CCOF

Organic Certification   Trade Association   Education & Outreach   Political Advocacy

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Petition for Amending the National List of the USDA's National Organic Program

ITEM A

CCOF, Inc. is submitting this petition to change the listing of Carbon Dioxide from synthetic in §205.605(b)(8) to non-synthetic §205.605(a) in the National List of Nonagricultural (non-organic) substances allowed in or on processed products labeled as "organic" or "made with organic...."

ITEM B

1. The substance's common name.

Carbon Dioxide

2. The manufacturer's name, address and telephone number.

There are many. See attached list of Known CO_2 Source Facilities in the United States.

3. The intended or current use of the substance such as use as a pesticide, animal feed additive, processing aid, nonagricultural ingredient, sanitizer or disinfectant.

4. A list of the crop, livestock or handling activities for which the substance will be used. If used for handling (including processing), the substance's mode of action must be described.

Carbon dioxide has many uses in Handling. Included in this petition:

Handling Activity	Type of Use	Mode of Action
Grains Storage	Pest control/fumigant	Modifying atmosphere of storage bins by replacing oxygen with CO_2 kills pests by suffocation and prevents new ones.
Herbs and Spices	Pest control/fumigant	Same as above.
Beverages: Soda, fruit juice, and beer	Ingredient for carbonation	Carbonation results from CO_2 being pumped into beverages. Also retards microbial breakdown.
Production of natural flavors and extracts	Processing aid: extracting agent	Oleoresins can be separated from other plant components in a supercritical liquid CO_2 environment. Temperature and pressure vary to wash soluble compound from plant bulk.
Oil Production	Processing aid: extracting agent	CO_2 can help break up plant parts to enable oil to be extracted without hexane. It also improves the antioxidant content of oil, allowing it to keep better.
Chicken processing	Slaughtering agent	Chickens placed in pure CO_2 cannot breathe and suffocate.
Milk Handling	Processing aid: microbial control	CO_2 is dissolved into milk (post pasteurization) to inactivate microbial decomposition. Keeps microbes from obtaining oxygen.

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Seed treatment for sprout production	Processing aid: disinfectant	Alfalfa seed can be soaked in concentrated CO_2 solution to kill seed borne pathogens as alternative to high chlorine.
Whipped cream	Propellant	Aids ejection of food from aerosol can.
Fruit storage	Pest control	Pre-conditioning stone fruits in CO_2 helps them withstand controlled atmosphere storage.
Coffee decaffeination	Processing aid: extracting agent	Separates caffeine from coffee without harmful chemicals.

5. The source of the substance and a detailed description of its manufacturing or processing procedures from the basic component(s) to the final product.
Carbon dioxide comes from many sources and regional conditions determine which source is available in which area. (See attached list of known CO_2 sources in the United States.) However, as a natural occurring material a non-synthetic designation is appropriate. Major sources are described here:

a. By-product of oil refinery operations - In order to generate hydrogen for oil refining, methane gas is exposed to steam to create hydrogen and carbon dioxide. The reaction is as follows:

$$CH_4 + 2\,H_2O \rightarrow CO_2 + 4\,H_2$$

The resulting mixture still has some moisture and uncracked methane in it. To purify the carbon dioxide, the water is removed by drying. Then the mixture is distilled in a column under pressure which removes hydrocarbons and hydrogen. Once the CO_2 is purified, the amount of impurities is in the parts per billion (ppb) range. It could be argued that the methane gas is non-synthetic, but there is a chemical change that happens under steam and pressure to crack the methane into carbon dioxide and hydrogen. This is the primary type of CO_2 available in urban areas near either coast, or areas where there are oil refineries. Capturing the CO_2 prevents it from rising into the air as pollution from the refinery.

b. By-product of ethanol production - Ethanol for fuel is produced by fermentation of the natural sugars in corn or other grains. Carbon dioxide is given off in this reaction and is captured for many uses. The reaction is as follows:

$$C_6H_{12}O_6 \rightarrow 2\,C_2H_5OH + 2\,CO_2$$

There are impurities associated with the carbon dioxide produced this way, such as aldehydes, glycerol, higher alcohols, and acids. These impurities may be removed either by use of activated carbon absorbers (the Backus process) or by the Reich process of purification.

c. By-product of ammonia production - The reaction and process here is the same as for oil refineries except that air is involved in the process so that the ratio of hydrogen to nitrogen is sufficient to synthesize ammonia. For each ton of ammonia produced, more than a ton of carbon dioxide is generated.

d. Underground wells - Deposits of carbon dioxide occur underground, frequently in association with natural gas deposits. The primary deposits are located in Mississippi, New Mexico and Colorado. These deposits frequently have natural gas as an impurity and this is separated from the CO_2 by absorption.

e, f, g, h. By-products of chemical synthesis - Carbon dioxide is given off in reactions to produce sulfuric acid, phosphoric acid, ethylene oxide and from co-generation plants. Some of these plants purify and sell the CO_2 produced from these reactions.

6. A summary of any available previous reviews by State or private certification programs or other organizations of the petitioned substance.
None available except the NOSB TAP review from 1995 (attached). In the 1995 TAP review, one reviewer stated the substance should be considered non-synthetic, one reviewer said either synthetic or non-synthetic, and one said synthetic. All three reviewers recommended carbon dioxide for the National List. The NOSB noted that it could be from several sources and it was not always easy to determine which source was available. Therefore they added it to the National List as synthetic so that both natural and synthetic sources could be used.

7. Information regarding EPA, FDA, and State regulatory authority registrations, including registration numbers.
Not Applicable.

8. The Chemical Abstract Service (CAS) number or other product numbers of the substance and labels of products that contains the petitioned substance.
CAS number: 124-38-9
RTECS number: FF6400000
EEC number: 2046969

9. The substance's physical properties and chemical mode of action including (a) chemical interactions with other substances, especially substances used in organic production; (b) toxicity and environmental persistence; (c) environmental impacts from its use or manufacture; (d) effects on human health; and, (e) effects on soil organisms, crops, or livestock.
Physical properties: colorless, odorless, non-flammable gas or white opaque solid ("dry ice"); can be liquid under pressure ("supercritical CO_2"). Boiling Point: -78.5 °C. Freezing Point: -56.6 °C. Vapor pressure at 70 °F: 856 psi. For modes of action in the various uses in organic handling, see the chart above in section #3.

a. Carbon dioxide is usually the end product of other processes and so has relatively little chemical interaction with other substances used in organic production.
b. As a basic component of the atmosphere, it has a high environmental persistence but this is not bad except to the overarching concern about global warming. At the rates occurring in air it is completely non-toxic and is exempt from having an LD50.
c. Most of the sources of carbon dioxide are reclaiming the substance from other primary processes. As such it is recycling something that would otherwise be given off into the atmosphere. However, it is likely to be released into the atmosphere anyway after its use in organic handling and so no evaluation can be made as to the overall impact on global warming and CO_2 enrichment of the atmosphere from organic uses. The manufacture of refined petroleum, ethanol, ammonia, or energy are the primary manufacturing processes that carbon dioxide is purified from and each of them have significant negative environmental impacts. Ethanol production also has some positive environmental impact in reducing the amount of non-renewable energy needed. However, the purification of the CO_2 from these sources does not substantially change the impact that the primary process has on the environment.
d. All oxygen breathing organisms will suffocate in pure CO_2, not from a toxic effect of the gas itself, but because of the lack of oxygen. There are no other direct effects on human health from the substance.
e. Although not relevant for organic handling uses, plants benefit from carbon dioxide enrichment of their environment, such as can be done in greenhouses.

