.

7. Carbon Monoxide as a Processing Aid

A "processing aid" Is defined in Standard 1.3.3 of the Food Standards Code (FSANZ) as

> a substance listed in clauses 3 to 19, where –
>
> a) the substance is used in the processing of raw materials, foods or ingredients, to fulfill a technological purpose relating to treatment or processing, but does not perform a technological function in the final food; and
> b) the proportion of the processing aid is no more than the maximum level necessary to achieve one or more technological functions under conditions of Good Manufacturing Practice (GMP).

Clause2 2 and 3 further state

> 2 General prohibition on the use of processing aids

Unless expressly permitted in this Standard, processing aids must not be added to food.

3 Generally permitted processing aids

The following processing aids may be used in the course of manufacture of any food at a level necessary to achieve a function in the processing of that food –

(a) foods, including water; and

(b) food additives listed in Schedule 2 of Standard 1.3.1; and

(c) a processing aid specified in the Table to this clause.

Carbon Monoxide is listed in Table 3.

8. Gas Mixtures

The use of "tasteless smoke" is currently approved in Australia.

This involves heating charcoal to 400-500^{o}C, Carbon Dioxide is submitted to the chamber. The resultant gas is removed, filtered, compressed, and then used as a colour stabilizer for Tuna. A typical analysis of the gas mixture shows that gas produced is essentially:

Hydrogen	10.9 %
Oxygen	2.0 %
Nitrogen	22.9 %
Carbon Dioxide	35.6 %
Carbon Monoxide	17.1 %

In the USA, a similar process is used where sawdust is burned and the resultant smoke put through scrubbers, etc to remove any smoky taste.

An alternative is to manufacture the gas according to the permitted specifications whereby there can be no chance of contamination, byproducts, taints, carcinogenic implications, etc.

All of these processes have the same inferred health risks as Carbon Monoxide. Banning Carbon Monoxide only and not Tasteless Smoke will have the effect of creating a commercial advantage for one company.

9. World Practice

The practice of post mortem treating fish with Carbon Monoxide is variable throughout the world but the initiative taken in the USA should be noted in particular where the product is to be labelled appropriately. As is states in the article referenced in the discussion paper,

> The F.D.A. has put carbon-monoxide-treated tuna on its list of substances generally regarded as safe (GRAS). The agency permits its use to preserve the color of fresh tuna, not to enhance brown tuna, and requires stores to label treated fish (Julkia Moskin, The New York Times, 2004).

Currently in the U.S., it is legal to use CO in case ready meat packaging.

Debate has centered as to whether Caron Monoxide should be considered as a Colour fixer and not a food additive. The respondents believe that CO is really a processing aid as identified in the Food Standards Code and its usage for fish should be permitted.

It is noted that where the use of CO is permitted, it should be labeled accordingly. The respondents fully support this view and believe that treated product should be labeled accordingly.

A study conducted by the European Commission in 2001 concluded that the practice of CO treatment is safe. Numerous studies in the USA dating back to the 1990's have generated similar conclusions.

In\n Japan, exposure of Tuna to Carbon Monoxide is not permitted but this is considered to be a matter of protection of the local industry rather than a Food Safety matter.

10. Food Safety Issues

As stated previously, the respondents contend that the prevention of color degradation through the use of CO as a processing aid in the gas mixture removes only one indicator of quality and the other indicators and measures remain in place. (Use By Date, odour, taste etc.

As such, we do not agree that the use of Carbon Monoxide poses a food safety issue, particularly where product is labeled appropriately.

The Australian Seafood Industry has an excellent track record for quality and food safety. There would not appear to be any reason why the current legislation should be at all changed.

In relation to histamine, the most effective methods of preventing formation are handling and processing under sanitary conditions, rapid cooling of the fish, and continued refrigeration from harvest through consumption. With this in mind, consideration needs to be given to cold smoking of scombroid fish in particular and the potential impact on histamine development. Hot-smoking temperatures have been found to inhibit the growth of bacteria that can lead to increased levels of histamine (http://www.fda.gov/Food/ScienceResearch/ResearchAreas/SafePracticesforFoodProcesses/ucm094576.htm).

