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Standard Guide for Analytical Testing of Substances of Very High Concern in Materials and Products[1]

This standard is issued under the fixed designation F2931; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε[1] NOTE—Keywords were added editorially in March 2017.

1. Scope

1.1 This guide contains a list of potential test methods for the analysis of Substances of Very High Concern (SVHC) as designated by ECHA, the European Chemicals Agency. Information on the test methods cited is publicly available and is drawn from a variety of sources. The guide is intended to assist in the selection of test methods that are applicable for the SVHCs identified.

1.2 The specific SVHCs covered within this guide are compiled from the ECHA Candidate List of Substances of Very High Concern. This list is also referred to as the REACH Candidate List.

1.3 This guide specifically addresses methods for the analysis of SVHCs in products. It is not intended to cover the many and varied analysis challenges associated in the manufacturing environment.

1.4 *Limitations:*

1.4.1 This guide is intended to provide a compilation of available test methods for the SVHCs listed on the ECHA Candidate list and is not intended to be exhaustive. The test methods within this guide are not the only ones available for any specific substances and this guide does not recommend any specific test method.

1.4.2 Test methods for specific substances at the detection limits required for REACH reporting are not always available. In some cases, it is necessary to deduce the quantity of substance present through the analysis and quantification of its elements. Although this approach is routinely used some degree of uncertainty exists in the final result due to the reduced specificity of the test method.

1.4.3 Although this guide is intended to be updated on a periodic basis to capture new developments in the field, there is no assurance that the information provided is the most current.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1257 Specification for High-Gravity Glycerin
D1385 Test Method for Hydrazine in Water
D1971 Practices for Digestion of Water Samples for Determination of Metals by Flame Atomic Absorption, Graphite Furnace Atomic Absorption, Plasma Emission Spectroscopy, or Plasma Mass Spectrometry
D3335 Test Method for Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy
D3545 Test Method for Alcohol Content and Purity of Acetate Esters by Gas Chromatography
D4309 Practice for Sample Digestion Using Closed Vessel Microwave Heating Technique for the Determination of Total Metals in Water
D5831 Test Method for Screening Fuels in Soils
D7065 Test Method for Determination of Nonylphenol, Bisphenol A, ***p-tert***-Octylphenol, Nonylphenol Monoethoxylate and Nonylphenol Diethoxylate in Environmental Waters by Gas Chromatography Mass Spectrometry
D7485 Test Method for Determination of Nonylphenol, p-***tert***-Octylphenol, Nonylphenol Monoethoxylate and Nonylphenol Diethoxylate in Environmental Waters by Liquid Chromatography/Tandem Mass Spectrometry
D7823 Test Method for Determination of Low Level, Regulated Phthalates in Poly (Vinyl Chloride) Plastics by

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[1] This guide is under the jurisdiction of ASTM Committee F40 on Declarable Substances in Materials and is the direct responsibility of Subcommittee F40.02 on Management Practices and Guides.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

Thermal Desorption—Gas Chromatography/Mass Spectrometry

D7968 Test Method for Determination of Perfluorinated Compounds in Soil by Liquid Chromatography Tandem Mass Spectrometry (LC/MS/MS)

E1621 Guide for Elemental Analysis by Wavelength Dispersive X-Ray Fluorescence Spectrometry

F2576 Terminology Relating to Declarable Substances in Materials

2.2 *European Commission:*[3]

Article 57 of the European Union Regulation #1907/2006

2.3 *International Electrotechnical Commission TC111:*[4]

IEC 62321 Electrotechnical Products – Determination of Levels of Six Regulated Substances (Lead, Mercury, Cadmium, Hexavalent Chromium, Polybrominated Biphenyls, Polybrominated Diphenyl Ethers)

2.4 *Joint Industry Guide (JIG):*[5]

JIG-101 Material Composition Declaration for Electrotechnical Products. Ed 4.0, 2011

3. Terminology

3.1 *Definitions:*

3.1.1 Terms and definitions related to declarable substances in materials may be found in Terminology F2576.

3.1.2 Terms and definitions in the guide not found in Terminology F2576 are found in a common dictionary or other reference documents such as the ASTM Dictionary of Engineering Science & Technology.[6]

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *article*—"an object which during production is given a special shape, surface or design which determines its function to a greater degree than its chemical composition" as defined in Article 3(3) of the REACH Regulation.

3.2.2 *brominated flame retardant*—a group of brominated organic compounds that are used to inhibit initiation of a fire.

3.2.3 *Joint Industry Guide*—An industry standard of the Electric Industries Alliance that "*establishes the relevant substances as well as reporting thresholds that the industry agrees should govern material content disclosures*."[5]

3.2.4 *phthalates—also known as phthalate esters*, are esters of phthalic acid primarily used as a plasticizer for polyvinyl chloride or as solvents for many different types of consumer products.

3.2.5 *plasticizer*—any of a group of substances used in plastics and other materials to control viscosity, flexibility or softness of the finished product.

3.2.6 *Substances of Very High Concern (SVHC)*—substances that have hazards of serious consequences and meet the criteria for carcinogenic, mutagenic and reproductive toxic substances of category 1 and 2.

3.2.6.1 *Discussion*—SVHC can be persistent, bioaccumulative and toxic (PBT) substances or very persistent and very bioaccumulative (VPvB) substances. Other substances giving rise to an equivalent level of concern as potential SVHC include endocrine disruptors.

3.3 *Acronyms:*

3.3.1 *AAS*—Atomic Absorption Spectrometry

3.3.2 *AED*—Atomic Emission Detection

3.3.3 *AES*—Atomic Emission Spectrometry

3.3.4 *AFS*—Atomic Fluorescence Spectometry

3.3.5 *BFR*—Brominated Flame Retardant

3.3.6 *CAS*—Chemical Abstract Services

3.3.7 *CMR*—Carcinogenic, Mutagenic and Toxic to Reproduction

3.3.8 *CPSC*—United States Consumer Product Safety Commission

3.3.9 *DMF*—Dimethylformamide

3.3.10 *ECD*—Electron Capture Detection

3.3.11 *ECHA*—European Chemicals Agency

3.3.12 *ECNI*—Electron Capture Negative Ion

3.3.13 *EEE*—Electrical and Electronic Equipment

3.3.14 *EIA*—Electronic Industries Alliance

3.3.15 *EPA*—United States Environmental Protection Agency

3.3.16 *EU*—European Union

3.3.17 *FID*—Flame Ionization Detection

3.3.18 *FPD*—Flame Photometric Detection

3.3.19 *GC-MS*—Gas Chromatography-Mass Spectrometry

3.3.20 *GFAA*—Graphite Furnace Atomic Absorption Spectrometry

3.3.21 *HAFID*—Hydrogen Atmosphere Flame Ionization Detection

3.3.22 *HFAA*—Heptaflurobutyric acid anhydride

3.3.23 *HIPS*—High Impact Polystyrene

3.3.24 *HPLC*—High Performance (or Pressure) Liquid Chromatography

3.3.25 *ICP-MS*—Inductively Coupled Plasma – Mass Spectrometry

3.3.26 *ICP-OES*—Inductively Coupled Plasma – Optical Emission Spectrometry

3.3.27 *IR*—Infrared Spectrometry

3.3.28 *LC-MS-MS*—Liquid Chromatography-Tandem

3.3.29 *MSP*—Microspectrophotometer

3.3.30 *NIOSH*—United States National Institute for Occupational Health and Safety

3.3.31 *PAH*—Polycyclic Aromatic Hydrocarbon

3.3.32 *PTFE*—Polytetrafluoroethylene (Teflon)

3.3.33 *PVC*—Polyvinyl Chloride

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[3] Europese Commissie, B-1049, Brussels, Belgium, http://ec.europa.eu/index_en.htm.

[4] Available from International Electrotechnical Commission (IEC), 3, rue de Varembé, P.O. Box 131, CH-1211 Geneva 20, Switzerland, http://www.iec.ch.

[5] Available from the Consumer Electronics Association, 1919 S. Eads St. Arlington, VA 22202, http://www.ce.org

[6] ASTM Dictionary of Engineering Science & Technology, 10th Edition. Available from www.astm.org.

3.3.34 *REACH*—Registration, Evaluation and Authorization of Chemicals

3.3.35 *RoHS*—Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

3.3.36 *UV-VIS*—UltraViolet-Visible Spectrometry

3.3.37 *XRF*—X-ray Fluorescence Spectrometry

4. Summary of Guide

4.1 This guide provides a list of test methods for the determination of the Substances of Very High Concern as identified in the REACH Candidate list. Screening methods are discussed in Appendix X2.

4.2 This guide provides identifiers for each substance such as chemical name, synonyms, chemical formulas, CAS and EU numbers.

4.3 Common uses for each of the substances are identified.

5. Significance and Use

5.1 The REACH Candidate list classifies substances as SVHCs thus making them subject to possible authorization. Compliance to the REACH regulation requires that any identified SVHC be present at a concentration of less than 0.1 % (w/w) of the total article weight to avoid triggering a reporting obligation. This guide is intended to assist in the identification of available test methods for quantitative analysis of the substance(s) of interest.

5.2 When possible, industry accepted standard test methods are cited. However, industry vetted test methods are not available for all of the substances contained in the REACH Candidate List. Thus, some caution and due diligence must be exercised when applying some of the methods listed in this guide.

5.3 In some cases, test methods for the identification and quantification of a specific substance are not available. An example would include $CoCl_2$. Methods currently in practice involve the individual determination of Co and Cl concentrations and use other sources of information or chemical judgment to assign the expected $CoCl_2$ concentration. This approach obviously has its limitations and pitfalls and must be used judiciously.

5.4 Under the REACH regulation, EU manufacturers, importers or distributors of articles containing more than 0.1 % (w/w) of a substance that the Agency has listed as being an SVHC shall provide their customers with the name of the substance and information allowing the safe use of the article. Producers and distributors of articles containing SVHC shall also supply the same information to consumers, upon request. In situations where this information is not readily available from the supply chain it is incumbent upon the supplier to collect this information through actual chemical analysis or other means. This guide is intended to assist in the selection of appropriate test methods in the event that chemical analysis is required.

6. Substance List and Uses

6.1 The substances listed in Table 1 were derived from the ECHA SVHC Candidate List published in October 2008. Any substances that have been subsequently added after October 2008 are not included.

6.2 The CAS or EU numbers are unique identifiers for the substance. It is possible for a particular substance to have one or more commonly used names.

6.3 Common uses of the substance help to identify in which products or materials these substance is likely to be found. Note that the list of common uses is not exhaustive.

7. SVHC Test Methods

7.1 This guide is not intended to be exhaustive in the identification of available test methods. The intent is to provide guidance and some examples of available test methods relevant to the required analysis. Some of the SVHCs do not have industry standard test methods associated with them. Literature citations of these non-standard methods are meant to be for information only.

7.2 Standard test methods do not exist for all of the SVHCs listed. Therefore, the test methods cited for those substances must be validated for analytical accuracy before use in regulatory compliance demonstration. Moreover, when a method is applied outside of its intended scope, validation of the altered method is required. Considerations such as sample matrix, analytical requirements, etc. for the intended analysis will determine its applicability. All deviations from the published method must be clearly noted.

NOTE 1—If a standardized method is used beyond the stated scope, that addition must be validated. All deviations from published methods must be documented.

7.3 In many cases, test methods that are specific for a particular substance have not been developed. Therefore, the approach to quantitative analysis is not straightforward. A combination of test methods and the use of logical assumptions are required. These assumptions shall be clearly articulated because they will determine the limitations of the approach.

7.4 Screening methods can be utilized to determine whether a detectable amount of a substance is present. In many situations the application of a screening process can obviate the need to perform full quantitative analysis. See Appendix X2 for more information on screening methodologies.

7.5 In some cases, sample preparation methods are dependent upon the physical state of the sample to be analyzed. For many of the test methods, several sample preparation references are cited when applicable.

7.6 In some cases, limitations in the sample preparation method cited in Appendix X1.2 can produce a sample for analysis that is non-optimal. Incomplete extraction, incomplete digestion, loss of analyte, etc. often require adjustments to the sample preparation methods to obtain the desired analytical result. At a minimum the limitations in the sample preparation method shall be accounted for, when possible, in the calculation of the analytical result. Additionally, if these adjustments to the method do not produce a satisfactory sample for analysis, it may be necessary to develop an alternative method. Validation of the sample preparation method will thus be required.

TABLE 1 SVHC Substances and Their Common Uses

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
4,4'-Diaminodiphenylmethane	4,4'-Methylene-dianiline, MDA	101-77-9	202-974-4	$C_{13}H_{14}N_2$	Converted to methylenedipheny diisocyanate (MDI). MDI used for polyurethane production. Other uses include: (1) hardener for epoxy resins and adhesives, (2) basic ingredient of colorant, and (3) intermediate for high-performance polymer.
5-tert-Butyl-2.4.6-Trinitro-m-Xylene	Musk Xylene (2,4,6-Trinitro-1,3-dimethyl-5-t-butylbenzene)	81-15-2	201-329-4	$C_{12}H_{15}N_3O_6$	Used as a fragrant particularly for consumer cosmetic products.
Alkanes, C10-13, chloro	Short Chain Chlorinated Paraffins (SCCP)	85535-84-8	287-476-5	$C_xH_{(2X-y+2)}$Cly where x=10^{-13} and y=1^{-13}	May act as a secondary plasticizer or flame retardant in PVC. Other uses include: (1) metal working lubricant, (2) rubber parts, (3) paints, (4) sealant, (5) leather work, and (6) fiber.
Anthracene	Paranaphthalene	120-12-7	204-371-1	$C_{14}H_{10}$	An intermediate in the production of dyes; used in the manufacturer of pyrotechnic products.
Benzyl butyl phthalate	Phthalic acid, benzyl butyl ester	85-68-7	201-622-7	$C_{19}H_{20}O_4$	Plasticizer in flooring material such as PVC foam. Other uses are as a plasticizer in traffic cones, food conveyor belts, artificial leather, etc.
Bis(2-ethylhexyl)phthalate	Dioctylphthalate	117-81-7	204-211-0	$C_{24}H_{38}O_4$	Commonly used as a platicizer in manufacturing of articles made of PVC, resins, rubbers, packaging materials, some paper products, and various medical devices, including the blood bags. It can also be found in some hydraulic fluids or dielectric fluids in capacitors. It is often found in coatings, pigments, textiles, or used as a solvent in light sticks.
Bis (tributyltin) oxide	Distannoxane, hexabutyl-	56-35-9	200-268-0	$C_{24}H_{54}OSn_2$	Primarily used as a biocide for boats, mildew proofing for leather work.
Cobalt dichloride	Cobaltous Chloride	7646-79-9	231-589-4	$CoCl_2$	This substance can be used for (1) humidity indicator, (2) absorbent of ammonia gas, (3) gas mask, (4) production for vitamin $B_1$2, (5) trace amount of nutrient factor for food, (6) trace amount of element for nitric-acid pesticides, (7) solvent in purifying magnesium. Additionally, it may be used for packaging.
Diarsenic pentaoxide	Diarsenic Pentoxide	1303-28-2	215-116-9	As_2O_5	This substance can be used for (1) colorants, (2) metal refining, (3) special glass production, and (4) antiseptic agent for wood.
Diarsenic trioxide	Arsenic Trioxide	1327-53-3	215-481-4	As_2O_3	This substance can be used for (1) decolorants for glasses and enamel, (2) purifying and oxidizing agent in production of special glasses and lead crystal, (3) antiseptic agent for wood, and (4) medicine for leukemia.
Dibutyl phthalate	1,2-Benzenedicarboxylic acid di-n-butyl ester	84-74-2	201-557-4	$C_{16}H_{22}O_4$	Common plasticizer used in various polymers to keep crystals from forming. It is also used in paints, pigments, or printing inks as an adhesive agent. It is soluble in various organic solvents. This property allows it to be used as fixatives in perfumes or as an ectoparasiticide.
Hexabromocyclododecane	Cyclododecane, hexabromo-isomers	25637-99-4	247-148-4	$C_{12}H_{18}Br_6$	Used as a brominated flame retardant for polystyrene materials, for example,, HIPS case material and packaging.
Lead hydrogen arsenate	Lead Acid Arsenate	7784-40-9	232-064-2	$(AsO_4H)Pb$	Insecticide or pesticide
Sodium dichromate dihydrate	Sodium Bichromate	7789-12-0	234-190-3	$Na_2Cr_2O_7.2H_2O$	Used for: (1) production of other chromium compounds, (2) production of inorganic chromate pigments, (3) preservative supplement, finishing of metal plating, (4) production of vitamin K.
Triethyl arsenate	Arsenic acid Triethyl Ester	15606-95-8	427-700-2	$(C_2H_5O)_3AsO$	Used for integrated circuit manufacturing as an intermediate for n-type doping of semiconductors.
2,4-Dinitrotoluene	1-methyl-2,4-dinitrobenzene	121-14-2	204-450-0	$C_7H_6N_2O_4$	2,4-dinitrotoluene is used in the production of toluene diisocyanate, which is used for the manufacture of flexible polyurethane foams. The substance is also used as gelatinizing-plasticizing agent for the manufacture of explosive mixtures (for example, for airbags in cars).
Aluminosilicate Refractory Ceramic Fibres	VITREOUS	142844-00-6			Refractory ceramic fibres are used for high-temperature insulation, almost exclusively in industrial applications (insulation of industrial furnaces and equipment, equipment for the automotive and aircraft/aerospace industry) and in fire protection (buildings and industrial process equipment).
Anthracene oil	Anthracene Phenanthrene Carbazole	90640-80-5	292-602-7	$C_{14}H_{10}$ $C_{12}H_9N$	The substances are mainly used in the manufacture of other substances such as anthracene and carbon black. They may also be used as reducing agents in blast furnaces, as components in bunker fuel, for impregnating, sealing and corrosion protection.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
Anthracene oil, anthracene paste	Anthracene Phenanthrene Carbazole	90640-81-6	292-603-2	$C_{14}H_{10}$ $C_{12}H_9N$	The substances are mainly used in the manufacture of other substances such as anthracene and carbon black. They may also be used as reducing agents in blast furnances, as components in bunker fuel, for impregnating, sealing and corrosion protection.
Anthracene oil, anthracene paste, anthracene fraction	Anthracene Phenanthrene Carbazole	91995-15-2	295-275-9	$C_{14}H_{10}$ $C_{12}H_9N$	The substances are mainly used in the manufacture of other substances such as anthracene and carbon black. They may also be used as reducing agents in blast furnances, as components in bunker fuel, for impregnating, sealing and corrosion protection.
Anthracene oil, anthracene paste,distn. lights	Anthracene Phenanthrene Carbazole	91995-17-4	295-278-5	$C_{14}H_{10}$ $C_{12}H_9N$	The substances are mainly used in the manufacture of other substances such as anthracene and carbon black. They may also be used as reducing agents in blast furnances, as components in bunker fuel, for impregnating, sealing and corrosion protection.
Anthracene oil, anthracene-low	Anthracene Phenanthrene Carbazole	90640-82-7	292-604-8	$C_{14}H_{10}$ $C_{12}H_9N$	The substances are mainly used in the manufacture of other substances such as anthracene and carbon black. They may also be used as reducing agents in blast furnances, as components in bunker fuel, for impregnating, sealing and corrosion protection.
Diisobutyl phthalate	Bis(2-methylpropyl) benzene-1,2-dicarboxylate	84-69-5	201-553-2	$C_{16}H_{22}O_4$	Diisobutyl phthalate is used as plasticiser for nitrocellulose, cellulose ether, polyacrylate and polyacetate dispersions, and as a gelling aid in combination with other plasticisers, which are widely used for plastics, lacquers, adhesives, explosive material and nail polish.
Lead chromate	Lead(2+) chromate	7758-97-6	231-846-0	$CrH_2O_4.Pb$	Lead chromate is used for manufacturing pigments and dyes, as a pigment or coating agent in industrial and maritime paint products or for embalming/restoring of art products. Further potential uses include as detergents and bleaches, photosensitive materials and for the manufacture of pyrotechnic powder.
Lead chromate molybdate sulphate red (C.I. Pigment Red 104)	Lead(2+) chromate lead(2+) sulfate lead(2+) molybdate	12656-85-8	235-759-9	$CrH_2O_4.Pb$ $H_2O_4S.Pb$ $PbMoO_4$	Lead chromate molybdate sulphate red (C.I. Pigment Red 104) is used as a colouring, painting and coating agent in sectors such as the rubber, plastic and paints, coatings and varnishes industries. Applications comprise the production of agricultural equipment, vehicles and aircraft as well as road and airstrip painting.
Lead sulfochromate yellow (C.I. Pigment Yellow 34)	Lead(2+) chromate lead(2+) sulfate	1344-37-2	215-693-7	$CrH_2O_4.Pb$ $H_2O_4S.Pb$	Lead sulfochromate yellow (C.I. Pigment Yellow 34) is used as a colouring, painting and coating agent in sectors such as the rubber, plastic and paints, coatings and varnishes industries. Applications comprise the production of agricultural equipment, vehicles and aircraft as well as road and airstrip painting. The substance is further used for camouflage or ammunition marking in the defence area.
Pitch, coal tar, high temperature	anode pitch, binder pitch, clay pigeon binder, electrode pitch, hard pitch, impregnating pitch, soft pitch, vacuum pitch	65996-93-2	266-028-2	not applicable	Pitch, coal tar, high temperature is mainly used in the production of electrodes for industrial applications. Smaller volumes are dedicated to specific uses such as heavy duty corrosion protection, special purpose paving, manufacture of other substances and the production of clay targets.
Tris(2-chloroethyl)phosphate		115-96-8	204-118-5	$C_6H_{12}Cl_3O_4P$	Tris(2-chloroethyl)phosphate is mainly used as an additive plasticiser and viscosity regulator with flame-retarding properties for acrylic resins, polyurethane, polyvinyl chloride and other polymers. Other fields of application are adhesives, coatings, flame-resistant paints and varnishes. The main industrial branches to use TCEP are the furniture, the textile and the building industry.
Zirconia Aluminosilicate Refractory Ceramic Fibres					Refractory ceramic fibres are used for high-temperature insulation, almost exclusively in industrial applications (insulation of industrial furnaces and equipment, equipment for the automotive and aircraft/aerospace industry) and in fire protection (buildings and industrial process equipment).
Acrylamide	Prop-2-enamide	79-06-1	201-173-7	C_3H_5NO	Acrylamide is almost exclusively used for the synthesis of polyacrylamides, which are used in various applications, in particular in waste water treatment and paper processing. Minor uses of acrylamide comprise the preparation of polyacrylamide gels for research purposes and as grouting agents in civil engineering.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
Ammonium dichromate	Diammonium dichromate, Ammonium bichromate, ammonium chromate, chromic acid [$H_2Cr_2O_7$] diammonium salt, diammonium dichromate, dichromic acid diammonium salt	7789-09-5	232-143-1	$Cr_2H_2O_7.2H_3N$	Ammonium dichromate is mainly used as an oxidising agent. Other known uses are in the manufacture of photosensitive screens and as mordant in the manufacture of textiles. Minor uses seem to comprise metal treatment and laboratory analytical agent.
Boric acid		10043-35-3 11113-50-1	233-139-2 234-343-4	BH_3O_3	Boric acid is widely used on account of its consistency-influencing, flame-retarding, antiseptic and preservative properties. It is a component of detergents and cleaners, adhesives, toys, industrial fluids, brake fluids, glass, ceramics, flame retardants, paints, disinfectants, cosmetics, food additives, fertilisers, insecticides and other products.
Disodium tetraborate, anhydrous	Disodium tetraborate decahydrate, Disodium tetraborate anhydrous, Disodium tetraborate pentahydrate, borax decahydrate, boric acid, disodium salt, borax pentahydrate	1303-96-4 1330-43-4 12179-04-3	215-540-4	$Na_2B_4O_7{\cdot}10H_2O$ $Na_2B_4O_7$ $Na_2B_4O_7{\cdot}5H_2O$	Disodium tetraborate and tetraboron disodium heptaoxide form the same compounds in aqueous solutions. Uses include a multitude of applications, for example, in detergents and cleaners, in glass and glass fibres, ceramics, industrial fluids, metallurgy, adhesives, flame retardants, personal care products, biocides, fertilisers.
Potassium chromate	Dipotassium chromate, Bipotassium chromate, Dipotassium monochromate, Bipotassium monochromate, Neutral potassium chromate, Potassium chromate (VI), Chromate of potash (potass), Chromic acid dipotassium salt	7789-00-6	232-140-5	K_2CrO_4	Potassium chromate is used as a corrosion inhibitor for treatment and coating of metals, for manufacture of reagents, chemicals and textiles, as a colouring agent in ceramics, in the manufacture of pigments/inks and in the laboratory as analytical agent.
Potassium dichromate	Chromic acid [$H_2Cr_2O_7$] dipotassium salt, dichromic acid dipotassium salt, dipotassium bichromate, dipotassium dichromate, Lopezite, potassium bichromate, potassium dichromate[VI], dipotassium dichromium hepta-oxide	7778-50-9	231-906-6	$K_2Cr_2O_7$	Potassium dichromate is used for chrome metal manufacturing and as corrosion inhibitor for treatment and coating of metals. It is further used as textile mordant, as laboratory analytical agent, for cleaning of laboratory glassware, in the manufacture of other reagents and as oxidising agent in photolithography.
Sodium chromate	Disodium chromate, Sodium monochromate, Disodium chromium tetraoxide	7775-11-3	231-889-5	Na_2CrO_4	Sodium chromate is mainly used as an intermediate in the manufacture of other chromium compounds as well as a laboratory analytical agent, but this use is limited. Other potential uses are mentioned in the literature but whether they occur in the EU is not clear.
Tetraboron disodium heptaoxide, hydrate		12267-73-1	235-541-3	$B_4Na_2O_7.x$ H_2O	Disodium tetraborate and tetraboron disodium heptaoxide form the same compounds in aqueous solutions. Uses include a multitude of applications, for example, in detergents and cleaners, in glass and glass fibres, ceramics, industrial fluids, metallurgy, adhesives, flame retardants, personal care products, biocides, fertilisers.
Trichloroethylene	Acetylene trichloride, Ethinyl trichloride, Trichloroethene, TRI, TRIC, 1-Chloro-2,2-dichloroethylene, 1,1,2-Trichloroethylene, Trilene, Triklone® , Trimar. Industrial abbreviations include trichloroethylene, trichlor, Trike, Tricky and trichloroethylene.	79-01-6	201-167-4	C_2 H Cl_3	Trichlororethylene is mainly used as intermediate in the manufacture of chlorinated and fluorinated organic compounds. Other uses are for cleaning and degreasing of metal parts or as solvent in adhesives.
Chromium trioxide	Trioxochromium	1333-82-0	215-607-8	CrO_3	Formulation of mixtures containing chromium trioxide, which are mainly used for for example, metal finishing/surface treatment or in much smaller amounts as catalysts containing chromium trioxide.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
Acids generated from chromium trioxide and their oligomers	Dichromic acid ($H_2Cr_2O_7$), hydroxy-(hydroxy(dioxo)chromio)oxy-dioxochromium, Chromic acid (H_2CrO_4), dihydroxy(dioxo)chromium	13530-68-2 7738-94-5	236-881-5 231-801-5	$Cr_2H_2O_7$ CrH_2O_4	Chromic acid, dichromic acid and oligomers of chromic and dichromic acid are spontaneously generated products of the reaction of chromic trioxide with water. Refer to the uses for chromium trioxide.
Cobalt (II) sulphate	Sulfuric acid, cobalt(2+) salt (1:1),	10124-43-3	233-334-2	CoH_2O_4S	Mainly used in the production of other chemicals. Further applications may include manufacture of catalysts and driers, surface treatments (such as electroplating), corrosion prevention, production of pigments, decolourising (in glass, pottery), batteries, animal food supplement, soil fertilizer, and others.
Cobalt (II) dinitrate		10141-05-6	233-402-1	CoN_2O_6	Mainly used in the production of other chemicals and the manufacture of catalysts. Further applications may include surface treatment and batteries.
Cobalt (II) carbonate		513-79-1	208-169-4	$CoCO_3$	Mainly used in the manufacture of catalysts. Minor uses may include feed additive, production of other chemicals, production of pigments, and adhesion (in ground coat frit).
Cobalt (II) diacetate	Cobalt di(acetate)	71-48-7	200-755-8	$C_4H_6CoO_4$	Mainly used in the manufacture of catalysts. Minor uses may include production of other chemicals, surface treatment, alloys, production of pigments, dyes, rubber adhesion, and feed additive.
2-Methoxyethanol	ethylene glycol monomethyl ether; EGME, Ethanol, 2-methoxy-	109-86-4	203-713-7	$C_3H_8O_2$	Mainly used as solvent, chemical intermediate and additive for fuels.
2-Ethoxyethanol	ethylene glycol monoethyl ether; EGEE, Ethanol, 2-ethoxy-	110-80-5	203-804-1	$C_4H_{10}O_2$	Mainly used as solvent and chemical intermediate.
2-ethoxyethyl acetate	Ethanol, 2-ethoxy-, acetate, Ethylglycol acetate; ethylene glycol mono ethyl ether acetate; 2-EEA; acetic acid, 2-ethoxyethyl ester; ethoxyethanol acetate	111-15-9	203-839-2	$C_6H_{12}O_3$	As solvent in coatings and in the chemical industry, intermediate in the manufacture of cyanoacrylate adhesives.
Strontium chromate	Chromic acid (H_2CrO_4), strontium salt (1:1), Chromium diolatodioxo-strontium salt (1:1), C.I. Pigment Yellow 32, Deep Lemon Yellow, Strontium chromate (VI), Strontium Yellow	7789-06-2	232-142-6	$SrCrO_4$	As corrosion inhibitor in coating mixtures used in the aeronautic / aerospace sector, in the coil coating sector of steel and aluminium and in the vehicle coating sector.
1,2-Benzenedicarboxylic acid, di-C7-11 branched and linear alkyl esters	Di-C_7-11-(linear and branched)-alkyl phthalate, Dialkyl phthalate (C_7-11) branched and linear phthalate ester; 711P; D711P; Di-711-phthalate; Dialkyl(C_7-11-branched and linear) phthalate (DHNUP); Di(heptyl, nonyl, undecyl) phthalate (mixed isomers); Phthalic acid, dialkyl (C_7-$C_1$1) ester; Santicizer 711	68515-42-4	271-084-6	$C_{22}H_{34}O_4$– $C_{30}H_{50}O_4$	As plasticiser in PVC, foam, adhesives and coatings.
Hydrazine	H_70; H_70 (fuel); Levoxine; Nitrogen hydride(N_2H_4);Oxytreat 35	7803-57-8 302-01-2 10217-52-4	206-114-9	H_4N_2	As intermediate in the manufacture of hydrazine derivatives, as a monomer in polymerisations, as a corrosion inhibitor in water treatment and for metal reduction and refining of chemicals. It is also used as a propellant for aerospace vehicles and as fuel in military (emergency) power units.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
1-methyl-2-pyrrolidone	2-Pyrrolidinone, 1-methyl-, 1-Methylpyrrolidin-2-one, 1-Methyl-2-pyrrolidinone 1-Methyl-5-pyrrolidinone 1-Methylazacyclopentan-2-one 1-Methylpyrrolidone AgsolEx 1 M-Pyrol Microposit 2001 N 0131 N-Methyl-α-pyrrolidinone N-Methyl-α-pyrrolidone N-Methyl-γ-butyrolactam N-Methyl-2-ketopyrrolidine N-Methyl-2-pyrrolidinone N-Methyl-2-pyrrolidone N-Methylbutyrolactam N-Methylpyrrolidone NMP NSC 4594 Pharmasolve Pyrol M SL 1332	872-50-4	212-828-1	C_5H_9NO	As solvent in coatings, cleaning products, for electronic equipment manufacture, as well as in semiconductor industry, petrochemical processing, pharmaceuticals and agrochemicals.
1,2,3-trichloropropane	Propane, 1,2,3-trichloro-, Allyl trichloride; Glycerol trichlorohydrin; Glyceryl trichlorohydrin; NSC 35403; Trichlorohydrin;	96-18-4	202-486-1	$C_3\ H_5\ Cl_3$	Intermediate in the manufacture of chlorinated solvents and agricultural products. It is also used as monomer. In the past, it was used as solvent, paint and varnish remover and as degreasing agent.
1,2-Benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich	C_6-8-(branched)-Alkyl benzene-1,2-dicarboxylate, C_6-8-(branched)-Alkyl phthalate, Diisoheptyl phthalate, DIHP	71888-89-6	276-158-1		As plasticiser in PVC and in sealants, coatings and potentially printing inks.
Dichromium tris(chromate)	Chromic acid (H_2CrO_4), chromium(3+) salt (3:2), Dichromium(3+) trichromate, Chromic chromate, Chromium (III) chromate, Dichromium Trischromate, Accomet C; other trade names are confidential	24613-89-6	246-356-2	Cr_5O_{12} $CrH_2O_4.2/3Cr$	In mixtures for metal surface treatment in the aeronautic/aerospace, steel, and aluminium coating industries.
Potassium hydroxyoctaoxodizincatedi-chromate		11103-86-9	234-329-8		Aeronautic/ aerospace coating, steel and aluminium coil coating, and vehicle coating.
Pentazinc chromate octahydroxide	Zinc chromate hydroxide (Zn5(CrO_4)(OH)8), Zinc tetraoxychromate, Zinc tetroxy chromate, Zinc chromate, hydroxide, Basic zinc chromate, Zinc chromate, Trizinc, dioxido(dioxo)chromium dihydroxide	49663-84-5	256-418-0	$CrH_8O_{12}Zn_5$	Vehicle coating and aeronautic / aerospace coating.
Formaldehyde, oligomeric reaction products with aniline (technical MDA)	Formaldehyde, polymer with benzenamine, polymeric MDA3, PMDA, MDA, technical grade, crude MDA	25214-70-4	500-036-1	$(C_6H_7N.CH_2O)x$	Manufacture of other substances. Minor uses are as ion exchange resins in nuclear power plants, as hardener for epoxy resins.
Bis(2-methoxyethyl) phthalate	1,2-Benzenedicarboxylic acid, 1,2-bis(2methoxyethyl) ester, Di(methoxyethyl) phthalate, Bis(methylglycol) phthalate	117-82-8	204-212-6	$C_{14}H_{18}O_6$	Plasticiser in polymeric materials and paints, lacquers and varnishes, including printing inks.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
2-Methoxyaniline; o-Anisidine	Benzenamine, 2-methoxy-, 2-methoxybenzenamine	90-04-0	201-963-1	C_7H_9NO	Manufacture of dyes for tattooing and coloration of paper, polymers and aluminium foil.
4-(1,1,3,3-Tetramethylbutyl)phenol, (4-tert-Octylphenol)	4-(2,4,4-trimethylpentan-2-yl)phenol, Phenol, 4-(1,1,3,3-tetramethylbutyl)-	140-66-9	205-426-2	$C_{14}H_{22}O$	Manufacture of polymer preparations and of ethoxylate surfactants. Also used as a component in adhesives, coatings, inks and rubber articles.
1,2-Dichloroethane	Ethane, 1,2-dichloro-, Ethylene dichloride, dichloroethylene, 1,2-DCE,, 1,2-EDC	107-06-2	203-458-1	$C_2\ H_4\ Cl_2$	Manufacture of other substances. Minor uses as solvent in chemical and pharmaceutical industries.
Bis(2-methoxyethyl) ether	Ethane, 1,1'-oxybis[2-methoxy-, 1-methoxy-2-(2-methoxyethoxy)ethane, Diglyme, DEGDME, Diethylenglycoldimethylether, Dimethyldiglycol, 2-(2-Methoxyethoxy)-1-methoxyethane, 2,5,8-Trioxanonane, Di(2, Methoxyethyl) ether, Dimethyl carbitol, Ether, bis(2-methoxyethyl), 1,1'-Oxybis[2-methoxyethane], Methyldiglyme, (CAS registry numbers still in use: 70-992-86-8, 54631-70-8, 142939-39-7 although deleted in CAS, registry)	111-96-6	203-924-4	$C_6H_{14}O_3$	Used primarily as a reaction solvent or process chemical in a wide variety of applications. Also used as solvent for battery electrolytes, and possibly in sealants, adhesives, fuels and automotive care products.
Arsenic acid	Arsenic acid (H_3AsO_4), arsenic acid, trihydroxidooxidoarsenic (IUPAC 2005), Orthoarsenic acid	7778-39-4	231-901-9	AsH_3O_4	Mainly used to remove gas bubbles from ceramic glass melt (fining agent) and in production of laminated printed circuit boards. Also used in the manufacture of semiconductors and as laboratory agent.
Calcium arsenate	Arsenic acid (H_3AsO_4), calcium salt (2:3), Tricalcium(2+) diarsenate, Arsenic acid calcium salt; calcium orthoarsenate; tricalcium arsenate	7778-44-1	231-904-5	$As_2Ca_3O_8$	Present in complex raw materials that are used mainly for copper and lead refining. Also used to precipitate nickel from the molten metal and to manufacture diarsenic trioxide.
Trilead diarsenate	Arsenic acid (H_3AsO_4), lead salt (2:3), Trilead (2+) diarsenate, Lead (II) arsenate, lead arsenate	3687-31-8	222-979-5	$As_2O_8Pb_3$	Present in complex raw materials for manufacture of copper, lead and a range of precious metals.
N,N-dimethylacetamide (DMAC)	Acetamide, N,N-dimethyl-, Acetdimethylamide, DMA, DMAA, DMAc, Dimethylamide acetate, N,N-Dimethylethanamide	127-19-5	204-826-4	$C_4\ H_9\ N\ O$	Used as solvent, mainly in the manufacture of various substances and in the production of fibres for clothing. Also used as reagent, and in products such as industrial coatings, insulation paper, polyimide films, paint strippers and ink removers.
2,2'-Dichloro-4,4'-methylenedianiline (MOCA)	4,4'-methylenebis[2-chloroaniline], Benzenamine, 4,4'-methylenebis[2-chloro-, Bisamine A, 2,2'-Dichloro-4,4'-methylenedianiline, 3,3'-Dichloro-4,4'-diaminodiphenylmethane, Bis(4-amino-3-chlorophenyl)methane	101-14-4	202-918-9	$C_{13}H_{12}Cl_2\ N_2$	Mainly used as curing agent in resins and in the production of polymer articles and also for manufacture of other substances.
Phenolphthalein	1(3H)-Isobenzofuranone, 3,3-bis(4-hydroxyphenyl)-; 3,3-Bis(4-hydroxyphenyl)-2-benzofuran-1(3H)-one; 3,3-Bis(p-hydroxyphenyl)phthalide; 3,3-Bis(4-hydroxyphenyl)phthalide; 3,3-Bis(4-hydroxyphenyl)-1(3H)-isobenzofuranone	77-09-8	201-004-7	$C_{20}H_{14}O_4$	Mainly used as laboratory agent (pH indicator solutions). Minor uses are in pharmaceutical preparations and in some special applications.
Lead azide Lead diazide	Lead azide (Pb(N_3)2); Lead(2+) diazide	13424-46-9	236-542-1	$N_6\ Pb$	Mainly used as initiator or booster in detonators for both civilian and military uses and as initiator in pyrotechnic devices.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
Lead styphnate	lead 2,4,6-trinitro-m-phenylene dioxide; 1,3-Benzenediol, 2,4,6-trinitro-, lead(2+) salt (1:1); Lead(2+) 2,4,6-trinitrobenzene-1,3-diolate; 2,4-Dioxa-3-plumbabicyclo[3.3.1]nona-1(9),5,7-triene; 3,3didehydro-6,8,9-trinitro-; Lead, [styphnato(2-)]-; Resorcinol, 2,4,6-trinitro-, lead(2+) salt (1:1); Lead styphnate; Lead tricinate; Lead trinitroresorcinate; Tricinat	15245-44-0	239-290-0	$C_6\ H\ N_3\ O_8\ Pb$	Mainly used as a primer for small calibre and rifle ammunition. Other common uses are in ammunition pyrotechnics, powder actuated devices and detonators for civilian use.
Lead dipicrate	Phenol, 2,4,6-trinitro-, lead(2+) salt (2:1); Lead(2+) bis(2,4,6-trinitrophenolate); Lead, bis(picryloxy)-; Phenol, 2,4,6-trinitro-, lead(2+) salt; Picric acid, lead(2+) salt; Lead(II) picrate	6477-64-1	229-335-2	$C_{12}H_4\ N_6\ O_{14}Pb$	The substance is an explosive like lead diazide and lead styphnate.
1,2-bis(2-Methoxyethoxy)ethane (TEGDME; triglyme)	2,5,8,11-tetraoxadodecane; Triglyme; TEGDME Triethylene glycol dimethyl ether; Ansul Ether 161; DMTG; Ethane, 1,2-bis(2-methoxyethoxy)-; Glyme 4; Hisolve MTM; Methyltriglyme; NSC 66400	112-49-2	203-977-3	$C_8H_{18}O_4$	Triglyme is used as an inert solvent for grignard-, reduction- and alkylation-reactions. Reactions involving alkali metals can be carried out in triglyme and alkali metal dispersions in triglyme are used for etching of Teflon and Fluoropolymers. Triglyme is also used as an inert solvent for reduction reactions using Sodium borohydride and used as a solvent to carry out methylation reactions using dimethyl carbonate (and other dialkyl carbonates). Triglyme is also used as part of absorbing liquids in the industrial cleaning of gases. Triglyme has been reported to be used in Brake fluids.
1,2-Dimethoxyethane; ethylene glycol dimethyl ether (EGDME)	Ethane, 1,2-dimethoxy-; EGDME; Ethylene glycol dimethyl ether; 1,2-Dimethoxyethane; 1,2-Ethanediol, dimethyl ether; 2,5-Dioxahexane;DME; DME (glycol ether); Dimethyl Cellosolve; Ethylene dimethyl ether; Glycol dimethyl ether; Glyme;Hisolve MMM; Monoethylene glycol dimethyl ether; Monoglyme; NSC 60542; α,β-Dimethoxyethane.	110-71-4	203-794-9	$C_4H_{10}O_2$	EGDME is used as a solvent or processing aid in the manufacture or formulation of industrial chemicals. The large majority of the EGDME sold by the producer is used as a site limited processing aid for industrial chemical manufacture.
Ammoniumpentadecafluoro otanoate (APFO)	APFO	3825-26-1	223-320-4	$C_8H_4NF_{15}NO_2$	PFOA is used as a group name for PFOA and its salts, and PFOA is mainly produced and used as its ammonium salt, ammoniumpentadecafluorootanoate (APFO, CAS Number: 3825-26-1). However, the perfluorooctanoate anion is the molecule of primary interest. APFO and PFOA are sometimes used interchangeably as both PFO-anion and PFOA (neutral species) exist in solution.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
C.I. Basic Blue 26 ([4-[[4-anilino-1-naphthyl][4-(dimethylamino)phenyl]methylene]cyclohexa-2,5-dien-1-ylidene]dimethylammonium chloride)	Methanaminium, N-[4-[[4-(dimethylamino)phenyl][4-(phenylamino)-1-naphthalenyl]methylene]-2,5-cyclohexadien-1-ylidene]-N-methyl-, chloride (1:1); 4-{[4-(Dimethylamino)phenyl][4-(phenylamino)naphthalen-1-yl]methylidene}-N,N-dimethylcyclohexa-2,5-dien-1-iminium Chloride; C.I. Basic Blue 26; Methanaminium, N-[4-[[4-(dimethylamino)phenyl][4-(phenylamino)-1-naphthalenyl]methylene]-2,5-cyclohexadien-1-ylidene]-N-methyl-; chloride; Victoria Blue B; ADC Victoria Blue B; Aizen Victoria Blue BH; BTK Victoria Blue; Basazol C Blue 57; Basic Blue; 26; Basic Blue B; Basic Victoria Blue B; Basonyl Blue 640; Basonyl Blue 644; Basovict Victoria Blue; C-WR Blue 8; C.I. 44045; Calcozine Blue B; Conbasic Blue AK; Dycosbasic Victoria Blue B; Flexo Blue 630; Flexo Blue 640; Hecto Blue B; Hidaco Victoria Blue B; Libbase Victoria Blue LB; Lowacryl Blue 26; Mitsui Victoria Blue B; Ravi Victoria Blue ;Tertrophene Blue; Victoria Blue; Victoria Blue 2B; Victoria Blue B 353; Victoria Blue B chloride; Victoria Blue BA; Victoria Blue BH; Victoria Blue BN; Victoria Blue BN CI 44045; Victoria Blue BP; Victoria Blue BS; Victoria Blue BSA; Victoria Blue BX; Victoria Blue FB; Victoria Pure Blue B; Victoria Pure Blue BC	2580-56-5	219-943-6	$C_{33}H_{32}ClN_3$	Basic Blue 26 is used in inks, dyes, paints, and pigments. Among potential uses registered by companies in the Colour Index (2012)7, for products (dyestuff) containing Basic Blue 26, are in printing inks (according to Gessner and Mayer, 2000, melted in oleic or stearic acid), spirit inks, and pigments. According to Denmal et al. (2010), blue and black ball point pen inks may contain Basic Blue 26; with around 80% of blue and black ball point pen inks containing “Basic Violet 3 and its homologues”.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
C.I. Basic Violet 3	[4-[4,4'-bis(dimethylamino) benzhydrylidene]cyclohexa-2,5-dien-1-ylidene] dimethylammonium chloride; Methanaminium, N-[4-[bis[4-(dimethylamino)phenyl] methylene]-2,5-cyclohexadien-1-ylidene]-N-methyl-, chloride(1:1); 4-{Bis[4-(dimethylamino)phenyl] methylidene}-N,N-dimethylcyclohexa-2,5-dien-1-iminium; Chloride; Basic Violet 3; Crystal Violet Technical; Crystal Violet USP; Gentersal; Gentian violet; Gentian Violet B; Gentiaverm; Genticid; Gentioletten; Hecto Violet R; Hectograph Violet SR; Hexamethyl violet; Hexamethyl-p-rosaniline chloride; Hexamethylpararosaniline chloride	548-62-9	208-953-6	$C_{25}H_{30}ClN_3$	The main uses of C.I. Basic Violet 3 are as a dye in ink applied in cartridges for printers and in ball pens and as dyestuff for paper colouring. Minor dyestuff uses include carbon papers (where dyestuff is suspended in wax and applied to a thin impregnated paper), staining of dried flowers/plants (dried plants dyed by immersion in a hot water solution of the dyestuff) and as a marker (i.e. where dyestuff is used to improve the visibility of a liquid). Furthermore, C.I. Basic Violet 3 is used in microbial and clinical laboratories (for example, as stain to distinguish gram negative from gram positive bacteria) in presumably thousands of laboratories and teaching institutions around Europe.
C.I. Solvent Blue 4;(α,α-bis[4-(dimethylamino)phenyl]-4 (phenylamino)naphthalene-1-methanol);	[4-(Dimet; hylamino)-5,8-dihydronaphthalen-1-yl]{bis[4-(dimethylamino)phenyl]}methanol; Victoria Blue B; Base B Baso Blue 645; Aizen Victoria Blue B Base; Brilliant Oil Blue B Base; C.I. 44045B; Fast Oil Blue B Base; Victoria Blue B Base; -Victoria Blue BA Base; Victoria Blue BDP Base; Victoria Blue Base; Victoria Blue Base B; Victoria Blue Base FB; Waxoline Victoria Blue B	6786-83-0	229-851-8	$C_{33}H_{33}N_3$ O	The main use of the substance is in the production of inks.
C.I. Solvent Violet 8;(4,4'-bis(dimethylamino)-4''-(methylamino)trityl alcohol)	Benzenemethanol, α,α-bis[4-(dimethylamino)phenyl]-4-(methylamino)-; Bis[4-(dimethylamino)phenyl][4-(methylamino)phenyl]methanol;	561-41-1	209-218-2	$C_{24}H_{29}N_3$ O	Uses of 4,4'-bis(dimethylamino)-4''-(methylamino)trityl alcohol are as formulation and production of writing inks.
Di-n-pentyl phthalate		131-18-0	205-017-9		Undetermined
Diboron trioxide, boric oxide	Boron oxide (B_2O_3); diboron trioxide	1303-86-2	215-125-8	B_2O_3	Undetermined
Diisopentylphthalate		605-50-5	210-088-4		Undetermined
Distillates (coal tar), heavy oils		90640-86-1	292-607-4		Undetermined
Distillates (coal tar), heavy oils, pyrene fraction		91995-42-5	295-304-5		Undetermined
Distillates (coal tar), pitch, pyrene fraction		91995-52-7	295-313-4		Undetermined
Formamide		75-12-7	200-842-0	CH_3NO	Although formamide is not registered for consumer use it was measured in toys like wooden toys (Danish EPA, 2005) and foam puzzle mats as well as in fitness and exercise mats which are made of ethylene vinyl acetate (EVA).
Further Arsenic compounds					Undetermined

