

Form 399 - ATTACHMENT TO ECONOMIC AND FISCAL IMPACT STATEMENT
Photovoltaic Modules (PV Modules) – Universal Waste Management

This document details the background of the economic and fiscal impacts of Department of Toxic Substances Control's (DTSC's) proposed regulation to allow waste photovoltaic modules to be managed in accordance with California Standards for Universal Waste Management, found in California Code of Regulations, title 22, division 4.5, chapter 23.

Background

California's universal waste program, modeled after the federal Universal Waste Rule (40 Code of Federal Regulations part 273), was adopted into regulation in 2002. It provides a set of simplified hazardous waste management standards for a subset of hazardous wastes, which include batteries, electronic devices, lamps, mercury-containing equipment, cathode ray tubes, cathode ray tube glass, and aerosol cans. Universal wastes are generated by various entities, such as retail stores, office buildings, and households. Universal wastes are considered low-risk hazardous wastes due to their composition, management, and the quantity and the rate generated. The requirements of the universal waste program include:

- 1) Allowing generators to ship universal wastes without a hazardous waste manifest and without using registered hazardous waste transporters;
- 2) Removing requirements for generators to prepare biennial reports, contingency plans, and land disposal restriction notifications;
- 3) Allowing simpler training for employees; and
- 4) Increasing the accumulation time that generators can store universal wastes without obtaining a hazardous waste facility permit.

Need for Regulation

Many waste photovoltaic modules (hereinafter referred to as waste PV modules) are hazardous wastes due to the presence of metals (e.g., cadmium, copper, lead, and selenium),¹ which results in them exhibiting the hazardous waste characteristic of toxicity. Waste PV modules that fail the federal hazardous waste criteria for toxicity are regulated under the U.S. Resource Conservation and Recovery Act (RCRA) and are considered a RCRA hazardous waste.

Managing hazardous waste PV modules as fully regulated hazardous waste reduces environmental and human health risks associated with their management and disposal. However, generators of hazardous waste PV modules do not always manage them in compliance with the regulations, partly because they fail to recognize PV modules may be hazardous based on their appearance (i.e., they don't "look" hazardous). Another factor associated with mismanagement of waste PV modules is that generators must

¹ "End-of-Life Management: Solar Photovoltaic Panels," International Renewable Energy Agency and International Energy Agency Photovoltaic Power Systems (IRENA and IEA-PVPS) (2016). Available at http://www.irena.org/DocumentDownloads/Publications/IRENA_IEAPVPS_End-of-Life_Solar_PV_Panels_2016.pdf

determine the presence and quantity of toxic substances, which requires time and cost associated with sampling and laboratory testing, and may discourage generators of waste PV modules from making these determinations. Failure to properly handle and dispose of hazardous wastes increases the risk for adverse impacts on human health and the environment. In the absence of government intervention, generators may continue to improperly and illegally dispose of hazardous PV modules in nonhazardous municipal solid waste landfills.

As of 2018, the number of PV modules managed as waste in California and the number of hazardous waste PV modules are relatively low. These numbers are expected to rise as more PV modules are installed and those that expire are replaced, prompted by California's initiatives to promote the use of renewable energy throughout the state.²

Categorizing PV modules as a universal waste significantly simplifies the waste management process, reduces the regulatory burden and cost, and provides an incentive for generators to properly manage and dispose of waste PV modules. Imposing universal waste regulations on PV modules at this time is beneficial, as their popularity grows and market demand for energy alternatives accelerates, with a resulting increase in the generation of waste.

Proposed Regulation

Under the proposed regulation, any person who generates, transports, treats, or stores hazardous waste PV modules has an option to manage these wastes as universal waste pursuant to California's Standards for Universal Waste Management, rather than California's full hazardous waste management requirements.

