UNIVERSITY
OF
CALIFORNIA

Herbicide Task Force
Report and Recommendations on the Use of Herbicides and Other Pesticides

Contents

Introduction and Executive Summary

In light of various concerns, President Napolitano issued a temporary suspension of the use of glyphosate-based herbicides at the University of California (UC), with four explicit exceptions: agricultural operations, fuel-load management programs to reduce wildfire risk, native habitat preservation or restoration activities, and research that requires glyphosate-based herbicides. The temporary suspension became effective on June 1, 2019.

While scientific disagreement still exists regarding the possible dangers posed by glyphosate-based herbicides, the President believed that it was prudent to move swiftly and decisively. However, the President recognized the need for a longer-term approach that would balance the various factors under consideration and result in a review of UC's pesticide use more broadly. Thus, in tandem with the temporary suspension, the President also established a task force comprised of experts and stakeholder representatives to review UC's current use of glyphosate-based herbicides for vegetation management purposes and to recommend future approaches to pesticides more broadly.

The "UC Herbicide Task Force" is comprised of faculty and other expert individuals from across the UC system, including the following constituencies: faculty (toxicology, reproductive health, and environmental law); students; Agriculture and Natural Resources; facilities management; groundskeeping; sustainability; Environment, Health and Safety; and the Office of the General Counsel. Both the Academic Senate and union leaders were consulted and provided nominees who agreed to serve on the Task Force. Appendix A lists the Task Force roster.

The President charged the Task Force with several responsibilities, as follows[1]:

Table 1: President Napolitano's Charges to the Task Force.

GLYPHOSATE-BASED HERBICIDES	1. Compile a summary of current glyphosate-based herbicide use activities by UC location, amount, type, needs, possible alternatives, and estimated fiscal impact of discontinued use. 2. Evaluate current toxicological research and relevant legal considerations. 3. Confirm or recommend revisions to the existing use exceptions detailed in the temporary suspension of glyphosate-based herbicides, based on risk assessment considerations and feasible alternatives.

[1] The number refers to the order of bullet points in the appointment letter.

	4. Research and recommend long-term glyphosate-based herbicide application and management practices, as well as appropriate protective controls. 5. Review and approve/deny location-specific glyphosate-based herbicide exception requests.
ALL PESTICIDES	6. Recommend a strategy for evaluating the sustainable use of pesticides generally, including overall integrated pest management practices and the implementation of organic solutions and non-pesticide-based strategies.
REPORT	7. Submit a report to the President by November 1, 2019, addressing the above tasks, and prioritize and propose a timeline for implementing the Task Force's recommendations.

The Task Force convened for the first time on June 18, 2019, and met roughly every two weeks in order to provide its recommendations to the President within the timeframe outlined above. The Task Force tackled the issue of pesticides holistically and comprehensively, pursuant to the President's directive while remaining sensitive to the necessity of allowing for locally relevant approaches, given the differences among the various UC locations' needs. In response to questions from UC locations, the Task Force also issued clarifying guidance related to the President's temporary suspension of glyphosate use.

The President and Task Force recognize the significant internal and external interest in the issue of pesticide use and the concerns prompted by recent jury decisions related to glyphosate. The President and Task Force are committed to examining and addressing this issue in a meaningful and comprehensive fashion, with the objective of both protecting the health of the University's students, staff, faculty, and visitors and acting based on scientific principles.

The President requested this report based on "concerns about growing legal and reputational risks associated with the use of these herbicides; however, some interests associated with UC have also raised concerns about possible human health and ecological hazards." This report details the findings and recommendations of the UC Herbicide Task Force.

Pesticides, including herbicides, are designed to kill living organisms. While they are useful for certain types of pest and weed management, there is also concern about their ancillary effects on ecology and health. Accordingly, it is important that UC manages pesticides in the safest and most sustainable approach feasible.

The Task Force found that at present, there is no system-wide coordination or communication about pesticide use. The Task Force recommends that UC record in a systematic way all pesticides used across the system and report this use consistent with California law to the California Department of Pesticide Regulation and to other agencies with delegated authority so that UC can document use and trends in pesticide application across UC locations. The Task Force recommends the development of a systemwide Pesticide Use Authorization (PUA) software for all pesticide applicators, which will enable UC to verify the qualification, training and personal protective equipment of our pesticide applicators; to perform pre-use notifications to affected UC community members; and to perform regulatorily required post-use reporting.

To accomplish this, we recommend the promulgation of a Presidential Integrated Pest Management (IPM) Policy. That policy would require that all UC locations utilize an Integrated Pesticide Management (IPM) approach, and as part of the IPM approach, pesticides would be restricted based on high (coded as "red"), medium (coded as "yellow"); those in the highest tier would require stricter oversight and justification for their use. The policy would establish a Systemwide Pesticide Oversight Committee (SPOC) to categorize pesticides into high-, medium-, and low-hazard tiers, and to provide systemwide coordination and guidance.

Ultimately, this report and its recommendations represent a paradigm shift for authorizing pesticide use within the University. Currently, the decision as to when, where, and how to apply pesticides, and what pesticide to apply, is generally left to individual applicators.

