Safety and Health Investment Projects
FINAL REPORT REQUIREMENTS

The purpose of the final report of your SHIP project is to:

1. Evaluate and document the achievements, challenges, and shortcomings of the project for the constructive benefit of others interested in learning from SHIP projects; and
2. Provide the Division of Occupational Safety and Health with information that shows:
    a. The outcomes specified in the project application were met; and
    b. The grant was used for the purpose(s) for which it was approved and in accordance with relevant WAC rules and any special conditions or requirements; and
    c. The outputs of the project have been disseminated as specified in the application.

The report format has four sections:

1. Cover Sheet
2. Narrative Report (part I)
3. Financial Information (part II)
4. Attachments (part III)

Please provide complete and detailed information in the final report. If you have questions, please call your SHIP grant manager.

REMINDER!!: All products produced, whether by the grantee or a subcontractor to the grantee, as a result of a SHIP grant are in the public domain and cannot be copyrighted, patented, claimed as trade secrets, or otherwise restricted in any way.

SAFETY AND HEALTH INVESTMENT PROJECTS
FINAL REPORT

Measuring worker exposures to UV radiation in the cannabis industry, and efficacy of protective clothing
Grant #: 2016ZH000323
08/01/2016 - 06/30/2018

Christopher Simpson
simpson1@uw.edu

The Cannabis Alliance
&
Department of Environmental and Occupational health Sciences, School of Public Health, University of Washington

July 13, 2018

Christopher Simpson

Funding and support for this project has been provided by the State of Washington, Department of Labor & Industries, Safety & Health Investment Projects.

PART I

Narrative Report

Abstract:

Workers employed in cannabis cultivation in Washington State may be exposed to UV radiation from grow lamps in indoor grow operations, or from the sun for outdoor grow operations. Over-exposure to Ultraviolet (UV) light is known to cause skin cancer, premature aging, immune system suppression, and eye damage such as cataracts or pterygia. In the current project we evaluated UV radiation intensities and worker exposures to UV radiation in indoor and outdoor cannabis grow operations.

We measured UV exposures on 22 workers (87 work-shifts) at 5 different workplaces. We found that overall, worker exposures to UV radiation were highest in outdoor cannabis cultivation facilities.

We measured intensities of UV radiation emitted from different lighting technologies used in indoor cannabis cultivation facilities. UV emissions were lowest for light emitting diode (LED) and fluorescent bulbs. Exposures at 3-ft from each bulb were only likely to exceed the 8-hr permissible exposure limit (PEL) in the case of germicidal bulbs. Germicidal bulbs should not be used when workers are present, and rooms containing germicidal bulbs should be interlocked to prevent access when bulbs are on.

We found that long-sleeved UV protective shirts effectively attenuated UV exposure 50-fold to the portions of the body that were protected by the shirts. Workers who tested these shirts reported that they were comfortable to wear, did not interfere with work activities, and did not cause the workers to overheat.

We subsequently developed informational posters, in both English and Spanish, for employers and workers in cannabis cultivation facilities that provide information on sources of UV exposure in these facilities and provide specific, actionable recommendations for interventions to reduce workers' exposure to UV radiation. These informational posters have been widely distributed to cannabis workers, employers, business groups and health and safety professionals.

Purpose of Project:

Cultivation and processing of marijuana for recreational and medicinal use is a rapidly growing industry in Washington State. Because this industry is relatively new, there was limited quantitative information available about potential health and safety hazards that workers may be subjected to. One potential hazard of concern is exposure to UV radiation, which is generated by the grow lamps used in the indoor grower operations in Washington State. Therefore, we set out to survey worker exposures to UV radiation at cannabis cultivation facilities in Washington State. The specific aims of the project were as follows:

Aim 1. Evaluate the reliability and the effectiveness of a wearable UV sensor to monitor worker exposures to UV radiation.

Aim 2. Describe UV exposures within the cannabis growing industry, and the relationship between those exposures and physical characteristics of the grow rooms, lighting technologies used, and specific worker activities.