The proposed regulations will extend universal waste responsibilities and authorities to handlers of PV modules. Key provisions include the following:

- PV modules managed under the proposed regulation are not counted toward a business's hazardous waste generator status (i.e., large versus small quantity generator).
- All universal waste handlers must manage PV modules in a manner that prevents unauthorized releases to the environment.
- The containers that store PV modules must be labeled to easily identify their contents.
- Generators of PV modules may ship PV modules to handlers without using a hazardous waste manifest or a registered hazardous waste transporter.
- Other management standards include accumulation time limits, employee training, off-site shipment requirements, export requirements, notification, reporting and tracking requirements.
- Handlers may remove user-replaceable parts to facilitate their refurbishment, and/or dismantle PV modules into components for recycling prior to shipping, storing, or recycling them.

² California Renewables Portfolio Standard Program: Emissions of Greenhouse Gases, S. 100, Sess. Of 2018 (CA. 2018).

- Universal waste handlers of PV modules may conduct treatment specified in the proposed regulations and be deemed authorized by DTSC to do so if they comply with specific requirements outlined in the proposed regulations.

Economic Impact Statement

A. ESTIMATED PRIVATE SECTOR COST IMPACTS

The following parameters were used to estimate cost impacts:

Baseline Parameters	With Regulation Parameters
<p>All generators of waste PV modules who have determined that the PV modules are hazardous are subject to full hazardous waste management requirements.</p>	<p>All generators of waste PV modules may elect to manage their PV modules as universal waste. They do not need to make a hazardous waste determination if the modules are managed as universal waste.</p>
<p>Requirements for hazardous waste generators:</p> <ul style="list-style-type: none"> A. Acquire Identification Number B. Comply with accumulation time limit requirements C. Comply with hazardous waste label requirements D. Have emergency procedures/contingency plans E. Train employees F. Ship using a manifest and registered transporter G. Submit a biennial report if RCRA large quantity generator H. Maintain records for at least 3 years 	<p>Requirements for universal waste generators:</p> <ul style="list-style-type: none"> A. Do not require an Identification Number before accumulating 5,000 kg of universal waste B. Comply with longer accumulation time limit requirements C. Comply with universal waste label requirements D. Have emergency procedures, but not required to have contingency plans E. Train employees F. Transport universal waste using a shipping document in one's own vehicle or by a common carrier as allowed by U.S. Department of Transportation (DOT) and California law; Send universal waste to a universal waste handling facility that collects or recycles universal waste PV modules G. Do not require to submit a biennial report H. Do not require record maintenance

Baseline Parameters	With Regulation Parameters
<p>All generators send their waste PV modules to 10 disposal facilities evenly distributed geographically throughout the state that are authorized to accept PV modules because there are no recycling options available in California as of 2019.</p>	<p>All generators send their waste PV modules to universal waste handlers in California that comply with the self-implementing authorization requirements under chapter 23. There are approximately 10 universal waste handlers authorized in California, evenly distributed geographically throughout the state.</p>
<p>Disposal facility requirements:</p> <ul style="list-style-type: none"> A. Obtain Identification Number for each site that generates hazardous waste B. Comply with requirements for use and management of hazardous waste containers C. Have emergency procedures and contingency plans in place D. Train all employees to ensure they are thoroughly familiar with proper waste handling and emergency procedures E. Ship using only transporters that are registered or permitted by DTSC and comply with U.S. DOT requirements; Use a uniform hazardous waste manifest to accompany hazardous waste from the point of generation to the point of ultimate disposal F. Maintain records for at least 3 years G. Submit a biennial report 	<p>Universal waste handler requirements:</p> <ul style="list-style-type: none"> A. Obtain Identification Number for each site that handles universal waste B. Store PV modules for no more than one year from the accumulation start date; Document accumulation time; Label universal waste PV modules C. Conduct authorized treatment D. Train employees in proper universal waste management including handling, packaging, storing and labeling the waste, and in how to respond to releases E. Only ship universal waste to a destination facility Comply with applicable U.S. DOT rules; Prepare shipping documents; When sending universal waste outside of the country, comply with regulations addressing universal waste export F. Keep records of all shipments and receipts of universal waste for 3 years G. Do not require to submit a biennial report H. If a universal waste handler of PV modules decides to dispose of the PV modules or any components resulting from the authorized treatment of PV modules, they must manage them as hazardous waste, outlined in the baseline parameters.