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
Lead(II) bis(methanesulfonate)	Methanesulfonic acid, lead(2+) salt (2:1); Methanesulfonic acid, lead(2+) salt; Lead methane sulphonate; Lead salt FP (trade name); Methanesulfonicacid,lead(2+)salt; Lead Methane Sulfate; Imethanesulfonic acid, lead(II) salt; Lead methyl sulfonate	17570-76-2	401-750-5	$C_2 H_6 O_6 Pb S_2$	Methanesulphonic acid-based plating technology is the dominant electrolytic plating process for high-speed reel-to-reel processing of electronic components.
Michler’s Base;(N,N,N’,N’-tetramethyl-4,4’-methylenedianiline)	Benzenamine, 4,4’-methylenebis[N,N-dimethyl-; 4,4’-methylenebis(N,N-dimethylaniline); Aniline, 4,4’-methylenebis[N,N-dimethyl-(6CI,7CI,8CI); Aniline, p,p’-methylenedi- (4CI); 4,4’-(Dimethylamino)diphenylmethane; 4,4’-Bis(dimethylamino)diphenylmethane; 4,4’-Bis(dimethylaminophenyl)methane; 4,4’-Methylenebis[N,N-dimethylaniline]; 4,4’-Methylenebis[N,N dimethylbenzenamine]; 4,4’-Tetramethyldiaminodiphenylmethane; Arnold’s base; Bis[4-(N,N-dimethylamino)phenyl]methane; Bis[4-(dimethylamino)phenyl]methane; Bis[p-(N,N-dimethylamino)phenyl]methane; Bis[p-(dimethylamino)phenyl]methane; Michler’s Base; Michler’s hydride; Michler’s methane; N,N,N’,N-Tetramethyl-4,4’-methylenedianiline; N,N,N’,N’-Tetramethyl-4,4’-diaminodiphenylmethane; N,N,N’,N’-Tetramethyl-p,p’-diaminodiphenylmethane; NSC 36782; NSC 4892; NSC 9029; Reduced Michler’s ketone; Tetrabase; Tetramethyldiaminodiphenylmethane; p,p’-Bis(dimethylamino)diphenylmethane; p,p’-Tetramethyldiaminodiphenylmethane	101-61-1	202-959-2	$C_{17}H_{22}N_2$	Used as chemical intermediate in the manufacture of dyes and pigments, also used as chemical intermediate in the manufacture of its hydrochloric salt. The latter is used as an analytical reagent for the determination of lead.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
Michler's Ketone;(4,4'-bis(dimethylamino) benzophenone)	Methanone, bis[4-(dimethylamino)phenyl]-; bis[4-(dimethylamino)phenyl]methanone; Benzophenone, 4,4'-bis(dimethylamino)- (6CI,8CI); 4,4'-Bis(N,N-dimethylamino)benzophenone; 4,4'-Bis(dimethylamino)benzophenone; 4,4'-Tetramethyldiaminobenzophenone; Bis(4-dimethylaminophenyl) ketone; Bis[(4-dimethylamino)phenyl]methanone; Bis[p-(N,N-dimethylamino)phenyl] ketone; DABP; Di(p-dimethylamino)benzophenone; Michler's ketone; N,N,N',N'-Tetramethyl-4,4'-diaminobenzophenone; NSC 9602; Nisso Cure MABP; S 112; S 112 (ketone); p,p'-Bis(dimethylamino)benzophenone; p,p'-Tetramethyldiaminobenzophenone	90-94-8	202-027-5	$C_{17}H_{20}N_2O$	Michler's ketone is an important intermediate in the manufacture of triphenylmethane dyes.
Perfluorooctanic acid (PFOA)	Pentadecafluorooctanoic acid	335-67-1	206-397-9	$C_8HF_{15}O_2$ (PFOA)	PFOA is used in a variety of commercial applications as refrigerants, surfactants and polymers, and as components of pharmaceuticals, fire retardants, lubricants, adhesives, paints, cosmetics, paper coatings, and insecticides.
Residues (coal tar), pitch distn.		92061-94-4	295-507-9		Undetermined

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
TGIC (1,3,5-tris(oxiranylmethyl)-1,3,5-triazine-2,4,6(1H,3H,5H)-trione)	1,3,5-Triazine-2,4,6(1H,3H,5H)-trione, 1,3,5-tris(2-oxiranylmethyl)- (a combination of α and ß isomers of TGIC); 1,3,5-Tris(oxiran-2-ylmethyl)-1,3,5-triazinane-2,4,6-trione (a combination of α and ß-isomers); triglycidyl isocyanurate; TGIC; 1,3,5-triglycidyl isocyanurate; 1,3,5-triglycidyl-s-triazinetrione; 1,3,5-tris(2,3-epoxypropyl)-s-triazine-2,4,6(1H,3H,5H)-; trione; tris(2,3-epoxypropyl)isocyanurate; 1,3,5-Triglycidyl-s-triazine-2,4,6-trione; 1,3,5-Triglycidylhexahydro-1,3,5-triazine-2,4,6-trione; 1,3,5-Triglycidylisocyanuric acid; 1,3,5-Tris(2,3-epoxypropyl) isocyanurate; 1,3,5-Tris(oxiran-2-ylmethyl)-1,3,5-triazine-2,4,6-trione; 1,3,5-Tris(oxiranylmethyl)-1,3,5-triazine-2,4,6-trione; Glycidyl isocyanurate; N,N',N''-Triglycidyl isocyanurate; NSC 269934; PTGIC; TGT; Triglycidyl isocyanurate; Tris(2,3-epoxypropyl) isocyanurate; Tris(epoxypropyl) isocyanurate; TEPIC; Araldite PT 810; TK 10622	2451-62-9	219-514-3	$C_{12}H_{15}N_3O_6$	TGIC is an epoxy compound that is used as a hardener in resins and coatings. The main use is in polyester powder coatings for metal finishing.
β-TGIC; (1,3,5-tris[(2S and 2R)-2,3-epoxypropyl]-1,3,5-triazine-2,4,6-(1H,3H,5H)-trione)	1,3,5-Triazine-2,4,6(1H,3H,5H)-trione, 1,3,5-tris[(2R)-2-oxiranylmethyl]-, rel-; reaction mass of 1,3,5-tris[(2R)-oxiran-2-ylmethyl]-1,3,5-triazinane-2,4,6-trione and 1,3,5-tris[(2S)-oxiran-2-ylmethyl]1,3,5-triazinane-2,4,6-trione; triglycidyl isocyanurate; TGIC; 1,3,5-triglycidyl isocyanurate;1,3,5-triglycidyl-s-triazinetrione; 1,3,5-tris(2,3-epoxypropyl)-s-triazine-2,4,6(1H,3H,5H)-trione; tris(2,3-epoxypropyl)isocyanurate; ß—Triglycidyl isocyanates; NSC 296964; TEPIC-H	59653-74-6	423-400-0	$C_{12}H_{15}N_3O_6$	TGIC is an epoxy compound that is used as a hardener in resins and coatings. The main use is in polyester powder coatings for metal finishing.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
Cadmium	Cd rod Cd stangen kadmium stangen	7440-43-9	231-152-8	Cd	In the environment cadmium is mainly associated with zinc but also with lead and copper. Anthropogenic sources include by-products of the metallurgy of these elements. The release of cadmium into the human environment occurs via emission from mining activities and metal industries (the smelting of other metals), the combustion of fossil fuels, the incineration of waste materials or inappropriate waste disposal, leaching from landfill sites and the use of cadmium-rich phosphate fertilizers and sewage sludge. These anthropogenic activities have contributed to the contamination by cadmium of the food chain. However, there are also areas with naturally elevated cadmium concentrations in soil. Because cadmium is easily taken up by many plants, plant-based food, in particular wheat, rice and potatoes, is a major source of exposure to cadmium. Another source of exposure is tobacco smoking, mainly because the absorption in the lungs is higher than in the gastrointestinal tract.
Dipentyl phthalate (DPP)	1,2-Benzenedicarboxylic acid, 1,2-dipentyl ester 1,2-Benzenedicarboxylic acid, dipentyl ester Amoil Amyl phthalate Di-N-Pentyl Phthalate Di-n-pentylphthalatediamyl phthalate Dipentyl 1,2-benzenedicarboxylate Dipentyl phthalate Phthalic acid, diamyl ester Phthalic acid, dipentyl ester di-n-pentylphthalate Diamyl Phthalate Dipentyl phthalate	131-18-0	205-017-9	$C_{18}H_{26}O_4$	Phthalates in general are used in a large variety of products, from enteric coatings of pharmaceutical pills and nutritional supplements to viscosity control agents, gelling agents, film formers, stabilizers, dispersants, lubricants, binders, emulsifying agents, and suspending agents. End-applications include adhesives and glues, agricultural adjuvants, building materials, personal-care products, medical devices, detergents and surfactants, packaging, children's toys, modeling clay, waxes, paints, printing inks and coatings, pharmaceuticals, food products, and textiles. Phthalates are also frequently used in soft plastic fishing lures, caulk, paint and pigments. Phthalates are used in a variety of household applications such as shower curtains, vinyl upholstery, adhesives, floor tiles, food containers and wrappers, and cleaning materials. Personal-care items containing phthalates include perfume, eye shadow, moisturizer, nail polish, liquid soap, and hair spray. They are also found in modern electronics and medical applications such as catheters and blood transfusion devices.
4-Nonylphenol, branched and linear, ethoxylated [substances with a linear and/or branched alkyl chain with a carbon number of 9 covalently bound in position 4 to phenol, ethoxylated covering UVCB- and well-defined substances, polymers and homologues, which include any of the individual isomers and/or combinations thereof]		Including 26027-38-3 7311-27-5 20427-84-3 34166-38-6 27942-27-4 14409-72-4	Including 230-770-5 243-816-4 248-743-1	$(C_2H_4O)n$ $C_{15}H_{24}O$, with n≥1 Including $(C_2H_4O)n$ $C_{15}H_{24}O$ $C_{23}H_{40}O_5$ $C_{19}H_{32}O_3$ $C_{27}H_{48}O_7$ $C_{29}H_{52}O_8$ $C_{33}H_{60}O_{10}$	4-Nonylphenol, branched and linear, ethoxylated (4-NPnEO) degrade to 4-Nonylphenol, branched and linear, either already in wastewater treatment plants, or via further degradation processes in sediments (e.g. of aquatic bodies receiving the wastewater effluents) and soils (e.g. receiving sewage sludge). Available information for 4-NPnEO indicate that 4-NPnEO contribute to the 4-NP concentration in the environment. A significant amount is either degraded to 4-NP itself in waste water treatment plants or is released to rivers in a form which may undergo further degradation to 4-NP. According to available data from sewage treatment plants, 4-NP formed from degradation of 4-NPnEO is responsible for an increase of the 4-NP load to the environment (soil, sediment and water) by 54 to 758 %. Sediment organisms may be exposed to 4-NP, which results from the degradation of 4-NPnEO, either directly, downstream of the effluent, or in the longer term after its adsorption to sediment and soil. Similar holds true for pelagic organisms such as fish which may be exposed via remobilization of 4-NP from sediment to the water body.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
Cadmium oxide	Cadmium(II)oxide Cadmium monoxide Monteponite Tienek kadmu	1306-19-0 12139-21-8 (Monteponite (CdO))	215-146-2	CdO	Cadmium is a natural element, which is present in all environmental compartments (as Cd^{++}). Cadmium emissions to the environment may therefore arise from both natural and anthropogenic or man-made sources. Estimates of the proportion of total cadmium emissions due to natural sources have ranged from 10 % to 50 %. Some of these natural emission sources include weathering and erosion of parent rocks, volcanic activity and forest fires (ICdA 2012). The overall cadmium anthropogenic exposure is then in the range of 50 to 90 %. When cadmium ions are present in the environment, they will interact with the environmental matrix and biota. The fate will depend on processes like dissolution, absorption, precipitation, complexation, inclusion into (soil) matrix, etc. In freshwater or seawater cadmium may occur in both suspended and dissolved forms and is partitioned over a number of chemical species. In the water, cadmium interacts with components of the water and influences the bioavailability. In sediment, cadmium binds to the sulphide fraction to form less soluble CdS.
Hexahydromethylphthalic anhydride [1], Hexahydro-4-methylphthalic anhydride [2], Hexahydro-1-methylphthalic anhydride [3], Hexahydro-3-methylphthalic anhydride [4] [The individual isomers [2], [3] and [4] (including their cis- and trans- stereo isomeric forms) and all possible combinations of the isomers [1] are covered by this entry]	MHHPA HN-5500 Methylhexahydrophthalic anhydride Hexahydromethylphthalic anhydride 1,3-Isobenzofuranedion, hexahydromethyl	25550-51-0 19438-60-9 48122-14-1 57110-29-9	247-094-1 243-072-0 256-356-4 260-566-1	$C_9H_{12}O_3$	MHHPA is a thermo-setting epoxy resin curing agent mainly used in electric and electron field. MHHPA is widely used for impregnating electrical coils, casting electricity components and sealing semiconductors, e.g. outdoor insulators, capacitors, light emitting diodes and digital displays. MHHPA is commonly used in a specific mixture with HHPA.
6-methoxy-m-toluidine (p-cresidine)	Benzenamine, 2-methoxy-5-methyl- Anisidine, 5-methyl- 1-Amino-2-methoxy-5-methylbenzene 2-Methoxy-5-methylaniline 2-Methoxy-5-methylbenzenamine 3-Amino-4-methoxytoluene 3-Methyl-6-methoxyaniline 4-Methyl-2-aminoanisole 5-Methyl-2-methoxyaniline 5-Methyl-o-anisidine 6-Methoxy-m-toluidine Cresidine Krezidin m-Amino-p-cresol methyl ether p-Cresidine	120-71-8	204-419-1	$C_8H_{11}NO$	P-Cresidine is used exclusively as a synthetic chemical intermediate to produce azo dyes and pigments, such as Direct Orange 72, FD&C Red 40, and Direct Violet 9. These dyes are produced commercially in the United States and are used in the textile industry. P-Cresidine was selected for bioassay by the National Cancer Institute in response to the high incidence of bladder cancer observed among dye manufacturing industry workers.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
Cyclohexane-1,2-dicarboxylic anhydride [1], cis-cyclohexane-1,2-dicarboxylic anhydride [2], trans-cyclohexane-1,2-dicarboxylic anhydride [3] [The individual cis- [2] and trans- [3] isomer substances and all possible combinations of the cis- and trans-isomers [1] are covered by this entry]	hexahydro-2-benzofuran-1,3-dione HHPA Hexahydro-isobenzofuran-1,3-dione Hexahydrophthalic anhydride Cyclohexane-1,2-dicarboxylic anhydride 1,3-Isobenzofurandione, hexahydro- 1,2-Cyclohexanedicarboxylic Anhydride 1,3-Isobenzofurandione, hexahydro-, (3aR,7aR)-rel-(3aR*,7aR*)-Hexahydro-2-benzofuran-1,3-dione trans-Cyclohexane-1,2-dicarboxylic anhydride Hexahydro-2-benzofuran-1,3-dione, trans	85-42-7 13149-00-3 14166-21-3 Including 95327-28-9 102483-85-2 109265-67-0 117276-22-9 97233-90-4 128049-67-2	201-604-9 236-086-3 238-009-9	$C_8H_{10}O_3$	The substance can be found in plant producing capacitors, fixed and isolated with epoxy resin with HHPA and MHHPA as hardeners.
Pyrochlore, antimony lead yellow	C.I. Pigment Yellow 41 Lead antimonite Antimony lead yellow Antimony yellow C.I. 77588 Lead antimonate yellow Lead antimonate yellow pyrochlore Lead antimony yellow pyrochlore Naples yellow Pigment Yellow 41 Sicocer F Orange 2208	8012-00-8	232-382-1		It is a poisonous, water-insoluble orange-yellow powder, used as a paint pigment and to stain glass and ceramics.
Henicosafluoroundecanoic acid	Henicosafluoroundecanoic acid C11-PFCA Perfluoroundecanoic acid Perfluoroundecylic acid	2058-94-8 110961-38-1	218-165-4	$C_{11}HF_{21}O_2$	Perfluoroalkyls are stable unique chemicals that they repel oil, grease, and water. They have been used in surface protection products such as carpet and clothing treatments and coatings for paper and cardboard packaging. Perfluoroalkyls have been used in fire-fighting foams.
4-Aminoazobenzene	Benzenamine, 4-(2-phenyldiazenyl)- 4-(Phenylazo)aniline Benzenamine, 4-(phenylazo)- C.I. Solvent Yellow 1 4-(Phenylazo)aniline 4-(Phenylazo)benzenamine; 4-Aminoazobenzene 4-Aminoazobenzol Aniline yellow; Brasilazina Oil Yellow G; p-(Phenylazo)aniline p-Aminoazobenzene p-Aminoazobenzol p-Aminodiphenylimide	60-09-3	200-453-6	$C_{12}H_{11}N_3$	It is used in the form of its salts as a dye and as an intermediate in manufacture of Acid Yellow, diazo dyes, and indulines.
Silicic acid, lead salt	Lead(2+) silicate	11120-22-2	234-363-3	O_3PbSi	It is used in ceramics and fireproofing fabrics. This material is used as anti-X-ray absorbers CPT, but also for the glass enamel industry. It is an important raw material and intermediate used in Organic Synthesis, Pharmaceuticals, and Agrochemicals.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
Lead titanium zirconium oxide	Lead titanium zirconium oxide ($Pb(Ti,Zr)O_3$) Lead titanium zirconium trioxide Lead titanate zirconate Lead titanate zirconate ($Pb(Ti,Zr)O_3$) Lead titanate zirconate ($PbTi0\text{-}1Zr0\text{-}1O_3$) Lead titanium zirconium oxide ($PbTi0\text{-}1Zr0\text{-}1O_3$) Lead zirconate titanate	12626-81-2	235-727-4	(Pbx Tiy Zrz) O_3	It is used in electronics (stereos, transducers, computer memory, ceramic filters, resonators, traps, piezoelectric).
Lead monoxide (lead oxide)	C.I. 77577 C.I. Pigment Yellow 46 Lead monooxide Lead oxide Lead oxide yellow Lead protoxide Lead(2+) oxide Lead(II) oxide Pigment Yellow 46 Plumbous oxide Yellow lead ochre	1317-36-8	215-267-0	OPb	It is used in lead-based industrial glass and industrial ceramics, including computer components. Other less dominating applications include the vulcanization of rubber and the production of certain pigments (e.g., litharge, massicot) and paints (yellow, exterior primers).
o-Toluidine	Benzenamine, 2-methyl- 2-Methylaniline 1-Amino-2-methylbenzene 2-Amino-1-methylbenzene 2-Aminotoluene 2-Methyl-1-aminobenzene 2-Methylbenzenamine 2-Methylphenylamine 2-Tolylamine o-Aminotoluene o-Methylaniline o-Methylbenzenamine	95-53-4	202-429-0	C_7H_9N	2-Tolidine is a commercially important aromatic amine used mainly for dye production, but also for the production of certain elastomers. 2-Tolidine is an intermediate for the production of soluble azo dyes and insoluble pigments used particularly in the textile, leather and paper industries. 2-Tolidine also widely used as a reagent or indicator in analytical, clinical and forensic chemistry, such as in the analytical determination of gold.
3-ethyl-2-methyl-2-(3-methylbutyl)-1,3-oxazolidine	Oxazolidine, 3-ethyl-2-methyl-2-(3-methylbutyl)- Zoldine MS-PLUS	143860-04-2	421-150-7	$C_{11}H_{23}NO$	It is a fast reacting, low viscosity oxazolidine-based moisture scavenger for use in urethane coatings, sealants and elastomers.
Dibutyltin dichloride (DBTC)	stannane, dibutyldichloro- Axion CS 2430 DBTCl Dibutyltindichloride (DBTC) Dibutyldichlorostannane Tin dibutyl-dichloride	683-18-1	211-670-0	$C_8H_{18}Cl_2Sn$	Dibutyltin dichloride (DBTC) is widely used as a stabilizer for polyvinylchloride plastics.
Lead bis(tetrafluoroborate)	Borate(1-), tetrafluoro-, lead(2+) (2:1) Lead(2+) ditetrafluoroborate Borate(1-), tetrafluoro-, lead(2+) Lead fluoborate ($Pb(BF_4)_2$) Lead tetrafluoroborate ($Pb(BF_4)_2$) Lead boron fluoride Lead fluoroborate Lead fluoroborate ($Pb(BF_4)_2$) Lead(II) tetrafluoroborate	13814-96-5	237-486-0	B_2F_8Pb	Fluoroboric acid is used in plating circuits; metal finishing; electropolishing of aluminium and its alloy; component of galvanic baths; organic synthesis as catalyst for alkylations and polymerisation; stabilisation of diazo salts; manufacturing of inorganic fluoroborate salts. Inorganic fluoroborate salts are used as components of fluxing and plating, as catalysts, in flame-retardant manufacture, in metal treatment; grain refining agents; as active fillers in resin bonded abrasives; in electrolytic generation of boron, preparation of glazing frits.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
Lead dinitrate	Nitric acid, lead(2+) salt (2:1) Lead(2+) dinitrate Nitric acid, lead(2+) salt Lead dinitrate; Lead nitrate; Lead nitrate ($Pb(NO_3)_2$); Lead(2+) bis(nitrate); Lead(2+) nitrate; Lead(II) dinitrate; Lead(II) nitrate; Plumbous nitrate	10099-74-8	233-245-9	N_2O_6Pb	It is used as heat stabiliser in nylon and polyesters, as a coating for photothermographic paper, and in rodenticides.
Silicic acid ($H_2Si_2O_5$), barium salt (1:1), lead-doped [with lead (Pb) content above the applicable generic concentration limit for 'toxicity for reproduction' Repr. 1A (CLP) or category 1 (DSD); the substance is a member of the group entry of lead compounds, with index number 082-001-00-6 in Regulation (EC) No 1272/2008]	Barium silicate, lead-doped	68784-75-8	272-271-5		It is used in specialty fluorescent lamps, particularly for tanning applications.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
Trilead bis(carbonate)dihydroxide	Lead carbonate hydroxide ($Pb_3(CO_3)_2(OH)_2$) Lead(2+) carbonate hydroxide (3:2:2) Lead carbonate ($2PbCO_3.Pb(OH)_2$) Lead carbonate hydroxide ($2PbCO_3.Pb(OH)_2$) Lead, bis(carbonato)dihydroxytri- Lead, bis[carbonato(2-)] dihydroxytri-Almex Basic carbonate white lead Basic lead carbonate Basic lead carbonate ($2PbCO_3.Pb(OH)_2$) Berlin White C.I. 77597 C.I. Pigment White 1 Carbonic acid, lead salt, basic Cremnitz White Dutch White Lead Enpaku Flake White Krems White Lead carbonate hydroxide ($Pb_3(OH)_2(CO_3)_2$) Lead carbonate oxide ($Pb_3O(CO_3)_2$), monohydrate Lead hydroxide carbonate [$2PbCO_3.Pb(OH)_2$] Lead subcarbonate Lead white Novade Rolite lead Silver White Slate White Stabilisator 5012NS Tricarbonatodihydroxytrilead Venetian White White Lead Wartburg White lead	1319-46-6	215-290-6	$C_2H_2O_8Pb_3$	Found naturally as the mineral hydrocerussite, it is used as pigment (exterior paints, ceramic glazes, temperature-sensitive inks, UV light reflective paints, and iridescent plastic sheets), catalyst for polyesters, curing agent for peroxides in polyethylene wire insulation, smudge-resistant film on electrically sensitive recording sheets, cool gun-propellant stabilizer, and heat stabilizer for PVC polymers. It is also used in lubricating greases, nylon-reinforced fish nets made from PVC fibers, cements, and for making putty and lead carbonate paper and parchment; no longer used as a white hiding pigment in paints.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
4,4'-methylenedi-o-toluidine	Benzenamine, 4,4'-methylenebis[2-methyl- 4,4'-Methanediylbis(2-methylaniline) Toluidine, 4,4'-methylenedi- 2,2'-Dimethyl-4,4'-methylenedianiline 3,3'-Dimethyl-4,4'-diaminodiphenylmethane 4,4'-Amino-3,3'-dimethyldiphenylmethane 4,4'-Diamino-3,3'-dimethyldiphenylmethane 4,4'-Methylenebis(o-toluidine) 4,4'-Methylenebis[2-methylaniline] Bis(3-methyl-4-aminophenyl)methane Bis(4-amino-3-methylphenyl)methane Di(3-methyl-4-aminophenyl)methane	838-88-0	212-658-8	$C_{15}H_{18}N_2$	The azo-dyes are used in textiles and leather articles, as well as tattoos.
Diethyl sulphate	Sulfuric acid, diethyl ester Ethyl sulfate (Et2SO$_4$) DES Ethyl sulfate	64-67-5	200-589-6	$C_4H_{10}O_4S$	Diethyl sulfate occurs as a colorless liquid with a peppermint odor. It is used as an alkylating agent to prepare ethyl derivatives of phenols, amines, and thiols.
Dimethyl sulphate	Sulfuric acid, dimethyl ester	77-78-1	201-058-1	$C_2H_6O_4S$	It is mainly used as a methylating agent in organic synthesis. It is best known as a reagent for the methylation of phenols, amines, and thiols.
N,N-dimethylformamide	Formamide, N,N-dimethyl- Dimethylformamide DMF N,N-Dimethylformamide Formamide, N,N-dimethyl- (8CI, 9CI) DMFA N-Formyldimethylamine N,N-Dimethylmethanamide DMF (amide)	68-12-2	200-679-5	C_3H_7NO	The primary use of dimethylformamide is as a solvent with low evaporation rate. It is used in the production of acrylic fibers and plastics. It is also used as a solvent in peptide coupling for pharmaceuticals, in the development and production of pesticides, and in the manufacture of adhesives, synthetic leathers, fibers, films, and surface coatings.
4-(1,1,3,3-tetramethylbutyl)phenol, ethoxylated [covering well-defined substances and UVCB substances, polymers and homologues]				$(C_2H_4O)n$ $C_{14}H_{22}O$	It is a nonionic surfactant, with excellent emulsifying and high detergency properties. End applications include: detergents and Industrial cleaners, dispersants, Stabilizers, Sanitizers, defoaming agents. agrochemical emulsifiers, metal working, textile processing, paper de-inking, drilling products intermediate anionic surfactants synthesis, dust control, adhesive, plastic industry, lube oil, cosmetic and pharmaceuticals.
4-Nonylphenol, branched and linear [substances with a linear and/or branched alkyl chain with a carbon number of 9 covalently bound in position 4 to phenol, covering also UVCB- and well-defined substances which include any of the individual isomers or a combination thereof]				$C_{15}H_{24}O$	Nonylphenol is a subset of the alkylphenols. Alkylphenols are subjected to ethoxylation to give alkylphenol ethoxylates, which are widely used as industrial surfactants. They are used in applications as disparate as the processing of wool and metals, as emulsifiers for emulsion polymerization, as laboratory detergents, and as pesticides.
Furan		110-00-9	203-727-3	C_4H_4O	Furan is good solvent. Its usage includes preservatives, fungicides, herbicides, disinfectants, therapeutic agents. It is also used in phenolic resins. Its additional applications include textile wetting agents, fuels, paper pulping agent, antifreezes, and floatation agents.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
Lead oxide sulfate	Lead oxide sulfate ($Pb_2O(SO_4)$) Dilead oxide sulphate Lead sulfate ($Pb_2O(SO_4)$) Lead oxide sulfate ($Pb_2(SO_4)O$) Lead sulfate (Pb_2SO_5)	12036-76-9	234-853-7	O_5Pb_2S	Lead oxide sulfate is used in plastics for wire and cables, exterior construction, water pipes, and mini blinds. It is also used in protection for pipes and profiles for cables, gas pipes, and mirror backings. It is also used in manufacturing of active paste for lead acid batteries.
Lead titanium trioxide	Lead titanium oxide ($PbTiO_3$) C.I. Pigment Yellow 47 Lead titanate Lead titanate ($PbO.TiO_2$) Lead titanate ($PbTiO_3$) Pigment Yellow 47	12060-00-3	235-038-9	O_3PbTi	It is used as coloring matter in paints. Lead titanate is one of the end members of the lead zirconate titanate ($Pb[ZrxTi1\text{-}x]O_3$ $0 \le x \le 1$, PZT) system, which is technologically one of the most important ferroelectric ceramics.
Bis(pentabromophenyl) ether (decabromodiphenyl ether; DecaBDE)	Benzene, 1,1'-oxybis[2,3,4,5,6-pentabromo-] 1,1'-Oxybis(pentabromobenzene) decabromodiphenyl ether decabromodiphenyl oxide bis(pentabromophenyl) oxide decabromo biphenyl oxide decabromo phenoxybenzene benzene 1,1' oxybis-, decabromo derivative decaBDE DBDPE DBBE DBBO DBDPO	1163-19-5 109945-70-2 145538-74-5 1201677-32-8	214-604-9	$C_{12}Br_{10}O$	DecaBDE is widely detected in the European environment, residing mainly in sediments and soils at concentrations up to several milligrams per kilogram (parts per million) on a dry weight basis. It is also present in many types of aquatic and terrestrial wildlife species (including tissues of sensitive life stages such as bird eggs) at numerous geographical locations; although tissue concentrations are often low (close to the limits of analytical detection, or below), it can attain concentrations up to a few hundred micrograms per kilogram (parts per billion) on a wet weight basis in some top predators.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
Dinoseb (6-sec-butyl-2,4-dinitrophenol)	Phenol, 2-(1-methylpropyl)-4,6-dinitro- Phenol, 2-sec-butyl-4,6-dinitro- 2,4-Dinitro-6-(1-methylpropyl)phenol 2,4-Dinitro-6-sec-butylphenol 2-(1-Methylpropyl)-4,6-dinitrophenol 2-sec-Butyl-4,6-dinitrophenol 4,6-Dinitro-2-(1-methyl-n-propyl)phenol 4,6-Dinitro-2-(2-butyl)phenol 4,6-Dinitro-2-sec-butylphenol 4,6-Dinitro-o-sec-butylphenol 6-sec-Butyl-2,4-dinitrophenol Aatox Blaartox BNP 20 BNP 30 Butaphen Butaphene Chemox P.E. DBNF Desicoil Dibutox Dibutox 20CE DN 289 DNBP DNOSBP DNSBP Dow General Dytop Hivertox Ladob Laseb Liro DNBP NSC 202753 Premerge Super Kabrol WSX 8365	88-85-7	201-861-7	$C_{10}H_{12}N_2O_5$	It is mainly used in herbicides, insecticides, and pesticides.
1,2-Diethoxyethane	Ethane, 1,2- diethoxy- ethylene glycol diethyl ether EGDEE Ethyl glyme diethyl glycol diethyl cellosolve	629-14-1	211-076-1	$C_6H_{14}O_2$	The typical use is as solvents in manufacturing.
N-methylacetamide	Acetamide, N-methyl- Monomethylacetamide Methylacetamide	79-16-3	201-182-6	C_3H_7NO	N-Methylacetamide is used as a chemical intermediate in the production of life science, agrochemicals, electronic materials and construction materials.
Tetralead trioxide sulphate	Lead oxide sulfate ($Pb_4O_3(SO_4)$)	12202-17-4	235-380-9	O_7Pb_4S	Due to good flow properties Tribasic Lead Sulphate is used for making PVC and Board products (Stabilizer of Plastic PVC Products) e.g. rubber, cables, pipes, artificial leather and other products are made using it. Tribasic Lead Sulphate is used in cable sheathing due to good electrical properties; used in production of Pipes for conveyance of gases and liquids and injection moulding.
Acetic acid, lead salt, basic	Lead(2+) hydroxide acetate (1:1:1)	51404-69-4	257-175-3	$C_2H_4O_3Pb$	Acetic acid, lead salt, basic is used as a chemical intermediate in the manufacture of chemicals and chemical products.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
[Phthalato(2-)]dioxotrilead	Lead, [1,2-benzenedicarboxylato(2-)]dioxotri- 1,2-Benzenedicarboxylic acid, lead complex	69011-06-9	273-688-5	$C_8H_4O_6Pb_3$	[Phthalato(2-)]dioxotrilead is used in plastics for wire and cables, exterior construction, water pipes, and mini blinds. It is also used in protection for pipes and profiles for cables, and gas pipes.
Tetraethyllead	Plumbane, tetraethyl- Tetraethylplumbane	78-00-2	201-075-4	$C_8H_{20}Pb$	Tetraethyllead (common name tetraethyl lead), abbreviated TEL, is an additive in performance gasoline fuels and some aviation fuels.
N-pentyl-isopentylphthalate	1,2-benzenedicarboxylic acid, 1-(3-methylbutyl) 2-pentyl ester 1,2-Benzenedicarboxylic acid, 3-methylbutyl pentyl ester	776297-69-9		$C_{18}H_{26}O_4$	Phthalates in general are used in a large variety of products, from enteric coatings of pharmaceutical pills and nutritional supplements to viscosity control agents, gelling agents, film formers, stabilizers, dispersants, lubricants, binders, emulsifying agents, and suspending agents. End-applications include adhesives and glues, agricultural adjuvants, building materials, personal-care products, medical devices, detergents and surfactants, packaging, children's toys, modeling clay, waxes, paints, printing inks and coatings, pharmaceuticals, food products, and textiles. Phthalates are also frequently used in soft plastic fishing lures, caulk, paint and pigments. Phthalates are used in a variety of household applications such as shower curtains, vinyl upholstery, adhesives, floor tiles, food containers and wrappers, and cleaning materials. Personal-care items containing phthalates include perfume, eye shadow, moisturizer, nail polish, liquid soap, and hair spray. They are also found in modern electronics and medical applications such as catheters and blood transfusion devices.
Pentalead tetraoxide sulphate	Lead oxide sulfate ($Pb_5O_4(SO_4)$) Lead oxide sulfate ($4PbO.PbSO_4$) Tetrabasic lead sulfate	12065-90-6	235-067-7	O_8Pb_5S	It is used in plastics for exterior construction; plastics use for water pipes; plastics for mini-blinds; protection pipes and profiles for cables; gas pipes; battery plates; mirror backing.
Heptacosafluorotetradecanoic acid	Tetradecanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,14-heptacosafluoro- C14-PFCA Perfluoromyristic acid Perfluorotetradecanecarboxylic acid Perfluorotetradecanoic acid	376-06-7	206-803-4	$C_{14}HF_{27}O_2$	Perfluoroalkyls are stable unique chemicals that they repel oil, grease, and water. They have been used in surface protection products such as carpet and clothing treatments and coatings for paper and cardboard packaging. Perfluoroalkyls have been used in fire-fighting foams.
Tricosafluorododecanoic acid	Dodecanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,12-tricosafluoro- Dodecanoic acid, tricosafluoro- C12-PFCA Perfluorododecanoic acid Perfluorolauric acid	307-55-1	206-203-2	$C_{12}HF_{23}O_2$	Perfluoroalkyls are stable unique chemicals that they repel oil, grease, and water. They have been used in surface protection products such as carpet and clothing treatments and coatings for paper and cardboard packaging. Perfluoroalkyls have been used in fire-fighting foams.
1-bromopropane (n-propyl bromide)	Propane, 1-bromo- 1-Propyl bromide Propyl bromide n-Propyl bromide	106-94-5	203-445-0	C_3H_7Br	It is a colorless liquid that is used as a solvent. It is used for the cleaning of metal surfaces, removal of soldering residues from electronic circuit boards. It is also a solvent for adhesives. It has been deployed as a replacement for perchloroethylene as a dry cleaning solvent.
Dioxobis(stearato)trilead	Lead, bis(octadecanoato)dioxotri- Octadecanoic acid, lead complex	12578-12-0	235-702-8	$C_{36}H_{70}O_6Pb_3$	Dioxobis(stearato)trilead is used as a stabilizer in plastics for wire and cables, exterior construction, water pipes, and mini blinds. It is also used in protection for pipes and profiles for cables, and gas pipes.
Pentacosafluorotridecanoic acid	Tridecanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,13-pentacosafluoro- C13-PFCA Tridecanoic acid, pentacosafluoro- Perfluorotridecanoic acid	72629-94-8	276-745-2	$C_{13}HF_{25}O_2$	Perfluoroalkyls are stable unique chemicals that they repel oil, grease, and water. They have been used in surface protection products such as carpet and clothing treatments and coatings for paper and cardboard packaging. Perfluoroalkyls have been used in fire-fighting foams.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
Methoxyacetic acid	Acetic acid, 2-methoxy- 2-Methoxyacetic acid	625-45-6	210-894-6	$C_3H_6O_3$	Methoxyacetic acid is the primary active metabolite of the industrial chemical ethylene glycol monomethyl ether, a component of paints, inks, varnishes and anti-icing additive in jet fuels.
Methyloxirane (Propylene oxide)	Oxirane, 2-methyl- 2-Methyloxirane Oxirane, methyl- Oxypropylene Propane, 1,2-epoxy- Propylene oxide (±)-1,2-Epoxypropane (±)-2-Methyloxirane (±)-Epoxypropane (±)-Methyloxirane (±)-Propylene oxide 1,2-Epoxypropane 1,2-Propylene oxide 2,3-Epoxypropane 2-Methyloxirane DL-1,2-Epoxypropane Epihydrin Epoxypropane Methyloxacyclopropane Methyloxirane Propene oxide Propozone Propylene epoxide dl-Propylene oxide	75-56-9	200-879-2	C_3H_6O	The United States Food and Drug Administration has approved the use of propylene oxide to pasteurize raw almonds beginning on September 1, 2007 in response to two incidents of contamination by *Salmonella* in commercial orchards, one incident occurring in Canada, and one incident in the United States. Pistachio nuts can also be subjected to propylene oxide to control *Salmonella*. It is a method approved by the FDA. Propylene oxide is commonly used in the preparation of biological samples for electron microscopy, to remove residual ethanol previously used for dehydration.
Trilead dioxide phosphonate	Lead oxide phosphonate ($Pb_3O_2(HPO_3)$) Lead oxide phosphite Dibasic lead phosphite	12141-20-7	235-252-2	HO_5PPb_3	It is used as stabilizer in plastics, in particular PVC for wire and cables, exterior construction, water pipes, and mini blinds. It is also used in protection for pipes and profiles for cables, and gas pipes.
o-aminoazotoluene	4-o-tolylazo-o-toluidine Benzenamine, 2-methyl-4-[2-(2-methylphenyl)diazenyl]- 2-Methyl-4-[(2-methylphenyl)diazenyl]aniline Benzenamine, 2-methyl-4-[(2-methylphenyl)azo]- C.I. Solvent Yellow 3 o-Toluidine, 4-o-tolylazo- 2,3'-Dimethyl-4'-aminoazobenzene 2-Aminoazotoluene 2-Methyl-4-[(2-methylphenyl)diazenyl]amine 2-Methyl-4-[(o-tolyl)azo]aniline 2',3-Dimethyl-4-aminoazobenzene 4-(o-Tolylazo)-otoluidine 4-Amino-2',3-dimethylazobenzene	97-56-3	202-591-2	$C_{14}H_{15}N_3$	*O-Aminoazotoluene* is used to color oils, fats, and waxes. It is also used as a chemical intermediate for the production of the dyes C.I. solvent red 24 and C.I. acid red 115.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
4-methyl-m-phenylenediamine (toluene-2,4-diamine)	1,3-Benzenediamine, 4-methyl- 4-Methylbenzene-1,3-diamine Toluene-2,4-diamine 1,3-Diamino-4-methylbenzene 2,4-Diamino-1-methylbenzene 2,4-Diaminotoluene 2,4-Tolylenediamine 3-Amino-4-methylaniline 4-Methyl-1,3-benzendiamine 4-Methyl-1,3-benzenediamine 4-Methyl-1,3-phenylenediamine 4-Methyl-m-phenylenediamine C.I. Oxidation Base 35 TDA TDA (diamine) m-Toluenediamine m-Tolylenediamine	95-80-7	202-453-1	$C_7H_{10}N_2$	Toluene-2,4-diamine is used primarily in the production of toluene diisocyanate, which is used in the production of polyurethane. It is used as an intermediate in the synthesis of dyes and heterocyclic compounds. Toluene-2,4-diamine is also used to prepare direct oxidation black, a dye for hair and furs, and to prepare dyes for leather. Other uses of toluene-2,4-diamine include enhancement of thermal stability in polyamides, fatigue resistance and dyeability in fibers, and the preparation of impact-resistant resins, polyimides with superior wire-coating properties, benzimidazolethiols (antioxidants), hydraulic fluids, urethane foams, fungicide stabilizers, and sensitizers for explosives.
Biphenyl-4-ylamine	[1,1'-Biphenyl]-4-amine Biphenyl-4-amine 4-Biphenylamine (1,1'-Biphenyl-4-yl)amine 4-Amino-1,1'-biphenyl 4-Aminobiphenyl 4-Aminodiphenyl 4-Phenylaniline 4-Phenylbenzenamine Xenylamine p-Aminobiphenyl p-Aminodiphenyl p-Biphenylamine p-Phenylaniline p-Xenylamine	92-67-1	202-177-1	$C_{12}H_{11}N$	It is used to prevent the growth of moulds. It is directly used in the preservation of citrus fruits as a fungistat in transportation containers. It is a raw material for polychlorinated diphenyls. is used as an intermediate for the production of a wide range of organic compounds (e.g. emulsifiers, optical brighteners, crop protection products, plastics), as a heat transfer medium alone or with diphenyl ether in heating fluids, as a dyestuff carrier for textiles and copying paper and as a solvent in pharmaceutical production. Aminodiphenyls are used as rubber antioxidants and intermediates for the synthesis of organic compounds (azo dyes and pharmaceuticals).
Fatty acids, C16-18, lead salts	C16-18-(even numbered)-fatty acids, lead salts	91031-62-8	292-966-7	Pb_2+[$H_3C(CH_2)$14-16C(O)O-]2	It is used in the manufacture of polymer preparations and compounds and in the production of stabilizers, especially PVC.
Orange lead (lead tetroxide)	Lead oxide (Pb_3O_4)	1314-41-6	215-235-6	O_4Pb_3	It is used as pigment for primer paints for iron objects and may be used in the manufacture of glass, especially lead glass. It is often used in paint, radiation protective agents including fluorescent light, vacuum tube, and cathode-ray tube, etc., optical glass, general glass, ceramic, enamel, storage battery, pigment, rubber, medicine, synthetic resin, electronic material.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
4,4’-oxydianiline and its salts	Benzenamine, 4,4’-oxybis- Aniline, 4,4’-oxydi- 1-Amino-4-(4-aminophenoxy)benzene 4,4’-Diaminobiphenyl ether 4,4’-Diaminobiphenyl oxide 4,4’-Diaminodiphenyl ether 4,4’-Diaminodiphenyl oxide 4,4’-Diaminophenyl ether 4,4’-Oxybis(aniline) 4,4’-Oxybis[benzenamine] 4,4’-Oxydianiline 4,4’-Oxydiphenylamine 4-(4-Aminophenoxy)phenylamine 4-Aminophenyl ether Bis(4-aminophenyl) ether Bis(p-aminophenyl) ether Di(4-aminophenyl) ether Oxybis(4-aminobenzene) Oxydi-p-phenylenediamine Oxydianiline p,p’-Diaminodiphenyl ether p,p’-Oxybis[aniline] p,p’-Oxydianiline p-Aminophenyl ether	101-80-4	202-977-0	$C_{12}H_{12}N_2O$	Its primary use is in the manufacture of polyimide and poly(ester-imide) resins. Other applications include the manufacture of heat-resistant wire enamels and coatings, as an intermediates in the manufacture of epoxy resins and adhesives, and in the production of aromatic polyether imides.
Diazene-1,2-dicarboxamide (C,C’-azodi(formamide))	1,2-Diazenedicarboxamide Azobiscarboxamide Azodicarbonamide (ADCA, ADA) Azobiscarbonamide Azodicarboxylic acid diamide 1,1’-Azobis(formamide) 1,1’-Azobiscarbamide Diazenedicarboxamide 1,1’-Azobisformamide	123-77-3	204-650-8	$C_2H_4N_4O_2$	It is widely used in high density PVC, PE, PP pipe, NBR and PVC insulation, automobile parts. It is especially valuable to leather foaming agent of foam and wallpaper foam, PE molding foam, PVC molding foam, extrusion and coating, and rubber and extrusion molding foam.
Sulfurous acid, lead salt, dibasic	Lead(2+) hydroxide sulfite (2:2:1) Dibasic lead sulfite	62229-08-7	263-467-1	$H_2O_5Pb_2S$	It is used in plastics for wire and cables, exterior construction, water pipes, mini-blinds. It may also be used in protection pipes and projects for cable and gas pipes.
Lead cyanamidate	Cyanamide, lead(2+) salt (1:1) Lead(2+) cyanamide	20837-86-9	244-073-9	CH_2N_2Pb	It is used as a pigment in rust protective paint and as a corrosion inhibitor.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
Cadmium sulphide	Cadmium sulfide; C. P. Golden Yellow 55; Cadmium Golden 366; Cadmium Lemon Yellow 527; Cadmium Primrose 819; Cadmium Yellow 000; Cadmium Yellow 10G conc; Cadmium Yellow 892; Cadmium Yellow Conc. Deep; Cadmium Yellow Conc. Golden; Cadmium Yellow Conc. Lemon; Cadmium Yellow Conc. Primrose; Cadmium Yellow OZ dark; Cadmium Yellow Primrose 47-4100; Cadmium Yellow ST; Cadmium monosulfide; Cadmium sulfide yellow; Cadmium yellow; Cadmopur Golden Yellow N; Cadmopur Yellow; Capsebon; Ferro Lemon Yellow; Ferro Orange Yellow; Ferro Yellow; GSK; PC 108; Primrose 1466; Reckitt Yellow 12; Sicotherm Yellow L 1001	1306-23-6	215-147-8	CdS	It is used as a high performance pigment and semiconducting substance in photoelectronics components like solar panels.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
Disodium 3,3'-[[1,1'-biphenyl]-4,4'-diylbis(azo)]bis(4-aminonaphthalene-1-sulphonate) (C.I. Direct Red 28)	1-Naphthalenesulfonic acid, 3,3'-[[1,1'-biphenyl]-4,4'-diylbis(2,1-diazenediyl)]bis[4-amino-, sodium salt (1:2); Disodium 4-amino-3-[(4-{4-[(1-amino-4-sulfonatonaphthalen-2-yl)diazenyl]phenyl}phenyl)diazenyl] naphthalene-1-sulfonate; AI3-63036 Atlantic Congo Red Atul Congo Red Azocard Red Congo Benzo Congo Red Brasilamina congo 4B C.I. 22120 C.I. Direct Red 28 C.I. Direct Red 28, disodium salt Cerven kongo Cerven prima 28 Congazone sodium Congo Red Congo Red 4B Congo Red 4BX Congo Red CR Congo Red H Congo Red ICI Congo Red L Congo Red M Congo Red N Congo Red R Congo Red W Congo Red WS Cotton Red 4BC Cotton Red 5B Cotton Red L Diacotton Congo Red Direct Red 28 Direct Red C Direct Red DC-CF Direct Red K Erie Congo 4B Haemomedical Haemonorm Hemorrhagyl Hispamin congo 4B Kayaku Congo Red Mitsui Congo Red NSC 56651 NSC 7232 Peeramine Congo Red Red K Sodium diphenyldiazo-bis(alphanaphthylaminesulfonate) Solucongo Sugai Congo Red Tertrodirect Red C Trisulfon Congo Red UNII-3U05FHG59S Vondacel Red CL	573-58-0	209-358-4	$C_{32}H_{24}N_6O_6S_2.2Na$	It is used as pigment in textile and other dyes. Used as a pH indicator, as an addition to culture media and for biological staining as well as a gelling agent for poly (vinyl alcohol) in applications where coloured films or coatings can be tolerated.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
Disodium 4-amino-3-[[4'-[(2,4-diaminophenyl)azo][1,1'-biphenyl]-4-yl]azo] -5-hydroxy-6-(phenylazo)naphthalene-2,7-disulphonate (C.I. Direct Black 38)	2,7-Naphthalenedisulfonic acid, 4-amino-3-[2-[4'-[2-(2,4-diaminophenyl)diazenyl][1,1'-biphenyl]-4-yl]diazenyl]-5-hydroxy-6-(2-phenyldiazenyl)-, sodium salt (1:2); Ahco Direct Black GX; Airedale Black ED; Aizen Direct Deep Black EH; Aizen Direct Deep Black GH; Aizen Direct Deep Black RH; Amanil Black GL; Amanil Black WD; Apomine Black GX; Atlantic Black BD; Atlantic Black C; Atlantic Black E; Atlantic Black EA; Atlantic Black GAC; Atlantic Black GG; Atlantic Black GXCW; Atlantic Black GXOO; Atlantic Black SD; Atul Direct Black E; Azine Deep Black EW; Azocard Black EW; Azomine Black EWO; Belamine Black GX; Bencidal Black E; Benzanil Black E; Benzo Deep Black E; BenzoLeather Black E; Benzoform Black BCN-CF; Black 2EMBL; Black 4EMBL; Brasilamina Black GN; Brilliant Chrome Leather Black H; C.I. 30235; C.I. Direct Black 38, disodium salt; Calcomine; Black; Calcomine Black EXL; Carbide Black E; Chloramine Black C; Chloramine Black EC; Chloramine Black ERT; Chloramine Black EX; Chloramine Black EXR; Chloramine Black XO; Chloramine Carbon Black S; Chloramine Carbon Black SJ; Chloramine Carbon Black SN; Chlorazol Black E; Chlorazol Black EA; Chlorazol Black EN; Chlorazol Burl Black E; Chlorazol Leather Black ENP; Chlorazol Silk Black G; Chlorozol Black E; Chrome Leather Black E; Chrome Leather Black EC; Chrome Leather Black EM; Chrome Leather Black G; Chrome Leather Brilliant Black ER; Coir Deep Black; Columbia Black EP;	1937-37-7	217-710-3	$C_{34}H_{25}N_9Na_2O_7S_2$	Dye cellulose, wool, silk, bast, and hog's hair; print cellulose, wool and silk; dye leather, plastics, vegetable-ivory buttons and wood flour used as a resin filler; stain wool, silk, acetate, nylon, wood and biological materials, and produce aqueous inks. It has reportedly been used in hair dyes.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
	Coranil Direct Black F; Diacotton Deep Black; Diacotton Deep Black RX; Diamine Deep Black EC; Diamine DirectBlack E; Diaphtamine Black V; Diazine Black E; Diazine Direct Black E; Diazine Direct Black G; Diazol Black 2V; Diphenyl Deep Black G; Direct Black A; Direct Black BRN; Direct Black CX; Direct Black CXR; Direct Black E; Direct Black EW; Direct Black EX; Direct Black FR; Direct Black GAC; Direct Black GW; Direct Black GX; Direct Black GXR; Direct Black JET; Direct Black Meta; Direct Black methyl; Direct Black N; Direct Black RX; Direct Black SD; Direct Black WS; Direct Black Z; Direct Black ZSh; Direct Deep Black E; Direct Deep Black E Extra; Direct Deep Black E-EX; Direct Deep Black EA-CF; Direct Deep Black EAC; Direct Deep Black EW; Direct Deep Black EX; Direct Deep Black WX; Enianil Black CN; Erie Black B; Erie Black BF; Erie Black GAC; Erie Black GXOO; Erie Black JET; Erie Black NUG; Erie Black RXOO; Erie Brilliant Black S; Erie Fibre Black VP; Fenamin Black E; Fibre Black VF; Fixanol Black E; Formaline Black C; Formic Black C; Formic Black CW; Formic Black EA; Formic Black MTG; Formic Black TG; Hispamin Black EF; Interchem Direct Black Z; Kayaku Direct Deep Black EX; Kayaku Direct Deep Black GX; Kayaku Direct Deep Black S; Kayaku Direct Leather Black EX; Kayaku Direct Special Black AAX; Lurazol Black BA; Meta Black; Mitsui Direct Black EX; Mitsui Direct Black GX;				