10. Safety information about the substance including a Material Safety Data Sheet (MSDS) and a substance report from the National Institute of Environmental Health Studies.
MSDS attached.

11. Research information about the substance which includes comprehensive substance research reviews and research bibliographies, including reviews and bibliographies which present contrasting positions to those presented by the petitioner in supporting the substance's inclusion on or removal from the National List.

Ahmadi, H., W.V Biasi, E.J Mitcham. 1999. "Control of Brown Rot Decay of Nectarines with 15% Carbon Dioxide Atmospheres." Journal of the American Society for Horticultural Science. Nov 1999. v. 124 (6) p. 708-712. Alexandria, Va. DNAL, 81 SO12
Abstract: Effects of short-term exposure to a 15% CO_2 atmosphere on nectarines [Prunes persica (L.) Batsch (Nectarine Group) 'Summer Red'] inoculated with Monilinia fructicola (Wint.) (Causal agent of brown rot) were investigated. Nectarines were inoculated with spores of M. fructicola and incubated at 20 degrees C for 24, 48 or 72 hours and then transferred to storage in either air or air enriched with 15% CO_2 at 5 degrees C. Fruit were removed from storage after 5 and 16 days and were examined for brown rot decay immediately and after ripening in air for 3 days at 20 degrees C. Non-inoculated nectarines were stored and treated likewise for evaluation of post-harvest fruit attributes to determine their tolerance to 15% CO_2. Incubation period after

inoculation, storage duration, and storage atmosphere had highly significant effects on fruit decay. After 3 days ripening in air at 20 degrees C, the progression of brown rot disease was rapid in all inoculated nectarines, demonstrating the fungistatic effect of 15% CO_2.

American Society for Horticultural Science. In the special section: "Modified Atmosphere Packaging--Toward 2000 and Beyond." Paper presented at a symposium held July 28-31, 1999, Minneapolis, Minnesota. DNAL, SB317.5.H68

Abstract: The tolerances of horticultural commodities to CO2 are outlined, as are also the associated biochemical and physiological aspects of differences in tolerance between and within commodity types. These tolerances are related to responses to the use of modified atmosphere packaging (MAP) during storage. Commodities vary widely in their responses to elevated CO2, and low tolerance to the gas limits its use to maintain quality in some cases. Factors such as cultivar and post-harvest treatment before imposing high CO2 can influence responses of commodities to CO2, but are rarely considered in cultivar selection or in commercial application. A better understanding of the physiology and biochemistry of commodity responses to CO2 is required for increased use of MAP.

Cossentine, J.E., et al. "Fumigation of Empty Fruit Bins with Carbon Dioxide to Control Diapausing Codling Moth Larvae and Penicillium Expansum Link. ex Thom Spores." HortScience. American Society for Horticultural Science. 2004 Apr. v. 39, no. 2 1022656803 p. 429-432. DNAL, SB1.H6

Daniels, James A.; Rajagopalan Krishnamurthi, Syed Rizvi. A Review of Effects of Carbon Dioxide on Microbial Growth and Food Quality. J. Food Protection. Ames, IA 1985. v. 48 (6) p. 532-537. DNAL 44.8 - J824.

Abstract: Carbon dioxide is effective for extending the shelf-life of perishable foods by retarding bacterial growth. The overall effect of carbon dioxide is to increase both the lag phase and the generation time of spoilage microorganisms; however, the specific mechanism for the bacteriostatic effect is not known. Displacement of oxygen and intracellular acidification were possible mechanisms that were first proposed then discounted by early researchers. Rapid cellular penetration and alteration of cell permeability characteristics have also been reported, but their relation to the overall mechanism is not clear. Several researchers have proposed that carbon dioxide may first be solubilized into the liquid phase of the treated tissue to form carbonic acid (H_2CO_3), and investigations by the authors tend to confirm this step, as well as to indicate the possible direct use of carbonic acid for retarding bacterial spoilage. Most recently, a metabolic mechanism has been studied by a number of researchers whereby carbon dioxide in the cell has negative effects on various enzymatic and biochemical pathways. The combined effects of these metabolic interferences are though to constitute a stress on the system, and result in a slowing of the growth rate. The degree to which carbon dioxide is effective generally increases with concentration, but high levels raise the possibility of establishing conditions where pathogenic organisms such as Clostridium Botulinum may survive. It is thought that such risks can be minimized with proper sanitation and temperature control, and that the commercial development of food packaging systems employing carbon dioxide will increase in the coming years.

Dziezak, J.D. "Innovative separation process finding its way into the food industry." Food Technology. Chicago, IL 1986. v. 40 (6) p. 66 - 69. DNAL 389.8 - F7398.

Abstract: A technological process is described, using carbon dioxide in its supercritical state to selectively extract and fractionate desirable components from a food mixture in 1 step. The basic supercritical process is illustrated schematically and discussed. Various supercritical processing applications (e.g., the production of supercritically-decaffeinated tea) are described. The energy savings of supercritical fluid extraction for the food industry are cited.

Hotchkiss, J.H., Chen, J.H., Lawless, H.T. 1999. "Combined Effects of Carbon Dioxide Addition and Barrier Films on Microbial and Sensory Changes in Pasteurized Milk." Journal of Dairy Science. Apr 1999. v. 82 (4) American Dairy Science Association, Savoy, Ill. p. 690-695. DNAL, 44.8 J822

Abstract: The growth of psychrotrophic microorganisms is an important factor in the deterioration of refrigerated pasteurized milk. Dissolved CO_2 inhibits certain spoilage microorganisms in foods provided that the packaging offers a sufficient barrier to CO_2 evolution. The objectives of this work were, first, to estimate the sensory threshold for dissolved CO_2 in 2% milk and, second, to determine the relationship between microbial growth and package barrier properties for pasteurized milk to which CO_2 had been added at

concentrations near the flavor threshold. Pasteurized milk was inoculated with a cocktail of spoilage microorganisms, packaged in different barrier film pouches, and stored at 6.1 degrees C for up to 28 d. The addition of CO_2 at concentrations of 8.7 and 21.5 mM increased the time needed to reach 10(6) cfu/ml from 6.4 d (no CO_2) to 8.0 and 10.9 d, respectively, in low barrier pouches. In high barrier pouches, the time needed to reach 10(6) cfu/ml was increased to 9.7 and 13.4 d, respectively, at CO_2 concentrations of 8.7 and 21.5 mM. This increase represents an increase in shelf-life of approximately 25 to 200%. Microbial counts had longer lag times and lower growth rates and took longer to reach stationary growth as the concentration of CO_2 increased in all films than did the control milk. The control milk curdled in less than 17 d, but the test milk in the high barrier packaging had not curdled at 28 d. These data suggest that the shelf-life of pasteurized refrigerated milk could be extended by at least 25 to 200% at CO_2 concentrations near the sensory threshold.