3. Enter the total number of businesses impacted: Approximately 3,000

Describe the types of businesses (Include nonprofits):

The proposed regulation impacts those who generate, transport, treat, and store PV modules. Most PV modules are generated during four life cycle phases:

- 1) Manufacturing;
- 2) Transportation;
- 3) Installation, maintenance, and servicing during use; and
- 4) End-of-life, when the PV modules are taken out of service.

The types of businesses that are expected to be impacted include PV module manufacturers, installers or developers,³ service companies, utilities, and organizations that install PV modules for their businesses or customers.

As of 2017 the Solar Energy Industries Association,⁴ a PV module industry association, indicates that there are approximately 28,906 businesses in California that may generate, manage, or handle waste PV modules. The number includes the following businesses:

- 493 PV module manufacturers, including companies that manufacture photovoltaic cells encapsulated in glass. Manufacturers also include distributors and companies that assemble PV modules.
- 1,449 PV module installers/developers that install PV modules.
- 901 businesses that provide services, such as maintenance, for PV module installations.
- 26,057 buildings (nonresidential) with rooftop installations, which include commercial, industrial, business-owned, school, and hospital facilities.
- 6 utility companies that own and operate 455 utility-scale PV module installations that generate electricity to augment other sources of electricity to meet customer demands.

As of 2018, there are no businesses in California with a hazardous waste facility permit to store or treat PV modules. However, during a stakeholder workshop held by DTSC on August 22, 2017, businesses that currently manage and recycle universal waste electronic devices (e-waste) expressed interest in potentially expanding their operations to manage waste PV modules. (As of 2018, 25 e-waste recyclers operate in California.)⁵ It is unclear whether these businesses will modify their operations to manage hazardous waste PV modules or develop new and separate businesses to perform a similar role.

Although DTSC estimates that 28,906 businesses in California may generate, manage, or handle waste PV modules in the future, businesses with rooftop installations (a total of 26,057) are not anticipated to generate waste PV modules for their expected service

³ A developer arranges for the design, permitting, financing and installation of a solar energy system on a customer's property through an agreement: <https://www.seia.org/research-resources/solar-power-purchase-agreements>

⁴ SEIA/GTM Research U.S. Solar Market Insight.

⁵ Approved Recyclers in Covered Electronic Waste Payment System of the Department of Resources Recycling and Recovery (CalRecycle). See page 2 in the following link: <https://www.calrecycle.ca.gov/docs/cr/Electronics/CEW/ProgramStats.pdf>

life of 30 years.⁶ DTSC assumes that businesses and residences with rooftop PV installations have warranties that cover the service life of their PV modules, and that removal of any waste PV modules is covered under warranty. Under the warranty, service providers are responsible for PV modules that are discarded from rooftop installations and act as generators. Thus, the total number of businesses used to estimate the economic impact is 2,849.

Enter the number or percentage of total businesses impacted that are small businesses: Approximately 98.3%

Government Code section 11346.3 defines a small business as any business that employs fewer than 100 employees. According to 2016 labor market information from the California Employment Development Department (the most current full year of data available),⁷ 98.3 percent of all businesses in California employ less than 100 employees. DTSC does not have any other information indicating to what degree small businesses are impacted. Therefore, DTSC estimates that 98.3 percent of the businesses impacted by the proposed regulation are small businesses.

4. The number of businesses created or eliminated within the State of California

Created: Unknown; eliminated: None

The use of PV modules continues to grow as demand for alternative energy in California increases. The increase in the number of PV modules installed will ultimately lead to an increase in the number of waste PV modules generated when they are taken out of service. PV modules that are determined to be hazardous waste must be handled as any other hazardous waste, and are subject to the requirements for fully regulated hazardous waste.

