3.01 A Appendix B: Chemical and Material Screening Criteria Guidelines

This document is to be used to help the Chemical and Material Screening Coordinator (CMSC) in determining the TI category (category 1, category 2, or category 3) in conjunction with the Chemical and Material Request system “Decisions Page”. The document is not all inclusive to every situation or chemical product or material that may exist. If the CMSC is unsure if additional screening or information is required, the request should be elevated to the CMRB.

Use of Criteria:

All chemicals, gases or materials (CGMs) that meet the criteria of ESH standard 3.01A for screening should be classified as Category 1, 2, or 3. This includes CGMs that are:

* New to a specific site
* Being considered for a new use or changed process including Special Order to Permanent Part Number
* Being re-evaluated due to new information regarding hazards or customer concerns

Screening criteria should be applied to the chemical or gas product, as a whole, as well as the individual constituents whenever possible. If the product contains a TI RCM in any known concentration, it is a Category 1. If the product contains a non-TI RCM equal to or greater than 0.1% of a Category 1 or 2 chemical, then the product itself is a Category 1 or 2, respectively. If the product contains less than these percentages of a Category 1or 2 chemical, and as a whole does not meet the criteria of Category 1 or Category 2, then the product is considered a Category 3.

As a reminder:

#### The following uses are considered to be Category 3, and may be reviewed at the site level per the site’s review process for they types of chemicals and materials. Full component information is not required to approve these chemicals or materials. These chemicals and materials are not required to be captured within the Chemical Request System unless CMRB review is requested by the site. However, you are required to keep them on your chemical inventory and must be able to demonstrate through documentation that ESH has reviewed and approved the chemistries.

##### Contractor Turn-Key chemicals. One time use projects.

##### Facilities; non-process related chemicals (for example: lubricant oils, greases, vacuum pump oils, cooling tower chemicals, waste water treatment chemicals)

##### Cleaning/Janitorial/Housekeeping chemicals

##### General consumer products that are being purchased to be used in the method that they were intended by the manufacturer and in a quantity that would be consistent with general consumer use

##### Lab Use for chemicals and materials that will not touch or become part of the final product.

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**Condensed Chemical and Material Screening Decision Tree**

(Use in conjunction with 3.01A Appendix B)

YES

NO

NO

NO

**Category 1:**

CGMs that meet one or more of the following criteria are expected to be prohibited from use at TI. Limited exceptions will only be made by the appropriate business leadership team following required review as determined on a case-by-case basis by the Chemical and Material Review Board (CMRB.)

1. TI RCM list
   * Not all categories on the TI RCM list contain all applicable CAS numbers. Some categories are listed as chemical and any compound containing that constituent. For example: lead and its compounds. In these instances, the screener must be aware and elevate the chemical or material to the CMRB
2. Health
   * Neutron emitting sources
   * Bio-safety Level 3 or 4
3. Explosive
   * Shipping Hazard Class 1, Division 1.1, 1.2, 1.3 or 1.5
   * GHS: Explosives: Category Unstable Explosives 1.1, 1.2, 1.3, or 1.5
4. Flammability and Reactivity
   * NFPA flammability rating of 4 AND reactivity rating of 3 or 4 AND becomes UNSTABLE over time.
   * GHS
     1. Flammable gases: Category 1 and reactive and UNSTABLE over time
     2. Flammable liquids: Category 1 or Category 2 and reactive and UNSTABLE over time
     3. Flammable solids: Category 1 and reactive and UNSTABLE over time

**Category 2:**

CGMs that meet one or more of the following criteria are considered to be moderate risk. Less hazardous chemistries should be used when possible. All Category 2 CGMs require a higher level of evaluation, controls, and documentation before ESH can approve. A Process Safety Review (PSR), or other additional documentation, including business leadership approval, may be required before the CMRB can approve. Limited exceptions shall be made by the CMRB based on a case-by-case assessment.

