



**Matthew Rodriguez**  
Secretary for  
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## Department of Toxic Substances Control

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**Edmund G. Brown Jr.**  
Governor

### TITLE 22

#### 45-DAY PUBLIC NOTICE AND COMMENT PERIOD

#### *Standards for Management of Hazardous Waste Solar Modules*

**Department Reference Number: R-2010-01**  
**Office of Administrative Law Notice File Number: Z-2012-0802-01**

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**NOTICE IS HEREBY GIVEN** that the Department of Toxic Substances Control (DTSC) proposes to amend California Code of Regulations, title 22, division 4.5, section 66260.10 of chapter 10, sections 66261.6 and 66261.9 of chapter 11, and sections 66273.1, 66273.7.1, 66273.9, 66273.32, 66273.33, 66273.34, 66273.36, 66273.39, and 66273.51 of chapter 23. The proposed regulations will implement Health and Safety Code division 20, chapter 6.5, section 25150.

#### **PUBLIC HEARING**

DTSC will hold a public hearing on the proposed regulations on **October 1, 2012** in the **Sierra Hearing Room**, Cal/EPA Building, 2nd Floor, 1001 "I" Street, Sacramento, at which time any person may present statements or arguments orally or in writing relevant to this proposal. The public hearing will convene at 9:00 a.m. and will remain open as long as attendees are presenting testimony. Please submit written comments to the contact person listed at the end of this notice. For written comments to be considered they must be submitted no later than 5:00 p.m. on **October 1, 2012**.

Representatives of DTSC will preside at the hearing. DTSC requests persons who wish to speak to register before the hearing. Pre-hearing registration is conducted at the location of the hearing from **(8.30 a.m. to 10.30 a.m.)**. Registered persons will be heard in the order of their registration. Anyone else wishing to speak at the hearing will have an opportunity after all registered persons have been heard.

All visitors are required to sign in prior to attending any meeting at the Visitor and Environmental Services Center, located just inside and to the left of the building's public entrance. Please allow adequate time to sign in and receive a visitor badge before the public hearing begins.

**Notice to Hearing Impaired – Accessibility.** If you have special accommodation or language needs, please contact our Reasonable Accommodation Coordinator, **Mr. Adrian Recio**, at (916) 324-3095 or by e-mail at [arecio@dtsc.ca.gov](mailto:arecio@dtsc.ca.gov) as soon as you read this document. TTY/TDD/Speech-to-Speech users may dial 7-1-1 for the California Relay Service.

## **AUTHORITY AND REFERENCE**

These regulations are being proposed under the following authorities:

Health and Safety Code section 25150. This section grants DTSC authority to adopt standards regarding the management and recycling of hazardous waste.

Health and Safety Code section 58012. This section grants DTSC authority to adopt regulations to execute its duties.

These regulations implement, interpret, or make specific the following:

Health and Safety Code section 25150. This section grants DTSC authority to adopt standards regarding the management and recycling of hazardous waste.

These regulations are based on, but are not identical to, the following federal regulations: 40 Code of Federal Regulations, part 273.

## **INFORMATIVE DIGEST/POLICY STATEMENT OVERVIEW**

### **Policy Statement Overview**

The State of California is currently experiencing increased deployment of photovoltaic module technology (e.g., solar modules). Photovoltaic technology has been in existence for many years and it has only recently become both affordable and efficient enough to challenge more traditional forms of electrical production in the marketplace. It is expected that market demands<sup>1</sup> and government programs<sup>2</sup> will increase the number of installed solar modules in California by hundreds of millions in the next 20 years. The installation of that magnitude of solar module arrays is part of the California strategy to combat global warming and increase renewable energy resources.

Solar modules are a form of photovoltaic technology where a semiconductor material, such as silicon, cadmium telluride or copper indium selenium, is encapsulated between two sheets of tempered glass. Solar modules are relatively simple, being comprised

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<sup>1</sup> To achieve the goals of Assembly Bill 32, the state has passed legislation requiring utilities to obtain 20% of their electricity from renewable energy sources, such as solar modules, by 2010.

<sup>2</sup> [SB 585, signed by Governor Brown to finance solar installations by increasing by \\$200 million the amount of money collected from independent-owned utilities customers for shortfalls to the California Solar Initiative \(CSI\).](#)

[Former](#) Governor Schwarzenegger established a “Million Solar Roofs” initiative, which was designed to encourage individuals to install one million solar module arrays on their roofs by 2018. Senate Bill 1 (Stats. of 2004).

predominately of a silicon or semiconductor substrate, which for thin-film modules is a thin layer of two or more metal-based semiconductors applied to the surface of glass.