DTSC anticipates that the number of hazardous waste PV modules generated in the future will be the same whether or not DTSC adopts the proposed regulation. These hazardous waste PV modules must be managed as hazardous wastes and shall be sent to businesses that possess hazardous waste facility permits from DTSC, or appropriate permits issued by the state where the destination facility is located, to accept and manage them. As of 2018, very few waste management businesses carry out PV module management because only a limited amount of these wastes is being generated from a limited number of generators.⁸

The proposed universal waste management requirements reduce the burden for businesses that receive, handle, and treat waste PV modules (e.g., remove user-replaceable components, dismantle or manually segregate components from PV

⁶ End-of-Life Management: Solar Photovoltaic Panels, International Renewable Energy Agency and International Energy Agency Photovoltaic Power Systems (IRENA and IEA-PVPS) (2016). Available at http://www.irena.org/DocumentDownloads/Publications/IRENA_IEAPVPS_End-of-Life_Solar_PV_Panels_2016.pdf

⁷ California Employment Development Department's Labor Market Information for 2016. https://www.labormarketinfo.edd.ca.gov/LMID/Size_of_Business_Data_for_CA.html

⁸ <https://www.solarpowerworldonline.com/2018/04/its-time-to-plan-for-solar-panel-recycling-in-the-united-states/>

modules). As more PV modules become wastes, DTSC anticipates more businesses will be created or expanded in California to accept and manage these wastes. At this time, DTSC cannot predict the number of businesses that might be created.

DTSC does not anticipate the proposed regulation will result in elimination of businesses in California.

6. The number of jobs created or eliminated within the State of California

Created: Unknown; eliminated: None

As discussed in A.4. above, DTSC predicts an increase in PV module installation across all sectors as the demand for alternative energy increases, which will ultimately lead to an increase in the number of waste PV modules as they are taken out of service. As more PV modules become wastes, DTSC anticipates more businesses will be created or expanded in California to accept and manage these wastes. These businesses will likely add employees to manage the added work. Therefore, DTSC does not anticipate the proposed regulation will result in elimination of jobs in California. Also, new businesses created as a result of the proposed regulation will likely hire employees to manage PV modules. At this time, DTSC cannot estimate the number of jobs that might be created.

Describe the types of jobs or occupations impacted

Regulating PV modules as universal waste will incentivize proper collection, transportation, and disposal or recycling of waste PV modules, like other universal wastes such as batteries and electronic devices, which consumers and businesses are more familiar with. An entity managing PV modules according to universal waste standards will have confidence its operations are lawful and with the benefit of the reduced cost and time universal waste standards afford. Businesses that manage waste PV modules will be similar to those that manage e-waste, another type of universal waste. Types of occupation employed by these businesses are handlers, transporters, sorters, shredder operators, materials coordinators, and recycling specialists, as well as business support positions, such as administration.

B. ESTIMATED COSTS

1. What are the total statewide dollar costs that businesses and individuals may incur to comply with this regulation over its lifetime?

First, the proposed regulation does not impact the requirements for disposal of hazardous PV modules. The costs associated with transporting hazardous waste PV modules to a permitted hazardous waste disposal facility via a registered hazardous waste transporter remain the same for both the baseline and with regulation.

Second, a unit cost, defined as the total estimated expenditure incurred by a single business to comply with a regulation, is estimated for both the baseline and with regulation. The unit cost is categorized into one-time costs, fixed annual costs, and variable costs, which are further divided into specific line items. Total costs, calculated

by multiplying the estimated unit costs by the total number of businesses, vary between generators and disposal facilities. Please see the Appendix, which details the methodology DTSC used to calculate these costs.

Table 1 is a summary of one-time costs, fixed costs, and variable costs estimated for generators and disposal facilities, for the baseline and with regulation. The total cost estimated for generators with regulation is lower than that of the baseline. For handlers, a slight increase in the total cost is estimated after the proposed regulation is adopted, mainly due to having to add a new waste stream to the business and becoming familiar with a new regulation. DTSC assumes that these costs will be passed back on to generators as universal waste disposal fees.

