Biodegradability Redefined and Volatile Organic Compounds Update

Government regulations are changing the rules for compliance – but what are they?

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ave you ever played a game with others and in the middle of the game they start changing the rules? Frustrating, isn't it? Or maybe you played a game and nobody knew what to expect next. You don't know if the old rules apply, or if they are making the game up as they go along (perhaps so they can win?). On the other side of the coin, perhaps the changes were made so that the playing field is leveled, or perhaps the original "rules" were unreasonable and left everyone confused and in doubt.

It appears that this is what is happening with the definition of biodegradability. New federal rules, regulations and definitions are now in effect, but there has been little in the way of notification to the players. The purpose of this paper is to provide precasters with current information on this changing environmental landscape to help them make decisions regarding form release agents.

Biodegradability

One thing is for certain: Humans generate a lot of garbage (both personal and industrial), some of which is considered toxic waste and some of which will contaminate our environment. Perhaps we won't see the impact of this contamination for years to come. Other waste, both personal and industrial, will degrade back to the natural environment over a short period of time and may even be beneficial to our environment. But how do we know what is – and what is not – environmentally acceptable? And what are we using in our plants that is environmentally responsible or detrimental to the environment?

As outlined in "Form Release and the Law" (Precast Inc., Jan/Feb 2006), the word "biodegradable" has been terribly misused. Given enough time, everything is biodegradable. Unfortunately, in many cases, by the time the degrading process has taken place, the environment is contaminated. For that reason, and many others, I'm sure, the U.S. Environmental Protection Agency (EPA) issued guidelines as to how and when the word "biodegradable" can and should be used. Further, while there is no official organization to verify the use of the claim of biodegradability, the U.S. Federal Trade Commission (FTC) has issued some general guidelines on what type of products qualify as legitimately biodegradable. They have even sued some companies for unsubstantiated, misleading and/or deceptive use of the term on product labels.

More attention is now being paid to biodegradability, and many agencies, companies and organizations are getting involved. Again, given enough time, anything is biodegradable.

Because the word "biodegradable" has been inappropriately used in the past, it is important that we understand how it is truly defined and what criteria a product must meet in order to be considered biodegradable. One definition of "biodegradability" can be found in the EPA 1998, "Fate, Transport and Transportation Test Guidelines, Office of Prevention, Pesticides and Toxic Substances (OPPTS) 835.3100, Aerobic Aquatic Biodegradation"; and in EPA 712-C-98-O and ASTM D-5864-00, "Standard Test Methods for Determining Aerobic Aquatic Biodegradation of Lubricants or Their Components." This reference gives everyone the guidelines to be followed when determining biodegradability and using the word "biodegradable" in claims relating to various products, including concrete form release agents. The U.S. EPA definition includes an allowable "28-day half-life" of materials in order to be considered biodegradable. Half-life is the time required for the decay of one-half of a given component in a system.

Precast operations that are near free-running water or have relatively shallow aquifers should be especially concerned about contaminants in the soil that may adversely affect the environment. A word of caution: Just because a release agent is "water-based" does not necessarily mean it will meet the EPA requirement to be classified as biodegradable. If you plan to use a form release (or any material, for that matter) that claims to be biodegradable, ask whether the material meets the 28-day half-life criteria that U.S. EPA describes. As there are often misunderstandings on the term "biodegradable," it is wise to go that extra step in clarifying that the material meets the criteria you require.

While it appears that there are no federal mandates on biodegradability of concrete form release agents, we can certainly expect new rules and regulations in the future. How soon is anyone's guess, but we do see more precasters trying to pre-empt the regulations that are expected, or are in some cases already in effect in their local region (wetlands are a good example).

Based on my research, there is no current legal definition of "biodegradable" or "biodegradability." The ASTM (American Society for Testing and Materials) defines the term as "degradation caused by biological activity, especially enzymatic action, leading to a significant change in the chemical structure of the material." The EPA, however, has given more specific be classified as biodegradable. (EPA 1998 Fate, transport and transportation test guidelines, office of Prevention, Pesticides and Toxic Substances (OPPTS) 835.3100, "Aerobic Aquatic Biodegradation"; and in EPA 712-C-98-O and ASTM D-5864-00, "Standard Test Methods for Determining Aerobic Aquatic Biodegradation of Lubricants or Their Components")

The Consumers Union maintains that if a manufacturer has solid scientific evidence demonstrating that the product will break down and decompose into by-products found in nature in a short period of time, then claiming that it is "biodegradable" is not deceptive. Words like "Environmentally Acceptable," "Environmentally Friendly," "Environmentally Preferable" and "Environmentally Responsible" are also used to describe items produced with biodegradable materials or, in many cases, part biodegradable material, without knowing if the

guidelines of biodegradability (like the 28-day half-life that have been accepted by industry and governmental agencies.)

Based on the Federal Trade Commission (FTC) definition, only products that contain materials that "break down and decompose into elements found in nature within a reasonably short amount of



whole formulation could be rated as biodegradable.

The California Advertising Statute, amended April 30, 1991, states that a manufacturer cannot claim that a product is biodegradable unless it meets the following definition: "Biodegradable means that a material has the proven capability to decompose in

time when they are exposed to air, moisture and bacteria or other organisms" should be marketed as "biodegradable." Also, the FTC acknowledges that even products appropriately labeled as biodegradable may not break down easily if they are buried in a landfill or are otherwise not exposed to sunlight, air and moisture, the key agents of biodegradation (aerobic vs. anaerobic).

According to federal regulations (Federal Register Part 260 16 CFR 260 7), the claim of biodegradability must be substantiated using environmental biodegradable testing. As form release agents are subject to both aerobic (with oxygen) and anaerobic (without oxygen) conditions, it is normally necessary to evaluate degradation under both conditions before claiming "biodegradability" to whatever extent.