For the high-red tier pesticides, the decision to use these pesticides would shift from individual applicators to a local Integrated Pest Management Committee (IPMC) operating within the restrictions of the systemwide policy. This IPMC would weigh the overall risks encountered from pests with the potential risks from the control method selected to treat the pest. This committee would ultimately make the decision whether or not to allow the application of a high-red tier pesticide in that location. The IPMC would follow an established scientifically and sustainably based Integrated Pest Management (IPM) approach that considers all possible control solutions to pest management, including non-chemical and chemical controls. IPM calls for pesticide use only after the consideration of applicable risks to human and ecosystem health, and determination, based on a careful and thorough evaluation, that other alternatives are not feasible.

This report also recommends to the President that the current glyphosate-based herbicide temporary suspension with exemptions remain intact until the recommended elements of a systemwide IPM policy and local IPM plans can be implemented. The Task Force recommends that, at that time, all high-red tier pesticides (not just glyphosate-based herbicides) should be prohibited from use unless specifically authorized as described above. The committee recommends referring to this more correctly as a restriction, given that the use of a high-red tier pesticide may be warranted in some cases,subject to local IPMC review and in conformity with the systemwide IPM policy.

Table 2: Summary of Recommendations by Charge.

In order to ensure sustainable and responsible use of pesticides, the Herbicide Task Force recommends the following:

	Herbicide Task Force Charge	Recommendation
GLYPHOSATE BASED HERBICIDES	1. Compile a summary of current glyphosate-based herbicide use activities by UC location, amount, type, needs, possible alternatives, and estimated fiscal impact of discontinued use.	1. **Direct OP Risk Services (OPRS) to develop or adopt a systemwide Pesticide Use Authorization (PUA) software application**. (By Nov. 2021) The PUA software would facilitate all required pre-use notifications and transmission of Pesticide Use Reports as required by state law. It would be used as a record of all pesticide use within the University, including glyphosate. The PUA software should be modeled after the City and County of San Francisco's Pesticide Exemption Request form and be used for all tiers of pesticide use. 2. **Recommend that the Chancellors assess their facilities and grounds budget to account for additional equipment or resources, including staff augmentation.**
	2. Evaluate current toxicological research and relevant legal considerations.	N/A
	3. Confirm or recommend revisions to the existing use exceptions detailed in the temporary suspension of glyphosate-based herbicides, based on risk assessment considerations and feasible alternatives.	The Task Force has already recommended that the President clarify for UC locations the existing glyphosate-based herbicide suspension and provide specific details regarding requests for a specially tailored exception. The President accepted that recommendation and sent a letter to UC locations on August 12, 2019.
	4. Research and recommend long-term glyphosate-based herbicide application and management practices,	3. **Require, within 1 year, all pesticides at UC be applied only by California licensed/certified applicators.** (By Nov. 2020) UC, by the IPM Policy, would not allow non-licensed or non-certified applicators to apply

	as well as appropriate protective controls.	pesticides even if under direct supervision by a licensed individual. 4. **Provide UCOP support for QAL/QAC initial qualification training to all UC pesticide applicators.** That training should be funded by OPRS. The financial responsibility for examination and the fees for continuing education should be the responsibility of the local department.
	5. Review and approve/deny location-specific glyphosate-based herbicide exception requests.	5. **Continue the glyphosate suspension until a Presidential IPM Policy is implemented and locations complete their IPM plans, as detailed in recommendation number 7.** 6. **Continue to charge the Herbicide Task Force with reviewing and approving location-specific glyphosate-based herbicide exception requests until the location has implemented its local IPM Committee (IPMC) and plan.**
ALL PESTICIDES	6. Recommend a strategy for evaluating the sustainable use of pesticides generally, including overall integrated pest management practices and the implementation of organic solutions and non-pesticide-based strategies.	7. **Adopt a Presidential Integrated Pest Management (IPM) Policy that enacts the recommendations that were accepted by the President.** (By Nov. 2020). **The IPM Policy would:** a. **Require that all UC pesticide use follow IPM practices.** b. **Restrict the use of all Tier 1 (high-red banded) pesticides and permit their use only after a local IPM Committee (IPMC), as defined by the local IPM plan, has reviewed and approved its specific use application following an IPM-based assessment.** c. **Provide that lower-tier classified pesticides (medium-yellow, low-green) be subject to limitations of use and review as determined by the IPMC.** This Policy should apply to all UC locations and all UC pesticide applications, whether applied by UC personnel or contracted pesticide applicator vendors. The Policy would limit the categorical exemption to only Research. The requirement for complying with the Policy should be included in new relevant contracts (e.g., leases, partnerships, etc.) requiring adherence to the Policy. The Task Force has drafted an outline of the

IPM Policy based on a review of best practices and input from Integrated Pest Management experts.
Note: Glyphosate is classified in the San Francisco hazard classification scheme as a Tier 1 pesticide, as are other known or probable carcinogens, many of which are widely used in California.