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
	Nippon Deep Black; Nippon Deep Black GX; Paper Black BA; Paper Black T; Paper Deep Black C; Paramine Black B; Paramine Black E; Peeramine Black E; Peeramine Black GXOO; Phenamine Black BCNCF; Phenamine Black CL; Phenamine Black E; Phenamine Black E 200; Pheno Black EP; Pheno Black SGN; Pontamine Black E; Pontamine Black; EBN; Sandopel Black EX; Seristan Black B; Telon Fast Black E; Tertrodirect Black E; Tertrodirect Black EFD; Tetrazo Deep Black G; Union Black EM; Vondacel Black N				
Dihexyl phthalate	1,2-Benzenedicarboxylic acid, dihexyl ester	84-75-3	201-559-5	$C_{20}H_{30}O_4$	It is used as plasticizer in plastics and coatings.
Imidazolidine-2-thione (2-imidazoline-2-thiol)	2-imidazolidinethione; imidazolidine-2-thione; ethylene thiourea; ETU	96-45-7	202-506-9	$C_3H_6N_2S$	It is widely used as vulcanization agent in neoprene and polyacrylate rubber articles.
Lead di(acetate)	Acetic acid, lead(2+) salt (2:1); Lead(2+) diacetate; Acetic acid, lead(2++) salt; Acetic acid, lead(2+) salt; Lead acetate; Plomo(II) Acetato 3-hidrato; Lead(2+) diacetate; Lead(II) diethanoate-3-water	301-04-2	206-104-4	$C_4H_6O_4Pb$	It is used as intermediate for other lead compounds or as chemicals.
Trixylyl phosphate	Phenol, dimethyl-, 1,1',1''-phosphate; Reaction product of phosphorous oxytrichloric acid and xylenols containing tris (dimethylphenyl and/or ethylphenyl) phosphates Trixylenylphosphate Dimethylphenol phosphate (3:1) Phenol, dimethyl-, phosphate (3:1) Phosphoric acid, trixylyl ester Xylenol, phosphate (3:1) Tri-dimethyl phenyl phosphate Tris (dimethylphenol) phosphate Kronitex TXP (Trade name) Phosflex TXP (Trade name)	25155-23-1	246-677-8	$C_{24}H_{27}O_4P$	It is used as industrial chemicals such as flame retardant, additive in metal working fluid, hydraulic fluid, or other lubricants, or as plasticizer in polymers.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
1,2-Benzenedicarboxylic acid, dihexyl ester, branched and linear	1,2-Benzenedicarboxylic acid, 1,2-dihexyl ester, branched and linear; Dihexylphthalate, branched and linear; Phthalic acid, dihexyl ester, branched and linear; Dihexylphthalate, mixed isomers; Phthalic anhydride, reaction products with hexanol, branched and linear; Esterification of phthalic anhydride and hexanol, branched and linear	68515-50-4	271-093-5	$C_{20}H_{30}O_4$	It is used as plasticiser in PVC and in sealants, coatings and potentially printing inks.
Sodium perborate; perboric acid, sodium salt	Perboric acid ($HBO(O_2)$), sodium salt, monohydrate; Perboric acid ($H_3BO_2(O_2)$), monosodium salt, trihydrate; Perboric acid ($HBO(O_2)$), sodium salt, hydrate (1:1:4); Perboric acid, sodium salt, tetrahydrate; Borate(2-), tetrahydroxybis[μ-(peroxy-κO1:κO2)]di-, sodium (1:2); molecular formula $B_2H_4O_8.2Na$); Borate(2-), tetrahydroxybis[μ-(peroxy-κO1:κO2)]di-, sodium, hydrate (1:2:6); molecular formula $B_2H_4O_8.6H_2O.2Na$); PBS1; PBSM; Sodium perborate monohydrate; Sodium perborate tetrahydrate; PBS4; PBST	15120-21-5 11138-47-9 10332-33-9 13517-20-9 10486-00-7 37244-98-7 90568-23-3 125022-34-6	239-172-9 234-390-0	$BHO_3.Na$ $BH_3O_4.Nac$ $BHO_3.H_2O.Na$ $BH_3O_4.3H_2O.Na$ $BHO_3.4H_2O.Na$	It is used in detergents, cleaning products, laundry bleaches, or tooth bleaching products.
Sodium peroxometaborate	Perboric acid ($HBO(O_2)$), sodium salt (1:1); Perboric acid ($HBO(O_2)$), sodium salt (9Cl); Perboric acid (HBO_3), sodium salt (8Cl); Sodium perborate ($NaBO_3$) (6Cl,7Cl); Perborn; Sodium borate ($NaBO_3$); Sodium perborate; Sodium peroxoborate	7632-04-4 12040-72-1 10332-33-9 13517-20-9 10486-00-7 37244-98-7	231-556-4	$BHO_3.Na$ * * The molecular and structural information provided here is theoretical and the information in the literature indicates that the substance is not well-defined.	It is mainly used as bleaching agent in laundry detergents and machine dishwashing products.
Cadmium chloride	Cadmium dichloride; Cadmium dichloride; Cadmium(II) chloride; Dichlorocadmium	10108-64-2 7790-78-5	233-296-7	$CdCl_2$	Cadmium chloride is used for the preparation of cadmium sulfide, used as "Cadmium Yellow", a brilliant-yellow stable inorganic pigment.
Cadmium sulphate	Cadmium sulfate hydrate Sulfuric acid, cadmium salt (1:1), hydrate (3:8) Cadmium(2+) sulfate hydrate cadmium(2+) trisulfate octahydrate	10124-36-4 31119-53-6 7790-84-3, Sulfuric acid, cadmium salt (1:1), hydrate (3:8) (CLP database). 15244-3-6, Sulphuric acid, cadmium salt (1:1), unspecified hydration rate	233-331-6	$Cd.H_2O_4S$	Cadmium sulfate is used widely for the electroplating of cadmium in electronic circuits. It is also a precursor to cadmium-based pigment such as cadmium sulfide. It is also used for electrolyte in a Weston standard cell as well as a pigment in fluorescent screens.
Cadmium fluoride	Cadmium difluoride Cadmium(2+) fluoride Cadmium(II) fluoride Cadmium(ii) fluoride	7790-79-6	232-222-0	CdF_2	Cadmium fluoride is a cadmium source used in oxygen sensitive applications, such as production of metallic alloys. Extremely low concentration (ppm) level are used in specific medical treatments.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
2-(2H-benzotriazol-2-yl)-4,6-ditertpentylphenol (UV-328)	Phenol, 2-(2H-benzotriazol-2-yl)-4,6-bis(1,1-dimethylpropyl)- 2-(2H-benzotriazol-2-yl)-4,6-bis(2-methylbutan-2-yl)phenol UV-328 Phenol, 2-(2H-benzotriazol-2-yl)-4,6-di-tert-pentyl- (7CI,8CI) 2-(2-Hydroxy-3,5-di-tert-amylphenyl)-2H-benzotriazole 2-(2-Hydroxy-3,5-di-tert-amylphenyl)benzotriazole 2-(2-Hydroxy-3,5-di-tert-pentylphenyl)benzotriazole 2-(2H-Benzotriazol-2-yl)-4,6-bis(1,1-dimethylpropyl)phenol 2-(2H-Benzotriazol-2-yl)-4,6-di-tert-pentylphenol 2-(2’-Hydroxy-3’,5’-di-tert-amylphenyl)benzotriazole 2-(3,5-Di-tert-amyl-2-hydroxyphenyl)-2Hbenzotriazole 2-(3,5-Di-tert-amyl-2-hydroxyphenyl)benzotriazole 2-(3,5-Di-tert-pentyl-2-hydroxyphenyl)-2Hbenzotriazole 2-(3,5-Di-tert-pentyl-2-hydroxyphenyl)benzotriazole 2-(3’,5’-Di-tert-amyl-2’-hydroxyphenyl)benzotriazole Chisorb 328 Cyasorb UV 2337 Eversorb 74 Kemisorb 74 Lowilite 28 Seesorb 704 Sumisorb 350 Tin 328 Tinuvin 328 UV 2337 UV-328 UV 74 Viosorb 591	25973-55-1	247-384-8	$C_{22}H_{29}N_3O$	It is a highly effective light stablizer for a variety of plastics and other organic substrates.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
reaction mass of 2-ethylhexyl 10-ethyl-4,4-dioctyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate and 2-ethylhexyl 10-ethyl-4-[[2-[(2-ethylhexyl)oxy]-2-oxoethyl]thio]-4-octyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate (reaction mass of DOTE and MOTE)	DOTE DOT(EHMA)2 Di-octyltin bis(2-ethylhexyl mercaptoacetate) Dioctyltin bis(2-ethylhexyl) mercaptoacetate Advastab 17MOL 17MOK Advastab 17 MOK Acetic acid, 2,2'((dioctylstannylene)-bis(thio))bis-, di-2-ethylhexyl ester Bis(2-ethylhexyl thioglycolato)dioctyltin Bis(2-ethylhexyl) ((dioctylstannylene)dithio)diacetate, Bis(carboxymethylthio)dioctylstannylene, di(2-ethylhexyl) ester Di-n-octyltin bis(2-ethylhexyl mercaptoacetate) Di-noctyltin-dithioglycolic acid 2-ethylhexyl ester Dioctyltin bis(2-ethylhexyl thioglycolate) Dioctyltin bis(2-ethylhexylmercaptoacetate) MOTE MO(EHMA)3 Mono-octyltin tris(2-ethylhexyl mercaptoacetate) Octyltin tris(2-ethylhexyl mercaptoacetate) Acetic acid, ((octylstannylidyne)trithio)tri-tris(2-ethylhexyl) ester Acetic acid, ((octylstannylidyne)trithio)tris-,tris(2-ethylhexyl) ester Mono-n-octyl-tin-tris-(2-ethylhexylmercaptoacetate) Octyltintris(2-ethylhexyl mercaptoacetate) Octyltris(2-ethylhexyloxycarbonylmethylthio)stannane Tin, octyl-tris(isooctylthio glycollate) Acetic acid, ((octylstannylidyne)trithio)tris-,tris(2-ethylhexyl) ester			$C_{36}H_{72}O_4S_2Sn$ (DOTE) $C_{38}H_{74}O_6S_3Sn$ (MOTE)	It is used as a stabilizer in polymers and medicine pills.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
2-ethylhexyl 10-ethyl-4,4-dioctyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate (DOTE)	8-Oxa-3,5-dithia-4-stannatetradecanoic acid, 10-ethyl-4,4-dioctyl-7-oxo-, 2-ethylhexyl ester DOTE DOT(EHMA)2 Dioctyltin bis(2-ethylhexyl mercaptoacetate) Dioctyltin bis(2-ethylhexyl) mercaptoacetate Advastab 17MOL 17MOK Advastab 17 MOK Acetic acid, 2,2'((dioctylstannylene)-bis(thio))bis-, di-2-ethylhexyl ester Bis(2-ethylhexyl thioglycolato)dioctyltin Bis(2-ethylhexyl)((dioctylstannylene)dithio)diacetate Bis(carboxymethylthio)dioctylstannylene, di(2-ethylhexyl) ester Di-n-octyltin bis(2-ethylhexyl mercaptoacetate) Di-noctyltin-dithioglycolic acid 2-ethylhexyl ester Dioctyltin bis(2-ethylhexyl thioglycolate) Dioctyltin bis(2-ethylhexylmercaptoacetate)	15571-58-1	239-622-4	$C_{36}H_{72}O_4S_2Sn$	It is used as a stabilizer in polymers and medicine pills.
2-benzotriazol-2-yl-4,6-di-tert-butylphenol (UV-320)	Phenol, 2-(2H-benzotriazol-2-yl)-4,6-bis(1,1-dimethylethyl)- 2-(2H-benzotriazol-2-yl)-4,6-di-tert-butylphenol UV 320 2-(2'-Hydroxy-3',5'-di-t-butylphenyl)benzotriazole 2-(2'-Hydroxy-3',5'-di-tert-butylphenyl)benzotriazole 2-(2'-Hydroxy-3'5-di-tert-butylphenyl) benzotriazole 2-(2-Benzotriazolyl)-4,6-di-tert-butylphenol 2-(2-Hydroxy-3,5-di-tert-butylphenyl)-2Hbenzotriazole 2-(2-Hydroxy-3,5-di-tert-butylphenyl)benzotriazole 2-(3',5'-Di-tert-butyl-2'-hydroxyphenyl)benzotriazole	3846-71-7	223-346-6	$C_{20}H_{25}N_3O$	It is a highly effective light stabilizer for a variety of plastics and other organic substrates.
1,3-propanesultone	1,2-oxathiolane 2,2-dioxide; 1,3-Propane sultone; 1,3-Propanesultone; 1,3-Propansulton; Propane Sultone; 1,2-oxathiolane-2,2-dione	1120-71-4	214-317-9	$C_3H_6O_3S$	This substance is used in the scientific research and development. It is also used for the manufacture of: chemicals and electrical, electronic and optical equipment. This substance can be found in complex articles, with no release intended, such as electrical batteries and accumulators.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
2,4-di-tert-butyl-6-(5-chlorobenzotriazol-2-yl)phenol (UV-327)	phenol, 2-(5-chloro-2Hbenzotriazol-2-yl)-4,6-bis(1,1-dimethylethyl)-; phenol, 2,4-di-tert-butyl-6-(5-chloro-2H-benzotriazol-2-yl)-; 2,4-di-tert-butyl-6-(5-chloro-2H-benzotriazol-2-yl)phenol; 2,4-di-tert-butyl-6-(5-chlorobenzotriazol-2-yl)phenol; 2-(2-hydroxy-3,5-di-tert-butylphenyl)-5-chloro-2H-benzotriazole; 2-(2-hydroxy-3,5-di-tertbutylphenyl)-5-chlorobenzotriazole; 2-(2'-hydroxy-3',5'-di-tertbutylphenyl)-5-chlorobenzotriazole; 2-(3,5-di-tert-butyl-2-hydroxyphenyl)-5-chloro-2H-benzotriazole; 2-(3,5-ditert-butyl-2-hydroxyphenyl)-5-chlorobenzotriazole; 2-(3',5'-di-tert-butyl-2'-hydroxyphenyl)-5-chlorobenzotriazole; 5-chloro-2-(2-hydroxy-3,5-ditert-butylphenyl)-2Hbenzotriazole; 5-chloro-2-(2-hydroxy-3,5-di-tertbutylphenyl) benzotriazole; 5-chloro-2-(3,5-di-tert-butyl-2-hydroxyphenyl)-2Hbenzotriazole; 5-chloro-2-(3,5-di-tert-butyl-2-hydroxyphenyl)benzotriazole; 5-chloro-2-(3',5'-di-tertbutyl- 2'-hydroxyphenyl)benzotriazole; ADK Stab LA 34; Antioxidant 327; Cyasorb UV 5357; Eversorb 75; Hisorb 327; Kemisorb 72; LA 34; Lowilite 27; Mark LA 34; Seesorb 702; TNV 327; Tinuvin 327; UV 2; UV 2 (UV stabilizer); UV 327; UV-Chek AM 607; Viosorb 580; 2-(5-chloro-2Hbenzotriazol-2-yl)-4,6-bis(2-methyl-2-propanyl)phenol	3864-99-1	223-383-8	$C_{20}H_{24}ClN_3O$	It is used as UV filters.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
2-(2H-benzotriazol-2-yl)-4-(tert-butyl)-6-(secbutyl) phenol (UV-350)	phenol, 2-(2H-benzotriazol- 2-yl)-4-(1,1-dimethylethyl)-6-(1-methylpropyl)-; 2-(2Hbenzotriazol-2-yl)-6-secbutyl-4-tert-butylphenol; UV 350; Reaction mass of 2-(2Hbenzotriazol-2-yl)-6-[(2R)-butan-2-yl]-4-tertbuthylphenol and 2-(2H-benzotriazol-2-yl)-6-[(2S)-butan-2-yl]-4-tertbuthylphenol; 2-(2-hydroxy-3-sec-butyl-5-tertbutylphenyl) benzotriazole; 2-(2-hydroxy-3-sec-butyl-5-tert-butylphenyl)-2Hbenzotriazole; 2-(2Hbenzotriazol- 2-yl)-4-(tertbutyl)- 6-(sec-butyl)phenol; 2-(3-sec-butyl-5-tert-butyl-2-hydroxyphenyl)benzotriazole; 2-(3'-sec-butyl-5'-tert-butyl-2'-hydroxyphenyl)benzotriazole; 4-tert-butyl-6-sec-butyl-2-(2H-benzotriazol-2-yl)phenol; Chisorb 350; Eversorb 79	36437-37-3	253-037-1	$C_{20}H_{25}N_3O$	It is used as UV filters.
Nitrobenzene	Benzene, nitro-; Nitrobenzol, mirbane oil, essence of mirbane, p-Nitrobenzene, Mononitrobenzene	98-95-3	202-716-0	$C_6H_5NO_2$	It is used in chemical processes or as laboratory chemical for research.
Perfluorononan-1-oic-acid [1] and its sodium [2] and ammonium salts [3]	Nonanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,9-heptadecafluoro- [1]; Nonanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,9-heptadecafluoro-, sodium salt (1:1) [2]; Nonanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,9-heptadecafluoro-, ammonium salt (1:1) [3]; heptadecafluorononanoic acid [1]; sodium heptadecafluorononanoate [2]; ammonium heptadecafluorononanoate [3]; C9-PFA; heptadecafluorononanoic acid; Nonanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,9-heptadecafluoro-; Nonanoic acid, heptadecafluoro-; perfluoron- nonanoic acid; perfluoro-nnonanoic acid, ammonium salt; perfluoro-n-nonanoic acid, sodium salt; Perfluorononanoic acid; Perfluoroonanoic acid (PFNA); PFNA; PFNonanoic acid; Serum Perfluorononanoic Acid	375-95-1 [1] 21049-39-8 [2] 4149-60-4 [3]	206-801-3 [1] Not applicable [2] Not applicable [3]	$C_9HF_{17}O$ [1]	Per- and polyfluoroalkyl substances (PFASs), are a large group of chemicals used as ingredients or intermediates of surfactants and surface protectors for assorted industrial and consumer applications. It is a type of highly persistent material.

