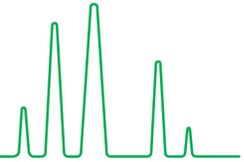


# SPECIALTY GAS REPORT



*A supplement to CryoGas International, dedicated to the specialty and medical gases business*

## Making the Grade

by **Bob Yeoman**

Over the years, as regulations evolved, many independent companies experienced some level of confusion about which grade of gas they were permitted to supply to what type of company or application. While most firms by now have figured out which companies they can sell medical grade to and which companies they cannot, a new set of issues has recently arisen around food and beverage grade gases that is once again creating some of the same kind of confusion. This article will examine the differences between food and beverage grade gases, and attempt to clarify this issue.

Food gases are those gas products either labeled as food grade, or when sold are intended to be used as an ingredient in “food”, or as an item expected to be delivered with a food product as part of the packaging or processing. In the U.S. some, but not all, food grade gases are listed in an official document called the Food Chemical Codex (FCC). The Food Chemical Codex, which is owned by the United States Pharmacopeia, is a quasi-government organization tasked by a joint resolution of Congress to develop and maintain the official listing of food items and their monographs in the United States. Products listed in the FCC have specific product monographs. These FCC product monographs establish the purity specifications and the amount of any potential contaminants for a product.

FCC monographs also establish the specific procedures that describe in detail how any analytical testing for product purity or contaminant testing is to be performed.

Under U.S. regulations FDA has authority to regulate any product listed in the FCC just by virtue of the inclusion of that product into the FCC list. This means food gases such as Carbon Dioxide and (food grade) Nitrogen are directly regulated under FDA authority as they are part of the FCC list.

However, there are a growing number of gases currently being marketed to food companies that are not listed in the FCC, such as Argon and Oxygen to name just a few. It may surprise some people to know that FDA also has the full legal authority to regulate these products, even though they are not officially listed in the Food Chemical Codex. Under the FDA Food Code the term “Food” has multiple definitions. One of those definitions defines Food as any items sold or labeled as food grade or when sold the items are intended for use in a food product. This means FDA has the legal authority to regulate gas products if they are sold as food grade or if when sold they are intended for use in a food product. In other words, just because the FCC has yet to list a number of gases as food grade those products, when sold as food grade or for food applications, are FDA regulated products. So, for

example, firms selling Argon to wineries, where the Argon product is used to inert the wine, and firms selling Oxygen to micro-breeds to jump start the yeast reaction are subject to FDA regulation, even though Argon and Oxygen are not currently listed in the FCC. Then next question we invariably get is - if there is no official FCC monograph what am I supposed to use for product specifications. Until such time as an official FCC monograph is created those companies selling food gases not on the FCC list would need to create and follow their own monograph for those products or follow CGA guidance where that exists.

The next step up in the quality of gases used in the food industry is beverage grade gases. Currently this applies only to Carbon Dioxide, but a Beverage Grade guideline for Nitrogen is in the process of being released. The guidance for beverage grade CO<sub>2</sub> comes from the International Society of Beverage Technologists (ISBT).

This is an industry organization primarily comprised of the major gas companies, the major beverage companies, and a broad conglomeration of companies that do business or provide services to one or both of those former two groups. The ISBT committee process blends the knowledge of the gas industry with the scientific capabilities of the beverage industry, and has produced a guideline for product quality

and testing for Carbon Dioxide which is endorsed and supported by all the major beverage companies. In reality there are two ISBT Carbon Dioxide guidelines, one for bulk and one for fountain. However, the product guidelines are the same in both documents.

The ISBT documents are “guidelines”. However, for Carbon Dioxide the Compressed Gas Association (CGA) has adopted a grade of product known as Grade I, which mirrors the ISBT guideline. These are industry “standards”, as CGA is an ANSI accredited standards setting organization. However, guideline or standards do not carry the weight of law, and the impetus to adopt the ISBT guideline is not being driven by a regulatory agency.

The major beverage companies have unanimously adopted ISBT Guideline for bulk Carbon Dioxide as the product they use to manufacture carbonated beverages. These companies no longer accept FCC grade product. This evolution began a number of years ago, and today bulk CO2 provided to the major beverage companies must meet the ISBT guideline for purity and contaminant levels. ISBT product is referred to as beverage grade I. The following chart outlines the differences between food and beverage grade Carbon Dioxide.

