

IBEL Content – Work Group Packet

April 15, 2010



VOCs and Chronic Inhalation

Call-In Information

This document has been developed for use during the **May 13, 2010**, IBEL workgroup call, scheduled from **11-1 PM** Eastern. To participate, please use the following call-in information. Thanks.

(218) 936-1100 Access Code #105445.

Meeting Agenda

The agenda for the meeting is as follows:

- Status of Work Group Recommended Criteria
- Review of proposed criteria
- Upcoming Meeting Dates – Work Group and Core Committee

IBEL Content- Working Menu

The following is a working list of potential IBEL content. Entries in the table indicate proposed categories and the associated IBEL metric(s) to be measured or reported. Please note: Not all metrics will necessarily apply to all products. This list will continue to evolve through the decisions of work groups, and will be updated periodically to reflect the most recent status. When completed, this list will constitute a **MENU** of metrics against which product data can be reported. Individual metrics will be selected from this menu to assemble the product label content for each product category in future calls. **Shaded entries in the table represent those topics we will be discussing during the May 13, 2010 Working Group call.**

Human Health & Environmental

| Category | Reportable IBEL Metric | Status |
|---------------------------------------|------------------------|--------|
| Acute Chemical Concern - Oral | Oral LD50, GHS | Final |
| Acute Chemical Concern - Inhalation | Inhalation LC50, GHS | Final |
| Acute Chemical Concern - Dermal | Dermal LD50, GHS | Final |
| Corrosivity to Skin | | May 24 |
| Skin Sensitizer | | May 24 |
| Product Absorption via Skin | | May 24 |
| Volatile Organic Compound Content | | May 13 |
| Chronic Chemical Concern - Oral | | June 4 |
| Chronic Chemical Concern - Inhalation | | May 13 |

| | | |
|--|---|---------------|
| Chronic Chemical Concern - Dermal | | May 24 |
| Phosphorus Eutrophication | Phosphorus Content – Wt % Phosphorus Content – grams /use (at most conc dilution) | Final |
| Biodegradable Content – Aquatic | % of product content considered biodegradable, grams/use | Final |
| Bioaccumulating content | BAF, BCF | Final |
| Toxicity to Aquatic Life | Acute LC50 (for all 3 species - Fish, Daphnia, and Algae) | Final |
| Product Embodied Energy | | May 19 |
| Product Embodied Water | | May 19 |

Product Performance

| Category | Reportable IBEL Metric | Status |
|---|------------------------|---------------------------------------|
| Product Performance (specific to product type) | | Under Development (Mar 11) |
| Energy Efficiency | | May 19 |
| Water Efficiency | | May 19 |

Additional Product/Packaging

| Category | Reportable IBEL Metric | Status |
|--|--|--|
| Reportable Content | | Under Development (April 9) |
| Trace contaminants – CMRs (unintentionally added) | | June 4 |
| Fragrance | Fragrance Added (No/IFRA/DfE/Other) | Final |
| Color and dyes | Colorant added (Yes/No) | Final |
| Combustibility | Flash point, (°F) | Final |
| Post-Consumer Material content (packaging only) | PC Packaging content (%) | Final |
| Renewable /Biobased Material content (Includes product and packaging) | Renew/Biobased Product Content (%) Renew/Biobased Packaging content (%) | Final |
| Recyclable Product Content (packaging only) | % of Product Recyclable | Final |
| Packaging Efficiency | Total pkg/Total product wt | June 4 Newly Added |
| EOL – Product Takeback (packaging only) | | May 19 |
| EOL- Biodegradable/compostable Content – Land disposal | | June 4 |
| Labeling content (ingredient disclosure) | | June 4 |

Corporate Performance Categories

| Category | Reportable IBEL Metric | Status |
|----------------------------|------------------------|--------|
| Sustainability Reporting | | May 19 |
| Environmental Mgmt program | | May 19 |
| Supply Chain mgmt program | | May 19 |
| Sustainable Energy Use | | May 19 |

Upcoming Meeting Schedule

Future meeting dates have been set for the upcoming months of April and May. Scheduled meetings include the dates listed below. An official schedule of upcoming calls is kept on a calendar posted on the IBEL Development website.