8. **Appoint a Center of Excellence (CoE) on IPM to coordinate activities systemwide and advise locations on implementing these recommendations, as well as to provide training.** (By Feb 2020) This CoE should be funded by OPRS.

9. **Direct OP Risk Services to regularly convene a Systemwide Pesticide Oversight Committee (SPOC).** (By Nov. 2020)
    a. Continue the Herbicide Task Force as the inaugural SPOC until its charter and membership can be established.
    b. The SPOC should collect and maintain a library of all the location-specific IPM plans for reference by the IPMCs. The SPOC would review the location-specific IPM plans for consistency with the IPM Policy.
    c. The SPOC would facilitate best practices sharing among the locations.
    d. The SPOC should collect data through the PUA software and other methods to report IPM practices within UC annually. These reports should include a summary of pests affecting UC locations, alternative methods utilized, public comments, and a review of annual pesticide use.
    e. The SPOC would be responsible for oversight of and revising the Presidential IPM Policy.

10. **Task the SPOC to curate a methodology to classify pesticides into a series of tiered hazard bands (high-red, medium-yellow, low-green) using existing authoritative bodies.** (By Nov. 2021) The classification methodology should use methods similar to those that have been adopted and successfully used by other entities that are based on authoritative bodies. <u>As an initial classification methodology, the SPOC should use the *City and County of San Francisco Reduced Risk Pesticide List* hazard tier classification system.</u>

		11. **Direct each UC Location to establish or designate an existing committee as a local IPM Committee (IPMC)**. (By Nov. 2021) The IPMC would provide the coordination necessary to ensure proactive review and advisement on the location's Integrated Pest Management plan. The IPMC would: a. Develop a location-based IPM plan; b. Solicit stakeholder engagement as part of the IPM plan development and revision process; c. Review and approve pesticide use authorizations. The IPMC would be responsible for determining the controls for safe pesticide applications based on the proposed or anticipated use and the hazard tier of that pesticide. The IPMC should evaluate the Pesticide Use Authorization following requirements set forth in the location-specific IPM-based assessment.
REPORT	7. Submit a report to the President by November 1, 2019, addressing the above tasks, and prioritize and propose a timeline for implementing the Task Force's recommendations.	N/A

Note: A list of the technical terms and abbreviations used in this report is included in the Glossary at the end of the document.

Approach

The Task Force used a number of methods to gather data and input to complete its work. First, the Task Force conferred with a number of experts both within UC and from other institutions of higher education to gain additional insight from multiple perspectives. Several Task Force members attended presentations from staff and consultants working on organic landscape management strategies from the University of Colorado-Boulder, Harvard University, Pepperdine University, and UC Berkeley. In order to obtain a better understanding of the complex issues involving weeds and weed management, the Task Force arranged briefings by a number of weed scientists from ANR.

The Task Force relied on data collected from internal surveys of pesticide use at the UC locations. The surveys were instrumental in revealing potential gaps in practices, training, and the level of institutional oversight of pesticide use. These potential gaps informed the recommendations ultimately made by the Task Force.

The Task Force conducted two on-campus visits in conjunction with its meetings. The first, held at UCLA, focused on the demonstration of a steam machine that thermally kills the plant using heated water and a mild soap solution to create an insulating layer of bubbles to remove weeds from hardscape areas. During the second visit, to the ANR Citrus Station located at UC Riverside, members of the Task Force received a tour of the pesticide use operation conducted at that facility. They observed numerous types of agricultural equipment used to apply pesticides to the various crops in research experiments at the station.

The Task Force also leveraged the services provided by a risk consulting firm contracted by the Office of the President, Risk Services (OPRS), to conduct focus group sessions comprised of UC pesticide applicators from various departments. These sessions were conducted at UC Berkeley and UC Santa Barbara. The Task Force felt that it was important to use an independent party to conduct these sessions to help obtain an accurate summary of the anonymous opinions and perspectives expressed by these applicators. A written summary of that report was presented to the Task Force members for use in formulating their recommendations.

Lastly, in writing this report, the Task Force reviewed and discussed information from various written sources, including public and governmental agencies, peer-reviewed literature, and articles from civil society organizations. To the extent possible, this report is based on information from governmental agencies, authoritative bodies, and peer-reviewed literature.

Developing Recommendations

The Task Force developed its recommendations by direct discussion during 12 conference calls, five all-day in-person meetings, email correspondence, and electronic polling of its members. To develop specific recommendations, the response to each charge-point was led by one or two Task Force

members, who were responsible for background research, presentation, leading the discussion, and drafting the corresponding section of the report.

The recommendations of the Task Force are highlighted in blue shading.

The Task Force reached a consensus on the majority of its recommendations, and each recommendation is provided with its corresponding charge item in the report below.

Two of the Task Force members comprised a minority opinion with regard to the recommendations on Charge 6. This report includes their viewpoint in the recommendations under that Charge.

Findings and Recommendations

Charge 1: Summary of glyphosate-based herbicide use activities and estimated fiscal impact of discontinued use.