TABLE 1 *Continued*

Substance Name	Synonym	CAS Number	EU Number	Chemical Formula	Common Uses
1,2-benzenedicarboxylic acid, di-C6-10-alkyl esters or mixed decyl and hexyl and octyl diesters	Di-C6-10 alkyl phthalate; Di(C6-C10)alkyl phthalate; Phthalic acid, di(C6-C10)-alkyl esters; Linear610Phthalate; Esterification of phthalic anhydride and C6-10-alcohol; Di-C6-10 (even numbered) alkyl Phthalate; Esterification of phthalic anhydride and hexanol, octanol and decanol	68515-51-5 68648-93-1	271-094-0 272-013-1	undefined	The substance can be used as plasticizer or additive.
5-sec-butyl-2-(2,4-dimethylcyclohex-3-en-1-yl)-5-methyl-1,3-dioxane [1], 5-sec-butyl-2-(4,6-dimethylcyclohex-3-en-1-yl)-5-methyl-1,3-dioxane [2]	[covering any of the individual stereoisomers of [1] and [2] or any combination thereof]	Undefined Nonexhaustive list of substances include 117933-89-8 343934-04-3 343934-05-4 676367-02-5 676367-03-6 676367-04-7 676367-05-8 676367-06-9 676367-07-0 676367-08-1 676367-09-2 186309-28-4	Undefined Nonexhaustive list of substances include 413-720-9	$C_{17}H_{30}O_2$	It is used as an ingredient in fragrance.

7.7 Detection limits for the test methods are given when available and for reference only. It is necessary when reporting analytical results that they conform to the definition given by the reporting requirement.

7.8 Under certain circumstances it is advisable to employ external technical consulting services if the analysis being addressed is beyond the expertise of internal resources. There exist a number of laboratories that specialize in analysis of regulated substances for a fee.

TABLE 2 Test Method(s) for 4, 4'-Diaminodiphenylmethane

Chemical Formula	$C_{13}H_{14}N_2$
Test Method	**United States Department of Labor – OSHA Organic Method #57**
Description	This method is applicable to samples in air matrix. Analysis is performed by analyzing for the heptafluorobutyric acid anhydride (HFAA) derivative of $C_{13}N_{14}N_2$ by gas chromatography using an electron capture detector.
Technique	GC-ECD
Sample Prep Method	Air extraction using sulfuric acid treated glass fiber filters. Derivatization of $C_{13}H_{14}N_2$ with HFAA. Extraction with toluene.
Analyte	HFAA derivative of $C_{13}H_{14}N_2$ in toluene.
Detection	Electron capture detection of the HFAA derivative of $C_{13}H_{14}N_2$
Detection Limit	8.1 ng/sample (10 ppt or 81 ng/m^3 of air) for overall procedure; 3.2 pg/injection for analytical procedure.
Range	Not provided

TABLE 3 Test Method(s) for Anthracene

Chemical Formula	$C_{14}H_{10}$
Test Method	**EPA Method 8310**
Description	EPA Method 8310 is used to determine the concentration of certain polynuclear aromatic hydrocarbons (PAH) in ground water and wastes.
Technique	HPLC
Sample Prep Method	EPA Method 3540 or 3550 for solid samples
Analyte	$C_{14}H_{10}$ extracted into an appropriate solvent
Detection	Ultraviolet (UV) – Fluorescence
Detection Limit	0.66 µg/L
Range	Not provided
Test Method	**EPA Method 8270D**
Description	EPA Method 8270D is used to determine the concentration of semi-volatile organic compounds in extracts prepared from many types of solid waste matrices, soils, air sampling media and water samples
Technique	GC-MS
Sample Prep Method	EPA Method 3535, 3542 and 3561
Analyte	$C_{14}H_{10}$ extracted into an appropriate solvent
Detection	Mass spectrometry – primary ion at m/z 178
Detection Limit	10 µg/L
Range	Not provided
Test Method	**EPA Method 8100**
Description	EPA Method 8100 is used to determine the concentration of certain polynuclear aromatic hydrocarbons
Technique	GC-FID
Sample Prep Method	EPA Method 3540 or 3550 for solid samples
Analyte	$C_{14}H_{10}$ extracted into an appropriate solvent
Detection	Flame ionization
Detection Limit	1 µg/L
Range	Not provided

TABLE 4 Test Method(s) for Arsenic Pentoxide

Chemical Formula	As_2O_5
Analytical Approach	No test method is known for detecting As_2O_5 directly. Elemental Arsenic is detected and calculated as if all of the As is from As_2O_5.
Test Method	**EPA Method 7010**
Description	Metals in solution may be readily determined by graphite furnace atomic absorption spectrophotometry. The method is simple, quick, and applicable to a large number of metals in environmental samples including, but not limited to, water, domestic and industrial wastes, extracts, soils, sludges and sediments.
Technique	GFAA
Sample Prep Method	Acid digestion. Reference: EPA Method 3051A, Microwave assisted digestion of sediments, sludges, soils and oils; ASTM Practices D1971; ASTM Practice D4309.
Analyte	As (elemental)
Detection	Absorption at 193.7 nm
Detection Limit	1 µg/L
Range	Not provided
Caveats	Aluminum may interfere depending upon background correction method. Worst case scenario attributes that all the As has reacted with O. Knowledge of the system, either from manufacturer, engineering knowledge or other sources, is required to assume less than this worst case.
Test Method	**EPA Method 6020**
Description	This method is of wide applicability for analysis of a variety of elements in different types of matrices using Inductively Couple Plasma/Mass Spectrometry.
Technique	ICP-MS
Sample Prep Method	EPS Method 3051A, Microwave assisted digestion of sediments, sludges, soils and oils
Analyte	As (elemental)
Detection	Mass spectrometry of primary ion at m/z 75
Detection Limit	0.01 µg/L
Range	0.1 µg/L to 1000 µg/L
Caveats	Worst case scenario attributes that all the As has reacted with O. Knowledge of the system, either from manufacturer, engineering knowledge or other sources, is required to assume less than this worst case.
Test Method	**NIOSH Manual of Analytical Methods, Method 7901**
Description	This method was developed for particulate arsenic compounds
Technique	GFAA
Sample Prep Method	Digestion is required for all samples with the exception of those where the As is dissolved. A matrix modifier shall be added to all digestates prior to analysis to minimize volatilization losses during drying and ashing. Reference: US EPA Method 3051A, Microwave assisted digestion of sediments, sludges, soils and oils; ASTM Practices D1971, ASTM Practice D4309. Similar standardized methods for AAS sample preparation may be used.
Analyte	As (elemental)
Detection	Absorption at 193.7 nm
Detection Limit	0.06 µg
Range	0.3 µg to 13 µg
Caveats	Aluminum may interfere depending upon background correction method. Worst case scenario attributes that all the As has reacted with O. Knowledge of the system, either from manufacturer, engineering knowledge or other sources, is required to assume less than this worst case.

TABLE 5 Test Method(s) for Arsenic Trioxide

Chemical Formula	As_2O_3
Analytical Approach	No test method is known for detecting As_2O_3 directly. Elemental Arsenic is detected and calculated as if all of the As is from As_2O_3.
Test Method	**EPA Method 7010**
Description	Metals in solution may be readily determined by graphite furnace atomic absorption spectrophotometry. The method is simple, quick, and applicable to a large number of metals in environmental samples including, but not limited to, ground water, domestic and industrial wastes, extracts, soils, sludges, sediments, and similar wastes.
Technique	GFAA
Sample Prep Method	Digestion is required for all samples with the exception of those where the As is dissolved. A matrix modifier shall be added to all digestates prior to analysis to minimize volatilization losses during drying and ashing. Reference: US EPA Method 3051A, Microwave assisted digestion of sediments, sludges, soils and oils; ASTM Practices D1971; ASTM Practice D4309. Similar standardized methods for AAS sample preparation may be used.
Analyte	As (elemental)
Detection	Absorption at 193.7 nm
Detection Limit	1 µg/L
Range	Not provided
Caveats	Aluminum may interfere depending upon background correction method. Worst case scenario attributes that all the As has reacted with O. Knowledge of the system, either from manufacturer, engineering knowledge or other sources, is required to assume less than this worst case.
Test Method	**EPA Method 6020**
Description	This method is of wide applicability for analysis of a variety of elements in different types of matrices using Inductively Couple Plasma/Mass Spectrometry.
Technique	ICP-MS
Sample Prep Method	Digestion is required for all samples with the exception of those where the As is dissolved. A matrix modifier shall be added to all digestates prior to analysis to minimize volatilization losses during drying and ashing. Reference: US EPA Method 3051A, Microwave assisted digestion of sediments, sludges, soils and oils; ASTM Practices D1971; ASTM Practice D4309.
Analyte	As (elemental)
Detection	Mass spectrometry of primary ion at m/z 75
Detection Limit	0.01 µg/L
Range	0.1 µg/L to 1000 µg/L
Caveats	Worst case scenario attributes that all the As has reacted with O. Knowledge of the system, either from manufacturer, engineering knowledge or other sources, is required to assume less than this worst case.
Test Method	**NIOSH Manual of Analytical Methods, Method 7901**
Description	This method was developed for particulate arsenic compounds. Metals in solution may be readily determined by graphite furnace atomic absorption spectrophotometry. The method is simple, quick, and applicable to a large number of metals in environmental samples. With the exception of the analysis for dissolved constituents, all samples require digestion prior to analysis. Analysis for dissolved elements does not require digestion if the sample has been filtered and then acidified.
Technique	GFAA
Sample Prep Method	Digestion is required for all samples with the exception of those where the As is dissolved. A matrix modifier shall be added to all digestates prior to analysis to minimize volatilization losses during drying and ashing. Reference: US EPA Method 3051A, Microwave assisted digestion of sediments, sludges, soils and oils; ASTM Practices D1971; ASTM Practice D4309. Similar standardized methods for AAS sample preparation may be used.
Analyte	As (elemental)
Detection	Absorption at 193.7 nm
Detection Limit	0.06 µg per sample
Range	0.3 µg to 13 µg per sample

TABLE 6 Test Method(s) for Benzylbutyl Phthalate

Chemical Formula	$C_{19}H_{20}O_4$
Test Method	**EPA Method 8270D**
Description	EPA Method 8270D is used to determine the concentration of semivolatile organic compounds in extracts prepared from many types of solid waste matrices, soils, air sampling media and water samples
Technique	GC-MS
Sample Prep Method	EPA Method 3510, 3520, 3540 and 3550
Analyte	$C_{19}H_{20}O_4$
Detection	Mass spectrometry – ion at m/z 91, 149 and 206
Detection Limit	10 µg/L
Range	Not provided
Test Method	**CPSC-CH-C$_1$001-09.3**
Description	This method is used by the U.S. Consumer Product Safety Commission for the analysis of phthalates in child care items and toys.
Technique	GC-MS
Sample Prep Method	Initial polymer solublization with tetrahyrofuran, followed by polymer precipitation with hexane, and addition of internal standard Benzyl Benzoate solution to filtrate for analysis. Alternative extraction methods are referenced.
Analyte	$C_{19}H_{20}O_4$
Detection	Mass spectrometry – ion at m/z 91, 149 and 206, abundance ratio 27, 149:206
Detection Limit	≤0.01 % µg/L(w/w)
Range	Prescreen with IR for phthalate content 10 % or greater. Dilute analyte accordingly.

TABLE 7 Test Method(s) for Bis (2-ethylhexyl) Phthalate

Chemical Formula	$C_{24}H_{38}O_4$
Test Method	**EPA Method 8270D**
Description	EPA Method 8270D is used to determine the concentration of semivolatile organic compounds in extracts prepared from many types of solid waste matrices, soils, air sampling media and water samples
Technique	GC-MS
Sample Prep Method	EPA Method 3510, 3520, 3540 and 3550
Analyte	$C_{24}H_{38}O_4$
Detection	Mass spectrometry – ion at m/z 149, 167 and 279
Detection Limit	10 µg/L
Range	Not provided
Test Method	**CPSC-CH-$C_1$001-09.3**
Description	This method is used by the U.S. Consumer Product Safety Commission for the analysis of phthalates in child care items and toys.
Technique	GC-MS
Sample Prep Method	Initial polymer solublization with tetrahyrofuran, followed by polymer precipitation with hexame, and addition of internal standard Benzyl Benzoate solution to filtrate for analysis. Alternative extraction methods are referenced.
Analyte	$C_{24}H_{38}O_4$
Detection	Mass spectrometry – ion at m/z 149, 167 and 279, abundance ratio 10, 149:279
Detection Limit	≤0.01 wt %
Range	Prescreen with IR for phthalate content 10 % or greater. Dilute analyte accordingly. GC/MS analysis for phthalate content <10 %.

TABLE 8 Test Method(s) for Bis (tributyltin) Oxide

Chemical Formula	$C_{24}H_{54}OSn_2$
Analytical Approach	Test directly for bis (tributyltin) oxide
Test Method	**ISO 17353-2004**
Description	This method is used to detect organotin compounds in water after solvent extraction and analysis by GC-MS or other detection methods.
Technique	GC-MS; also AED (atomic emission detection), FPD (flame photometric detection) and other types of detection systems are applicable.
Sample Prep Method	Organotin compounds in water are alkylated with sodium tetraethylborate. Extraction of the tetrasubstituted organotin compound in hexane followed by cleanup with silica is performed. After concentration the extract is analyzed in the GC-MS.
Analyte	Tributylmonoethyl tin
Detection	Mass spectrometry of the tributylmonoethyl tin; mass clusters at m/z 291/289, 263/261 and 179/177
Detection Limit	Not provided
Range	10 ng/L to 1000 ng/L
Test Method	**Journal of Pharmaceutical and Biomedical Analysis, 19(3-4). pp. 327-333, 1999**
Description	This method uses liquid extraction and on-line hydride conversion to determine bis(tributyltin) oxide in substances using GC/MS.
Technique	GC-MS
Sample Prep Method	Conversion of the tributyltin oxide to its chloride with hydrochloric acid. The chloride is extracted with hexane and concentrated. The tributyltin chloride is converted into the hydride using sodium borohydride in the injection port of the GC.
Analyte	$C_{24}H_{54}OSn_2$
Detection	Mass spectrometry of tributyltin hydride fragments in the range of 165 to 185 amu
Detection Limit	1 ppm
Range	Not provided
Test Method	**Journal of Chromatographic Science, Vol. 23, May, 1985, pp. 209-213**
Description	Detection of organotins after gas chromatography by flame ionization-quenching uses a HAFI detector with GC. The HAFID is a hydrogen atmosphere FID. The big difference between FID and HAFID is that HAFID uses hydrogen and a silane doping agent. HAFID is sensitive to organometallics and not hydrocarbons while the opposite is true for FID.
Technique	GC-HAFID
Sample Prep Method	Extract with several small aliquots of acetone, centrifuging and filtering the combined extracts to eliminate any solid material, and diluting to 100 mL with acetone.
Analyte	$C_{24}H_{54}OSn_2$
Detection	Retention time of a standard and calibration curve.
Detection Limit	0.5×10^{-12}g
Range	0.5×10^{-12}g to 1×10^{-9}g

TABLE 9 Test Method(s) for Cobalt Dichloride

Chemical Formula	$CoCl_2$
Analytical Approach	No test method is known for detecting $CoCl_2$directly. Screen for cobalt and chlorine separately.
Testing Approach	**Screen for Cobalt and Chlorine separately.**
Strategy	A common screening method uses X-ray fluorescence. See Appendix X2. Chlorine and cobalt are detected separately. A calculation is performed to see if a worst case would trigger further action. Worst case associates all the chlorine and cobalt with each other to form $CoCl_2$. When the measured concentration exceeds the stoichiometric trigger value then cobalt and chlorine analysis should be done by a quantitative method.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See Appendix X1.2.
Caveats	Worst case scenario attributes that all the Co has reacted with Cl or all the Cl has reacted with Co. Knowledge of the system, either from manufacturer, engineering knowledge or other sources, is required to assume less than the worst case.
Test Approach	**EPA Method 9056A: Determination of Inorganic Anions by Ion Chromatography**
Description	Standard test method for determination of inorganic anions such as chloride, fluoride, bromide, nitrate, nitrite in aqueous solutions. Prepare the solid sample by incorporating the halogens into an aqueous solution. Use ion chromatography to identify and quantify the chloride concentration.
Technique	Ion chromatography, use EPA Method 9056A or similar as guidance.
Sample Prep Method	Solid is combusted with oxygen, the halogenated compounds are absorbed in a bicarbonate solution. Bicarbonate solution is used for analysis. Use EPA Method 5050 Bomb Preparation Method for Solid Waste or similar as guidance.
Analyte	Chlorine
Detection	Conductivity cell
Detection Limit	20 µg/L
Range	By proper dilution, samples with >500 ppm chloride can be analyzed.
Caveats	Worst case scenario attributes that all the Co has reacted with Cl or all the Cl has reacted with Co. Knowledge of the system, either from manufacturer or other sources, is required to assume less than the worst case.
Test Approach	**ASTM Test Method D3335**
Description	Dissolve the sample by acid digestion, or similar, then analyze for cobalt by atomic absorption spectrometry. Follow the standard additions method for cobalt by AAS since chlorine may interfere.
Technique	AAS. Use ASTM Test Method D3335-85a(2009), or similar as guidance.
Sample Prep Method	Acid digestion. Reference: ASTM Practices D1971; ASTM Practice D4309. Similar standardized methods for AAS sample preparation may be used.
Analyte	Cobalt
Detection	240.7 nm
Detection Limit	1 mg/kg
Range	50 – 2000 mg/kg. Higher levels of Co could be determined by this test method, provided that appropriate dilutions and adjustments in specimen size and reagent quantities are made.
Caveats	Interferences may occur due to organic acids such as formate and acetate. Cobalt and chlorine need to be analyzed separately. Worst case scenario attributes that all the Co has reacted with Cl or all the Cl has reacted with Co. Knowledge of the system, either from manufacturer or other sources, is required to assume less than the worst case.

TABLE 10 Test Method(s) for Dibutyl Phthalate

Chemical Formula	$C_{16}H_{22}O_4$
Testing Method	**EPA Method 8270D**
Description	EPA Method 8270D is used to determine the concentration of semivolatile organic compounds in extracts prepared from many types of solid waste matrices, soils, air sampling media and water samples
Technique	GC-MS
Sample Prep Method	EPA Method 3510, 3520, 3540 and 3550
Analyte	$C_{16}H_{22}O_4$
Detection	Mass spectrometry – primary ion at m/z 149; secondary ions at 150 and 104
Detection Limit	10 µg/L
Range	Not provided
Test Method	**CPSC-CH-$C_1$001-09.3**
Description	This method is used by the U.S. Consumer Product Safety Commission for the analysis of phthalates in child care items and toys.
Technique	GC-MS
Sample Prep Method	Initial polymer solublization with tetrahyrofuran, followed by polymer precipitation with hexane, and addition of internal standard Benzyl Benzoate solution to filtrate for analysis. Alternative extraction methods are referenced.
Analyte	$C_{16}H_{22}O_4$
Detection	Mass spectrometry - ion at m/z 149, 167, 205, 223, abundance ratio 4, 149:223.
Detection Limit	≤0.1 % (w/w)
Range	Prescreen with IR for phthalate content 10 % or greater. Dilute analyte accordingly. GC/MS analysis for phthalate content <10 %.

TABLE 11 Test Method(s) for Lead Hydrogen Arsenate

Chemical Formula	$(AsO_4H)Pb$
Analytical Approach	No test method is known for detecting $(AsO_4H)Pb$ directly. Elemental Arsenic or lead is detected and calculated as if all of the As or Pb is from $(AsO_4H)Pb$.
Test Method	**EPA Method 7010**
Description	Metals in solution may be readily determined by graphite furnace atomic absorption spectrophotometry. The method is simple, quick, and applicable to a large number of metals in environmental samples including, but not limited to, ground water, domestic and industrial wastes, extracts, soils, sludges, sediments, and similar wastes. With the exception of the analyses for dissolved constituents, all samples require digestion prior to analysis. Analysis for dissolved elements does not require digestion if the sample has been filtered and then acidified.
Technique	GFAA
Sample Prep Method	Digestion is required for all samples with the exception of those where the As is dissolved. A matrix modifier shall be added to all digestates prior to analysis to minimize volatilization losses during drying and ashing. Reference: US EPA Method 3051A, Microwave assisted digestion of sediments, sludges, soils and oils; ASTM Practices D1971, ASTM Practice D4309, US EPA Method 3050B Acid Digestion of Sediments, Sludges, and Soils. Similar standardized methods for AAS sample preparation may be used.
Analyte	As (elemental)
Detection	Absorption at 193.7 nm
Detection Limit	1 µg/L
Range	Not provided
Caveats	Worst case scenario attributes that all the As has reacted to from $(AsO_4H)Pb$. Knowledge of the system, either from manufacturer or other sources, is required to assume less than the worst case.
Test Method	**EPA Method 6020**
Description	This method is of wide applicability for analysis of a variety of elements in different types of matrices using Inductively Couple Plasma/Mass Spectrometry.
Technique	ICP-MS
Sample Prep Method	Digestion is required for all samples with the exception of those where the As is dissolved. A matrix modifier shall be added to all digestates prior to analysis to minimize volatilization losses during drying and ashing. Reference: US EPA Method 3051A, Microwave assisted digestion of sediments, sludges, soils and oils; ASTM Practices D1971; ASTM Practice D4309; US EPA Method 3050B Acid Digestion of Sediments, Sludges, and Soils. Similar standardized methods for AAS sample preparation may be used.
Analyte	As (elemental)
Detection	Mass spectrometry of primary ion at m/z 75
Detection Limit	0.01 µg/L
Range	0.1 - 1000 µg/L
Caveats	Worst case scenario attributes that all the As has reacted to from $(AsO_4H)Pb$. Knowledge of the system, either from manufacturer or other sources, is required to assume less than the worst case.
Test Method	**NIOSH Manual of Analytical Methods, Method 7901**
Description	This method was developed for particulate arsenic compounds.
Technique	GFAA
Sample Prep Method	Digestion is required for all samples with the exception of those where the As is dissolved. A matrix modifier shall be added to all digestates prior to analysis to minimize volatilization losses during drying and ashing. Reference: US EPA Method 3051A, Microwave assisted digestion of sediments, sludges, soils and oils; ASTM Practices D1971; ASTM Practice D4309; US EPA Method 3050B Acid Digestion of Sediments, Sludges, and Soils. Similar standardized methods for AAS sample preparation may be used.
Analyte	As (elemental)
Detection	Absorption at 193.7 nm
Detection Limit	0.06 µg per sample
Range	0.3 µg to 13 µg per sample
Caveats	Worst case scenario attributes that all the As has reacted to from $(AsO_4H)Pb$. Knowledge of the system, either from manufacturer or other sources, is required to assume less than the worst case.
Test Method	**IEC 62321**
Description	Method for determining lead in electronic products using several different analytical approaches.
Technique	ICP-OES, ICP-MS and AAS
Sample Prep Method	Acid digestion, see IEC 62321 for details
Analyte	Pb (elemental)
Detection	Absorption at 283.3 and 217.0 nm.
Detection Limit	<10 mg/kg
Range	Not provided
Caveats	Worst case scenario attributes that all the Pb has reacted to from $(AsO_4H)Pb$. Knowledge of the system, either from manufacturer or other sources, is required to assume less than the worst case.

TABLE 12 Test Method(s) for 5-tert-Butyl-2,4,6-Trinitro-m-Xylene (Musk Xyelene)

Chemical Formula	$C_{12}H_{15}O_6$
Test Method	**Journal of chromatography. B, Biomedical sciences and applications, 693, 71-78, 1997**
Description	This method was initially developed for the analysis of Musk xylene in human blood samples.
Technique	GC-ECD
Sample Prep Method	Solid phase extraction using a silica gel column and elution with petroleum benzine. See test method reference for details.
Analyte	$C_{12}H_{15}O_6$
Detection	Electron capture detection
Detection Limit	0.1 µg/L of plasma
Range	Not provided
Test Method	**Chemosphere 29(3), 477-84, 1994**
Description	This method was developed for the analysis of Musk xylene in human blood samples.
Technique	GC-MS with negative chemical ionization.
Sample Prep Method	Extraction of blood plasma using n-hexane. The extract was further processed using a silica gel column. Elution of the compounds of interest was accomplished using dichloromethane.
Analyte	$C_{12}H_{15}O_6$
Detection	Mass spectrometry - primary $[M]^-$ at 297 and $[M-30]^-$ at 267
Detection Limit	50 fg absolute
Range	Not provided

TABLE 13 Test Method(s) for Sodium Dichromate

Chemical Formula	$Na_2Cr_2O_7$
Analytical Approach	No test method is known for detecting $Na_2Cr_2O_7$ directly. To calculate a hypothetical maximum of $Na_2Cr_2O_7$, elemental chromium is detected and calculated as if all of the Cr is from $Na_2Cr_2O_7$.
Test Method	**EPA Method 7196A/IEC 62321**
Description	Dissolved hexavalent chromium may be determined colorimetrically by reaction with diphenylcarbazide in acid solution. A red-violet color of unknown composition is produced. The reaction is very sensitive, the absorbancy index per gram atom of chromium being about 40,000 at 540 nm. Addition of an excess of diphenylcarbazide yields the red-violet product, and its absorbance is measured photometrically at 540 nm.
Technique	UV-Vis or colorimeter with 540 nm filter
Sample Prep Method	EPA Method 3060A, Alkaline Digestion
Analyte	Cr(VI)
Detection	Absorption at 540 nm
Detection Limit	30 µg/L
Range	0.5 mg/L to 50 mg/L
Caveat	The chromium reaction with diphenylcarbazide is usually free from interferences. However, certain substances may interfere if the chromium concentration is relatively low. Hexavalent molybdenum and mercury salts also react to form color with the reagent; however, the red-violet intensities produced are much lower than those for chromium at the specified pH. Concentrations of up to 200 mg/L of molybdenum and mercury can be tolerated. Vanadium (V) interferes strongly, but concentrations up to 10 times that of chromium will not cause trouble. Iron can interfere as well but is less likely.

TABLE 14 Test Method(s) for Triethyl Arsenate

Chemical Formula	$(C_2H_5O)_3AsO$
Test Method	**EPA Method 7010**
Description	This method involves analysis by graphite furnace atomic absorption spectrophotometry and was developed primarily for environmental samples. This technique is only capable of detecting elemental arsenic and not its compounds.
Technique	GFAA
Sample Prep Method	Digestion is required for all samples with the exception of those where the As is dissolved. A matrix modifier shall be added to all digestates prior to analysis to minimize volatilization losses during drying and ashing. Reference: US EPA Method 3051A, Microwave assisted digestion of sediments, sludges, soils and oils; ASTM Practices D1971; ASTM Practice D4309; US EPA Method 3050B Acid Digestion of Sediments, Sludges, and Soils. Similar standardized methods for AAS sample preparation may be used.
Analyte	As (elemental)
Detection	Absorption at 193.7 nm
Detection Limit	1 µg/L
Range	Not provided
Test Method	**EPA Method 6020**
Description	This method is of wide applicability for analysis of a variety of elements in different types of matrices using Inductively Couple Plasma/Mass Spectrometry.
Technique	ICP-MS
Sample Prep Method	Digestion is required for all samples with the exception of those where the As is dissolved. A matrix modifier shall be added to all digestates prior to analysis to minimize volatilization losses during drying and ashing. Reference: US EPA Method 3051A, Microwave assisted digestion of sediments, sludges, soils and oils; ASTM Practices D1971; ASTM Practice D4309; US EPA Method 3050B Acid Digestion of Sediments, Sludges, and Soils. Similar standardized methods for AAS sample preparation may be used.
Analyte	As (elemental)
Detection	Mass spectrometry of primary ion at m/z 75
Detection Limit	0.01 µg/L
Range	0.01 µl/L to 1000 µl/L

TABLE 15 Test Method(s) for Hexabromocyclododecane

Chemical Formula	$C_{12}H_{18}Br_6$
Test Method	**Screen for Br**
Strategy	A common screening method uses X-Ray fluorescence. See Appendix X2. A calculation is performed to see if a worst case would trigger further action. When the measured concentration exceeds the trigger value then hexabromocyclododecane analysis should be done by a quantitative method.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF, reference IEC 62321 or EPA SW-846 Method 6200.
Sample Prep Method	Sample needs to be homogeneous. See Appendix X1.2.
Caveats	Worst case scenario attributes that the Br is associated with the hexabromocyclododecane. Knowledge of the system, either from manufacturer, engineering knowledge or other sources, is required to assume less than the worst case.
Test Method	**Analytical Sciences, 22, 469-474, 2006**
Description	Method to determine the concentrations of the three diastereoisomers (α, β,γ) of HBCDD in water and sediments.
Technique	LC-MS
Sample Prep Method	Solid phase extraction or solvent extraction using CH_2Cl_2
Analyte	$C_{12}H_{18}Br_6$
Detection	Mass spectrometry - primary ion at m/z 640.6 $[M\text{-}H]^-$
Detection Limit	Not provided
Range	Not provided

TABLE 16 Test Method(s) for Short Chain Chlorinated Paraffins

Chemical Formula	CxH(2x-y+2) Cly where x = 10-13 and y = 1-13
Testing Approach	**Screen for Chlorine**
Strategy	A common screening method uses X-Ray fluorescence. See Appendix X2. A calculation is performed to see if a worst case would trigger further action. When the measured concentration exceeds the trigger value then short chain chlorinated paraffin analysis should be done by a quantitative method.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF, reference IEC 62321 or EPA SW-846 Method 6200.
Sample Prep Method	Sample needs to be homogeneous. See Appendix X1.2.
Caveats	Worst case scenario attributes that the Cl is associated with short chain chlorinated paraffin. Knowledge of the system, either from manufacturer, engineering knowledge or other sources, is required to assume less than the worst case.
Test Method	**Chemosphere 58 (2005), 253-262**
Description	This method was developed primarily for analysis of sediment samples.
Technique	Short column GC with electron capture negative ion mass spectrometry (ECNI)
Sample Prep Method	Soxhlet extraction with dichloromethane. Evaporation to near dryness followed by addition of n-hexane and sulfuric acid digestion. Hexane fraction evaporation to near dryness followed by activated copper addition. Final sample purification is carried out with packed silica column chromatography with selected solvents, followed by semi-prep GPC. The desired sample portion is isolated, dried, and dissolved in n-hexane for GC analysis.
Analyte	$CxH_{(2x-y+2)}Cly$ where x=10-13 and y=1-13
Detection	Various ion masses (m/z) were monitored for quantitative analysis. For C_{10}: 313/349/383/417 C_{11}: 329/361/395/431/465 C_{12}: 341/375/409/445/477 C_{13}: 389/424/457/491
Detection Limit	0.5 ng/g
Range	Not provided
Test Method	**Journal of Chromatography A, 984, (2003), 1-8**
Description	This method was developed for analysis of short chain chlorinated paraffins in water samples
Technique	GC-ECD
Sample Prep Method	Solid phase micro-extraction using fibers of various compositions for example, polydimethylsiloxane, polyacrylate and others.
Analyte	$C_xH_{(2x-y+2)}Cly$ where x=10-13 and y=1-13
Detection	Electron capture
Detection Limit	0.3 µg/L
Range	Not provided

TABLE 17 Test Method(s) for 2,4-Dinitrotoluene

Chemical Formula	$C_7H_6N_2O_4$
Test Method	**EPA Method 8095**
Description	This method may be used to determine the concentrations 2,4-dinitrotoluene in water and soil using capillary column gas chromatography with an electron capture detector (GC-ECD).
Technique	GC-ECD
Sample Prep Method	Soxhlet extraction using EPA Method 3540
Analyte	2,4-Dinitrotoluene
Detection	retention time in capillary column
Detection Limit	0.003 to 0.5 µg/L
Range	0.03 to 5 µg/L
Test Method	**EPA Method 8515**
Description	The method is performed using an extract of a sample. The sample is treated with color-change reagents and is read in a spectrophotometer. The colorimetric nature of the test is based on the visual detection of the reaction product that is formed when polynitroaromatic compounds react with acetone by ketone substitution in the presence of base.
Technique	UV-Vis spectrometer capable of measuring at 540 nm
Sample Prep Method	EPA Method 3051, Microwave assisted acid digestion
Analyte	Polynitroaromatic compounds
Detection	UV-Vis at 540 nm
Detection Limit	0.7 mg/kg
Range	1 to 30 mg/kg

TABLE 18 Test Method(s) for Aluminosilicate Refractory Ceramic Fibres

Chemical Formula	Man-made amorphous fiber of $A_{l2}O_3$ and SiO_2 in variable concentrations with alkaline oxide and alkali earth oxide (Na_2O+K_2O+CaO+MgO+BaO) content less or equal to 18 % by weight.
Analytical Approach	No test method is known for detecting Aluminosilicate refractory ceramic fibres directly. Aluminosilicate refractory ceramic fibres belong to the group of the refractory ceramic fibres. A complete chemical identification is not possible. The fibres are either blown or spun from molten clay (kaolin), or, molten alumina and silica mixtures (roughly 50% each). The diameters of fibres produced are usually between 1-3 microns or micrometers (1µm = 0.001 mm). Raw forms usually look like a white or gray fibrous material supplied in bulk fibre, or blanket form. They can also be part of solid products such as cast refractories used as insulation for furnaces. The silica part of the final product is not crystalline silica, rather the silica molecule has been combined with the alumina to form an alumino-silicate. After use in high temperature applications the silicate may be transformed into crystalline silica (cristobalite) if the temperature is high enough (greater than 1000°C). Both physical and chemical properties must be considered for identification.
Test Method	**ASTM D5831, EPA Method 6200**
Description	Refractory ceramic fibres containing zirconium oxide as one of the main starting materials do not have the same CAS number, therefore are not on the SVHC list. Quantifying the zirconium aluminum and silicon content by XRF can quickly determine the fibretype. Other oxides like potassium oxide (< 0.01 %), sodium oxide (0.5 %), magnesium oxide (< 0.1 %), calcium oxide (< 0.1 %), titanium oxide (2 %), zirconium oxide (0.1 %), iron oxide (1 %) and chromium oxide (< 0.03 %) are sometimes incorporated to change the fibre properties. Quantification of metals to calculate their oxide contents, or quantifying the metal oxide by XRF will confirm if the content of the alkaline and alkaline earth oxides is lower than 1 %, and if a content of Na_2O+K_2O+CaO+MgO+BaO less or equal to 18 % by weight. Thus the classification for these substances in this CAS number can be fulfilled.
Technique	XRF
Sample Prep Method	Ensure representative, homogeneous and with an even surface, for example, pressing a pellet or briquette
Analyte	Al, Si, Zr, K, Na, Ca, Mg, Ba, or their oxides
Detection	Quantification of targeted metal or metal oxide to calculate their composition.
Detection Limit	100 to 200 mg/kg

TABLE 19 Test Method(s) for Anthracene Oil

Chemical Formula	$C_{14}H_{10}C_{12}H_9N$
Test Method	**Various including: German ZEK01.4-08 "Testing and Validation of Polycyclic Aromatic Hydrocarbons (PAH) in the course of GS-Mark Certification" (Polymers), US EPA Method "Polynuclear Aromatic Hydrocarbons" (610 Municipal and Industrial Wastewater, 625 Municipal and Industrial Wastewater, 8100 Solid Waste, 8310 Ground Water and Wastes) and US EPA Method "Semivolatile Organic Compounds" (8270 Solid Waste, Soils, Air Sampling Media and Water Samples).**
Description	Anthracene oil and paste are coal tar distillation product substances of variable composition. They are characterized by a high content of polycyclic aromatic hydrocarbons (PAHs) including anthracene, phenanthrene and fluorene as well as other heterocyclic compounds. While there are no published consensus standard test methods for anthracene oil or paste or their distillation fractions, common methods for the determination of PAH's could be validated for each matrix under evaluation for their indirect determination.
Technique	Multiple including HPLC, GC-FID & GC-MS
Sample Prep Method	Various solvent extraction methods including: soxhlet, ultrasonic and kaderna-danish (See US EPA Method 3500, 3510, 3520, 3540/3541, 3550, 3580).
Analyte	PAH's including anthracene, phenanthrene and fluorene.
Detection	Various including ultraviolet, fluorescence, flame ionization and mass spectrometry.
Detection Limit	The following detection limits can be anticipated: <0.2 mg/kg for individual PAH's in solid matrices, <1.0 µg/l for individual PAH's in solution
Range	Unknown Usable method range should be established during validation with sample matrix similar to actual samples.

TABLE 20 Test Method(s) for Anthracene Oil, Anthracene Paste

Chemical Formula	$C_{14}H_{10}C_{12}H_9N$
Test Method	**Various including: German ZEK01.4-08 "Testing and Validation of Polycyclic Aromatic Hydrocarbons (PAH) in the course of GS-Mark Certification" (Polymers), US EPA Method "Polynuclear Aromatic Hydrocarbons" (610 Municipal and Industrial Wastewater, 625 Municipal and Industrial Wastewater, 8100 Solid Waste, 8310 Ground Water and Wastes) and US EPA Method "Semivolatile Organic Compounds" (8270 Solid Waste, Soils, Air Sampling Media and Water Samples).**
Description	Anthracene oil and paste are coal tar distillation product substances of variable composition. They are characterized by a high content of polycyclic aromatic hydrocarbons (PAHs) including anthracene, phenanthrene and fluorene as well as other heterocyclic compounds. While there are no published consensus standard test methods for anthracene oil or paste or their distillation fractions, common methods for the determination of PAH's could be validated for each matrix under evaluation for their indirect determination.
Technique	Multiple including HPLC, GC-FID & GC-MS
Sample Prep Method	Various solvent extraction methods including: soxhlet, ultrasonic and kaderna-danish (See US EPA Method 3500, 3510, 3520, 3540/3541, 3550, 3580).
Analyte	PAH's including anthracene, phenanthrene and fluorene.
Detection	Various including ultraviolet, fluorescence, flame ionization and mass spectrometry.
Detection Limit	The following detection limits can be anticipated: <0.2 mg/kg for individual PAH's in solid matrices, <1.0 µg/l for individual PAH's in solution
Range	Unknown Usable method range should be established during validation with sample matrix similar to actual samples.