Core Committee Meetings:

May 27

June 24

July 29 (date corrected)

Work Group Meetings:

May 19 (1 PM) – Corporate Performance/Sustainable production/ EOL management

May 24 (3 PM) – Dermal Impacts

June 4 (2 PM) – Chronic Oral/Ingredient disclosure/ EOL Compostable Content/Pkg Efficiency

June 10 (1 PM) – Criteria wrap up (misc)

TBD – Non-Chemical Products

Chronic Toxicity - Inhalation

This is an important consideration, but kind of a mess to consider for IBEL. Most methods involve lists or significant testing with no consistent established approach. The following is less of a proposed criterion and more of a place to start discussions.

Note: Other chronic effects like carcinogenicity, reproductive toxicity, etc. are dealt with under the reportable substances requirements.

IBEL Proposed Metric(s)–

1. Chronic Toxicity - Inhalation

- **IBEL Reported Value –**
 - o 1) TVOC content, and
 - o 2) Identity and % by weight of ingredients on the following lists
 - CA OEHHA CRELs
 - European Chemicals Bureau as R48/23: Danger of serious damage to health by prolonged exposure through inhalation
- **Method for Reporting /Measurement – TBD**
- **Verification – TBD**
- **Rationale for inclusion in IBEL –** The use of some cleaning chemicals can result in exposures with the potential to pose a chronic toxicity concern over prolonged and repeated exposures
- **Reporting Context –** GHS does not address Chronic hazards. Ideas?

Definitions

Chronic Reference Exposure Limit (CREL) – Chronic RELs are inhalation concentrations to which the general population, including sensitive individuals, may be exposed for long periods (10 years or more) without the likelihood of serious adverse systemic effects other than cancer. Generally, VOCs with chronic RELs also appear on the TAC list. Cal/EPA ARB list of Toxic Air Contaminants (TACs). This list is accessible at <http://www.arb.ca.gov/toxics/taclist.htm>. The TAC list includes all substances on the EPA list of Hazardous Air Pollutants plus additional compounds.

Toxicant: A harmful substance or agent that may injure an exposed organism. (Source: <http://www.epa.gov/OCEPATERMS/tterms.html>)

Toxicity: The degree to which a substance or mixture of substances can harm humans or animals. *Acute toxicity* involves harmful effects in an organism through a single or short-term exposure. *Chronic toxicity* is the ability of a substance or mixture of substances to cause harmful effects over an extended period, usually upon repeated or continuous exposure sometimes

lasting for the entire life of the exposed organism. *Subchronic toxicity* is the ability of the substance to cause effects for more than one year but less than the lifetime of the exposed organism. (Source: <http://www.epa.gov/OCEPATERMS/tterms.html>)

Green Seal (GS-37) Approach

4.10.1 Chronic Inhalation Toxicity. The product *as used* shall not contain ingredients with a vapor pressure above 1 mm mercury at ambient conditions (1 atm pressure and 20-25° C) that cause chronic inhalation toxicity as evidenced by either of the following:

- Listed by the European Chemicals Bureau as R48/23: Danger of serious damage to health by prolonged exposure through inhalation.
- Classified as producing significant toxic effects in mammals from repeated inhalation exposure at or below 1.0 mg/L as a vapor according to OECD Harmonized Integrated Classification System for Human Health and Environmental Hazards of Chemical Substances and Mixtures. For the purposes of this standard, significant toxic effects in mammals from repeated inhalation exposure at or below 1.0 mg/L as a vapor shall be established by a NOAEL, based on a test duration of 90 days at 6 hours per day; values from other exposure regimes shall be estimated (extrapolated) per the principles of Haber's rule. In lieu of a NOAEL, the LOAEL can be used with a ten-fold safety factor (i.e., LOAEL/10).

4.10.2 Chamber Testing. A product *as used* shall meet the inhalation criteria and as tested according to the method used for the GREENGUARD Children and Schools Certification for Cleaners and Cleaning Maintenance Products and Systems, which includes office, school, and restroom models (also called the GREENGUARD Standard Method for Measuring and Evaluating Chemical Emissions from Cleaners and Cleaning Maintenance Systems Using Dynamic Environmental Chambers).

EPA DfE Approach

REPEATED DOSE TOXICITY

3.6.1 Criteria and Data Evaluation

Components that are considered systemic toxicants under GHS [70] (see guidance values in Table 6) will not pass the screen. Data for all available routes of exposure will be evaluated, and any study must be 28 days or greater to satisfy this endpoint. Should testing be pursued to meet the screen data requirement, a functional observational battery (FOB) should be added to the test method to provide neurotoxicity information.

