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Formerly Occupational Hazards

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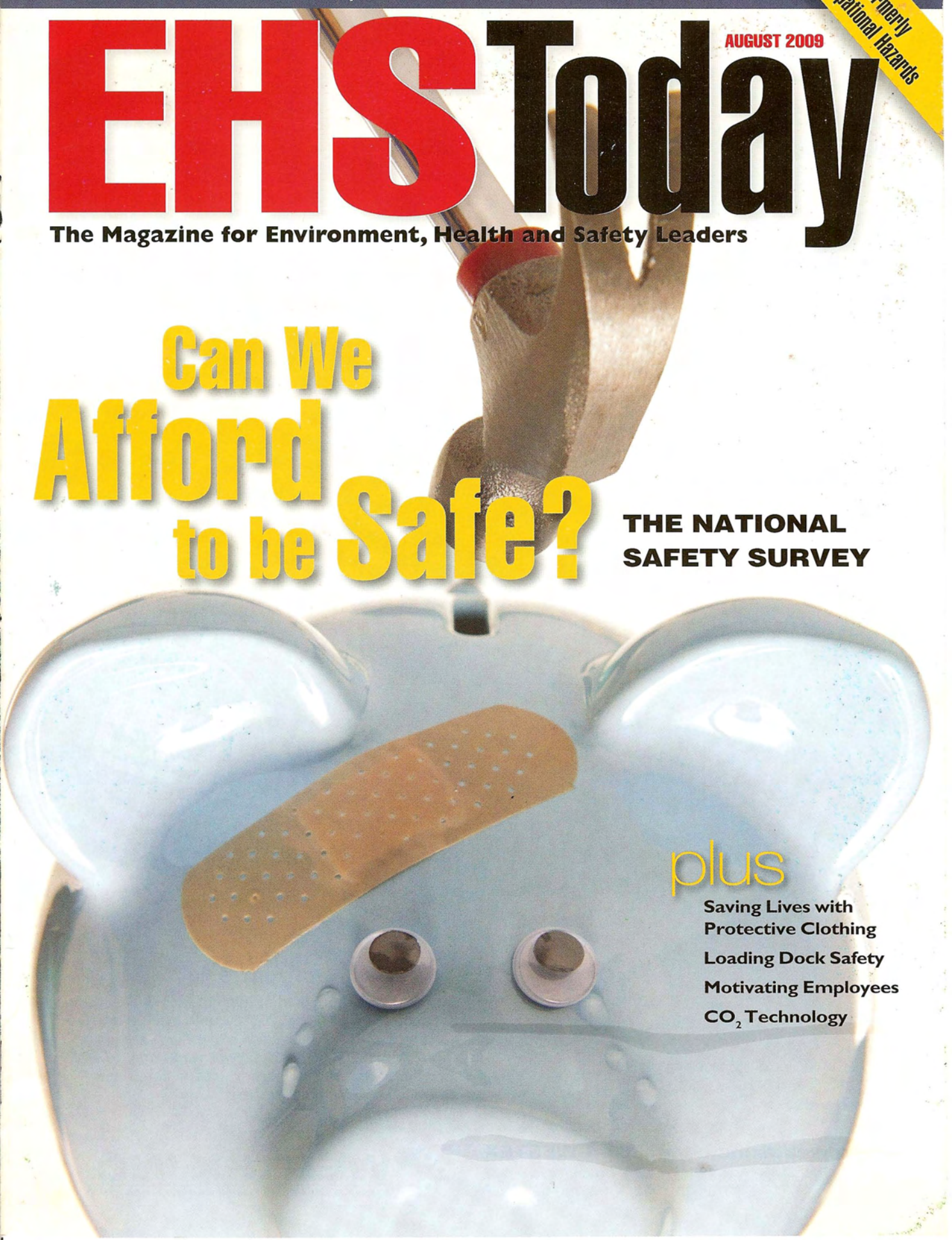


Can We Afford to be Safe?

