

Carbon Monoxide

Masking the Truth About Meat?



food&waterwatch



About Food & Water Watch

Food & Water Watch is a nonprofit consumer organization that works to ensure clean water and safe food. We challenge the corporate control and abuse of our food and water resources by empowering people to take action and by transforming the public consciousness about what we eat and drink. Food & Water Watch works with grassroots organizations around the world to create an economically and environmentally viable future. Through research, public and policymaker education, media, and lobbying, we advocate policies that guarantee safe, wholesome food produced in a humane and sustainable manner, and public, rather than private, control of water resources including oceans, rivers, and groundwater.

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Introduction

The barbecue is Sunday, and as you stroll down the grocery store aisles, there's only one thing on your mind: meat. Not just any meat, though. Tender, juicy ground beef, just waiting for a grill and a bun. Sitting there in its case, it looks perfect; the kind of fresh, healthy red that promises a mouthwatering hamburger and a full belly.

Two days later, when you and three of your best friends are suffering from painful abdominal cramps and diarrhea – the symptoms of *Clostridium perfringens* poisoning – you wonder to yourself “How did this happen? The meat looked so good!”

But in today's world, seeing is not believing – at least not when it comes to meat. Because of an ill-thought decision by our Food and Drug Administration, the meat industry was allowed to inject the toxic gas carbon monoxide into your ground beef's packaging. The gas kept the meat red and fresh looking long after it had already spoiled, and when you ate it (past its sell-by date; you looked at that, didn't you?) you also consumed the bacterial condoplex that had sprung up in the interim.

There was no way for you to know that your meat had been cased in an atmosphere different from normal air, because companies are not required to let consumers know about things like that. Then again, there should be no problem with that, right? Amazingly enough, FDA thinks not.

Carbon monoxide (often referred to as CO) is a colorless, odorless, tasteless gas, one measly oxygen atom away from the carbon dioxide we all exhale. But that one atom makes a big difference in that it does very, very bad things to the human body at very, very low concentrations.

A natural byproduct of the Earth's volcanic eruptions, humans also add to CO's presence in the atmosphere through driving, manufacturing, and the incomplete combustion that takes place in furnaces. The gas is all around us, albeit typically at levels that cause little trouble (usually around 0.1 parts per million in the open air). However, when that count goes up, the problems start – hence the need for CO detectors in our homes.

CO is toxic because it sticks to hemoglobin, a molecule in blood that usually carries oxygen, even better than oxygen can. When people are exposed to higher levels of CO, the gas takes the place of oxygen in the bloodstream and wreaks havoc. Milder exposures mean headaches, confusion, and tiredness. Higher exposures mean unconsciousness and death, and even those who survive CO poisoning can suffer serious long-term neurological consequences.¹

So why would anyone ever want to package food with this stuff? The answer is simple, clever, and potentially dangerous: it keeps meat redder, longer. Today, food usually does quite a bit of traveling before it hits the table, and producers, processors, and grocers have to maintain a delicate balancing act to ensure it stays – and looks – fresh. The meat industry alone is estimated to lose around \$1 billion every year to meat that has started to look unappetizing.²

So industry scientists, pressed to find new and more effective ways of maintaining food's appearance for longer and longer stretches, decided to exploit CO's very toxicity to squeeze in a few more days of red.

As noted, CO binds more effectively to hemoglobin than oxygen does, but it also out competes oxygen for the attentions of another molecule, myoglobin. Myoglobin is a protein found in muscle tissue, such as meat, and is responsible for the same role hemoglobin fills in the bloodstream.



In the presence of oxygen, myoglobin grabs it and becomes oxymyoglobin, reddening in the process. CO, however, sticks to myoglobin far more readily than oxygen, forming (naturally enough) carboxymyoglobin, and an even more vivid and long-lasting pigment.