1. The GHS signal word “Danger” for any category
2. Known or suspect carcinogens
   1. IARC Group 1, 2A or 2B
   2. ACGIH A1, A2
   3. NTP “known carcinogen” or “reasonably anticipated to be a carcinogen”
   4. Prop 65 Carcinogen
   5. GHS Category 1A, 1B, or 2, Carcinogen
3. Known or suspect reproductive toxin
   1. National Toxicology Program (NTP) “Clear evidence of reproductive toxicity” or “Some evidence of reproductive toxicity”
   2. Proposition 65 Reproductive toxin
   3. GHS Toxic to Reproduction: Category 1A, 1B, or Category 2
4. Explosive
   1. Shipping Hazard Class 1, Division 1.4 as defined by UN/DOT
   2. GHS: Explosives: Category 1.4
5. Flammability and Reactivity
   1. NFPA flammability rating of 3 or 4 AND reactivity rating of 3 or 4. (Not time sensitive)
   2. GHS Flammability rating
      1. Flammable gases Category 1 and reactive
      2. Flammable liquids Category 1 or Category 2 and reactive
      3. Flammable solids Category 1 and reactive
6. Pyrophoric
7. Bio-safety level 2
8. Health
   1. NFPA health rating of 3 or 4 with potential for dermal absorption
   2. ACGIH Skin Notation
   3. Other indicator of dermal absorption
   4. GHS Acute toxicity: Category 1, 2, 3 with potential for dermal absorption
9. Highly toxic
   1. Oral LD50 <50 mg/kg
   2. Dermal LD50 <200mg/kg
   3. Inhalation
      1. LC50 <200ppm gas or vapor
      2. LC50<2mg/l mist, fume, or dust
   4. GHS oral, dermal, or inhalation: Category 1 or 2
10. Select chemistries
    1. TMAH (CAS 75-59-2) =>1%
    2. Chlorine trifluoride ClF3 (CAS 7790-91-2)
    3. Dimethyl sulfoxide (DMSO) (67-68-5)
    4. Radiation producing sources (including check sources)
    5. Endocrine disrupters
    6. Nanotechnology
11. Horizon issues
12. Insufficient data
    1. Including less than 100% of ingredient information
13. Environmental – US ONLY
    1. TSCA
       1. Not listed on TSCA inventory
       2. PMN filed
       3. Subject to SNUR
       4. R&D exemption
    2. Potential for export outside of US
    3. Hazardous Air Pollutant (HAPs)
    4. International equivalents?

Category 3:

CGMs that do not meet the criteria for Category 1 or 2 require site ESH review only, but may still have requirements for additional controls, reporting and/or employee training as determined by the site ESH team. Category 3 chemicals and materials may be elevated to the CMRB due to [regulatory/regional requirements](#Govregs), customer requirements, horizon issues, or insufficient data, or based on professional judgment of site ESH.

**Definitions and/or references used in development and interpretation of the criteria for 3.01A.**

**American Conference of Governmental Industrial Hygienists (“ACGIH”)**

An autonomous, non-governmental organization of professionals devoted to the administrative and technical aspects of occupational and environmental health.

**Bioaccumulation**

Increase in concentration of a pollutant from the environment to the first organism in a food chain.

**Biosafety in Microbiological and Biomedical Laboratories (BMBL)**

Biosafety in Microbiological and Biomedical Laboratories (BMBL), 4th Edition May 1999; published by U.S. Department of Health and Human Services, Centers for Disease Control and Prevention and the National Institutes of Health. This document establishes Bio-safety Levels based on the risks associated with laboratory activities involving the use of infectious agents. The characteristics of infectious agents and the primary laboratory hazards of working with the agents are described generically for agents in Bio-Safety Levels 1-4, and specifically for individual agents or groups in Section VII of this publication.

**Biosafety Level 1 (BSL-1) -** Biosafety Level 1 is suitable for work involving well-characterized agents not known to consistently cause disease in healthy adult humans, and of minimal potential hazard to laboratory personnel and the environment.

**Biosafety Level 2 (BSL-2) -** Biosafety Level 2 is similar to Biosafety Level 1 and is suitable for work involving agents of moderate potential hazard to personnel and the environment.

**Biosafety Level 3 (BSL-3) -** Biosafety Level 3 is applicable to clinical, diagnostic, teaching, research, or production facilities in which work is done with indigenous or exotic agents which may cause serious or potentially lethal disease as a result of exposure by the inhalation route. Laboratory personnel have specific training in handling pathogenic and potentially lethal agents, and are supervised by competent scientists who are experienced in working with these agents.

**Biosafety Level 4 (BSL-4) -** Biosafety Level 4 is required for work with dangerous and exotic agents that pose a high individual risk of aerosol-transmitted laboratory infections and life-threatening disease. Agents with a close or identical antigenic relationship to Biosafety Level 4 agents are handled at this level until sufficient data are obtained either to confirm continued work at this level, or to work with them at a lower level.

**Carcinogen**

Chemical or material that meets one or more of the following criteria:

* IARC Group 1: Carcinogenic to humans, Group 2A: Probably carcinogenic to humans or Group 2B: Possibly carcinogenic to humans;
* National Toxicology Program (NTP) “known carcinogens” or “reasonably anticipated to be carcinogens”;
* ACGIH Categories A1: Confirmed Human Carcinogen, A2: Suspected Human Carcinogen or A3: Confirmed Animal Carcinogen with Unknown Relevance to Humans;
* Listed on Proposition 65 as Chemicals Known to the State (California) to Cause Cancer; or
* Other data supports sufficient evidence of carcinogenicity.
* GHS Category 1A, 1B, or Category 2.