Glyphosate Survey and Focus Groups

Two electronic surveys, as well as in-person herbicide applicator focus group sessions were conducted as part of gathering glyphosate-based herbicide information in the UC system. An initial survey was distributed to EH&S Directors in April 2019 to better understand the scope of glyphosate-based herbicide use, estimate the fiscal impacts of discontinued use, and assist leadership in establishing the parameters of the suspension. A second and more comprehensive survey was conducted to evaluate the historical and current use rates of glyphosate-based herbicides, determine reduction during the temporary suspension period, and to assess need, possible alternatives, training, and the availability of Integrated Pest Management plans. The distribution of this survey at each location was performed primarily by the campus's EH&S Director and related staff. The survey was department-based at each location; that is, a complete survey response was requested from each department or unit using pesticides. Common operational departments and units submitting information included Facilities, Housing, Grounds, Athletics, the location's associated Natural Reserve System sites, and a large number of Agriculture and Natural Resources staff. In some cases, locations compiled all the information for their campus and submitted one survey response for their entire site.

The herbicide applicator in-person focus group sessions were conducted at two campuses, UC Berkeley and UC Santa Barbara, and were valuable for gathering direct feedback and engaging in conversations about pesticide use management and safety considerations with front-line applicators. Throughout this section of the report, the term "survey" is used to reference the two electronic surveys that were distributed across the system, and the phrase "focus group sessions" relates to information gathered in-person at the UC Berkeley and UC Santa Barbara meetings.

To ease the burden of completing the electronic survey, respondents were provided a great deal of latitude in terms of how they reported estimated use rates. Although this latitude resulted in a wide variety of formulations, quantities, mixtures, pounds of the active ingredient reported, etc., a final conversion of these figures and units into the amount of estimated glyphosate use in pounds of acid equivalent[2] was performed, thereby allowing the Task Force to normalize the data for comparison and summary purposes. An opportunity was provided for individual respondents to list and document

[2] The active ingredient (a.i.) of glyphosate is listed as a salt + glyphosate acid on the label of commercial herbicides. Glyphosate acid is the herbicidal form of glyphosate in plants but the salt portion can vary depending on the formulation. Because the salt portion can have different weights, acid equivalent (a.e.) is used instead of a.i.for glyphosate to provide a more appropriate comparison of the herbicidal active portion among different formulations.

concerns regarding the suspension as well as to state the pros and cons of alternative methods of weed control.

The Task Force would like to stress several key points that were noted as part of conducting these surveys and focus group sessions. First, the surveys and focus group sessions highlight the distributed nature of pesticide use across the UC system. There are many different departments and individuals within those departments applying pesticides, as well as designated pesticide applications that are contracted to a third party. Second, given the timeframe available to collect survey information and in some cases the lack of detailed record-keeping, a high degree of uncertainty exists in regards to the estimated use rates provided by respondents. Third, the Task Force recognizes that the survey may not have reached all departments or individuals applying pesticides in the UC system. Lastly, estimating the financial impacts of a long-term suspension or ban on glyphosate-based herbicides was extremely difficult for locations and resulted in a wide range of potential cost impacts being reported. All of these factors must be considered when evaluating the survey information and considering its accuracy; however, the Task Force does believe there was great value in conducting the survey as it provided valuable feedback on broader trends, applicator concerns, and where potential reductions in glyphosate-based herbicides are perhaps more feasible from both an economic and weed control perspective.

Glyphosate-Based Herbicide Use Information

Prior to the President's temporary suspension, several UC locations had already ceased using glyphosate-based herbicides for applications other than agriculture, while other campuses had begun transitioning to alternatives. Four of the five medical centers were not using glyphosate-based herbicides (UC Irvine was the exception), and two of the campuses (UCLA and UC San Francisco) had already discontinued the use of glyphosate-based herbicides. UC Riverside had discontinued the use on the main campus but still used glyphosate-based herbicides in its agriculture operations.

Additionally, some UC locations have implemented or are testing a variety of alternative weed control solutions that do not involve synthetic pesticides. Some of those alternative solutions include student-led initiatives and were driven and dependent on the availability of student volunteers (e.g., manual weeding); while other methods have relied on new technology and equipment such as using hot foam to kill weeds in designated hardscape areas, or the strategic use of goats grazing in open spaces prone to wildfires. Staff responsible for weed control have begun sharing these alternative approaches with their peers in other UC locations, and the President's actions have accelerated this knowledge-sharing effort.

Glyphosate Survey Summary Results

- 49 total respondents successfully completed the survey
- 26 responses were from ANR respondents
- All 10 campuses responded

- Three health system locations responded to the comprehensive survey, all five health systems responded to the initial survey

Glyphosate Use During the Suspension

- 13 respondents reduced the use of glyphosate relative to FY 17/18 rates by 100% during the suspension
- 18 respondents continued the use of glyphosate under one of the four allowed exceptions
    - Agricultural operations and native habitat restoration were the most commonly applied exceptions
- There was a 27% reduction in glyphosate use reported during the temporary suspension compared to FY 17/18, although this number may be elevated due to gaps in reported use estimates for two locations during the suspension period.