When consumers see the fresh, unspoiled color of packaged, case ready meat – meaning that it arrives at the grocery store ready to go on display, rather than needing a butcher’s preparation – it is only natural for them to assume its hue is natural. But there is nothing natural about it; it is an artificial interloper, the product of carboxymyoglobin, specifically introduced by meat companies to appeal to the eye.

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To be clear, CO has no physical effect on meat’s safety. Eating CO-treated meat alone will not make you sick. However, its supercharged color lasts up to a year, far beyond the date when steaks, ground beef, and fish are no longer safe for human consumption. The process of treating meat by sucking oxygen out of a package and pumping CO in, used by industry as part of a so-called “Modified Atmosphere Packaging” system, saves meat processors billions of dollars every year. The only costs to shoppers are their right to know and their health.

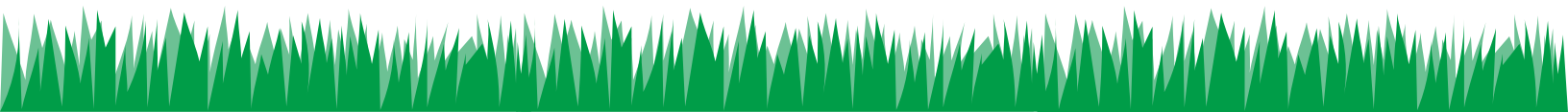
To defend the practice, which has been banned in countries across the world, FDA has tossed up an argument illogical at best and disingenuous at worst. Consumers, they claim, simply do not care about meat’s color and pay it no mind when making purchasing decisions.

Cargill, one of the nation’s largest food companies, has offered a similarly perplexing rationale behind keeping CO’s presence a secret. Telling consumers, CEO Gregory Page suggested, would be confusing and pointless. “I don’t think people want to be distracted by information that’s not helpful to their purchasing decision,” he said.³

Luckily, these arguments have not passed muster with citizens, consumer groups, and a few interested lawmakers. “To put it bluntly,” Rep. Bart Stupak said in a 2007 hearing on the technology, “the sole purpose of carbon monoxide packaging is to fool consumers into believing that the meat and fish they buy is fresh, no matter how old it is and no matter how decayed it might be.”⁴

The public deserves to know what it is eating, how it has been prepared, and how it has been packaged. If FDA is serious about its goal of protecting the public health, it must allow consumers to make educated decisions based on sound regulations and end the practice of secretly packaging meat in an environment that turns its appearance into a lie. In order to fulfill its mission, FDA must rescind its approval of this controversial, deceptive, and unsafe practice.

FDA must rescind its position that carbon monoxide should be classified as something generally recognized as safe. If allowed in meat and fish packaging, CO must be reconsidered as a color additive and be subjected to the formal FDA approval process for color additives, including a federally mandated notice and comment period. Companies that wish to use CO in their packaged meat products should be legally required to label for the presence of the gas so that consumers can make educated decisions about their purchases and health.



Generally Recognized as...Safe?

The controversy over the use of carbon monoxide in meat packaging (as well as packaging for fish, such as tuna) goes back to FDA's approval of the gas as "Generally Recognized as Safe" when used in a modified atmosphere packaging system.

When a food, additive, or ingredient is designated GRAS, the decision is theoretically based on consensus among qualified scientific experts that it poses no risk to the general population. FDA's move is then subject to a 60-day notice and comment period, allowing stakeholders to voice their support or opposition, and then a final determination is made. Any substances designated GRAS are given a green light from the agency and are no longer subject to premarket review, the process by which FDA determines if a food or ingredient is safe.⁵

Although the GRAS program has been in place for years, FDA's current use of the term was never formalized. In 1997, FDA issued a proposed rule modifying the GRAS system in several key ways.⁶ Under the proposed revision:

- Industry submits a notification to FDA that a substance is GRAS and scientific information supporting its claim
- FDA evaluates the notification and either poses no questions to the notifier or issues a decision that the supporting evidence does not stand up to the GRAS standard
- If the agency determines the substance is GRAS, it issues a "No Questions" letter to the notifying company. Crucially, the agency does *not* actually issue an affirmative GRAS designation, but rather accepts the petitioner's argument that the substance is safe
- There is no notice and comment period