GHS, carcinogens are categorized as either known/presumed carcinogens (Category 1) or suspected carcinogens (Category 2) for Carcinogenicity.

**Dermal Absorption**

The transfer of contaminant across the skin and subsequent incorporation into the body. Would include:

* ACGIH skin notation
* GHS Hazard Category 1, 2, 3: Acute Toxicity

**GHS Classification and labeling summary**

Globally Harmonized System of Classification and Labeling of Chemicals.

**Hazardous Air Pollutant (HAPs)**

Hazardous Air Pollutant orHAP’s are generally defined as those pollutants that are known or suspected to cause serious health problems. HAPs are emitted from a variety of source categories that include stationary major and area sources, other stationary sources, and mobile sources. For the purpose of the CMRB, EPA's National Emissions Inventory (NEI) database will be used to identify HAPs.

**Horizon Issues**

Horizon issues include, but are not limited to:

* “Geo-Political” Issues - Chemicals or materials which, for a variety of reasons appear likely to become subject to worldwide or regional regulatory attention. (Examples include persistence in the environment, global warming, pollution, waste generation, water consumption, energy consumption, etc.)
* Persistent, Bio-accumulative Toxics (“PBT”s) - Persistent, bioaccumulative and toxic pollutants (PBTs) are long lasting substances that can build up in the food chain to levels that are potentially harmful to human health and the environment. They can be associated with a range of adverse human health effects, including the nervous system, reproductive, cancer and genetic impacts. Chemicals or materials that are targeted as PBTs will come under greater regulatory review and voluntary reduction strategies.
* Endocrine Disrupters – The endocrine system controls a variety of functions including reproductive, immune, respiratory and digestive functions. Though there is not currently a statutory or regulatory definition of “endocrine disruption,” a belief exists that exposure to certain chemicals or materials over time can have a negative effect on the endocrine system.
* Children’s Health – There is a concern worldwide for chemicals or materials that have been shown to have negative effects on children’s health. As an example, the U.S. EPA has instituted the Voluntary Children’s Chemical Evaluation Program (“VCCEP”) in which the focus is on chemicals or materials found in children’s products, food, air and water.
* Aquatic Toxin - Aquatic toxicity data on products, pure compounds, formulations and other test chemicals or materials may be required for registration with regulatory agencies, incorporation into Safety Data Sheets (“SDS”), use in risk assessments, interpretation of Toxicity Identification Evaluation (“TIE”) data or as a requirement for materials destined to enter treatment plants with whole effluent toxicity (“WET”) limits. Product screening tests are typically conducted with either the larval or juvenile stages of one of several freshwater or saltwater fish species. Stages of invertebrate species typically used in testing are the early in-star stage. Types of evaluations performed are biomonitoring (“WET”), sediment, and material and bioaccumulation tests. The EPA has a searchable database that houses accumulated data on aquatic toxicity termed “Aquire”.

**International Agency for Research on Cancer (“IARC”)**

International Agency for Research on Cancer ("IARC") is part of the World Health Organization. IARCs mission is to coordinate and conduct research on the causes of human cancer, the mechanisms of carcinogenesis, and to develop scientific strategies for cancer control.

**Lethal Concentration 50 or LC50**

The airborne concentration of a given substance that when inhaled over a period of time will kill 50% of the animals under test.

**Lethal Dose 50 or LD50**

The dose required to produce death in 50% of the exposed species, usually within the first 30 days.

**National Fire Protection Association (“NFPA”)**

The NFPA 704 rating system is intended to address health, flammability, reactivity and related hazards that may be presented by short-term, acute exposure to a material during handling under conditions of fire, spill, or similar emergencies. It is not applicable to chronic exposure or to non-emergency occupational exposure.

