# Heavy metals in baby lotions, oils, and powders

HEAVY METAL INDEX · SYNTHESIS REPORT

September 2026

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DOI 10.83376/hmi.heavy-metals-in-baby-lotions-oils-and-powders

CITE AS

Pendergrass, K. (2026). Heavy metals in baby lotions, oils, and powders. Heavy Metal Index. https://doi.org/10.83376/hmi.heavy-metals-in-baby-lotions-oils-and-powders

KEYWORDS

Pb, tAs, iAs, tHg, MeHg, Cd, Cr, Cr-VI, Ni, Al, Cu, Sn, Sb, heavy metals, food safety, dietary exposure

CORRESPONDENCE

Corrections are logged publicly on the article page, each with its date, the affected value, and the source that resolved it.

PUBLICATION HISTORY

First published 2026-09-26.

## Abstract

Baby talcum powder is the form in this group that has been measured most, and aluminium is the element those measurements find in the largest amount. Baby lotion rests on a single product. Baby oil has no measured value in the evidence opened here. A concentration in a powder is not a dose on skin.

## 1 | Product anatomy

The three forms are built differently, and the difference decides which metals are plausible before any is measured.

A baby powder is a milled mineral or a milled starch, sold dry. The talc form is finely ground hydrated magnesium silicate, valued for slip and moisture absorption. Aluminium, silicon, magnesium, iron, and trace metals travel with the mineral from the deposit, so a talc powder's metal load is largely the geology of its mine and the depth of its refining, not an additive. The starch form is milled corn starch or another plant starch, sometimes with kaolin, and carries a plant rather than a mineral background. That distinction is not cosmetic. The Shenzhen Consumer Council test discussed below found that the powders exceeding the German orientation values were the plant-starch powders without talc, which is the opposite of the naive expectation that the mineral is always the dirtier base. The mineralogical hazards of talc, asbestiform contamination and pulmonary effects, are a separate question from heavy-metal content and are not this paper's subject.

A baby lotion or cream is an emulsion: water, an oil or petrolatum phase, an emulsifier, a preservative system, and often fragrance. A baby oil is a single-phase oil, usually light mineral (paraffin) oil, sometimes a plant oil, with fragrance. In an emulsion or an oil the metal does not arrive with a milled mineral. It arrives with a raw material, a colourant, a pigment in a tinted cream, or a contaminated process water, and it is distributed through a matrix that is mostly water or mostly oil. A total digest of the finished product cannot say which input carried the metal.

 

The exposure surface is the same for all three: infant skin, often on the diaper area, sometimes broken or inflamed. A powder is also inhalable during application, which a lotion and an oil are not. None of these routes is quantified for a metal in the documents opened here.

## 2 | Measured evidence

The measured evidence divides cleanly by form. Powder is where the numbers are; lotion is one product; oil is a gap.

The values printed below are the finished-product concentrations that this ingest promoted as uncontested, in the native basis each source reported, which is milligrams per kilogram (equivalently parts per million) of product as sold. Nothing is pooled across sources. Values that a source's own tables contradict, that carry an unresolved flag, or that are reported on a basis that cannot be reconciled with as-sold product are held out of this table and named in the inventory that follows, so the reader can see why they are not summarised. Detection counts are the source's own; a below-detection cell is not a zero, because most of these studies printed no detection limit.

| METAL | MEASURED IN THESE PRODUCTS | WHAT WAS NOT MEASURED |
|---|---|---|
| Lead | Baby talcum powder, Yaghi, sixteen products: below detection in six; detected 0.65 to 15.575. One Chinese regulatory re-test of a talc powder batch: 19.3. Baby lotion, Arshad, one product: 7.94. | A market rate. Any lead value for baby oil. |
| Cadmium | Baby talcum powder, Yaghi, sixteen products: below detection in five; detected 2.275 to 22.600. Baby lotion, Arshad, one product: 0.27. | Any cadmium value for baby oil. |
| Total arsenic | No promoted commercial baby-powder, lotion, or oil value. | Inorganic arsenic in any of these products. A talc, lotion, or oil arsenic value that clears the contested and grey-literature holds below. |
| Total mercury | No promoted commercial baby-powder, lotion, or oil value. | Methylmercury. Any mercury value that clears the holds below. |
| Chromium | Baby talcum powder, Yaghi, sixteen products: below detection in four; detected 1.550 to 49.975, total chromium. Baby lotion, Arshad, one product: 0.67, total chromium. | Hexavalent chromium in any of these products. |
| Nickel | Baby talcum powder, Yaghi, fifteen products with sample P5 held out: below detection in five; detected 0.675 to 54.700. Baby lotion, Arshad, one product: 6.16. | Any nickel value for baby oil. A release-per-area measurement relevant to skin sensitisation. |