THE NATIONAL SAFETY SURVEY

plus

- Saving Lives with Protective Clothing
- Loading Dock Safety
- Motivating Employees
- CO_2 Technology

Setting the Record Straight:

CO_2 Technology is Part of the Solution

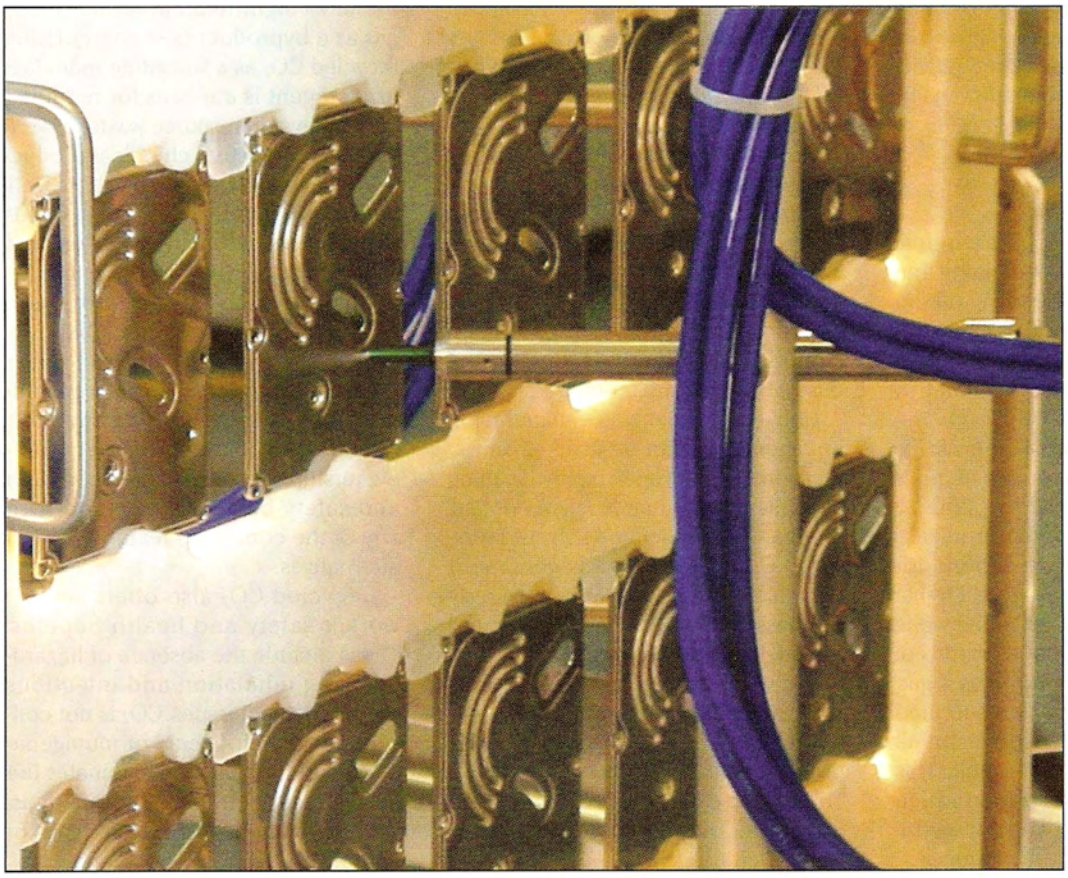
Carbon dioxide technology often is misunderstood, especially regarding the global warming controversy. The bottom line is that CO_2 technology is good for people, businesses and the environment.

BY DAVID JACKSON

Carbon dioxide (CO_2) technology is important in many commercial and industrial applications. For example, leading companies including Western Digital, Pentel, Gillette-PaperMate, Raytheon and Seagate have implemented CO_2-based cleaning technology because it has improved the productivity, worker safety and profitability of their precision cleaning operations. These same businesses have implemented CO_2 technology as a strategy for complying with stringent environmental regulations.