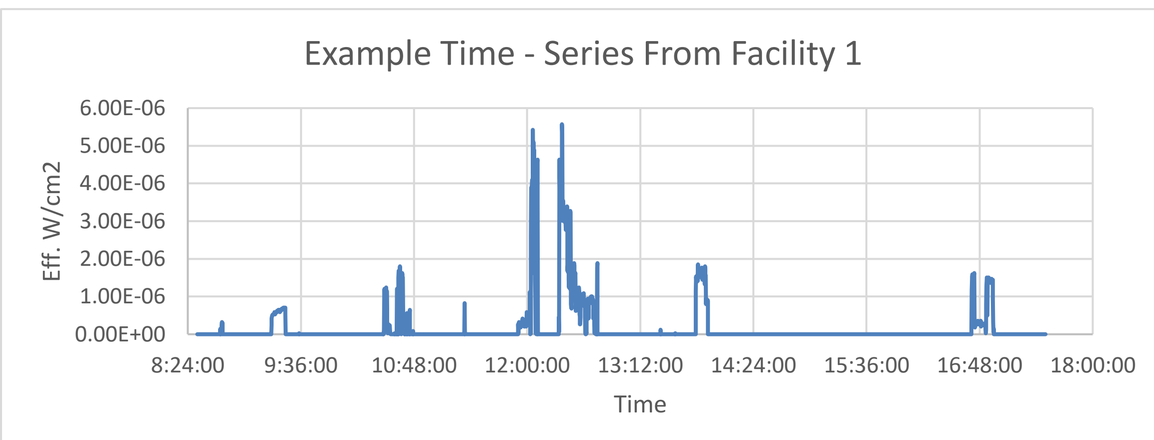
Aim 3. Evaluate the effectiveness of commercially available UV protective garments to mitigate worker exposures to UV radiation.

Aim 4. Develop training materials informing growers and their employees of the potential hazards of UV exposures in cannabis growing operations, and describing practical interventions to reduce those exposures.

Statement and Evidence of the Results:

Study results Aim 1. Evaluate the reliability and the effectiveness of a wearable UV sensor to monitor worker exposures to UV radiation.

We evaluated two low cost personal exposure monitors for UV radiation: (i) The Sunwatch™, and (ii) a continuous-reading data-logging UV dosimeter. Both dosimeters have a UV response function that approximates the CIE hazard response function. The Sunwatch™ is a wristwatch style device that costs ~$50. It has data-logging capability, but does not record a data time series - only reporting current instantaneous UV intensity and accumulated UV exposure. In contrast the UV dosimeter (produced by Dr. Martin Allen, Christchurch, NZ) cost ~$300 and records time series data that can be downloaded, as indicated in the figure below. Both instruments were calibrated via co-location with an International Light Technologies model 2400 radiometer (Peabody, MA) with a SED 240 sensor, that was factory calibrated.



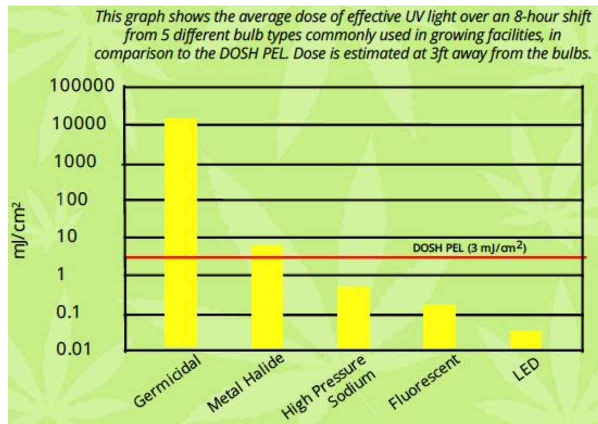
This figure illustrates a data time series recorded using the personal dosimeter on a worker at an indoor cannabis cultivation facility. The time series illustrates several "spikes" in UV exposure, several of which correspond to when the worker was outside - for example the major spikes between 12:00and 13:00 occurred when the worker took their lunch break outside.

We found that the Sunwatch™ was not suitable for this application. The UV sensor on the Sunwatch could become obscured by the workers clothing if they wore long sleeved garments, or at became covered with resin from the cannabis plants which substantially attenuated it's response.