Mann, D.D., et al. "Efficient Carbon Dioxide Fumigation of Wheat in Welded-steel Hopper Bins." Applied Engineering in Agriculture. Jan 1999. v. 15 (1) p. 57-63. DNAL, S671.A66
Abstract: Two welded-steel hopper bins were modified for fumigation with carbon dioxide (CO_2) and a method for efficiently purging the air from the bins was developed. Concentrations of CO_2 during experimental fumigations were less than the concentrations predicted theoretically, but were high enough to kill more than 99% of caged adult rusty grain beetles in three separate experiments. Between 58 and 75% of the CO_2 initially added remained in the bin at the time when the CO_2 concentrations peaked. The positive results from this research mean that stored-product insects in stored grain can be controlled using CO_2 rather than continuing to rely on synthetic insecticides and fumigants that present health and environmental concerns.

Mazzoni, A.M., et al. "Supercritical Carbon Dioxide Treatment to Inactivate Aerobic Microorganisms on Alfalfa Seeds." Journal of Food Safety. Dec 2001. v. 21 (4). p. 215-223. Food & Nutrition Press, Inc., Trumbull, Conn. DNAL, TP373.5.J62
Abstract: The supercritical carbon dioxide (SC- CO_2) process involves pressurizing CO_2 in a chamber which generates liquid phase of carbon dioxide. Pressurized liquid CO_2 has a strong extraction capability of organic and inorganic compounds. The recent studies have also demonstrated that antimicrobial effect of SC- CO_2 due extraction some cellular components of microorganisms. The efficacy of a supercritical carbon dioxide treatment on alfalfa seeds contaminated with Escherichia coli K12 was tested at 2000, 3000, and 4000 psi at 50 degrees C. Samples were treated for 15, 30, and 60 min at each pressure. Treated seeds were evaluated in terms of germination characteristics. For aerobic plate count, the effect of pressure in the range of 2000-4000 psi was not statistically significant ($p > 0.05$) even though 85.6% inactivation was achieved at 4000 psi for 60 min. For E. coli, the reductions for 2000, 3000, and 4000 psi treatments for 15 min were 26.6, 68.1, and 81.3%, respectively. As the time was increased from 15 to 60 min at 4000 psi, the percent E. coli reduction increased from 81.3% to 92.8%. The percent germination for all treatments was over 90%. There was no significant difference ($p > 0.05$) in the germination rate of treated and untreated seeds. Supercritical carbon dioxide treatments demonstrated a reduction of E. coli K12 and total aerobic counts without affecting the germination characteristics of alfalfa seeds ($p < 0.05$). This study was a step in the direction of improving safety of alfalfa seeds used to produce fresh sprouts, which have been the cause of several outbreaks.

United States Agricultural Research Service. Carbon Dioxide Extracts Seed Oils Replacement for Hexane Solvent Process. Agricultural research - United States Agricultural Research Service. Washington, D.C. The Service. Mar 1982. v. 30 (9) p. 8-9.

Watkins, C.B. "Responses of Horticultural Commodities to High Carbon Dioxide as Related to Modified Atmosphere Packaging." HortTechnology July/Sept 2000. v. 10 (3). p. 501-506.

12. A ``Petition Justification Statement" which provides justification for one of the following actions requested in the petition:
Carbon dioxide is currently widely used in organic handling. In light of the court decision that supported Mr. Harvey regarding the use of synthetic materials in processing, we request that the National List be changed so that carbon dioxide is moved from synthetic in §205.605(b)(8) to non-synthetic §205.605(a) in the National List of Nonagricultural (non-organic) substances allowed in or on processed products labeled as "organic" or "made with organic."

History and Alternatives

As described above, there are many sources of CO_2 throughout the country. Some of these sources, from ethanol fermentation and from underground wells, could be evaluated as non-synthetic. The NOSB recognized this during the first review of CO_2, but decided that it was very difficult for buyers to determine the source of CO_2 when they purchase it, and therefore it would be appropriate to allow both the synthetic and non-synthetic forms. Therefore it was added to the National List of Synthetics allowed (§205.605(b)) so that untraceable sources remained permissible.

The chart below indicates the main alternatives for the uses of carbon dioxide. In all cases (except possibly the chicken slaughter using physical means) the alternatives are far more toxic and less acceptable or prohibited in an organic handling system. Because of a fairly long history of use in organics, there has not been much investigation into alternatives that might be acceptable for organic food.

Handling Activity	Type of Use	Alternatives
Grains Storage/Herbs and Spices	Pest control/fumigant	Methyl bromide, other chemical fumigants.
Beverages: Soda, fruit juice, and beer	Ingredient for carbonation	None for soda and juice, beer uses recycled CO_2 from its own fermentation.
Natural flavors, extracts, oils, decaffeination.	Processing aid: extracting agent	Hexane, other synthetic and non-synthetic alcohols.
Chicken processing	Slaughtering agent	Decapitation.
Milk Handling	Processing aid: microbial control	Chemical preservatives.
Seed treatment for sprout production	Processing aid: disinfectant	High levels of chlorine.
Whipped Cream	Propellant	Chlorofluorocarbons.

Interpretation of the Organic Food Production Act (OFPA)

Here are a few OFPA citations for the discussion below:

§6502 DEFINITIONS.

(21) Synthetic. The term 'synthetic' means a substance that is formulated or manufactured by a chemical process or by a process that chemically changes a substance extracted from naturally occurring plant, animal, or mineral sources, except that such term shall not apply to substances created by naturally occurring biological processes.

§6510 HANDLING.

(a) In General. For a handling operation to be certified under this chapter, each person on such handling operation shall not, with respect to any agricultural product covered by this chapter

(1) add any synthetic ingredient during the processing or any post harvest handling of the product

§6512 OTHER PRODUCTION AND HANDLING PRACTICES.

If a production or handling practice is not prohibited or otherwise restricted under this chapter, such practice shall be permitted unless it is determined that such practice would be inconsistent with the applicable organic certification program.

Argument 1: Under the definition of synthetic used in both OFPA and the final rule, the starting substance would have to be derived from a plant, animal or mineral source. Carbon dioxide from air is not from any of these sources and so the synthetic definition does not apply here. Therefore, following §6512, cited above, carbon dioxide should be permitted because the use of gas is not prohibited or restricted under the chapter.