However, cold-smoking does not expose the fish to temperatures high enough to inhibit the bacteria. Cold-smoking of scombroid fish, a legal process could therefore produce a product that appears fresh as the CO in the smoke will fix colour in the fish, but due to the temperatures used during the process could lead to the growth of histamine producing bacteria resulting in increased levels of histamine. Moreover, the smoking process also imparts a smoke smell into the flesh which can mask one of the indicators used to assess quality/freshness of the product. Cold-smoking of scombroid fish therefore could pose the same or greater consumer based concerns as highlighted in Proposal 1019 for post mortem CO treated fish.

Furthermore, the inference that Tuna with high Histamine levels are going to proliferate the market is unsubstantiated by fact.

There have been 8 incidents related to Histamine poisoning in 5 years in Australia. There have been zero positive test results for imported product.

11. Aquaculture

Carbon Monoxide is presently being used in countries such as China as an anesthetic to humanely kill such fish as Tilapia.

A recent report by researchers at the University of Florida compared CO euthanized Tilapia fillets and post-mortem CO treated Tilapia fillets and found that CO euthanized fillets retained a better redness and whiteness level after one (1) month of storage at -20^{o}C than post mortem treated products (Mantilla, D.,et al (2008)).

Carbon Dioxide was the main anesthetic used in the slaughter process of salmon in Norway, however, as of July 1 2012 as it causes strong aversive reactions and severe stress to the animal. As a result attention is now being given to the use of Carbon Monoxide. A recently completed doctoral thesis by Bjørlykke GA (2012), Carbon Monoxide was investigated as an alternative anesthetic agent in the slaughter of Norwegian cultured salmon. The study concluded that CO treatment at harvest did not have the negative effects of Carbon Dioxide but rather positive effects on product quality and animal welfare. Product quality was improved due to calmer fish with lower cortisol levels during the slaughter process. Furthermore the study found that CO treatment at harvest prevented fat oxidation in the flesh and the fillets had a higher degree of red colour – an improvement in product quality.

Presently Carbon Monoxide for use as an anesthetic is not banned in Australia and its use has been investigated by various companies. To the respondents knowledge the practice is not presently being utilized by any Australian company.

Carbon Monoxide as an anesthetic in the slaughter process of fish is a humane option and is a practice growing in the global aquaculture community. The fillet products from CO euthanized fish have been shown to have the same attributes as post mortem CO treated fish products but with added quality benefits (i.e. lower stress during slaughter improves general flesh quality).

If the arguments put forward in Proposal 1019 in terms of deceiving the consumer were considered, how would products produced from CO euthanized fish be handled when they display the same and potentially better attributes than post mortem CO treated products?

The studies have found that CO euthanized products are a better quality and so the consumer would be purchasing a better product than they presently do, but would these fall under the same ban as presently being put forward by Proposal 1019.

If Norway moves to using CO as the slaughter gas would all salmon products from Norway then be banned?

Moreover in areas where histamine prone fish are harvested during high ambient air and water temperatures (summer), such as kingfish in South Australia, it could be argued that CO used during harvest and slaughter to calm the fish could in fact reduce the risk of histamine formation. Right or wrong, Proposal 1019 highlights the potential masking of Histamine contaminated fish due to CO post mortem treatment, if this is the case, would it not make sense to have a slaughter process that potentially reduces this risk to the consumer and as an additional benefit maintains the fresh cut appearance of the products?

12. Risk Management

Comment was made in the Discussion Paper under Section 3.3.3 Consumers that treatment with Carbon Monoxide may cover evidence that a product has been mistreated preventing the consumers from identifying spoilt product or product treated in a way that could cause histamine poisoning. The same could therefore be said for Tasteless smoke treated products and also Cold Smoked scombroid products.

While this may be technically possible, the reality is that under a risk management framework, **ALL** seafood products are handled under strict temperature control on the vessel. As mentioned above the most effective methods of preventing spoilage and health issues are handling and processing under sanitary conditions, rapid cooling of the fish, and continued refrigeration from harvest through consumption.

The presence or absence of CO or Tasteless Smoke in products is independent of the levels of histamine in a product. If the product is temperature abused at any point in the cold chain, other indicators will prevail as warning signs.

Despite high testing frequency, not one of the respondents has had product rejected because of elevated Histamine levels. If “old” or abused substandard product was being imported or processed, the Histamine tests would demonstrate this whether or not product has been treated with Carbon Monoxide or Tasteless Smoke.