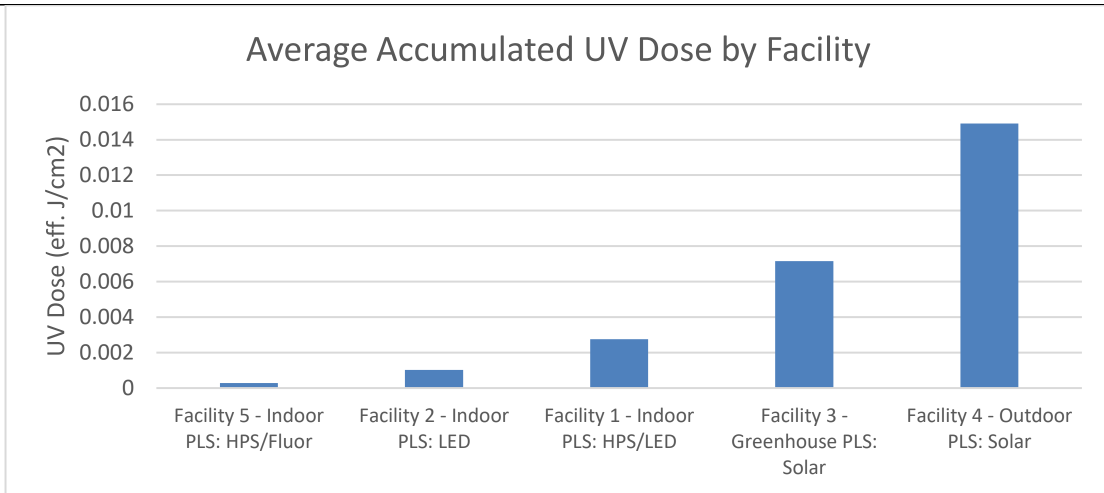
The personal dosimeter was effective at measuring workers' UV exposures in this study. We attached the dosimeter to the workers clothing at the back of their necks as we judged this to be the part of the body likely to receive the highest UV exposure. Furthermore, when the dosimeter was worn at the back of the workers necks it did not interfere with their ability to perform their tasks, and it did not becomes covered in resin from the cannabis plants as would have been the case if the dosimeter was worn on the wrist.

<u>Study results Aim 2. Describe UV exposures within the cannabis growing industry, and the relationship between those exposures and physical characteristics of the grow rooms, lighting technologies used, and specific worker activities.</u>

We used an International Light Technologies model 2400 radiometer (Peabody, MA) with SED 240 sensor attachment to measure UV emissions from the artificial light sources in the indoor facilities, and from the sun in the shadehouse and outdoor facilities. The radiometer's SED240 sensor emulates the American Conference of Governmental Industrial Hygienists (ACGIH) weighting function. UV emissions were measured from 40 different bulbs covering a variety of lighting technologies, and are summarized in the figure at right. LED and fluorescent bulbs generated the lowest UV emissions. As indicated in the figure UV exposures from bulbs in indoor facilities were unlikely to exceed the DOSH PEL (3 mJ/cm^2 for an 8-hr workshift), with the exception of germicidal bulbs. Germicidal bulbs emit high levels of UV radiation – typically in the UV-C wavelengths (e.g. 254nm), and exposures in the vicinity of germicidal bulbs could exceed the 8-hr PEL within seconds to minutes. Consequently germicidal bulbs should never be used when workers are present. Rooms containing germicidal bulbs should be interlocked to prevent access when lamps are on.



We used a data-logging dosimeter to measure UV exposures on the workers in five cannabis cultivation facilities (3 indoor, one shadehouse and one outdoor). Full-shift exposures were measured on 22 workers for a total of 87 work-shifts. The data are summarized for each facility in the figure below:



In general, exposures were lowest in the indoor facilities, intermediate at the greenhouse facility, and highest at the outdoor facility. However, workers at the outdoor facility showed the greatest awareness of the hazards of UV exposure, and used personal protective equipment (PPE) appropriately to mitigate those hazards. Typically they wore long sleeved shirts and pants, sunglasses and broad brimmed hats or scarves, and their employer provided a shaded area for breaks. In contrast, workers at the indoor and shadehouse facilities typically wore short sleeved shirts and did not wear hats.

We also collected urine samples from workers and analyzed them for a biomarker of UV exposure – 8-hydroxydeoxyguanosine (8-OHdG). Urine samples were collected pre- and post-shift (112 samples were analyzed representing 56 pre & post workshift pairs, from 21 workers). The 8-OHdG levels were (average±SD): pre-shift 4.44±2.79 ng/mL, post-shift 5.27±3.90 ng/mL, cross-shift change 0.82±3.78 ng/mL. 8-OHdG levels were not significantly elevated in post-shift vs pre-shift urine samples, and post-shift 8-OHdG concentrations did not differ significantly among the five facilities that we surveyed. In summary, the urinary 8-OHdG measurements showed no evidence of elevations in association with UV exposure.