Argument 2: In §6510 of OFPA, only synthetics used as <u>ingredients</u> are not allowed. Noting the carbon dioxide usage chart, only for carbonation and possibly as a propellant would carbon dioxide be considered an ingredient. Its other uses are processing aids, extracting agents, and pest control and as such are not be required to be non-synthetic in origin. CO_2 could therefore be required as an ingredient in carbonation from one of the non-synthetic sources discussed above, but any source could be used for the other purposes.

Interpretation of the National Organic Program Final Rule, 7 CFR Part 205

This petitioner is aware of various efforts by the NOSB and others to re-classify groups of substances used as processing aids, cleaning agents, extractants, and packaging materials. Because of the many uses of carbon dioxide, some would fall under each sub group under discussion. Two such interpretations in particular could apply already.

Section 205.271(c) is the Facility Pest Management Practice Standard. This paragraph states, "(c) If the practices provided for in paragraphs (a) and (b) are not effective to prevent or control pests, a non-synthetic or synthetic substance consistent with the National List may be applied." Concerning its use as pest control through atmospheric modification of a grain or herb storage facility, carbon dioxide is part of this practice standard. Regardless of the outcome of the Harvey lawsuit on ingredients used in processed food, CO_2 should stay on the National List for this specific use to meet this section of the rule.

The second interpretation concerns the uses of carbon dioxide as an extracting agent for natural flavors, oils, and decaffeination of coffee and tea. There is no definition of extraction in either OFPA or the NOP Final Rule. The NOSB proposed this definition: "Extraction: The concentration, separation and removal of a substance from a plant, animal microbiological or mineral source. Materials used in plant crop and animal production may be extracted in any way that does not result in synthetic reaction as defined by §2103(21). The products of any other methods of extraction shall be considered on a case by case basis and reviewed for compatibility under OFPA §2119(m)(1-7)." (NOSB, 1995; Austin, Texas). There is nothing that requires that an extracting agent be non-synthetic since there is none of it left in the final product and no chemical change has occurred in the extraction. The final rule only prohibits volatile synthetic solvents in §205.270(c)(2), but would allow anything else on the National List.

Availability Issues

Because carbon dioxide is produced in many places in many ways, and because transporting the highly pressurized gas or liquid for long distances is not particularly feasibly or desirable, some regions are at a very distinct disadvantage if it were required to source non-synthetic sources. Ethanol plants, a common source, tend to be in the grain producing areas of the country, while the mined sources are in Mississippi, New Mexico, and Colorado. In industrialized areas such as California and the Northeastern seaboard, the primary availability is from oil refining operations. When California companies requested their suppliers to try to get an ethanol source, they were informed that they would have to get an entire railcar full, about 80 tons of carbon dioxide. The storage capacity of a medium size grain processing operation is about 24 tons, making a railcar commitment not feasible. Organic handling uses are a miniscule percentage of all the CO_2 used in the country and so this situation is not likely to change in the near future.

Conclusion

Carbon dioxide is an important part of many Organic Handling Systems for a wide variety of uses in a wide variety of foods. It is safe, better than the alternatives, and compatible with organic production. It is essential that it remain available to Organic systems in the face of changing regulatory issues. Therefore this petition is a request to re-classify carbon dioxide in whatever way is necessary to enable its continued use.

Other References

Air Liquide Group personal communication with: David Cheng, Bay area sales agent; Christine Boisrobert, Chicago office; and Tom Kuruc, manager of CO_2 and N_2O manufacturing unit.
Kirk Othmer Encyclopedia of Chemical Technology, 3rd edition.
National Organic Standards Board, 1995. TAP review of Carbon Dioxide.

Attachments:

1. MSDS for Carbon Dioxide
2. Sources of CO_2 in the United States (courtesy of Air Liquide Group)
3. Carbon Dioxide Production Flow Chart
4. Original TAP Review for Carbon Dioxide.

ENERGAS

MSDS FOR CARBON DIOXIDE (COMPRESSED)

Rev 2 (10/2000)

1. Identification of the Substance/ Preparation and of the Company

Product Name: **Carbon Dioxide (Compressed)**

Chemical Formula: CO_2

Company Identification: Energas Limited
Westmorland Street
Hull HU2 0HX

Emergency Telephone No: 01482 329333

2. Composition/ Information on Ingredients

Substance/ Preparation: Substance
Components/ Impurities: Contains no other impurities which will influence the classification of the product.

CAS Number: 00124-38-9
EEC Number: 2046969 (from EINECS)

3. Hazardous Properties

Liquefied gas.
In high concentrations may cause asphyxiation.

4. First Aid Measures

Inhalation:
Low concentrations of carbon dioxide cause increased respiration and headaches.
In high concentrations may cause asphyxiation.
Symptoms may include loss of mobility/ consciousness.
Victim may not be aware of asphyxiation.
Remove victim to uncontaminated area wearing self-contained breathing apparatus.
Keep victim warm and rested. Call a doctor.
Apply artificial respiration if breathing has stopped.

Skin/ Eye Contact:
Flush eyes copiously with water for at least 15 minutes. Obtain medical assistance.

5. Fire Fighting Measures

Suitable Extinguishing Media:
All known extinguishants can be used.

Specific Hazards:
Exposure to fire may cause containers to rupture/ explode. Non-flammable.

Specific Methods:
If safe to do so, stop flow of product.
Move container away or cool with water from a protected position.

Hazard Combustion Products:
None.

Special Protective Equipment for Fire Fighters:
In confined spaces use self-contained breathing apparatus.

6. Accidental Release Measures

Personal Precautions
Evacuate area.
Ensure adequate air ventilation.
Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe.

Environmental Precautions
Try to stop release.
Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.

Clean Up Methods
Ventilate area.

7. Handling and Storage

Handling:
Refer to Energas Storage and Handling instructions.
Use only properly specified equipment which is suitable for this product, its supply pressure and temperature.
Open cylinder valve slowly to avoid pressure shock.
Do not allow backfeed into the container.
Suck back of water into the container must be prevented.
Contact Energas Limited if in doubt.

Storage:
Keep container below 50°C in a well ventilated place.

8. Exposure Controls/ Personal Protection

Exposure Limit Value:
LTEL : 5000 ppm (8 hr TWA ref. period)
STEL : 15000 ppm (15 min. ref. period)

Personal Protection:
Ensure adequate ventilation.

ENERGAS

MSDS FOR CARBON DIOXIDE (COMPRESSED)

9. Physical and Chemical Properties

Appearance/ Colour: Colourless gas.
Odour: Odourless

Melting Point:	-56ºC
Boiling Point:	-75ºC
Critical Temperature:	30°C
Relative Density (Liquid):	0.82 (liquid = 1)
Relative Density (Gas):	1.52 (air = 1)
Vapour Pressure @ 20°C:	57.3 bar
Solubility (water):	2000 mg/l

10. Stability and Reactivity

Stable under normal conditions.

