

2.3 Safety

2.3.1 Are solar panels toxic?

Solar panels largely consist of widely-used and non-toxic components, including an aluminum frame, tempered glass, and various common plastics. The most common type of solar panel consists of crystalline silicon PV cells which generate electricity when exposed to light. These non-toxic crystalline silicon cells consist almost entirely of silicon, one of the most common elements in the Earth's crust.⁶

Cadmium-based thin-film solar panels are the second most common type of panel (accounting for less than 15% worldwide), however NYSERDA is not aware of any of these installations currently in New York.^{7,8} While cadmium is toxic, the form of cadmium used in these types of solar panels is cadmium telluride (CdTe), which has 1/100th the toxicity of elemental cadmium. When a CdTe panel is exposed to fire, the glass panels absorb the cadmium such that more than 99.9% of the cadmium is stored in the glass itself and not released into the environment. CdTe panels have also passed the EPA's Toxic Characteristic Leaching Procedure test, which tests the potential for crushed panels in a landfill to leach hazardous substances into groundwater.

Some minor system components, including solder, may contain toxic chemicals at extremely low concentrations. Analysis performed by the North Carolina Clean Energy Technology Center did not find a potential toxicity threat from leaching, even in worst case scenarios (hurricane, fire, tornado, etc.), indicating an insignificant threat to human health and the environment.

Release of toxic chemicals from other solar system equipment including inverters, racking, and cabling is also unlikely as solar installations must conform to state fire safety and electric codes, and they pose little or no risk of contaminating the soil or ground water.

2.3.2 Can solar panels break and release toxic materials?

The most common solar panel failure modes include glass breakage and various failures of internal electrical connections, neither of which would typically result in the release of any materials to the environment. Solar panels are constructed primarily of silicon or cadmium telluride, tempered glass, and metals. Similar to a car windshield, when solar panels experience a catastrophic event, the panels typically stay fully intact, thus not releasing any materials into the environment.

Additionally, reputable solar panel manufacturers will ensure that their equipment is certified to applicable performance and safety standards including those established by the International Electrotechnical Commission (IEC) and Underwriters Laboratory (UL).

2.3.3 Do solar panels affect water runoff at the site?

Federal, state, and local rules are in place to ensure that solar arrays are installed in ways that protect public water supplies, wetlands, and other water resources. Rooftop solar systems have little to no effects on the direction or flow of water. Ground-mounted systems will be designed to manage runoff using deep-rooted vegetation such as "pollinator-friendly" grasses and wildflowers, pervious pavement, or topographical features such as berms, swales, or retention ponds, which can provide a net water quality benefit.

Various state agencies also maintain requirements and relevant guidance on this topic:

- The Department of Environmental Conservation's State Pollutant Discharge Elimination System (SPDES) website details permit requirements for stormwater discharge.⁹
- The Department of Agriculture and Markets' Guidelines for Solar Energy Projects includes guidance related to drainage for solar installations on agricultural lands.¹⁰

⁶ "Health and Safety Impacts of Solar Photovoltaics." NC Clean Energy Technology Center, May 2017, ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2017/10/Health-and-Safety-Impacts-of-Solar-Photovoltaics-2017_white-paper-1.pdf.

⁷ <https://data.ny.gov/Energy-Environment/Solar-Electric-Programs-Reported-by-NYSERDA-Beginn/3x8r-34rs>

⁸ "Crystalline Silicon Photovoltaics Research." Energy.gov, <https://www.energy.gov/eere/solar/crystalline-silicon-photovoltaics-research>

⁹ State Pollutant Discharge Elimination System (SPDES) website <https://www.dec.ny.gov/chemical/43133.html>

¹⁰ https://agriculture.ny.gov/system/files/documents/2019/10/solar_energy_guidelines.pdf