Table 1. Costs for Generators and Disposal Facilities/Handlers – Baseline and With Regulation

COST CATEGORY	NO ACTION ALTERNATIVE (BASELINE)		WITH REGULATION		COSTS OR SAVINGS	
	Generators	Disposal Facilities	Generators	Handlers ¹	Generators	Handlers ¹
One-time Costs	\$23,814	\$74,430	\$12,250	\$19,034	-\$11,564	-\$55,396
Fixed Annual Costs	\$6,028,484	\$772,080	\$3,894,583	\$42,970	-\$2,133,901	-\$729,110
Variable Costs	\$135,325,677	\$122,464,043	\$125,580,444	\$123,403,318	-\$9,745,232	\$939,276
Total Costs	\$141,377,975	\$123,310,553	\$129,487,277	\$123,465,322	-\$11,890,697	\$154,770
Total Costs (Generators and Disposal Facilities / Handlers)	\$264,688,527		\$252,952,600		-\$11,735,928	

¹ Handlers refer to universal waste handlers who treat and store waste PV modules who are authorized to accept PV modules as universal waste. Once handlers dispose of waste PV modules, they become generators of hazardous waste and must comply with full hazardous waste disposal requirements.

The difference in costs associated with the baseline and with regulation are presented in **Table 2** to compare and predict the economic impact of the proposed regulation. DTSC estimates cost savings of \$11,890,697 for generators and additional costs of \$154,770 for universal waste recyclers/handlers annually. The majority of cost savings if the regulations are enacted will result from a reduction in the fixed annual costs for generators, largely because they will no longer need to manage PV modules as a fully regulated hazardous waste and ship PV modules on a manifest or prepare biennial reports. Most notably, because there are currently no recycling markets for PV module glass in California, the variable costs under both the baseline and with regulation are nearly identical. Generator fee liability will shift from generators to universal waste handlers under the proposed regulation. DTSC anticipates that rates that universal waste handlers will charge to handle PV modules, once new businesses are created to manage waste PV modules, will be adjusted to account for all variable costs and will be passed back to generators for universal waste disposal.

Table 2. Costs Comparison for PV Modules Generators and Disposal Facilities/Universal Waste Handlers Before and After the Proposed Regulation

COST CATEGORY	GENERATORS		DISPOSAL FACILITIES / HANDLERS	
	Cost Savings	Change from Baseline (%)	Cost Savings	Change from Baseline (%)
One-Time Cost Savings	\$11,564	48.6	\$55,396	0.0
Fixed Annual Cost Savings	\$2,133,901	35.4	\$729,110	94.4
Variable Cost Savings	\$9,745,232	7.2	-\$939,276 ¹	-0.8
Total Cost Savings	\$11,890,697	8.4	-\$154,770 ¹	-0.1

¹The increased costs to PV module handlers is attributable to the Generator Fee. Under the baseline scenario, the PV module generators pay the Generator Fee. Under the post-rule scenario, the PV module universal waste generators are not subject the Generator Fee, but the PV module universal waste handlers become subject to the generator fee for the PV module waste being sent for disposal as hazardous waste.

3. If the regulation imposes reporting requirements, enter the annual costs a typical business may incur to comply with these requirements. Include the dollar costs to do programming, recordkeeping, reporting, and other paperwork, whether or not the paperwork must be submitted.

Currently, generators that are RCRA Large Quantity Generators of hazardous waste PV modules are required to submit a biennial report. DTSC estimates the annualized cost of reporting to comply with the baseline regulations is \$419 per year for RCRA Large Quantity Generators (see **Section 3.3.3** in the Appendix). Biennial reporting is not required for generators under the proposed regulation.

Under existing regulations, a disposal facility that accepts hazardous wastes from a generator must be authorized to do so via a standardized permit and is required to submit an annual report to DTSC. DTSC estimated that the cost of permit compliance with the existing regulations is \$837 per disposal facility per year.

The proposed regulation requires businesses that intend to accept PV modules from generators to submit a notification to DTSC prior to accepting waste PV modules, and to submit an annual report to DTSC on universal waste handling activities from the prior year. DTSC estimated that the costs for businesses to prepare and submit the initial notification and the annual report are approximately the same as the costs under the existing regulations (\$837 per handler per year).

5. Are there comparable federal regulations? No

Explain the need for state regulation given the existence or absence of federal regulations.