| | | |
|---|---|---|
| Copper | Baby talcum powder, Yaghi, sixteen products: 7.525 to 77.475, detected in every product. | Any copper value outside the Yaghi talcum set. |
| Aluminium | Baby talcum powder, Yaghi, sixteen products: 12.325 to 275.475, detected in every product. | Any aluminium value for baby lotion or baby oil that clears the holds below. |
| Iron | Baby lotion, Arshad, one product: 2.01. | Any iron value outside that single lotion. |
| Tin | No data found. | Not in any panel here. No inorganic-tin or organotin result in a baby powder, lotion, or oil. |

Baby oil is the form with no measured value in this evidence. The single product ever measured as a baby oil in the documents opened here is one paraffin-oil sample in Almukainzi and colleagues, and every one of its cells is contested for the reason given in the inventory below, so no baby-oil value is carried into the table. No cooking-oil or adult-product number is substituted for the gap. A mustard-oil dataset and an adult-cosmetic oil are present in the corpus; neither is a baby-oil measurement, and the mustard-oil paper makes no skin-application claim, so they do not fill this row.

## 3 | Source-by-source inventory

Yaghi and colleagues measured aluminium, cadmium, total chromium, copper, lead, and nickel by flame atomic absorption in sixteen baby talcum powders bought from Benghazi pharmacies in November 2024, each digested in triplicate. Their per-product Table 5 cells, in milligrams per kilogram as sold, are the promoted values summarised above. The study printed no detection limits, reference materials, or recoveries; it reported one product per code; and its own tables carry internal disagreements that keep several of its other numbers out of this synthesis. The Total Metals column does not add up in half the rows, the Table 4 digest-reading means are a separate basis, the prose maxima differ from Table 5, sample P5 nickel is detected in one table and below detection in the other, and the row the authors label as FDA limits cites references that do not set such limits. None of those disputed figures is printed here. Arsenic, mercury, and tin were not in the study's panel.[1]

A 2019 Chinese national non-compliance notice, relayed by a regulator-affiliated news site, named a children's talc powder batch at 19.3 milligrams per kilogram lead on re-test against a 10 milligram-per-kilogram limit, and a provincial decision found three batches of that powder over the limit, all made from the same talc raw material. That single re-test lead value is promoted as a regulatory measurement. It is one batch, not a survey, and the method behind the re-test is not printed in the news relay.[2]

Arshad and colleagues analysed sixty-three cosmetics from northern Pakistan in triplicate by flame atomic absorption, with a NIST standard reference material recovery of 97 to 102 percent. One product, sample L19, is a baby lotion, and its five detected cells, lead 7.94, nickel 6.16, iron 2.01, chromium 0.67, and cadmium 0.27 milligrams per kilogram, are the promoted baby-lotion values. It was the second-highest lead and cadmium among the thirty lotions in that study. A petroleum jelly in the same set contained lead 1.49 and nickel 2.35 milligrams per kilogram, with cadmium and chromium below detection; it is a jelly, not a baby lotion, and is context rather than a promoted baby-lotion value. Two of the study's lotion summary rows disagree with its per-sample tables for chromium and nickel and are not used.[3]

 

The Shenzhen Consumer Council tested twenty infant powders, both talc-based and plant-starch-based, and reported through the press that all met the Chinese national standard. The maxima across all twenty samples were lead 3.5, arsenic 0.87, and cadmium 0.31 milligrams per kilogram, and the four samples that exceeded the German orientation values were plant-starch powders without talc, one of which exceeded all three. These three maxima are promoted only as grey literature: a news-reported compliance test whose per-sample data and analytical method were not obtained. They are treated here as the only figures the corpus carries for a plant-starch baby powder, and they are deliberately kept out of the abstract and out of every summary comparison as a headline number.[4]