Available information indicates that some solar modules are likely to exhibit the characteristic of toxicity due to heavy metals (e.g., cadmium, copper, lead, and selenium) and thus would be classified as hazardous waste, if disposed. As such, these devices may not be disposed of in municipal solid waste landfills.

Cadmium and certain cadmium compounds (as particulates) are possible human carcinogens and long-term exposure to cadmium can have detrimental effects on the kidneys, lungs, and bones. Cadmium's primary toxic route of exposure is inhalation, although some forms of cadmium can be ingested through contaminated water and food.

Lead is a potent developmental neurotoxicant. Recent research has shown that any measurable level of lead found in children's blood is accompanied by statistically significant deficits in intellectual performance. Additionally, lead exposure can result in toxic effects upon the kidneys and circulatory and skeletal systems.

Currently, the volume of waste solar modules in California is very small with the exact number unknown. However, with the increase in deployment of solar modules throughout the state to meet its increasing energy needs, as well as meet the renewable energy goals established by the Governor, that volume of waste solar modules is anticipated to increase at a steady rate over the next 20 years. Older solar modules will be replaced by new module technology and the first large scale change-outs of this kind will occur over the next five to 10 years. Solar modules that are determined to be hazardous waste will need to be managed appropriately and in accordance with existing standards.

Research has been conducted on whether solar modules, both existing technologies and new technologies, are amenable to recycling. Research has shown, primarily in pilot scale applications, that solar modules can be recycled. Due to the simplicity of the modules and the recyclable nature of their components, very high recycling recovery rates may be achieved.<sup>3</sup> For example, certain thin-film solar modules that use rare metal alloys in their semiconductor layers (e.g., cadmium-telluride modules), have been shown through recent research that recycling can recover over 95% of the semiconductor metals and a similarly high percentage of the glass.<sup>4</sup> The high value of the semiconductors,<sup>5</sup> combined with their relative scarcity and the high recovery rate which can be achieved when waste solar modules are recycled, makes it possible for

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<sup>3</sup> Brookhaven National Laboratory, "Recycling of CdTe Photovoltaic Modules: Recovery of Cadmium and Tellurium," 2006. Brookhaven National Laboratory, "Extraction and Separation of Cd and Te from Cadmium Telluride Photovoltaic Manufacturing Scrap," 2006. BMU/EPIA, "Study on the Development of a Take Back and Recovery System for Photovoltaic Products," 2007.

<sup>4</sup> *Id.*

<sup>5</sup> Tellurium, for example, currently trades at over \$100 a pound. The price for indium fluctuated in 2007 from \$700 to \$1000 per kilogram. The value of gallium was in the range of \$500 per kilogram in 2007.

manufacturers or independent facilities to derive economic value from the recycling of thin-film semiconductor modules.

Currently, there is only one permitted facility in California that DTSC is aware of which recycles solar modules, and there currently is only one industrial-scale solar module recycling facility in Ohio. To reclaim portions of solar modules for reuse requires the use of both thermal and chemical processes. In California, such hazardous waste recycling processes (i.e., hazardous waste treatment) require a permit or other grant of authorization from DTSC.

It is anticipated that with the increasing volumes of waste solar modules over time that recycling opportunities will also increase as new and existing recycling businesses enter the solar module recycling market. And, given that solar modules can be recycled and that portions of the modules can be reclaimed for use in new modules, or used in other products such as fiberglass, it is timely for DTSC to evaluate the benefits of creating regulatory mechanisms that will both encourage recycling and facilitate collection and transport. The new regulatory mechanisms proposed provide that standards for such activities be protective of human health and the environment.

Based on DTSC's experience in managing other similar waste streams, such as electronic wastes, it believes that waste solar modules fit well within an alternative set of management standards which are commensurate with the risks posed in managing such modules. In addition, encouraging the recycling of solar modules conserves valuable resources which further California's renewable energy generation goals.

The broad objectives of these regulations are to:

- Establish a conditional exemption in section 66261.6 (recyclable materials) for non-RCRA<sup>6</sup> hazardous waste solar modules that are collected, transported and recycled by being reclaimed as part of a reclamation program administered by a solar module vendor (as defined in the proposed regulations).
- Designate hazardous waste solar modules, that are either RCRA hazardous waste or non-RCRA hazardous waste, as universal waste provided that the solar modules are recycled, not disposed, and are managed in accordance with the existing requirements of chapter 23 (Standards for Universal Waste Management).
- Maintain the existing hazardous waste requirement for recycling activities, including reclamation activities and other forms of hazardous waste treatment activities, which require a hazardous waste facility permit or other grant of authorization from DTSC.