11. Toxicological Information

Carbon Dioxide is classified as a non-flammable, non-toxic liquefied gas. It is normally present in atmospheric air at a level of approximately 350 parts per million (0.035%). It is a normal product of metabolism being held in bodily fluids and tissues where it forms part of the bodies normal chemical environment. In the body it acts in the linking of respiration, circulation and vascular response to the demands of metabolism both at rest and in exercise.

The effects of inhaling low concentrations of carbon dioxide are physiologically reversible but in high concentrations the effects are toxic and damaging.

NB The effects of carbon dioxide are entirely independent of the effects of oxygen deficiency.

The oxygen content in the atmosphere is therefore not an effective indication of the danger. It is possible to have an acceptable low oxygen content of 18% and a high carbon dioxide content, of 14% which is very dangerous.

Individual tolerances can vary widely, dependant on the physical conditions of the person and the temperature and humidity of the atmosphere, but as a general guide, the effects of inhaling varying concentrations of carbon dioxide are likely to be as follows:-

Concentration by Volume - Likely Effects

1 to 1.5%	Slight effect on chemical metabolism after exposures of several hours.
3%	The gas is weakly narcotic at this level, giving rise to deeper breathing, reduced hearing ability, coupled with headache, an increase in blood pressure and pulse rate.
4 - 5%	Stimulation of the respiratory centre occurs resulting in deeper and more rapid breathing. Signs of intoxication will become evident after 30 minutes exposure.
5 - 10%	Breathing becomes more laborious with headache and loss of judgement.
10 -100%	When the carbon dioxide concentration increases above 10%, unconsciousness will occur in under one minute and unless prompt action is taken, further exposure to high levels will eventually result in death.

The recommended exposure limit for carbon dioxide is 5000 parts per million (0.5%) by volume, calculated on an 8 hour time weighted average concentration in air.
Depending on regulations in individual countries carbon dioxide concentration peaks up to 30000 parts per million (3.0%) in air are allowed, where by the duration of exposure is between 10 minutes and 1 hour.
Cardiac or respiratory defects are likely to increase the hazards of inhalation.
Wherever any doubt exists, the recommended exposure limit of 5000 parts per million carbon dioxide in air should be regarded as the maximum level of the individual concerned.

12. Ecological Information

May contribute to the "Greenhouse Effect" when discharged in large quantities.
May cause pH changes in water.

13. Disposal Considerations

Vent to atmosphere in a well ventilated place.
Do not discharge into any place where its accumulation could be dangerous.
Contact Energas Limited if guidance is required.

14. Transport Information

UN No.	:	1013
Class/ Division	:	2.2
ADR/RID item	:	2.5°A
Emergency Action Code	:	2RE App "A"
Hazard Identification No.	:	20
CEFIC Tremcard No.	:	11-1/20g39
Labelling ADR	:	Label 2: Non-toxic, non-flammable gas.

Avoid transport on vehicles where the load space is not separated from the driver's compartment.

Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or emergency.

Ensure all cylinder valves are closed and not leaking and the load is firmly secured and complies with the applicable regulations.

15. Regulatory Information

EC Classification : Not classified as a dangerous substance.

- Symbols - road transport symbols are used and selected to the most stringent product classification.

  EC or ADR - Label 2 : Non-toxic, non-flammable gas.

- **Risk Phrases**
  RAs Asphyxiant in high concentrations

- **Safety Phrases**
  S9 Keep container in a well ventilated place.
  S23 Do not breathe gas.

16. Other Information

Valve Connection: BS 341 No. 8

Ensure all users of this product understand the hazards of asphyxiation.

Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out.

Details given in this document are believed correct at the time of going to press.

Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use can be accepted.

Refer to Energas Limited General Safety and Handling Data Sheet for further details.

ENERGAS

MSDS FOR CARBON DIOXIDE (COMPRESSED)

Rev 2 (10/2000)

CYLINDER IDENTIFICATION TO BS EN 1089-3
GROUND COLOUR : DUSTY GREY (RAL 7037)

ENERGAS GENERAL SAFETY AND HANDLING DATA

1. GENERAL

Only trained persons should handle compressed gases.
Observe all regulations and local requirements regarding the storage of containers.
Do not remove or deface labels provided by the supplier for the identification of the container contents.
Ascertain the identity of the gas before using it.
Know and understand the properties and hazards associated with each gas before using it.
When doubt exists as to the correct handling procedure for a particular gas contact the supplier.

2 HANDLING AND USE

Wear stout gloves.
Never lift a container by the cap or guard unless the supplier states it is designed for that purpose.
Use a trolley or other suitable device or technique for transporting heavy containers, even for a short distance.
Where necessary wear suitable eye and face protection . The choice between safety glasses, chemical goggles, or full face shield will depend on the pressure and nature of the gas being used.

Where necessary for toxic gases see that self-contained positive pressure breathing apparatus or full face air line respirator is available in the vicinity of the working area.
Employ suitable pressure regulating devices on all containers when the gas is being emitted to systems with a lower pressure rating than that of the container.
Ascertain that all electrical systems in the area are suitable for service with each gas.

Never use direct flame or electrical heating devices to raise the pressure of a container. Containers should not be subjected to temperatures above 45°C.
Never re-compress a gas mixture without consulting the supplier. Never attempt to transfer gases from one container to another.
Do not use containers as rollers or supports, or for any other purpose than to contain the gas as supplied.
Never permit oil, grease or other readily combustible substances to come into contact with valves of containers containing oxygen or other oxidants.
Keep container valve outlets clean and free from contaminants, particularly oil and water.
Do not subject containers to abnormal mechanical shocks which may cause damage to their valves or safety devices.

Never attempt to repair or modify container valves or safety relief devices. Damaged valves should be reported immediately to the supplier.
Close the container valve whenever gas is not required even if the container is still connected to the equipment.

3 STORAGE

Containers should be stored in a well ventilated area. Some gases will require a purpose built area.
Store containers in a location free from fire risk and away from sources of heat and ignition. Designation as a no smoking area may be desirable.

Gas containers should be segregated in the storage area according to the various categories.

The storage area should be kept clear and access should be restricted to authorised persons only , the area should be clearly marked as a storage area and appropriate hazard warning signs displayed (Flammable Toxic etc,).
The amount of flammable or toxic gases should be kept to a minimum.
Flammable gases should be stored away from other combustible materials.

Containers held in storage should be periodically checked for general condition and leakage.
Containers in storage should be properly secured to prevent toppling or rolling .
Vertical storage is recommended where the container is designed for this.
Container valves should be tightly closed and where appropriate, valve outlets should be capped or plugged. Protect containers stored in the open against rusting and extremes of weather.
Containers should not be stored in conditions likely to encourage corrosion.
Store full and empty containers separately and arrange full containers so that the oldest stock is used first.