Study results Aim 3. Evaluate the effectiveness of commercially available UV protective garments to mitigate worker exposures to UV radiation.

We had male and female workers from the outdoor and shadehouse cultivation facilities (i.e. the two workplaces that we surveyed where workers had the highest UV exposures) evaluate a selection of long sleeved shirts with a sun protection factor (SPF) of 50. Workers evaluated the garments based on style, comfort and suitability for their work tasks. Based on worker feedback we selected long sleeved t-shirts from Solbari Ltd (https://www.solbari.com), and provided these to the workers at the outdoor and shadehouse cultivation facilities. We used the personal dosimeter and the radiometer to verify that these garments attenuated health-weighted measurements of UV radiation in the 200-400nm wavelength range by 50-fold. After wearing these garments for three days, each worker was asked to provide feedback on the garments. All workers expressed that the garments were comfortable to wear, did not interfere with their work tasks, and did not cause them to overheat. Management at the outdoor facility stated that they planned to provide these garments to their workers free of charge during the next cannabis growing season. In summary the SPF shirts were acceptable to the workers and appear to be an effective intervention to help reduce workers' exposure to UV radiation.

Study results Aim 4. Develop training materials informing growers and their employees of the potential hazards of UV exposures in cannabis growing operations, and describing practical interventions to reduce those exposures.

Based on the study findings in aims 1-3, we developed four informational posters for employers and workers at cannabis cultivation facilities. The four posters, which are available in both English and Spanish, are included in the appendix, and are available for free download from the following website: http://bit.ly/ShineLightSafety

The two informational posters that focus on UV exposures indoors provide employers with specific, actionable information on how to minimize worker exposure to UV radiation, including (i) choosing lighting technologies that emit lower levels of UV radiation (LED bulbs and fluorescent bulbs); (ii) designing facilities to increase distance between workers and UV-emitting bulbs in order to reduce worker exposures; (iii) provide appropriate PPE to workers (UV-protective eyewear); (iv) provide employees with appropriate training in the hazards of UV exposures, and the precautions employees can take to reduce their exposures; (v) use interlock systems to prevent worker exposure to UV radiation from the germicidal lamps that are used in this industry to control powdery mildew.

The two informational posters developed through this project that focus on UV exposures outdoors provide employers with specific, actionable information on how to minimize worker exposure to UV radiation from the sun, including (i) encourage employees to wear sun-protective clothing, wide-brimmed hats and sunglasses; (ii) include sun-safety information in workplace wellness programs; (iii) adjust work schedules to minimize outdoor work during the middle part of the day; (iv) provide shade for employees through the use of tents and shelters; (iv) provide broad spectrum sunscreen for employees to use.

Measures to Judge Success:

1. L&I specialists reviewed and approved the four informational posters to ensure the accuracy of their content.
2. Our community partner, Lara Kaminsky with The Cannabis Alliance, provided valuable feedback on the choice of communication mode, tag line "Shine a Light on Safety," and general aesthetics of the four information posters. She further helped to identify effective methods of disimination for the target populations.
3. Narrative feedback from cannabis growers (both employers and employees) has been uniformly positive and has testified to the value of the informational posters that we developed
4. We are collecting metrics regarding the number of poster downloads, and the number of electronic media views to assess our effectiveness at disseminating these safety messages to cannabis growers.

Relevant Processes and Lessons Learned:

Lessons Learned:

1. The Sunwatch™ wristwatch-style personal UV exposure sensors were not well suited to measuring UV exposures in this setting. The sensor elements could become obscured if workers wore long sleeved shirts, and they would get covered in resin from the cannabis plants which attenuated the sensor's response.
2. The personal UV dosimeters did prove effective in this setting. However, they also had some important limitations:
   a. UV exposures at many of the indoor facilities were too low to be detected using the standard personal UV dosimeters. We worked with the manufacturer to modify the dosimeter to increase its sensitivity to detect the low-level exposures indoor. However, the modified dosimeter had a reduced dynamic range and would saturate under conditions of bright sun outdoors.
   b. The response function for these personal UV dosimeters differs substantially from the hazard function. When a single radiation source is present (e.g. the sun, or a single type of bulb), the dosimeter can be calibrated against the radiometer to convert the dosimeter reading into a PEL-equivalent value. However, this is not possible if multiple UV radiation sources are present, which was the case in several of the facilities we visited.
3. The commercial cannabis industry is still in its infancy, and the technologies used in cannabis cultivation continue to evolve rapidly. There were two specific technological advances that were relevant to this project: (i) suppliers began to produce UV-emitting LED systems and market them to cannabis growers, and (ii) manufacturers of germicidal bulbs began to market their products to cannabis growers as a tool to control powdery mildew. The market penetrance of these technologies was low at the time of this study – none of the facilities we visited used either of these technologies, although one began to trial the use of germicidal bulbs shortly after field work for this study was completed. Future research studies in this field should be aware of advances in lighting technologies. Visiting trade shows, cannabis cultivation facilities and lighting suppliers are all helpful ways to find out which products are currently being sold to cannabis growers.
4. Our partnership with The Cannabis Alliance was critical to the success of this project. As an organization that is trusted by cannabis growers, The Cannabis Alliance was able to build a bridge between the UW research team and cannabis growers, which ultimately allowed us to collect personal exposure data on the workers.

Product Dissemination:

The major products generated through this project are a series of four informational brochures for employers and employees at indoor and outdoor cannabis grow operations that describe the hazards of UV exposure in this industry, and provide specific, actionable guidance on measures to reduce worker exposure to UV radiation in this industry. The four informational posters, available in English and Spanish, are included in the appendix, and are available for free download from the following website: http://bit.ly/ShineLightSafety

We have distributed this url widely via email, social media and other electronic formats to cannabis businesses and health and safety professionals in Washington State and throughout the US. Some examples include:

- AIHA Cannabis Occupational Health and Safety Working Group
- Network of NIOSH Agricultural Safety and Health Centers
- Network of NIOSH Education and Research Center Continuing Education Programs
- I502 Google group - a forum for i502 licensees in Washington State with 1899 members. Post was viewed 151 times as of August 2018.
- Posted on University of Washington Marijuana Health and Safety webpage: http://deohs.washington.edu/marijuana-growing-occupational-health-safety
- Posted on Northwest center Blog post: https://nwcohs.blog/2018/03/20/is-over-exposure-to-uv-light-a-hazard-in-cannabis-growing-facilities-uw-researchers-say-yes/ (updated August 2018; 280 views)
- A short "teaser" video was created to encourage downloads of the informational posters via social media. This was posted to the UW DEOHS Continuing Education Programs' facebook page, and has received 134 views and 4 shares as of August, 2018.
- Contributed to article on DEOHS blog "Protecting the pot workforce" http://deohs.washington.edu/hsm-blog/protecting-pot-workforce
- Tweets, Facebook, LinkedIn messages all advertising our blog page and associated materials.

In addition:

- The Colorado Department of Public Health and the Environment are distributing these posters to 80 participants in a Marijuana Cultivation safety training event that put on in August 2018.
- Our industry partner, the Cannabis Alliance is distributing the url to their membership via the own website.
- 150 posters were distributed at Cannacon (a Cannabis Industry conference held in Seattle in February, 2018) through The Cannabis Alliance booth, the L&I booth, and in person to growers and lighting manufacturers.

The website where the four informational posters are hosted allows us to track the number of times that the posters are downloaded. To date there have been 107 downloads of the informational posters.

We have also shared information regarding the potential hazards of UV exposure associated with cannabis cultivation in a variety of other venues:

1. Student poster at the American Industrial Hygiene Association Conference and Exposition in Philadelphia in 2018.
2. Student poster at the American Industrial Hygiene Association Conference and Exposition in Seattle in 2017.
3. Student presentation at the American Public Health Association Conference in Denver, CO in 2017.
4. Oral presentation to participants in an educational tour of a cannabis cultivation facility as part of the American Industrial Hygiene Association Conference and Exposition in Seattle in 2017.
5. Presentation at The Cannabis Alliance monthly meeting (June, 2017).
6. Blog post from Pacific Northwest Occupational Health and Safety Center https://nwcohs.blog/2017/10/19/nwc-graduate-pursues-first-of-its-kind-research-on-health-risks-among-marijuana-production-workers/ (October, 2017).
7. Lecture on "Occupational UV exposure in Marijuana Grow Operations" as part of a two day continuing education course on Radiation Safety – Principles, Practice, and Emerging Issues, hosted by the Pacific Northwest OSHA Education Center. https://osha.washington.edu/pages/radiation-safety-day-1-agenda
8. Articles in Pacific Northwest OSHA Education Center Newsletter Issue#25 (March 2018). https://qe205.infusionsoft.com/app/hostedEmail/2090202/14cd7a46acb82d65
9. Blog post from Pacific Northwest Occupational Health and Safety Center https://nwcohs.blog/2018/03/20/is-over-exposure-to-uv-light-a-hazard-in-cannabis-growing-facilities-uw-researchers-say-yes/ (March 2018)
10. Lecture entitled "Potential Occupational health concerns in Washington State's Cannabis industry" delivered at the University of Washington (January 2018).
11. Lecture entitled "Identifying Worker Health and Safety Needs in a "Growing Field" delivered at the University of Washington (June, 2018)

Feedback:

- Comments from cannabis growers:
  "This is great. Thank you" – Cannabis grower (greenhouse), Western Washington
  "SWEET! Thank you! Got any new awesome research studies for us to be part of!?!" – Cannabis grower (indoor), Western Washington
  "Thank you for sending this over! We are excited to distribute this information. Looks really great!" Cannabis grower (indoor), Western Washington

Project's Promotion of Prevention:
The measurements of UV emissions from various light sources at five cannabis cultivation facilities, and UV exposures on 22 workers at these facilities allowed us to identify specific lighting technologies with the lowest UV emissions, and best practices for minimizing worker exposure to UV radiation at indoor and outdoor cannabis cultivation facilities. We then generated four informational posters that communicate these findings and best practices to minimize UV exposures. The posters have been distributed widely to cannabis workers, employers, lighting manufacturers, PPE manufacturers, and to health and safety professionals who work with the cannabis industry. Adoption and implementation of these best practices will minimize worker exposure to damaging UV radiation and will reduce the incidence of illness and disease associated with this exposure.

Uses:
1. During this project we validated a low-cost (~$300) personal UV exposure monitor with continuous reading and data-logging capabilities. Although the response-function for this sensor does not perfectly match the UV hazard function reflected in the PEL, and hence cannot be used to demonstrate compliance with the PEL, the sensor does allow employers to identify locations and work-tasks within their facilities that are associated with the highest levels of UV exposure, and therefore should be the focus of any exposure control measures. 2. The two informational posters developed through this project that focus on UV exposures <u>indoors</u> provide employers with specific, actionable information on how to minimize worker exposure to UV radiation, including (i) choosing lighting technologies that emit lower levels of UV radiation (LED bulbs and fluorescent bulbs); (ii) designing facilities to increase distance between workers and UV-emitting bulbs in order to reduce worker exposures; (iii) provide appropriate PPE to workers (UV-protective eyewear); (iv) provide employees with appropriate training in the hazards of UV exposures, and the precautions employees can take to reduce their exposures; (v) use interlock systems to prevent workers' exposure to UV radiation from the germicidal lamps that are used in this industry to control powdery mildew. 3. The two informational posters developed through this project that focus on UV exposures <u>outdoors</u> provide employers with specific, actionable information on how to minimize worker exposure to UV radiation from the sun, including (i) encourage employees to wear sun-protective clothing, wide-brimmed hats and sunglasses; (ii) include sun-safety information in workplace wellness programs; (iii) adjust work schedules to minimize outdoor work during the middle part of the day; (iv) provide shade for employees through the use of tents and shelters; (iv) provide broad spectrum sunscreen for employees to use. 4. Exposure to UV radiation from the sun is common in a number of industries and workplaces including agriculture, forestry, and construction. The two informational posters developed through this project that were focused on UV exposures at outdoor cannabis grow operations would be useful for workers and employers in any of these industries in which workers are outside and exposure to solar radiation is an important occupational hazard.