TABLE 21 Test Method(s) for Anthracene Oil, Anthracene Paste, Anthracene Fraction

Chemical Formula	$C_{14}H_{10}C_{12}H_9N$
Test Method	**Various including: German ZEK01.4-08 "Testing and Validation of Polycyclic Aromatic Hydrocarbons (PAH) in the course of GS-Mark Certification" (Polymers), US EPA Method "Polynuclear Aromatic Hydrocarbons" (610 Municipal and Industrial Wastewater, 625 Municipal and Industrial Wastewater, 8100 Solid Waste, 8310 Ground Water and Wastes) and US EPA Method "Semivolatile Organic Compounds" (8270 Solid Waste, Soils, Air Sampling Media and Water Samples).**
Description	Anthracene oil and paste are coal tar distillation product substances of variable composition. They are characterized by a high content of polycyclic aromatic hydrocarbons (PAHs) including anthracene, phenanthrene and fluorene as well as other heterocyclic compounds. While there are no published consensus standard test methods for anthracene oil or paste or their distillation fractions, common methods for the determination of PAH's could be validated for each matrix under evaluation for their indirect determination.
Technique	Multiple including HPLC, GC-FID & GC-MS
Sample Prep Method	Various solvent extraction methods including: soxhlet, ultrasonic and kaderna-danish (See US EPA Method 3500, 3510, 3520, 3540/3541, 3550, 3580).
Analyte	PAH's including anthracene, phenanthrene and fluorene.
Detection	Various including ultraviolet, fluorescence, flame ionization and mass spectrometry.
Detection Limit	The following detection limits can be anticipated: <0.2 mg/kg for individual PAH's in solid matrices, <1.0 µg/l for individual PAH's in solution
Range	Unknown Usable method range should be established during validation with sample matrix similar to actual samples.

TABLE 22 Test Method(s) for Anthracene Oil, Anthracene Paste, Distn. Lights

Chemical Formula	$C_{14}H_{10}C_{12}H_9N$
Test Method	**Various including: German ZEK01.4-08 "Testing and Validation of Polycyclic Aromatic Hydrocarbons (PAH) in the course of GS-Mark Certification" (Polymers), US EPA Method "Polynuclear Aromatic Hydrocarbons" (610 Municipal and Industrial Wastewater, 625 Municipal and Industrial Wastewater, 8100 Solid Waste, 8310 Ground Water and Wastes) and US EPA Method "Semivolatile Organic Compounds" (8270 Solid Waste, Soils, Air Sampling Media and Water Samples).**
Description	Anthracene oil and paste are coal tar distillation product substances of variable composition. They are characterized by a high content of polycyclic aromatic hydrocarbons (PAHs) including anthracene, phenanthrene and fluorene as well as other heterocyclic compounds. While there are no published consensus standard test methods for anthracene oil or paste or their distillation fractions, common methods for the determination of PAH's could be validated for each matrix under evaluation for their indirect determination.
Technique	Multiple including HPLC, GC-FID & GC-MS
Sample Prep Method	Various solvent extraction methods including: soxhlet, ultrasonic and kaderna-danish (See US EPA Method 3500, 3510, 3520, 3540/3541, 3550, 3580).
Analyte	PAH's including anthracene, phenanthrene and fluorene.
Detection	Various including ultraviolet, fluorescence, flame ionization and mass spectrometry.
Detection Limit	The following detection limits can be anticipated: <0.2 mg/kg for individual PAH's in solid matrices, <1.0 µg/l for individual PAH's in solution
Range	Unknown Usable method range should be established during validation with sample matrix similar to actual samples.

TABLE 23 Test Method(s) for Anthracene Oil, Anthracene-low

Chemical Formula	$C_{14}H_{10}C_{12}H_9N$
Test Method	**Various including: German ZEK01.4-08 “Testing and Validation of Polycyclic Aromatic Hydrocarbons (PAH) in the course of GS-Mark Certification” (Polymers), US EPA Method “Polynuclear Aromatic Hydrocarbons” (610 Municipal and Industrial Wastewater, 625 Municipal and Industrial Wastewater, 8100 Solid Waste, 8310 Ground Water and Wastes) and US EPA Method “Semivolatile Organic Compounds” (8270 Solid Waste, Soils, Air Sampling Media and Water Samples).**
Description	Anthracene oil and paste are coal tar distillation product substances of variable composition. They are characterized by a high content of polycyclic aromatic hydrocarbons (PAHs) including anthracene, phenanthrene and fluorene as well as other heterocyclic compounds. While there are no published consensus standard test methods for anthracene oil or paste or their distillation fractions, common methods for the determination of PAH’s could be validated for each matrix under evaluation for their indirect determination.
Technique	Multiple including HPLC, GC-FID & GC-MS
Sample Prep Method	Various solvent extraction methods including: soxhlet, ultrasonic and kaderna-danish (See US EPA Method 3500, 3510, 3520, 3540/3541, 3550, 3580).
Analyte	PAH’s including anthracene, phenanthrene and fluorene.
Detection	Various including ultraviolet, fluorescence, flame ionization and mass spectrometry.
Detection Limit	The following detection limits can be anticipated: <0.2 mg/kg for individual PAH’s in solid matrices, <1.0 µg/l for individual PAH’s in solution
Range	Unknown Usable method range should be established during validation with sample matrix similar to actual samples.

TABLE 24 Test Method(s) for Diisobutyl Phthalate

Chemical Formula	$C_{16}H_{22}O_4$
Test Method	**EN 14372:2004**
Description	A sample of polymer is extracted and the extracted phthalates are then run through a gas chromatograph. This method has not been validated for this analyte.
Technique	GC-MS
Sample Prep Method	2 g of the article is obtained for analysis. The sample is extracted in a Soxhlet extraction apparatus with diethyl ether for 6 h.
Analyte	Diisobutyl phthalate
Detection	Mass spectrometry
Detection Limit	0.2 mg/kg
Range	0.2 mg/kg – 10 mg/kg

TABLE 25 Test Method(s) for Lead Chromate

Chemical Formulab	CrH_2O_4Pb
Analytical Approach	Standard test method does not exist for CrH_2O_4Pb. Therefore, the test method cited for CrH_2O_4Pb must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**EPA Method 7196A**
Description	Dissolved hexavalent chromium may be determined colorimetrically by reaction with diphenylcarbazide in acid solution. A red-violet color of unknown composition is produced. The reaction is very sensitive, the absorbancy index per gram atom of chromium being about 40,000 at 540 nm. Addition of an excess of diphenylcarbazide yields the red-violet product, and its absorbance is measured photometrically at 540 nm.
Technique	UV-Vis or colorimeter with 540 nm filter
Sample Prep Method	EPA Method 3060A, Alkaline Digestion
Analyte	Cr(VI)
Detection	Absorption at 540 nm
Detection Limit	30 µg/L
Range	0.5 mg/L to 50 mg/L
Caveat	The chromium reaction with diphenylcarbazide is usually free from interferences. However, certain substances may interfere if the chromium concentration is relatively low. Hexavalent molybdenum and mercury salts also react to form color with the reagent; however, the red-violet intensities produced are much lower than those for chromium at the specified pH. Concentrations of up to 200 mg/L of molybdenum and mercury can be tolerated. Vanadium (V) interferes strongly, but concentrations up to 10 times that of chromium will not cause trouble. Iron can interfere as well but is less likely.

TABLE 26 Test Method(s) for Lead Chromate Molybdate Sulphate Red (C.I. Pigment Red 104)

Chemical Formula	Pb(Cr,S,Mo)O_4
Analytical Approach	No test method is known for detecting Pb(Cr,S,Mo)O_4 directly. To calculate a hypothetical maximum of Pb(Cr,S,Mo)O_4, chromium (VI) ion is detected and calculated as if all of the Cr(VI) is from Pb(Cr,S,Mo)O_4.
Test Method	**EPA Method 7196A**
Description	Dissolved hexavalent chromium may be determined colorimetrically by reaction with diphenylcarbazide in acid solution. A red-violet color of unknown composition is produced. The reaction is very sensitive, the absorbancy index per gram atom of chromium being about 40,000 at 540 nm. Addition of an excess of diphenylcarbazide yields the red-violet product, and its absorbance is measured photometrically at 540 nm.
Technique	UV-Vis or colorimeter with 540 nm filter
Sample Prep Method	EPA Method 3060A, Alkaline Digestion
Analyte	Cr(VI)
Detection	Absorption at 540 nm
Detection Limit	30 µg/L
Range	0.5 mg/L to 50 mg/L
Caveat	The chromium reaction with diphenylcarbazide is usually free from interferences. However, certain substances may interfere if the chromium concentration is relatively low. Hexavalent molybdenum and mercury salts also react to form color with the reagent; however, the red-violet intensities produced are much lower than those for chromium at the specified pH. Concentrations of up to 200 mg/L of molybdenum and mercury can be tolerated. Vanadium (V) interferes strongly, but concentrations up to 10 times that of chromium will not cause trouble. Iron can interfere as well but is less likely.

TABLE 27 Test Method(s) for Lead Sulfochromate Yellow (C.I. Pigment Yellow 34)

Chemical Formula	$PbCrO_4$+$PbSO_4$
Analytical Approach	No test method is known for detecting $PbCrO_4$+$PbSO_4$ directly. To calculate a hypothetical maximum of $PbCrO_4$+$PbSO_4$, chromium (VI) ion is detected and calculated as if all of the Cr(VI) is from $PbCrO_4$+$PbSO_4$.
Test Method	**EPA Method 7196A**
Description	Dissolved hexavalent chromium may be determined colorimetrically by reaction with diphenylcarbazide in acid solution. A red-violet color of unknown composition is produced. The reaction is very sensitive, the absorbancy index per gram atom of chromium being about 40,000 at 540 nm. Addition of an excess of diphenylcarbazide yields the red-violet product, and its absorbance is measured photometrically at 540 nm.
Technique	UV-Vis or colorimeter with 540 nm filter
Sample Prep Method	EPA Method 3060A, Alkaline Digestion
Analyte	Cr(VI)
Detection	Absorption at 540 nm
Detection Limit	30 µg/L
Range	0.5 mg/L to 50 mg/L
Caveat	The chromium reaction with diphenylcarbazide is usually free from interferences. However, certain substances may interfere if the chromium concentration is relatively low. Hexavalent molybdenum and mercury salts also react to form color with the reagent; however, the red-violet intensities produced are much lower than those for chromium at the specified pH. Concentrations of up to 200 mg/L of molybdenum and mercury can be tolerated. Vanadium (V) interferes strongly, but concentrations up to 10 times that of chromium will not cause trouble. Iron can interfere as well but is less likely.

TABLE 28 Test Method(s) for Pitch, Coal Tar, High Temperature

Chemical Formula	Not Applicable. Few effect data has existed specifically on CTP(ht) and the associated coal tar pitch volatiles (CTPV). The risk assessment is largely based on data on PAHs, especially on benzo(a)pyrene (B(a)P), in coal tar, creosote and other related products. When coal tar pitch is heated, coal tar pitch volatiles (CTPV) are released, most of them being PAHs. Because the composition of CTP(ht) is variable and no single representative composition/data exist, this is an acceptable approach. PAHs are the most relevant components in terms of toxicity; there are most data on B(a)P and it serves as a relevant indicator (in addition to references in the RAR, Spinelli et al., 2006, Friesen et al., 2008).
Test Method	**EPA Method 8270D, The expanded scan for PAHs [828] (a modified EPA Method 8270 including alkyl homologues and lower detection limits)**
Description	This method is used to determine the concentration of semi volatile organic compounds in extracts prepared from many types of solid waste matrices, soils, air sampling media and water samples.
Technique	GC-MS
Sample Prep Method	Various methods are recommended for various matrices. EPA Method 5030, EPA Method 3510, EPA Method 3520, EPA Method 5041, EPA Method 3540, EPA Method 3550, EPA Method 3580.
Analyte	Pyrene and polycyclic aromatic hydrocarbons and alkylated polycyclic aromatic hydrocarbons
Detection	Gas chromatography retention time and mass spectrometry – primary ion and confirmation ion.
Detection Limit	Reference method table for specific analyte
Range	Reference method table for specific analyte
Test Method	**EPA Method 8310**
Description	This method is used to determine the concentration of certain polynuclear aromatic hydrocarbons in ground water and wastes.
Technique	HPLC
Sample Prep Method	Extraction with methylenechloride followed by exchange to acetonitrile
Analyte	Pyrene and polycyclic aromatic hydrocarbons and alkylated polycyclic aromatic hydrocarbons
Detection	Liquid chromatography retention time and ultraviolet spectrum
Detection Limit	Reference method table for specific analyte
Range	Reference method table for specific analyte

TABLE 29 Test Method(s) for Tris(2-chloroethyl)phosphate (TCEP)

Chemical Formula	$C_6H_{12}Cl_3O_4P$
Test Method	**Health Canada C-38**
Description	Soxhlet extraction of TCEP in polyurethane and related materials in toluene followed by rotovap concentration and GC-MS
Technique	GC-MS
Sample Prep Method	1 g of sample is extracted in 250 mL toluene using a soxhlet apparatus and concentrated to < 10 mL in a rotovap following extraction. TCEP is then determined by GC-MS using 4,4'-Dibromooctafluorobiphenyl as an internal standard
Analyte	TCEP. Quantifier ion: 249. Qualifier ions 205/143/63
Detection	GC-MS using 4,4'-Dibromooctafluorobiphenyl as an internal standard. TCEP Quantifier ion: 249. Qualifier ions 205/143/63
Detection Limit	200 mg/kg.
Range	Not provided.
Test Method	**Analytical Sciences, Vol 19 pp. 1617-1620, December 2003**
Description	Polyurethane foam is dissolved in sulfuric acid to release TCEP. TCEP is determined by GC-Flame Photometric Detection
Technique	GC-Flame Photometric Detection
Sample Prep Method	Polyurethane foam is dissolved in sulfuric acid. Water is added to separate out dissolved polyurethane. pH is adjusted, sodium chloride added, and TCEP extracted with toluene. Toluene solution is concentrated.
Analyte	TCEP
Detection	GC with Flame Photometric Detection
Detection Limit	0.6 µg/g for 0.05 g sample
Range	Not provided
Test Method	**USGS NWQL O-1433-01**
Description	TCEP in wastewater is determined by polystyrene-divinylbenzene solid phase extraction followed by GC-MS
Technique	GC-MS
Sample Prep Method	Water samples are filtered to remove particulates, then extracted in solid phase extraction columns containing polystyrene-divinylbenzene. Sorbed TCEP is eluted with a mixture of dichloromethane and ethyl ether and the solution then concentrated.
Analyte	TCEP
Detection	GC-MS, quantitation ion m/z 249, confirmation ions m/z 251 and 205, phenanthrene-d_{10} internal standard
Detection Limit	0.08 µg/L
Range	Not provided

TABLE 30 Test Method(s) for Zirconia Aluminosilicate Refractory Ceramic Fibres (5)

Chemical Formula	SiO_2 $Al2O_3$ Fe_2O_3 TiO_2 MnO CaO Na_2O K_2O Cr_2O_3 ZrO_2 $P2O_5$
Test Method	**ISO 21587-3**
Description	This method is used for the identification of the presence of refractory ceramic fibers.
Technique	This method uses ICP-AES spectroscopy or FAA spectrometry for the identification of elements associated with these fibers.
Sample Prep Method	Acid digestion
Analyte	Silicon Aluminum Iron Titanium Manganese Calcium Magnesium Sodium Potassium Chromium Zirconium Phosphorus
Detection	Elemental ratios are used to establish the presence of the fibers which have a fixed chemical formula. Another sample is ashed and the residue examined under microscope for fibers matching the regulated fibers in width and length.
Detection Limit	Matrix dependent
Range	0.1 mg/L - 60 mg/L

TABLE 31 Test Method(s) for Acrylamide

Chemical Formula	C_3H_5NO
Test Method	**EPA Method 8032A**
Description	This method is used to detect acrylamide in aqueous matrices after bromination of the double bond and extraction with ethyl acetate.
Technique	GC-ECD (electron capture detection). GC-MS may be used for compound confirmation.
Sample Prep Method	Acrylamide in water is brominated with KBr / HBr. Reaction product (2,3-dibromopropionamide) is extracted with ethyl acetate. Florosil column is used to remove interferences and impurities from KBr. Eluate from florisil column injected into GC-ECD
Analyte	Acrylamide following bromination to 2,3-dibromopropionamide
Detection	GC-ECD using dimethyl phthalate as internal standard
Detection Limit	0.032 µg/L
Range	Method found to be linear over range 0-5 µg/L of acrylamide monomer
Test Method	**Journal of Food and Drug Analysis, Vol. 17, No. 3, 2009, Pages 190-197**
Description	Acrylamide in food is determined using solid phase extraction followed by LC-MS-MS
Technique	LC-MS-MS
Sample Prep Method	Food is pulverized in a food processor, mixed with water, homogenized and centrifuged. Sample is cleaned using solid phase extraction.
Analyte	Acrylamide
Detection	LC-MS-MS using $^{13}C_3$ acrylamide as internal standard
Detection Limit	3 µg/kg
Range	Linear calibration curve between 5 and 1000 µg/L acrylamide in water

TABLE 32 Test Method(s) for Ammonium Dichromate

Chemical Formula	$(NH_4)_2Cr_2O_7$
Analytical Approach	No test method is known for detecting $(NH_4)_2Cr_2O_7$ directly. To calculate a hypothetical maximum of $(NH_4)_2Cr_2O_7$, chromium (VI) ion is detected and calculated as if all of the Cr(VI) is from $(NH_4)_2Cr_2O_7$. The test method cited for $(NH_4)_2Cr_2O_7$ must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**EPA Method 7196A**
Description	Dissolved hexavalent chromium may be determined colorimetrically by reaction with diphenylcarbazide in acid solution. A red-violet color of unknown composition is produced. The reaction is very sensitive, the absorbancy index per gram atom of chromium being about 40,000 at 540 nm. Addition of an excess of diphenylcarbazide yields the red-violet product, and its absorbance is measured photometrically at 540 nm.
Technique	UV-Vis or colorimeter with 540 nm filter
Sample Prep Method	EPA Method 3060A, Alkaline Digestion
Analyte	Cr(VI)
Detection	Absorption at 540 nm
Detection Limit	30 µg/L
Range	0.5 mg/L to 50 mg/L
Caveat	The chromium reaction with diphenylcarbazide is usually free from interferences. However, certain substances may interfere if the chromium concentration is relatively low. Hexavalent molybdenum and mercury salts also react to form color with the reagent; however, the red-violet intensities produced are much lower than those for chromium at the specified pH. Concentrations of up to 200 mg/L of molybdenum and mercury can be tolerated. Vanadium (V) interferes strongly, but concentrations up to 10 times that of chromium will not cause trouble. Iron can interfere as well but is less likely.

TABLE 33 Test Method(s) for Boric Acid

Chemical Formula	BH_3O_3
Analytical Approach	No test method is known for detecting BH_3O_3 directly. To calculate a hypothetical maximum of BH_3O_3, elemental boron is detected and calculated as if all of the boron is from BH_3O_3. The test method cited for BH_3O_3 must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**EPA Method 6010**
Description	The characteristic emission spectra are measured by optical spectrometry. Samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by radio-frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and the intensities of the emission lines are monitored by photosensitive devices.
Technique	ICP-OES
Sample Prep Method	EPA Method 3051, Microwave assisted acid digestion
Analyte	B
Detection	Atomic emission at 249.679 nm
Detection Limit	4 µg/L
Range	Unknown
Caveat	Method scoped for soils and wastes samples. Method should be validated with sample matrix similar to actual samples.

TABLE 34 Test Method(s) for Disodium Tetraborate, Anhydrous

Chemical Formula	$Na_2B_4O_7 \cdot 10H_2O$; $Na_2B_4O_7$; $Na_2B_4O_7 \cdot 5H_2O$
Analytical Approach	No test method is known for detecting borates directly. To calculate a hypothetical maximum of borate, elemental boron is detected and calculated as if all of the boron is from $Na_2B_4O_7$.The test method cited for $Na_2B_4O_7$ must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**EPA Method 6010**
Description	The characteristic emission spectra are measured by optical spectrometry. Samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by a radio-frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and the intensities of the emission lines are monitored by photosensitive detectors.
Technique	ICP-OES
Sample Prep Method	EPA Method 3051, Microwave assisted acid digestion
Analyte	B
Detection	Atomic emission at 249.679 nm
Detection Limit	4 µg/L
Range	Unknown
Caveat	Method scoped for soils and wastes samples. Method should be validated with sample matrix similar to actual samples.

TABLE 35 Test Method(s) for Potassium Chromate

Chemical Formula	K_2CrO_4
Analytical Approach	Standard test method does not exist for K_2CrO_4. Therefore, the test method cited for K_2CrO_4 must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**EPA Method 7196A**
Description	Dissolved hexavalent chromium may be determined colorimetrically by reaction with diphenylcarbazide in acid solution. A red-violet color of unknown composition is produced. The reaction is very sensitive, the absorbancy index per gram atom of chromium being about 40,000 at 540 nm. Addition of an excess of diphenylcarbazide yields the red-violet product, and its absorbance is measured photometrically at 540 nm.
Technique	UV-Vis or colorimeter with 540 nm filter.
Sample Prep Method	EPA Method 3060A, Alkaline Digestion
Analyte	Cr(VI)
Detection	Absorption at 540 nm
Detection Limit	30 µg/L
Range	0.5 mg/L to 50 mg/L
Caveat	The chromium reaction with diphenylcarbazide is usually free from interferences. However, certain substances may interfere if the chromium concentration is relatively low. Hexavalent molybdenum and mercury salts also react to form color with the reagent; however, the red-violet intensities produced are much lower than those for chromium at the specified pH. Concentrations of up to 200 mg/L of molybdenum and mercury can be tolerated. Vanadium (V) interferes strongly, but concentrations up to 10 times that of chromium will not cause trouble. Iron can interfere as well but is less likely.

TABLE 36 Test Method(s) for Potassium Dichromate

Chemical Formula	$K_2Cr_2O_7$
Analytical Approach	Standard test method does not exist for $K_2Cr_2O_7$. Therefore, the test method cited for $K_2Cr_2O_7$ must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**EPA Method 7196A**
Description	Dissolved hexavalent chromium may be determined colorimetrically by reaction with diphenylcarbazide in acid solution. A red-violet color of unknown composition is produced. The reaction is very sensitive, the absorbancy index per gram atom of chromium being about 40,000 at 540 nm. Addition of an excess of diphenylcarbazide yields the red-violet product, and its absorbance is measured photometrically at 540 nm.
Technique	UV-Vis or colorimeter with 540 nm filter.
Sample Prep Method	EPA Method 3060A, Alkaline Digestion
Analyte	Cr(VI)
Detection	Absorption at 540 nm
Detection Limit	30 µg/L
Range	0.5 mg/L to 50 mg/L
Caveat	The chromium reaction with diphenylcarbazide is usually free from interferences. However, certain substances may interfere if the chromium concentration is relatively low. Hexavalent molybdenum and mercury salts also react to form color with the reagent; however, the red-violet intensities produced are much lower than those for chromium at the specified pH. Concentrations of up to 200 mg/L of molybdenum and mercury can be tolerated. Vanadium (V) interferes strongly, but concentrations up to 10 times that of chromium will not cause trouble. Iron can interfere as well but is less likely.

TABLE 37 Test Method(s) for Sodium Chromate

Chemical Formula	Na_2CrO_4
Analytical Approach	Standard test method does not exist for Na_2CrO_4. Therefore, the test method cited for Na_2CrO_4 must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**EPA Method 7196A**
Description	Dissolved hexavalent chromium may be determined colorimetrically by reaction with diphenylcarbazide in acid solution. A red-violet color of unknown composition is produced. The reaction is very sensitive, the absorbancy index per gram atom of chromium being about 40,000 at 540 nm. Addition of an excess of diphenylcarbazide yields the red-violet product, and its absorbance is measured photometrically at 540 nm.
Technique	UV-Vis or colorimeter with 540 nm filter.
Sample Prep Method	EPA Method 3060A, Alkaline Digestion
Analyte	Cr(VI)
Detection	Absorption at 540 nm
Detection Limit	30 µg/L
Range	0.5 mg/L to 50 mg/L
Caveat	The chromium reaction with diphenylcarbazide is usually free from interferences. However, certain substances may interfere if the chromium concentration is relatively low. Hexavalent molybdenum and mercury salts also react to form color with the reagent; however, the red-violet intensities produced are much lower than those for chromium at the specified pH. Concentrations of up to 200 mg/L of molybdenum and mercury can be tolerated. Vanadium (V) interferes strongly, but concentrations up to 10 times that of chromium will not cause trouble. Iron can interfere as well but is less likely.

TABLE 38 Test Method(s) for Tetraboron Disodium Heptaoxide, Hydrate

Chemical Formula	$B_4Na_2O_7 \cdot x\ H_2O$
Analytical Approach	No test method is known for detecting borates directly. To calculate a hypothetical maximum of borate, elemental boron is detected and calculated as if all of the boron is from $B_4Na_2O_7 \cdot H_2O$.
Test Method	**EPA Method 6010**
Description	The characteristic emission spectra are measured by optical spectrometry. Samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by a radio-frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and the intensities of the emission lines are monitored by photosensitive detectors.
Technique	ICP-OES
Sample Prep Method	EPA Method 3051, Microwave assisted acid digestion
Analyte	B
Detection	Atomic emission at 249.679 nm
Detection Limit	4 µg/L
Range	Unknown
Caveat	Method scoped for soils and wastes samples. Method should be validated with sample matrix similar to actual samples.

TABLE 39 Test Method(s) for Trichloroethylene

Chemical Formula	C_2HCl_3
Test Method	**EPA Method 8260**
Description	The volatile compounds are introduced into the GC-MS by injecting the sample extract into a gas chromatograph (GC) equipped with a capillary column. The GC column is temperature-programmed to separate the analytes, which are then detected with a mass spectrometer (MS) connected to the gas chromatograph. Quantitation is accomplished by comparing the response of a major (quantitation) ion relative to an internal standard using an appropriate calibration curve for the intended application.
Technique	GC-MS
Sample Prep Method	EPA Method 5035
Analyte	Trichloroethylene
Detection	Retention time from GC, m/z of 95, 97, 130 and 132 in MS
Detection Limit	Approximately 0.14 µg/L
Range	Unknown
Caveat	Method scoped for soils and wastes samples. Method should be validated with sample matrix similar to actual samples.

TABLE 40 Test Method(s) for Chromium Trioxide

Chemical Formula	CrO_3
Analytical Approach	Standard test method does not exist for CrO_3. Therefore, the test method cited for CrO_3 must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**EPA Method 7196A**
Description	Dissolved hexavalent chromium may be determined colorimetrically by reaction with diphenylcarbazide in acid solution. A red-violet color of unknown composition is produced. The reaction is very sensitive, the absorbancy index per gram atom of chromium being about 40,000 at 540 nm. Addition of an excess of diphenylcarbazide yields the red-violet product, and its absorbance is measured photometrically at 540 nm.
Technique	UV-Vis or colorimeter with 540 nm filter.
Sample Prep Method	EPA Method 3060A, Alkaline Digestion
Analyte	Cr(VI)
Detection	Absorption at 540 nm
Detection Limit	30 µg/L
Range	0.5 mg/L to 50 mg/L
Caveat	The chromium reaction with diphenylcarbazide is usually free from interferences. However, certain substances may interfere if the chromium concentration is relatively low. Hexavalent molybdenum and mercury salts also react to form color with the reagent; however, the red-violet intensities produced are much lower than those for chromium at the specified pH. Concentrations of up to 200 mg/L of molybdenum and mercury can be tolerated. Vanadium (V) interferes strongly, but concentrations up to 10 times that of chromium will not cause trouble. Iron can interfere as well but is less likely.

TABLE 41 Test Method(s) for Acids Generated from Chromium Trioxide and their Oligomers

Chemical Formula	$Cr_2H_2O_7$ CrH_2O_4
Analytical Approach	Standard test method does not exist for $H_2Cr_2O_7$/H_2CrO_4. Therefore, the test method cited for $H_2Cr_2O_7$/H_2CrO_4 must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**EPA Method 7196A**
Description	Dissolved hexavalent chromium may be determined colorimetrically by reaction with diphenylcarbazide in acid solution. A red-violet color of unknown composition is produced. The reaction is very sensitive, the absorbancy index per gram atom of chromium being about 40,000 at 540 nm. Addition of an excess of diphenylcarbazide yields the red-violet product, and its absorbance is measured photometrically at 540 nm.
Technique	UV-Vis or colorimeter with 540 nm filter.
Sample Prep Method	EPA Method 3060A, Alkaline Digestion
Analyte	Cr(VI)
Detection	Absorption at 540 nm
Detection Limit	30 µg/L
Range	0.5 mg/L to 50 mg/L
Caveat	The chromium reaction with diphenylcarbazide is usually free from interferences. However, certain substances may interfere if the chromium concentration is relatively low. Hexavalent molybdenum and mercury salts also react to form color with the reagent; however, the red-violet intensities produced are much lower than those for chromium at the specified pH. Concentrations of up to 200 mg/L of molybdenum and mercury can be tolerated. Vanadium (V) interferes strongly, but concentrations up to 10 times that of chromium will not cause trouble. Iron can interfere as well but is less likely.

TABLE 42 Method(s) for Cobalt (II) Sulphate

Chemical Formula	$CoSO_4$
Analytical Approach	No test method is known for detecting $CoSO_4$ directly.
Test Method	**Screen for Cobalt using EPA Method 6200 or ASTM E1621**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the cobalt as $CoSO_4$. When the measured concentration exceeds the stoichiometric trigger value then cobalt and suplhate analysis should be done by a quantitative method.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See Appendix X1.2.
Analyte	Co
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 43 Test Method(s) for Cobalt (II) Dinitrate

Chemical Formula	CoN_2O_6
Analytical Approach	No test method is known for detecting CoN_2O_6 directly.
Test Method	**Screen for Cobalt using EPA Method 6200 or 1621**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the cobalt as CoN_2O_6. When the measured concentration exceeds the stoichiometric trigger value then cobalt and nitrate analysis should be done by a quantitative method.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Co
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 44 Test Method(s) for Cobalt (II) Carbonate

Chemical Formula	$CoCO_3$
Analytical Approach	No test method is known for detecting $CoCO_3$ directly.
Test Method	**Screen for Cobalt using EPA Method 6200 or 1621**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the cobalt as $CoCO_3$. When the measured concentration exceeds the stoichiometric trigger value then cobalt and carbonate analysis should be done by a quantitative method.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Co
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 45 Test Method(s) for Cobalt (II) Diacetate

Chemical Formula	$C_4H_6CoO_4$
Analytical Approach	No test method is known for detecting $C_4H_6CoO_4$ directly.
Test Method	**Screen for Cobalt using EPA Method 6200 or 1621**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the cobalt as $C_4H_6CoO_4$. When the measured concentration exceeds the stoichiometric trigger value then cobalt and acetate analysis should be done by a quantitative method.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Co
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 46 Test Method(s) for 2-Methoxyethanol

Chemical Formula	$C_3H_8O_2$
Test Method	**EPA Method 1671**
Description	This method is used to determine certain non-purgeable volatile organic pollutants that are specific to the pharmaceutical manufacturing industry in waters, soils, and municipal sludges by direct aqueous gas chromatography injection and detection by a flame ionization detector
Technique	GC-FID
Sample Prep Method	The percent solids content of the sample is determined, followed by internal standard(s) addition, sonication, and centrifuge.
Analyte	2-Methoxyethanol
Detection	Chromatogram retention time, calibration, and internal standard is used for identification and quantification of analyte.
Detection Limit	20 mg/L
Range	Not provided

TABLE 47 Test Method(s) for 2-Ethoxyethanol

Chemical Formula	$C_4H_{10}O_2$
Analytical Approach	2-Ethoxyethanol is similar to and in the boiling range of the volatile organic compounds listed in EPA Method 8260B
Test Method	**EPA Method 8260B**
Description	This method is used to determine volatile organic compounds in a variety of matrices by gas chromatography and mass spectrometry.
Technique	GC-MS
Sample Prep Method	Various methods are recommended for various matrices. EPA Method 5030, EPA Method 5032, EPA Method 5035, EPA Method 5041, EPA Method 3585, EPA Method 5021, EPA Method 8260
Analyte	1,2-Dichloroethane
Detection	Mass spectrometry – primary ion at m/z = 31 and 59; confirmation ion at m/z = 45 and 72
Detection Limit	Not provided
Range	Not provided

TABLE 48 Test Method(s) for 2-Ethoxyethyl Acetate

Chemical Formula	$C_6H_{12}O_3$
Test Method	**ASTM D3545-06,**
Description	This method covers the determination by gas chromatography of the ester content and the corresponding alcohol content of acetate esters, including 2-ethoxyethyl acetate.
Technique	GC-FID
Sample Prep Method	Sample preparation from matrix is not specified in the method. Various methods recommended in EPC Method 8260B can be referenced.
Analyte	2-Ethoxyethyl acetate
Detection	Not provided
Detection Limit	Not provided
Analytical Approach	2-Ethoxyethyl acetate is similar to and in the boiling range of the volatile organic compounds listed in EPA Method 8260B. ASTM D3545-06 specified condition can be used for GC.
Test Method	**EPA Method 8260B**
Description	EPA Method 8260B is used to determine volatile organic compounds in a variety of matrices by gas chromatography and mass spectrometry.
Technique	GC-MS
Sample Prep Method	Various methods are recommended for various matrices. EPA Method 5030, EPA Method 5032, EPA Method 5035, EPA Method 5041, EPA Method 3585, EPA Method 5021, EPA Method 8260
Analyte	2-Ethoxyethyl acetate
Detection	Mass spectrometry – primary ion at m/z = 43; confirmation ion at m/z = 31, 59, and 72; minor ion at m/z= 87.
Detection Limit	Not provided
Range	Not provided

TABLE 49 Test Method(s) for Strontium Chromate

Chemical Formula	$SrCrO_4$
Analytical Approach	Standard test method does not exist for $SrCrO_4$. Therefore, the test method cited for $SrCrO_4$ must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**EPA Method 7196A**
Description	Dissolved hexavalent chromium may be determined colorimetrically by reaction with diphenylcarbazide in acid solution. A red-violet color of unknown composition is produced. The reaction is very sensitive, the absorbancy index per gram atom of chromium being about 40,000 at 540 nm. Addition of an excess of diphenylcarbazide yields the red-violet product, and its absorbance is measured photometrically at 540 nm.
Technique	UV-Vis or colorimeter with 540 nm filter.
Sample Prep Method	EPA Method 3060A, Alkaline Digestion
Analyte	Cr(VI)
Detection	Absorption at 540 nm
Detection Limit	30 µg/L
Range	0.5 mg/L to 50 mg/L
Caveat	The chromium reaction with diphenylcarbazide is usually free from interferences. However, certain substances may interfere if the chromium concentration is relatively low. Hexavalent molybdenum and mercury salts also react to form color with the reagent; however, the red-violet intensities produced are much lower than those for chromium at the specified pH. Concentrations of up to 200 mg/L of molybdenum and mercury can be tolerated. Vanadium (V) interferes strongly, but concentrations up to 10 times that of chromium will not cause trouble. Iron can interfere as well but is less likely.

TABLE 50 Test Method(s) for 1,2-Benzenedicarboxylic Acid, di-C7-11 Branched and Linear Alkyl Esters

Chemical Formula	$C_{22}H_{34}O_4$–$C_{30}H_{50}O_4$
Test Method	**EN 14372:2004**
Description	A sample of polymer is extracted and the extracted phthalates are then run through a gas chromatograph. This method has not been validated for this analyte.
Technique	Soxhlet extraction
Sample Prep Method	2 g of the article is obtained for analysis. The sample is extracted in a Soxhlet extraction apparatus with diethyl ether for 6 h.
Analyte	1,2-benzenedicarboxylic acid
Detection	Mass spectrometry
Detection Limit	0.2 mg/kg
Range	0.2 mg/kg – 10 mg/kg

TABLE 51 Test Method(s) for Hydrazine

Chemical Formula	H_4N_2
Test Method	**ASTM Test Method D1385**
Description	A solution of p-dimethylaminobenzaldehyde in methyl alcohol and hydrochloric acid is added to hydrazine in diluted hydrochloric acid solution to form a yellow color of p-dimethylaminobenzalazine. The yellow color formed is proportional to the hydrazine present.
Technique	UV-Vis
Sample Prep Method	Sample to be acidified with concentrated hydrochloric acid
Analyte	Hydrazine
Detection	Hydrazine reacts with p-dimethylaminobenzaldehyde to form a yellow complex. Measurements are taken at 458 nm using a 50 mm cell
Detection Limit	5.0 ppb
Range	5.0-200 ppb
Caveat	Method scoped for water samples such as boiler feeds and well water. Method should be validated with sample matrix similar to actual samples.

