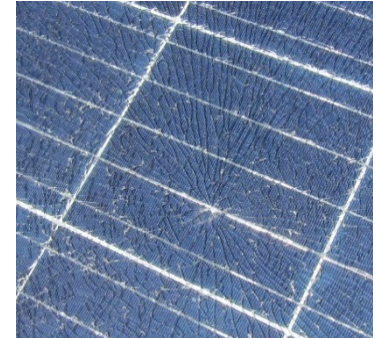


insulation and physical protection. Like silicon modules there is no liquid to leak. The only aspect of CdTe modules that raises toxicity concern is the cadmium in the cadmium telluride and cadmium sulfide. Cadmium is a toxic heavy metal, but when cadmium is chemically bonded to tellurium in the crystalline structure of the cadmium telluride compound, it has only 1/100<sup>th</sup> toxicity to humans of cadmium on its own (i.e. not bonded to another element in a compound, also known as free cadmium).<sup>8</sup> The compound cadmium telluride is very stable, so it does not easily break down into cadmium and tellurium.

Cadmium telluride PV panels have been in use for decades, and their potential for creating a health hazard has been studied as long. As shown in the sections below and the some of the reading resources linked at the end of this section, CdTe panels are extremely safe and do not pose any risk to public health and safety, even if installed in large numbers.

### *Broken PV Panels*

There is zero risk of toxicity escaping from undamaged PV panels because any lead or cadmium is sealed from air and water exposure. Individual panels damaged during the life of the solar facility are identified in days to months through either remote monitoring of system performance or from visual inspections during maintenance by onsite staff. In 2019, an international team of experts conducted an International Energy Agency (“IEA”) - Photovoltaic Power Systems Programme (“PVPS”) study to assess if there is a public health hazard caused by lead leaching from the broken silicon PV panels or cadmium leaching from cadmium telluride PV panels during the life of a utility-scale solar facility utilizing conservative assumptions to evaluate extreme scenarios.<sup>9</sup> The study examined worst-case exposure routes of soil, air, and ground water for a typical 100 MW<sub>AC</sub> PV facility for both module types (crystalline and cadmium telluride). For example, the worst-case residential groundwater exposure assumed that all broken panels from the entire array were within 25 feet of the groundwater well, and the chemicals released from every broken panel transported to the same groundwater well. The study found that worst-case lead or cadmium exposure via air, soil, and water were each orders of magnitude less than the maximum levels defined by the EPA to have no adverse health effects. In the case of water, the health-screening level is the same as the maximum concentration level (“MCL”) set by the EPA for water quality in public water systems. This study demonstrates that there is no risk to public health from lead or cadmium leached from broken PV panels.



*Figure 4. Close-up photo of impact point that broke the glass front of this PV panel*

### *GenX and PFAS*

Some solar opponents have raised questions about the possibility of GenX or other per- and polyfluoroalkyl substances (“PFAS”) chemicals being emitted by solar panels. PFAS chemicals are a group of chemicals informally known as “forever chemicals” due to their durability in the environment. These chemicals are found in many products, including food packaging materials, firefighting foam, waterproof clothing, and stain resistant carpet treatments, and may have negative health risk. Nearly all the components of a PV panel are PFAS-free, however there is one component that often does contain PFAS, which is the module backsheet, which is the thin plastic layer on the rear of a panel providing electrical insulation and physical protection. An extremely common type of backsheet is based on a plastic known as polyvinyl fluoride (PVF), which is a PFAS material, but not all backsheets contain PVF or other PFAS. Bi-facial modules like those planned for Morven Solar, and other PV panels that have a sheet of glass covering the back of the module, do not require a backsheet because the glass serves the same purpose and thus these modules do not contain any PFAS. Unlike many PFAS products, a PVF backsheet creates very little direct PFAS human exposure. Also, unlike firefighting foams that are a significant source of PFAS in the environment, a PV backsheet is not directly exposed to sun or rain, and does not wash away. Studies of 30-year-old modules with PVF backsheets find that the backsheets are generally still complete and in good functional condition. A fact sheet from the University of Michigan entitled “Facts about solar panels: PFAS contamination” explains more about PFAS and PV panels.<sup>10</sup>

<sup>8</sup> C. Miller, I.M. Peters, and S. Zaveri, Thin Film CdTe Photovoltaics and the U.S. Energy Transition in 2020, <https://gesst.org/resources/thin-film-pv-report-2020/>, June 2020

<sup>9</sup> P. Sinha, G. Heath, A. Wade, K. Komoto, 2019, Human health risk assessment methods for PV, Part 2: Breakage risks, International Energy Agency (IEA) PVPS Task 12, Report T12-15:2019. ISBN 978-3-906042-87-9, September 2019

<sup>10</sup> “Clean Energy in Michigan” Series, Number 12, Facts about solar panels: PFAS contamination, By Dr. Annick Antcil, <https://graham.umich.edu/media/pubs/Facts-about-solar-panels--PFAS-contamination-47485.pdf>