Organization Profile:
<u>Department of Environmental and Occupational Health Sciences, School of Public Health, University of Washington:</u> The Department of Environmental & Occupational Health Sciences (http://deohs.washington.edu/) is part of the School of Public Health at the University of Washington. Our mission is to create healthy, safe and sustainable communities and workplaces by training students and professionals in environmental and occupational health, by conducting research to prevent occupational injury and illness, and by disseminating our research findings to promote best practices to protect the health of workers. <u>The Cannabis Alliance:</u> The Cannabis Alliance (https://www.thecannabisalliance.us/) is a non-profit, membership-based association of individuals, businesses, government officials, and non-profit organizations dedicated to the advancement of a sustainable, vital and ethical cannabis industry. We actively engage in building a unified industry by promoting safe and ethical corporate citizenship, advancing the institution and infrastructure for a sustainable and vital cannabis industry, and by fostering education, communication and informational exchanges within the cannabis industry, and between the industry, our communities, and policy makers. Almost 200 cannabis businesses are members of the Cannabis Alliance.

Additional Information

<table>
<tr><td colspan="2">

Project Type

☒Best Practice
☐Technical Innovation
☒Training and Education Development
☐Event
☒Intervention
☒Research
☐ Return to Work
☐Other (Explain):

</td><td rowspan="3">

Industry Classification (check industry(s) this project reached directly)

☒ 11 Agriculture, Forestry, Fishing and Hunting
☐ 21 Mining
☐ 22 Utilities
☐ 23 Construction
☐ 31-33 Manufacturing
☐ 42 Wholesale Trade
☐ 44-45 Retail Trade
☐ 48-49 Transportation and Warehousing
☐ 51 Information
☐ 52 Finance and Insurance
☐ 53 Real Estate and Rental and Leasing
☐ 54 Professional, Scientific, and Technical Services
☐ 55 Management of Companies and Enterprises
☐ 56 Administrative and Support and Waste Management and Remediation Services
☐ 61 Educational Services
☐ 62 Health Care and Social Assistance
☐ 71 Arts, Entertainment, and Recreation
☐ 72 Accommodation and Food Services
☐ 81 Other Services (except Public Administration)
☐ 92 Public Administration

</td></tr>
<tr><td colspan="2">

Target Audience: employers and workers at cannabis farms

</td></tr>
<tr><td colspan="2">

Languages: English

</td></tr>
<tr><td colspan="2">

Please provide the following information - -
(information may not apply to all projects)

</td><td rowspan="5">

List, by number above, industries that project products could potentially be applied to.
11, 21, 23

</td></tr>
<tr><td># classes/events:</td><td>N/A</td></tr>
<tr><td># hours trained</td><td>N/A</td></tr>
<tr><td># students under 18</td><td>0</td></tr>
<tr><td># workers</td><td>N/A</td></tr>
<tr><td># companies represented</td><td>N/A</td><td rowspan="3">

Potential impact (in number of persons or companies) after life of project?
600 active cannabis producer/processor businesses in Washington State, with a total of 3000 full time employees.

</td></tr>
<tr><td># reached (if awareness activities)</td><td>>500</td></tr>
<tr><td>Total reached</td><td>>500</td></tr>
<tr><td colspan="3">

Have there been requests for project products from external sources? Yes
If Yes, please indicate sources of requests:
Roberta Smith (Colorado Department of Public Health and the Environment) requested to use the informational psoters in a health and safety training that they were putting on for cannabis workers in Colorado.
Jeff Jackson (Oregon OSHA) requested to use the informational posters in a 2-day health and safety training that he is co-ordinating putting for cannabis workers in Oregon (safetyseries.cvent.com/central18).

</td></tr>
</table>

PART II

Financial Information
Budget Summary

Project Title:	Measuring Worker Exposure to UV Radiation In the Cannabis Industry, and Efficacy of Protective Clothing		
Project #:	2016ZH00323	**Report Date:**	08/31/2018
Contact Person:	Christopher Simpson	**Contact #:**	206-543-3222
Start Date:	08/01/2016	**Completion Date:**	08/31/2018

1.	**Total original budget for the project**	$ 199,996.14
2.	**Total original SHIP Grant Award**	$ 199,996.14
3.	**Total of SHIP Funds Used**	$ 199,996.14
4.	**Budget Modifications (= or - if applicable)**	$ 0.00
5.	**Total In-kind contributions**	$ 0.00
6.	**Total Expenditures (lines 3+4+5)**	$ 199,996.14