TABLE 52 Test Method(s) for 1-methyl-2-pyrrolidone

Chemical Formula	C_5H_9NO
Test Method	**Acta Poloniae Pharmaceutic – Drug Research**
Description	Sample is dissolved in DMF to form 5 % solution, then analyzed by GC-FID
Technique	GC-FID.
Sample Prep Method	Dissolve sample in DMF to produce 5% solution. Use ultrasonic bath to clarify.
Analyte	1-methyl-2-pyrrolidone
Detection	GC-FID using dimethyl phthalate as internal standard. Detect by retention time.
Detection Limit	2.2 mg/L
Range	Linearity reported between 7.5 and 638 mg/L
Test Method	**US FDA Method 21cfr 500 subpart F**
Description	Bovine liver is extracted with methanol followed by acetonitrile and measured using LC-MS-MS
Technique	LC-MS-MS
Sample Prep Method	Bovine liver samples are processed in a blender with dry ice, extracted with methanol followed by acetonitrile. Extract is centrifuged and diluted with acetonitrile.
Analyte	1-methyl-2-pyrrolidone
Detection	LC-MS-MS using d_9-1-methyl-2-pyrrolidone internal standard using ion transition 100→58 for quantitation
Detection Limit	Not provided
Range	8-20 µg/g

TABLE 53 Test Method(s) for 1,2,3-Trichloropropane

Chemical Formula	$C_3H_5Cl_3$
Test Method	**EPA Method 504.1**
Description	This method is used to determine specific compounds in finished drinking water and groundwater by micro extraction and gas chromatography.
Technique	GC-ECD
Sample Prep Method	Hexane extraction.
Analyte	1,2,3-Trichloropropane
Detection	Chromatogram retention time and calibration is used for identification and quantification of analyte.
Detection Limit	0.02 µg/L
Range	0.03-200 µg/L
Test Method	**EPA Method 8260B**
Description	This method is used to determine volatile organic compounds in a variety of matrices by gas chromatography and mass spectrometry.
Technique	GC-MS
Sample Prep Method	Various methods are recommended for various matrices. EPA Method 5030, EPA Method 5032, EPA Method 5035, EPA Method 5041, EPA Method 3585, EPA Method 5021, EPA Method 8260
Analyte	1,2,3-Trichloropropane
Detection	Mass spectrometry – primary ion at m/z =75; confirmation ion at m/z = 77
Detection Limit	5 µg/kg (wet weight) for soil/sediment samples, 0.5 mg/kg (wet weight) for wastes, and 5 µg/L for ground water
Range	Not provided

TABLE 54 Test Method(s) for 1,2-Benzenedicarboxylic Acid, di-C6-8-branched alkyl esters, C_7-rich

Chemical Formula	$C_{22}H_{34}O_4$
Test Method	**EN 14372:2004**
Description	A sample of polymer is extracted and the extracted phthalates are then run through a gas chromatograph. This method has not been validated for this analyte.
Technique	GC-MS
Sample Prep Method	2 g of the article is obtained for analysis. The sample is extracted in a Soxhlet extraction apparatus with diethyl ether for 6 h.
Analyte	1,2-benzenedicarboxylic acid esters
Detection	Mass spectrometry
Detection Limit	0.2 mg/kg
Range	0.2 mg/kg – 10 mg/kg

TABLE 55 Test Method(s) for Dichromium Tris(chromate)

Chemical Formula	Cr_5O_{12} $CrH_2O_4.2/3Cr$
Analytical Approach	Standard test method does not exist for $Cr_2(CrO_4)_3$. Therefore, the test method cited for $Cr_2(CrO_4)_3$ must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**EPA Method 7196A**
Description	Dissolved hexavalent chromium may be determined colorimetrically by reaction with diphenylcarbazide in acid solution. A red-violet color of unknown composition is produced. The reaction is very sensitive, the absorbancy index per gram atom of chromium being about 40,000 at 540 nm. Addition of an excess of diphenylcarbazide yields the red-violet product, and its absorbance is measured photometrically at 540 nm.
Technique	UV-Vis or colorimeter with 540 nm filter.
Sample Prep Method	EPA Method 3060A, Alkaline Digestion
Analyte	Cr(VI)
Detection	Absorption at 540 nm
Detection Limit	30 µg/L
Range	0.5 mg/L to 50 mg/L
Caveat	The chromium reaction with diphenylcarbazide is usually free from interferences. However, certain substances may interfere if the chromium concentration is relatively low. Hexavalent molybdenum and mercury salts also react to form color with the reagent; however, the red-violet intensities produced are much lower than those for chromium at the specified pH. Concentrations of up to 200 mg/L of molybdenum and mercury can be tolerated. Vanadium (V) interferes strongly, but concentrations up to 10 times that of chromium will not cause trouble. Iron can interfere as well but is less likely.

TABLE 56 Test Method(s) for Potassium Hydroxyoctaoxodizincatedi-chromate

Chemical Formula	$KZn_2(CrO_4)_2(OH)$
Analytical Approach	Standard test method does not exist for $KZn_2(CrO_4)_2(OH)$. Therefore, the test method cited for $KZn_2(CrO_4)_2(OH)$ must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**EPA Method 7196A**
Description	Dissolved hexavalent chromium may be determined colorimetrically by reaction with diphenylcarbazide in acid solution. A red-violet color of unknown composition is produced. The reaction is very sensitive, the absorbancy index per gram atom of chromium being about 40,000 at 540 nm. Addition of an excess of diphenylcarbazide yields the red-violet product, and its absorbance is measured photometrically at 540 nm.
Technique	UV-Vis or colorimeter with 540 nm filter.
Sample Prep Method	EPA Method 3060A, Alkaline Digestion
Analyte	Cr(VI)
Detection	Absorption at 540 nm
Detection Limit	30 µg/L
Range	0.5 mg/L to 50 mg/L
Caveat	The chromium reaction with diphenylcarbazide is usually free from interferences. However, certain substances may interfere if the chromium concentration is relatively low. Hexavalent molybdenum and mercury salts also react to form color with the reagent; however, the red-violet intensities produced are much lower than those for chromium at the specified pH. Concentrations of up to 200 mg/L of molybdenum and mercury can be tolerated. Vanadium (V) interferes strongly, but concentrations up to 10 times that of chromium will not cause trouble. Iron can interfere as well but is less likely.

TABLE 57 Test Method(s) for Pentazinc Chromate Octahydroxide

Chemical Formula	$Zn_5CrH_8O_{12}$
Analytical Approach	Standard test method does not exist for $Zn_5(CrO_4)(OH)_8$. Therefore, the test method cited for $Zn_5(CrO_4)(OH)_8$ must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**EPA Method 7196A**
Description	Dissolved hexavalent chromium may be determined colorimetrically by reaction with diphenylcarbazide in acid solution. A red-violet color of unknown composition is produced. The reaction is very sensitive, the absorbancy index per gram atom of chromium being about 40,000 at 540 nm. Addition of an excess of diphenylcarbazide yields the red-violet product, and its absorbance is measured photometrically at 540 nm.
Technique	UV-Vis or colorimeter with 540 nm filter.
Sample Prep Method	EPA Method 3060A, Alkaline Digestion
Analyte	Cr(VI)
Detection	Absorption at 540 nm
Detection Limit	30 µg/L
Range	0.5 mg/L to 50 mg/L
Caveat	The chromium reaction with diphenylcarbazide is usually free from interferences. However, certain substances may interfere if the chromium concentration is relatively low. Hexavalent molybdenum and mercury salts also react to form color with the reagent; however, the red-violet intensities produced are much lower than those for chromium at the specified pH. Concentrations of up to 200 mg/L of molybdenum and mercury can be tolerated. Vanadium (V) interferes strongly, but concentrations up to 10 times that of chromium will not cause trouble. Iron can interfere as well but is less likely.

TABLE 58 Test Method(s) for Formaldehyde, Oligomeric Reaction Products with Aniline (technical MDA)

Chemical Formula	$(C_6H_7N.CH_2O)x$
Test Method	**EPA Method 8131**
Description	The semivolatile compounds are introduced into the GC by injecting the sample extract into a gas chromatograph (GC) equipped with a capillary column. The GC column is temperature-programmed to separate the analytes, which are then detected with a detector connected to the gas chromatograph. Quantitation is accomplished by comparing the response of a major peak area relative to an internal standard using an appropriate calibration curve for the intended application.
Technique	GC-MS
Sample Prep Method	Soxhlet extraction or similar.
Analyte	$(C_6H_7N.CH_2O)x$
Detection	GC retention time and m/z from MSD. Use standard to determine proper m/z.
Detection Limit	Approximately 5 µg/L
Range	Unknown

TABLE 59 Test Method(s) for Bis(2-methoxyethyl) Phthalate

Chemical Formula	$C_{14}H_{18}O_6$
Test Method	**EN 14372:2004**
Description	A sample of polymer is extracted and the extracted phthalates are then run through a gas chromatograph. This method has not been validated for this analyte.
Technique	GC-MS
Sample Prep Method	2 g of the article is obtained for analysis. The sample is extracted in a Soxhlet extraction apparatus with diethyl ether for 6 h.
Analyte	Bis(2-methoxyethyl) phthalate
Detection	Mass spectrometry
Detection Limit	0.2 mg/kg
Range	0.2 mg/kg – 10 mg/kg

TABLE 60 Test Method(s) for 2-Methoxyaniline; o-Anisidine

Chemical Formula	C_7H_9NO
Test Method	**EN 14362-1**
Description	This method can be used to determine the concentration of o-Anisidine in natural, synthetic and blended textiles using gas chromatography with a mass spectrometer detector.
Technique	GC-MS
Sample Prep Method	The sample is subjected to a reducing agent followed by a separation and extraction procedure. The extract is introduced into the GC-MS by injecting the sample extract into a gas chromatograph (GC) equipped with a capillary column. The GC column is temperature-programmed to separate the analytes, which are then detected with a mass spectrometer (MS) connected to the gas chromatograph. Quantitation is accomplished by comparing the response of a major (quantitation) ion relative to an internal standard using an appropriate calibration curve for the intended application.
Analyte	o-Anisidine
Detection	Retention time from GC, m/z of 123, 108, 80 and 53 in mass spectrometer
Detection Limit	5 mg/kg
Range	5 mg/kg to 60 mg/kg
Test Method	**EN 17234**
Description	This method can be used to determine the concentration of o-Anisidine in leather using gas chromatography with a mass spectrometer detector.
Technique	GC-MS
Sample Prep Method	The sample is degreased and then subjected to a reducing agent followed by a separation and extraction procedure. The extract is introduced into the GC-MS by injecting the sample extract into a gas chromatograph (GC) equipped with a capillary column. The GC column is temperature-programmed to separate the analytes, which are then detected with a mass spectrometer (MS) connected to the gas chromatograph. Quantitation is accomplished by comparing the response of a major (quantitation) ion relative to an internal standard using an appropriate calibration curve for the intended application.
Analyte	o-Anisidine
Detection	Retention time from GC, m/z of 123, 108, 80 and 53 in mass spectrometer
Detection Limit	5 mg/kg
Range	5 mg/kg to 60 mg/kg

TABLE 61 Test Method(s) for 4-(1,1,3,3-Tetramethylbutyl)phenol, (4-tert-Octylphenol)

Chemical Formula	$C_{14}H_{22}O$
Test Method	**ASTM D7485-09**
Description	This test method is used to determine the quantity of Octylphenol and related compounds extracted from water utilizing solid phase extraction after separation by liquid chromatography and detection by tandem mass spectrometry.
Technique	LC-MS-MS
Sample Prep Method	Solid phase extraction at pH 2 using concentrated hydrochloric acid.
Analyte	Octylphenol
Detection	Tandem mass spectrometry with single reaction monitoring; mass transition 205.2 >133
Detection Limit	24 ng/L
Range	100-2000 ng/L
Test Method	**ASTM D7065-11**
Description	This test method is used to determine the quantity of Octylphenol and related compounds that are partitioned into organic solvent, separated using gas chromatography and detected with mass selective detection.
Technique	GC-MS
Sample Prep Method	Continuous liquid-liquid extraction at pH 2 using methylene chloride.
Analyte	Octylphenol
Detection	Mass spectrometry – primary ion at m/z =135; confirmation ions at m/z = 107, 91
Detection Limit	0.2 µg/L
Range	1.0-16.0 µg/L

TABLE 62 Test Method(s) for 1,2-Dichloroethane

Chemical Formula	$C_2H_4Cl_2$
Test Method	**EPA Method 524.2**
Description	This is a general purpose method for the identification and simultaneous measurement of purgeable volatile organic compounds in surface water, ground water, and drinking water in any stage of treatment by gas chromatography and mass spectrometry.
Technique	GC-MS
Sample Prep Method	Inert gas purge and absorbent trap, then heated and back flushed for analysis
Analyte	1,2-Dichloroethane
Detection	Mass spectrometry – primary ion at m/z =62; confirmation ion at m/z = 98
Detection Limit	0.02 µg/L
Range	0.02-200 µg/L for wide-bore thick-film capillary column, 0.02-20 µg/L for narrow-bore thin-film capillary column.
Test Method	**EPA Method 8260B**
Description	This method is used to determine volatile organic compounds in a variety of matrices by gas chromatography and mass spectrometry.
Technique	GC-MS
Sample Prep Method	Various methods are recommended for various matrices. EPA Method 5030, EPA Method 5032, EPA Method 5035, EPA Method 5041, EPA Method 3585, EPA Method 5021, EPA Method 8260
Analyte	1,2-Dichloroethane
Detection	Mass spectrometry – primary ion at m/z =62; confirmation ion at m/z = 98
Detection Limit	5 µg/kg (wet weight) for soil/sediment samples, 0.5 mg/kg(wet weight) for wastes, and 5 µg/L for ground water
Range	Not provided

TABLE 63 Test Method(s) for Bis(2-methoxyethyl) Ether

Chemical Formula	$C_6H_{14}O_3$
Analytical Approach	Bis(2-methoxyethyl) ether is similar to and in the boiling range of the volatile organic compounds listed in EPA Method 8260B
Test Method	**EPA Method 8260B**
Description	This method is used to determine volatile organic compounds in a variety of matrices by gas chromatography and mass spectrometry.
Technique	GC-MS
Sample Prep Method	Various methods are recommended for various matrices. EPA Method 5030, EPA Method 5032, EPA Method 5035, EPA Method 5041, EPA Method 3585, EPA Method 5021, EPA Method 8260
Analyte	Bis(2-methoxyethyl) ether
Detection	Mass spectrometry – primary ion at m/z = 59; confirmation ion at m/z = 45 ; secondary conformation ion at m/z= 89
Detection Limit	Not provided
Range	Not provided

TABLE 64 Test Method(s) for Arsenic Acid

Chemical Formula	AsH_3O_4
Analytical Approach	No test method is known for detecting arsenic acid directly. To calculate a hypothetical maximum of arsenic acid, elemental arsenic is detected and calculated as if all of the arsenic is from AsH_3O_4.
Test Method	**EPA 6010**
Description	The characteristic emission spectra are measured by optical spectrometry. Samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by a radio-frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and the intensities of the emission lines are monitored by photosensitive detectors.
Technique	ICP-OES
Sample Prep Method	EPA Method 3051, Microwave assisted acid digestion
Analyte	Arsenic
Detection	Atomic Emission at 193.696 nm
Detection Limit	35 µg/L
Range	Unknown
Caveat	Method scoped for soils and wastes samples. Method should be validated with sample matrix similar to actual samples.

TABLE 65 Test Method(s) for Calcium Arsenate

Chemical Formula	$As_2Ca_3O_8$
Analytical Approach	No test method is known for detecting calcium arsenate directly. To calculate a hypothetical maximum of calcium arsenate, elemental calcium is detected and calculated as if all of the calcium is from $As_2Ca_3O_8$
Test Method	**EPA 6010**
Description	The characteristic emission spectra are measured by optical spectrometry. Samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by a radio-frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and the intensities of the emission lines are monitored by photosensitive detectors.
Technique	ICP-OES
Sample Prep Method	EPA Method 3051, Microwave assisted acid digestion
Analyte	Calcium
Detection	Atomic Emission at 317.933 nm
Detection Limit	6.7 µg/L
Range	Unknown
Caveat	Method scoped for soils and wastes samples. Method should be validated with sample matrix similar to actual samples.

TABLE 66 Test Method(s) for Trilead Diarsenate

Chemical Formula	$As_2O_8Pb_3$
Analytical Approach	No test method is known for detecting trileaddiarsenate directly. To calculate a hypothetical maximum of trilead diarsenate, elemental lead is detected and calculated as if all of the lead is from $As_2O_8Pb_3$
Test Method	**EPA 6010**
Description	The characteristic emission spectra are measured by optical spectrometry. Samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by a radio-frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and the intensities of the emission lines are monitored by photosensitive detectors.
Technique	ICP-OES
Sample Prep Method	EPA Method 3052, Microwave assisted acid digestion
Analyte	Lead
Detection	Atomic Emission at 220.353 nm
Detection Limit	28 µg/L
Range	Unknown
Caveat	Method scoped for soils and wastes samples. Method should be validated with sample matrix similar to actual samples.

TABLE 67 Test Method(s) for N,N-dimethylacetamide (DMAC)

Chemical Formula	C_4H_9NO
Test Method	**NIOSH Manual of Analytical Method 2004**
Description	The semivolatile compounds are introduced into the GC by injecting the sample extract into a gas chromatograph (GC) equipped with a capillary column. The GC column is temperature-programmed to separate the analytes, which are then detected with a flame ionization detector (FID) connected to the gas chromatograph. Quantitation is accomplished by comparing the response of a major peak area relative to an internal standard using an appropriate calibration curve for the intended application.
Technique	GC-FID
Sample Prep Method	Solid sorbent tubes
Analyte	C_4H_9NO
Detection	Retention time from GC.
Detection Limit	0.05 mg
Range	0.5-4 mg/sample

TABLE 68 Test Method(s) for 2,2'-Dichloro-4,4'-methylenedianiline (MOCA)

Chemical Formula	$C_{13}H_{12}Cl_2N_2$
Test Method	**EPA Method 8270**
Description	The semivolatile compounds are introduced into the GC/MS by injecting the sample extract into a gas chromatograph (GC) equipped with a narrow-bore fused-silica capillary column. The GC column is temperature-programmed to separate the analytes, which are then detected with a mass spectrometer (MS) connected to the gas chromatograph. Quantitation is accomplished by comparing the response of a major (quantitation) ion relative to an internal standard using an appropriate calibration curve for the intended application.
Technique	GC-MS
Sample Prep Method	EPA Method 3541, Automated Soxhlet Extraction
Analyte	$C_{13}H_{12}Cl_2N_2$
Detection	Retention time from GC, m/z of 231 266,268,140,195 in mass spectrometer
Detection Limit	Approx. 50 ng
Range	Unknown

TABLE 69 Test Method(s) for Phenolphthalein

Chemical Formula	$C_{20}H_{14}O_4$
Analytical Approach	Phenolphthalein is a pH indicator with four molecular forms, presenting different colors according to its surrounding pH value in the solution. It is solid up to 260°C. Extraction with alcohol followed by solvent evaporation isolates the solid. Buffer solutions in specific pH ranges will identify the color change ranges characteristic to phenolphthalein.
Test Method	**"Practical chemistry" J. Lambert and T.A. Muir, 3rd. Ed. Heineman, London.**
Description	Buffer solutions are prepared in specific pH ranges, followed by addition to the substance. Observation of specific colors present at specific pH range provides identification of the substance.
Technique	pH color indicator
Sample Prep Method	Ethanol extraction, evaporate to dry or near dry, ready for pH buffer solution test.
Analyte	Phenolphthalein
Detection	Orange at pH<0, colorless at pH=0-8.2, pink to fuchsia at pH=8.2-12.0, colorless at pH>12.0
Detection Limit	Not provided
Range	Not provided

TABLE 70 Test Method(s) for Lead Azide

Chemical Formula	$Pb(N_3)_2$
Analytical Approach	No test method was located for determining lead azide directly. Methods below are for the determination of azide ion. Lead can be determined separately and lead azide from the lower of the two concentrations
Test Method	**Analyst 122, 315-319, 1997**
Description	This method is used to detect azide in environmental samples by sequential injection amperometry. A microporous gas permeable membrane in a gas diffusion unit separates azide from other anions that can be oxidized.
Technique	Sequential injection amperometry
Sample Prep Method	Azide passes from an aqueous donor stream to a stopped flow acceptor stream through a PTFE membrane in a gas diffusion cell.
Analyte	Azide ion.
Detection	Amperometric oxidation of azide to nitrogen gas according to $N_3 \rightarrow 3/2\ N_2 + e^-$
Detection Limit	24.6 µg/L.
Range	Linear to 0.5 µg/mL.Nonlinear to 20 µg/mL
Test Method	**OSHA Method ID-211**
Description	Airborne azides (NaN_3 or HN_3) are collected, desorbed in a weak sodium carbonate/bicarbonate buffer solution. Resultant N_3^- ion is analyzed by ion chromatography with UV detector at 210 nm.
Technique	Ion Chromatography with UV detection at 210 nm
Sample Prep Method	NaN_3 and HN_3 are collected in air and desorbed from filters using a sodium carbonate/bicarbonate solution that also serves as eluent.
Analyte	HN_3
Detection	UV absorption at 210 nm.
Detection Limit	3.47 µg/L azide in solution corresponding to 0.001 ppm HN_3 or 0.004 mg/m^3 NaN_3 for a 5-L air volume
Range	This method was validated over the concentration range of 0.057 to 0.263 ppm as HN_3.

TABLE 71 Test Method(s) for Lead Styphnate

Chemical Formula	$C_6HN_3O_8Pb$
Analytical Approach	No test method is known for detecting $C_6HN_3O_8Pb$ directly.
Test Method	**Screen for Lead**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as $C_6HN_3O_8Pb$.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 72 Test Method(s) for Lead Dipicrate

Chemical Formula	$C_{12}H_4N_6O_{14}Pb$
Analytical Approach	No test method was located for determining lead dipicrate directly. The method below is for the determination of picrate/picric acid
Test Method	**USGS Method O-3112-83**
Description	Picric acid is extracted from water or water-suspended sediment with methylene chloride. Extract is concentrated and measured using HPLC with UV detection.
Technique	HPLC with dual wavelength UV detection
Sample Prep Method	HCl and NaCl are added to water followed by extraction with methylene chloride. Extract is concentrated prior to HPLC.
Analyte	Picric acid
Detection	HPLC with UV detection
Detection Limit	2 µg/L
Range	Not provided

TABLE 73 Test Method(s) for 1,2-Bis(2-methoxyethoxy)ethane (TEGDME; triglyme)

Chemical Formula	$C_8H_{18}O_4$
Analytical Approach	1,2-Bis(2-methoxyethoxy)ethane is similar to and in the boiling range of the volatile organic compounds listed in EPA Method 8260B
Test Method	**EPA Method 8260B**
Description	This method is used to determine volatile organic compounds in a variety of matrices by gas chromatography and mass spectrometry.
Technique	GC-MS
Sample Prep Method	Various methods are recommended for various matrices. EPA Method 5030, EPA Method 5032, EPA Method 5035, EPA Method 5041, EPA Method 3585, EPA Method 5021, EPA Method 8260
Analyte	1,2-Bis(2-methoxyethoxy)ethane
Detection	Mass spectrometry – primary ion at $m/z = 59$; confirmation ion at $m/z = 45$; secondary conformation ion at $m/z= 29,89,103,133$
Detection Limit	Not provided
Range	Not provided

TABLE 74 Test Method(s) for 1,2-Dimethoxyethane; Ethylene Glycol Dimethyl Ether (EGDME)

Chemical Formula	$C_4H_{10}O_2$
Analytical Approach	1,2-Dimethoxyethane is similar to and in the boiling range of the volatile organic compounds listed in EPA Method 8260B
Test Method	**EPA Method 8260B**
Description	This method is used to determine volatile organic compounds in a variety of matrices by gas chromatography and mass spectrometry.
Technique	GC-MS
Sample Prep Method	Various methods are recommended for various matrices. EPA Method 5030, EPA Method 5032, EPA Method 5035, EPA Method 5041, EPA Method 3585, EPA Method 5021, EPA Method 8260
Analyte	1,2-Dimethoxyethane
Detection	Mass spectrometry – primary ion at m/z = 45; confirmation ion at m/z = 29,60, 90
Detection Limit	Not provided
Range	Not provided

TABLE 75 Test Method(s) for Ammoniumpentadecafluorooctanoate (APFO)

Chemical Formula	$C_8H_4NF_{15}NO_2$
Test Method	**CEN/TS 15968**
Description	The compounds are introduced into the LC-MS by injecting the sample extract into a liquid chromatograph (LC) equipped with a C18 column. The LC column is temperature programmed to separate the analytes, which are then detected with a mass spectrometer (MS) connected to the liquid chromatograph. Quantitation is accomplished by comparing the response of a major (quantitation) ion relative to an appropriate calibration curve for the intended application.
Technique	LC-tandemMS or LC-qMS
Sample Prep Method	CEN/TS 15968
Analyte	Ammoniumpentadecafluorooctanoate (APFO)
Detection	Retention time from LC-MS, m/Z of 413 and 369 in MS
Detection Limit	Unknown
Range	0.5 µg/L to 50 µg/L in extract

TABLE 76 Test Method(s) for C.I. Basic Blue 26 ([4-[[4-anilino-1-naphthyl][4-(dimethylamino)phenyl]methylene]cyclohexa-2,5-dien-1-ylidene]dimethylammonium chloride)

Chemical Formula	$C_{33}H_{32}ClN_3$
Test Method	**Standard Guide for Microspectrometry and Color Measurement in Forensic Paint Analysis**
Description	This is a qualitative test for colorants. Suitable instruments with appropriate optics, sensitivity, resolution, and dynamic range can measure and produce spectral curves of light energy from small samples as that light is transmitted, absorbed, or reflected by the sample. These spectra are collected over small measurement steps or increments of one-half to a few nanometers each. MSPs typically operate in the visible spectral region (~380 to ~800 nm) and also in the ultraviolet region (~190 to ~380 nm). They should not be confused with broadband or absorption filter-based, tristimulus systems or low resolution, large measurement step (5 nm or more) spectral analyzers.
Technique	Microspectrophotometer comparison with standards.
Sample Prep Method	Present a relatively flat surface or relatively transparent thin sample to spectrometer.
Analyte	$C_{33}H_{32}ClN_3$
Detection	The processes responsible for producing the color of pigments include: crystal-field effects with transition metal compounds (most of the inorganic pigments belong to this group), electron transitions between molecular orbitals in compounds with conjugated double bonds (organic pigments), electron transitions in compounds with conduction energy bands (metal pigments and pure semiconductors), and other processes caused by geometrical and wave optics (interference, scattering, diffraction in optically variable pigments, liquid crystal pigments, and so forth). All of these processes are based on the interaction between ultraviolet-visible (UV-Vis) light waves themselves or with electrons in pigments and can be measured and compared using MSP.
Detection Limit	Unknown
Range	190-800 nm

TABLE 77 Test Method(s) for C.I. Basic Violet 3

Chemical Formula	$C_{25}H_{30}ClN_3$
Test Method	**Standard Guide for Microspectrometry and Color Measurement in Forensic Paint Analysis**
Description	This is a qualitative test for colorants. Suitable instruments with appropriate optics, sensitivity, resolution, and dynamic range can measure and produce spectral curves of light energy from small samples as that light is transmitted, absorbed, or reflected by the sample. These spectra are collected over small measurement steps or increments of one-half to a few nanometers each. MSPs typically operate in the visible spectral region (~380 to ~800 nm) and also in the ultraviolet region (~190 to ~380 nm). They should not be confused with broadband or absorption filter-based, tristimulus systems or low resolution, large measurement step (5 nm or more) spectral analyzers.
Technique	Microspectrophotometer comparison with standards.
Sample Prep Method	Present a relatively flat surface or relatively transparent thin sample to spectrometer.
Analyte	$C_{25}H_{30}ClN_3$
Detection	The processes responsible for producing the color of pigments include: crystal-field effects with transition metal compounds (most of the inorganic pigments belong to this group), electron transitions between molecular orbitals in compounds with conjugated double bonds (organic pigments), electron transitions in compounds with conduction energy bands (metal pigments and pure semiconductors), and other processes caused by geometrical and wave optics (interference, scattering, diffraction in optically variable pigments, liquid crystal pigments, and so forth). All of these processes are based on the interaction between ultraviolet-visible (UV-Vis) light waves themselves or with electrons in pigments and can be measured and compared using MSP.
Detection Limit	Unknown
Range	190-800 nm

TABLE 78 Test Method(s) for C.I. Solvent Blue 4; (α,α-bis[4-(dimethylamino)phenyl]-4 (phenylamino)naphthalene-1-methanol)

Chemical Formula	$C_{33}H_{33}N_3O$
Test Method	**Standard Guide for Microspectrometry and Color Measurement in Forensic Paint Analysis**
Description	This is a qualitative test for colorants. Suitable instruments with appropriate optics, sensitivity, resolution, and dynamic range can measure and produce spectral curves of light energy from small samples as that light is transmitted, absorbed, or reflected by the sample. These spectra are collected over small measurement steps or increments of one-half to a few nanometers each. MSPs typically operate in the visible spectral region (~380 to ~800 nm) and also in the ultraviolet region (~190 to ~380 nm). They should not be confused with broadband or absorption filter-based, tristimulus systems or low resolution, large measurement step (5 nm or more) spectral analyzers.
Technique	Microspectrophotometer comparison with standards.
Sample Prep Method	Present a relatively flat surface or relatively transparent thin sample to spectrometer.
Analyte	$C_{33}H_{33}N_3\ O$
Detection	The processes responsible for producing the color of pigments include: crystal-field effects with transition metal compounds (most of the inorganic pigments belong to this group), electron transitions between molecular orbitals in compounds with conjugated double bonds (organic pigments), electron transitions in compounds with conduction energy bands (metal pigments and pure semiconductors), and other processes caused by geometrical and wave optics (interference, scattering, diffraction in optically variable pigments, liquid crystal pigments, and so forth). All of these processes are based on the interaction between ultraviolet-visible (UV-Vis) light waves themselves or with electrons in pigments and can be measured and compared using MSP.
Detection Limit	Unknown
Range	190-800 nm

TABLE 79 Test Method(s) for C.I. Solvent Violet 8; (4,4'-bis(dimethylamino)-4''-(methylamino)trityl alcohol)

Chemical Formula	$C_{24}H_{29}N_3O$
Test Method	**Standard Guide for Microspectrometry and Color Measurement in Forensic Paint Analysis**
Description	This is a qualitative test for colorants. Suitable instruments with appropriate optics, sensitivity, resolution, and dynamic range can measure and produce spectral curves of light energy from small samples as that light is transmitted, absorbed, or reflected by the sample. These spectra are collected over small measurement steps or increments of one-half to a few nanometers each. MSPs typically operate in the visible spectral region (~380 to ~800 nm) and also in the ultraviolet region (~190 to ~380 nm). They should not be confused with broadband or absorption filter-based, tristimulus systems or low resolution, large measurement step (5 nm or more) spectral analyzers.
Technique	Microspectrophotometer comparison with standards.
Sample Prep Method	Present a relatively flat surface or relatively transparent thin sample to spectrometer.
Analyte	$C_{24}H_{29}N_3$ O
Detection	The processes responsible for producing the color of pigments include: crystal-field effects with transition metal compounds (most of the inorganic pigments belong to this group), electron transitions between molecular orbitals in compounds with conjugated double bonds (organic pigments), electron transitions in compounds with conduction energy bands (metal pigments and pure semiconductors), and other processes caused by geometrical and wave optics (interference, scattering, diffraction in optically variable pigments, liquid crystal pigments, and so forth). All of these processes are based on the interaction between ultraviolet-visible (UV-Vis) light waves themselves or with electrons in pigments and can be measured and compared using MSP.
Detection Limit	Unknown
Range	190-800 nm

TABLE 80 Test Method(s) for Di-n-pentyl Phthalate

Chemical Formula	$C_{18}H_{26}O_4$
Test Method	**EN 14372:2004**
Description	A sample of polymer is extracted and the extracted phthalates are then run through a gas chromatograph. This method has not been validated for this analyte.
Technique	Soxhlet extraction
Sample Prep Method	2 g of the article is obtained for analysis. The sample is extracted in a Soxhlet extraction apparatus with diethyl ether for 6 h.
Analyte	Di-n-pentyl phthalate
Detection	Mass spectrometry
Detection Limit	0.2 mg/kg
Range	0.2 mg/kg – 10 mg/kg

TABLE 81 Test Method(s) for Diboron Trioxide, Boric Oxide

Chemical Formula	B_2O_3
Analytical Approach	No test method is known for detecting B_2O_3 directly. To calculate a hypothetical maximum of B_2O_3, elemental boron is detected and calculated as if all of the boron is from B_2O_3.
Test Method	**EPA Method 6010**
Description	The characteristic emission spectra are measured by optical spectrometry. Samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by a radio-frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and the intensities of the emission lines are monitored by photosensitive detectors.
Technique	ICP-OES
Sample Prep Method	EPA Method 3051, Microwave assisted acid digestion
Analyte	B (elemental)
Detection	Atomic emission at 249.679 nm
Detection Limit	4 µg/L
Range	Unknown
Caveat	Method scoped for soils and wastes samples. Method should be validated with sample matrix similar to actual samples.

TABLE 82 Test Method(s) for Diisopentyl Phthalate

Chemical Formula	$C_{18}H_{26}O_4$
Test Method	**EN 14372:2004**
Description	A sample of polymer is extracted and the extracted phthalates are then run through a gas chromatograph. This method has not been validated for this analyte.
Technique	Soxhlet extraction
Sample Prep Method	2 g of the article is obtained for analysis. The sample is extracted in a Soxhlet extraction apparatus with diethyl ether for 6 h.
Analyte	Diisopentyl phthalate
Detection	Mass spectrometry
Detection Limit	0.2 mg/kg
Range	0.2 mg/kg – 10 mg/kg

TABLE 83 Test Method(s) for Distillates (coal tar), Heavy Oils

Chemical Formula	XXXX
Analytical Approach	Coal tar distillates are made up of crude coke oven tar components, which are produced during the high temperature coking of bituminous coal. They boil between 100°C and 400°C during the distillation process to produce carbon pitch. Refined chemical oil distills between 210°C and 315°C. The distillates that distill above 315°C are high molecular weight aromatic hydrocarbons (middle and heavy distillates). The final residue after distillation is called coal-tar pitch. Coal tar distillates contain greater than 75 wt% polycyclic aromatic hydrocarbons and alkylated polycyclic aromatic hydrocarbons. Distillates (coal tar), heavy oils is considered persistent bioaccumulative toxic chemical.
Reference	Environmental contaminants encyclopedia coal tar entry, July 1, 1997, Roy J. Irwin, National Park Service
Test Method	**EPA Method 8270D, The expanded scan for PAHs [828] (a modified EPA Method 8270 including alkyl homologues and lower detection limits)**
Description	This method is used to determine the concentration of semi volatile organic compounds in extracts prepared from many types of solid waste matrices, soils, air sampling media and water samples.
Technique	GC-MS
Sample Prep Method	Various methods are recommended for various matrices. EPA Method 5030, EPA Method 3510, EPA Method 3520, EPA Method 5041, EPA Method 3540, EPA Method 3550, EPA Method 3580.
Analyte	Polycyclic aromatic hydrocarbons and alkylated polycyclic aromatic hydrocarbons
Detection	Gas chromatography retention time and mass spectrometry – primary ion and confirmation ion.
Detection Limit	Reference method table for specific analyte
Range	Reference method table for specific analyte
Test Method	**EPA Method 8310**
Description	This method is used to determine the concentration of certain polynuclear aromatic hydrocarbons in ground water and wastes.
Technique	HPLC
Sample Prep Method	Extraction with methylenechloride followed by exchange to acetonitrile
Analyte	Polycyclic aromatic hydrocarbons and alkylated polycyclic aromatic hydrocarbons
Detection	Liquid chromatography retention time and ultraviolet spectrum
Detection Limit	Reference method table for specific analyte
Range	Reference method table for specific analyte

TABLE 84 Test Method(s) for Distillates (coal tar), Heavy Oils, Pyrene Fraction

Chemical Formula	XXXX
Analytical Approach	Coal tar distillates are made up of crude coke oven tar components, which are produced during the high temperature coking of bituminous coal. They boil between 100°C and 400°C during the distillation process to produce carbon pitch. Refined chemical oil distills between 210°C and 315°C. The distillates that distill above 315°C are high molecular weight aromatic hydrocarbons (middle and heavy distillates). The final residue after distillation is called coal-tar pitch. Coal tar distillates contain greater than 75 wt% polycyclic aromatic hydrocarbons and alkylated polycyclic aromatic hydrocarbons. Coal tar contains up to 2 wt% pyrene. Distillates (coal tar), heavy oils, pyrene fraction is considered persistent bioaccumulative toxic chemical.
Reference	Environmental contaminants encyclopedia coal tar entry, July 1, 1997, Roy J. Irwin, National Park Service
Test Method	**EPA Method 8270D, The expanded scan for PAHs [828] (a modified EPA Method 8270 including alkyl homologues and lower detection limits)**
Description	This method is used to determine the concentration of semi volatile organic compounds in extracts prepared from many types of solid waste matrices, soils, air sampling media and water samples.
Technique	GC-MS
Sample Prep Method	Various methods are recommended for various matrices. EPA Method 5030, EPA Method 3510, EPA Method 3520, EPA Method 5041, EPA Method 3540, EPA Method 3550, EPA Method 3580.
Analyte	Pyrene and polycyclic aromatic hydrocarbons and alkylated polycyclic aromatic hydrocarbons
Detection	Gas chromatography retention time and mass spectrometry – primary ion and confirmation ion.
Detection Limit	Reference method table for specific analyte
Range	Reference method table for specific analyte
Test Method	**EPA Method 8310**
Description	This method is used to determine the concentration of certain polynuclear aromatic hydrocarbons in ground water and wastes.
Technique	HPLC
Sample Prep Method	Extraction with methylenechloride followed by exchange to acetonitrile
Analyte	Pyrene and polycyclic aromatic hydrocarbons and alkylated polycyclic aromatic hydrocarbons
Detection	Liquid chromatography retention time and ultraviolet spectrum
Detection Limit	Reference method table for specific analyte
Range	Reference method table for specific analyte

TABLE 85 Test Method(s) for Distillates (coal tar), Pitch, Pyrene Fraction

Chemical Formula	XXXX
Analytical Approach	Coal tar distillates are made up of crude coke oven tar components, which are produced during the high temperature coking of bituminous coal. They boil between 100°C and 400°C during the distillation process to produce carbon pitch. Refined chemical oil distills between 210°C and 315°C. The distillates that distill above 315°C are high molecular weight aromatic hydrocarbons (middle and heavy distillates). The final residue after distillation is called coal-tar pitch. Coal tar distillates contain greater than 75 wt% polycyclic aromatic hydrocarbons and alkylated polycyclic aromatic hydrocarbons. Coal tar contains up to 2 wt% pyrene. Distillates (coal tar), pitch, pyrene fraction is considered persistent bioaccumulative toxic chemical.
Reference	Environmental contaminants encyclopedia coal tar entry, July 1, 1997, Roy J. Irwin, NationalPark Service
Test Method	**EPA Method 8270D, The expanded scan for PAHs [828] (a modified EPA Method 8270 including alkyl homologues and lower detection limits)**
Description	This method is used to determine the concentration of semi volatile organic compounds in extracts prepared from many types of solid waste matrices, soils, air sampling media and water samples.
Technique	GC-MS
Sample Prep Method	Various methods are recommended for various matrices. EPA Method 5030, EPA Method 3510, EPA Method 3520, EPA Method 5041, EPA Method 3540, EPA Method 3550, EPA Method 3580.
Analyte	Pyrene and polycyclic aromatic hydrocarbons and alkylated polycyclic aromatic hydrocarbons
Detection	Gas chromatography retention time and mass spectrometry – primary ion and confirmation ion.
Detection Limit	Reference method table for specific analyte
Range	Reference method table for specific analyte
Test Method	**EPA Method 8310**
Description	This method is used to determine the concentration of certain polynuclear aromatic hydrocarbons in ground water and wastes.
Technique	HPLC
Sample Prep Method	Extraction with methylenechloride followed by exchange to acetonitrile
Analyte	Pyrene and polycyclic aromatic hydrocarbons and alkylated polycyclic aromatic hydrocarbons
Detection	Liquid chromatography retention time and ultraviolet spectrum
Detection Limit	Reference method table for specific analyte
Range	Reference method table for specific analyte

TABLE 86 Test Method(s) for Formamide

Chemical Formula	CH_3NO
Test Method	**EPA 1671**
Description	Direct analysis of environmental samples by GC-FID
Technique	GC-FID
Sample Prep Method	Aqueous portion of sample is separated from solids and measured using GC-FID after addition of internal standard
Analyte	Formamide
Detection	Direct aqueous injection GC-FID using tetrahydrofuran as internal standard
Detection Limit	100 mg/L
Range	Method found to be linear over range 0-5 µg/L of acrylamide monomer

TABLE 87 Test Method(s) for Further Arsenic Compounds

Chemical Formula	Various
Analytical Approach	No test method is known for detecting arsenic compounds directly. To calculate a hypothetical maximum of arsenic compounds, elemental arsenic is detected and calculated as if all of the arsenic is from an arsenic compound.
Test Method	**EPA 6010**
Description	The characteristic emission spectra are measured by optical spectrometry. Samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by a radio-frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and the intensities of the emission lines are monitored by photosensitive devices.
Technique	ICP-OES
Sample Prep Method	EPA Method 3051, Microwave assisted acid digestion
Analyte	Arsenic
Detection	Atomic Emission at 193.696
Detection Limit	35 µg/L
Range	Unknown
Caveat	Method scoped for soils and wastes samples. Method should be validated with sample matrix similar to actual samples.