Table 3: Summary of Glyphosate Use (Pounds of Acid Equivalent) by Campus and Health System

UC Location	FY 17/18 Use (lbs. a.e.)	Current Use (lbs. a.e.)	% Reduction During Suspension
UC ANR	3,033	2,427	20%
UC Berkeley	406	DNR*	NA
UC Davis	4,720	4,400	7%
UC Davis Health	363	0	100%
UC Irvine	9	0	100%
UC Irvine Health	167	DNR	-
UCLA[3]	278	0	100%
UC Merced	170	170	0%
UC Riverside	360	356	1%
UC San Diego	105	0	100%
UC San Diego Health	0	0	-
UCSF[4]	0	0	-
UC Santa Barbara	429	0	100%
UC Santa Cruz	22	0.5	98%
TOTAL	**10,062**	**7,354**	**27%**
*, # Did Not Report			

[3] Includes both Campus and Health System.

[4] UCSF's landscape manager, Morgan Vaisset-Fauvel, communicated that they manage both its open space areas and landscaping on all campuses without glyphosates or any other chemicals. Instead, UCSF removes weeds and clears landscaped areas by hand, with goats, through burning, and, occasionally, using mechanization. When they are re-landscaping an area, they design it in a way that discourages the introduction of weeds in the first place.

Fiscal Impact of Alternatives

Potential fiscal impacts of a permanent ban on the use of glyphosate-based herbicides were extremely difficult for respondents to quantify. The survey respondents estimated fiscal impacts that ranged from several hundred thousand dollars to over two million dollars, with the projected cost increases going towards additional employees to conduct hand weeding, equipment such as steam machines, or more expensive alternate chemical herbicides. The dollar figures provided were typically expressed in very broad ranges representing the uncertainty in how many additional FTE would be required or how much more time an alternative means of control would take to implement, as well as the challenge of not understanding the long-term efficacy of alternative control strategies.

Alternative Means of Control:

- Hand weeding and mulching were the most common alternative methods of control used
- 19 respondents reported using an alternative chemical herbicide or herbicides during the suspension
- Most common noted concerns of alternative means of control:
    - More costly (equipment, alternative herbicides, more frequent applications)
    - More labor-intensive (hand-weeding is very labor-intensive)
    - Not as effective (most alternatives do not provide as long a control interval between treatments)

The Herbicide Task Force does believe there would be both short-term and long-term cost ramifications of indefinitely banning the use of glyphosate-based herbicides; however, those figures will vary significantly among operational departments and UC locations depending on the following variables:

- Types of alternative weed control strategies used,
- Implementation of weed control strategies,
- General campus environment (urban versus more rural),
- Terrain (steep hillsides versus flatter landscapes),
- Type and amount of development (landscaped areas, hardscape areas, native plant habitat areas, etc.), and
- Aesthetic expectations for the location.

Herbicide Applicator Focus Group Sessions

Two herbicide applicator in-person focus group sessions were conducted; one at UC Berkeley on September 17, 2019, and another at UC Santa Barbara on September 18, 2019. In both cases, the sessions were conducted by a third-party risk consulting firm to support the open sharing of information by UC herbicide applicators. In each session, the consulting firm stressed the fact that this

was an opportunity for attendees to speak freely and express their concerns and thoughts related to herbicide use in the UC system and the current suspension of glyphosate-based herbicides. The detailed results of the focus group sessions are available in Appendix B. For this public report, all names have been withheld, and individuals are referred to by title only.

During the focus group sessions, participants were asked to provide their opinions on a variety of topics, including their general use of pesticides, training, use of personal protective equipment, safety practices, potential alternative weed control mechanisms, and overall risk considerations. In both cases, the sessions were noted to be informative interactions with participants being actively engaged in the discussions and eager to provide feedback. Representative job classifications and functions included groundskeepers/applicators, fire prevention staff, land and resource stewards from research reserves, environmental protection representative, habitat restoration coordinator, and a student. A total of 18 individuals attended and participated in the in-person focus group sessions.

An overall common opinion between focus group participants from both campuses was that if the glyphosate suspension continues, there will have to be tradeoffs regarding landscape aesthetics, budget, or worker safety.

Summary of Activities and Fiscal Impact

The survey data generally indicated:

- Herbicides are used by a wide variety of individuals and within multiple operational departments across the UC system.
- There is no common pesticide inventory or tracking system in place for the UC system.
    - There is a large degree of variability in the accuracy of pesticide inventories currently being maintained.
- Locations with extensive agricultural research operations rely more on glyphosate-based herbicides than other locations.
- Many locations would use multiple means of alternative weed control strategies, including other chemical herbicides if glyphosate were permanently banned (based on currently available information, some of those alternative chemical herbicides may have greater acute or chronic toxicity concerns relative to glyphosate).
- Most locations believe a permanent ban on glyphosate would result in a significant fiscal impact due to increased labor costs and a greater cost associated with alternative means of control; however, the degree of that impact is very difficult to quantify.

The survey also revealed potential areas for improvement in gathering this information.

