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INITIAL STATEMENT OF REASONS

Standards for the Management of Hazardous Waste Solar Modules

Department of Toxic Substances Control
Reference Number: R-2010-01

Office of Administrative Law Notice File Number*: Z-2012-0802-01*

DETAILED STATEMENT OF THE SPECIFIC PURPOSE AND RATIONALE

Photovoltaic module technology or Solar Panels are devices that convert solar energy into electricity. Solar panels are considered a greener alternative to fossil fuels and demand for the number of installed solar modules in California is expected to increase in California by hundreds of millions in the next 20 years. The manufacture of solar modules involves toxic heavy metals, such as cadmium, copper, lead, and selenium and therefore some solar modules are likely to exhibit the characteristic of toxicity which has adverse environmental and public health effects. 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 take measures to adopt regulations that both encourage recycling and facilitate collection and transport of solar modules.

DTSC proposes to amend regulations in California Code of Regulations, title 22, division 4.5, chapter 10 (commencing with §66260.10), chapter 11 (commencing with §66261.1), and chapter 23 (commencing with §66273.1) 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.

ECONOMIC IMPACT ANALYSIS

In accordance with Government Code Section 11346.3(b), DTSC has made the following assessments 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 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 Current California Businesses

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.

Anticipated Benefits

California will benefit through these proposed regulations by providing alternatives to the current hazardous waste management scheme for solar modules. While remaining protective of the public health and the environment, the proposed regulations will increase the management of a fast-growing waste stream through recycling rather than through disposal. The proposed regulations will also achieve a desired goal of helping to protect the environment by reducing the number of solar modules disposed in landfills. The universal waste approach that has been proposed in these regulations for solar modules has been chosen because it has already been demonstrated that it will successfully achieve DTSC's goal of protecting human health and the environment while ensuring the regulatory requirements are kept to a minimum.

REPORTS RELIED ON

DTSC has relied upon the Economic Impact Assessment (STD 399) in proposing the regulatory action.

"Review and Comments on Reports by NGI: Environmental Risks Regarding the Use and Final Disposal of CdTe PV Modules and Leaching from CdTe PV Module Material – Results from Batch, Column, and Availability Tests," Golder Associates, May 2010.

Study on the Development of a Take Back and Recovery System for Photovoltaic Products, Funded by the German Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety, November 2007.

Regulations on Photovoltaic Module Disposal and Recycling, Brookhaven National Laboratory, Vasilis Fthenakis, under contract to the U.S. Department of Energy, January 29, 2001.

A Voluntary Take Back Scheme and Industrial Recycling of Photovoltaic Modules, Photovoltaics, Recycling Scoping Workshop, 34th PV Specialists Conference, slide 16.

Sierra Analytical Labs, Inc. Report to The Non-Toxic Solar Alliance e.V., July 22, 2010.

"Environmental risks regarding the use and end-of-life disposal of CdTe PV modules," Norwegian Geotechnical Institute, April 16, 2010.

Recovery of Solar Valuable Materials, Enrichment and Decontamination, Recovery of Solar Valuable Materials, Enrichment and Decontamination (RESOLVED), LIFE04 ENV/D/000047, 2008

A novel approach for the recycling of thin film photovoltaic modules, Berger W, et al., Resource Conservation Recycling; 2009.

Product Stewardship Framework Policy Document, ASTSWMO, Prepared by the Product Stewardship Task Force of the ASTSWMO Sustainability Subcommittee, October 28, 2009.

Recycling of Cadmium and Selenium from Photovoltaic Modules and Manufacturing Wastes: A Workshop Report, P.D. Moskowitz and K. Zweibel, Editors, Sponsored by: U.S. Department of Energy, National Renewable Energy Laboratory, Electric Power Research Institute, The Cadmium Council, Inc., and Brookhaven National Laboratory, October 1992.

California Department of Forestry and Fire Protection - Office of the State Fire Marshal, Solar Photovoltaic Installation Guideline, April 22, 2008.

"Could CdTe PV Modules Pollute the Environment?", Vasilis M. Fthenakis, National Photovoltaic Environmental Health and Safety Assistance Center, Brookhaven National Laboratory, 2002.

Cadmium ToxFAQs, U.S. Department of Health and Human Services, Public Health Service Agency for Toxic Substances and Disease Registry, September 2008.

Rapid Reactive Transfer Printing of CIGS Photovoltaics, Louay Eldada, Baosheng Sang, Matthew Taylor, Peter Hersh, and Billy J. Stanbery, HelioVolt Corporation, August 25, 2009.

Recycling of CIG Photovoltaic Waste, Drinkard Jr., et.al., Patent Number: 5,779,877, July 14, 1998.

"An Update on Environmental, Health and Safety Issues of Interest to the Photovoltaic Industry," P.D. Moskowitz, J. Viren and V.M. Fthenakis, Analytical Sciences Division Brookhaven National Laboratory, December 1992.

"CdTe PV: Real and Perceived EHS Risks," V. Fthenakis (National PV EHS Assistance Program) and K. Zweibel (National Renewable Energy Laboratory); Presented at the National Center for Photovoltaics and Solar Program Review Meeting Denver, Colorado March 24-26, 2003, NREL/CP-520-33561, May 2003.

"Swimming Upstream: Product Stewardship and the Promise of Green Design," Prepared on behalf of the 2010 Oregon Department of Environmental Quality Product Stewardship Stakeholder Group, David Stitzhal, MRP, Full Circle Environmental, Inc., May, 2010.

"Overview of Potential Hazards, " V.M. Fthenakis, National PV EHS Assistance Center, Department of Environmental Sciences, Brookhaven National Laboratory; Chapter VII-2, Practical Handbook of Photovoltaics: Fundamentals and Applications, General editors T. Markvart and L. Castaner, 2003.

"Ultra-Low-Cost Solar Electricity Cells: An Overview of Nanosolar's Cell Technology Platform," Nanosolar, September 2009.

"The Nanosolar Utility Panel™: An Overview of the Technology and its Advantages," Nanosolar, September 2009.

"Recycling Silicon Photovoltaic Modules," Bohland, et.al., Patent Number: 6,063,995, May 16, 2000.

"Little Smiles on Long Faces," Photon International, March 2009. (Cell and module production survey, 2008.)

"Model Institutional Infrastructures for Recycling of Photovoltaic Modules," Reavan, Sheldon J., Moskowitz, Paul D., Fthenakis,Vasilis, Biomedical and Environmental Assessment Group, Analytical Sciences Division, Department of Applied Science, Brookhaven National Laboratory, Associated University, Inc., January 1996.

"Toward a Just and Sustainable Solar Energy Industry," White Paper, Silicon Valley Toxics Coalition, January 14, 2009.

"Solar Scorecard," Silicon Valley Toxics Coalition, First Edition, 2010.

"Solar Company Survey," Silicon Valley Toxics Coalition, 2009.

"Tracking the Sun II: The Installed Cost of Photovoltaics in the U.S. from 1998-2008," Ryan Wiser, Galen Barbose, Carla Peterman, Naïm Darghouth, Lawrence Berkeley National Laboratory, October 2009.

"Efficient Solar Cells from Cheaper Materials," Kevin Bullis, Technology Review, February 11, 2010.

"Recycling of PV-Thin-Film-Modules," Recovery of Solar Materials, Enrichment and Decontamination (RESOLVED), August 2007.