The half-life of a material is still the most common definition of whether a material can truly be considered biodegradable. That is still true, but there have been alternative guidelines published that change the wording and allowances of being biodegradable. Originally, concrete form release agents were required to have a half-life of a maximum of 28 days in order to the most common environment where the material is disposed of within three years through natural biological processes into nontoxic carbonaceous soil, water, carbon dioxide or methane."

Also, the term "bio-based" is used to describe products from vegetable, plant or animal based materials. However, just because the term "bio-based" is used, it does not necessarily mean the composition is readily biodegradable or ultimately biodegradable. It would depend on the other base oils that may be included in the formulation.

The EPA and FTC (Federal Trade Commission) have restated the definition of biodegradability into two specific clauses:

- 1. Readily Biodegradable Pertaining to the material having a 60 percent or greater degradation in 28 days.
- 2. Inherently Biodegradable Pertaining to having a maximum half-life of 60 days or less.

The Degradation Accumulation Expert Group of the Organization Economic Cooperation Development (OECD) Environmental Committees has established a series of tests that classify compounds as:

- Readily Biodegradable Rapid and compete mineralization
- Inherently biodegradable 20 percent to 70 percent biodegradable within 28 days
- Non-biodegradable Negligible removal of material under test conditions

The OECD recommends that degradation rates, or half-lives, are preferably determined in simulation biodegradation tests conducted under conditions that are realistic for the particular environment they are subject to or presented with (surface water, sediment, soil, etc.).

The OECD's 301-B CO2 Evaluation Test (Modified Sturm) is probably the most recognized test in the lubricant (petroleum solvent) industry, and is listed in the EPA Guidelines.

The EPA and FTC now recognize ASTM OECD-301 B Modified Sturm procedures within ASTM-5684-00 and CEC-33-T-82 as "Standard Test Methods for Determining Aerobic Aquatic Biodegradation of Lubricants." While these tests may be expensive, they provide reliable and repeatable results for testing of biodegradability. The test method "covers the determination of the degree of aerobic aquatic biodegradation of fully formulated lubricants or their components on exposure to bacterial inoculums under laboratory conditions," according to the "Renewable Lubricants Manual" (see listing in sidebar "References").

Volatile Organic Compounds in the United States and Canada

United States. In September 1999, the Environmental Protection Agency enacted Volatile Organic Compounds (VOC) regulations that affect the concrete industry. These regulations can be found in the Federal Register, Vol. 63, No. 176, Friday, Sept. 11, 1998, under 40 CFR-59, [AD-FRL-6149-7], RIN 2060-AE55, National Volatile Organic Compound Emission Standards for Architectural Coatings, pages 44848-48887. There are 64 materials used in the concrete industry that are subject to VOC regulations and limits. Concrete form release agents are listed (specifically) and allowed a maximum of 450 gallons per liter (g/L). Further, some individual states have passed legislation allowing a maximum of 250 g/L or 2.1 pounds per gallon of VOCs. Fifteen states and the District of Columbia have passed legislation reducing the allowable levels of VOCs in concrete form release agents from 450 g/L (federal allowable levels) to 250 g/L. Keep in mind that any state can have more stringent requirements than the federal levels, but no state can be less stringent than federal levels. As of today, the following states have maximum allowable levels of VOCs of 250 g/L: California, Illinois, Ohio, Virginia, Connecticut, Delaware, Maine, Vermont, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island and the District of Columbia. All of these states are members of the South



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Coast Air Quality Management District (SCAQMD), the Ozone Transport Commission (OTC) or the Lake Michigan Air Directors Consortium (LADCO). While individual states have taken the initiative to make changes in lower allowable VOC levels, the EPA has yet to act on making the requirements nationwide. We can, however, expect the bureaucracy to follow suit in the near future based on the number of states that have already taken this step forward.

The U.S. EPA has been forecasting changes to the VOCs (on form release agents and other products), but has not taken any steps to make these changes. It continues to forecast "in six months," but has not yet taken any definitive action. Is EPA leaving the individual states to make the changes in anticipation of a federal mandate? Perhaps so, considering the activity of state legislatures to take matters into their own hands without federal government involvement.

Canada. The Canadian Ministry of the Environment – Environment Canada has also become a player on VOCs. Dating back to April 26, 2008, the Ministers of Environment and Health published a Notice of Intent entitled "Federal Agenda on the Reduction of Emissions of Volatile Organic Compounds from Consumer and Commercial Products." This document outlined a series of measures intended to reduce emissions. The thenproposed "Volatile Organic Compound (VOC) concentration Limits for Architectural Coating Regulations" were published in the Canada Gazette, Part I, on April 26, 2008. The proposed regulations set out specific VOC concentration limits for 49 categories of architectural coatings, including form release compounds. In the case of concrete form release agents, the effective date for a maximum allowable level of VOCs of 250 g/L is Sept. 9, 2012.

Conclusions

- Biodegradable/biodegradability continues to be left to ambiguous interpretation. However, there are now established test methods that give positive indications of the environmentally friendly or responsible attributes of many materials, including form release agents. It behooves you and your supplier to discuss and substantiate claims of biodegradability in order to protect your operation and your environment.
- Biodegradability "redefined" has some benefits to the precast industry as there are some petroleum solvents that are readily and inherently biodegradable. On the negative side, there is a price to be paid for this quality.
- We can expect the U.S. EPA to continue its efforts in reducing VOCs to a federal level of 250 g/L.
- Without specific testing, it is difficult for a supplier to the industry to make claims regarding biodegradability and VOC compliance. As definitions become more specific, and allowable testing procedures are outlined, suppliers must invest in the precast industry by making reliable data available to the precaster.

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