CO_2 is produced and captured as a by-product of natural and industrial processes (aka recycled CO_2) and is a valuable resource for a number of commercial and industrial processes. Recycled CO_2 is a net benefit in terms of energy conservation, pollution reduction and other important societal benefits. No additional quantities of CO_2 are added to the atmosphere by using this valuable waste byproduct. Users of recycled CO_2 are not considered generators of CO_2. This is the position of the United States Environmental Protection Agency (EPA).[1]

Arguably, the most important reason for using recycled CO_2



Unlike other manufacturing agents, CO_2 can be used as a spray agent (pictured), immersion cleaning agent, surface treatment agent, coolant, lubricant and extraction solvent.

is that it efficiently replaces the valuable function provided by industrial processing agents such as de-ionized water, solvents, soaps, lubricants and coolants. Recycled CO_2 eliminates the negative environmental and energy consequences associated with manufacturing, packaging, transporting, treating, recycling or disposing of conventional processing agents. Replacing conventional manufacturing agents with recycled CO_2 conserves natural and human resources – water, oil, energy, time, capital and labor. Producing, transporting and consuming less processing agents eliminates the production of associated environmental pollution and waste by-products such as solid wastes, liquid wastes, Hazardous Air Pollutants (HAPs), Volatile Organic Compounds (VOCs) and greenhouse gases (GHGs).

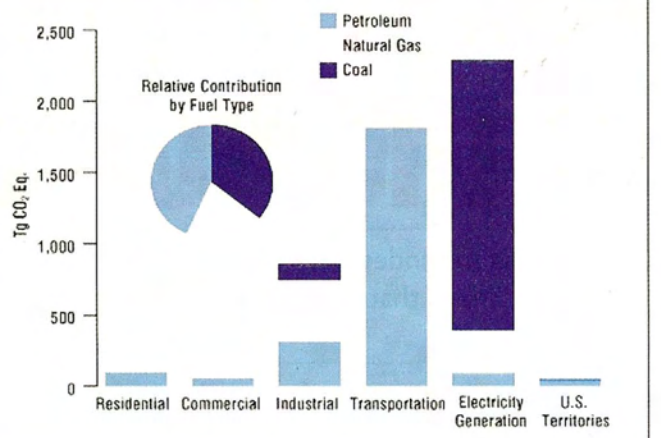
Moreover, utilization of recycled CO_2 delivers additional societal benefits such as safer working environments, cleaner air, cleaner products, longer lasting machines and tools, higher production yields, increased productivity and improved global competitiveness.

A RECYCLABLE BYPRODUCT

The CO_2 used in industrial applications such as cleaning, machining and thermal control, among many others, is commercially obtained as a gaseous by-product from ammonia and petrochemical plants as well as natural CO_2 gas wells.

CO_2 is an integral part of the basic life cycle in nature. Humans and animals give off CO_2 that is used by plants to help them grow. Plants, in turn, release oxygen, upon which we depend for survival. In fact, it's the same CO_2 that you are producing and exhaling while reading this article, about 2 pounds of it each day! CO_2 is captured as a gas, compressed to a liquid and supplied commercially in steel cylinders, mini-bulk tanks, and bulk storage tanks. This is the starting compound from which important solid, liquid and supercritical CO_2 process agents are produced.

2004 CO_2 Emissions from Fossil Fuel Combustion by Sector and Fuel Type



Note: Electricity generation also includes emissions of less than 1 Tg CO_2 Eq. from geothermal-based electricity generation.

EPA

CLEAN AND VERSATILE

Carbon dioxide technology is a cost- and performance-effective replacement for a variety of environmentally undesirable industrial agents such as HCFCs, VOCs, methylene chloride, n-propyl bromide (nPB) and perchloroethylene. CO_2 cleaning technology has demonstrated enhanced product yields, process performance and manufacturing productivity, while improving environmental quality in the workplace.

CO_2 offers environmental and cost benefits because it is non-toxic, non-hazardous, non-corrosive and non-flammable; it offers a competitive cost-of-ownership; there are no waste by-products and no drying; and it will not run out of supply since it is an abundant byproduct of numerous industrial and natural processes.

Unlike any other single manufacturing agent, CO_2 can be used as an immersion cleaning agent, spray cleaning agent, surface treatment agent, coolant, lubricant and extraction solvent. Moreover, CO_2 technology can accomplish manufacturing tasks in ways previously not possible, such as being integrated directly into production tools or combined without significant constraints with most manufacturing operations. Entirely new manufacturing tools and processes can be produced as a result. This unique capability can be exploited in many industrial markets and applications, including general or precision cleaning, biomedical treatment, textile processing, materials extraction, surface modification, precision machining and thermal control.