Federal Register, Volume 74, Number 174, pgs. 46644-46654, Department of Transportation, Notice of Administrative Determination of Preemption, Maine Department of Environmental Protection Requirements on Transportation of Cathode Ray Tubes, September 10, 2009.

"The Value and Feasibility of Proactive Recycling," V. M. Fthenakis and P.D. Moskowitz, National Photovoltaics Environmental Research Center, Brookhaven National Laboratory, June 18, 2008.

MANDATED USE OF SPECIFIC TECHNOLOGIES OR EQUIPMENT

The proposed regulations do not mandate the use of a specific technology or equipment.

REASONABLE ALTERNATIVES CONSIDERED

DTSC has identified four possible alternatives. Of the four, DTSC has chosen two:

- the universal waste option (**Alternative 1**) for solar modules that are either RCRA[1] hazardous waste or non-RCRA hazardous waste; and
- the conditional exemption option (**Alternative 2**) for solar modules that are non-RCRA hazardous waste and which are managed as part of a solar module reclamation program.

This section explains why DTSC has chosen these two management options over the other alternatives.

In 2009, DTSC became aware that some solar modules may be hazardous waste by California standards for non-RCRA hazardous waste (i.e., solar modules that fail California's hazardous waste criteria for toxicity). DTSC conducted further research and found that few solar modules on the market had undergone hazardous waste testing. However, available information indicates that most solar modules do not fail the federal hazardous waste criteria for toxicity (i.e., are not federally-regulated RCRA hazardous waste). If such solar modules then fail California hazardous waste criteria, then those solar modules would be non-RCRA hazardous waste. Therefore, based on available information on hazardous waste testing to date, DTSC believes that some solar modules would likely only be hazardous waste under California hazardous waste criteria for toxicity. Thus, these non-RCRA hazardous waste solar modules would be subject to full hazardous waste management standards when handled in California.

[1] RCRA means the federal Resource Conservation and Recovery Act.

Given that most solar modules that become waste in California are typically not subjected to hazardous waste testing, DTSC has determined that the majority of solar modules generated within California are not being property managed as hazardous waste. Based on similarly-generated hazardous wastes (i.e., household-generated universal wastes), there can be two reasons that solar modules are not being properly managed, but instead are being disposed at municipal solid waste landfills in California. The first reason is that households and businesses are not aware that solar modules contain toxic metals (e.g., cadmium, copper, lead, or selenium) and are hazardous wastes when discarded. The second reason is that there is little available recycling capacity for solar modules in the state.

The proposed regulations will achieve a desired goal of helping to protect the environment by reducing the number of solar modules disposed in landfills. To a large extent, the universal waste approach that has been proposed in these regulations for solar modules has been chosen because it has already been demonstrated that it will successfully achieve DTSC's goal of protecting human health and the environment while ensuring the regulatory requirements are kept to a minimum. Also, because solar modules are currently generated in small quantities by a wide variety of entities, this waste is more appropriately managed under the universal waste regulations.

The universal waste approach is not an alternative to the "do nothing" full hazardous waste regulation approach. The proposed rule is not mutually exclusive with that approach, but instead is an alternative set of management standards that generators may apply to the management of these wastes. There can be no doubt that the "do nothing "approach ensures maximum protection of the environment. However, DTSC believes that the universal waste regulations are as protective as the full hazardous waste requirements for the vast majority of the generators of solar modules. This is the main reason that DTSC has rejected the "do nothing" alternative.

However, **Alternative 1** and **Alternative 2** (which will be discussed further) will facilitate the collection and recycling of solar modules. For this reason and because the universal waste approach has been demonstrated to be successful, DTSC has selected both the universal waste alternative and the conditional exemption approaches over the other alternatives.

Alternative 1: <u>First Selected Alternative--Universal Waste Regulations</u>
Establish universal waste management standards in regulations to foster collection and recycling of waste solar modules. The regulations establish a new management approach for solar modules in the same way as other universal wastes. Limited treatment (e.g., removal of the junction box and junction cables from the module) is allowed without authorization. Disposal in a hazardous waste landfill is allowed, but solar modules destined for disposal must be managed as hazardous waste (i.e., must be manifested) if they are not recycled. The requirements for most handlers are minimal in an effort to achieve greater compliance. The regulations do not allow further treatment of solar modules without a hazardous waste permit or other grant of authorization from the Department.

For additional information on the universal waste approach in general, please refer to the Final Statement of Reasons for California's Universal Waste Rule (February 2002) and the Federal Registers accompanying the federal Universal Waste Rule [58 Fed. Reg. 8102 (February 11, 1993): Proposed Universal Waste Rule; 59 Fed. Reg. 38288 (July 27, 1994): Proposed Lamps Rule; 60 Fed. Reg. 25492 (May 11, 1995): Final Universal Waste Rule; 64 Fed. Reg. 36466 (July 6, 1999): Final Rule - Hazardous Waste Lamps].

Why is DTSC proposing to add solar modules to the universal waste category?
Discarded solar modules can be characteristically hazardous. However, generators of these wastes frequently are not aware that they are hazardous and often dispose of them in the municipal solid waste landfills. Once in the landfill, the hazardous constituents in these devices (primarily heavy metals such as lead and cadmium) can leach into and contaminate the ground water. DTSC believes that placing these wastes in the universal waste category will facilitate the segregation, collection, and proper recycling and disposal of these wastes. Furthermore, DTSC believes that these wastes fit the criteria that the U.S. EPA set forth for designating waste as universal wastes, which are the same criteria that DTSC has established for adding universal waste through regulation.

DTSC has the responsibility to implement, maintain, and enforce the hazardous waste regulations in California. Solar modules may be hazardous waste pursuant to existing laws and regulations. Because of the potential for future large numbers of generators and volumes of solar modules produced in California, DTSC finds it necessary to adopt the proposed universal waste standards for these wastes that (1) create a regulatory scheme that is tailored to these waste streams, and (2) is permissible under the federal RCRA authorization program. The universal waste approach proposed is the only regulatory scheme that is allowed under RCRA authorization where both RCRA and non-RCRA universal wastes can be managed, and that is practical given the large volumes of waste solar modules that are anticipated in the next 5 to 10 years.

Criteria for Addition to the State's Universal Waste Rule
Following are factors set forth in California Code of Regulations, title 22, division 4.5, section 66260.23 (based on criteria found in 40 C.F.R. section 273.80 and 273.81) that DTSC must use to determine whether a waste can be designated as universal waste.

(a) The waste or category of waste, as generated by a wide variety of generators, is listed in article 4 of chapter 11 of this division, or if not listed, a proportion of the waste stream exhibits one or more characteristics of hazardous waste identified in article 3 of chapter 11 of this division.

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

predominately 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.

DTSC is limiting the scope of the proposed regulations to apply to only those solar modules that are hazardous solely because they exhibit the characteristic of toxicity.

(b) The waste or category of waste is not exclusive to a specific industry or group of industries, is commonly generated by a wide variety of types of establishments (including for example, households, retail and commercial businesses, office complexes, conditionally exempt small quantity generators, small businesses, governmental organizations, as well as large industrial facilities).

