



## HEAVY METALS - EXTRACTABLE

**Other Names** See below for heavy metal substances that have extractable limits in the AFIRM RSL

CAS Number	Substance
7440-36-0	Antimony (Sb)
7440-38-2	Arsenic (As)
7440-39-3	Barium (Ba)

*List continued in "Additional Information"*

- May Be Found In**
- Dyed or printed textiles
  - Antimony as catalyst in polyester
  - Leather
  - Pigments, dyes, inks and paints
  - Metal alloys and coatings
  - Plastics including PVC

Heavy metals are a loosely defined group of elements that have metallic properties including the ability to conduct heat and electricity. In most cases, classification of a heavy metal is based on molecular weight, atomic number, or related physical properties. Extractable heavy metals are those metals that release from a material under specific conditions.

### Uses in the Supply Chain

Heavy metals are found in various parts of the apparel, equipment, and footwear supply chains. Extractable metals are those metals that release from a material under specific conditions. Heavy metals may be used in pigments, dyes, paints, inks, heat stabilizers, surface treatments, catalysts, metal trim parts, and leather tanning processes.

- Pigments and dyes: chromium, cobalt, nickel and copper may be found in metal-complex dyes.
- Antimony, arsenic, barium, cadmium, chromium, lead, mercury, and nickel may be found in some pigments.
- Polyester Synthesis: This process often involves antimony as a polymer catalyst.
- Metal alloys and coatings
- Leather Tanning: barium, arsenic, and chromium can be used in leather tanning processes.
- Polyvinyl chloride (PVC) heat stabilization may be accomplished with either cadmium or lead.
- Copper may be found in turquoise, blue, green dyes (reactive, direct, pigments).
- Nickel can be found in brilliant green dyes (reactive).
- Chromium is found in metal complex and acid dyes and brilliant/dark dyes (wood, silk, animal fibers, PA).
- Cobalt may be found in acid dyes.
- Selenium may be found in paints, inks, plastics, and synthetic fibers.

### Why Heavy Metals are Restricted

- Legislation in major markets around the world restricts the presence of heavy metals in finished products.
- Heavy metals are associated with the following environmental and human toxicity characteristics:
  - Aquatic toxicity: arsenic, barium, cadmium, copper, cobalt, lead, mercury, nickel, and selenium



## Chemical Information Sheet

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- Carcinogenicity: arsenic, cadmium, cobalt, nickel
- Kidney, brain and/or reproductive toxicity: barium, lead, mercury
- High acute toxicity: arsenic, cadmium, mercury
- Chemical hazard information for many chemicals can be found at the following external databases:
  - GESTIS Substance Database: [Here \(external link\)](#)
  - US National Library of Medicine: [Here \(external link\)](#)
  - US OSHA Occupational Chemical Database: [Here \(external link\)](#)

### Sourcing Compliant Materials from Your Suppliers

- Contact your suppliers and explain that you require their manufactured materials to be compliant with the current AFIRM RSL limits.<sup>1</sup>
- Require suppliers to submit a confirmation of material compliance or a test report from a third-party laboratory.
- When materials are received, consider performing risk-based testing to ensure the current AFIRM RSL limits are met.<sup>1</sup>
- Screens used in printing applications may contain nickel. Ask suppliers to use nickel free screens when appropriate.
- Antimony free polyester may be available for some applications, but performance and aesthetic should be reviewed.

### Sourcing Compliant Formulations from Your Chemical Suppliers

- For all formulations, request SDS documentation that meets current GHS requirements.
- Contact your suppliers and explain that you require formulations to be compliant with current ZDHC MRSL limits whenever applicable.<sup>2</sup>
- Discuss with your chemical supplier whether any safer alternatives are available that are suitable substitutes for your production needs.
- Prior to procuring any formulation, the chemical properties must be reviewed to ensure that proper protective equipment, chemical storage facilities, facility engineering controls, and associated treatment/disposal facilities are appropriate for the chemical(s).
- Pay particular attention to low quality pigments and metal-complex dyes that are not properly bound to dyed materials.

### Safer Alternatives

- There are alternatives to pigments containing heavy metals, please inquire with your supplier.
- Any chosen pigment alternatives and other formulations must be ZDHC MRSL compliant whenever applicable.
- Ensure restricted organotins are not used as a replacement for lead or cadmium as a heat stabilizer in PVC.
- Alternatives to chromium in dyeing/printing/digital printing of wood/silk/animal fibers/PA: Use reactive dyes or heavy metal-free acid dyes
- Calcium-zinc stabilizers may be used in the form of metal carboxylates. These stabilizers are suitable for production of products with a high degree of clarity, good mechanical properties, excellent organoleptic properties, and good weatherability.
- Organic-based stabilizers are calcium-zinc stabilizers with zinc nearly or completely replaced with organic co-stabilizers. Benefits of these stabilizers include low migration, low odor, low VOC emissions, good initial color, and excellent transparency.
- In all cases, review the alternative to ensure no regrettable substitutions are made, prior to implementing in the production facility.



### Additional Information

- Visit ECHA's Candidate List of substances of very high concern to view dossiers for many restricted substances <https://echa.europa.eu/candidate-list-table>.
- Ecological and Toxicological Association of Dyes and Organic Pigments Manufacturers (ETAD) – <http://www.etad.com>

Continued list of CAS numbers and substance names from first page:

CAS Number	Substance
7440-43-9	Cadmium (Cd)
7440-47-3	Chromium (Cr)
18540-29-9	Chromium (Cr VI) – <i>See Chromium VI Chemical Information Sheet for more specific information</i>
7440-48-4	Cobalt (Co)
7440-50-8	Copper (Cu)
7439-92-1	Lead (Pb)
7439-97-6	Mercury (Hg)
7440-02-0	Nickel (Ni) – <i>See Nickel Chemical Information Sheet for more specific information</i>
7782-49-2	Selenium (Se)

### References

- <sup>1</sup> Apparel and Footwear International RSL Management Group Restricted Substances List (AFIRM RSL) <http://afirm-group.com/afirm-rsl/>
- <sup>2</sup> ZDHC Manufacturing Restricted Substances List (ZDHC MRSL) [https://www.roadmapzero.com/mrsl\\_online/](https://www.roadmapzero.com/mrsl_online/)