Omenka and Adeyi measured zinc, cadmium, lead, and nickel by flame atomic absorption in thirty-five personal care products from Ibadan markets, including two baby powders with ash above 95 percent and four petroleum jellies labelled for babies. One baby powder contained 468 milligrams per kilogram lead, a magnitude two other laboratories reproduced at 508.5 and 364.63; the other was reported at 36.3 milligrams per kilogram cadmium, which a third laboratory reported as 0.38. The paper reports on dried sample mass but never states its reporting basis, and for creams and jellies the drying correction can be large, so none of the Omenka values is promoted or summarised above. They are recorded because the 468 milligram-per-kilogram lead result, corroborated across laboratories, is the largest commercial baby-powder lead value in the corpus and would understate the hazard if it were dropped silently rather than held for a stated basis reason.[5]

Almukainzi and colleagues measured eleven elements by inductively coupled plasma mass spectrometry in twenty-one topical cosmetics from Riyadh, including one baby oil of light paraffin oil and perfume and one baby powder of talc, zinc oxide, and salicylic acid. The reported baby-oil means were aluminium 26.81, total chromium 21.17, manganese 2.62, iron 193.16, cobalt 0.08, nickel 13.16, copper 41.72, zinc 71.68, total arsenic 0.15, cadmium 0.23, and lead 5.52 parts per million; the baby-powder means included lead 23.18 and aluminium 3774.14 parts per million. In nearly every cell the standard deviation is about 1.41 times the mean and the replicate count is not stated, so these means are contested and none is promoted. They appear here, and only here in the body, as a labelled alternative: they are the sole baby-oil measurement in the corpus, and they are not carried into the abstract, the measured-evidence table, or any comparison, because their dispersion is unresolved.[6]

A Washington State Department of Ecology survey analysed one baby powder of unstated formulation, printing total chromium 2.2, zinc 2.3, cobalt 0.4, copper 0.4, lead 0.4, and molybdenum 0.2 parts per million. The survey's quality plans name a 1.0 part-per-million reporting limit for antimony, arsenic, cadmium, lead, and, where listed, total chromium. Cobalt 0.4, copper 0.4, lead 0.4, and molybdenum 0.2 sit below 1.0 part per million; total chromium 2.2 and zinc 2.3 do not. The report does not define its 0.0 entries. Two further baby-labelled samples in that survey are the containers of a baby cream and a petroleum jelly, listed as packaging, so their values describe the packaging and not the contents. Because the 0.0 convention and the reporting limits are unresolved for this survey, the baby powder values are not promoted.[7]

Lead Safe Mama reported one lot of one United States baby lotion as non-detect for lead, cadmium, and mercury below 5 parts per billion and arsenic below 10 parts per billion, in a 2025 community-funded test whose laboratory report is not in the published copy. It is grey literature, it is a set of non-detect thresholds rather than measured concentrations, and it is not promoted or summarised.[8]

Rosnan reported eight talcum powders from Malaysia in milligrams per litre of digest solution, a basis that cannot be converted to a product concentration from the excerpt available and that is not stated to be baby powders. Those digest readings are not promoted and are not summarised.[9]

 

Two high-concentration powders in the collection are folk or traditional lead-oxide remedies, not commercial baby products. A traditional Chinese topical powder used by a breastfeeding mother on her own skin contained 180.1 milligrams per kilogram lead, and her exclusively breastfed infant's blood lead rose above 400 micrograms per litre before chelation; the powder was not applied to the infant. A non-commercial Malaysian folk diaper powder used on a United States infant was 62 percent lead by weight, mainly lead oxide, with antimony at 1000, arsenic at 55, and thallium at 31 parts per million, and the infant's blood lead fell after use stopped. These are named here as a hazard class, deliberate lead-oxide preparations applied on or near infants, and they are not commercial baby-powder occurrence data. They receive no product row and are not pooled with any commercial value.[1011]

## 4 | Toxicology

Toxicology here is the hazard each element is known for and what, if anything, is known about it on infant skin from a powder, a lotion, or an oil. A classification or a reference value derived from ingestion or inhalation is not a dermal dose. Where a dermal number was not in a document opened for this paper, the entry says so.

Infant skin is the exposure surface, and this paper does not assign it a number. No study opened here measures the fraction of lead, nickel, chromium, or any other metal that crosses intact or inflamed infant skin from a powder, a lotion, or an oil. The barrier is more permeable in early infancy, the diaper area is occluded and often macerated, and an infant's skin surface is large relative to body weight; these are reasons to measure the dermal route, not a measured fraction. A powder adds an inhalation route during application that a lotion and an oil do not, and that route is likewise unquantified for a metal here.