Waste solar modules will be generated when roof- or ground-mounted solar module arrays are removed from residential housing units and from various types of businesses, governmental, and other entities in the state. As the need for alternative and renewable energy sources increases over the next decade, more applications of solar modules will be created to power all types of equipment and provide power to a wider variety of end-users. Types of variant uses of solar modules currently used include:

- Utility companies and large industrial complexes typically use the largest numbers of solar modules, primarily crystalline silicon modules, to generate electricity.
- A typical commercial or residential property may place solar modules on roofs to augment the energy needs.
- Solar module systems are increasing in desert areas (i.e., solar farms) over installing thermal collection technologies because of the large water usage necessary for heat transfer in thermal collection applications.

(c) The waste or category of waste is generated by a large number of generators and is frequently generated in relatively small quantities by each generator.

Solar modules meet this criterion as individual generators typically generate these wastes sporadically in limited quantities. For example, a solar farm or large industrial business might generate 100 to 200 waste solar modules over the lifetime of the system. Typically, systems have a lifetime of 20 to 25 years under normal operating conditions. When these systems are removed or replaced with new solar modules, these entities may generate 400 to 4,000 waste solar modules. Some of these solar array decommissions will occur in the next 5 to 10 years. Currently, most waste solar modules are generated in very small quantities, less than 10 modules per year for large arrays. Generation rates from household solar module arrays are a fraction of those for

industrial applications. The universal waste management structure is aligned with the sporadic household generations rates, where a household may need to dispose of a single module every few years.

These generation scenarios dictate that the risks posed by one specific generator who may mismanage the waste are relatively small, as opposed to the traditional industrial process-generated hazardous waste that is routinely generated in significant volumes by a generator, but the risk posed by the aggregate volume of the waste solar module stream over time is significant, perhaps even more significant than the traditional hazardous waste stream and, therefore, cannot be ignored.

(d) Systems for collecting the waste or category of waste (including packaging, marking, and labeling practices) would ensure close stewardship of the waste.

DTSC believes that the universal waste requirements will ensure that solar modules are not mismanaged. The proposed regulations require recycling of solar module managed as universal waste to ensure that the primary hazardous component of the solar module (the semiconductor materials that can contain toxic heavy metals) is properly controlled. In addition, by incorporation of solar modules into the existing universal waste management standards, these modules will also be required to adhere to existing universal waste requirements including labeling, accumulation time limits, personnel training, offsite shipments, response to releases, tracking shipments, transportation, and export requirements to ensure proper stewardship of the waste solar modules.

(e) The risk posed by the waste or category of waste during accumulation and transport is relatively low compared to other hazardous wastes, and specific management standards proposed or referenced by the petitioner (e.g., waste management requirements appropriate to be added to sections 66273.13, 66273.33, and 66273.52; and/or applicable Department of Transportation requirements) would be protective of human health and the environment during accumulation and transport.

DTSC believes solar modules are low risk compared to most other hazardous wastes. In fact, most people routinely handle these intact solar modules on a daily basis without any special precautions. Individual solar modules are often portable and are routinely carried and moved without breakage. Typically, the hazardous constituents in the solar modules are contained in the semiconductor materials which are encased in the modules by non-hazardous glass or other protective substrate. Solar modules are designed to withstand severe environmental conditions which require that they are durable and maintain their structural integrity for long-term efficiency. In addition, solar module hazardous constituents are typically found in the semiconductor layer, which is encapsulated. Therefore, no volatile compounds or liquids are present in solar modules that would be released during accumulation or transport.

This proposed rulemaking applies similar packaging standards to solar modules that are applied to universal waste electronic devices. However, there is little difference

between the acute hazards of managing electronic devices and solar modules. For both wastes, the hazardous components are in a form that minimizes the potential for any release during normal handling. Therefore, DTSC believes that because of the relatively low acute hazards associated with handling solar modules, the proposed management standards (e.g., packaging standards that prevents breakage and ensuring proper handling and immediate response to releases) provide more than adequate protection to human health and the environment. These standards apply to the wastes through all phases of handling, collection, accumulation, and transport.

The proposed regulations for solar modules apply the same standards for transport of universal wastes. Handlers can only transport the wastes to approved destination facilities or to another handler. If the handler sends a waste offsite that is a hazardous material under U.S. Department of Transportation (DOT) requirements, then the handler must comply with all applicable DOT requirements for the shipment. If a universal waste shipment is rejected, then the originating handler must take back the shipment or arrange with the rejecting facility/handler to send the waste to another destination. DTSC is concerned that solar modules may be exported from California to developing countries where the waste may be inappropriately managed or incorrectly categorized as a usable product. For this reason, DTSC proposes to apply the full export requirements that currently apply to non-RCRA hazardous waste(s) to solar modules exports to further ensure the protection of human health and the environment.

DTSC is not proposing to allow any destructive form of treatment for solar modules managed under the universal waste standards. In California, any treatment or recycling conducted on universal waste solar modules would be fully regulated under the hazardous waste management standards, including the issuance of a hazardous waste facility permit or other grant of authorization and compliance with any occupational safety and health laws.

(f) Regulation of the waste or waste category under chapter 23 will increase the likelihood that the waste will be diverted from non-hazardous waste management systems (e.g., the municipal waste stream, non-hazardous industrial or commercial waste stream, municipal sewer or stormwater systems) to recycling, treatment, or disposal in compliance with division 4.5 and division 20 of the California Health and Safety Code.

Currently, generators of solar modules that are hazardous waste can only transport the waste to a permitted facility using a hazardous waste manifest and a registered hazardous waste transporter. They can also take the waste to a household hazardous waste collection facility. Once classified as universal waste, the solar module generators will be considered handlers of universal waste rather than generators of hazardous waste. Thus, the collection and consolidation options for these wastes would be more plentiful and more readily available because any handler could ship to any other handler via common carrier. More importantly, DTSC anticipates that business entities will arise that can serve as consolidation points for the wastes prior to their ultimate recycling or disposal. Collecting the wastes at such consolidation points

and reducing the cost of proper transportation will make it less likely that the wastes will be mismanaged in the municipal solid waste stream.

(g) Regulation of the waste or category of waste under chapter 23 will improve implementation of and compliance with the hazardous waste regulatory program.

DTSC expects compliance to increase over time as persons who manage solar modules become familiar with the new universal waste standards. DTSC has seen similar trends in the management of electronic waste, and these compliance trends typically can be attributed to two primary factors. First, many local governments have developed local collection programs at landfills, transfer stations, and county yards in response to the greater flexibility provided under the universal waste standards. These collection programs will provide a place for households and small quantity generators to take their solar modules. Second, these regulations will provide incentives to existing universal waste handlers and transporters to enter the new universal waste solar module handling market. This will increase opportunities for solar modules to be collected as part of existing universal waste collection efforts (e.g., curbside collection of electronic wastes and other household wastes), thus providing adequate collection and transport capacity for the growth anticipated in generation rates for waste solar modules over the next 5 to 10 years. These entities already collect and consolidate existing universal wastes, thus diverting them from the municipal landfills and funneling them to more environmentally protective destinations, such as lead smelters. DTSC believes that such existing infrastructure will also grow to accommodate universal waste solar modules.