Table 6 – Repeated-Dose Toxicity

Route of Exposure Guidance values^a

Oral (mg/kg-bw/day) >100

Dermal (mg/kg-bw/day) >200

Inhalation (gas) (ppm/6h/day) >250

Inhalation (vapor) (mg/L/6h/day) >1.0

Inhalation (dust/mist/fume) (mg/L/6h/day) >0.2

aThe doses provided are for 90-day studies. Guidance values are tripled for chemicals evaluated in 28-day studies and similarly modified for studies of longer durations.

3.6.2 Preferred Test Methods

- OECD Test Guideline 408: Repeated Dose 90-Day Oral Toxicity Study in Rodents [71]
- OECD Test Guideline 409: Repeated Dose 90-Day Oral Toxicity Study in Non-Rodents [72]
- OECD Test Guideline 411: Subchronic Dermal Toxicity: 90-day Study [73]
- OECD Test Guideline 413: Subchronic Inhalation Toxicity: 90-day Study [74]
- OPPTS Harmonized Guideline 870.3100: 90-Day oral toxicity in rodents [75]
- OPPTS Harmonized Guideline 870.3150: 90-Day oral toxicity in nonrodents [76]
- OPPTS Harmonized Guideline 870.3250: 90-Day dermal toxicity [77]
- OPPTS Harmonized Guideline 870.3465: 90-Day inhalation toxicity [78]

3.6.3 Acceptable Test Methods

- OECD Test Guideline 412: Repeated Dose Inhalation Toxicity: 28-day Study [79]
- OECD Test Guideline 410: Repeated Dose Dermal Toxicity: 28-day Study [80]
- OECD Test Guidelines 407: Repeated Dose 28-day Oral Toxicity Study in Rodents [81]
- OECD Test Guideline 422, Combined Repeated Dose Toxicity Study with the Reproduction/Developmental Toxicity Screening Test [82]
- OPPTS Harmonized Guideline 870.3050: Repeated dose 28-day oral toxicity study in rodents [83]
- OPPTS Harmonized Guideline 870.3200: 28-Day dermal toxicity [84]

3.6.4 Data Interpretation

GHS Specific Target Organ Toxicity – Repeated Exposure [70]

Strawman & Comments

The following is a subsection of the original IBEL strawman and all comments submitted for each relevant metric under discussion during this call.

| Acute Chemical Concern – Oral | Acute potential – Oral (LD50) Method of determination (test/calc) Test method (if applicable) |
|--|---|
| COMMENTS: | |
| <u>Libby Sommer</u> How does this certification evaluate “chronic inhalation toxicity”? | |
| <u>Toni Stein</u> 1. Inhalation-remove the Green Guard test requirement. Include calculations for CRELs and MRLs and RD 50 2. Fragrance-add the DfE and GS-37 criteria | |
| <p>-LBNL room testing model used to meet MRELs, CA OEEHA CRELs, or RD 50 limits.</p> <p>-Does the product in its <i>as dispensed form</i> contain any volatile ingredients listed by the European Chemicals Bureau as R48/23 (Yes/No)</p> <p>-Does the product in its <i>as dispensed form</i> contain only volatile organic compound (VOCs) ingredients (including additives and fragrances) with a repeated dose inhalation toxicity levels (LOAEL), divided by a safety factor of 10 (i.e., LOAEL/10), for mammals greater than 250 ppm as a gas and 1.0 mg/L (1,000 mg/m³) as a vapor. (Yes/No)</p> <p>-Does the product in its <i>as dispensed form</i> contain any volatile ingredients that exceed the MRELs, CA OEEHA CRELs, or RD 50 limits in a commercial, school or residential room scenario for inhalation toxicity? (Yes/No)</p> <p>-Note: The LOAEL shall be the lowest exposure level showing a serious effect, as described in the Organization for Economic Co-operation and Development (OECD) Harmonized Integrated Classification System for Human Health and Environmental Hazards of Chemical Substances and Mixtures, Chapter 2.9, Sections 242-243 (OECD ENV/JM/MOMO[2001]6). In lieu of a LOAEL, the NOAEL can be used (instead of LOAEL/10).</p> | |

The LOAEL criterion shall be compared based on a test duration of 90 days at 6 hours per day; values from other exposure regimes shall be estimated (extrapolated) per the principles of Haber's rule.