Instructions:
- Complete the Supplemental Schedule (Budget) form first (on the next page).
- The final report must include all expenditures from date of completion of interim report through termination date of grant.
- Indicate period covered by report by specifying the inclusive dates.
- Report and itemize all expenditures during specified reporting period per the attached supplemental schedule.
- Forms must be signed by authorized person (see last page).
- Forward one copy of the report to **Grant Manager Name, SHIP Grant Manager** at **PO Box 44612, Olympia, WA 98504-4612**

PART II *(Continued)*

Financial Information
Supplemental Schedules (Budget)

Project Title:	Measuring Worker Exposure to UV Radiation In the Cannabis Industry, and Efficacy of Protective Clothing		
Project #:	2016ZH00323	**Report Date:**	08/31/2018
Contact Person:	Christopher Simpson	**Contact #:**	206-543-3222
Total Awarded:	$199,996.14		

ITEMIZED BUDGET: How were SHIP award funds used to achieve the purpose of your project?

	Budgeted for Project	Amount Paid Out	Difference
A. PERSONNEL	$130,524.67	$139,358.91	-$8,834.24

Explanation for Difference and other relevant information:
During milestone period 7 we added a communications specialist to assist with preparation of educational posters, and dissemination of those posters via multiple electronic approaches.
Extension for the project timeline also resulted in higher FTE costs for the project PI.

	Budgeted for Project	Amount Paid Out	Difference
B. SUBCONTRACTOR	$10,000.00	$10,343.40	-$343.40

Explanation for Difference and other relevant information:
Contracter was reimbursed for additiona travel expenses due to several study site lcoations being in Eastern Washington.

	Budgeted for Project	Amount Paid Out	Difference
C. TRAVEL	$1,890.00	$7,762.94	-$5,872.94

Explanation for Difference and other relevant information:
Travel costs were greater than originally budgeted because most of the workplaces that agreed to participate in this study were outside of Seattle, including Bellingham, Tacoma, Omak and Spokane. This required additional mileage and overnight accomodation costs.

	Budgeted for Project	Amount Paid Out	Difference
D. SUPPLIES	$20,440.00	$7,764.57	$12,675.43

Explanation for Difference and other relevant information:
We purchased fewer UV-protective shirts than budgeted because our exposure measuremnts demonstrated that occupational UV exposures were not significant at the indoor facilities we visited. Therefore we only purchased shirts for the workers at the higher exposed outdoor and shadehosue facilities. used reusable instead of disposable monitors.
Costs for personal moitoring were lower than budgeted because we were able to purchase resuable personal dosimeters, rather than disposable personal sensors that were originally budgeted for.

	Budgeted for Project	Amount Paid Out	Difference
E. PUBLICATIONS	$2,160.00	$85.18	$2,074.82

Explanation for Difference and other relevant information: We preferred to disseminate the posters primarily via electronic download rather than distribution of paper copies. The electronic downloads allowed us to better trach who was receiving the posters.

	Budgeted for Project	Amount Paid Out	Difference
F. OTHER	$16,800.00	$16,499.63	$300.37
Explanation for Difference and other relevant information:			

	Budgeted for Project	Amount Paid Out	Difference
TOTAL DIRECT COSTS	$181,814.67	$181,814.63	$0.04
	Budgeted for Project	Amount Paid Out	Difference
TOTAL INDIRECT COSTS	$18,181.47	$18,181.51	-$0.04
	Budgeted for Project	Amount Paid Out	Difference
TOTAL SHIP BUDGET	$199,996.14	$199,996.14	$0.00

	Budgeted for Project	Amount Paid Out	Difference
G. IN-KIND			
Explanation for Difference and other relevant information:			

I hereby certify that the expenditures listed on this report were made with my approval:

July 13, 2018

Date

CD Simpson

Signature of Project Manager

PART III
Attachments:

A pdf containing four informational posters is attached:

1. Indoor UV Exposure_For Employers
2. Indoor UV Exposure_For Employees
3. Outdoor UV Exposure_For Employers
4. Outdoor UV Exposure_For Employees

Both English and Spanish versions of the posters have been created.

REMINDER!!: All products produced, whether by the grantee or a subcontractor to the grantee, as a result of a SHIP grant are in the public domain and cannot be copyrighted, patented, claimed as trade secrets, or otherwise restricted in any way.