The proposed regulations will also increase compliance simply by raising awareness. Many generators are still unaware that some solar modules are hazardous waste when they are discarded. By designating these wastes as universal waste and by defining the words “solar modules” in regulation, many generators will be alerted that these materials require proper handling. The universal waste standards are confined to a single chapter in the regulations and they are more easily applied by the diverse community of generators that this rule effects. Therefore, DTSC believes the universal waste standards themselves will help encourage and achieve increased compliance with the overall hazardous waste program.

Alternative 2: <u>For Non-RCRA Hazardous Waste, Conditional Exemption for Solar Modules that are Part of a Solar Module Vendor Reclamation Program</u>

DTSC will create through regulation an exemption in section 66261.6 similar to the exemption for scrap metal with the added caveat that the solar modules must be destined for reclamation. Reclamation is a form of recycling that requires that the solar modules be recycled to recover usable material and hazardous constituents which caused the solar module to be classified as hazardous waste.

The proposed regulations contain necessary requirements to be applied directly as conditions for obtaining the "self-implementing" exemption. This alternative could

effectively reduce or remove the regulatory requirements placed on the generators and transporters of solar modules. However, this alternative does not alleviate the requirement for a solar modules recycler (i.e., a facility that conducts treatment, including reclamation processes) to have a hazardous waste facility permit or other grant of authorization, if such activities are conducted in California. In addition, export to foreign countries will continue to be regulated as are other non-RCRA hazardous waste exports.

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. This new regulatory mechanism will also provide standards for such activities that will be protective of human health and the environment.

Based on DTSC's experience in managing other similar waste streams, such as electronic wastes, DTSC 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.

Alternative 3: For Non-RCRA Hazardous Waste, Conditional or Full Exclusion for Solar Modules

Exclude from hazardous waste management all discarded solar modules pursuant to California Health and Safety Code section 25143.2. Health and Safety Code section 25143.2, subdivision (d)(5) exempts non-RCRA hazardous wastes from the hazardous waste requirements when they are recycled in certain manners. Some solar modules may be RCRA hazardous waste, while other solar modules may not (i.e., non-RCRA hazardous waste). In order to exclude all solar modules under the federal hazardous waste management standards [pursuant to the recycling exemption of 40 C.F.R. §261.2, subsection (e)(1)(i) and subsection (e)(1)(ii)], an interpretation would need to be made that the solar modules are not reclaimed, which is a form of recycling to which the exemption does not apply. The proposed regulations contain a condition that requires that for the exemption to apply, the solar modules must be reclaimed to recover the hazardous constituents. That form of recycling is not allowable under either the federal exemption or through the exclusions offered under Health and Safety Code section 25143.2, subdivision (d)(5).

However, if this federal recycling exclusion could be applied, solar modules would become non-RCRA hazardous waste. Under this non-RCRA hazardous waste designation, the recycling exclusion of California Health and Safety Code section 25143.2 could be applied to the recycling of solar modules. However, prior

interpretations by DTSC of California Health and Safety Code section 25143.2 to other non-RCRA hazardous wastes recycling activities would be inconsistent with the interpretation that solar modules that are reclaimed, as proposed in these regulations, could be excluded under section 25143.2.

In addition, persons claiming recycling exclusions pursuant to the current hazardous waste control law incur greater regulatory duties than the proposed universal waste standards. Therefore, persons choosing to manage solar modules under this alternative would not realize a substantial decrease in the regulatory requirements. For instance, if this alternative were chosen, all persons managing solar modules would be required to submit a notification to local authorities and may be required to provide secondary containment during storage, and persons managing these wastes would have to keep records pursuant to Health and Safety Code sections 25143.9 and 25143.10. For these reasons, this conditional exclusion alternative was rejected.

DTSC also evaluated the alternative to establish a "full" exclusion for solar modules from the classification as a "waste" pursuant to section 66261.4. This alternative would also impose certain management conditions for solar modules as is discussed in Alternative 2. In theory, DTSC creates by regulation an exemption similar to the exemption for scrap metal with the added caveat that the solar modules must be destined for recycling. Necessary conditions could be applied directly as conditions for obtaining the exemption. This alternative could effectively reduce or remove the regulatory requirements placed on the generators and transporters of solar modules.

While this approach would completely eliminate all regulatory requirements and, therefore, encourage recycling, it would also allow unregulated export of solar modules. In the past few years, the exportation of electronic waste to China and other less developed countries has become a concern to the environmental community. Although DTSC has no jurisdiction outside of California, DTSC has rejected this alternative in part in an effort to maintain the ability to enforce the existing requirements for exports of hazardous waste (i.e., receipt of export notifications).

In addition, this alternative was also rejected for several other reasons:

- conditions placed on the management of a material is that is not a "waste" does not support the conclusion that the materials poses risk commensurate with other solid wastes, such as municipal solid wastes; and
- some solar modules have been found to meet the hazardous waste characteristics for certain heavy metals, thus not supporting a full exclusion.

Alternative 4: Do Nothing

Under existing hazardous waste control laws, all solar modules that fail a hazardous waste characteristic are hazardous waste when discarded. This current law subjects generators of these wastes to the hazardous waste generator standards, transporters to the manifesting and registration requirements, and facilities to the hazardous waste permit standards. Although, theoretically, this alternative ensures the greatest

protection of the environment, the regulatory requirements this alternative places on generators and transporters of solar modules could be construed as a disincentive to recycling.

If hazardous waste solar modules continue to remain subject to full hazardous waste requirements, the issuance of ID numbers to all generators of these waste categories, the registration of all transporters, the inspection and enforcement activities involved, and the issuance of hazardous waste permits to all storage facilities would require massive augmentation of both DTSC's and the Certified Unified Program Agencies' (CUPA) fiscal resources. Thus, it is not feasible to choose the "do nothing" alternative.

This alternative also fails to establish waste management standards for solar modules that are commensurate with the risks of these materials. DTSC has concluded that because solar modules are low risk and generated by a wide segment of society, the application of universal waste management standards for these wastes provides appropriate protection of the environment.

EVIDENCE SUPPORTING A DETERMINATION OF NO ADVERSE ECONOMIC IMPACT ON BUSINESS

DTSC has prepared an Economic Analysis/Assessment, STD. 399 (Rev. 2/98, electronic version 8-00) which describes the estimates of costs and savings to business in California potentially affected by these proposed regulations. DTSC is unable to estimate the cost or savings businesses would incur by managing solar modules as universal waste or as conditionally exempt hazardous waste. Data is not available on the number of waste solar modules generated by businesses. Because the average cost to recycle solar modules is unknown, DTSC concludes that private entities would incur nonquantifiable costs or savings to manage solar modules either as universal waste or as conditionally exempt hazardous wastes.

DTSC obtained its estimates on the number of small businesses in California based on information obtained at the California Employment Development Department's Labor Market Information for 2010. The estimates of the number of solar module manufacturers and installers in California were obtained from information provided by the Solar Energy Industry Association.

DUPLICATION OR CONFLICTS WITH FEDERAL REGULATIONS

Both the United States Environmental Protection Agency (U.S. EPA) and DTSC currently regulate the following hazardous wastes as universal wastes: batteries, lamps, and mercury containing-equipment. DTSC also regulates other hazardous wastes as universal waste, including electronic devices, cathode ray tubes (CRTs), and CRT glass. These other universal wastes are not regulated by U.S. EPA as universal wastes.

The proposed regulations will neither duplicate nor conflict with the federal regulations because solar modules are not included in the federal universal waste rule at this time.