TABLE 88 Test Method(s) for Lead(II) bis(methanesulfonate)

Chemical Formula	$C_2H_6O_6PbS_2$
Analytical Approach	No test method is known for detecting $C_2H_6O_6PbS_2$ directly.
Test Method	**Screen for Lead**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as $C_2H_6O_6PbS_2$.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 89 Test Method(s) for Michler's Base; (N,N,N',N'-tetramethyl-4,4'-methylenedianiline)

Chemical Formula	$C_{17}H_{22}N_2$
Analytical Approach	N,N,N',N'-tetramethyl-4,4'-methylenedianiline is similar in structure to and in the boiling range of the semi volatile organic compounds listed in EPA Method 625. Direct injection is recommended.
Test Method	**EPA Method 625**
Description	This method is to be used to analyze semi-volatile organic compounds, which are extractable from municipal and industrial discharges by isotope dilution gas chromatography mass spectrometry.
Technique	GC-MS
Sample Prep Method	Methylenechloride extraction followed by evaporation, then analyzed
Analyte	N,N,N',N'-tetramethyl-4,4'-methylenedianiline
Detection	Mass spectrometry – primary ion at m/z = 254; confirmation ion at m/z = 210 and 134; secondary conformation ion at m/z= 237 and 165
Detection Limit	Not provided
Range	Not provided

TABLE 90 Test Method(s) for Michler's Ketone; (4,4'-bis(dimethylamino)benzophenone)

Chemical Formula	$C_{17}H_{20}N_2O$
Analytical Approach	4,4'-bis(dimethylamino)benzophenone is similar in structure to and in the boiling range of the semi volatile organic compounds listed in EPA Method 625. Direct injection is recommended.
Test Method	**EPA Method 625**
Description	This method is to be used to analyze semi volatile organic compounds, which are extractable from municipal and industrial discharges by isotope dilution gas chromatography mass spectrometry.
Technique	GC-MS
Sample Prep Method	Methylenechloride extraction followed by evaporation, then analyzed
Analyte	4,4'-bis(dimethylamino)benzophenone
Detection	Mass spectrometry – primary ion at m/z = 148; confirmation ion at m/z = 268; secondary conformation ion at m/z= 224 and 251
Detection Limit	Not provided
Range	Not provided

TABLE 91 Test Method(s) for Perfluorooctanic Acid (PFOA)

Chemical Formula	$C_8HF_{15}O_2$ (PFOA)
Test Method	**CEN/TS 15968**
Description	The compounds are introduced into the LC-MS by injecting the sample extract into a liquid chromatograph (LC) equipped with a C_{18} column. The LC column is temperature programmed to separate the analytes, which are then detected with a mass spectrometer (MS) connected to the liquid chromatograph. Quantitation is accomplished by comparing the response of a major (quantitation) ion relative to an appropriate calibration curve for the intended application.
Technique	LC-tandemMS or LC-qMS
Sample Prep Method	CEN/TS 15968
Analyte	Perfluorooctanoic acid (PFOA)
Detection	Retention time from LC-MS, m/Z of 413 and 369 in MS
Detection Limit	Unknown
Range	0.5 µg/L to 50 µg/L in extract

TABLE 92 Test Method(s) for Residues (coal tar), Pitch Distillation

Chemical Formula	XXXX
Analytical Approach	Coal tar distillates are made up of crude coke oven tar components, which are produced during the high temperature coking of bituminous coal. They boil between 100°C and 400°C during the distillation process to produce carbon pitch. Refined chemical oil distills between 210°C and 315°C. The distillates that distill above 315°C are high molecular weight aromatic hydrocarbons (middle and heavy distillates). The final residue after distillation is called coal-tar pitch. Coal tar distillates contain greater than 75 wt% polycyclic aromatic hydrocarbons and alkylated polycyclic aromatic hydrocarbons. Coal-tar pitches are shiny, dark-brown to black residues produced during the distillation of coal tars. They contain various PAHs, their methyl and polymethyl derivatives, and heteronuclear compounds. Residues (coal tar), pitch distillation is considered persistent bioaccumulative toxic chemical.
Reference	Environmental contaminants encyclopedia coal tar entry, July 1, 1997, Roy J. Irwin, National Park Service
Test Method	**EPA Method 8270D, The expanded scan for PAHs [828] (a modified EPA Method 8270 including alkyl homologues and lower detection limits)**
Description	This method is used to determine the concentration of semi-volatile organic compounds in extracts prepared from many types of solid waste matrices, soils, air sampling media and water samples.
Technique	GC-MS
Sample Prep Method	Various methods are recommended for various matrices. EPA Method 5030, EPA Method 3510, EPA Method 3520, EPA Method 5041, EPA Method 3540, EPA Method 3550, EPA Method 3580.
Analyte	Pyrene and polycyclic aromatic hydrocarbons and alkylated polycyclic aromatic hydrocarbons
Detection	Gas chromatography retention time and mass spectrometry – primary ion and confirmation ion.
Detection Limit	Reference method table for specific analyte
Range	Reference method table for specific analyte
Test Method	**EPA Method 8310**
Description	This method is used to determine the concentration of certain polynuclear aromatic hydrocarbons in ground water and wastes.
Technique	HPLC
Sample Prep Method	Extraction with methylenechloride followed by exchange to acetonitrile
Analyte	Pyrene and polycyclic aromatic hydrocarbons and alkylated polycyclic aromatic hydrocarbons
Detection	Liquid chromatography retention time and ultraviolet spectrum
Detection Limit	Reference method table for specific analyte
Range	Reference method table for specific analyte

TABLE 93 Test Method(s) for TGIC (1,3,5-tris(oxiranylmethyl)-1,3,5-triazine-2,4,6(1H,3H,5H)-trione)

Chemical Formula	$C_{12}H_{15}N_3O_6$
Test Method	**AV-052 Ambient Monitoring Method for TGIC ISBN 0 644 33389 8**
Description	Extracted samples are introduced into the column where they are separated. The characteristics retention time and UV detector are the analytical signals.
Technique	HPLC-UV
Sample Prep Method	Extraction with HPLC eluent
Analyte	TGIC
Detection	Retention time with UV
Detection Limit	0.4 µg
Range	6 to 240 µg

TABLE 94 Test Method(s) for β-TGIC; (1,3,5-tris[(2S and 2R)-2,3-epoxypropyl]-1,3,5-triazine-2,4,6-(1H,3H,5H)-trione)

Chemical Formula	$C_{12}H_{15}N_3O_6$
Test Method	**AV-052 Ambient Monitoring Method for TGIC ISBN 0 644 33389 8**
Description	Extracted samples are introduced into the column where they are separated. The characteristics retention time and UV detector are the analytical signals.
Technique	HPLC-UV
Sample Prep Method	Extraction with HPLC eluent
Analyte	TGIC
Detection	Retention time with UV
Detection Limit	0.4 µg
Range	6 to 240 µg

TABLE 95 Test Method(s) for Cadmium

Chemical Formula	Cd
Test Method	**IEC 62321-3-1**
Description	IEC 62321-3-1 describes the screening analysis of cadmium in uniform materials in electrotechnical products using X-ray fluorescence (XRF) spectrometry.
Technique	X-ray fluorescence (XRF) spectrometry
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321-2.
Analyte	Cd
Detection	Preferred X-ray line $\text{K-L}_{2,3}$ ($\text{Ka}_{1,2}$)
Detection Limit	Not provided; dependent on the sample matrix
Range	Cd (< 3 mg/kg) not detectable for lead-free solder; 10–183 mg/kg for ABS; 19.6–141 mg/kg for PE
Test Method	**IEC 62321-5**
Description	IEC 62321-5 describes the test methods for cadmium in polymers, metals and electronics by AAS, AFS, ICP-OES and ICP-MS.
Technique	AAS, AFS, ICP-OES and ICP-MS
Sample Prep Method	The sample is pre-cut and milled to an appropriate size for the method selected. The test solution is prepared by dry ashing or by sample digestion with acids such as nitric acid and sulfuric acid. Reference IEC 62321-2.
Analyte	Cd
Detection	ICP-OES: 214.439, 226.502, 228.802, 361.051 nm; ICP-MS: 111, 112, 113, 114 m/z of isotopes; AAS and AFS: 228.8 nm;
Detection Limit	ICP-OES: 10 mg/kg; AAS: 10 mg/kg; ICP-MS: 0.1 mg/kg; AFS: 1.5 mg/kg
Range	Not provided

TABLE 96 Test Method(s) for Dipentyl Phthalate (DPP)

Chemical Formula	$C_{18}H_{26}O_4$
Test Method	**EN 14372:2004**
Description	A sample of polymer is extracted and the extracted phthalates are then run through a gas chromatograph. This method has not been validated for this analyte.
Technique	GC-MS
Sample Prep Method	2 g of the article is obtained for analysis. The sample is extracted in a Soxhlet extraction apparatus with diethyl ether for 6 h.
Analyte	Diisobutyl phthalate
Detection	Mass spectrometry
Detection Limit	0.2 mg/kg
Range	0.2 mg/kg – 10 mg/kg

TABLE 97 Test Method(s) for 4-Nonylphenol, Branched and Linear, Ethoxylated

Chemical Formula	$(C_2H_4O)n\ C_{15}H_{24}O$, with $n \geq 1$
Test Method	**CEN/TC BT WI CSS99040**
Description	This European Standard primarily describes the analysis of sludge, soil and treated bio-waste. Other solid materials like sediment and selected solid wastes may also be analyzed by the method. The analyte is extracted and detected by GC-MS.
Technique	GC-MS
Sample Prep Method	Test sample is extracted by shaking the sample with a mixture of acetone and petroleum ether (1:1). If necessary interfering compounds are removed from the extract by a clean-up on a suitable column.
Analyte	4-Nonylphenol, branched and linear, ethoxylated
Detection	GC retention time and mass ions are used. Target ion m/z=251, qualifier ions m/z=265 and 279 are used to identify monoethoxylate. Target ion m/z=295, qualifier ions m/z=309 and 323 are used to identify diethoxylate. Higher polyethoxylates are not specified in this method.
Detection Limit	mg/L Lower LOD's may be achieved by concentrating the extract by solvent evaporation.
Range	0.01 mg/L-5 mg/L
Test Method	**Government Chemist Programme, LGC/GC/2006/019**
Description	Nonyl and octyl phenol ethoxylates in textiles were extracted, followed by solid phase extraction clean up, and then analyzed with GC-MS.
Technique	GC-MS
Sample Prep Method	Test sample is extracted using a Dionex ASE-200 with 11 mL extraction cell with a solvent composition of 1:1 ratio of methanol and water. Solid phase extraction may be followed.
Analyte	octylphenol, ethoxylated
Detection	GC retention time and mass ions are used. Target ion sets of three are provided in the method from ethoxylate 1 to 10.
Detection Limit	50 µg/mL
Range	undetermined

TABLE 98 Test Method(s) for Cadmium Oxide

Chemical Formula	CdO
Analytical Approach	Standard test method does not exist for CdO. To calculate a hypothetical maximum of CdO, elemental cadmium is detected and calculated as if all of the cadmium is from CdO. The test method cited for CdO must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**IEC 62321-3-1**
Description	IEC 62321-3-1 describes the screening analysis of cadmium in uniform materials in electrotechnical products using X-ray fluorescence (XRF) spectrometry.
Technique	X-ray fluorescence (XRF) spectrometry
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321-2.
Analyte	Cd
Detection	Preferred X-ray line K-L$_{2,3}$ (Ka$_{1,2}$)
Detection Limit	Not provided; dependent on the sample matrix
Range	Cd (< 3 mg/kg) not detectable for lead-free solder; 10–183 mg/kg for ABS; 19.6–141 mg/kg for PE
Test Method	**IEC 62321-5**
Description	IEC 62321-5 describes the test methods for cadmium in polymers, metals and electronics by AAS, AFS, ICP-OES and ICP-MS.
Technique	AAS, AFS, ICP-OES and ICP-MS
Sample Prep Method	The sample is pre-cut and milled to an appropriate size for the method selected. The test solution is prepared by dry ashing or by sample digestion with acids such as nitric acid and sulfuric acid. Reference IEC 62321-2.
Analyte	Cd
Detection	ICP-OES: 214.439, 226.502, 228.802, 361.051 nm; ICP-MS: 111, 112, 113, 114 m/z of isotopes; AAS and AFS: 228.8 nm;
Detection Limit	ICP-OES: 10 mg/kg; AAS: 10 mg/kg; ICP-MS: 0.1 mg/kg; AFS: 1.5 mg/kg
Range	Not provided

TABLE 99 Test Method(s) for Hexahydromethylphthalic anhydride [1], Hexahydro-4-methylphthalic anhydride [2], Hexahydro-1-methylphthalic anhydride [3], Hexahydro-3-methylphthalic anhydride [4]

Chemical Formula	$C_9H_{12}O_3$
Analytical Approach	The cyclic anhydrides category contains both solid and liquid compounds that have moderate vapor pressure. The water solubility of the cyclic anhydrides cannot be accurately determined since the category members hydrolyze to their corresponding cyclic diacid rapidly. The cyclic anhydrides are expected to have high mobility in soil, but would hydrolyze to the cyclic diacid before traveling far. Volatilization of the cyclic anhydrides is expected to be low since these compounds hydrolyze rapidly to their corresponding cyclic diacid, which exist as anions in the environment.
Test Method	**Cyclic Acid Anhydrides: Human Health Aspects by IPCS**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	Hexahydromethylphthalic anhydride Hexahydromethylphthalic diacids
Detection	Anhydride analyte is identified and quantified by retention time and mass spectrum precursor ion m/z=170. Diacids analyte is identified and quantified by retention time and mass ions m/z=96 and 141
Detection Limit	undetermined
Range	undetermined

TABLE 100 Test Method(s) for 6-methoxy-m-toluidine (p-cresidine)

Chemical Formula	$C_8H_{11}NO$
Analytical Approach	No test method is known for detecting 6-methoxy-m-toluidine directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	6-methoxy-m-toluidine
Detection	The analyte is identified and quantified by retention time and mass ions m/z=122, 137, and 94.
Detection Limit	undetermined
Range	undetermined

TABLE 101 Test Method(s) for Cyclohexane-1,2-dicarboxylic anhydride [1], cis-cyclohexane-1,2-dicarboxylic anhydride [2], trans-cyclohexane-1,2-dicarboxylic anhydride [3]

Chemical Formula	$C_8H_{10}O_3$
Analytical Approach	The cyclic anhydrides category contains both solid and liquid compounds that have moderate vapor pressure. The water solubility of the cyclic anhydrides cannot be accurately determined since the category members hydrolyze to their corresponding cyclic diacid rapidly. The cyclic anhydrides are expected to have high mobility in soil, but would hydrolyze to the cyclic diacid before traveling far. Volatilization of the cyclic anhydrides is expected to be low since these compounds hydrolyze rapidly to their corresponding cyclic diacid, which exist as anions in the environment. In organic solvent, anhydrides exhibit typical behavior in their mass spectra.
Test Method	**Cyclic Acid Anhydrides: Human Health Aspects by IPCS**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	Cyclohexane-1,2-dicarboxylic anhydride Cyclohexane-1,2-dicarboxylic diacids
Detection	Anhydride analyte is identified and quantified by retention time and mass ion m/z=155. Diacids analyte is identified and quantified by retention time and mass ions m/z=81 and 126
Detection Limit	undetermined
Range	undetermined

TABLE 102 Test Method(s) for Pyrochlore, Antimony Lead Yellow

Chemical Formula	$Pb_3(SbO_4)_3$, $Pb(SbO_3)_2$
Test Method	**Screen for lead and antimony**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead and arsenic as $Pb_3(SbO_4)_3$.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb and Sb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence. The absence of either Pb or Sb indicates this SVHC is not present at detection limit levels.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 103 Test Method(s) for Henicosafluoroundecanoic Acid

Chemical Formula	$C_{11}HF_{21}O_2$
Test Method	**EPA Method 537**
Description	This method is for the determination of selected perfluorinated alkyl acids in drinking water. Accuracy and precision data have been generated in reagent water, and finished ground and surface waters.
Technique	LC-MS-MS
Sample Prep Method	A 250-mL water sample is fortified with surrogates and passed through a solid phase extraction cartridge containing polystyrenedivinylbenzene. The compounds are eluted from the solid phase with a small amount of methanol, dried with nitrogen in a heated water bath, and then adjusted to a 1-mL volume with 96:4 % (vol/vol) methanol:water after adding the internal standard(s), then analyzed with LC-MS-MS.
Analyte	Henicosafluoroundecanoic acid
Detection	Analyte is identified and quantified by retention time and mass spectrum precursor ion m/z=563 and product ion m/z=519.
Detection Limit	2.8 ng/L
Range	5.4–54 ng/L

TABLE 104 Test Method(s) for 4-Aminoazobenzene

Chemical Formula	$C_{12}H_{11}N_3$
Analytical Approach	No test method is known for detecting 4-Aminoazobenzene directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	4-Aminoazobenzene
Detection	The analyte is identified and quantified by retention time and mass ions m/z=92, 197, 120, 77, and 65.
Detection Limit	undetermined
Range	undetermined

TABLE 105 Test Method(s) for Silicic Acid, Lead Salt

Chemical Formula	O_3PbSi
Test Method	**Screen for lead and silicon**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead and silicon as O_3PbSi.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb, Si
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence. The absence of either Pb or Si indicates this SVHC is not present at detection limit levels.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 106 Test Method(s) for Lead Titanium Zirconium Oxide

Chemical Formula	(Pbx Tiy Zrz) O_3
Test Method	**Screen for lead, titanium and zirconium**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead, titanium and zirconium as $(PbTiZr)O_3$.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb, Ti and Zr
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence. The absence of any one of the three elements will indicate lead titanium zirconium oxide is not present at minimal detection levels.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 107 Test Method(s) for Lead Monoxide (Lead Oxide)

Chemical Formula	OPb
Test Method	**Screen for lead**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as PbO.
Technique	EPA Method 6200, Field portable X-ray fluoresence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 108 Test Method(s) for o-Toluidine

Chemical Formula	C_7H_9N
Analytical Approach	No test method is known for detecting o-Toluidine directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	o-Toluidine
Detection	The analyte is identified and quantified by retention time and mass ions m/z=106, 107, and 77.
Detection Limit	undetermined
Range	undetermined

TABLE 109 Test Method(s) for 3-ethyl-2-methyl-2-(3-methylbutyl)-1,3-oxazolidine

Chemical Formula	$C_{11}H_{23}NO$
Analytical Approach	No test method is known for detecting 3-ethyl-2-methyl-2-(3-methylbutyl)-1,3-oxazolidine directly. GC retention time and IR spectrum can be used for identification.
Test Method	**National Industrial Chemicals Notification and Assessment Scheme, File No: NA/278 Date: April 1996**
Description	GC retention time and IR spectrum are used as reference to identify the analyte.
Technique	GC, IR
Sample Prep Method	Solvent extraction from the matrix
Analyte	3-ethyl-2-methyl-2-(3-methylbutyl)-1,3-oxazolidine
Detection	GC retention time match. IR ten strongest bands at 2955, 2872, 2801, 1467, 1382, 1255, 1189, 1062, and 855 cm^{-1}
Detection Limit	undetermined
Range	undetermined

TABLE 110 Test Method(s) for Dibutyltin Dichloride (DBTC)

Chemical Formula	$C_8H_{18}Cl_2Sn$
Test Method	**ISO 17353-2004**
Description	This method is used to detect organotin compounds in water after solvent extraction and analysis by GC/MS or other detection methods.
Technique	GC-MS; also AED (atomic emission detection), FPD (flame photometric detection) and other types of detection systems are applicable.
Sample Prep Method	Organotin compounds in water are alkylated with sodium tetraethylborate. Extraction of the tetrasubstituted organotin compound in hexane followed by cleanup with silica is performed. After concentration the extract is analyzed in the GC/MS.
Analyte	Tributylmonoethyl tin
Detection	Mass spectrometry of the tributylmonoethyl tin; mass clusters at 291/289, 263/261 and 179/177
Detection Limit	Not provided
Range	10 ng/L to 1000 ng/L
Test Method	**EPA Method 8323**
Description	This method covers the use of solid-phase extraction (SPE) discs, solvent extractions (for biological tissues), and reversed-phase micro-liquid chromatographic (µLC) and electrospray (ES) mass spectrometric (MS) conditions for the determination of organotins (as the cation) in waters and biological tissues without the use of hydrolysis and derivatization in the extraction procedure.
Technique	µLC-ES-ITMS, micro-liquid chromatography (µLC) coupled with electrospray ion trap mass spectrometry (ES-ITMS)
Sample Prep Method	Water samples are prepared by acidifying the waters with 12 N hydrochloric acid (HCl) before extraction through pre-prepared solid-phase extraction (SPE) discs. Tissue samples (e.g., fish, brain), are extracted by using a solvent mixture of hexane:acetic acid:tropolone (99:1:0.1 v/v). After sonication is completed, the sample is adjusted to pH 2 with a small quantity of 12N HCl and then centrifuged.
Analyte	Organotin cation
Detection	Mass spectrometry of the Organotin cation; Major ion 355 m/z, other ions 241 m/z (15 %)
Detection Limit	970 pg
Range	Not provided

TABLE 111 Test Method(s) for Lead bis(tetrafluoroborate)

Chemical Formula	B_2F_8Pb
Test Method	**Screen for lead**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as B_2F_8Pb.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 112 Test Method(s) for Lead Dinitrate

Chemical Formula	N_2O_6Pb
Test Method	**Screen for lead**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as N_2O_6Pb.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 113 Test Method(s) for Silicic Acid ($H_2Si_2O_5$), Barium Salt (1:1), Lead-Doped

Chemical Formula	$H_2Si_2O_5$, barium salt (1:1), lead-doped
Test Method	**Screen for lead, barium and silicon**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as $H_2Si_2O_5BaPb$.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb, Ba, Si
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence. The absence of any one of the three elements will indicate $H_2Si_2O_5$, barium salt (1:1), lead-doped is not present at minimal detection levels.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 114 Test Method(s) for Trilead bis(carbonate)dihydroxide

Chemical Formula	$C_2H_2O_8Pb_3$
Test Method	**Screen for lead**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as $C_2H_2O_8Pb_3$.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 115 Test Method(s) for 4,4'-methylenedi-o-toluidine

Chemical Formula	$C_{15}H_{18}N_2$
Analytical Approach	No test method is known for detecting 4,4'-methylenedi-o-toluidine directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**Thermo scientific Application Note-10329**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	4,4'-methylenedi-o-toluidine
Detection	The analyte is identified and quantified by retention time and mass spectrum.
Detection Limit	undetermined
Range	undetermined

TABLE 116 Test Method(s) for Diethyl Sulphate

Chemical Formula	$C_4H_{10}O_4S$
Analytical Approach	No test method is known for detecting Diethyl sulphate directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	Diethyl sulphate
Detection	The analyte is identified and quantified by retention time and mass ions m/z=125, 139, 111, 99, and 29, 45, 59.
Detection Limit	undetermined
Range	undetermined

TABLE 117 Test Method(s) for Dimethyl Sulphate

Chemical Formula	$C_2H_6O_4S$
Analytical Approach	No test method is known for detecting Dimethyl sulphate directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	Dimethyl sulphate
Detection	The analyte is identified and quantified by retention time and mass ions m/z=95 and 31.
Detection Limit	undetermined
Range	undetermined

TABLE 118 Test Method(s) for N,N-dimethylformamide

Chemical Formula	C_3H_7NO
Analytical Approach	No test method is known for detecting N,N-dimethylformamide directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	N,N-dimethylformamide
Detection	The analyte is identified and quantified by retention time and mass ions m/z=73 and 44.
Detection Limit	undetermined
Range	undetermined

TABLE 119 Test Method(s) for 4-(1,1,3,3-tetramethylbutyl)phenol, ethoxylated

Chemical Formula	$(C_2H_4O)n\ C_{14}H_{22}O$
Test Method	**Government Chemist Programme, LGC/GC/2006/019**
Description	Nonyl and octyl phenol ethoxylates in textiles were extracted, followed by solid phase extraction clean up, and then analyzed with GC-MS.
Technique	GC-MS
Sample Prep Method	Test sample is extracted using a Dionex ASE-200 with 11 mL extraction cell with a solvent composition of 1:1 ratio of methanol and water. Solid phase extraction may be followed.
Analyte	octylphenol, ethoxylated
Detection	GC retention time and mass ions are used. Target ion pairs are provided in the method from ethoxylate 1 to 10.
Detection Limit	50 µg/mL
Range	undetermined

TABLE 120 Test Method(s) for 4-Nonylphenol, Branched and Linear

Chemical Formula	$C_{15}H_{24}O$
Analytical Approach	No test method is known for detecting 4-Nonylphenol, branched and linear directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	4-Nonylphenol, branched
Detection	The analyte is identified and quantified by retention time and mass ions m/z=220 and 107.
Detection Limit	undetermined
Range	undetermined

TABLE 121 Test Method(s) for Furan

Chemical Formula	C_4H_4O
Analytical Approach	No test method is known for detecting Furan directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	Furan
Detection	The analyte is identified and quantified by retention time and mass ions m/z=68 and 39.
Detection Limit	undetermined
Range	undetermined

TABLE 122 Test Method(s) for Lead Oxide Sulfate

Chemical Formula	O_5Pb_2S
Test Method	**Screen for lead**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as O_5Pb_2S.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 123 Test Method(s) for Lead Titanium Trioxide

Chemical Formula	O_3PbTi
Test Method	**Screen for lead and titanium**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as O_3PbTi.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb, Ti
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence. The absence of any one of the two elements will indicate lead titanium trioxide is not present at minimal detection levels.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 124 Test Method(s) for Bis(pentabromophenyl) ether (decabromodiphenyl ether; DecaBDE)

Chemical Formula	$C_{12}Br_{10}O$
Test Method	**NIOSH Manual of Analytical Methods 2559**
Description	Solvent extraction followed by HPLC analysis.
Technique	HPLC
Sample Prep Method	DMSO extraction
Analyte	Bis(pentabromophenyl) ether (decabromodiphenyl ether; DecaBDE)
Detection	UV
Detection Limit	1.0 µg
Range	0.002 to 5.0 mg/m^3

TABLE 125 Test Method(s) for Dinoseb (6-sec-butyl-2,4-dinitrophenol)

Chemical Formula	$C_{10}H_{12}N_2O_5$
Analytical Approach	No test method is known for detecting Dinoseb (6-sec-butyl-2,4-dinitrophenol) directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	Dinoseb (6-sec-butyl-2,4-dinitrophenol)
Detection	The analyte is identified and quantified by retention time and mass ion m/z=211 as target, and m/z=240, 163, 147, and 117.
Detection Limit	undetermined
Range	undetermined

TABLE 126 Test Method(s) for 1,2-Diethoxyethane

Chemical Formula	$C_6H_{14}O_2$
Analytical Approach	No test method is known for detecting 1,2-Diethoxyethane directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	1,2-Diethoxyethane
Detection	The analyte is identified and quantified by retention time and mass ions m/z=74, 59, 45, and 31.
Detection Limit	undetermined
Range	undetermined

TABLE 127 Test Method(s) for N-methylacetamide

Chemical Formula	C_3H_7NO
Analytical Approach	No test method is known for detecting N-methylacetamide directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	N-methylacetamide
Detection	The analyte is identified and quantified by retention time and mass ions m/z=73, 58, 43, 30, and 15.
Detection Limit	undetermined
Range	undetermined

TABLE 128 Test Method(s) for Tetralead Trioxide Sulphate

Chemical Formula	O_7Pb_4S
Test Method	**Screen for lead**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as O_7Pb_4S.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 129 Test Method(s) for Acetic Acid, Lead Salt, Basic

Chemical Formula	$C_2H_4O_3Pb$
Test Method	**Screen for lead**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as $C_2H_4O_3Pb$.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 130 Test Method(s) for [Phthalato(2-)]dioxotrilead

Chemical Formula	$C_8H_4O_6Pb_3$
Test Method	**Screen for lead**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as $C_8H_4O_6Pb_3$.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 131 Test Method(s) for Tetraethyllead

Chemical Formula	$C_8H_{20}Pb$
Test Method	**Screen for lead**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as $C_8H_{20}Pb$.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 132 Test Method(s) for N-pentyl-isopentylphthalate

Chemical Formula	$C_{18}H_{26}O_4$
Test Method	**EN 14372:2004**
Description	A sample of polymer is extracted and the extracted phthalates are then run through a gas chromatograph. This method has not been validated for this analyte.
Technique	GC-MS
Sample Prep Method	2 g of the article is obtained for analysis. The sample is extracted in a Soxhlet extraction apparatus with diethyl ether for 6 h.
Analyte	Diisobutyl phthalate
Detection	Mass spectrometry
Detection Limit	0.2 mg/kg
Range	0.2 mg/kg – 10 mg/kg

TABLE 133 Test Method(s) for Pentalead Tetraoxide Sulphate

Chemical Formula	O_8Pb_5S
Test Method	**Screen for lead**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as O_8Pb_5S.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 134 Test Method(s) for Heptacosafluorotetradecanoic Acid

Chemical Formula	$C_{14}HF_{27}O_2$
Test Method	**EPA Method 537**
Description	This method is for the determination of selected perfluorinated alkyl acids in drinking water. Accuracy and precision data have been generated in reagent water, and finished ground and surface waters.
Technique	LC-MS-MS
Sample Prep Method	A 250-mL water sample is fortified with surrogates and passed through a solid phase extraction cartridge containing polystyrenedivinylbenzene. The compounds are eluted from the solid phase with a small amount of methanol, dried with nitrogen in a heated water bath, and then adjusted to a 1-mL volume with 96:4 % (vol/vol) methanol:water after adding the internal standard(s), then analyzed with LC-MS-MS.
Analyte	Heptacosafluorotetradecanoic acid
Detection	Analyte is identified and quantified by retention time and mass spectrum precursor ion m/z=713 and product ion m/z=669.
Detection Limit	1.7 ng/L
Range	4.4–44 ng/L

TABLE 135 Test Method(s) for Tricosafluorododecanoic Acid

Chemical Formula	$C_{12}HF_{23}O_2$
Test Method	**EPA Method 537**
Description	This method is for the determination of selected perfluorinated alkyl acids in drinking water. Accuracy and precision data have been generated in reagent water, and finished ground and surface waters.
Technique	LC-MS-MS
Sample Prep Method	A 250-mL water sample is fortified with surrogates and passed through a solid phase extraction cartridge containing polystyrenedivinylbenzene. The compounds are eluted from the solid phase with a small amount of methanol, dried with nitrogen in a heated water bath, and then adjusted to a 1-mL volume with 96:4 % (vol/vol) methanol:water after adding the internal standard(s), then analyzed with LC-MS-MS.
Analyte	Tricosafluorododecanoic acid
Detection	Analyte is identified and quantified by retention time and mass spectrum precursor ion m/z=613 and product ion m/z=569.
Detection Limit	1.1 ng/L
Range	3.7–37 ng/L

TABLE 136 Test Method(s) for 1-bromopropane (n-propyl bromide)

Chemical Formula	C_3H_7Br
Analytical Approach	No test method is known for detecting 1-bromopropane (n-propyl bromide) directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	1-bromopropane (n-propyl bromide)
Detection	The analyte is identified and quantified by retention time and mass ions m/z=43 as target, and m/z=41, 27, 122, and 124.
Detection Limit	undetermined
Range	undetermined

TABLE 137 Test Method(s) for Dioxobis(stearato)trilead

Chemical Formula	$C_{36}H_{70}O_6Pb_3$
Test Method	**Screen for lead**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as $C_{36}H_{70}O_6Pb_3$.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 138 Test Method(s) for Pentacosafluorotridecanoic Acid

Chemical Formula	$C_{13}HF_{25}O_2$
Test Method	**EPA Method 537**
Description	This method is for the determination of selected perfluorinated alkyl acids in drinking water. Accuracy and precision data have been generated in reagent water, and finished ground and surface waters.
Technique	LC-MS-MS
Sample Prep Method	A 250-mL water sample is fortified with surrogates and passed through a solid phase extraction cartridge containing polystyrenedivinylbenzene. The compounds are eluted from the solid phase with a small amount of methanol, dried with nitrogen in a heated water bath, and then adjusted to a 1-mL volume with 96:4 % (vol/vol) methanol:water after adding the internal standard(s), then analyzed with LC-MS-MS.
Analyte	Pentacosafluorotridecanoic acid
Detection	Analyte is identified and quantified by retention time and mass spectrum precursor ion m/z=663 and product ion m/z=619.
Detection Limit	2.2 ng/L
Range	5.5–55 ng/L

TABLE 139 Test Method(s) for Methoxyacetic Acid

Chemical Formula	$C_3H_6O_3$
Analytical Approach	No test method is known for detecting Methoxyacetic acid directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	Methoxyacetic acid
Detection	The analyte is identified and quantified by retention time and mass ions m/z=45, 60, and 29.
Detection Limit	undetermined
Range	undetermined

TABLE 140 Test Method(s) for Methyloxirane (Propylene Oxide)

Chemical Formula	C_3H_6O
Analytical Approach	No test method is known for detecting Methyloxirane (Propylene oxide) directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	Methyloxirane (Propylene oxide)
Detection	The analyte is identified and quantified by retention time and mass ions m/z=58, 43, and 28.
Detection Limit	undetermined
Range	undetermined

TABLE 141 Test Method(s) for Trilead Dioxide Phosphonate

Chemical Formula	HO_5PPb_3
Test Method	**Screen for lead**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as HO_5PPb_3.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 142 Test Method(s) for o-aminoazotoluene

Chemical Formula	$C_{14}H_{15}N_3$
Analytical Approach	No test method is known for detecting o-aminoazotoluene directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	o-aminoazotoluene
Detection	The analyte is identified and quantified by retention time and mass ions m/z=106, 225, and 134.
Detection Limit	undetermined
Range	undetermined

TABLE 143 Test Method(s) for 4-methyl-m-phenylenediamine (toluene-2,4-diamine)

Chemical Formula	$C_7H_{10}N_2$
Analytical Approach	No test method is known for detecting 4-methyl-m-phenylenediamine (toluene-2,4-diamine) directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	4-methyl-m-phenylenediamine (toluene-2,4-diamine)
Detection	The analyte is identified and quantified by retention time and mass ions m/z=121, 122, and 94.
Detection Limit	undetermined
Range	undetermined

TABLE 144 Test Method(s) for Biphenyl-4-ylamine

Chemical Formula	$C_{12}H_{11}N$
Analytical Approach	No test method is known for detecting Biphenyl-4-ylamine and its salts directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	Biphenyl-4-ylamine
Detection	The analyte is identified and quantified by retention time and mass ions m/z=169, 141, and 115.
Detection Limit	undetermined
Range	undetermined

TABLE 145 Test Method(s) for Fatty Acids, C16-18, Lead Salts

Chemical Formula	$Pb_2+[H_3C(CH_2)14\text{-}16C(O)O\text{-}]_2$
Test Method	**Screen for lead**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 146 Test Method(s) for Orange Lead (Lead Tetroxide)

Chemical Formula	O_4Pb_3
Test Method	**Screen for lead**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as O_4Pb_3.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 147 Test Method(s) for 4,4'-oxydianiline and its Salts

Chemical Formula	$C_{12}H_{12}N_2O$
Analytical Approach	No test method is known for detecting 4,4'-oxydianiline and its salts directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	4,4'-oxydianiline and its salts
Detection	The analyte is identified and quantified by retention time and mass ions m/z=200, 171, and 108.
Detection Limit	undetermined
Range	undetermined

TABLE 148 Test Method(s) for Diazene-1,2-dicarboxamide (C,C'-azodi(formamide))

Chemical Formula	$C_2H_4N_4O_2$
Analytical Approach	No test method is known for detecting Diazene-1,2-dicarboxamide (C,C'-azodi(formamide)) directly. GC retention time and mass spectrum of the species can be used for identification.
Test Method	**NIST/EPA/NIH Mass Spectral Library**
Description	Analyte is typically extracted from the matrix, followed by analysis with GC-MS.
Technique	GC-MS
Sample Prep Method	Solvent extraction
Analyte	Diazene-1,2-dicarboxamide (C,C'-azodi(formamide))
Detection	Mass spectrum
Detection Limit	undetermined
Range	undetermined

TABLE 149 Test Method(s) for Sulfurous Acid, Lead Salt, Dibasic

Chemical Formula	$H_2O_5Pb_2S$
Test Method	**Screen for lead**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as $H_2O_5Pb_2S$.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 150 Test Method(s) for Lead Cyanamidate

Chemical Formula	CH_2N_2Pb
Test Method	**Screen for lead**
Description	A common screening method uses X-ray fluorescence. See Appendix X2. Calculation is performed to see if a worst case would trigger further action. Worst case associates all of the lead as CH_2N_2Pb.
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM Guide E1621; ASTM Guide D5831. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321. See X1.2.
Analyte	Pb
Detection	When a sample is irradiated with X rays, the source X rays may undergo either scattering or absorption by sample atoms. This latter process is known as the photoelectric effect. When an atom absorbs the source X rays, the incident radiation dislodges electrons from the innermost shells of the atom, creating vacancies. The electron vacancies are filled by electrons cascading in from outer electron shells. Electrons in outer shells have higher energy states than inner shell electrons, and the outer shell electrons give off energy as they cascade down into the inner shell vacancies. This rearrangement of electrons results in emission of X rays characteristic of the given atom. The emission of X rays, in this manner, is termed X-ray fluorescence.
Detection Limit	60 mg/Kg
Range	Unknown

TABLE 151 Test Method(s) for Cadmium Sulphide

Chemical Formula	CdS
Analytical Approach	Standard test method does not exist for CdS. To calculate a hypothetical maximum of CdS, elemental cadmium is detected and calculated as if all of the cadmium is from CdS. The test method cited for CdS must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**IEC 62321-3-1**
Description	IEC 62321-3-1 describes the screening analysis of cadmium in uniform materials in electrotechnical products using X-ray fluorescence (XRF) spectrometry.
Technique	X-ray fluorescence (XRF) spectrometry
Sample Prep Method	Sample must be homogeneous. Reference ASTM Guide D1257; IEC 62321-2.
Analyte	Cd
Detection	Preferred X-ray line K-$L_{2,3}$ ($Ka_{1,2}$)
Detection Limit	Not provided; dependent on the sample matrix
Range	Cd (< 3 mg/kg) not detectable for lead-free solder; 10–183 mg/kg for ABS; 19.6–141 mg/kg for PE
Test Method	**IEC 62321-5**
Description	IEC 62321-5 describes the test methods for cadmium in polymers, metals and electronics by AAS, AFS, ICP-OES and ICP-MS.
Technique	AAS, AFS, ICP-OES and ICP-MS
Sample Prep Method	The sample is pre-cut and milled to an appropriate size for the method selected. The test solution is prepared by dry ashing or by sample digestion with acids such as nitric acid and sulfuric acid. Reference IEC 62321-2.
Analyte	Cd
Detection	ICP-OES: 214.439, 226.502, 228.802, 361.051 nm; ICP-MS: 111, 112, 113, 114 m/z of isotopes; AAS and AFS: 228.8 nm;
Detection Limit	ICP-OES: 10 mg/kg; AAS: 10 mg/kg; ICP-MS: 0.1 mg/kg; AFS: 1.5 mg/kg
Range	Not provided
Chemical Formula	CdS