Don Versteeg

Should different product types be assessed differently, so spray products use inhalation and oral, but nonspray use oral?

Table A1. All chronic inhalation Reference Exposure Levels (RELs) **adopted by Cal/EPA OEHHA as of August 2003¹**.

| Substance | CAS No. | Chronic REL (µg/m ³) | Target system(s) |
|--|----------------------------|-------------------------------------|---|
| Acetaldehyde | 75-07-0 | 9 | Respiratory system |
| Acrolein | 107-02-8 | 0.06 | Respiratory system; eyes |
| Acrylonitrile | 107-13-1 | 5 | Respiratory system |
| Ammonia | 7664-41-7 | 200 | Respiratory system |
| Arsenic & arsenic compounds | 7440-38-2 | 0.03 | Development; Cardiovascular system; Nervous system |
| Benzene | 71-43-2 | 60 | Hematopoietic system; development; nervous system |
| Beryllium & beryllium compounds | 7440-41-7 | 0.007 | Respiratory system; immune system |
| Butadiene | 106-99-0 | 20 | Reproductive system |
| Cadmium & cadmium compounds | 7440-43-9 | 0.02 | Kidney; respiratory system |
| Carbon tetrachloride | 56-23-5 | 40 | Alimentary system; development; nervous system |
| Carbon disulfide | 75-15-0 | 800 | Nervous system; reproductive system |
| Chlorinated dioxins & dibenzofurans | 1746-01-6 & 5120-73-19 | 0.00004 | Alimentary system (liver); reproductive system; development; endocrine system; respiratory system; hematopoietic system |
| Chlorine | 7782-50-5 | 0.2 | Respiratory system |
| Chlorine dioxide | 10049-04-4 | 0.6 | Respiratory system |
| Chlorobenzene | 108-90-7 | 1000 | Alimentary system; kidney; reproductive system |
| Chloroform | 67-66-3 | 300 | Alimentary system; kidney; development |
| Chromium hexavalent: soluble except chromic trioxide | | 0.2 | Respiratory system |
| Chromic trioxide (as chromic acid mist) | | 0.002 | Respiratory system |
| Cresol mixtures | 1319-77-3 | 600 | Nervous system |
| Dichlorobenzene (1,4-) | 106-46-7 | 800 | Nervous system; respiratory system; alimentary system; kidney |
| Dichloroethylene (1,1) | 75-35-4 | 70 | Alimentary system |
| Diesel Exhaust | | 5 | Respiratory system |
| Diethanolamine | 111-42-2 | 3 | Cardiovascular system; nervous system |

¹ Most recent version shall be used as published at http://www.oehha.ca.gov/air/chronic_rels/AllChrels.html

Table A1 continued

| Substance | CAS No. | Chronic REL ($\mu\text{g}/\text{m}^3$) | Target system(s) |
|--|--------------------------|---|--|
| Dimethylformamide (N,N-) | 68-12-2 | 80 | Alimentary system ; respiratory system |
| Dioxane (1,4-) | 123-91-1 | 3,000 | Alimentary system; kidney; cardiovascular system |
| Epichlorohydrin | 106-89-8 | 3 | Respiratory system; eyes |
| Epoxybutane (1,2-) | 106-88-7 | 20 | Respiratory system; cardiovascular system |
| Ethylbenzene | 100-41-4 | 2,000 | Development; alimentary system (liver); kidney; endocrine system |
| Ethyl chloride | 75-00-3 | 30,000 | Development; alimentary system |
| Ethylene dibromide | 106-93-4 | 0.8 | Reproductive system |
| Ethylene dichloride | 107-06-2 | 400 | Alimentary system (liver) |
| Ethylene glycol | 107-21-1 | 400 | Respiratory system; kidney; development |
| Ethylene glycol monoethyl ether | 110-80-5 | 70 | Reproductive system; hematopoietic system |
| Ethylene glycol monoethyl ether acetate | 111-15-9 | 300 | Development |
| Ethylene glycol monomethyl ether | 109-86-4 | 60 | Reproductive system |
| Ethylene glycol monomethyl ether acetate | 110-49-6 | 90 | Reproductive system |
| Ethylene oxide | 75-21-8 | 30 | Nervous system |
| Fluoride including Hydrogen Fluoride | | 13 F 14 HF | Bone and teeth; respiratory system |
| Formaldehyde | 50-00-0 | 3 ² | Respiratory system; eyes |
| Glutaraldehyde | 111-30-8 | 0.08 | Respiratory system |
| Hexane (n-) | 110-54-3 | 7000 | Nervous system |
| Hydrazine | 302-01-2 | 0.2 | Alimentary system; endocrine system |
| Hydrogen chloride | 7647-01-0 | 9 | Respiratory system |
| Hydrogen cyanide | 74-90-8 | 9 | Nervous system; endocrine system; cardiovascular system |
| Hydrogen sulfide | 7783-06-4 | 10 | Respiratory system |
| Isopropanol | 67-63-0 | 7,000 | Kidney; development |
| Maleic anhydride | 108-31-6 | 0.7 | Respiratory system |
| Manganese & manganese compounds | | 0.2 | Nervous system |