Solar modules are not currently proposed by the U.S. EPA for inclusion under the federal universal waste program. DTSC is not aware that U.S. EPA has any future plans to include this category of wastes in the federal program.

DETAILED STATEMENT OF REASONS: SUMMARY AND RATIONALE

Amend Table of Contents:

Amend the Table of Contents for California Code of Regulations, title 22, division 4.5: chapter 23, sections 66273.7.1 and 66273.33. This amendment is made for clarity and consistency.

Amend the following sections contained in Chapter 10. Hazardous Waste Management System: General[2]

Amend Section 66260.10, Definitions: Two terms and their associated definitions are added to this section: solar module and solar module vendor. These definitions are added to chapter 10 as these terms are used within division 4.5. The term "solar module" is used in chapter 10 and chapter 23. This amendment is necessary to ensure that when this term is encountered in both chapters, persons can find an accurate definition in this section which serves as the primary location for definitions for this division.

Amend the following Sections of Chapter 11. Identification and Listing of Hazardous Waste

Amend Section 66261.6, Requirements for Recyclable Materials: This section establishes the requirements for recyclable materials, as defined in section 66260.10, which are generally hazardous wastes that can be recycled. "Recycled materials" are materials that are used, reused, or reclaimed. Further, "reclaimed" means that a material is processed to recover a usable product, or that it is regenerated. Examples of reclamation are recovery of lead values from spent batteries and regeneration of spent solvents (see section 66260.10). Reclamation of solar modules to recover semiconductor materials that are the basis for the solar module being hazardous waste is a form of recycling (i.e., hazardous waste treatment), and which is a hazardous waste management activity that falls under the department's statutory authority.

Subsection (a)(3) provides a list of materials and wastes that are not subject to regulations under division 4.5. However, waste listed in this subsection is subject to the requirements contained in each of the section(s) of the Health and Safety Code, or state or federal hazardous waste regulations specified for each. **Subsection (a)(3)(D)** has been added to include solar modules that are destined for reclamation as a category of hazardous wastes that are recyclable materials. The conditions placed on these solar modules are that the solar modules are reclaimed within the United States, that the

[2] Unless otherwise specified, all regulatory citations from this point forward are to the Cal. Code Regs., tit. 22, div. 4.5.

reclamation program is administered by a solar module vendor (as defined in section 66260.10), and that the solar modules are managed pursuant to the standards proposed in subsection (a)(8) of this section. These management conditions include standards for containment, accumulation, labeling, transportation, and export. In addition, as part of the conditions placed on solar modules managed under the proposed subsection, these solar modules are subject to full hazardous waste regulations once they arrive at a designated facility located in California (i.e., a facility that treats hazardous waste in accordance with a permit or other grant of authorization from the department). These management conditions established in this subsection for solar modules are necessary to ensure that solar modules handled under this "hazardous waste conditional exemption" are managed to protect public health and the environment.

Subsection (a)(8)(A) is added to clarify and establish the conditions on the exemption that solar modules managed under this subsection are required to be handled in a manner to prevent breakage of the solar modules, and are managed to prevent releases from solar modules or any hazardous component of the solar module to the environment (i.e., release of solar module hazardous constituents/components to air, water, or soil). This subsection is necessary so that persons who manage solar modules pursuant to this subsection should also plan for changing conditions that could cause releases, i.e., "reasonably foreseeable conditions."

Subsection (a)(8)(B) is added to establish that only intact solar modules are managed under the provision of this subsection. Intact solar modules, as described in the definition of solar module in section 66260.10, are non-functional modules that are complete with no component removed or missing (i.e., fragments of solar modules are not considered intact for purposes of this subsection). This subsection also establishes that solar modules or containers of solar modules that show evidence of leakage or breakage are to be managed in accordance with the containment standards provided in proposed section 66273.33, subsection (d) (universal waste solar module management requirements). These provisions are necessary to ensure that solar modules remain intact during handling and that any components or parts that may break off the solar modules are managed and contained appropriately.

Subsection (a)(8)(C) is added to establish the labeling requirements for solar modules or containers of solar modules managed pursuant to the provision of this subsection. Labeling is necessary to ensure that persons managing solar modules are aware of the contents and can distinguish solar modules from other types of wastes or containers of wastes that may look similar or be managed similarly to solar modules.

Subsection (a)(8)(D) is added to require that any spills or releases of solar modules or hazardous components thereof be cleaned up immediately and be managed pursuant to the requirements of proposed subsection (a)(8)(B) of this section. The term "immediate" is not defined by a time limit and is based on the judgment of the person responsible for the responding to the release. That person is responsible for determining the nature and extent of the spill or release as well as the appropriate

method(s) of cleanup. The requirements of this section are necessary to ensure that spills or releases are identified and adequately responded to so that releases to the environment are eliminated or minimized.

Subsection (a)(8)(E) is added to establish the requirement that solar modules managed pursuant to this subsection shall not be accumulated for longer than one year from the date the solar module became a waste. This accumulation time limit is necessary to provide enough time for the solar module vendor or generator to accumulate sufficient quantities for transportation and recycling purposes. Currently, waste solar modules are generated at a very low rate, perhaps one or two modules a month for large arrays. By providing a longer time to accumulate solar modules, the solar module generator or vendor will be able to lower their transportation costs for shipments to the reclamation facility. This requirement will also discourage stockpiling of waste solar modules. The containment and labeling standards of subsections (a)(8)(B) and (a)(8)(C) still apply during this one year period, as does the standard to prevent breakage under proposed subsection (a)(8)(A) of this section.

Subsection (a)(8)(F) is added to establish the requirements for transporters of solar modules. The transporter is required to manage the solar modules pursuant to the standards for universal waste transport, found in article 5 of chapter 23, Standards for Universal Waste Transporters. These requirements include, as applicable, prohibitions on disposal, dilution or treatment, containment standards, response to releases, transport in compliance with applicable U.S. Department of Transportation requirements, universal waste transfer facility storage limits, and export requirements as appropriate. The requirements of this section ensure that solar modules are transported in accordance with these existing universal waste standards, which provide adequate protection and are commensurate with lower risk wastes.

Subsection (a)(8)(G) is added to clarify that a transporter of solar modules can only transport these wastes to a reclamation facility located in the U.S. or its territories. This reclamation facility is designated by the solar module vendor for receipt of the solar modules. Limiting the reclamation facility location to the U.S. or its territories provides the appropriate restrictions so that export to a foreign country is not allowed under the conditions of this exemption, unless done so in accordance with the requirements of proposed subsection (a)(8)(H) of this section.

Subsection (a)(8)(H) is added to prohibit the export of solar modules to a foreign country, unless the export is conducted in accordance with the requirements for hazardous waste exports described in chapter 12 (specifically , article 5 of chapter 12, Exports of Hazardous Waste). The requirements of this subsection are necessary to ensure that hazardous waste exports from California to a foreign country are accomplished in accordance with existing federal and state hazardous waste export requirements. Those existing requirements contain certain pre-export notifications so that the U.S. EPA or DTSC may monitor export activities. In the case of solar modules, those requirements would be the export notification for non-RCRA hazardous waste as the provisions of the conditional exemption offered by this subsection only apply to non-

RCRA hazardous waste. Any person who exports solar modules becomes the primary exporter of non-RCRA hazardous waste, and assumes the responsibilities as such under article 5 of chapter 12.