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| **Flammability (red)** | |
| **0** | Materials that will not burn under typical fire conditions (e.g. Carbon tetrachloride), including intrinsically noncombustible materials such as concrete, stone and sand (Materials that will not burn in air when exposed to a temperature of 820 °C (1,500 °F) for a period of 5 minutes) |
| **1** | Materials that require considerable preheating, under all ambient temperature conditions, before ignition and combustion can occur (e.g. mineral oil, ammonia). Includes some finely divided suspended solids that do not require heating before ignition can occur. Flash point at or above 93.3 °C (200 °F). |
| **2** | Must be moderately heated or exposed to relatively high ambient temperature before ignition can occur (e.g. diesel fuel) and multiple finely divided suspended solids that do not require heating before ignition can occur. Flash point between 37.8 and 93.3 °C (100 and 200 °F). |
| **3** | Liquids and solids (including finely divided suspended solids) that can be ignited under almost all ambient temperature conditions (e.g. gasoline, acetone). Liquids having a flash point below 22.8 °C (73 °F) and having a boiling point at or above 37.8 °C (100 °F) or having a flash point between 22.8 and 37.8 °C (73 and 100 °F). |
| **4** | Will rapidly or completely vaporize at normal atmospheric pressure and temperature, or is readily dispersed in air and will burn readily (e.g. acetylene, propane, liquid hydrogen). Includes pyrophoric substances. Flash point below room temperature at 22.8 °C (73 °F). |

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| **Health (blue)** | |
| **0** | Poses no health hazard, no precautions necessary and would offer no hazard beyond that of ordinary combustible materials (e.g. wood, paper) |
| **1** | Exposure would cause irritation with only minor residual injury (e.g. acetone, sodium bromate) |
| **2** | Intense or continued but not chronic exposure could cause temporary incapacitation or possible residual injury (e.g. diethyl ether, ammonium phosphate) |
| **3** | Short exposure could cause serious temporary or moderate residual injury (e.g. liquid hydrogen, carbon monoxide, calcium hypochlorite) |
| **4** | Very short exposure could cause death or major residual injury (e.g. hydrogen cyanide, phosgene, methyl isocyanate, hydrofluoric acid) |
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| **Instability/reactivity (yellow)** | |
| **0** | Normally stable, even under fire exposure conditions, and is not reactive with water (e.g. helium, N2) |
| **1** | Normally stable, but can become unstable at elevated temperatures and pressures (e.g. propene) |
| **2** | Undergoes violent chemical change at elevated temperatures and pressures, reacts violently with water, or may form explosive mixtures with water (e.g. white phosphorus, potassium, sodium) |
| **3** | Capable of detonation or explosive decomposition but requires a strong initiating source, must be heated under confinement before initiation, reacts explosively with water, or will detonate if severely shocked (e.g. ammonium nitrate, chlorine trifluoride) |
| **4** | Readily capable of detonation or explosive decomposition at normal temperatures and pressures (e.g. nitroglycerin, chlorine azide, chlorine dioxide, nitrogen triiodide) |

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| **Special notice (white)** | |
| The white "special notice" area can contain several symbols. The following symbols are defined by the NFPA 704 standard. | |
| **OX** | Oxidizer, allows chemicals to burn without an air supply (e.g. potassium perchlorate, ammonium nitrate, hydrogen peroxide). |
| **₩** | Reacts with water in an unusual or dangerous manner (e.g. caesium, sodium, sulfuric acid). |
| **SA** | Simple asphyxiant gas. Specifically limited to the following gases: nitrogen, helium, neon, argon, krypton and xenon.[2] |
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| **Non-standard symbols (white)** | |
| These hazard codes are ***not part of the NFPA 704 standard***, but are occasionally used in an unofficial manner. The use of non-standard codes may be permitted, required or disallowed by the authority having jurisdiction (e.g. fire department). | |
| **COR** | Corrosive; strong acid or base (e.g. sulfuric acid, potassium hydroxide) |
| **ACID**, **ALK** | Acid or alkaline, to be more specific |
| **BIO or** | Biological hazard (e.g. flu virus, rabies virus) |
| **POI** | Poisonous (e.g. strychnine, alpha-Amanitin) |
| **RA, RAD** | Radioactive (e.g. plutonium, cobalt-60) |
| **CRY** or **CRYO** | Cryogenic (e.g. liquid nitrogen) |

**Neutron Emitting Isotopes**

Radioactive materials that spontaneously fission or emit neutrons from the nucleus.

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| Z Isotope Emission  35 Bromine 87 N  35 Bromine 89 N  53 Iodine 137 N | 96 Curium 248 SF  96 Curium 250 SF  98 Californium 252 SF  98 Californium 254 SF  100 Fermium 256 SF |

# *Note: All radioactive materials must be approved by the Radiation Safety Office (RSO.)*

**Neutron Emitting Sources**

Radioactive isotopes that emit neutrons as a result of spontaneous fission or fission byproduct. Most of the neutron emitting isotopes are very short lived, but there are neutron sources that take alpha emitters mixed with beryllium and the mixture becomes a neutron emitting source. This should also include fissile materials.