The proposed regulations are, in effect, a preemptive strategy to limit the number of hazardous waste solar modules in California's landfills by managing the waste stream and recycling activities of solar modules. Fewer hazardous substances in our environment lead to healthier air quality, cleaner drinking water, and a safer workplace.

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<sup>6</sup> RCRA means the federal Resource Conservation and Recovery Act.

## **Existing Laws and Regulations**

The following hazardous wastes are eligible for management as universal wastes under California Code of Regulations, title 22, division 4.5<sup>7</sup>, chapter 23 (commencing with §66273.1): batteries; electronic devices; mercury-containing equipment; lamps; cathode ray tubes (CRTs); and CRT glass.

Section 66260.22 establishes the petition process for adding additional hazardous waste or a category of hazardous waste to the universal waste category. This section provides DTSC with the flexibility to add additional universal wastes.

Section 66260.23 provides the factors that DTSC uses to add a universal waste as well as to evaluate a petition made pursuant to section 66260.22. In evaluation of these factors, DTSC considers the overall weight of evidence presented in determining whether regulation under the universal waste rule is appropriate for the waste, and whether the chapter 23 regulation will further DTSC's goals of improving management practices for the waste and improving implementation of the hazardous waste program.

California Health and Safety Code section 25150, subdivision (e) provides DTSC with the authority to "adopt, and revise when appropriate, regulations for the recycling of hazardous waste to protect against hazards to the public health, domestic livestock, wildlife, or to the environment, and to encourage the best use of natural resources." Health and Safety Code section 25150, subdivisions (a) and (e) also provide statutory authority to develop regulations for the management and recycling of hazardous wastes.

## **Relation to Existing Federal Regulations**

Existing federal universal waste regulations are set forth at 40 Code of Federal Regulations part 273. These regulations provide streamlined collection and management requirements for hazardous waste batteries, pesticides, mercury-containing equipment and lamps. Unlike the California rules, they do not address universal waste electronic devices, CRTs, or CRT glass.

The United States Environmental Protection Agency (U.S. EPA) has not proposed regulations regarding solar modules, nor is there any indication that the agency is planning to do so. Therefore, the proposed regulations will neither duplicate nor conflict with the federal regulations. In addition, available and published information indicates that most solar modules do not meet federal hazardous waste criteria.

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<sup>7</sup> Unless otherwise specified, all regulatory citations from this point forward are to the Cal. Code Regs., tit. 22, div. 4.5.

## **Relation to Existing State Regulations**

Proposed regulations in California Code of Regulations, title 22, division 4.5, chapter 10 (commencing with §66260.10) and chapter 11 (commencing with §66261.1):

- Define solar modules and solar module vendor for purposes of the conditional exemption proposed under section 66261.6 for recyclable materials. Add hazardous waste solar modules to the list of recyclable materials in section 66261.6, and provide the management standards of the conditional exemption. Includes a provision that the hazardous waste solar modules managed pursuant to this section are part of a reclamation program administered by a solar module vendor.
- Under a separate management structure (not part of the conditional exemption proposed in section 66261.6 for solar modules managed under the specified reclamation program), add solar modules to the list of hazardous wastes that may be managed as universal waste under chapter 23. Provide the same exemption status for universal waste solar modules as existing universal wastes.

Proposed regulations in California Code of Regulations, title 22, division 4.5, chapter 23 (commencing with §66273.1):

- Add solar modules to the list of universal wastes under which the standards of chapter 23 apply.
- Provide an applicability section which contains an explanation of when a hazardous waste may be managed pursuant to chapter 23, and when it must continue to be managed as a hazardous waste, or under some other existing exclusion or exemption. Also provides guidance on when a solar module becomes a waste and thus subject to regulation.
- Add universal waste solar modules to the existing requirements in chapter 23, including containment, labeling, accumulation time limits, personnel training, record-keeping of shipments, response to releases and export.
- Add a provision that certain universal waste handlers of solar modules provide notification to DTSC (handlers who accumulate at any one time 10,000 kilograms of solar modules).

The proposed regulations are consistent and compatible with the existing state regulations because DTSC believes that these wastes fit the same criteria that have been established for adding universal waste through regulation.

An automated search of Title 18, 22 and 26 using the following keywords “solar module”, “photovoltaic modules”, and “cadmium telluride” was conducted via Westlaw and yielded no conflicting state regulations. The same keywords were also searched via the California Legislative Information search engine and yielded no related statutes. No additional information regarding the management of solar panels at the end-of-life was found.