Subsection (a)(8)(I) is added to require that solar modules managed pursuant to this subsection are to be recycled by being reclaimed only. No other forms of recycling are allowed for solar modules managed pursuant to this conditional exemption. Section 66260.10 defines "reclaimed" to mean that a material is processed to recover a usable product, or that it is regenerated. Recovery of the hazardous constituents which caused the solar module to be classified as hazardous waste (e.g., semiconductor materials) is an allowable form of reclamation under these provisions. This subsection also requires that the solar modules be reclaimed at a designated facility, as defined in section 66260.10 (e.g., a permitted hazardous waste facility). The limit on acceptable recycling activities is necessary to ensure that solar modules managed pursuant to this subsection are not recycled through reuse, for example, if hazardous waste solar modules are presumed being "reused" when they actually are exported to a foreign country where they are managed or mismanaged as waste.

Subsection (a)(8)(J): This subsection establishes the contents of the solar module vendor notification that is required under this subsection. The information contained in this notification is necessary so that the Department can contact the facility, record the location of the universal waste solar module handling activities, and document the types of solar modules managed at that location. This section is also necessary so that DTSC may obtain accurate information describing the operations of the persons who manage a solar module reclamation program for hazardous waste solar modules generated in California. This information is necessary to ensure that solar modules are managed appropriately, including the determination that reclamation activities are conducted in accordance with the conditions of this exemption.

The notification required in this subsection includes:

- **Subsection (a)(8)(J)1.a.:** The name of the solar module vendor.
- **Subsection (a)(8)(J)1.b.:** The Identification Number, either state or federal as applicable, of the solar module vendor.
- **Subsection (a)(8)(J)1.c.:** The telephone number of the solar module vendor.
- **Subsection (a)(8)(J)1.d.:** The mailing and physical addresses of the solar module vendor. Often times the physical location of the accumulation location is not the business mailing address for a given business entity. For this reason, this information is required in order to provide DTSC with a means to contact the solar module vendor via certified mail.
- **Subsection (a)(8)(J)1.e.:** The name the person who can be contacted at the solar modules vendor's site and who can address solar module reclamation program activities.
- **Subsection (a)(8)(J)1.f.:** The telephone number of the solar module vendor contact person.

- **Subsection (a)(8)(J)1.g.:** The email address of the solar module vendor contact person or organization, as appropriate for that organization. Some solar module vendors may be acting as third party entities, such as trade organizations.
- **Subsection (a)(8)(J)1.h.:** The types of solar modules expected to be managed by the solar module vendor as part of the reclamation program that they administer. Examples of types of solar modules include, but are not limited to, thin-film CdTe/CdS, thin-film CIGS/CdS, thin-film amorphous silicon, thin-film CIGS/InP, and/or crystalline silicon.
- **Subsection (a)(8)(J)1.i.:** The sources of the solar modules accumulated or collected by the solar module vendor. These source types include residential, commercial, or governmental entities.
- **Subsection (a)(8)(J)j.:** The name, address and contact person(s) name of the designated facility or location where the solar modules will be reclaimed.

Subsection (a)(8)(J)2.: This subsection establishes the requirement that DTSC be notified 30 day prior to any changes in the information provided pursuant to subparagraph (a)(8)(J)1. of this section. This requirement is necessary so that DTSC maintains current information on the location and types solar modules managed by solar module vendors subject to these provisions.

Subsection (a)(8)(J)3.: This subsection provides the mailing address to which notifications made pursuant to this subsection are mailed. Electronic notification is not currently available.

Amend Section 66261.9, Requirements for Universal Waste: This section designates the specific categories of hazardous wastes that are subject to regulation as universal wastes under chapter 23. **Subsection (a)(8)** is added to include solar modules as exempt from regulation under chapter 6.5 of the Health and Safety Code, if these solar modules are handled in accordance with management standards for universal waste found in chapter 23 in lieu of existing hazardous waste management standards.

This amendment is necessary because to manage solar modules under the universal waste regulations contained in chapter 23, solar modules must be specifically exempted from regulation under chapter 6.5 of the Health and Safety Code except as specified in chapter 23. It is necessary to exempt solar modules from the full hazardous waste requirements so that these solar modules may be managed solely pursuant to chapter 23, and are not subject to two sets of requirements.

Note however, that if a handler fails to properly manage universal waste pursuant to chapter 23, the waste is regulated as hazardous waste under chapter 6.5 of the Health and Safety Code and must be managed and disposed of accordingly.

Amend or Add the following Sections to Chapter 23. Standards for Universal Waste Management

Amend Section 66273.1, Scope: This section designates the specific categories of universal wastes that are subject to regulation under chapter 23. This section establishes chapter 23 requirements for the management of universal wastes. Chapter 23 management standards are an alternative to the existing hazardous waste management regulations found in chapters 10 through 16, 18, and 20 through 22 of this division.

This section parallels the language found in 40 C.F.R. section 273.1, except that several hazardous wastes have been added that are not presently included in the federal rule. Hazardous wastes that have been added to the state universal waste regulations by inclusion in this section are batteries, electronic devices, mercury-containing equipment, lamps, CRTs, CRT glass, and aerosol cans.

Subsection (a)(8): This new subsection is necessary to include solar modules in the list of universal wastes managed pursuant to the standards in chapter 23. This waste category is defined in section 66273.7.1 of the proposed regulations.

Add Section 66273.7.1, Applicability—Solar Modules: This section describes the solar modules covered under chapter 23.

Subsection (a) is added to require persons who manage solar modules, as defined in section 66273.9, to manage those solar modules in accordance with the applicable requirements contained in chapter 23. This subsection is necessary to clarify who must comply with the requirements of chapter 23 when they manage specifically-defined solar modules.

Amendments are made in this section to clearly limit the applicability of chapter 23 to only those universal waste solar modules that are destined for recycling. This limitation will provide an additional incentive to recycle hazardous waste solar modules. To achieve this result, it is necessary to add **subsection (b)** to make the universal waste standards **inapplicable** to solar modules that are not yet wastes, destined for disposal as hazardous waste, managed as hazardous waste (i.e., manifested), exempted under other provisions of the regulations, or returned to service as a useable product.

Subsection (b)(1) is added to clarify and establish that solar modules that are not yet a waste, as specified in subsection (c) of this section, are not to be managed under this chapter. Solar modules that are not a waste are not regulated under this division.

Subsection (b)(2) is added to clarify and establish that solar modules that do not exhibit a characteristic of hazardous waste, and that are otherwise not identified as hazardous waste pursuant to chapter 11 (such as some listed hazardous wastes containing mercury pursuant to chapter 11, article 4.1), are not to be managed under chapter 23 (i.e., they are not hazardous waste subject to regulation under this division).

Subsection (b)(3) is added to clarify and establish that solar modules that are being recycled through being disposed are not eligible for management as universal waste pursuant to chapter 23. Amendments have also been made in this subsection that

clearly identify for the regulated community those hazardous waste solar modules that are not eligible for management under chapter 23 standards, even when being recycled. In such cases, these universal waste solar modules must be managed appropriately as hazardous waste.