² Indoor REL for this chemical has been established at 33 $\mu\text{g}/\text{m}^3$ (see Section 4.3)

Table A1. continued

| Substance | CAS No. | Chronic REL ($\mu\text{g}/\text{m}^3$) | Target system(s) |
|---|--------------------------|--|---|
| Mercury & mercury compounds (inorganic) | | 0.09 | Nervous system |
| Methanol | 67-56-1 | 4,000 | Development |
| Methyl bromide | 74-83-9 | 5 | Respiratory system; nervous system; development |
| Methyl chloroform | 71-55-6 | 1,000 | Nervous system |
| Methyl isocyanate | 624-83-9 | 1 | Respiratory system; reproductive system |
| Methyl t-butyl ether | 1634-04-4 | 8,000 | Kidney; eyes; alimentary system (liver) |
| Methylene chloride | 75-09-2 | 400 | Cardiovascular system; nervous system |
| Methylene dianiline (4,4'-) | 75-09-2 | 20 | Eyes; alimentary system (hepatotoxicity) |
| Methylene diphenyl isocyanate | 101-68-8 | 0.7 | Respiratory system |
| Naphthalene | 91-20-3 | 9 | Respiratory system |
| Nickel & compounds (except nickel oxide) | | 0.05 | Respiratory system; hematopoietic system |
| Nickel oxide | 1313-99-1 | 0.1 | Respiratory system; hematopoietic system |
| Phenol | 108-95-2 | 200 | Alimentary system; cardiovascular system; kidney; nervous system |
| Phosphine | 7803-51-2 | 0.8 | Respiratory system; alimentary system; nervous system; kidney; hematopoietic system |
| Phosphoric acid | 7664-38-2 | 7 | Respiratory system |
| Phthalic anhydride | 85-44-9 | 20 | Respiratory system |
| Propylene | 115-07-1 | 3,000 | Respiratory system |
| Propylene glycol monomethyl ether | 107-98-2 | 7,000 | Alimentary system (liver) |
| Propylene oxide | 75-56-9 | 30 | Respiratory system |
| Selenium & selenium compounds (other than hydrogen selenide) | | 20 | Alimentary system; cardiovascular system; nervous system |
| Styrene | 100-42-5 | 900 | Nervous system |
| Sulfuric acid | 7664-93-9 | 1 | Respiratory system |
| Tetrachloroethylene (perchloroethylene) | 127-18-4 | 35 | Kidney; alimentary system (liver) |

Table A1. continued

| Substance | CAS No. | Chronic REL ($\mu\text{g}/\text{m}^3$) | Target system(s) |
|---|-----------------------------------|--|---|
| Toluene | 108-88-3 | 300 | Nervous system; respiratory system; development |
| Toluene diisocyanates (2,4-&2,6-) | | 0.07 | Respiratory system |
| Trichloroethylene | 79-01-6 | 600 | Nervous system; eyes |
| Triethylamine | 121-44-8 | 200 | Eyes |
| Vinyl acetate | 108-05-4 | 200 | Respiratory system |
| Xylenes (m-, o-, p-) | 108-38-3, 95-47-6, 106-42-3 | 700 | Nervous system; respiratory system |

VOC DEFINITIONS

US EPA 40 CFR § 51.100 (s), (s) (1) – (7)³

Volatile organic compounds (VOC) means any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions. [additional exceptions listed:]