## **CONSIDERATION OF ALTERNATIVES**

DTSC must determine that no reasonable alternative it considered or that has otherwise been identified and brought to the attention of DTSC would be more effective in carrying out the purpose for which the action is proposed, would be as effective and less burdensome to affected private persons than the proposed action, or would be more cost-effective to affected private persons and equally effective in implementing the statutory policy or other provision of law. DTSC invites interested persons to present arguments, with respect to the various options, at the scheduled hearing or during the written comment period.

## **MANDATES ON LOCAL AGENCIES OR SCHOOL DISTRICTS**

DTSC has made a preliminary determination that adoption of these regulations will create no new local mandates.

## **COST OR SAVINGS TO STATE OR LOCAL AGENCIES, OR SCHOOL DISTRICTS SUBJECT TO REIMBURSEMENT**

Local agencies, acting as Certified Unified Program Agencies (CUPAs), are responsible for inspecting many of the businesses that generate hazardous waste, universal waste being a subset of hazardous waste. CUPAs are authorized by Health and Safety Code section 25404.3 to assess fees to cover the costs of these inspections and enforcement programs. DTSC has made a preliminary determination that the proposed regulations will not impose a local mandate or result in costs subject to reimbursement pursuant to part 7 of division 4, commencing with section 17500, of the Government Code or other nondiscretionary costs or savings to local agencies or school districts.

**Cost or Savings to Any State Agency:** DTSC has made a preliminary determination that the proposed regulations will have no significant impacts on State revenue or costs. In the event that a state agency may generate waste solar modules, the proposed regulations would allow state agencies to choose to manage solar modules as universal wastes instead of managing them as hazardous wastes. The potential cost savings to state agencies for managing solar modules is unknown as there is no indication that state agencies currently manage any waste solar modules. Managing waste solar modules as universal waste would provide cost savings for state agencies through non-payment of generator fees, not manifesting shipments, and not using a registered hazardous waste transporter.

DTSC could incur minimal costs associated with receipt and tracking of notifications for solar module vendors and certain universal waste handlers of solar modules as described in the proposed regulations. However, this cost would be absorbable. DTSC may also incur costs to train CUPAs and industry on the new regulations. These costs would also be absorbable because the associated workload would be incorporated into DTSC's existing training on universal waste standards.

**Cost or Savings in Federal Funding to the State:** DTSC has made a preliminary determination that the proposed regulations will have no impact on federal revenue or costs. The proposed regulations place solar modules in the universal waste category, which is permissible for an authorized state program operating in lieu of the federal hazardous waste management program.

## **DETERMINATION OF NO ADVERSE STATEWIDE ECONOMIC IMPACT**

DTSC has made an initial determination that the proposed regulations will not have a significant statewide adverse economic impact directly affecting businesses, including the ability to compete with businesses in other states.

**Business report** - DTSC has determined that this rulemaking will not require businesses to write a new report, as defined by Government Code section 11346.3(c). However, the proposed regulations would require a brief notification be made to DTSC for solar module vendors and certain universal waste handlers of solar modules. The substance of these notifications is not beyond the typical information that these types of entities already compile and maintain as part of normal business practices. General information on the specific entities that will be managing hazardous waste solar modules is necessary for DTSC to obtain location and contact information to ensure the solar modules are managed appropriately and in a manner that is protective of human health and public safety.

## **COST IMPACTS ON REPRESENTATIVE PRIVATE PERSONS OR BUSINESSES**

DTSC is not aware of any cost impacts that a representative private person or business would necessarily incur in reasonable compliance with the proposed action.

## **RESULTS OF REGULATORY ECONOMIC IMPACT ANALYSIS**

Per the economic impact assessment required by Government Code section 11346.3, DTSC has determined the following regarding the proposed regulation:

**Creation or elimination of jobs within California** – DTSC has made a preliminary determination that no jobs will be created or eliminated in California as a result of the proposed regulations. However, the proposed regulations may lead to some increase in the employment in the collection and transport of solar modules, which is different than current disposal operations. DTSC does not expect that the regulations will lead to the elimination of any jobs at businesses involved in hazardous waste transport or disposal.

**Creation of new businesses or the elimination of existing businesses within California** – DTSC has made a preliminary determination that no businesses will be created or eliminated in California as a result of the proposed regulations. A few new businesses may be created to meet the demands for collection and transport services, although it is more likely that existing universal waste businesses will expand to accommodate this new demand. Businesses currently handling or disposing of solar

modules would not be eliminated because this waste stream comprises a minor share of the waste handled by these firms, if handled at all.

**Expansion of businesses currently doing business in California** – DTSC has made a preliminary determination that recycling businesses in California may expand as a result of the proposed regulations. DTSC is unable to quantify the amount of this expansion.