This last point is particularly worrisome; as the new process was never officially sanctioned, the old GRAS system is still technically law.⁷ However, according to the Congressional Research Service, "the FDA has effectively been using the GRAS notification procedure outlined in the proposed rule since 1998 without ever issuing a final rule." This means the 1997 revision counts only as an informal guidance for industry, not a law.⁸

The current GRAS process results in a strange legal gray area for substances granted the designation. They are not approved as GRAS, although the agency treats them as such. The public has had no opportunity to comment on their safety or express its health concerns. Most impor-



Tuna - one of the meats often treated with CO to preserve its bright color.

tantly, there is no actual oversight of how supposedly GRAS substances are used. "In contrast to [the previous regulation], the GRAS notification procedures in the FDA's proposed rule do not appear to impose limits on the conditions of use," CRS explained.⁹

It was under this muddled authority that FDA first approved CO's use in meat and fish packaging. Under the CO GRAS notifications FDA has allowed, companies take meats and fish and place them in an "impermeable film similar to a vacuum package." Then "the air [is evacuated] from the package and replac[ed] ... with a specified mixture of gases that provides for better control of product properties."¹⁰

FDA has given its unofficial stamp of approval to CO four times, first in 2000, when it allowed Hawaii International Seafood, Inc., to use the gas on raw tuna. As a part of a "tasteless smoke" system, CO keeps tuna fresh-looking and red, much like it does for meat. However, while FDA did not contest Hawaii International's GRAS notification, it did determine that CO represented a preservative and so must be labeled to avoid consumer deception.¹¹

While it is not particularly surprising that a panel of industry's own scientists found CO to be perfectly harmless, if FDA had done a little sleuthing of its own it would have found a different story – namely, that it had already banned the gas.

These points are indisputable, which is perhaps why FDA has never bothered to address them. When pressed, the agency comes back with claims that the technology is safe and backed up by science – science presented by very companies trying to ensure CO’s use.

The agency’s other decisions regarding CO have not been so transparent. The next “No Questions” letter, issued in 2002, allowed Pactiv, a meat processing company, to use CO on its products. Two more followed, for notifications filed by Precept Foods, LLC (a 51 percent owned joint venture between Hormel Foods Corporation and Cargill Meat Solutions Corporation, formerly Excel Corporation) and Tyson Foods, Inc. None of them required companies to let consumers know what was in their packaging.^{12,13,14}

Examining the Evidence

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The agency, which under a memorandum of understanding co-regulates packaged meats with USDA’s Food Safety and Inspection Service, ignored an agreement between the two that prohibits the introduction of ingredients in fresh meat that would “result in the products becoming adulterated or misbranded, e.g., making products look better or of greater value than untreated products or masking normal spoilage indicators.”¹⁵

USDA’s Office of the Inspector General, which recently reviewed the use of CO in meat packaging, has criticized this standard, noting that the issue of how, exactly, a food might “‘appear better or of greater value’ is not addressed in any

agency-issued guidance or policy.” The office also criticized the FSIS acceptance of data submitted under FDA’s proposed rule, rather than the previously standing final rule.¹⁶

Moreover, FDA’s own Food Code – the supposed Bible of agency thinking on food safety issues – warns about the dangers of a modified atmosphere packaging system. “ROP [reduced oxygen packaging] which provides an environment that contains little or no oxygen...raises many microbiological concerns,” the code says. It further states that “the inhibition of the spoilage bacteria is significant because without these competing organisms, tell-tale signs signaling that the product is no longer fit for consumption will not occur.”¹⁷

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According to the agency, industry scientists from Pactiv, Precept and Tyson presented it with information showing CO’s harmlessness. This information cited an overall lack of effect on a cut of meat’s microbial population, the very small amounts of carbon monoxide that would be consumed when the meat was eaten and the resumption of natural browning and aging when the packaging was removed.^{18,19,20}