PRODUCTION SITE ADDRESSES

Engineering and Welding Limited	Energas Limited	Energas Limited
Westmorland Street	Haslams Lane	Brownroyd Street
Hull	Alfreton Road	Off Thornton Road, Bradford
HU2 0HX	Derby, DE22 1EB	West Yorkshire, BD8 9AF
Tel: 01482 329333	Tel: 01332 364121	Tel: 01274 549090
Fax: 01482 212335	Fax: 01332 291590	Fax: 01274 548181

FOR FURTHER INFORMATION CONTACT YOUR NEAREST DISTRIBUTION CENTRE

Known Carbon Dioxide Sources in the United States

PRODUCER	CITY	ST	ZIP	Source Type	Start YR	Nameplate (Capacity)
<Confidential>	Richmond	VA	23241	Acid	85	90
	Saint Johns	AZ	85936	CO2-P	90	100
	Brandon	MS	39043	CO2-P	88	900
	Brandon	MS	39047	CO2-P	88	1000
	Guymon	OK	73942	CO2-P		400
	Denver City	TX	79323	CO2-P	85	210
	Odessa	TX	79761	CO2-P	90	350
	Green River	WY	82935	CO2-P	91	300
	Rock Springs	WY	82901	CO2-P	98	400
	Cortez	CO	81321	CO2-W	50	150
	Walden	CO	80480	CO2-W	85	300
	Brandon	MS	39601	CO2-W	2002	700
	Brookhaven	MS	39601	CO2-W	2002	700
	Goshen Springs	MS	39208	CO2-W	93	300
	Madison	MS	39110	CO2-W	88	750
	Star	MS	39167	CO2-W	87	1400
	Bueyeros	NM	88412	CO2-W	85	270
	Clayton	NM	88415	CO2-W	87	180
	Valley	NM	88412	CO2-W	70	120
	Price	UT	84501	CO2-W	2002	220
	Cumberland	MD	21501	Cogen	2000	150
	Poteau	OK	74953	Cogen	91	200
	Bayport	TX	77507	EO	82	350
	Beaumont	TX	77701	EO	95	250
	Cedar Rapids	IA	52405	Ethnl	86	500
	Clinton	IA		Ethnl	91	250
	Eddyville	IA	52553	Ethnl	94	240
	Galva	IA	51020	Ethnl	2002	150
	Muscatine	IA	52761	Ethnl	1994	500
	Decatur	IL	62523	Ethnl	80	800
	Pekin	IL	61554	Ethnl	82	650
	Pekin	IL	61554	Ethnl	1995	300
	Pekin	IL	61554	Ethnl	86	300
	Lawrenceburg	IN	47025	Ethnl	88	120
	South Bend	IN	46601	Ethnl	85	480
	Washington	IN	47501	Ethnl	2000	400
	Atchison	KS	66002	Ethnl	67	140
	Colwich	KS	67030	Ethnl	2003	100
	Russell	KS	67665	Ethnl	2002	300
	Hopkinsville	KY	42240	Ethnl	2005	150
	Albert Lea	MN		Ethnl	2001	260
	Bingham Lake	MN	56118	Ethnl	2000	260
	Claremont	MN	55924	Ethnl	2004	250
	Marshall	MN	56258	Ethnl	89	200
	Preston	MN		Ethnl	2002	400
	Winnebago	MN	56098	Ethnl	98	225
	Winthrop	MN	55396	Ethnl	1994	120
	Macon	MO	63552	Ethnl	2002	400
	Aurora	NE	68818	Ethnl	2001	120
	York	NE	68467	Ethnl	98	200
	Scotland	SD	57059	Ethnl	98	80

Known Carbon Dioxide Sources in the United States

Loudon	TN	37774	Ethnl	2001	275
Loudon	TN	37774	Ethnl	84	350
Monroe	WI	53566	Ethnl	2004	400
Oshkosh	WI	54902	Ethnl	2003	250
Stanley	WI	54768	Ethnl	2003	300
Decatur	AL	35602	H2	84	90
Decatur	AL	35699	H2	87	120
Benicia	CA	94510	H2	80	300
Carson	CA	90744	H2	87	250
El Segundo	CA	90245	H2	2000	600
Long Beach	CA	90747	H2	67	550
Martinez	CA	94553	H2	79	360
Richmond	CA	94850	H2	79	425
Torrance	CA	90503	H2	78	350
Wilmington	CA	90748	H2	77	300
Delaware City	DE	19706	H2	71	500
Augusta	GA	30917	H2	78	150
Barbers Point	HI	96707	H2	x	40
Chicago	IL	60607	H2	98	250
Wood River	IL	62095	H2	88	250
New Orleans	LA	70126	H2	81	480
New Orleans	LA	70126	H2	2003	200
St. Paul	MN	55124	H2	79	250
Toledo	OH	43659	H2	70	230
Memphis	TN	37501	H2	84	70
Baytown	TX	77521	H2	78	400
Texas City	TX	77591	H2	71	160
Ferndale	WA	98226	H2	79	650
Corpus Christi	TX	78426	H2	80	350
Marmet	WV	25315	N.Gas	82	1000
Cherokee	AL	35616	NH3	80	300
Courtright ON	CAN	48060	NH3	86	330
Medicine Hat AB	CAN		NH3	85	800
Augusta	GA	30917	NH3	94	1250
Creston	IA	50801	NH3	77	215
Fort Dodge	IA	50501	NH3	71	400
Sioux City	IA	51054	NH3	88	250
East Dubuque	IL	61025	NH3	84	550
Dodge City	KS	67801	NH3	72	300
Donaldsonville	LA	70346	NH3	77	250
Pollock	LA	71467	NH3	93	230
Beatrice	NE	68310	NH3	90	250
Beatrice	NE	68310	NH3	1995	225
Lima	OH	45801	NH3	70	800
Enid	OK	73701	NH3	77	350
Verdigris	OK	74116	NH3	x	450
Woodward	OK	73802	NH3	83	275
St. Helens	OR	97051	NH3	80	50
Borger	TX	79007	NH3	77	160
Dumas	TX	79029	NH3	65	40
Hopewell	VA	23860	NH3	2003	650
Hopewell	VA	23860	NH3	55	435
Hopewell	VA	23860	NH3	78	500

