

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
- Sb as catalyst in polyester
- Leather
- Pigments and dyes
- Metal alloys and coatings
- 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.¹ 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, heat stabilizers, surface treatments, catalysts, and leather tanning processes.

- Pigments and dyes: Cr, Co, Ni and Cu may be found in metal-complex dyes.
- Sb, As, Ba, Cd, Cr, Pb, Hg and Ni may be found in some pigments.
- Polyester Synthesis: This process often involves Sb as a polymer catalyst.
- Metal alloys and coatings
- Leather Tanning: Ba, As, and Cr can be used in leather tanning processes.
- Polyvinyl chloride (PVC) heat stabilization may be accomplished with either Cd or Pb.¹
- Cu may be found in turquoise, blue, green dyes (reactive, direct, pigments).
- Ni can be found in brilliant green dyes (reactive).
- Cr is found in metal complex and acid dyes, brilliant/dark dyes (wood, silk, animal fibers, PA).
- Co may be found in acid dyes.

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
 - Carcinogenicity: arsenic, cadmium, cobalt, nickel
 - Kidney, brain and/or reproductive toxicity: barium, lead, mercury
 - High acute toxicity: arsenic, cadmium¹
- 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 \(external link\)](#)
 - USA EPA 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.²
- 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.
- Share this information sheet with your material suppliers so they have full visibility and understand your sourcing requirements.
- 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.³
- 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.²

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 for Cr 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.²
- 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)
7440-48-4	Cobalt (Co)
7440-50-8	Copper (Cu)
7440-47-3	Chromium (Cr)
7439-92-1	Lead (Pb)
7439-97-6	Mercury (Hg)
7440-02-0	Nickel (Ni)

References

¹ Hohenstein Institute & Textile Exchange. (2017). Chemical Snapshots – Heavy Metals. Revision 0.2. Retrieved March 17, 2017.

² Apparel and Footwear International RSL Management Group (Ed.). (2018, January 31). Restricted Substances List (RSL). Retrieved <http://afirm-group.com/afirm-rsl/>

³ Manufacturing Restricted Substances List (Publication). (2015, December). Retrieved <http://www.roadmaptozero.com/programme/manufacturing-restricted-substances-list-mrsl-conformity-guidance/>