PV modules are not listed under the federal universal waste management regulations or under any exemptions or exclusions. PV modules that are determined by the generator to be federally regulated hazardous waste are required to be managed as RCRA hazardous waste. When DTSC inspected e-waste handling facilities and their records in 2012, it found that hazardous waste PV modules were being illegally accepted and improperly handled. This indicates that PV modules that are determined to be hazardous waste are being improperly and illegally disposed of.

DTSC determined that PV modules have low hazardous risks due to their manufacturing design; silicon wafers that contain heavy metals are immobilized and protected between panes of glass to prevent damage and untimely release. DTSC also determined that universal waste requirements, designed to be protective of public health and the environment, are adequate for such risks posed by PV modules. Managing PV modules under universal waste standards will divert hazardous waste PV modules out of solid waste streams and into proper management and disposal. It will also incentivize and encourage proper collection, transportation, and disposal or recycling of the modules, similar to other universal wastes.

DTSC currently seeks authorization from the U.S. Environmental Protection Agency (U.S. EPA) for its universal waste management program. Once authorized, a state can designate additional waste streams as universal waste at the same time that it creates its own universal waste rule. DTSC projects completion of its universal waste management program authorization by U.S. EPA prior to this proposed regulation. Authorization will allow for waste PV modules that are determined by the generator to be federally regulated hazardous waste to be managed as universal waste in California. Once waste PV modules leave the state boundary, California's universal waste requirements will no longer apply and the waste must be managed according to federal, state, and local requirements.

C. ESTIMATED BENEFITS

1. Briefly summarize the benefits of the regulation, which may include (among others) the health and welfare of California residents, worker safety and the state's environment.

DTSC has determined that the proposed regulation will increase protection of public health and the environment by reducing the mismanagement and the number of PV modules illegally disposed of as solid waste. DTSC witnessed similar improved waste management practices with the management of e-waste and other universal wastes after they were included in DTSC's universal waste program. In addition, DTSC estimates that the proposed regulation will save PV module generators a significant amount of costs compared to management of PV modules as fully regulated hazardous waste.

2. Are the benefits the result of specific statutory requirements?

Health and Safety Code section 25259 was added by Senate Bill 489 (Monning, ch. 419, stats. 2015), effective January 1, 2016, authorizing DTSC to adopt regulations to designate hazardous waste PV modules as a universal waste to be managed according to universal waste requirements. Although inclusion of PV modules in California's universal waste program requires DTSC to adopt the proposed regulation, the Legislature and Governor, in enacting this statute, anticipated benefits that would result from the proposed regulation.

3. What are the total statewide benefits from this regulation over its lifetime?

Other than the cost savings described in B.1. above, DTSC cannot estimate or quantify other total statewide benefits of this regulation over its lifetime (e.g., savings due to avoided environmental contamination or avoided health impacts from exposure to the hazardous constituents in waste PV modules). DTSC also cannot quantify the amount of recycling that may result from this regulation and its facilitation of transfer and accumulation of PV modules by handlers. DTSC anticipates that, as more PV modules become wastes in the future, recycling options will be developed and become available, reducing the number of PV modules disposed of. However, DTSC cannot forecast when this might occur.

4. Briefly describe any expansion of businesses currently doing business within the state of California that would result from this regulation.

The rate of generation of hazardous waste PV modules is expected to increase in the future, and that is likely to increase in the number of businesses needed to handle hazardous waste PV modules. DTSC observed this in the creation of approximately 25 e-waste treatment facilities after e-waste was added to California's universal waste program. Participants in workshops that DTSC held with stakeholders regarding the proposed PV module regulations expressed interest in expanding their businesses to manage PV modules if they are regulated as a universal waste. Businesses that currently manufacture, install or provide maintenance services for PV modules may also expand their operations to include some type of waste PV module treatment.

At this time, DTSC cannot estimate the number of businesses that might be established or choose to expand.

D. ALTERNATIVES TO THE REGULATION

1. List alternatives considered and describe them below. If no alternatives were considered, explain why not.

The following alternatives were not selected in the proposed regulation. The recommended alternative is not listed here as it has already been addressed in previous sections of this analysis.