<http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=7b81d116dd15e8060b111e6e45026221&rgn=div8&view=text&node=40:2.0.1.1.2.3.8.1&idno=40>

California Air Resources Board Suggested Control Measure for Architectural Coatings

Volatile Organic Compound (VOC): any volatile compound containing at least one atom of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, and excluding the following:

http://www.arb.ca.gov/coatings/arch/Approved_2007_SCM.pdf

California Air Resources Board Regulation for Reducing VOCs from Consumer Products

Volatile Organic Compound (VOC): any volatile compound containing at least one atom of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, and excluding the following:

<http://www.arb.ca.gov/consprod/regs/cp.pdf>

South Coast Air Quality Management District, Rule 1113 Architectural Coatings

Volatile Organic Compound (VOC) is as defined in Rule 102 – Definition of Terms. For the purpose of this rule, tertiary butyl acetate (TBAC) is not a VOC when used in industrial maintenance coatings including zinc-rich industrial maintenance coatings.

³ GS-11 issued 1993: Volatile Organic Compounds (VOCs): Compounds as defined by US Environmental Protection Agency (EPA) in 40 CFR § 51.100 (s), (s) (1).

<http://www.aqmd.gov/rules/reg/reg11/r1113.pdf>

South Coast Air Quality Management District, 102 Definition of Terms

Volatile Organic Compound (VOC) is any volatile organic compound of carbon, excluding methane, carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, ammonium carbonate, and exempt compounds.

<http://www.aqmd.gov/rules/reg/reg01/r102.pdf>

EU Directive 1999/133/EC (Solvent Emissions Directive)

Volatile organic compound (VOC) shall mean any organic compound having at 293.15 K (i.e. 20°C) a vapor pressure of 0.01 kPa or more, or having a corresponding volatility under the particular conditions of use. For the purpose of this Directive, the fraction of creosote which exceeds this value of vapor pressure 293.13 K shall be considered a VOC.⁴

Organic compound shall mean any compound containing at least the element carbon and one or more of hydrogen, halogens, oxygen, sulfur, phosphorus, silicon, or nitrogen, with the exception of carbon oxides and inorganic carbonates and bicarbonates.

[http://eur-](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1999L0013:19990329:EN:PDF)

[lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1999L0013:19990329:EN:PDF](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1999L0013:19990329:EN:PDF)

EU Directive 2004/42/EC (Paints Directive)

Volatile organic compound (VOC) means any organic compound having an initial boiling point less than or equal to 250°C measured at standard pressure of 101.3 kPa.

Organic compound shall mean any compound containing at least the element carbon and one or more of hydrogen, halogens, oxygen, sulfur, phosphorus, silicon, or nitrogen, with the exception of carbon oxides and inorganic carbonates and bicarbonates.

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:143:0087:0096:EN:PDF>

European Union EcoFlower 2002/739/EC Indoor Paints and Varnishes

In this context, volatile organic compound with, at normal condition for pressure, a boiling point (or initial boiling point) lower than or equal to 250°C.

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002D0739:EN:HTML>

European Solvents Industry Group (ESIG) document: VOC Definition in Europe

Austria 1995 Solvents Ordinance – maximum boiling point of 200°C

Switzerland VOC Ordinance – maximum boiling point of 240°C

www.esig.org/uploads/documents/81-518-voc%20definition%20in%20europe.doc

Canada EcoLogo CCD-047 Surface Coatings

Volatile organic compound or (VOC) means any organic compound which participates in atmospheric photochemical reactions. It excludes those organic compounds which the ECP designates as having negligible photochemical reactivity found in Appendix 1.

<http://www.ecologo.org/common/assets/criterias/CCD-047.pdf>

Canada EcoLogo CCD-166 Disinfectants and Disinfectant-Cleaners

⁴ Methane, ethane, carbon monoxide, carbon dioxide, organometallic compounds and organic acids are excluded from this definition. For hydrocarbon solvents, a vapor pressure of 0.01 kPa grossly corresponds to 215-220°C boiling point [from ESIG document: VOC Definition in Europe]

VOC means volatile organic compound and is any organic compound which participates in atmospheric photochemical reactions to create smog and/or contribute to poor indoor air quality. VOCs include carbon containing compounds (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonates and ammonium carbonate) with vapor pressure >0.01 KPa at 20°C.