Pesticide Use Records

The Task Force notes that some of the reported survey challenges reflect the dispersed nature of pesticide applications across the UC system,as well as the variability in operational departments or units tracking and documenting the use of pesticides. The difficulty for campuses and medical centers to summarize this information and for individual applicators to track routine use of pesticides supports the recommendation that a systematic approach is implemented to promote more standardized pesticide management practices, including improved oversight, inventory maintenance, and training within UC.

The Task Force discussed the pros and cons of recommending that UC manage its pesticide use via a Pesticide Use Authorizations (PUAs) process. A PUA is a means of implementing *a priori* approval for pesticide uses. This is envisioned similar to existing use authorization (UA) controls implemented by EH&S for other program areas such as radiation safety (RUA), biosafety (BUA), lasers (LUA), and controlled substances (CSUA). With this PUA, departments that foresee or encounter the need to use a pesticide would submit a use authorization application indicating the type of pest, the location where the pesticide will be used, the pesticide application method, the intended pesticide(s) and additional information needed to evaluate the overall risk. That PUA request would be reviewed and approved following that location's Integrated Pest Management plan (discussed later in the report).

The PUA process is envisioned to be implemented by online software developed by and for UC as part of the existing EH&S suite of safety tools[5] designed to improve the management of safety programs and streamline regulatory compliance. Some of the Task Force members participated in a design scoping process to outline the Pesticide Use Authorization (PUA) development process.

[5] https://riskandsafety.com/

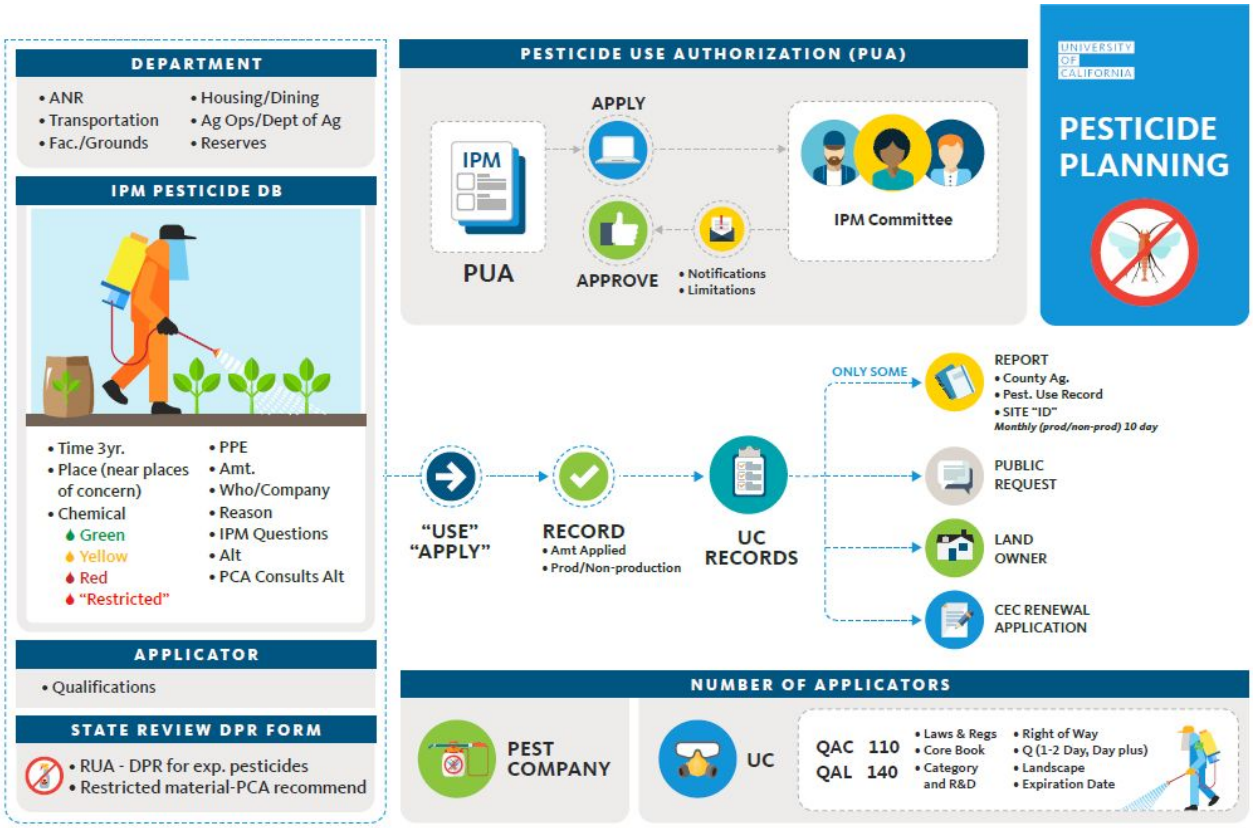

Figure 1: Conceptual Infographic of the Pesticide Use Authorization Application

The Pesticide Use Authorization (PUA) software would allow UC locations to manage and document pesticide needs and justifications before applying pesticides. The PUA software would ensure that the permitted use of the pesticide follows the hierarchy of Integrated Pest Management[6] practices by documenting the alternative evaluations before approving the use of a pesticide. The PUA software would also track the qualifications and licensure of applicators, identify and communicate the appropriate PPE needed for the applications, identify any pre-application required notifications that should be communicated to affected UC location community constituents, and complete the state-required post-application pesticide use reports. The PUA software would collect use records of all pesticides used both for state-required Pesticide Use Reports and UC's annual pesticide use totals.