* Alpha-neutron reactions dominate:
  + Po(210)-Li
  + Po(210)-Be
  + Ra-Be
  + Pu (238)-Be
  + Am(241)-Be
* Gamma-Neutron Sources:
  + Na(24)-Be
  + Na(24)-D2O
  + Ga(72)-Be
  + Y(88)-Be
  + In(116)-Be
  + Sb(124)-Be
  + La(140)-Be
  + Th(228)-Be

Additional sources of neutrons are from fusion reactions such as Deuterium-Deuterium (D-D) reactions and Deuterium-Tritium (D-T) reactions that produce very high energy neutrons.

The issue associated with producing or emitting neutrons is the activation (making atoms radioactive) of the surrounding materials. This process is highly regulated and requires specific licenses and controls

*Note: All radioactive materials (including check sources) must be approved by the Radiation Safety Office (RSO.)*

**Proposition 65**

Proposition 65 is a U.S. California state law, The Safe Drinking Water and Toxic Enforcement Act of 1986. The Safe Drinking Water and Toxic Enforcement Act requires that the Governor revise and republish at least once per year the list of chemicals known to the State to cause cancer or reproductive toxicity.

**Pyrophoric**

Materials that will ignite spontaneously in air at or below 130°F (54.4°C.)

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**Regulatory/Regional Requirements**

Material is under regulatory or regional requirements for the country or countries that the material will potentially be used. Material usage could affect permitting conditions and/or special safety & health requirements such as training, air monitoring, etc. In the U.S., this category would include materials contained in OSHA regulation 29CFR 1910.1001-1199.

**Reproductive Toxin**

Reproductive toxicity covers three main areas of effects:

* Ability to Reproduce - Some reproductive toxicants can interfere with or disable a species from successfully conceiving offspring.
* Developmental or [Teratogenic](#Teratogen) Toxins - This includes toxic agents that cause the fetus to develop improperly during gestation causing physical deformity and/or mental dysfunction.
* Mutagenic Toxins - These toxic agents cause unknown chromosomal effects to offspring of a future generation, which may not be the next successive one. These chromosomal effects can cause other systemic health effects such as birth defects of possibly cancer.
* National Toxicology Program (NTP) “Clear evidence of reproductive toxicity” or “Some evidence of reproductive toxicity”;
* Listed on Proposition 65 as Chemicals Known to the State (California) to be a reproductive toxin
* GHS Category 1A, 1B, or Category 2: Toxic to Reproduction.
* Other data supports sufficient evidence of reproductive toxin.

**TI Restricted Chemicals and Materials List (TI RCM List)**

Edge document 6494169.

**T****oxic Substance Control Act (“TSCA”)**

The Toxic Substances Control Act. For the purpose of the screening process, when screening CGMs for use in the U.S., ensure that all components are listed on the TSCA inventory and/or have Low Volume Exemptions (LVE), Low Risk of Exposure Exemptions (LoRex) or Polymer Exemption. For any other listings and/or exemptions, contact the TI TSCA Coordinator. An Research and Development order is not a TSCA listed chemical. Research and Development Chemicals must be reported to the TI TSCA Coordinator.

**United Nations/Department of Transportation (UN/DOT) Class 1 (Explosive) Materials**

DIV DEFINITION

1.1 Explosives that have a mass hazard explosion. A mass explosion is one which affects almost the entire load instantaneously. (Examples include dynamite, cap-sensitive water gels, slurries, emulsions and cast boosters.)

1.2 Explosives that have a projection hazard but are not a mass explosion hazard. (Examples include ammunitions, projectiles and bombs.)

1.3 Explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard. (Examples include some propellants, some fireworks and flares.)

1.4 Explosive devices that present a minor explosion hazard. External fire must not cause virtually instantaneous explosion of almost the entire contents of the package. (Examples include some detonators and detonating cords, safety fuse, electric squibs, igniters, igniting cords, and some fireworks.)

1.5 Very insensitive explosives. This division is comprised of substances which have a mass explosion hazard but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport. (Examples include blasting agents such as ammonium nitrate combined with fuel oil.

1.6 Extremely insensitive articles which do not have a mass explosion hazard. This division is comprised of articles which contain only extremely insensitive detonating substances and which demonstrate a negligible probability of accidental initiation or propagation. (This division is not commonly used for commercial explosives.)

**REVISION HISTORY**

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| --- | --- | --- | --- | --- |
| **Rev#** | **Date** | **Nature of Revision** | **Author/Editor** | **Approver** |
| A | 2/15/13 | Tri-annual review | Michele Smith | ELC |
| B | 9/13/17 | Formatting and GHS changes | Michele Smith | ELC |
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