But a leaked industry e-mail showed that the companies were not so sure about those carbon monoxide safety claims: A Hormel Foods (part-owner of Pactiv) employee had serious trouble with the results of a company test on CO-treated meat. “Believe me, we are also puzzled by the data,” said the 2004 email. “Quite honestly, this test seemed to raise more questions than...it answered.”²¹ According to *The Washington Post* coverage of the story: “... microbial counts on meat that had been left under-refrigerated went down over time instead of up, as expected, even as other indicators of spoilage increased, suggesting the possibility of some kind of error.”²²

But even assuming the accuracy of industry’s science, their safety arguments do not hold water. The dangers of CO’s use do not stem from its direct effects on meat or even consumers. Carboxymyoglobin’s bright pink will not harm a hungry grocery shopper. Eating spoiled meat that looks fresh, however, will, and the evidence shows that CO’s use in the meat’s packaging makes that a very real possibility.

Studies showing unnaturally long persistence of fresh coloration in CO-treated meat are not difficult to find. A 1998 examination found that CO in ground beef, beef loin steaks,

and pork chops created “a stable bright red colour [sic] that lasted beyond the time of spoilage,” persisting the entire length of the 21-day test.²³

The European Commission’s Scientific Committee agreed. It noted that CO’s “stable cherry-colour can last beyond the microbial shelf life of the meat and thus mask spoilage.”²⁴ The European Union subsequently banned CO in meat and tuna packaging.

Taking such scientific findings and European regulatory action into account, it’s safe to say that FDA’s decision to allow carbon monoxide in beef was poorly thought out, a fact recognized by former agency staffers. “The FDA should not have accepted carbon monoxide in meat without doing its own independent evaluation of the safety implications,” said Elizabeth Campbell, former head of FDA’s office of food labeling.²⁵

Despite all that evidence, the public’s awareness of CO’s dangers remained low - until FDA was forced to justify its reasoning.

A Growing Controversy

As is so often the case, the controversy over CO’s use in meat packaging was initially rooted in a simple business dispute. Kalsec, Inc., a manufacturer of natural food preservatives, filed an FDA petition in which it asked the agency to rescind its GRAS designations for CO in an MAP system.

Disappointingly, industry and FDA have responded by questioning whether consumers care about color.

“Color is not a good indicator” of freshness, claimed FDA’s Linda Tarantino, director of the office of food additives. “There are ways to tell meat is not fresh,” she said, discounting the importance of a product’s appearance on consumers’ buying decisions.²⁶

“If we had evidence that consumers would be misled into buying meat that was spoiled because of the use of this technology, that is something we’d be concerned about,” Tarantino continued, noting that she was unaware of any studies showing consumers associate freshness with color.²⁷

Such claims strain credibility almost beyond belief. If there were no benefit to industry from using CO in meat packaging, why would it do so? In fact, Kalsec’s original petition, filed months before Tarantino’s comments, cited studies and literature from the meat industry itself indicating just how strong a role color plays in a consumer’s perception of food’s freshness:

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- “Consumer studies have shown that physical appearance of a retail cut in the display case is the most important factor determining retail selection of meat products.” – *Journal of Food Science*, 1972²⁸
- “Consumers view color as one of the most important attributes of fresh beef when making a decision to purchase retail product.” – *Colorado State University study*, 2001²⁹
- “Meat color is the main factor affecting beef product acceptability at retail points of purchase.” – *Journal of Animal Science*, 1996³⁰
- “Meat color is the single greatest appearance factor that determines whether or not a meat cut will be purchased.” – *National Pork Board/American Meat Science Association fact sheet*³¹

Further attempts at deflection came from FDA press officers. Susan Bro, who handles press for FDA commissioner Andrew von Eschenbach, suggested concerned citizens should “use the skills [they] have as a consumer to be aware of what is a safe and fresh meat product.”³²

Skills such as...eyesight? As the *New York Times* explained, things are not quite so simple. “Because packages of this treated meat are not marked, consumers have to use other clues to distinguish it. The meat is packaged in deep plastic

containers, sometimes black and sometimes white, and is tightly sealed with clear plastic. The plastic, which does not touch the meat, carries the Department of Agriculture inspection seal.”