Many of the differences in the contaminant levels seem almost too small to worry about. However, the scientific testing performed by ISBT has determined that these small differences can have a huge potential impact in the sensory attributes of a high quality carbonated beverage. For example, the ISBT specification for Hydrogen Sulfide (H2S), which produces a rotten egg smell, is less than 0.1 parts per million (PPM). Testing has shown that the human nose can detect H2S at levels approaching 0.2 PPM. The FCC

Contaminant	ISBT – CGA I		Food Chemical Codex – CGA H	
	Method	Spec	Method	Spec
Assay	Wet Chemistry or GC	≥ 99.9%	Wet Chemistry	≥ 99.5%
Odor of Solid CO <sub>2</sub>	Olfactory	None	Olfactory	None
Odor & Taste in H <sub>2</sub> O	Olfactory	None	Olfactory	None
Identification	Detector Tube	Positive	Detector Tube	Positive
Oxygen	Paramagnetic	< 30 ppm	Paramagnetic	< 50 ppm
Carbon Monoxide	Detector Tube	≤ 10 ppm	Detector Tube	≤ 10 ppm
Ammonia	Detector Tube	2.5 ppm max		
Nitric Oxide	Detector Tube	≤ 2.5 ppm	Detector Tube	≤ 5 ppm
Nitrogen Dioxide	Detector Tube	≤ 2.5 ppm		
Non-Volatile Residue	Residue Weight Test	10 ppm max	Residue Weight Test	10 ppm max
NV Organic Residue	Residue Weight Test	5 ppm max	Residue Weight Test	10 ppm max
Phosphine	Detector Tube	≤ 0.3 ppm		
Hydrocarbons as C <sub>2</sub> H <sub>2</sub>	Gas Chromatography	≤ 50 ppm max	Gas Chromatography	≤ 50 ppm
Acetaldehyde	Detector Tube	≤ 0.2 ppm	Detector Tube	≤ 0.5 ppm
Aromatic Hydrocarbon	FID Analyzer or GC	20 ppb max		
Total Sulfur Content	Sulfur Analyzer	≤ 0.1 ppm	Sulfur Analyzer	≤ 0.5 ppm
Sulfur Dioxide	Detector Tube	1 ppm max		
Moisture	Detector Tube	≤ 20 ppm	Detector Tube	≤ 20 ppm
Hydrogen Sulfide	Detector Tube	≤ 0.1 ppm	Detector Tube	≤ 0.5 ppm
Carbonyl Sulfide	Detector Tube	≤ 0.1 ppm	Detector Tube	≤ 0.5 ppm
HCN	Infrared Analyzer	None		
Oil / Grease	Infrared Analyzer	5 ppm		
Methanol	Infrared Analyzer	10 ppm		

specification for H2S is 0.5 PPM. You can clearly see that if FCC grade CO2 was used to carbonate a beverage there is a strong likelihood that there would be a detectible off odor in the beverage produced with that CO2.

The move to ISBT or Beverage grade Carbon Dioxide product has recently begun to migrate and evolve. The current trend is a move to assure that the CO2 delivered to end users, such as restaurants and bars, in high pressure cylinders and mini-bulk deliveries also meets ISBT guidelines. This move is not being driven by any regulatory agency. This initiative is, in fact, being driven by leading beverage purveyors such as large restaurant chains, together with the major beverage companies themselves. This is not a concerted initiative by these firms. Rather it appears to be an outgrowth of their individual efforts to prepare for the new food safety regulations under the Food Safety Modernization Act. These companies have each independently arrived at the conclusion that the quality or grade of Carbon Dioxide they use could be a potential risk to their product. Their solution to mitigate that risk is to discontinue the use of

FCC grade product and use only ISBT or Beverage Grade product. While this move to Beverage Grade product is still in its infancy at this point, we fully expect it will continue to expand and gain momentum over the next couple of years, to the point that we expect that ISBT Guideline product will become the product to use when carbonating beverages.

A question we are hearing lately is – when will FDA start requiring me to supply Beverage Grade product to my beverage customers. The answer is – likely never. We would be surprised if in the foreseeable future FDA would regulate down to that level of detail in our industry, unless there was a major incident of product contamination.

The driving forces behind this change are your customers, many of whom own some of the most highly protected trademarks in the world. These customers see adopting beverage grade as an easy move to reduce the potential level of risk to their fountain soda product from Carbon Dioxide. So, while FDA may never get around to requiring beverage carbonation applications to be served with ISBT guideline product, it is highly likely

that in the near future one or more of your current customers will be inquiring about Beverage Grade CO2, and if you can supply it.

We see this shift to beverage grade for fountain beverages as inevitable. Our recommendation is that for customers you currently supply with FCC grade product that carbonate beverages, including beer gas, you should begin thinking and planning to transition those customers to beverage grade. There are a number of potential considerations in such a move, but it all starts with the supply of bulk product. Since not all bulk CO2 suppliers are capable of supplying beverage grade product the very first thing you may need to do is re-evaluate your supply side logistics as a result.

If you have questions about moving your organization to begin supplying beverage grade products and the specific cylinder filling procedures involved with beverage grade vs. food grade please give us a call or drop us a line.

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