

NICKEL in the garden

Nickel is a metal that has both natural and man-made sources. Nickel is used to produce stainless steel, cast iron, coins, rechargeable batteries, and more. Mining, coal power plants, and trash incinerators can all introduce nickel into the environment. Nickel comes in many different forms, some of which are more toxic than others.

Summary for Gardeners

- » People need very low levels of nickel, but high exposure levels can cause health problems.
- » The forms of nickel that do not dissolve in water are more often found in the environment, and are less toxic than forms of nickel that do dissolve in water.
- » Nickel is not easily taken up by plants, and so your garden produce is not likely to be a major source of exposure.

Sources of nickel exposure

Nickel is not easily taken up by plants, so direct contact with contaminated soil is the most likely route of exposure in the garden. Low level exposure from soil or water are not major concerns, but hotspots from man-made sources may also exist. Below are some of the main sources that release nickel into the environment or directly expose people.



nearby industry Power plant emissions and other industries that use nickel can release the metal into air, water, and soil.



incinerators Trash incinerators, like other power plants, emit nickel into the air. The metal attaches to small particles and stays in the air for many days.



on the job Occupational exposure by breathing in high levels of nickel can occur in some industries.



smoking Cigarette smoke typically contains nickel and can contribute to lung cancer.



foods Food contains low levels of nickel, but is still the main source for most people. Foods with the highest levels of nickel include chocolate, soybeans, oatmeal, and nuts.

Exposure to nickel in the garden

How am I exposed? Eating or direct skin contact with contaminated soil particles, or eating contaminated produce can cause exposure, but mainly at very low levels.

Are my garden plants safe to eat? Nickel binds very tightly to soil, and is not easily taken up by most plants. Some plants like Indian Mustard and sunflowers take up more nickel than other plants, but most of the metal will stay in the roots.

Should I be worried? When we consume nickel, only about 1% is absorbed by our bodies, which is then quickly excreted. The low levels we may be exposed to from produce is not a major concern, and there are many health benefits from gardening.

Limit children's exposure

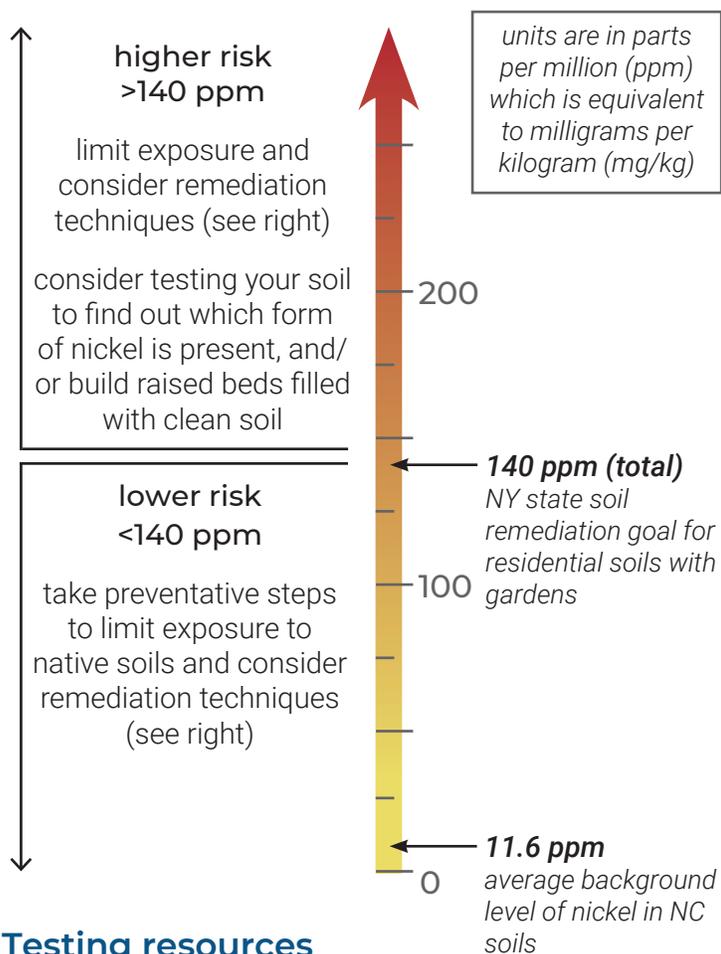
- Small doses matter. Children breathe, eat, and drink more relative to their size than adults
- Their bodies and brains are still developing
- Children spend more time on the ground and often put things (like dirt) into their mouths
- They have more skin surface area than adults, so skin exposure also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



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Making sense of regulatory standards

No official standards have been established in North Carolina for acceptable levels of nickel in garden soils. For eight different nickel compounds, the preliminary soil remediation goal (PSRG) for residential soils in NC ranges between **140 and 310 ppm**. A ninth compound, nickel subsulfide, is considered more toxic and has a PSRG of **0.41 ppm**.



Testing resources



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



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



Still have questions about nickel soil testing? Email us at superfund@duke.edu

Health impacts of nickel

People need very low levels of nickel in their bodies, which we get from food, but high levels of exposure can cause health problems.

Occupational exposure to high levels of airborne nickel can lead to chronic bronchitis, reduced lung function, lung and sinus cancers, and more. Nickel in cigarette smoke has also been linked to lung cancer.

Skin contact with nickel, usually from jewelry, can lead to skin irritation. This can occur in 10 to 20 percent of people after prolonged contact. In some people, eating or breathing nickel can lead to similar reactions or asthma attacks, but this is uncommon.

Reduce nickel exposure in the garden

- Adding compost or other organic matter from a contaminant-free source may help limit nickel uptake by plants. Check the [NC Composting Council](#) website to find STA or OMRI certified compost
- Adding agricultural lime (to raise soil pH above 6.0) can also limit plant uptake
- Thoroughly wash produce grown in nickel-contaminated soil to remove any soil or dust
- To reduce nickel particles in air from dust, cover bare soil with mulch and keep the soil moist, but not water-logged.
- If your soil nickel levels are high, consider **not** planting root vegetables, since nickel tends to stay in plant roots
- Conduct a soil safety training for all garden users on exposure reduction strategies
- Visit our website below for our factsheet on [10 Healthy Garden Habits](#)

For more information visit:

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

