Biogenic Carbon Dioxide Quality & Safety Topics

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Summary

- Historical Issues Shaping Thinking on CO2 Quality & Protocols
- ISBT Sourcing summary
- CO2 as an ingredient
- HACCP and Unaddressed Issues
- Sampling regime
- Conclusion

1990 and Perrier

Perrier Scandal

- In February 1990, a group of scientists working in the laboratory at the Mecklenberg County Environmental Protection Department in North Carolina was using small supply of Perrier as a testing control for other substances being tested for hazardous chemicals and other impurities. Scientists *discovered traces of benzene – an industrial solvent and suspected carcinogen* – in the Perrier itself
- The company claimed that the contamination was an isolated incident, caused by an operator error at an American filling plant. But Perrier's hopes were dashed when it emerged that benzene was also present in its bottled water in Europe. Source Perrier had to face the anger of European consumers who were faced with the fact that they had been drinking contaminated water for several months. Highly embarrassed, the firm recalled products worldwide. The media savagely criticised the company, saying they had shown a shocking disregard for consumer safety
- Within days Perrier Group of America announced a recall from the entire North American market 72 million bottles, totally worldwide – 160 million bottles

1997 Hunterston Nuclear Plant

- The Hunterston B Nuclear Power Station comprises two Advanced Gas-cooled Reactors (AGRs).
- These use carbon dioxide as reactor coolant
- A problem in 1997 resulted in a backflow of gas from a reactor's high-pressure coolant circuit to the station's storage tanks used for holding liquid carbon dioxide supplies.
- This raised concerns about the potential for transfer of radioactively contaminated carbon dioxide to road tankers making deliveries to the station's storage tanks, as these road tanker connected to the gas supplier's carbon dioxide distribution network after leaving the station.
- The possibility of onward spread of contamination to other carbon dioxide users affected the supplies of food and drink, and the potential for health impacts caused significant media interest, prompting the Secretary of State for Scotland to make a statement on the incident in the House of Commons.
- Outcome EIGA Guideline that needs to be included in CO2 system planning
- **DOC 68 / 18 - Prevention of carbon dioxide backfeed contamination**

NEWS

5th March 1997

Drinks in radiation leak scare

THE Hunterston nuclear power plant in Ayrshire was at the centre of a major public health scare last night over fears that radioactive gas had been transmitted to supplies of beer, soft drinks, mineral water, and other products.

Scottish Nuclear admitted that "slightly" contaminated carbon dioxide may have accidentally been carried away from the complex in three gas tankers which then made deliveries to other customers.

The Scottish Office last night said it thought the risk to health was "negligible", but has declared an official Food Hazard Warning, and has set up a helpline to deal with public concerns from this morning.

Scottish Secretary Michael Forsyth, who was informed about the radiation threat on Monday evening, said last night: "I appreciate, and share, public concern. I have ordered immediate action."

Following media inquiries, the Scottish Office issued a full list of drinks manufacturers which could have received contaminated supplies of C02.

1999 Major Product Withdrawals

- Product was not hazardous to health (as in all of above topics)
- Levels of some sulphide compounds above the level that would be expected
- Challenge for Beverage sector on question of what might be present and what might be monitored

- Outcome EIGA and ISBT Specifications

A case of mass hysteria

Coca-Cola dumped half a million bottles of soft drink in Belgium last month after a health scare. But it seems the problem was all in the mind.

Coca-Cola withdrew 30 million cans and bottles from sale in Belgium last month when nearly 100 people reported suffering stomach cramps, nausea, headaches and palpitations after drinking Coca-Cola products. The safety scare followed an unrelated alert over potentially cancer-causing dioxins in Belgian meat and poultry which helped bring down the government.

However, a preliminary inquiry has suggested that the Coca-Cola alert may have been due to nothing more toxic than an outbreak of mass hysteria. In a letter to the Lancet this week, four members of Belgium's Health Council say that preliminary inquiries suggest last month's epidemic was a case of "mass sociogenic illness" (the more politically-correct term for mass hysteria).

