

Solar Panel FAQs prepared by the DTSC Regulatory Assistance Office

This informal guidance document answers frequently asked questions received by the electronic waste enforcement team related to solar panels. To make it easier, questions and answers are grouped into the following categories:

- [Types of Solar Panels](#)
- [Is it a Hazardous Waste?](#)
- [Is it a Universal Waste?](#)
- [Are there any Exemptions?](#)
- [Accumulation](#)
- [Training requirements](#)
- [Managing broken solar panels](#)
- [Disposal](#)
- [Contact DTSC](#)

Note: This document does not address disassembling the solar panels into individual photovoltaic modules. This document may be updated to reflect the passing of recent legislation.

Brief description about Solar Panel Design

A solar panel converts the sun's radiant energy into electricity using photovoltaic cells commonly known as solar cells. Key ingredients in a solar panel include solar cells, photovoltaic modules, and semiconductors.

The solar cell is the first building block of a solar panel. Within each solar cell are semiconductors that perform an important role in the overall function of the solar panel. Semiconductors contained beneath the antireflective surface absorb photons of sunlight energy and turn that energy into electric current. Each cell is soldered together in series into one large unit called a photovoltaic module. Multiple photovoltaic modules are soldered together to form a larger unit called a solar panel. Electrons leaving the solar panel require an inverter to convert the

electron flow from DC current into usable AC current to power devices such as TVs, computers or hair dryers.

Solar panels are increasingly used by homeowners and industry as an alternative to non-renewable energy.

Types of Solar Panels

Q: How many types of panels are in circulation and what are the main types?

A: There are numerous types of solar panels in circulation. The main types are the monocrystalline silicon, polycrystalline silicon, the cadmium telluride (CdTe) types and the newer thin film types such as copper indium gallium selenide (CIS/CIGS). It is difficult to tell the type just by looking. Most owners will have documentation regarding what they purchased and had installed. This documentation can help with these determinations.

Is it a Hazardous Waste?

Q: When do solar panels become hazardous wastes?

A: A waste is any material that is discarded. A material is discarded if it is: abandoned or relinquished, recycled or considered inherently waste like. In general, a hazardous solar panel becomes hazardous waste when:

- 1) For unused solar panels, when the generator decides to discard them, and
- 2) For used solar panels that will not be reused, when they are disconnected /removed from service.

Q: How are solar panels hazardous?

A: Solar panel wastes include heavy metals such as silver, copper, lead, arsenic, cadmium, selenium that at certain levels may be classified as hazardous wastes.

Q: What does data show? What are the constituents that make the panels hazardous?

A: In general, data shows that older silicon panels may be hazardous due to lead solder. Some older silicon panels are hazardous for hexavalent chromium coatings. Cadmium tellurium (CdTe) panels are typically hazardous due to the cadmium. Gallium arsenide (GaAs) panels may be hazardous due to the arsenic. Thin film panels, such as copper indium gallium selenide (CIS/CIGS) panels, may be hazardous due to the copper and/or selenium.

Q: What about electronic components associated with the solar panels? What are they hazardous for?

A: The electronic components associated with the solar panels (e.g. drivers, inverters, circuit boards) contain all of the common electronic device hazardous constituents such as lead, arsenic, cadmium, selenium, and chromium.

Q: Does a generator have to test the solar panels it generates?

A: No. Sampling and analysis is conducted when determining whether or not a waste is a hazardous waste. However, a generator may use its generator knowledge and may forego sampling and analytical testing.

As for any waste, the generator must make the hazardous waste determination and manage the waste as hazardous waste if it determines the waste to be hazardous waste. I.e., if the waste solar panel is hazardous waste, it needs to be managed according to hazardous waste regulations.

Q: Are some types and brands of solar panels hazardous waste, and others not?

A: Yes, that is possible. One can consult with the manufacturer from which it came from to learn about the product. Below is a link to a database that profiles solar manufacturers and solar products which may be of helpful.

<http://www.enfsolar.com/directory/panel>

Q: Are there any markings or identifiable traits to look for?

A: Just like any manufactured article, the article, or panel, should have a make and model number. Identification tags affixed to the solar panel provide specific information such as product name, trade name and part number. One can consult with the manufacturer from which it came from to learn about the product.

Q: What if you know the type of panel? Can you tell if it's hazardous just by knowing what type of solar panel you have?

A: No, even when you know the type of solar panel, it is difficult to say if it is hazardous or not without performing testing.

Is it a Universal Waste?

Q: Are solar panels electronic devices under the universal waste regulations?

A: No. Solar panels are not considered electronic devices or universal wastes. A solar panel produces electricity to power devices such as TVs, computers, and hair dryers. The solar panel itself is not an electronic device that performs specific tasks such as processing data or sending emails. A solar panel is more akin to a battery in a car. Like a battery, solar panels produce electricity to power a device.

As for any waste, the generator must make the hazardous waste determination and manage the waste as hazardous waste if it determines the waste to be hazardous waste. I.e., if the waste solar panel is hazardous waste, it needs to be managed according to hazardous waste regulations.