Subsection (b)(4) is added to clarify and establish that solar modules that are managed as hazardous waste must continue to be managed in accordance with the applicable portions this division, namely chapters 10 through 16, 18, and 20 through 22 (i.e., once a discarded solar module is managed as a fully-regulated hazardous waste, it is no longer eligible for management under chapter 23 standards).

Subsection (b)(5) is added to clarify that solar modules that are managed pursuant to the proposed conditional exemption in subsection 66261.3 (a)(3)(D) are ineligible for management under chapter 23. This subsection is necessary to clarify that once a generator makes the decision to manage the hazardous waste solar modules under the section 66261.3 conditional exemption for recyclable materials, those standards apply fully to the management of those hazardous waste solar modules. In making that management decision, the hazardous waste generator is bound by the subsection 66261.3 (a)(3)(D) proposed standards.

Subsection (b)(6) is added to clarify and establish that solar modules that were previously identified as wastes, but have been refurbished and returned to service as a serviceable solar module are not required to be managed further as universal waste until they are discarded. This subsection is necessary to promote refurbishment of waste solar modules, thus promoting reuse of solar modules that remain serviceable.

Subsection (c)(1)(A) is added to clarify and establish that a used solar module becomes a waste on the date that the solar module is discarded (e.g., solar module is removed from service without the intent to re-install it). Once it is considered a waste, the generator must determine whether it is a hazardous waste by demonstrating that the waste is a listed waste or that it exhibits one or more hazardous waste characteristics, and subsequently whether it meets one of the universal waste categories. This section is necessary to clarify at what time a generator must decide that a solar module becomes a waste. This determination is necessary to ensure that the waste is properly managed under the applicable and appropriate waste management system (i.e., full hazardous waste management or universal waste management).

Subsection (c)(1)(B) is added to clarify that a solar module becomes a waste that is subject to chapter 23 on the date when it is first damaged, deteriorated, altered, or is cracked, fractured, fragmented, or otherwise no longer intact,

Subsection (c)(2) is also added to clarify that an unused solar module that is not a retrograde material becomes a waste on the date it is discarded (e.g., stored prior to being sent for reclamation). If an unused solar module is a retrograde material, the unused solar module becomes a waste on the date that it becomes a recyclable material pursuant to subsection (e) of the definition of “recyclable materials” in section

66260.10 (the definition of “recyclable material” also includes the conditions under which “retrograde material” becomes a waste). These amendments are necessary to clarify for universal waste handlers who reclaim unused solar modules when they are subject to requirements of chapter 23. These amendments are necessary to ensure that entities that handle universal waste solar modules understand when a solar module is a waste and when it is not a waste.

Subsection (d) is added to clarify and establish that a respondent in an enforcement case who makes a claim that a solar module is not a waste bears the burden of demonstrating that there is a known market or disposition for its use as a solar module. This requirement is necessary to establish the respondent in an enforcement action – not the enforcement agency (e.g., DTSC or a CUPA) is responsible for demonstrating proof of market or disposition. This requirement is necessary to facilitate DTSC inspection and enforcement activities.

Amend Section 66273.9, Definitions: This section defines the terms used in chapter 23. The definition added to this section is consistent with that added to chapter 10 of this division, where applicable.

Add the definition of “Solar module”: The definition is added to the section as it is necessary to clarify the use of the term for purposes of this chapter.

Amend Section 66273.32, US EPA Notification, Department Notification, and Reporting Requirements for Universal Waste Handlers: This section prescribes the notification and Identification Number requirements for handlers of all universal wastes. This section is amended to establish additional notification requirements for certain handlers of solar modules into this section similar to existing notification requirements for handlers of universal waste electronic devices, CRTs, and CRT glass.

Subsection (g) is added to require notification to DTSC by universal waste handlers who accept more than 10,000 kilograms of solar modules (approximately 550 solar modules) from all offsite sources, calculated collectively in a calendar year. This notification must be made 30 calendar days prior to reaching that accumulation limit at any one time for universal waste solar modules. The information required for this notification is similar to existing notification requirements contained in the current universal waste regulations for handlers who accept certain electronic wastes. This timeframe allows DTSC enough time to coordinate any facility inspections or notification to local agencies that might be necessary to implement these regulations.

The amount of solar modules that a facility accepts is a good indicator of the total quantities of waste that the facility is handling, it is easily verified by regulating agencies through an inspection of the facility, and it is a good indicator of the risk posed by the management of solar modules at the handler’s facility.

This section is necessary so that DTSC may obtain accurate information describing the operations of the persons who accumulate certain quantities of universal waste solar

modules in the state. This information is also necessary to ensure that solar modules are managed appropriately and to assist DTSC with compliance assistance.

Subsection (g)(2): This subsection establishes the contents of the notification that is required under this subsection. The information contained in this notification is necessary so that the Department can contact the facility, record the location of the universal waste solar module handling activities, and document the types of solar modules managed at that location. The notification must include:

- **Subsection (g)(2)(A):** The name of the universal waste handler of solar modules.
- **Subsection (g)(2)(B):** The Identification Number, both federal or state as applicable, of the universal waste handler of solar modules.
- **Subsection (g)(2)(C):** The telephone number of the universal waste handler of solar modules.
- **Subsection (g)(2)(D):** The mailing address of the universal waste handler of solar modules. Often times the physical location of the accumulation or generation location is not the business mailing address for a given business entity. For this reason, this information is required in order to provide DTSC with a means to contact a given universal waste handler via certified mail.
- **Subsection (g)(2)(E):** The name the person who can be contacted at the handler's site and who can address universal waste management activities.
- **Subsection (g)(2)(F):** The telephone number of contact person.
- **Subsection (g)(2)(G**): The email address of the contact person or organization, as appropriate for that organization.
- **Subsection (g)(2)(H):** The types of solar modules accepted by the universal waste handler. Examples include, but are not limited to, thin-film CdTe/CdS, thin-film CIGS/CdS, thin-film amorphous silicon, thin-film CIGS/InP, and/or crystalline silicon.
- **Subsection (g)(2)(I):** The sources of the solar modules accumulated or collected by the universal waste handler. These source types include residential, commercial, or governmental entities.

Subsection (g)(3): This subsection establishes the requirement that DTSC be notified within 30 days, of any changes in the information provided pursuant to subsections (g)(1) and (g)(2) of this section. This requirement is necessary so that DTSC maintains current information on the location and types solar modules managed by universal waste handlers subject to these provisions.

Amend Section 66273.33, Universal Waste Management Requirements for Batteries, Lamps, Mercury-Containing Equipment, and Solar Modules: This section contains waste management requirements for all universal wastes except CRT devices, CRTs, and CRT glass (which are found in existing section 66273.33.5). This section specifies the waste management requirements with which handlers of universal waste must comply. Amendments also require that a handler of universal waste, who handles universal wastes under this section, and subsequently generates other waste

that exhibits characteristics of hazardous waste, manage those wastes in compliance with the applicable hazardous waste requirements of this division. Those requirements include applicable standards for hazardous waste generators found in chapter 12 of this division.

Subsection (d) is added and establishes the waste management requirements for universal waste handlers of solar modules. This language is similar to the requirements for handlers of the other waste categories contained in this section. The subsection is necessary to clarify the management methods that are required to prevent releases to the environment and to make the management standards for universal waste handlers of solar modules consistent with the requirements for the other waste categories covered under this section.