Alternative 1. No Action

Under existing hazardous waste control laws, all PV modules that are characterized as hazardous are regulated as hazardous wastes when discarded. Generators of these wastes are subject to the hazardous waste generator standards, transporters to the manifesting and registration requirements, and receiving facilities to the hazardous waste facility permit standards. This alternative ensures the greatest protection of human health and the environment, but the regulatory requirements it places on generators and transporters of PV modules could be construed as a disincentive to proper collection, safe management practices, and proper recycling or disposal. This alternative also fails to establish waste management standards for PV modules that are commensurate with the risks posed by them. DTSC has concluded that because PV modules have lower hazardous risks and are generated by a wide segment of society, the application of universal waste management standards for these wastes provides an appropriate protection for human health and the environment. Note that the universal waste approach is not an alternative to the “do nothing” full hazardous waste regulation approach – nor are the two mutually exclusive. Instead, it is an alternative set of management standards that generators may, but are not mandated to, apply to manage these wastes. This is the main reason that DTSC has rejected the “do nothing” alternative.

This alternative has been evaluated as the baseline for cost calculations in which PV modules are regulated as a fully hazardous waste.

Alternative 2. Waste Exclusion

DTSC evaluated a waste exclusion for PV modules as another alternative. With this alternative, DTSC would create, by regulation, an exemption requiring PV modules to be sent for recycling, similar to the exemption for scrap metal, and for reclamation. Reclamation is a form of recycling that recovers usable materials and hazardous constituents. This alternative could reduce or remove the regulatory requirements placed on handlers and transporters if they intend to recycle the PV modules.

While this approach encourages the recycling of PV modules, at this time DTSC is unaware of any manufacturers or third-party businesses in California or other states that are currently recovering usable materials and hazardous constituents from PV modules. In addition, this approach renders it difficult for DTSC to enforce shipments out of state, since exempted PV modules claimed to be shipped out of state for recycling could potentially end up in out-of-state solid waste landfills or any unauthorized locations or uses. Finally, the success of an exclusion of this type would depend on the identification of a sustainable recycling market for PV modules. The PV module industry has not provided any evidence to DTSC that a sustainable recycling market exists for PV modules. As such, this alternative was not considered by DTSC.

4. Rulemaking law requires agencies to consider performance standards as an alternative if a regulation mandates the use of specific technologies or equipment or prescribes specific actions or procedures. Were performance standards considered to lower compliance costs?

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

E. MAJOR REGULATIONS

2. Briefly describe each alternative, or combination of alternatives, for which a cost-effectiveness analysis was performed.

Alternative 1: No Action

DTSC compared cost-effectiveness of the proposed regulation to the “no action” alternative (baseline). This baseline alternative represents the existing hazardous waste control laws where all PV modules that are characterized as hazardous are regulated as hazardous wastes when discarded. Under the baseline alternative, generators of hazardous wastes are subject to the hazardous waste generator standards, transporters to the manifesting and registration requirements, and receiving facilities to the hazardous waste facility permit standards. DTSC estimated the costs of managing PV modules under the baseline and compared to the costs under the proposed regulation, as shown in Table 1, which includes a summary of one-time costs, fixed costs, and variable costs estimated for generators and disposal facilities or handlers for the baseline alternative and with regulation. The total cost estimated for the baseline alternative (\$264,688,527) is greater than that of with the proposed regulation (\$252,952,600), with a cost saving of \$11,735,928.

Alternative 2: Waste Exclusion

DTSC evaluated a waste exclusion for PV modules as another alternative. This alternative depends on the identification of a sustainable recycling market for PV modules. However, the PV module industry has not provided any evidence to DTSC that a sustainable recycling market exists for PV modules. As of 2019, DTSC is unaware of any manufacturers or third-party businesses in California or other states that are currently recovering usable materials and hazardous constituents from PV modules. Therefore, DTSC is unable to estimate costs associated with management under this alternative, and a cost analysis was not performed.