<http://www.ecologo.org/common/assets/criterias/CCD-166.pdf>

Green Seal GS-11 Paints (1993)

Green Seal GS-43 Recycled Content Paints (2006)

Volatile Organic Compounds as defined by U.S. EPA 40 CFR § 51.100 (s), (s) (1).

Rationale for changing to boiling point definition:

Using the US EPA 40 CFR definition, the traditional measurement of VOCs is through EPA Method 24. EPA Method 24 is often referred to as the “indirect” method and is determined by weight fraction of the volatile matter minus weight fraction of the water (and any exempt solvents). The volatile matter is determined by ASTM D2369 *Standard Test Method for Volatile Content of Coatings* which says to heat up the sample to 110°C for 60 minutes and measure what evaporates during that time. With a minimal amount of volatile content and high water content, there is a large degree of error for low or zero-VOC products and can result in false negatives. This method has been largely criticized for its inability to measure low or zero-VOC products.

“The main problem people have with Method 24 is the water analysis for water-based coatings and inks. The higher the water content, the more problems people seem to have with getting good precision with the water analysis, which leads to imprecision in the VOC result.”

<http://www.epa.gov/ttn/emc/methods/method24.html#wptm>

In November 2006, ASTM reported in the Standardization News that there were new methods to measure waterbased coatings, namely ASTM D6886 *Standard Test Method for Speciation of the Volatile Organic Compounds (VOCs) in Low VOC Content Waterborne Air-Dry Coatings by Gas Chromatography*, which was published in 2003. ASTM D6886 is a direct measurement and much more accurate as the compounds pass through a column in a gas chromatography. The VOCs can be identified and are aggregated by peak area according to a boiling point marker. The improvement in precision is approximately tenfold and improves further as the VOC level approaches zero. The International Organization of Standards (ISO) 11890-Part 2 uses a boiling point marker of 250°C, consistent with the European Union Definition. ISO 11890-Part 1 Difference method is similar to EPA Method 24 and is used for VOC levels >15%.

http://www.astm.org/SNEWS/NOVEMBER_2006/p_wiljon_nov06.html

In examining the VOC definition, US EPA 40 CFR only addresses VOCs in terms of photochemical smog. In fact, there is a new approach by the American Chemistry Society's Solvent Industry Group that wants to further divide the compounds into which components are the most reactive, known as reactivity-based limits, or maximal increment reactivity (MIR). Green Seal, like CARB, elected not to use the new approach of reactivity-based limits which would only address contribution to photochemical smog. In order to address issues of indoor air quality, a closed chamber emission testing was initially proposed during the revision of GS-11,

but for several reasons was not adopted in the draft final revised standard. Therefore, Green Seal elected to adopt a boiling point definition of VOCs to address issues of indoor air quality and by doing so, Green Seal could utilize the direct methodology (using gas chromatography) of measuring VOCs. In addition, utilizing this methodology was appropriate for the low and zero-VOC products that would be applying for certification. Green Seal initially elected to use the boiling point from the European Union of 250°C. Comments received from the draft revised standard advised that by doing so would exclude a common solvent, 2,2,4-Trimethyl-1,3-pentanediol monoisobutyrate CAS No 25265-77-4 (TMPD-MIB). TMPD-MIB is a coalescing agent that is considered a VOC under the US EPA 40 CFR definition, but due to its boiling point of 254°C is not considered a VOC in the European Union. TMPD-MIB can substantially contribute to the VOC calculation (correspondence with CARB stated that TMPD-MIB can contribute 3x the amount of VOC, such that a product that meets a 50 g/L VOC definition excluding TMPD-MIB would actually have a VOC of 150 g/L.) Green Seal's intent was to establish stricter VOC limits by adopting the European Union boiling point approach and wants to avoid the inadvertent VOC determination that would result into considerably less stringent VOC limits than other VOC regulatory bodies. After discussion with the researchers of ASTM D6886, Green Seal resolved to raise the boiling point to 280°C to include TMPD-MIB and any semivolatile organic compounds that may still be retained in the film after 250°C.

Potential Green Seal GS-11 Paints and Coatings revision (anticipated 2008)

Volatile organic compound - Any organic compound which participates in atmospheric photochemical reactions as defined by the U.S. Environmental Protection Agency in 40 CFR §51.100 (s) and has an initial boiling point lower than or equal to 280°C measured at standard conditions of temperature and pressure.