### **Benefits of the Regulation**

The proposed regulations will reduce the number of hazardous waste solar modules in California's landfills by managing the waste stream and recycling activities of solar modules. Fewer hazardous substances in our environment lead to healthier air quality, cleaner drinking water and a safer workplace.

### **EFFECTS ON HOUSING COSTS**

DTSC has made an initial determination that there will be no impact on housing costs.

### **EFFECT ON SMALL BUSINESSES**

DTSC has made a preliminary determination that provisions of this rulemaking will have a positive effect on small businesses. The proposed regulations will allow small businesses to avoid the high compliance costs associated with managing waste solar modules as hazardous wastes, i.e., hazardous waste generator fees, manifest fees, hazardous waste transporter fees, and associated disposal costs.

### **CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA) COMPLIANCE**

DTSC has made a preliminary finding that this rulemaking project is exempt under CEQA as the proposed project will pose no significant effect on the environment. DTSC believes that a Notice of Exemption (NOE) is appropriate because the proposed regulations will result in the diversion of solar modules from land disposal to recycling facilities subject to full hazardous waste requirements thus ensuring human health and safety and the environment are protected. A draft of NOE will be made available for review with the rulemaking file prior to adoption of these proposed regulations. A copy of the draft NOE will be posted on the DTSC Internet site at [http://www.dtsc.ca.gov/LawsRegsPolicies/Regs/Reg\\_Exempt\\_HW\\_Solar\\_Panels.cfm](http://www.dtsc.ca.gov/LawsRegsPolicies/Regs/Reg_Exempt_HW_Solar_Panels.cfm).

### **PEER REVIEW**

Under the provisions of Health and Safety code section 57004, peer review is not required because the proposed regulations do not establish a regulatory level, standard or other requirement subject to scientific peer review.

## CONTACT PERSONS

Inquiries regarding technical aspects of the proposed regulations may be directed to Mr. Ron Ohta of DTSC at (916) 324-5192 or, if unavailable, Mr. Andre Algazi of DTSC at (916) 324-3114. However, such oral inquiries are not part of the rulemaking record.

A public comment period for has been established commencing on **August 17, 2012**, and closing on **October 1, 2012** for statements, arguments, or contentions regarding the rulemaking and/or supporting documents that must be submitted in writing or may be presented orally or in writing at the public hearing in order for them to be considered by DTSC before it adopts, amends, or repeals these regulations.

## AVAILABILITY OF TEXT OF REGULATIONS AND STATEMENT OF REASONS

Copies of the Notice, Initial Statement of Reasons, the text of the proposed regulations, all the information upon which its proposal is based, and the express terms of the proposed regulation are posted to DTSC's Internet site at <http://www.dtsc.ca.gov/LawsRegsPolicies/Regs/index.cfm> or may be obtained from **Kryisia Von Burg** of DTSC's Regulations Section as specified below.

After the close of the comment period, DTSC may adopt the proposed regulations. If substantial changes are made, the modified full text will be made available for comment for at least 15 days prior to adoption. Only persons who request the specific proposed regulations, attend the hearing, or provide written comments on these specific regulations will be sent a copy of the modified text if substantive changes are made.

Once regulations have been adopted, DTSC prepares a Final Statement of Reasons which updates the Initial Statement of Reasons and summarizes how DTSC addressed comments and includes other materials, as required by Government Code section 11346.9. Copies of the Final Statement of Reasons may be obtained from Ms. Von Burg at the address listed below. A copy of the Final Statement of Reasons will also be posted on DTSC's Internet site at [http://www.dtsc.ca.gov/LawsRegsPolicies/Regs/Reg\\_Exempt\\_HW\\_Solar\\_Panels.cfm](http://www.dtsc.ca.gov/LawsRegsPolicies/Regs/Reg_Exempt_HW_Solar_Panels.cfm), along with the date the rulemaking is filed with the Secretary of State and the effective date of the regulations.

To be included in this regulation package's mailing list, and to receive updates of this rulemaking, please visit <http://www.dtsc.ca.gov/ContactDTSC/ELists.cfm> and subscribe to the applicable EList or e-mail: [regs@dtsc.ca.gov](mailto:regs@dtsc.ca.gov).

Please direct all written comments, procedural inquiries and requests for documents by mail, e-mail or fax to:

Kryisia Von Burg, Regulations Coordinator  
Regulations Section  
Department of Toxic Substances Control

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Ms. Von Burg's phone number is (916) 324-2810. If Ms. Von Burg is unavailable, please call Mr. Jon Cordova at (916) 324-7193.