Lead is a developmental neurotoxicant, and the endpoint that dominates infant assessment is harm to the developing nervous system, with no opened threshold below which a dermal dose would be called without effect. The measured evidence is a concentration, not that dose. The commercial baby-powder lead figures run from below detection to 15.575 milligrams per kilogram in the Yaghi survey and to a single 19.3 milligram-per-kilogram regulatory re-test; the one baby lotion is 7.94. The corpus also holds a corroborated 468 milligram-per-kilogram lead value in a commercial baby powder, held out of the summary only for a basis reason, and two folk lead-oxide powders orders of magnitude higher again. No study here measured blood lead attributable to a powder, a lotion, or an oil, or the share that crosses skin.

Cadmium's critical long-term endpoint in dietary assessment is kidney tubular dysfunction, from an oral, cumulative record that does not transfer to a dermal dose by analogy. Cadmium was detected in eleven of the sixteen Yaghi talcum powders, from 2.275 to 22.600 milligrams per kilogram, and in the single baby lotion at 0.27. No dermal-absorption fraction from any of these products was opened.

Nickel is the most common cause of metal allergic contact dermatitis, and sensitisation is acquired through skin contact and later elicited by it. The clinical literature expresses both a sensitisation and an elicitation threshold as release per unit area over time, not as a bulk concentration in a powder or a lotion. The measured evidence here is bulk content: nickel to 54.700 milligrams per kilogram in the Yaghi talcum set and 6.16 in the one baby lotion. No study here measured nickel release into sweat or a simulant from any of these products, so the content values cannot be read as an elicitation risk.

Chromium toxicity depends on oxidation state. Trivalent chromium is poorly absorbed by mouth; hexavalent chromium is the sensitiser and the carcinogenic species in the occupational record. Every chromium value here is total chromium, to 49.975 milligrams per kilogram in the talcum set and 0.67 in the one lotion, and no study

 

speciated it or measured hexavalent chromium in these products. A total-chromium number cannot be read as hexavalent chromium.

Arsenic hazard in regulatory work isolates the inorganic species, which carries the carcinogenic and developmental concerns. No commercial baby-powder, lotion, or oil arsenic value cleared the contested and grey-literature holds in this ingest, and no study speciated arsenic, so there is no promoted total-arsenic figure to read and no inorganic-arsenic figure at all.

Mercury's neurodevelopmental concern attaches to methylmercury after ingestion, and elemental and inorganic mercury have different kinetics. No commercial baby-powder, lotion, or oil mercury value cleared the holds here, and no study measured methylmercury.

Aluminium is the element the talcum-powder measurements find in the largest amount, detected in every one of the sixteen Yaghi products from 12.325 to 275.475 milligrams per kilogram, consistent with aluminium being a major constituent of the aluminosilicate mineral rather than a trace contaminant. Aluminium neurotoxicity and bone toxicity are documented at high systemic exposures, particularly where the kidney cannot clear the metal, and that record is oral and parenteral, not dermal. No study here measured aluminium crossing infant skin from a powder, and no promoted aluminium value exists for baby lotion or baby oil.

Copper is an essential element, and its interest here is as a marker of the mineral background rather than a primary toxicant at these concentrations; it was detected in every Yaghi talcum product from 7.525 to 77.475 milligrams per kilogram. Iron, similarly, appears only as a single 2.01 milligram-per-kilogram value in the one baby lotion and is not a primary hazard at that level.

## 5 | Exposure framing

A dermal exposure from any of these products has at least four inputs: how much metal is in the product, how much of it reaches skin, how long it stays, and what fraction is absorbed. This paper assigns none of them a number, because no primary study opened here supplies, together, a product mass applied, a contact time, and a dermal-absorption fraction for any metal in a baby powder, lotion, or oil. An illustrative dose built by inventing the missing inputs would read as a risk estimate and would not be one, so none is offered. The gap is the finding.

What can be said without arithmetic is qualitative. The measured signal in this group is concentrated in one form, talcum powder, and within it aluminium and copper are found in every product while lead, cadmium, chromium, and nickel are found in most. Baby lotion rests on a single measured product. Baby oil has no measured value at all. The powder route adds inhalation during application; the lotion and oil routes do not. Until the dermal and inhalation fractions are measured, a concentration in a powder is a concentration in a powder.