PUA software would be used to monitor for regulatory compliance and help ensure safety by EH&S professionals at each UC location. Departments, applicators, researchers, EH&S staff, and IPM Coordinators would all be able to utilize the PUA software to monitor and complete the PUA process.

The Task Force envisions a computer-based system for users to apply for and renew their PUAs, and to facilitate the review of PUAs by Integrated Pest Management Committees (IPMCs). The PUA

[6] Explained further in the report.

software should also link to or align with the information that agricultural users already have to report to the County Agricultural Commissioners to avoid duplicative and redundant reporting.

The PUA software would be made available to all UC locations as part of an existing long-term strategic plan to create efficiencies through systemwide technology solutions. The PUA software would be developed by UCOP Risk Services' Risk and Safety Solutions (a UC Davis IT division) through close collaboration with functional representatives from key pesticide use stakeholder groups.

The Task Force believes that systemwide software would offer several critical benefits to the University system. The PUA software would promote standardized processes across the system and replaces campus-specific processes. The Task Force recognizes that a system that facilitates consolidated reporting would be desirable, but there would have to be some flexibility in the system to accommodate unique local needs.

UCOP Risk Services, in coordination with the SPOC, would be responsible for developing a standardized Pesticide Use Authorization (PUA) software form modeled after the *City and County of San Francisco's Pesticide Exemption Request* form[7] for all tiers of pesticide use. The PUA software would create a platform for the adoption of standard baseline justification questions for the use of high-red and medium-yellow banded pesticides at all locations. The PUA software should allow for location-specific questions and individualize data field collection. It is estimated that it would take a year to design and implement this program.

System Highlights:

- Easily accessible by all involved
- A secure and collaborative resource for conducting essential PUA processes and internal controls
- Allows applicators to apply for, manage, amend, and renew PUAs online
- Automates PUA renewal reminders
- Uses standardized PUA application questions that meet the needs of all UC locations
- Ensures greater compliance with the California Department of Pesticide Regulations (CDPR) regulations
- Scalable to accommodate change for new or revised regulatory requirements
- Utilizes and displays Pesticide Applicator training data from the Learning Management System (LMS) for all applicators

This software would collect the required information needed both internal to UC (for tracking purposes) and for external (e.g., state-mandated Pesticide Use Reports). The PUA software would record and track:

[7] https://sfetoxicsreduction.wufoo.com/forms/pesticide-exemption-request/

- UC-applied pesticides for inclusion in monthly Pesticide Use Reports for automated submittal to the County Agriculture Commissioner
- Documentation of IPM training attended by staff
- Certification and licensure of UC applicators by CDPR
- Documentation of progress towards UC's IPM goal for inclusion in the SPOC annual report, including the sharing of pesticide alternatives
- Public complaints received related to UC pesticide applications

Recommendations

The Herbicide Task Force recommends that the President:

1. **Direct OP Risk Services (OPRS)to develop or adopt a systemwide Pesticide Use Authorization (PUA) software application**. (By Nov. 2021) The PUA software would facilitate all required pre-use notifications and the transmission of Pesticide Use Reports required by state law. It would be used as a record of all pesticide use within the University, including glyphosate. The PUA software should be modeled after the City and County of San Francisco's Pesticide Exemption Request form and be used for all tiers of pesticide use.

2. **Recommend that the Chancellors assess their facilities and grounds budget to account for additional equipment or resources, including staff augmentation.**

Charge 2: Evaluate current *health and ecological hazards*[8] and relevant legal considerations

The evaluation presented below on current toxicological research conducted by the Task Force was based on authoritative scientific reports.

Human Health Hazards

Glyphosate (N-(phosphonomethyl)glycine) is a broad-spectrum systemic herbicide and crop desiccant that, for more than 40 years, has been marketed by Monsanto under the trade name Roundup. In 2018, Bayer acquired Monsanto. Monsanto's last commercially relevant patent in the United States expired in 2000, and glyphosate is currently marketed by many different agrochemical companies worldwide in different formulations in hundreds to thousands of different products. It is the world's most widely used herbicide, with annual worldwide usage estimated at 1.8 billion pounds in 2014, up 12-fold since 1995 (Benbrook, 2016). In the state of California, for 2017 (latest year on record), agricultural use of glyphosate totaled 11.7 million pounds of applied active ingredients[9] and 5.5 million cumulative acres treated. Compared to 2016, pounds of active ingredient decreased by just over 170,000 pounds (1.5 percent) while the acres treated decreased slightly by around 38,000 (<1 percent). Glyphosate was the pesticide with the highest cumulative acres treated and the 3rd highest in pounds applied. The amount of total reported agricultural pesticides used in California in 2017 was 205 million pounds, which were used on 104 million cumulative acres (CDPR, 2019). California has a broad definition of agricultural use which, in addition to common agricultural uses, also includes "parks, golf courses, cemeteries, rangeland, pastures, and along roadsides and railroad rights-of-way" (CDPR, 2019).