Are there any Exemptions?

Q: What kinds of regulatory exclusions or exemptions, if any, apply to solar panels?

A: There are no regulatory exclusions or exemptions specific to solar panels. However, recently passed legislation authorizes DTSC to adopt regulations to designate used/spent solar panels that are hazardous wastes as universal waste. Under this legislation, the waste panels would be managed under an alternative set of management standards in lieu of regulation as hazardous wastes pursuant

to chapters 10 through 16, 18, and 20 of Title 22, Division 4.5 of California Code of Regulations. Until the new regulations are adopted, hazardous waste solar panels must be managed as hazardous wastes and not as universal wastes. Please [click here](#) to read about the recent legislation in Chapter 419 and Chaptered by the Secretary of State on October 1, 2015.

Accumulation

Q: Can hazardous waste solar panels be accumulated and/or consolidated together with universal waste electronic devices (UWEDs)?

A: No. Solar panels are not considered universal waste and may not be managed as such.

Generators of solar panels must presently comply with the generator standards in Chapter 12 of Title 22, California Code of Regulations, including section 66262.34. Accumulation time limits vary with generator status. Typically, a generator will be required to send the solar panels offsite within 90, 180 or 270 days depending upon their monthly hazardous waste generation quantity.

Training requirements

Q: What kind of training do personnel have to receive on hazardous waste solar panel management?

A: Training requirements for generators of hazardous waste depends on the generator's status.

Generators that produce no more than 1,000kg of hazardous waste per month are required to comply with basic personnel training requirements pursuant with 40 CFR section 262.34(d)(5)(iii). These requirements are intended to ensure that generators of less than 1,000 kg of hazardous waste per month are adequately prepared to properly handle the types of hazardous wastes generated at the site and to respond to any emergencies that may arise. Basic training for employees with hazardous waste related duties includes hazardous waste related skills relevant to a person's job title and includes:

- Waste identification

- Manifest requirements
- Accumulation time limits
- Proper tank and container labeling

Generators that produce more than 1,000kg of hazardous waste per month are required to comply with personnel training applicable to interim standards for facilities outlined in Title 22, California Code of Regulations section 66265.16(a) – (e) of Personnel Training. These requirements are intended to ensure that generators of greater than 1,000 kg of hazardous waste per month receive instruction which teaches personnel hazardous waste management procedures relevant to the positions in which they are employed. Personnel training includes:

- Effective emergency response to problems that may arise
- Written training plan
- Timeframe to complete initial training
- Annual review of training received
- Retention of personnel training records

Managing broken solar panels

Q: How should I manage broken solar panels? Can solar panel debris be swept up and containerized separately from intact panels while being accumulated as HW? How do I use a spill kit?

A: Whether broken or intact, hazardous waste solar panels must be managed according to the hazardous waste regulations. Hazardous waste solar panels that are broken or cracked and not usable must be managed as hazardous waste. Broken pieces must be cleaned up and properly packaged/containerized as to minimize the potential release. Containers shall be structurally sound and prevent releases under reasonably unforeseeable conditions. When using a spill kit, follow the manufacturer's instructions. A generator who fails to respond to a spill or release within a timely manner may be cited.

Disposal

Q: What is the current status for disposal of solar panels?

A: Waste solar panels that are hazardous (e.g., hazardous waste CIGS panels) are fully regulated hazardous wastes. Hazardous waste solar panels must be managed according to all applicable hazardous waste laws and regulations, including obtaining an authorization for conducting treatment.

Non-hazardous waste such as glass, copper wire and aluminum framing from the non-hazardous solar panels can be taken to a non-hazardous landfill or to recycling centers to be disassembled and reclaimed for value through recycling activities.

Q: Can hazardous waste solar panels be taken to Household Hazardous Waste (HHW) collection events?

A: HHW collection events are intended for residents and very small quantity generators that generate 100 kg of hazardous waste or less per month and no more than 1 kg of extremely hazardous waste per month. Qualifying generators should contact the HHW collection facility and verify that the hazardous waste solar panel wastes will be accepted.

The transportation limits for generators self-transporting their hazardous waste solar panels to HHW collection facilities, 50, 125 or 220 pounds, may make it impractical to utilize HHW collection facilities as a means for generators to relinquish their solar panels.

Q: Can a homeowner break up the solar panel into small pieces for disposal?

A: If the waste solar panel is hazardous waste, it needs to be managed according to hazardous waste regulations. This type of activity is considered treatment and would require authorization.

Regulatory Assistance Office:

The Department of Toxic Substances Control (DTSC) Regulatory Assistance Office responds to inquiries from the regulated community, environmental firms, other agencies, and the public at large about Department issues.

Within California, you can contact a Regulatory Assistance Officer by calling (800) 728-6942. If you are calling from out-of-state, please call (916) 324-2439.

In addition to the toll free number, you may email questions directly to the Regulatory Assistance Officers at: RAO@dtsc.ca.gov