5. Briefly describe the following:

The increase or decrease of investment in the state:

DTSC is not aware of any increase or decrease of investment in the state that will result from the implementation of the proposed regulation. However, the alternative universal waste management standards could reduce or remove the regulatory requirements placed on the businesses handling or transporting PV modules. This could incentivize businesses to develop recycling options, as similar regulations have done for other universal wastes, thereby increasing potential investment in the state.

The incentive for innovation in products, materials, or processes:

As of 2018, DTSC is not aware of any incentive for innovation in PV module products, materials or processes that would result from the proposed regulation. The proposed regulation of universal waste management standards for PV modules could reduce or remove the regulatory requirements placed on the person managing and transporting PV modules and incentivize businesses to create new processes to recycle them, similar to processes in Asia or Europe. In addition, as manufacturers become aware that PV modules are identified as hazardous wastes and must be managed according to hazardous waste or the proposed universal waste regulations, they may explore material changes that do not contain hazardous constituents that make PV modules hazardous.

The benefits of the regulations, including but not limited to benefits to the health, safety, and welfare of California residents, worker safety, and the state's environment and quality of life, among any other benefits identified by the agency.

The proposed regulations will increase protection of public health and the environment by reducing the mismanagement of waste PV modules and the number of PV modules disposed of as solid waste. DTSC has witnessed similar improved waste management practices and public health and environmental protection with the management of e-waste and other universal wastes, when they were included in the DTSC's universal waste program.

In addition, DTSC estimates that the proposed regulation saves PV module generators and handlers a significant amount of costs compared to managing the modules as a fully regulated hazardous waste.

Fiscal Impact Statement

B. Fiscal Effect on State Government.

4. Other. Explain.

As the regulation becomes effective, DTSC will require permanent resources for the regulation roll-out and associated implementation work for inspections and recordkeeping. DTSC will allocate permanent scientific staff positions. Following the regulation roll-out, DTSC scientists will plan and organize workshops, meetings, and training within the department, to make sure DTSC inspectors are consistent in applying the newly adopted regulatory requirements towards the industry, and externally, to provide industry with guidance on adopting and complying with newly enacted regulatory requirements.

Once the regulation roll-out is completed, DTSC expects senior scientists and scientists to continue carry out inspection and enforcement related activities on impacted businesses for complying with the regulation. DTSC expects that reporting, reviewing, recordkeeping and tracking activities related to the regulation will be processed by scientists and analysts.

DTSC projects that the proposed regulation will cost DTSC an estimate of \$187,583 in the year following its adoption, and \$134,985 annually in the subsequent years. These costs are tabulated based on the estimated work hours DTSC scientists are expected to incur with and after the adoption of the proposed regulations and current salaries and benefits of DTSC scientists as shown in **Table 3 and 4.**

Table 3. Calculations for Fiscal Effect on State Government with the Adoption of the Proposed Regulation Fiscal Year 2020-21⁹

Task (Yearly)	Staff Classification	Total Salary & Benefits per PY¹	Estimated Time (hours)	Conversion to PY² (/1800)	Cost of PY²
Review and provide program information	Senior Environmental Scientist (Sup)	\$175,821	80	0.04	\$7,814
Provide program information and guidance	Senior Environmental Scientist (Spec)	\$133,874	1800	1	\$133,874
Present information/train 55 inspectors (CUPA and DTSC) 16 hrs. x 55 (inspectors)	Environmental Scientist	\$91,789	900	0.5	\$45,895
Total cost					\$187,583
¹ Personnel Year.					

⁹ Assumes that this regulation does not become effective until after January 1, 2020.

Table 4. Calculations for Fiscal Effect on State Government with the Adoption of the Proposed Regulation Fiscal Year 2021-22 and After

Task	Staff Classification	Total salary & benefits per PY¹	Estimated Time (Hours)	Conversion to PY¹ (/1,800)	Cost of PY¹
Review notifications/ Annual reports	Associate Governmental Program Analyst	\$104,684	407	0.226	\$23,659
Provide program information and guidance	Senior Environmental Scientist (Spec)	\$133,874	1250	0.69	\$92,968
Cost of Inspections by EERD	Environmental Scientist	\$91,789	360	0.2	18,358
Total cost					\$134,985
¹ Personnel Year.					