

# CHROMIUM in the garden

**Chromium** is metal that occurs naturally in the environment, but can also exist at higher levels due to human activity. Chromium comes in different forms, the most common is the low-toxicity trivalent chromium ( $\text{Cr}^{+3}$ ). Hexavalent chromium ( $\text{Cr}^{+6}$ ) is less common but far more toxic at low levels.

## Summary for Gardeners

- »  $\text{Cr}^{+6}$  dissolves more easily in water than  $\text{Cr}^{+3}$ , and so is more likely to be found in well water than garden soils. Chromium often shifts between these two forms, so there may be very small amounts of  $\text{Cr}^{+6}$  in soil.
- » Historical chromium inputs are less likely to be a cause for concern than current sources of chromium pollution.
- » Adding more organic matter (e.g. compost) can help convert chromium into the less-harmful  $\text{Cr}^{+3}$  form.

## Sources of chromium exposure

**Chromium** is not easily taken up by plants, so direct contact with contaminated soil is the most common exposure pathway in the garden. This can include breathing in or eating soil particles directly or from soil covered-produce, and tracking soil inside the home and breathing or eating the soil at a later time.

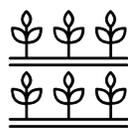
Chromium exposure can occur in and outside the garden.



**nearby industry** Industries producing steel, wood preservatives, paints, and more can release chromium ( $\text{Cr}^{+6}$  specifically) into air, water, and soil.



**well water** In some areas, well water is the most common source of  $\text{Cr}^{+6}$  exposure. Direct exposure can occur if a well is used for drinking water.



**in-garden sources** Well water or nearby industry can contaminate garden soils, but exposure via soils or garden produce is a minor source, particularly for  $\text{Cr}^{+6}$ .

## Chromium comes in different forms

$\text{Cr}^{+3}$

- » common in soils
- » essential nutrient
- » not harmful except at very high levels

total chromium

$\text{Cr}^{+5}$

$\text{Cr}^{+1}$

$\text{Cr}^{+2}$

$\text{Cr}^{+4}$

$\text{Cr}^{+6}$

- » uncommon in soils
- » main source is human activity
- » harmful at very low levels

## Exposure to chromium in the garden

**How am I exposed?** Ingestion, inhalation, or direct skin contact with contaminated soil particles can all be routes of exposure

**Are my garden plants safe to eat?** Most garden plants do not take up large amounts of chromium, so washed produce is unlikely to be a major source of chromium exposure. Root crops like carrots, onion, and beets can contain slightly higher concentrations of chromium.

**Should I be worried?** Exposure to chromium from garden soil is unlikely to be a major health concern for healthy adults unless there is a continuous addition of  $\text{Cr}^{+6}$  to the soil from a current pollution source.

## Limit children's exposure

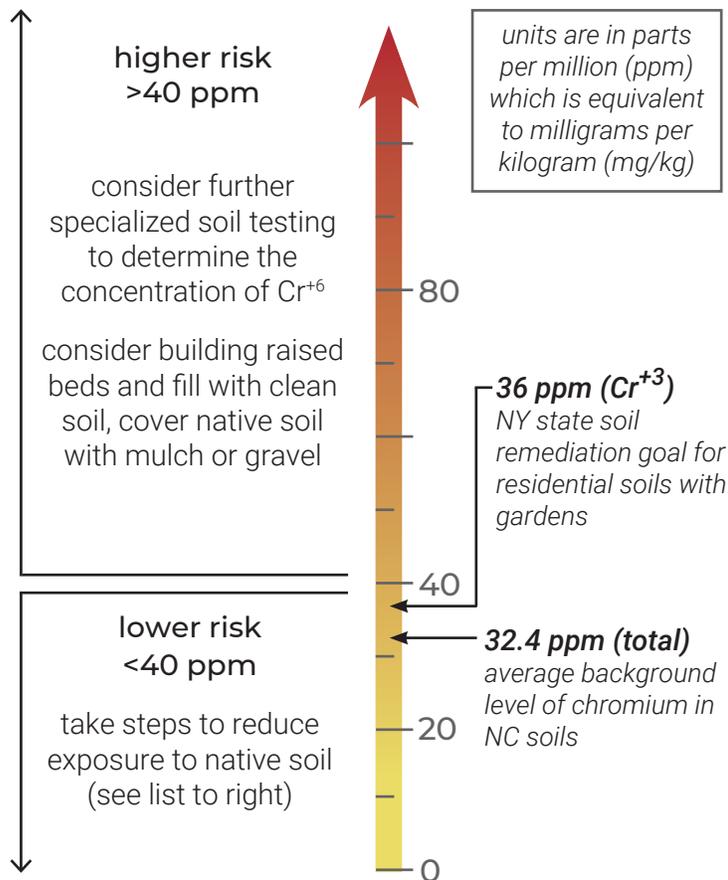
- Small doses matter. Children breathe, eat, and drink more relative to their size than adults
- Their bodies and brains are still developing
- Children spend more time on the ground and often put things (like dirt) into their mouths
- They have more skin surface area than adults, so skin exposure also matters



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## Making sense of regulatory standards

No official standards have been established in North Carolina for acceptable levels of chromium in garden soils. For remediating soil at industrial sites, NC uses EPA's guideline of **24,000 ppm for Cr<sup>+3</sup>**, and **0.3 ppm for Cr<sup>+6</sup>**. The guidelines below can help you contextualize the chromium levels in your garden soil.



## Testing resources



Well water testing for chromium:  
<https://epi.dph.ncdhhs.gov/oe/wellwater/howtotest.html>



How to test your soil and interpret the results: <https://sites.nicholas.duke.edu/superfundcec/gardens/soil-testing/>



Still have questions about chromium soil testing? Email us at [superfund@duke.edu](mailto:superfund@duke.edu)

## Health impacts of chromium

Cr<sup>+3</sup>, the more common form, is a beneficial nutrient in small doses and is not easily absorbed into the body. Cr<sup>+6</sup>, however, is a known carcinogen when inhaled and therefore has no "safe" level of exposure.

Exposure to Cr<sup>+6</sup> can increase your risk of developing breathing difficulty, asthma or allergy-like symptoms, stomach ulcers or irritation, anemia, lung cancer, and more. Long-term exposure to Cr<sup>+6</sup> may affect the male reproductive system.

It is unknown whether children are more vulnerable to the effects of Cr<sup>+6</sup> specifically, but it is still important to limit their contact with chromium.

## Reduce chromium exposure in the garden

- Adding compost or other organic matter from a contaminant-free source may help convert Cr<sup>+6</sup> into Cr<sup>+3</sup>. Check the [NC Composting Council](#) website to find STA or OMRI certified compost
- Thoroughly wash produce grown in chromium-contaminated soil
- Avoid growing root vegetables in soils with high levels of chromium, and peel root vegetables before eating to further minimize risk
- If applicable, test well water sources for chromium, specifically Cr<sup>+6</sup>
- Conduct a soil safety training to teach exposure reduction strategies to all garden users
- Visit our website below for our factsheet on [10 Healthy Garden Habits](#)

For more information visit:

<https://sites.nicholas.duke.edu/superfundcec/gardens/>