“Printed on the plastic in black lettering – which is not always easy to read – are the words ‘Use by or freeze by’ and a date, as much as 14 days from the date of purchase. The long shelf life is a clue that the meat has been treated with carbon monoxide.”³³ Further complicating the picture, the vast majority of case-ready meat products – not just those treated with CO – carry similar use or freeze by labels.

Faced with so much deception, a consumer may throw their hands up and grab whatever looks best, picking up contaminated product in the process. In the presence of CO, fish can accumulate dangerous levels of scombrototoxin (histamine) and appear fresh. Meat can play host to a wide variety of pathogens, including *E. coli*, *Clostridium perfringens*, and *Salmonella*, not to mention other spoilage agents. Thorough cooking will serve to kill some of these contaminants, but not all, and many of their toxins are strongly heat-resistant. Given the risks, FDA and industry’s continued insistence on CO’s safety is even more irresponsible.

When it comes down to it, consumers deserve to know what has been done to the food they eat. FDA’s decision to allow CO in meat packaging was based on an illegitimate law, carried out in violation of previously standing regulations. The gas is essentially used as a color additive, and has not been treated as such; the public is at risk, and has not been allowed to voice its concerns. The technology is unsafe, masking signs of spoilage long after they would have been visible under natural packaging conditions. The agency’s response to these legitimate concerns have been evasive and flimsy, in direct opposition to its regulatory responsibilities.

So, rewind to the grocery store. Still want that burger? Or do you want industry, and the government that supposedly regulates it and protects you, to let you use your eyes instead of deceiving them?



Recommendations

FDA must fix this mess. The agency should:

- Revoke its unofficial approval of CO as GRAS,
- Reexamine CO as a color additive, and
- Require adequate labeling for any products treated with this toxic gas.

To find out more about how to help safeguard the meat you eat:

- Visit Food & Water Watch’s website to find out how to take action on this issue: www.foodandwaterwatch.org
- Read congressional testimony from F&WW executive director Wenonah Hauter at www.foodandwaterwatch.org/food/foodsafety/food-technologies/carbon-monoxide
- Make better buying decisions by using the Eat Well Guide at www.eatwellguide.org

Happy grilling!