13. Marketability of Product

The use of Carbon Monoxide and/or Tasteless Smoke as a processing aid for fish no doubt assists with the marketability of the treated product.

Carbon Monoxide and Tasteless Smoke treated product does not oxidise and “brown” at the same rate as untreated product. This means that spoilage and colour retention can be brought more in line with each other hence achieving not only a safe product for consumers but also one that is economically viable due to reduce rejection or ullage rates.

The proposed changes could have a major damaging effect on the marketability of many fish products by reducing consumer appeal.

Additionally, banning the use of Carbon Monoxide for the treatment of product will restrict access to markets where the treatment of Tuna with Carbon Monoxide is allowed.

14. Export

Proposal 1019 focuses on the potential deceiving of consumers in the domestic market and so wants to ban the process in Australia and which would then stop the importation of post mortem treated CO products.

What Proposal 1019 does not take into account is the potential loss of export earnings due to a loss of export markets. If Proposal 1019 succeeds then local seafood processing companies could not produce a post mortem CO treated product for sale in markets where such products are legal (e.g. USA). This would significantly reduce the competitive advantage of these products in these exports markets especially when competing against post mortem CO treated products from lower cost of production companies such as those found in SE Asia.

Given Australia's high wages and present strong dollar, a loss of a processing aid that could help companies expand into a new market by supplying a like for like product could be the defining point which prevents companies from expanding into new market sectors that could generate export earnings for Australia. SE Asian producers of post mortem treated CO products already have the labour advantage and if Australia is unable to compete by producing a like for like product which is universally accepted in a target export market then the competitive advantage remains external to Australian producers.

Banning the use of CO post mortem treatment of fish products will only provide a competitive advantage to the one company producing Tasteless Smoke (a mixture of gases the includes CO and the products of which are the same in quality and characteristics as straight CO post mortem treated products). If Australian producers wish to manufacture fish products with the beneficial attributes that post mortem CO treatment provides then they will be forced to purchase the gas from one supplier with an unregulated pricing structure, how does this maintain a competitive advantage for the exporter or importer?

A processing aid that has been proven to be safe for consumers and is legal in other countries should be available to Australian based producers who wish to enter into Export Markets that allow the use of the processing aid. Under Proposal 1019, seafood processors would lose this ability.

15. Suggested Labelling Options

The respondents propose that all product be individually wrapped and all packaging be stamped with:

- Production code
- Process Date
- Country of Origin
- Use By Date
- Where relevant, statement that gas mixture including Carbon Monoxide (i.e. Tasteless Smoke, MAP mix with CO, straight CO Etc) is used as a processing aid for shelf life extension and colour retention.
- Where relevant, Statement regarding the composition of gas mixture used in process

16. Testing Frequency

The respondents as seafood importers are concerned that this will place an additional cost burden on our businesses due to increased compliance requirements.

These importers are presently subjected to a very high frequency and expensive random Histamine testing protocol for imported tuna and other fish lines. The respondents understand, acknowledge and agree with the need to monitor and control the importation of histamine affected products due to the public health risk. The respondents would add that to date all product imported by the respondents and tested has been cleared of elevated histamine levels.

Histamine testing of imported tuna is highly regulated by AQIS. A new international supplier must pass an initial 6 test and holds , a further 20 passes @ 25% test rate , and subsequently on to a 5% rate therefore proving themselves through historical Histamine passes.

In 5 years of testing, (literally 100's of random tuna samples from overseas suppliers), importers have yet to have 1 positive for histamine.

Locally caught tuna for the domestic market undergoes neither regulation nor histamine testing. It's absolutely no secret that the best Tuna caught in this country is exported to the lucrative and highly regulated Japanese markets. Rightly so as the higher quality fish exported can return a better sale price than if sold on the domestic market.

The balance of the tuna catch is then sold on the domestic market which generally has a lower return than export markets. These are variable quality fish, and often those that may have died whilst on the line and subjected to high water temperatures and other abuses. As a result, these fish would be more likely to incur quality issues including but not limited to elevated histamine levels.

Similarly, fish imported into this country and tested has been shown by the results returned to be a safe product for domestic consumers.

The respondents are already paying for the histamine compliance protocol imposed on imported tuna products. They are concerned that they will face an additional cost impost through testing for the possible presence of Carbon Monoxide.

This has the potential to render businesses unprofitable.

17. References

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