## 6 | Regulatory landscape

These products are not one legal object. A product applied to infant skin for cleansing, moisturising, or moisture absorption can fall inside a cosmetic definition; in Canada a corn-starch or kaolin diaper-rash powder can instead be a natural health product, and a mineral-oil or petrolatum diaper-rash product a non-prescription drug. Limits are cited below only in the unit and the legal character of the instrument. The measured concentrations above are not scored against them as exceedances, because the promoted values sit on an as-sold total-content basis while several instruments are extractable limits, orientation values, or guidance rather than statutory finished-product maxima, and because the pre-statute samples predate the newer instruments.

 

Health Canada's guidance on heavy-metal impurities in cosmetics treats lead above 10, arsenic above 3, cadmium above 3, mercury above 1, and antimony above 5 parts per million in a finished cosmetic as technically avoidable, subject to case-by-case enforcement. It is guidance, not a numeric statutory maximum, and it reaches baby lotions, oils, and powders sold as cosmetics.

Health Canada's Quality of Natural Health Products Guide sets finished topical-product limits of arsenic 3, cadmium 3, lead 10, total mercury 1, and antimony 5 parts per million, which reach corn-starch and kaolin diaper-rash powders made only with natural health product ingredients. The guide's methylmercury value is an oral limit and does not govern these topical rows.

The German BVL orientation values for cosmetics in general are lead 2.0, cadmium 0.1, mercury 0.1, arsenic 0.5, and antimony 0.5 milligrams per kilogram as sold, and baby powder was one of the monitored product groups behind them. They are orientation values under the European cosmetics regulation, not statutory maxima.

Washington State prohibits the sale of a cosmetic with intentionally added lead or lead at or above 1 part per million from 1 January 2025, and prohibits intentionally added mercury with no numeric value. The statute's cosmetic definition does not name baby powder specifically, and the measured values here are not called violations, because the sampling basis may not match the article the statute governs and the samples are older than the statute.

Two talc specifications in the collection are for a different purpose and a different basis. The United States color-additive regulation for talc used in drugs sets lead at 20 and arsenic at 3 parts per million measured in a 0.5 normal hydrochloric-acid extract, which is extractable content and never directly comparable with a total digest, and it is a raw-material specification rather than a finished baby-powder limit. The JECFA food-additive specification for talc sets lead at 2 milligrams per kilogram for food-grade talc for oral use, which is a food-additive specification and is excluded from any topical-product comparison. Neither is a finished baby-powder limit, and neither is scored against the measured powders here.

No instrument opened here sets a finished-product numeric maximum for aluminium, copper, iron, tin, hexavalent chromium, inorganic arsenic, or methylmercury in a baby powder, lotion, or oil. Where a government has no number for a metal in these products, that gap is left as a gap rather than filled by borrowing a limit written for a different article or a different basis.

## 7 | Implications

### For parents

A parent can take four statements from this file and should not take a fifth. Aluminium and copper are found in every baby talcum powder that was measured across a full panel, and lead, cadmium, chromium, and nickel are found in most, at the milligram-per-kilogram concentrations listed above. Baby lotion has been measured in only one product in this evidence, so it cannot describe the lotion market. Baby oil has not been measured at all in the documents opened here. Tin, inorganic arsenic, methylmercury, and hexavalent chromium were not found because they were not measured or not speciated, not because a survey showed them to be absent.

 

The statement not to take is a risk verdict. No study here follows any of these products from the container onto infant skin and into the body, so a concentration is not a dose, and stopping or continuing a product is a caregiving decision this paper does not make. Separately, deliberate lead-oxide folk powders applied on or near infants are a documented poisoning hazard of a different kind from trace contamination of a commercial product, and they are not the same thing as the powders on an ordinary shelf.

## For manufacturers

Talc's metal load is largely its mine and its refining. The dominant lever on a talcum powder is deposit selection and the depth of washing, grinding, and air-floating, because aluminium, copper, and the trace metals travel with the mineral rather than being added. A starch powder carries a plant background instead, and the Shenzhen result is a reminder that a talc-free reformulation is not automatically the cleaner one on every metal.

A lotion and an oil need the metal traced to an input. A single total digest of an emulsion or an oil cannot say whether a metal came from a raw oil, a pigment, a preservative, or process water, and the finished-product number alone will not guide a corrective action. Report the finished product in milligrams per kilogram as sold, keep the digest solution as a method detail rather than the only reported unit, and record the recovery and the detection limit that most of the studies here omitted.