A CLEANER, SAFER CHEMISTRY

Organic compounds such as n-propyl bromide, perchloroethylene, trichloroethylene, fluorocarbons and many other solvents, lubricants and surfactants are derived from our energy supplies. These compounds may be used as industrial cleaning, machining and refrigeration agents. The production of these chemicals produces millions of pounds of greenhouse gases as well as many other air polluting by-products each year. Moreover, significant electrical energy is consumed to produce these compounds, treat waste by-products and to transport these compounds.

Energy production alone produces the most significant amount of CO_2 gas as a byproduct (see chart). Using recycled CO_2 as a substitute manufacturing agent is a means for reducing the energy and resource wastes associated with industrial chemical production. This conserves our vital coal, oil, natural gas and bio-energy resources and prevents the creation of additional solid wastes, air and water pollution.

Compared to common organic cleaning solvents, recycled CO_2 costs less, does not deplete the ozone layer, is worker-friendly and is not considered a volatile organic compound.[2] CO_2 offers a combination of cost-of-ownership and environmental, health and safety benefits not found with any of the common cleaning solvent alternatives.

Recycled CO_2 also offers several worker safety and health benefits. These include the absence of hazardous lung inhalation and infectious dermal contact issues. CO_2 is not considered a carcinogenic or mutagenic compound. Finally, CO_2 eliminates fire hazards and equipment corrosion issues associated with certain types of manufacturing agents.

GREENHOUSE GAS REGULATIONS

Greenhouse gas emissions reporting legislation, proposed under USEPA 40 CFR Parts 86, 87, 89 et al, is intended for "generators" of CO_2 and other GHGs[3]. A user of recycled CO_2 is not considered a generator of CO_2. Recycled CO_2 delivered by gas suppliers to companies for use in commercial and industrial manufacturing processes already is accounted for in the EPA national GHG emissions inventory reporting requirements. Examples of significant sources of CO_2 generated as a byproduct of industrial processes and cited in proposed GHG reporting requirements include, among many others, electrical power generation and usage; chemical generation and usage; and transportation.

The use of CO_2 technology as a chemical substitute lowers electrical power usage, reduces manufacturing wastes, increases manufacturing productivity and decreases the need for chemicals such as lubricants and solvents. A reduction of manufacturing wastes or elimination of production chemical inputs of any kind decreases industrial CO_2 generation.

For example, less CO_2 is produced if less electricity is consumed; if less oil is refined, transported and consumed; if less cleaning solvents are produced, transported and consumed; if more products can be manufactured for the same energy inputs; if fewer chemical waste streams are treated, recycled or hauled away; if less rework is performed and scrap produced; and if products don't have to be cleaned or dried.

Therefore, using recycled CO_2 technology as a process and chemical substitute offsets CO_2 gas production and emission from both the industrial supply and consumption sides of the equation.

PART OF THE SOLUTION

Replacing conventional manufacturing agents used in industrial processes such as cleaning and machining with recycled CO_2 produces no net increase in pollution. In fact, recycled CO_2 is an opportunity to reduce the production and use of many manufacturing agents derived from our critical energy and water resources. This lowers energy costs and reduces the production of significant quantities of solid wastes, spent solvents, waste oils, wastewater and air pollution.

CO_2 technology is safer for people and offers a competitive cost-of-ownership when used in industrial processes such as precision cleaning, machining and dry cleaning textiles. The bottom line is that CO_2 technology is an important part of the global energy savings and pollution reduction solution. EHS

David Jackson has worked as both a corporate environmental manager and an independent environmental consultant. He has developed numerous CO_2-based cleaning, machining and thermal control products. He can be reached at david.jackson@coolclean.com or 661-775-5964.

[1] *Letter from United States Environmental Protection Agency (USEPA) to Deflex Corporation, November 25, 1997, Subject: Carbon Dioxide Emissions.*

[2] *Montreal Protocol on Substances that Deplete the Ozone Layer, United Nations Environmental Programme (UNEP) Report, Technology and Economic Assessment Panel (TEAP), April 2001*

[3] *USEPA, 40 CFR Parts 86, 87, 89 et al, Mandatory Reporting of Greenhouse Gases, Proposed Rule, April 10, 2009*