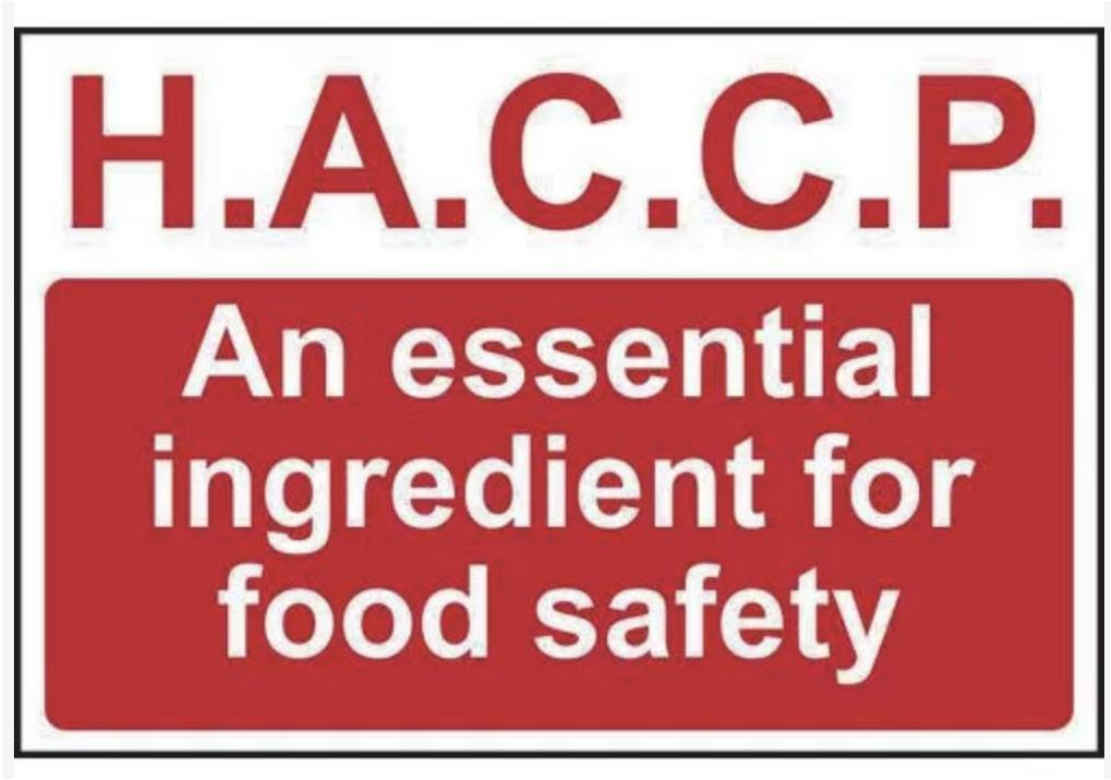
The story started on June 8, when 26 children from one school began feeling sick, tired and complaining of headaches, palpitations and stomach-ache after drinking bottled Coca-Cola. The next day the evening news announced that Coca-Cola was recalling the incriminated product, and within the next 48 hours several other children from the same school complained of the same symptoms, followed by children from other schools.

ISBT CO2 Source Material

- A wide variety of commercial *CO2 feed gas* sources are employed throughout the world for *beverage-grade CO2* production. Not all potential *feed gas* sources can or should be used for *beverage-grade CO2* pro- duction due to the presence of highly undesirable, hard-to-remove *impurities* or significant fluctuations in the *impurity* profile over time (ex. municipal landfill-sourced *CO2 feed gas*).
- Each type of acceptable *feed gas* source has a typical range of expected *impurities* that need to be identified and controlled.
- Periodic *feed gas* analysis is recommended as a comprehensive profile analysis can help detect and quantify:
  - New *impurities* that the *CO2* plant cannot remove which could contaminate their final product.
  - *Feed gas impurity* levels that have changed/increased from when the plant was first designed that
  - May result in an off-grade product or a hazardous operating condition due to the higher *impurity* loads.
  - *Feed gas impurity* levels that exceed the contractual purchase limits from an outside *feed gas* supplier. This could be the result of supplier maintenance or processing changes (ex. catalyst changes/poisoning).
  - *Feed gas* source changes (ex. underground natural well location switch-over). This could impart significantly different levels of important *impurities* (ex. sulfur and C2+ aliphatic and aromatic hydrocarbons).

Food Safety Topics – More than quality

- E290. Carbon Dioxide is a Food Ingredient
- CO2 usage in the Food and Beverage sector is more than about a quality specification
- For Crop fed AD then the process is close enough to follow fermentation
- For Waste fed AD then a different approach looking at the AD plant and feedstocks and controls is needed.
- There is also concern about contamination from packaging with different chemical inputs.
- In addition there are the Animal By Product regulations to consider



Off site testing of CO2 is still required for quality

- On-site analytical packages are important to verify release of product however the systems do not comply with prescribed testing methodologies
- It is essential therefore to include a regime of off site validation testing from expert laboratories
- Testing will initially be more frequent to establish a baseline and become more

Feedgas sample	Plants should submit a feedgas sample to an independent laboratory for detailed analysis on an annual basis. When required, special samples will be submitted to a laboratory for specific analysis. The feedgas sample should be taken from a flowing feedgas line (no dead legs) prior to any removal equipment or compression equipment. Low-pressure headers or systems operating in a vacuum should be sampled after booster blower /1st stage compression immediately prior to any removal equipment. • If a feedgas supplier has contaminant removal equipment in place that treats the feedgas before it enters the process (upstream dryers, ZnO beds, particulate filters), the company should perform an evaluation to determine the company's exposure risk if this equipment fails.

Feedgas purity baseline	Feedgas purity "baseline" should be established for all plants. Baselines consist of four consecutive quarterly analyses for: • new plant startup • initial year of plant operation • any plant with no established feedgas sampling history. Subsequent feedgas analysis should be conducted on an annual basis. Results can be used to identify the need for additional analysis, process equipment, or process changes. It is recommended for a natural well source that each well should have a feedgas purity baseline performed.

Summary

- For Food/ Beverage CO2 there is a historic basis for care
- CO2 is often a food ingredient
- This is not just a quality topic but a food safety issue hence HACCP
- There is a lot of work still to be done and today the issues are only understood by a limit number of experts.
- Food Grade CO2 is much more than a 1 page quality specification out of a 196 page document. Be aware of the opportunity but also your responsibilities