Endnotes

- ¹ Ilano AL, Raffin TA. "Management of carbon monoxide poisoning." 1990. Available at: www.ncbi.nlm.nih.gov/pubmed/2403894
- ² Weiss, Rick. "Studies Fail to Quell Concerns Over Gas Treatment of Meat." *The Washington Post*, July 23, 2006.
- ³ Diaz, Kevin. "Juicy debate: What is fresh meat's true color?" *Minneapolis Star Tribune*, Nov. 14, 2007
- ⁴ Ibid.
- ⁵ "FDA's Approach to the GRAS Provision: A History of Processes." Center for Food Safety and Applied Nutrition, U.S. Food and Drug Administration. Available at: www.cfsan.fda.gov/~dms/grashist.html
- ⁶ "About the GRAS Notification Program." Center for Food Safety and Applied Nutrition, U.S. FDA. Available at: www.cfsan.fda.gov/~dms/gras-ov.html
- ⁷ Ibid.
- ⁸ "Federal Regulation of Substances Generally Recognized as Safe (GRAS) and the Use of Carbon Monoxide in Packaging for Meat and Fish." Congressional Research Service, Nov. 9, 2007.
- ⁹ Ibid.
- ¹⁰ Sebranek, Joe. Department of Animal Science and Department of Food Science, Iowa State University. Statement before the House Committee on Agriculture, Oct. 30, 2007.
- ¹¹ "Agency Response Letter GRAS Notice No. GRN 000015." Center for Food Safety and Applied Nutrition, U.S. FDA, Mar. 10, 2000. Available at: www.cfsan.fda.gov/~rdb/opa-g015.html
- ¹² "Agency Response Letter GRAS Notice No. GRN 000083." Center for Food Safety and Applied Nutrition, U.S. FDA, Feb. 21, 2002. Available at: www.cfsan.fda.gov/~rdb/opa-g083.html
- ¹³ "Agency Response Letter GRAS Notice No. GRN 000143." Center for Food Safety and Applied Nutrition, U.S. FDA, July 29, 2004. Available at: www.cfsan.fda.gov/~rdb/opa-g143.html
- ¹⁴ "Agency Response Letter GRAS Notice No. GRN 000167." Center for Food Safety and Applied Nutrition, U.S. FDA, Sept. 29, 2005. Available at: www.cfsan.fda.gov/~rdb/opa-g167.html
- ¹⁵ "Guidance on the Procedures for Joint Food Safety and Inspection Service and Food and Drug Administration: Approval of Ingredients and Sources of Radiation Used in the Production of Meat and Poultry Products." United States Department of Agriculture, Food Safety and Inspection Service. Available at: www.fsis.usda.gov/OPPDE/rdad/FRPubs/00-022N/ApprovalofIngredients.htm
- ¹⁶ "Inspection Report: Food Safety and Inspection Service's Evaluation of the Carbon Monoxide-Based Modified Atmospheric Packaging Under the Generally Recognized as Safe Regulatory Process." United States Department of Agriculture, Office of the Inspector General, March 2008. Available at: www.usda.gov/oig/webdocs/24901-01-IR.pdf
- ¹⁷ "Food Code: 2005 Recommendations of the United States Public Health Service Food and Drug Administration." U.S. FDA, 2005. Available at: www.cfsan.fda.gov/~dms/fc05-toc.html
- ¹⁸ "Agency Response Letter GRAS Notice No. GRN 000083." Op. cit.
- ¹⁹ "Agency Response Letter GRAS Notice No. GRN 000143." Op. cit.
- ²⁰ "Agency Response Letter GRAS Notice No. GRN 000167." Op. cit.
- ²¹ Weiss, Rick. "Meat Treatment Got Approval Despite Safety Concerns." *The Washington Post*, Nov. 14, 2007.
- ²² Ibid.
- ²³ Sørheima, et. al. "The storage life of beef and pork packaged in an atmosphere with low carbon monoxide and high carbon dioxide." *Meat Science*, 52(2), June 1999.
- ²⁴ "Opinion of the Scientific Committee on Food on the use of carbon monoxide as component of packaging gases in modified atmosphere packaging for fresh meat." European Commission, Scientific Committee on Food, Dec. 13, 2001. Available at: http://ec.europa.eu/food/fs/sc/scf/out112_en.pdf
- ²⁵ Gay, Lance. "Oh oh: Supermarket meat may not be all that fresh." *Capitol Hill Blue*, Washington, D.C., Nov. 17, 2005.
- ²⁶ ElAmein, Ahmed. "FDA defends policy on allowing use of carbon monoxide." *Food Production Daily*, Feb. 23, 2006. Available at: www.foodqualitynews.com/news/ng.asp?n=66040-carbon-monoxide-meat-map
- ²⁷ Burros, Marianne. "Stores react to meat reports." *The New York Times*, March 1, 2006.
- ²⁸ "Citizen Petition Requesting FDA to Enforce Ban on Carbon Monoxide Gas in Fresh Meat Packaging." Kalsec, Inc., Nov. 15, 2005. FDA Docket No. 2005P-0459. Available at: www.fda.gov/ohrms/dockets/dockets/05p0459/05p-0459-cp00001-toc.htm
- ²⁹ Ibid.
- ³⁰ Ibid.
- ³¹ Ibid.
- ³² Weiss, Rick. Op. cit.
- ³³ Burros, Marianne. Op. cit.

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