Subsection (d)(1)(A) is added to establish and clarify that universal waste handlers of solar modules shall also comply with any applicable requirements of article 3 of this chapter. These requirements include prohibitions on disposal, appropriate notification, labeling and marking, accumulation time limits, personnel training, response to releases, offsite shipments, and tracking shipments. This language is necessary to provide these universal waste handlers with a list of applicable requirements to facilitate compliance with this chapter in the management of universal waste solar modules.

Subsection (d)(1)(B) is added to clarify that, in managing solar modules, a universal waste handler of solar modules shall prevent releases of any universal waste or component of that universal waste to the environment (e.g., a release of a hazardous constituent to air, water or soil) under reasonably foreseeable conditions. The requirements of this subsection are consistent with existing universal waste management standards, and are necessary to ensure that handlers of solar modules plan for changing conditions, i.e., “reasonably foreseeable conditions.”

Subsection (d)(1)(B)1.a is added to specify general containment requirements, which include the requirements that solar modules be managed in a manner that prevents breakage and release of hazardous components to the environment. Again, conditions that constitute a release to the environment are discussed in subsection (d)(1)(B), above. This subsection is necessary to clarify that, notwithstanding the regulations’ absence of prescriptive management requirements, solar modules must be managed in ways that prevent breakage during handling (e.g., by using appropriate packaging materials). Similarly, this subsection is necessary to also clarify that any container a handler opts to use must prevent releases to the environment during management under reasonably foreseeable conditions.

Subsection (d)(1)(B)1.b is added to allow the management of intact solar modules (e.g., solar modules that are complete with no component removed or missing) that may be palletized (e.g., using stretch-film to contain the solar modules on the pallet) as long as the solar modules are managed to prevent breakage and releases of hazardous components to the environment. This subsection also requires universal waste handlers of solar modules to plan for “reasonably foreseeable conditions” that could

result in a release to the environment from inadequate structural integrity of intact solar modules. This subsection is necessary to clarify the requirements for palletized solar modules so that handlers manage them to prevent breakage and releases to the environment. The containment requirements for palletized solar modules are the same as for individual solar modules or containers of solar modules (see above).

Subsection (d)(1)(B)2. is added to clarify that broken solar modules (e.g., fractured or fragmented pieces of the solar module) shall be immediately cleaned up when the solar module is unintentionally or accidentally broken, and if that broken solar module is reasonably expected to cause a release to the environment (e.g., a release of a hazardous constituent to air, water, or soil). The term "immediate" is not defined by a time limit and is based on the judgment of the person responsible for the responding to the release. That person is responsible for determining the nature and extent of the spill or release as well as the appropriate method(s) of cleanup. The requirements of this section are necessary to ensure that spills or releases are identified and adequately responded to so that releases to the environment are eliminated or minimized.

Subsection (d)(2) is added to allow limited treatment of solar modules without prior authorization from DTSC. Treatment activities are limited to removing junction boxes and junction box cables, provided that the solar module remains intact and the original shape and size of the solar module is not altered. The allowance of limited treatment activities is necessary so that junction boxes and junction box cables can be removed prior to transport. By allowing the removal of these components, solar modules can be packaged and recycled more efficiently by removal of potentially non-hazardous components. The standard to prevent breakage in subsection (d)(1)(A) of this section still applies during this treatment activity.

Subsection (d)(3) is added to clarify that when a universal waste handler of solar modules removes a junction box, junction box cables or other materials that may be waste, that handler is required to classify those wastes and manage them appropriately. If those wastes are determined to be classified as hazardous waste, then the handler is required to manage those hazardous wastes pursuant to applicable standards of division 4.5, including hazardous waste generator standards prescribed in chapter 12 of the division. This subsection is necessary to clarify the applicability of hazardous waste regulations to any materials remaining after this limited treatment of the solar modules is complete. If the wastes are determined to not be hazardous wastes, then the handler is required to manage those wastes in accordance with any applicable federal, state, or local solid waste regulation.

Amend Section 66273.34, Labeling/Marking: This section establishes the labeling and marking descriptions for each universal waste category. This section requires a universal waste handler of solar modules to label or mark universal waste solar modules individually or the containers of universal waste solar modules.

These amendments establish the labeling and marking descriptions for each container or pallet in or on which solar modules must be contained. For solar modules that are

palletized, it is not necessary to require that each container be labeled or marked because, typically, palletized loads are covered in plastic stretch-film (i.e., a single label may be affixed to the outermost stretch-film). This section parallels the language established for each of the other universal waste categories regulated by this section. Amendments made to this section are necessary to establish and maintain a consistent labeling and marking requirement applicable for each of the universal waste categories.

Subsection (g) is added to establish and clarify the labeling and marking descriptions for solar modules. Each solar module or each container or package that holds such waste is required to be clearly labeled or marked with the waste description using the following phrases: "Universal Waste—Solar Module(s)." This subsection is necessary to establish and maintain a consistent labeling and marking requirement for each universal waste category.

Subsection (i) is added to allow the accumulation, segregation, and management of larger quantities of solar modules by handlers. The amendments include allowing the accumulation of universal waste solar modules in a designated area if the boundaries are labeled with the words typically used to label containers or pallets of universal waste solar modules. This subsection is necessary to accommodate the labeling of large shipments of solar modules without the need to label individual solar modules or each container thereof.

Amend Section 66273.36, Personnel Training: This section specifies the training requirements for personnel who handle or manage universal waste at universal waste handler facilities. **Subsection (b)(1)** is amended and is necessary to include examples of hazards associated with solar modules, which can include toxic metals such as cadmium, lead, or selenium. These examples, which are specific to solar modules, have been added to the list of examples of types and hazards associated with universal waste. Knowledge of these hazards is a required element of the training materials described in this section.

Amend Section 66273.39, Tracking Universal Waste Shipments: This section specifies the record keeping requirements for shipments of universal wastes. This section creates a basic record keeping requirement to track universal waste shipments arriving and leaving universal waste handler facilities. Under existing universal waste standards, a uniform hazardous waste manifest is not required for off-site shipments. **Subsections (a)(2) and (c)(2)** are amended to include solar modules in the list of universal wastes contained in the parenthetical phases. This section requires that receipts of shipments (both received and shipped offsite) contain quantity information for each type of universal waste received or shipped. This amendment is necessary for clarity and consistency with existing standards for universal waste shipment record keeping.

Amend Article 5, Standards for Universal Waste Transporters, Section 66273.51, Prohibitions: This section prohibits a universal waste transporter from disposing of, diluting, or treating universal waste except in certain instances such as responding to releases (section 66273.54) or managing universal waste pursuant to section

66273.33..5. As used here, “disposing” means the transporter disposing directly onto land, into the municipal waste stream, or into a non-hazardous landfill. It does not mean a handler cannot send or take universal wastes waste offsite for proper hazardous waste disposal or recycling.

Subsection (e) is added to facilitate collection and transport of small quantities of solar modules by universal waste transporters without being subject to the containment standards described in proposed section 66273.33, subsection (d)(1)(B). This amendment is necessary to allow handlers to transport no more than 100 kg (or 220 lbs.) of solar modules without containerization, which is equivalent to approximately five solar modules, and is consistent with the existing quantity limits for CRTs and electronic devices as prescribed in existing subsections (c) and (d) of this section, respectively.