TABLE 152 Test Method(s) for Disodium 3,3’-[[1,1’-biphenyl]-4,4’-diylbis(azo)]bis(4-aminonaphthalene-1-sulphonate) (C.I. Direct Red 28)

Chemical Formula	$C_{32}H_{24}N_6O_6S_2.2Na$
Test Method	**ASTA Method 28.0: Determination of dyes in Capsicum samples and products by High Performance Liquid Chromatography**
Description	The sample needs to be dissolved or extracted, cleaned then injected to the HPLC. The analyte is determined by retention time of the standard. Quantification occurs by building a calibration curve at 505 nm.
Technique	HPLC-UV
Sample Prep Method	Extract or dissolve sample in acetonitrile, centrifuge and filter before injecting into the HPLC.
Analyte	Azo compounds
Detection	Retention time of standard at 505 nm
Detection Limit	Not provided
Range	0.1–10 µg/mL

TABLE 153 Test Method(s) for Disodium 4-amino-3-[[4’-[(2,4-diaminophenyl)azo][1,1’-biphenyl]-4-yl]azo] -5-hydroxy-6-(phenylazo)naphthalene-2,7-disulphonate (C.I. Direct Black 38)

Chemical Formula	$C_{34}H_{25}N_9Na_2O_7S_2$
Test Method	**Monitoring of toxicity and intermediates of C.I. Direct Black 38 azo dye through decolorization in an anaerobic/aerobic sequential reactor system; Mustafa Isik, Delia Teresa Sponza; Journal of Hazardous Materials, Volume 114, Issues 1–3, 18 October 2004, Pages 29–39**
Description	The pH of the aqueous sample first adjusted. Sodium chloride was added until it reached saturation. The sample was then extracted with methyl*tert*-butyl-ether. The ether fraction was combined and evaporated to dryness. Finally, the extract was reconstituted in methanol for GC/MS analysis. The mass spectrometer was operated in the electron impact mode with electron current of 70 eV. Aliquots were injected in splitless mode.
Technique	GC-MS (EI)
Sample Prep Method	Liquid/Liquid extraction as described in the article
Analyte	Benzidine (4,4-diaminobiphenyl)
Detection	m/z 92 and m/z 184
Detection Limit	0.01 ng/mL
Range	0.1–10,000 ng/mL

TABLE 154 Test Method(s) for Dihexyl Phthalate

Chemical Formula	$C_{20}H_{30}O_4$
Test Method	**EPA Method 8061A**
Description	This method is for aqueous and solid sample matrix by using extraction of the analyte from the matrix followed by dual column GC-ECD analysis.
Technique	GC-ECD
Sample Prep Method	EPA Method 3535,
Analyte	Dihexyl phthalate
Detection	Retention time 24.57 min, column 1, and retention time 21.85 min, column 2.
Detection Limit	68 ng/L
Range	Unknown

TABLE 155 Test Method(s) for Imidazolidine-2-thione (2-imidazoline-2-thiol)

Chemical Formula	$C_3H_6N_2S$
Test Method	**OSHA Method #95**
Description	This method is for air sample analysis by sample collection with glass fiber filter, extracted with water and analyzed by HPLC using a UV detector.
Technique	HPLC
Sample Prep Method	Absorption of analyte with glass fiber filter followed by extraction with water
Analyte	Imidazolidine-2-thione (2-imidazoline-2-thiol)
Detection	Comparison of retention time of a pure commercial standard. Confirmation of GC-FID or GC-MS is recommended.
Detection Limit	1.39 µg/m^3
Range	22 µg/m^3

TABLE 156 Test Method(s) for Lead Di(acetate)

Chemical Formula	$C_4H_6O_4Pb$
Test Method	**Screen for Pb**
Description	A common screening method uses X-Ray fluorescence. See Appendix X2. A calculation is performed to see if a worst case would trigger further action. Worse case associates all the lead as lead di(acetate).
Technique	EPA Method 6200, Field portable X-ray fluorescence spectrometry XRF; ASTM E1621, Standard Guide for X-Ray Emission Spectrometric Analysis; ASTM D5381, Standard Guide for X-Ray Fluorescence (XRF) Spectroscopy of Pigments and Extenders. Reference IEC 62321.
Sample Prep Method	Sample must be homogeneous. Reference ASTM D1257, Standard Guide for Evaluating Grinding Materials Used for Surface Preparation in Spectrochemical Analysis; IEC 62321. See X1.2.
Analyte	Pb
Detection	Characteristics X-rays from the Pb
Detection Limit	Not provided
Range	Not provided

TABLE 157 Test Method(s) for Trixylyl Phosphate

Chemical Formula	$C_{24}H_{27}O_4P$
Analytical Approach	“Trixylyl phosphate (TXP) is a UVCB substance containing over 50 different constituents and no additives. It is produced through the reaction of phosphorus oxytrochloride and xylenols. The xylenols (=dimethyl phenols) are present in a distillation fraction of naturally occurring coal tar derivatives which also contains different ethyl phenols. Reaction of the different xylenols and ethyl phenols results in alkylated triphenyl phosphates with a high amount of possible isomers that cannot be easily analyzed. Therefore, the exact composition is unknown. In studies that form the basis for harmonized classification and labelling, the substance was tested as such and the individual constituents are not the basis for the classification. A more precise chemical naming could be: Reaction product of phosphorous oxytrichloric acid and a mixture of xylenols containing >95 % tri (dimethylphenyl and ethylphenyl) phosphates” (ECHA, 2010). “According to Nobile (National Library of Medicine HSDB database, 1980), who investigated the composition of two TXP products, the xylyl phosphate isomers (in decreasing order of abundance) 2,5-, 2,3-, 3,5-, 2,4- and 3,4-isomers were present in the products. The 2,6-isomer was not present. Other components identified included 4- ethylphenol, p-cresol, phenol and trimethyl phenol.” There is no existing standard procedure for analyzing trixylyl phosphate. EPA chemistry discussions introduced a GC-MS method that can be used as reference procedure for analyzing organophosphates, including trixylyl phosphate.
Test Method	**EPA – Ion Composition Elucidation – “Identifying Compounds Despite Chromatographic Limitations: Organophosphates in Treated Sewage – Final Draft”**
Description	This method is used for treated sewage sample by using GC-MS followed with selected mass peak profiling.
Technique	GAS-Liquid Chromatography
Sample Prep Method	GC-MS
Analyte	Trixylyl phosphate
Detection	The analyte is identified and quantified by retention time and mass ions m/z=410, and 99.
Detection Limit	Unknown
Range	Unknown

TABLE 158 Test Method(s) for 1,2-Benzenedicarboxylic acid, dihexyl ester, branched and linear

Chemical Formula	$C_{20}H_{30}O_4$
Analytical Approach	The CAS number 68515-50-4 represents a reaction product containing branched or linear isomers, or both. Two out of many possible isomers found in the UVCB substance 1,2-Benzenedicarboxylic acid, dihexyl ester, branched and linear (CAS number 68515-50-4) are, for example, CAS number 71850-09-4 (di-isohexyl phthalate) and CAS number 84-75-3 (di-nhexylphthalate). CAS number 84-75-3, the linear dihexyl phthalate, can be analyzed according to Table 154 EPA Method 8061A. All linear and branched dihexyl phthalate can be analyzed with GC-MS. They share the same key mass ions. The only difference will be their boiling ranges, thus the retention times when they elute from the GC column. The more branched species will have lower boiling ranges. CPSC-CH-C1001-09.3 can be adapted and used as test method for 1,2-Benzenedicarboxylic acid, dihexyl ester, branched and linear, although it is not a target species in this method. The specific mass ions identified in this table shall be used for detection.
Test Method	**CPSC-CH-C1001-09.3**
Description	This method is used by the U.S. Consumer Product Safety Commission for the analysis of phthalates in child care items and toys.
Technique	GC-MS
Sample Prep Method	Initial polymer solublization with tetrahyrofuran, followed by polymer precipitation with hexane, and addition of internal standard Benzyl Benzoate solution to filtrate for analysis. Alternative extraction methods are referenced.
Analyte	$C_{20}H_{30}O_4$
Detection	Mass spectrometry – ion at m/z 149, 167 and 251
Detection Limit	#0.01 % µg/L(w/w)
Range	Prescreen with IR for phthalate content 10 % or greater. Dilute analyte accordingly.

TABLE 159 Test Method(s) for Sodium perborate; perboric acid, sodium salt

Chemical Formula	BHO_3.Na BH_3O_4.Nac $BHO_3.H_2O$.Na $BH_3O_4.3H_2O$.Na $BHO_3.4H_2O$.Na
Analytical Approach	No test method is known for detecting borates directly. To calculate a hypothetical maximum of borate, elemental boron is detected and calculated as if all of the boron is from BHO_3.Na. The test method cited for BHO_3.Na must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**EPA Method 6010**
Description	The characteristic emission spectra are measured by optical spectrometry. Samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by a radio-frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and the intensities of the emission lines are monitored by photosensitive detectors.
Technique	CP-OES
Sample Prep Method	EPA Method 3051, Microwave assisted acid digestion
Analyte	B
Detection	Atomic emission at 249.679 nm
Detection Limit	4 µg/L
Range	Unknown
Caveat	Method scoped for soils and wastes samples. Method should be validated with sample matrix similar to actual samples.

TABLE 160 Test Method(s) for Sodium peroxometaborate

Chemical Formula	BHO_3.Na
Analytical Approach	No test method is known for detecting borates directly. To calculate a hypothetical maximum of borate, elemental boron is detected and calculated as if all of the boron is from BHO_3.Na.The test method cited for BHO_3.Na must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**EPA Method 6010**
Description	The characteristic emission spectra are measured by optical spectrometry. Samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by a radio-frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and the intensities of the emission lines are monitored by photosensitive detectors.
Technique	CP-OES
Sample Prep Method	EPA Method 3051, Microwave assisted acid digestion
Analyte	B
Detection	Atomic emission at 249.679 nm
Detection Limit	4 µg/L
Range	Unknown
Caveat	Method scoped for soils and wastes samples. Method should be validated with sample matrix similar to actual samples.

TABLE 161 Test Method(s) for Cadmium chloride

Chemical Formula	$CdCl_2$
Analytical Approach	Standard test method does not exist for $CdCl_2$. To calculate a hypothetical maximum of $CdCl_2$, elemental cadmium is detected and calculated as if all of the cadmium is from $CdCl_2$. The test method cited for $CdCl_2$ must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**IEC 62321-3-1**
Description	IEC 62321-3-1 describes the screening analysis of cadmium in uniform materials in electrotechnical products using X-ray fluorescence (XRF) spectrometry.
Technique	X-ray fluorescence (XRF) spectrometry
Sample Prep Method	Sample must be homogeneous. Reference Guide D1257; IEC 62321-2.
Analyte	Cd
Detection	Preferred X-ray line K-L2,3 (Ka1,2)
Detection Limit	Not provided; dependent on the sample matrix
Range	Cd (< 3 mg/kg) not detectable for lead-free solder; 10 - 183 mg/kg for ABS; 19.6 - 141 mg/kg for PE
Test Method	**IEC 62321-5**
Description	IEC 62321-5 describes the test methods for cadmium in polymers, metals and electronics by AAS, AFS, ICP-OES and ICP-MS.
Technique	AAS, AFS, ICP-OES and ICP-MS
Sample Prep Method	The sample is pre-cut and milled to an appropriate size for the method selected. The test solution is prepared by dry ashing or by sample digestion with acids such as nitric acid and sulfuric acid. Reference IEC 62321-2.
Analyte	Cd
Detection	ICP-OES: 214.439, 226.502, 228.802, 361.051 nm; ICP-MS: 111, 112, 113, 114 m/z of isotopes; AAS and AFS: 228.8 nm;
Detection Limit	ICP-OES: 10 mg/kg; AAS: 10 mg/kg; ICP-MS: 0.1 mg/kg; AFS: 1.5 mg/kg
Range	Not provided
Chemical Formula	$CdCl_2$

TABLE 162 Test Method(s) for Cadmium sulphate

Chemical Formula	$Cd.H_2O_4S$
Analytical Approach	Standard test method does not exist for $Cd.H_2O_4S$. To calculate a hypothetical maximum of $Cd.H_2O_4S$, elemental cadmium is detected and calculated as if all of the cadmium is from $Cd.H_2O_4S$. The test method cited for $Cd.H_2O_4S$ must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**IEC 62321-3-1**
Description	IEC 62321-3-1 describes the screening analysis of cadmium in uniform materials in electrotechnical products using X-ray fluorescence (XRF) spectrometry.
Technique	X-ray fluorescence (XRF) spectrometry
Sample Prep Method	Sample must be homogeneous. Reference Guide D1257; IEC 62321-2.
Analyte	Cd
Detection	Preferred X-ray line K-L2,3 (Ka1,2)
Detection Limit	Not provided; dependent on the sample matrix
Range	Cd (< 3 mg/kg) not detectable for lead-free solder; 10 - 183 mg/kg for ABS; 19.6 - 141 mg/kg for PE
Test Method	**IEC 62321-5**
Description	IEC 62321-5 describes the test methods for cadmium in polymers, metals and electronics by AAS, AFS, ICP-OES and ICP-MS.
Technique	AAS, AFS, ICP-OES and ICP-MS
Sample Prep Method	The sample is pre-cut and milled to an appropriate size for the method selected. The test solution is prepared by dry ashing or by sample digestion with acids such as nitric acid and sulfuric acid. Reference IEC 62321-2.
Analyte	Cd
Detection	ICP-OES: 214.439, 226.502, 228.802, 361.051 nm; ICP-MS: 111, 112, 113, 114 m/z of isotopes; AAS and AFS: 228.8 nm;
Detection Limit	ICP-OES: 10 mg/kg; AAS: 10 mg/kg; ICP-MS: 0.1 mg/kg; AFS: 1.5 mg/kg
Range	Not provided
Chemical Formula	$Cd.H_2O_4S$

TABLE 163 Test Method(s) for Cadmium fluoride

Chemical Formula	CdF_2
Analytical Approach	Standard test method does not exist for CdF_2. To calculate a hypothetical maximum of CdF_2, elemental cadmium is detected and calculated as if all of the cadmium is from CdF_2. The test method cited for CdF_2 must be validated for analytical accuracy before use in regulatory compliance demonstration.
Test Method	**IEC 62321-3-1**
Description	IEC 62321-3-1 describes the screening analysis of cadmium in uniform materials in electrotechnical products using X-ray fluorescence (XRF) spectrometry.
Technique	X-ray fluorescence (XRF) spectrometry
Sample Prep Method	Sample must be homogeneous. Reference Guide D1257; IEC 62321-2.
Analyte	Cd
Detection	Preferred X-ray line K-L2,3 (Ka1,2)
Detection Limit	Not provided; dependent on the sample matrix
Range	Cd (< 3 mg/kg) not detectable for lead-free solder; 10 - 183 mg/kg for ABS; 19.6 - 141 mg/kg for PE
Test Method	**IEC 62321-5**
Description	IEC 62321-5 describes the test methods for cadmium in polymers, metals and electronics by AAS, AFS, ICP-OES and ICP-MS.
Technique	AAS, AFS, ICP-OES and ICP-MS
Sample Prep Method	The sample is pre-cut and milled to an appropriate size for the method selected. The test solution is prepared by dry ashing or by sample digestion with acids such as nitric acid and sulfuric acid. Reference IEC 62321-2.
Analyte	Cd
Detection	ICP-OES: 214.439, 226.502, 228.802, 361.051 nm; ICP-MS: 111, 112, 113, 114 m/z of isotopes; AAS and AFS: 228.8 nm;
Detection Limit	ICP-OES: 10 mg/kg; AAS: 10 mg/kg; ICP-MS: 0.1 mg/kg; AFS: 1.5 mg/kg
Range	Not provided
Chemical Formula	CdF_2

TABLE 164 Test Method(s) for 2-(2H-benzotriazol-2-yl)-4,6-ditertpentylphenol (UV-328)

Chemical Formula	$C_{22}H_{29}N_3O$
Test Method	**Interdisciplinary Studies on Environmental Chemistry – Environmental Specimen Bank, Eds., T. Isobe, K. Nomiyama, A. Subramanian and S. Tanabe, pp. 51-59. By TERRAPUB, 2010.**
Description	This method was developed to analyze benzotriazole UV stabilizers in wastewater treatment plant samples in Japan.
Technique	GC-MS
Sample Prep Method	Liquid phase extractions with hexane, followed by silica gel clean up and concentration. See test method reference for details.
Analyte	$C_{22}H_{29}N_3O$
Detection	Mass ions m/z=322, 351, and 336
Detection Limit	8.7 ng/L
Range	Not provided

TABLE 165 Test Method(s) for reaction mass of 2-ethylhexyl 10-ethyl-4,4-dioctyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate and 2-ethylhexyl 10-ethyl-4-[[2-[(2-ethylhexyl)oxy]-2-oxoethyl]thio]-4-octyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate (reaction mass of DOTE and MOTE)

Chemical Formula	$C_{36}H_{72}O_4S_2Sn$ (DOTE) $C_{38}H_{74}O_6S_3Sn$ (MOTE)
Analytical Approach	Carrying out aquatic testing in general for these substances is difficult owing to their poor solubility, rapid hydrolysis, and difficulties with their analysis. It can be measured on the basis of tin, using the NIOSH Method 5504 analysis for organotin compounds (as Sn),
Test Method	**NIOSH Method 5504**
Description	Organotin species are separated by cation exchange HPLC, followed with atomic absorption for tin.
Technique	HPLC-AAS
Sample Prep Method	Glass fiber filter sorbent is used to prepare sample for HPLC analysis.
Analyte	Sn
Detection	Absorption at 284.0 nm
Detection Limit	1 µg Sn
Range	0.015 to 1 mg/m_3 (as Sn)

TABLE 166 Test Method(s) for 2-ethylhexyl 10-ethyl-4,4-dioctyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate (DOTE)

Chemical Formula	$C_{36}H_{72}O_4S_2Sn$
Analytical Approach	Carrying out aquatic testing in general for these substances is difficult owing to their poor solubility, rapid hydrolysis, and difficulties with their analysis. It can be measured on the basis of tin, using the NIOSH Method 5504 analysis for organotin compounds (as Sn).
Test Method	**NIOSH Method 5504**
Description	Organotin species are separated by cation exchange HPLC, followed with atomic absorption for tin.
Technique	HPLC-AAS
Sample Prep Method	Glass fiber filter sorbent is used to prepare sample for HPLC analysis.
Analyte	Sn
Detection	Absorption at 284.0 nm
Detection Limit	1 µg Sn
Range	0.015 to 1 mg/m^3 (as Sn)

TABLE 167 Test Method(s) for 2-benzotriazol-2-yl-4,6-di-tert-butylphenol (UV-320)

Chemical Formula	$C_{20}H_{25}N_3O$
Test Method	**Interdisciplinary Studies on Environmental Chemistry – Environmental Specimen Bank, Eds., T. Isobe, K. Nomiyama, A. Subramanian and S. Tanabe, pp. 51-59. By TERRAPUB, 2010.**
Description	This method was developed to analyze benzotriazole UV stabilizers in wastewater treatment plant samples in Japan.
Technique	GC-MS
Sample Prep Method	Liquid phase extractions with hexane, followed by silica gel clean up and concentration. See test method reference for details.
Analyte	$C_{20}H_{25}N_3O$
Detection	Mass ions m/z=308, 323, and 252
Detection Limit	8.7 ng/L
Range	Not provided

TABLE 168 Test Method(s) for 1,3-propanesultone

Chemical Formula	$C_3H_6O_3S$
Test Method	**EPA Method 625, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Compendium Method TO-15, Determination of Volatile Organic Compounds (Vocs) in Air Collected in Specially-prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS)**
Description	This method is used to determine volatile organic compounds in ambient air.
Technique	GC-MS
Sample Prep Method	Air is sampled into a stainless steel canister, concentrated, dried, then analyzed by thermal desorption into gas chromatographic column.
Analyte	$C_3H_6O_3S$
Detection	Mass ions at m/z = 58, 122, and 65
Detection Limit	0.5 ppbv
Range	Not provided

TABLE 169 Test Method(s) for 2,4-di-tert-butyl-6-(5-chlorobenzotriazol-2-yl)phenol (UV- 327)

Chemical Formula	$C_{20}H_{24}ClN_3O$
Test Method	**Interdisciplinary Studies on Environmental Chemistry—Environmental Specimen Bank, Eds., T. Isobe, K. Nomiyama, A. Subramanian, and S. Tanabe, pp. 51-59. By TERRAPUB, 2010.**
Description	This method was developed to analyze benzotriazole UV stabilizers in wastewater treatment plant samples in Japan.
Technique	GC-MS
Sample Prep Method	Liquid phase extractions with hexane, followed by silica gel clean up and concentration. See test method reference for details.
Analyte	$C_{20}H_{24}ClN_3O$
Detection	Mass ions m/z = 342, 344, and 357
Detection Limit	8.7 ng/L
Range	Not provided

TABLE 170 Test Method(s) for 2-(2H-benzotriazol-2-yl)-4-(tert-butyl)-6-(sec-butyl)phenol (UV-350)

Chemical Formula	$C_{20}H_{25}N_3O$
Test Method	**Determination of Nine Benzotriazole UV Stabilizers in Environmental Water Samples by Automated on-line Solid Phase Extraction Coupled With High-performance Liquid Chromatography—Tandem Mass Spectrometry, Talanta 120 (2014) 158-166**
Description	This method was developed to analyze benzotriazole UV stabilizers in wastewater treatment plant samples.
Technique	LC-MS-MS
Sample Prep Method	On-line solid phase extractions cartridge. See test method reference for details.
Analyte	$C_{20}H_{25}N_3O$
Detection	Mass ions m/z = 323, and 308
Detection Limit	2.17 ng/L
Range	Not provided

TABLE 171 Test Method(s) for Nitrobenzene

Chemical Formula	$C_6H_5NO_2$
Test Method	**EPA Method 8091**
Description	This method uses gas chromatography with one or more electron capture detectors or nitrogen-phosphorus detectors to detect nitro aromatics and cyclic ketones in water, soil, and waste samples.
Technique	GC
Sample Prep Method	EPA Method 3500
Analyte	$C_6H_5NO_2$
Detection	Specified retention time
Detection Limit	Not provided
Range	Not provided

TABLE 172 Test Method(s) for perfluorononan-1-oic-acid [1] and its sodium [2] and ammonium salts [3]

Chemical Formula	$C_9HF_{17}O$ [1]
Test Method	**ASTM D7968**
Description	This method covers the determination of selected perfluorated compounds in a soil matrix using solvent extraction, filtration, followed by LC-MS-MS.
Technique	LC-MS-MS
Sample Prep Method	Field sample is collected in polypropylene containers, stored at or below 6°C, analyzed within 28 days. The sample is tumbled with methanol and water, 50:50, centrifuged for analysis.
Analyte	$C_9HF_{17}O$ [1] and its salts
Detection	Mass ions at m/z = 462.9, 418.9, and 219
Detection Limit	2.82 ng/kg
Range	2.82-1000 ng/kg

TABLE 173 Test Method(s) for 1,2-benzenedicarboxylic acid, di-C6-10-alkyl esters or mixed decyl and hexyl and octyl diesters

Chemical Formula	Undefined
Analytical Approach	Standard test method does not exist for 1,2-benzenedicarboxylic acid, di-C6-10-alkyl esters or mixed decyl and hexyl and octyl diesters. Test method ASTM D7823, which is used for quantifying other similar phthalate substances can be used, with a set of relevant mass ions as identifier for quantification.
Test Method	**ASTM D7823**
Description	This test method provides a procedure to identify and quantify six phthalates in poly plastic matrix by gas chromatography mass spectrometry.
Technique	GC-MS
Sample Prep Method	Polymer sample is dissolved in THF solvent and analyzed with GCMS.
Analyte	1,2-benzenedicarboxylic acid, di-C6-10-alkyl esters or mixed decyl and hexyl and octyl diesters
Detection	Mass ions at m/z = 149, 167, 251, 265, 279, 293, and 307. Or mass ions at m/z = 149, 167, 251, 279, and 307.
Detection Limit	0.1% (w/w)
Range	> 0.1% (w/w)

TABLE 174 Test Method(s) for 5-sec-butyl-2-(2,4-dimethylcyclohex-3-en-1-yl)-5-methyl-1,3- dioxane [1], 5-sec-butyl-2-(4,6-dimethylcyclohex-3-en-1-yl)-5-methyl-1,3-dioxane [2]

Chemical Formula	$C_{17}H_{30}O_2$
Analytical Approach	Standard test method does not exist for 5-sec-butyl-2-(2,4- dimethylcyclohex-3-en-1-yl)-5-methyl-1,3-dioxane [1], 5-sec-butyl- 2-(4,6-dimethylcyclohex-3-en-1-yl)-5-methyl-1,3-dioxane [2]. Non-exhaustive list of substances include a number of CAS numbers under this group entry. A common fragrance ingredient, Karanal, CAS number 117933-89-8 is used as example for quantification test method.
Test Method	**Chemistry and Technology of Flavors and Fragrances, David J. Rowe, CRC Press 2005, ISBN 1-4051-1450-9**
Description	This publication provides several extraction method from various matrixes. GC-MS is recommended for substance identification and quantification.
Technique	GC-MS
Sample Prep Method	Extraction with solvent
Analyte	$C_{17}H_{30}O_2$
Detection	Reference a standard for mass ions
Detection Limit	Not provided
Range	Not provided

8. Keywords

8.1 anthracine; arsenic oxide; brominated flame retardants; candidate list; cobalt dichloride; ECHA; ECHA candidate list; EU; EU manufacturers, importers or distributors; hexabromocyclododecane; lead hydrogen arsenate; MDA; musk xylene; phthalates; REACH; REACH candidate list; screening method; short chain chlorinated paraffins; sodium dichromate; Substances of Very High Concern; SVHC; SVHC candidate CAS number; SVHC candidate common uses; SVHC candidate EU number; SVHC test method; tributyltin oxide; triethyl arsenate

APPENDIXES

(Nonmandatory Information)[7]

X1. STANDARDIZED METHODS

X1.1 *Test Methods*—See Table X1.1.

X1.2 *Sample Preparation Methods*—See Table X1.2.

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[7] Only standard test methods are cited.

TABLE X1.1 Test Methods

Method	Description
ASTA Method 28.0	Determination of dyes in Capsicum samples and products by High Performance Liquid Chromatography
ASTM D1385	Standard Test Method for Hydrazine in Water
ASTM D3335	Standard Test Method for Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectrometry
ASTM D3545	Standard Test Method for Alcohol Content and Purity of Acetate Esters by Gas Chromatography
ASTM D5831	Standard Test Method for Screening Fuels in Soils
ASTM D7065-11	Standard Test Method for Determination of Nonylphenol, Bisphenol A, p-tert -Octylphenol, Nonylphenol Monoethoxylate and Nonylphenol Diethoxylate in Environmental Waters by Gas Chromatography Mass Spectrometry
ASTM D7485	Standard Test Method for Determination of Nonylphenol, p-tert-Octylphenol, Nonylphenol Monoethoxylate and Nonylphenol Diethoxylate in Environmental Waters by Liquid Chromatography/Tandem Mass Spectrometry
ASTM D7823	Standard Test Method for Determination of Perfluorinated Compounds in Soil by Liquid Chromatography Tandem Mass Spectrometry (LC/MS/MS)
ASTM D7968	Standard Test Method for Determination of Perfluorinated Compounds in Soil by Liquid Chromatography Tandem Mass Spectrometry (LC/MS/MS)
ASTM E1621	Standard Guide for X-Ray Emission Spectrometric Analysis
CEN/TS 15968	Determination of extractable perfluorooctanesulphonate (PFOS) in coated and impregnated solid articles, liquids and fire fighting foams - Method for sampling, extraction and analysis by LC-qMS or LC-tandem/MS
CEN/TC BT WI CSS99040	Soils, sludges and treated bio-waste – Determination of nonylphenos (NP) and nonylphenol-mono- and di-ethoxylates – Method by gas chromatography with mass selective detection (GC-MS)
Chemistry and Technology of Flavors and Fragrances, David J. Rowe, CRC Press 2005, ISBN 1-4051-1450-9	
CPSC-CH-C1001–09.3	Standard Operating Procedure for Determination of Phthalates
EN 14362-1	Textiles. Methods for determination of certain aromatic amines derived from azo colorants. Detection of the use of certain azo colorants accessible with and without extracting the fibres
EN 14372:2004	Child Use And Care Articles - Cutlery And Feeding Utensils - Safety Requirements And Tests
EN 17234	Leather. Chemical tests for the determination of certain azo colorants in dyed leathers. Determination of 4-aminoazobenzene
EPA – Ion Composition	Identifying Compounds Despite Chromatographic Limitations: Organophosphates in Treated Sewage – Final Draft
EPA Method 504.1	EDB, DBCP, 123TCP by Microextractin & GC
EPA Method 524.2	VOCs - Purge & Trap / Capillary Column GC/MS
EPA Method 537	Determination of selected perfluorinated alkyl acids in drinking water by solid phase extraction and liquid chromatography/tandem mass spectrometry (LC-MS-MS)
EPA Method 610	Polynuclear Aromatic Hydrocarbons
EPA Method 625	Acids and Base/Neutrals
EPA Method 1671	Volatile Organic Compounds - GC/FID
EPA Method 6010	Inorganics by ICP - Atomic Emission Spectroscopy
EPA Method 6020	Determination of over 60 substances in a variety of matrices by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)
EPA Method 6200	Field Portable X-ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment
EPA Method 7010	Determination of metals in solution by Graphite Furnace Atomic Absorption Spectrophotometry (GFAA)
EPA Method 7196A	Colorimetric determination of hexavalent chromium using diphenylcarbazide
EPA Method 8032A	Acrylamide by GC
EPA Method 8061A	Phthalate esters by gas chromatography with electron capture detection (GC-ECD)
EPA Method 8091	Nitroaromatics and Cyclic Ketones by Gas Chromatography
EPA Method 8095	Explosives by Gas Chromatography
EPA Method 8100	Determination of polynuclear aromatic hydrocarbons (PAHs) by Gas Chromatography and flame ionization detection
EPA Method 8131	Aniline & Selected Derivatives by Cap Column GC
EPA Method 8260B	VOCs by GC/MS Capillary Column Technique
EPA Method 8270D	Determination of semivolatile organic compounds by Gas Chromatography/Mass Spectrometry (GC-MS)
EPA Method 8310	Determination of the concentration of certain poly-nuclear aromatic hydrocarbons by High Performance Liquid Chromatography (HPLC)
EPA Method 8323	Determination of organotins by micro-liquid chromatography – electrospray ion trap mass spectrometry
EPA Method 8515	TNT in Soil by Coloimetric Screening
EPA Method 9056A	Determination of inorganic anions by ion chromatography
German ZEK01.4-08	Testing and Validation of Polycyclic Aromatic Hydrocarbons (PAH) in the course of GS-Mark Certification
Government Chemist Programme, LGC/GC/2006/019	Determination of specific alkylphenol ethoxylates in textiles
Health Canada C-38	Amendments to the Food and Drugs Act (Bill C-38)
IEC 62321	Determination of levels of six regulated substances (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, polybrominated diphenyl ethers) by a variety of analytical test methods.
Interdisciplinary Studies on Environmental Chemistry	Environmental Specimen Bank, Eds., T. Isobe, K. Nomiyama, A. Subramanian, and S. Tanabe, pp. 51-59. By TERRAPUB, 2010.
ISO 17353-2004	Water quality - Determination of selected organotin compounds - Gas chromatographic method
ISO 21587-3	Chemical analysis of aluminosilicate refractory products (alternative to the X-ray fluorescence method) - Part 3: Inductively coupled plasma and atomic absorption spectrometry methods

TABLE X1.1 *Continued*

Method	Description
Journal of Hazardous Materials, Volume 114, Issues 1–3, 18 October 2004, pages 29–39	Monitoring of toxicity and intermediates of C.I. Direct Black 38 azo dye through decolorization in an anaerobic/aerobic sequential reactor system; Mustafa Isik, Delia Teresa Sponza
National Industrial Chemicals Notification and Assessment Scheme, File No: NA/278 Date: April 1996	Australia National Industrial Chemicals Notification and Assessment Scheme full public report on 3-ethyl-2-methyl-2-(3-methylbutyl)-1,3-oxazolidine
NIOSH Manual of Analytical Method 2004	NMAM is a collection of methods for sampling and analysis of contaminants in workplace air, and in the blood and urine of workers who are occupationally exposed. These methods have been developed or adapted by NIOSH or its partners and have been evaluated according to established experimental protocols and performance criteria. NMAM also includes chapters on quality assurance, sampling, portable instrumentation, etc.
NIOSH Manual of Analytical Methods 2559	Decabromodiphenyl oxide analysis by HPLC
NIOSH Method 5504	
NIOSH Method 7901	Determination of As_2O_3 as As using Graphite Furnace Atomic Absorption Spectrophotometry
NIST/EPA/NIH Mass Spectral Library	NIST Standard Reference Database
OSHA Method #57	Determination of 4,4’-Methylenedianiline (MDA) by Gas Chromatography
OSHA Method #95	Sampling and Analytical Method: Thiourea
OSHA Method ID-211	Sampling and Analytical Method: Acrylamide
Talanta 120 (2014) 158-166	Determination of Nine Benzotriazole Uv Stabilizers in Environmental Water Samples by Automated Online Solid Phase Extraction Coupled With High-performance Liquid Chromatography–tandem Mass Spectrometry
Thermo scientific Application Note – 10329	Detection, identification, and quantitation of azo dyes in leather and textiles by GC-MS
US FDA Method 21cfr 500 subpart F	Methods for Detection of Residues of Carcinogenic Compounds Used in Food-Producing Animals
USGS NWQL O-1433-01	Method of Analysis by the U.S. Geological Survey National Water Quality Laboratory - Determination of Wastewater Compounds by Polystyrene-devinylbenzene Solid-Phase Extraction and Cappilary-Column Gas Chromatography/Mass Spectrometry
USGS Method O-3112-83	TNT, RDX, and picric acid, total recoverable, high-performance liquid chromatographic

TABLE X1.2 Sample Preparation Methods

Method	Description
ASTM D1257	Standard Guide for Evaluating Grinding Materials Used for Surface Preparation in Spectrochemical Analysis
ASTM D1971	Standard Practices for Digestion of Water Samples for Determination of Metals by Flame Atomic Absorption, Graphite Furnace Atomic Absorption, Plasma Emission Spectroscopy, or Plasma Mass Spectrometry
ASTM D4309	Standard Practice for Sample Digestion Using Closed Vessel Microwave Heating Technique for the Determination of Total Metals in Water
CEN/TS 15968	Determination of extractable perfluorooctanesulphonate (PFOS) in coated and impregnated solid articles, liquids and fire fighting foams - Method for sampling, extraction and analysis by LC-qMS or LC-tandem/MS
EPA Method 3050B	Digestion procedure for the preparation of sediments, sludges and soil samples with repeated additions of nitric acid and hydrogen peroxide
EPA Method 3051A	This microwave extraction method is designed to mimic extraction using conventional heating with nitric acid, or alternatively, nitric acid and hydrochloric acid.
EPA Method 3052	This method is applicable to microwave assisted acid digestion of siliceous, organic and other matrices.
EPA Method 3060	This method is an alkaline digestion procedure for extracting hexavalent Cr(VI) from soluble, absorbed and precipitated forms of chromium compounds in soils, sludges and sediments.
EPA Method 3500C	Organic extraction and sample preparation methods
EPA Method 3510C	Separatory Funnel Liquid-Liquid Extraction
EPA Method 3520C	Continuous Liquid-Liquid Extraction - Organics
EPA Method 3535	Solid Phase Extraction (SPE) - Organics
EPA Method 3540C	Soxhlet Extraction - Organics
EPA Method 3541	Automated Soxhlet Extraction
EPA Method 3550B	Ultrasonic Extraction - Organics
EPA Method 3550C	Ultrasonic Extraction (non or semi-volatile)
EPA Method 3580A	Waste Dilution
EPA Method 3585	Waste Dilution for Volatile Organics
EPA Method 5021	VOCs in Soils/Solid Matrices by Equilibrium Head
EPA Method 5030B	Purge & Trap for Aqueous Samples - Organic
EPA Method 5032	Volatile Organic Compounds - Vacuum Distillation
EPA Method 5035	Closed-System Purge/Trap/Extraction - Organics (and CLP- Volatiles in low level soils)
EPA Method 5041A	Desorption Sorbent Cartridges VOST - Cap GC/MS
EPA Method 5050	Bomb (combustion) sample preparation procedure for the determination of Cl.

X2. SCREENING METHOD AND LIMITATIONS

X2.1 Screening methods may be appropriate to determine whether a detectable amount of a substance is present. In many situations the application of a screening process may obviate the need to perform full quantitative analysis.

X2.2 Limits of detection, when practicable, should be validated. Otherwise, the presence determination will dictate a strategy requiring follow-up analysis for a more accurate and precise concentration determination. Ideally, the minimum detection level of the screening method is below the trigger level.

X2.3 Many samples can be effectively screened by detecting the key elements only. Methods based on X-ray fluorescence spectrometry (XRF) are widely employed for this purpose. Methods as described in IEC 62321 or EPA SW-846 Method 6200 are applicable. Other analytical capabilities may also be appropriate for screening the analyte of interest.

X2.4 Commercial XRF equipment typically can analyze sodium and heavier elements. Lithium to neon analysis is typically done by other methods. Refer to IEC 62321 or EPA SW-846 Method 6200 for XRF metrology details. The following caveats concerning XRF analysis should be heeded.

X2.4.1 Limits of detection for lighter elements can vary from fraction of a percent up to as much as 5 % (w/w).

X2.4.2 XRF signals of lighter elements represent mostly the near surface layer of the sample while the source of the heavier elements can be located at millimeters to centimeters in depth into the sample.

X2.4.3 XRF analysis is often used to analyze objects in their "as-is" condition. However, objects are often non-homogeneous by design. Qualitative determination may be the best that can be done in non-homogenous objects by XRF.

X2.4.4 X-ray line pairs for some combinations may not completely resolve. Therefore, care must be taken in the interpretation of the X-ray intensities. In some cases, alternative X-ray lines without interference can be used. Otherwise, mathematical calculations must be used to correct for the interferences. ASTM E1621 provides guidance on the mathematical corrections.

X2.5 Screening as an analytical approach for specific organic species, should be used with caution or even be avoided. Common screening techniques may not be able to distinguish targeted organic species from a general organic group of molecules that are not on the SVHC list, resulting in misidentification.

X2.6 Full quantitative analysis may be required if the substance is suspected to be present and it is not possible to determine whether its concentration is above or below a targeted threshold level.