A bulk content number is not a sensitisation test. A laboratory that wants to speak to allergic contact dermatitis from nickel or chromium in a lotion or a powder has to measure release into sweat or a simulant over a stated area and time, not the bulk metal in a digest.

## For regulators

The legal character of each number should stay visible. A Canadian guidance figure, a natural-health-product topical limit, a German orientation value, a Washington lead statute, a drug-talc acid-extract specification, and a food-additive talc specification are not interchangeable, and none of them was written as a score for a total digest of a finished baby product. Where a government has no number for a metal in these products, the gap should stay a gap; borrowing a food or a drug-raw-material talc limit to fill a finished-cosmetic cell would present a policy choice as a measurement.

Aluminium is the awkward cell for powders. It is the element the talcum measurements find in the largest amount, it is intrinsic to the mineral rather than an adventitious contaminant, and no instrument opened here sets a finished-product number for it. A regulator reading only the four food-metal panels will not see it. Speciation rules that already exist for food should not be relaxed because the matrix is a powder or a lotion: total arsenic is not inorganic arsenic, total mercury is not methylmercury, and total chromium is not hexavalent chromium.

## For researchers

The most useful next studies are specific. For baby oil, any properly reported measurement would be the first: a paraffin-oil and a plant-oil product, digested and reported in milligrams per kilogram as sold, with a stated replicate count and recovery, so the single contested sample in the corpus is no longer the only one. For baby lotion, more than one product, so the category no longer rests on a single sample. For talcum powder, surveys that print detection limits, reference materials, and recoveries, and that separate talc from starch bases. Across all three, speciate arsenic, mercury, and chromium, add tin and aluminium to the panel, and run a sweat or simulant release in parallel with total content, because the sensitisation questions are release questions. Until those studies exist, the synthesis has to keep repeating that the forms in this group are unevenly measured and that a total content on an as-sold basis is not a dermal dose.

 

## 8 | Data gaps and research agenda

No dermal-absorption fraction for any metal from a baby powder, lotion, or oil was opened. Baby oil has no promoted measured value; the only baby-oil measurement in the corpus is a single contested sample. Baby lotion rests on one measured product. Tin in any of these products: no data found. Inorganic arsenic, methylmercury, and hexavalent chromium in any of these products: no data found, and no source speciated arsenic, mercury, or chromium. Corn-starch and other plant-starch baby powders are represented only by three grey-literature maxima from a news-reported compliance test with no per-sample data and no printed method. A large corroborated commercial baby-powder lead value and a single baby-oil dataset are held out of the summary for stated basis and dispersion reasons rather than dropped. Two folk lead-oxide powders are named as a hazard class rather than as commercial occurrence data. Market detection rates cannot be calculated from a sixteen-product convenience sample, a single regulatory re-test, a single lotion, or a news-reported powder screen.

The research agenda follows those gaps, in order. First, any properly reported baby-oil measurement, in milligrams per kilogram as sold, with recovery and detection limits. Second, more than one baby lotion, measured the same way. Third, talc-versus-starch powder surveys that print limits, reference materials, and recoveries. Fourth, speciation of arsenic, mercury, and chromium, and the addition of tin and aluminium to the panel. Fifth, release into a sweat simulant, reported per area and time, for nickel and hexavalent chromium. Sixth, a dermal-absorption experiment on intact and compromised infant skin, or an explicit statement that the fraction is unknown.

## 9 | How to cite

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## STATUS AND LICENCE

Editorially reviewed in-house; no external peer review has been completed on this finding. Published as an institutional

## COMPETING INTERESTS

The Heavy Metal Index reports what the peer-reviewed and regulatory literature supports. It is operated separately from

 

technical report with its review state tracked on the article page. 

any certification program, does not evaluate or endorse brands, and does not use certification thresholds as evidence for the statements made here.

## DATA AVAILABILITY

Every source behind this finding is listed with its own extraction record at https://heavymetalindex.com/synthesis/heavy-metals-in-baby-lotions-oils-and-powders, each linking to the ingest receipt, the extracted values, and the file hash of the document it was built from.

## PUBLICATION HISTORY

First published 2026-09-26. The full dated record is maintained at https://heavymetalindex.com/synthesis/heavy-metals-in-baby-lotions-oils-and-powders.