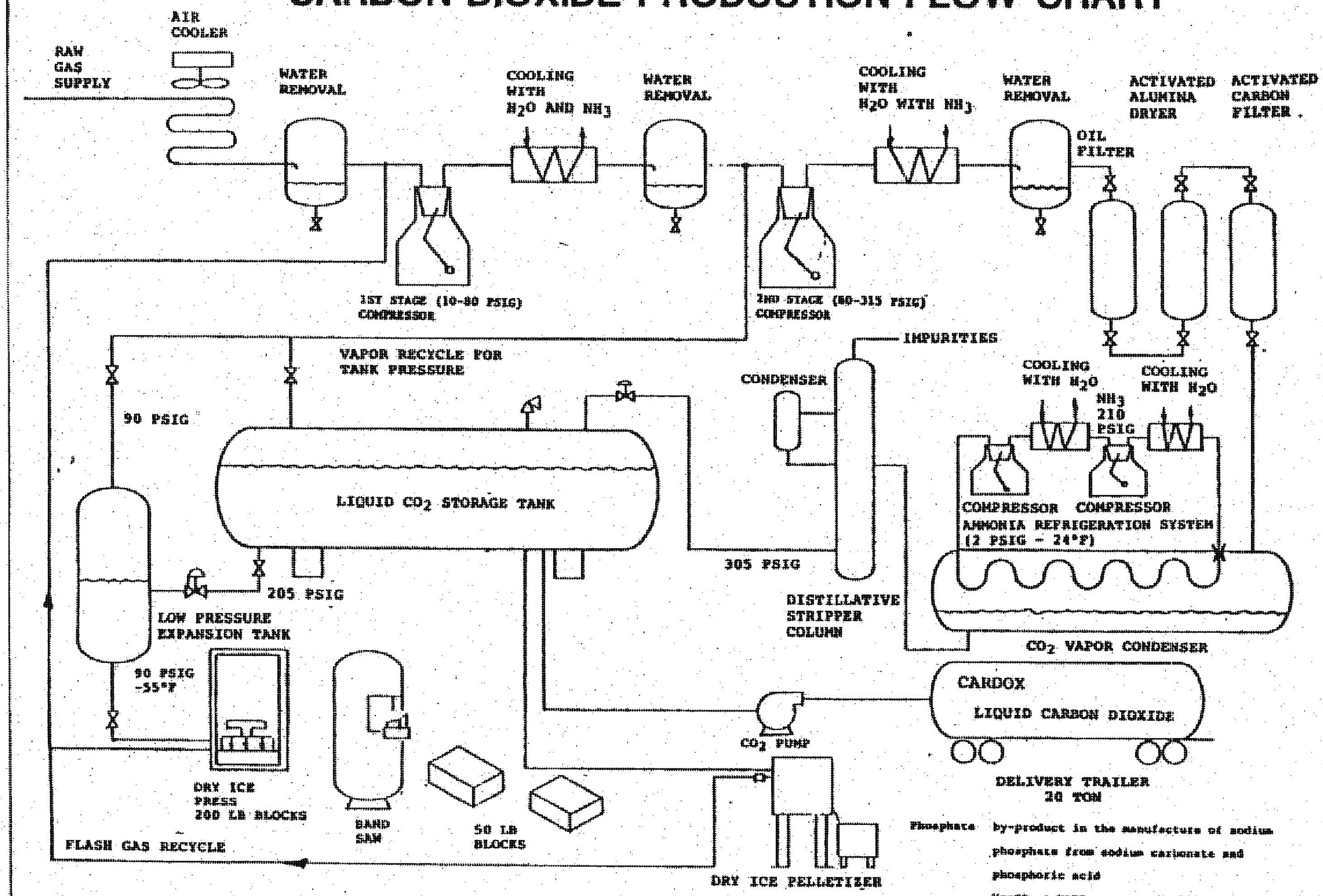
Known Carbon Dioxide Sources in the United States

Cheyenne	WY	82002	NH3	77	450
Lawrence	KS	66045	PO4	84	100
LaPorte	TX	77572	SNG	x	120

Source Key:

Acid	neutralization of sulfuric acid by-product
CO2-P	pipeline from a distant well
CO2-W	well (underground CO2 source) at location
Cogen	byproduct of Co-generation plant
EO	Ethylene oxide production by-product
Ethnl	Fermentation of ethanol source
H2	hydrogen plant for oil refining
N.Gas	Natural gas well mixed with CO2
NH3	by-product of ammonia production
PO4	phosphoric acid production by-product
SNG	synthetic natural gas plant

CARBON DIOXIDE PRODUCTION FLOW CHART



SOURCES OF RAW CO_2

Natural Gas Wells	in purity up to 99.7% or more
Fermentation	by-product in the fermentation of ethanol, whiskey, beer, and other distilled products $C_6H_{12}O_6$ ------ $2C_2H_5OH + 2CO_2$ carbohydrate ethyl alcohol
Ammonia	by-product in the manufacture of hydrogen from natural gas for ammonia production $CH_4 + O_2$ ------ $CO_2 + 2H_2$
Hydrogen	by-product in the manufacture of hydrogen for catalytic crackers in oil refineries and other petrochemical processors $CH_4 + 2H_2O$ ------ $4H_2 + CO_2$
Phosphate	by-product in the manufacture of sodium phosphate from sodium carbonate and phosphoric acid $Na_2CO_3 + H_3PO_4$ ---- $Na_2HPO_4 + CO_2 + H_2O$ sodium carbonate, phosphoric acid, sodium phosphate
SNG	by-product in the manufacture of substitute natural gas from residual fuel oil and steam residual fuel oil + steam ---- methanol + CO_2
Ethylene Oxide	by-product in the manufacture of ethylene oxide C_2H_4 + Air + Heat + Catalyst --- $C_2H_4O + CO_2$

COMPRESSION

Commercial carbon dioxide is manufactured from by-product stock obtained from a number of different sources. The product typically enters the system as a warm, wet gas. The CO_2 gas is then pressurized in turbine or piston driven compressors in at least two stages to approximately 300 psig. Carbon dioxide cooling is accomplished with water and ammonia heat exchangers after each compression stage, with moisture removal after each stage of compression.

PURIFICATION

The high pressure carbon dioxide vapor first passes through an oil filter where residual oil from compressor lubrication is removed. The CO_2 then enters a dryer where moisture is removed to a dewpoint below -60°F. The CO_2 then passes through activated carbon filters which remove any traces of alcohols, oils, or organic contaminants that might otherwise have objectionable taste or odor. The carbon dioxide then enters an ammonia-cooled condenser where the CO_2 is liquified at about 305 psig. Finally the CO_2 feeds into a distillative stripper column where methane, carbon monoxide, hydrogen, and other non-condensible gases are boiled off. The carbon dioxide liquid at 300 psig, 3°F leaving the distillative stripper is completely purified and of food-grade quality.

LIQUEFACTION

The ammonia refrigeration system is operated with two stages of compression and two heat exchangers; one following each stage of compression. The ammonia removes heat from the CO_2 vapor condenser at 2 psig, -24°F. The carbon dioxide is liquified, leaving at approximately 300 psig. Carbon dioxide liquid then flows through an expansion valve entering a 450 ton capacity storage tank where temperature and pressure are maintained at about 200 psig, -20°F. All tanks are equipped with a safety relief valve and a vapor recycle loop where tank vapor and flash gas are piped back to the second stage of compression.

DRY ICE PRODUCTION

For production of dry ice blocks, CO_2 liquid is drawn to a low pressure expansion tank where it is expanded to 90 psig, -55°F and then piped to a dry ice press. The CO_2 pressure is then dropped to atmospheric through an orifice producing CO_2 snow. The CO_2 snow is compressed into 200 lb. blocks with hydraulic presses and then cut into 50 lb. blocks for shipping. The carbon dioxide liquid is also used to produce dry ice pellets in a Cardox dry ice pelletizer which are then shipped in insulated boxes.

QUALITY CONTROL

Continuous quality control testing is performed at all Cardox CO_2 processing plants. Reports of all testing are reviewed by Cardox Quality Control Personnel. Test samples are sent at periodic intervals to the corporate lab for detailed, independent analysis to insure maintenance of pure, high-quality carbon dioxide production.

DISTRIBUTION

Liquid carbon dioxide is pumped into tank trailers and rail cars at approximately 200 psig. During transport, this pressure will often rise, depending on distance traveled, generally to a pressure no higher than 300 psig. The customers storage tank would normally be maintained at a pressure between 275 and 305 psig. Cardox has a number of production plants located throughout the country resulting in a reliable and efficient distribution network.

NOSB Materials Database

Identification

Common Name Carbon dioxide

Chemical Name

Other Names

Code #: CAS

Code #: Other

N. L. Category Non-agricultural

MSDS ◉ yes ○ no

Chemistry

Family

Composition CO_2.

Properties colorless, odorless gas or white opaque solid.

How Made Can be recovered from flue gases from coal burning, from synthetic ammonia and hydrogen plants, from fermentation of sugars, by a lime-kiln operation, from sodium phosphate manufacture, or from natural carbon dioxide gas wells. All of these processes are in commercial use and which is used is determined by local individual conditions. (details of each process are in the Kirk-Othmer Encyclopedia of Chemical Technology).

Use/Action

Type of Use Processing

Specific Use(s) carbonation of beverages. propellent, extraction method, fumigant

Action acts as a preservative to inhibit growth of mold and bacteria, as well as being a flavor enhancer.

Combinations

Status

OFPA

N. L. Restriction

EPA, FDA, etc

Directions

Safety Guidelines

State Differences

Historical status

Internationl status

NOSB Materials Database

OFPA Criteria

2119(m)1: chemical interactions Not Applicable

2119(m)2: toxicity & persistence Not Applicable

2119(m)3: manufacture & disposal consequences

2119(m)4: effect on human health

2119(m)5: agroecosystem biology Not Applicable

2119(m)6: alternatives to substance

2119(m)7: Is it compatible?

References

Kirk-Othmer Encyclopedia of Chemical Technology, 3rd. Ed.

see also attached.

USDA/TAP Reviewer Comment Form

Material: Carbon Dioxide

Reviewer: Bob Durst

Is this substance Natural or Synthetic? Explain (if appropriate)

This substance is natural.

This material should be added to the National List as:

_____ Synthetic Allowed   _____ Prohibited Natural

_____ Non–synthetic (allowed ingredient)   _____ Non–synthetic (allowed processing aid)

_____ This material does not belong on the National List because:

Are there any restriction or limitations that should be placed on this material by use or application on the National List?

Must be listed on the label if it is an ingredient (carbonated beverage for instance).

Please comment on the accuracy of the information in the file:

The file is accurate.

Any additional comments or references?

It should be used only in an oil–free grade.

Do you have a commercial interest in this material? __X__ No; ____ Yes

Signature____________________ Date ____________

Comments on the 7 criteria in the Organic Foods Production Act:

1) Detrimental interactions: None
2) Toxicity, breakdown products, persistence: No problems.
3) Contamination during manufacturing and disposal:
4) Human health effects: Suffocation hazard in extreme concentrations.
5) Interactions with ecosystem: No detrimental ones.
6) Alternatives: In some applications nitrogen.
7) Compatible with sustainable agriculture: Yes.

TAP REVIEWER COMMENT FORM for USDA/NOSB

Use this page or an equivalent to write down comments and summarize your evaluation regarding the data presented in the file of this potential National List material. Complete both sides of page. Attach additional sheets if you wish.

This file is due back to us by: August 29, 1995

Name of Material: Carbon Dioxide

Reviewer Name: Mary C. Mulry

Is this substance Synthetic or non-synthetic? Explain (if appropriate)

Non-synthetic

If synthetic, how is the material made? (please answer here if our database form is blank)

This material should be added to the National List as:

~~___~~ Synthetic Allowed ___ Prohibited Natural

or, X Non-synthetic (Allowed as an ingredient in organic food)

X Non-synthetic (Allowed as a processing aid for organic food)

or, ___ this material should not be on the National List

Are there any use restrictions or limitations that should be placed on this material on the National List?

Please comment on the accuracy of the information in the file:

Good accurate information

Any additional comments? (attachments welcomed)

Supercritical CO_2

May also be used as an extraction method — decaffeination of coffee + tea, essential oil extraction, etc (see references). Also used as a fumigant for herbs + spices.

Do you have a commercial interest in this material? ___ Yes; X No

Signature [signature] **Date** 9/20/95

TAP REVIEWER COMMENT FORM for USDA/NOSB

Use this page or an equivalent to write down comments and summarize your evaluation regarding the data presented in the file of this potential National List material. Complete both sides of page. Attach additional sheets if you wish.

This file is due back to us by: August 8

Name of Material: Carbon Dioxide

Reviewer Name: Dr. Joseph Montecalvo Jr.

Is this substance Synthetic or non-synthetic? Explain (if appropriate)

Synthetic

If synthetic, how is the material made? (please answer here if our database form is blank)

This material should be added to the National List as:

✓ **Synthetic Allowed** ____ **Prohibited Natural**

or, ____ **Non-synthetic (Allowed as an ingredient in organic food)**

____ **Non-synthetic (Allowed as a processing aid for organic food)**

or, ____ this material should not be on the National List

Are there any use restrictions or limitations that should be placed on this material on the National List? See uses

Please comment on the accuracy of the information in the file: good

Any additional comments? (attachments welcomed)

Also used as a propellant for aerosols foods (ie. whipped cream, cheese spread) Also used as a cryogenic freezing operations for foods.

Do you have a commercial interest in this material? ____ **Yes;** ✓ **No**

Signature [signature] **Date** 7/30/95

TAP REVIEWER COMMENT FORM for USDA/NOSB

Use this page or an equivalent to write down comments and summarize your evaluation regarding the data presented in the file of this potential National List material. Complete both sides of page. Attach additional sheets if you wish.

This file is due back to us by: August 8

Name of Material: Carbon Dioxide

Reviewer Name: R THEUER

Is this substance Synthetic or non-synthetic? Explain (if appropriate) EITHER!

If synthetic, how is the material made? (please answer here if our database form is blank)

GOOD INFO ATTACHED

This material should be added to the National List as:

___ Synthetic Allowed ___ Prohibited Natural

or, ✓ Non-synthetic (Allowed as an ingredient in organic food)

✓ Non-synthetic (Allowed as a processing aid for organic food)

or, ___ this material should not be on the National List

Are there any use restrictions or limitations that should be placed on this material on the National List?

NON-SYNTHETIC

Please comment on the accuracy of the information in the file:

GOOD

Any additional comments? (attachments welcomed)

Do you have a commercial interest in this material? ___ Yes; ✓ No

Signature [signature] **Date** 8/28/95