A limited number of studies have measured glyphosate exposure in humans via biomonitoring (e.g., measuring glyphosate or its metabolites in biospecimens such as urine) in the United States. A larger number have been conducted worldwide. A review of the available biomonitoring data worldwide concluded that the data are limited, but that mean urinary levels of glyphosate in the general population are generally below 4 µg/L and can be higher in areas that have used glyphosate for aerial spraying (mean as high as 7.6 µg/L). Further, levels found in children were higher than adults, and that urinary levels in the same population of 100 participants in California increased from 0.02 µg/ml in 1993 to 0.31 µg/ml in 2016 (Gillezeau et al. 2019).

Glyphosate is a modified amino acid that inhibits the shikimate pathway present in plants and some bacteria. Since this pathway is not present in mammals and glyphosate has exhibited low toxicity in standard tests, glyphosate has historically been considered to have low toxicity to humans.

In March 2015, a working group of the World Health Organization's (WHO) International Agency for Research on Cancer (IARC) conducted a hazard evaluation and concluded that glyphosate was a

[8] Note that the Task Force charge reads toxicological research but the Task Force interpreted the intent to mean human health and ecological hazards

[9] It is not known if this number includes glyphosate applied on UC lands.

probable human carcinogen (Group 2A) (IARC, 2015). In its evaluation, IARC considered the evidence of carcinogenicity to be limited based on human studies, but the evidence in animal studies was sufficient. It also concluded that mechanistic and other relevant data, specifically that glyphosate could induce genotoxicity and oxidative stress, supported the classification into Group 2A. Non-Hodgkin lymphoma (NHL) was identified as a cancer for which a positive association with glyphosate had been seen in humans. The working group estimated a meta-risk ratio of 1.3 (95% Confidence Interval (CI), 1.03–1.65) for NHL.

The IARC evaluation raised concerns throughout the world, and other regulatory agencies and authoritative groups convened expert committees to re-examine the potential hazards of glyphosate and consider the risks posed to the general population through exposure to glyphosate.

These authoritative agencies had access to the publicly available literature that IARC had reviewed, as well as, in some cases, hundreds of unpublished toxicity and cancer studies that had been submitted in support of the registration of glyphosate by various agrochemical companies, including Monsanto, that are not available to the public. These regulatory agencies concluded that glyphosate did not pose a mutagenic or carcinogenic risk to the general population, though some of them specified specific exposure scenarios (e.g., diet). For example, the WHO and Food and Agricultural Organization's Joint Meeting on Pesticide Residues (JMPR, 2016), recognized that there was some evidence of cancer in exposed workers, but considered the evidence from the animal cancer and mechanistic studies to be much more limited. Concerns were raised about the inconsistency of the results of the animal bioassays, and the extremely high doses administered in some of the studies. With regards to the mechanistic studies, while genotoxicity was seen in some lower species and in in-vitro models, the oral administration of glyphosate and its formulation products was not associated with genotoxic effects in an overwhelming majority of studies (29 of 33 bioassays) conducted in mammals, a model considered to be most appropriate for assessing genotoxic risks to humans. The JMPR concluded, "In view of the absence of carcinogenic potential in rodents at human-relevant doses and the absence of genotoxicity by the oral route in mammals, and considering the epidemiological evidence from occupational exposures, the Meeting concluded that glyphosate is unlikely to pose a carcinogenic risk to humans from exposure through the diet." This conclusion focused on exposure to glyphosate in the diet and did not cover other types of exposures to glyphosate, including occupational exposures. Also, the cancer studies did not include studies of developmental exposures such as fetal and childhood, which are more susceptible time periods for exposure to toxic chemicals, which are not evaluated in standard animal cancer bioassays. The conclusions of the agencies below are similar in terms of outlining the circumstances of exposure.

Similar conclusions indicating a lack of cancer-causing effects in some cases for various exposure scenarios (e.g. diet) were reached after scientific reviews by the European Food Safety Agency (2015), the European Chemicals Agency (2017), Health Canada (2017), and regulatory agencies of Japan (2016), South Korea (2017), New Zealand (2019), and Australia (2017). Ongoing, near-final evaluations by the Brazilian pesticide regulatory agency and the US Environmental Protection Agency

(2019) reached similar conclusions that glyphosate was not mutagenic or carcinogenic (note that for the US EPA, not all the peer reviewers agreed with EPA's characterization and said that the evidence is suggestive of human carcinogenic potential of glyphosate. These peer reviewers subsequently published the Zhang et al. study described below). As stated in early 2019 by Health Canada, "no pesticide regulatory authority in the world currently considers glyphosate to be a cancer risk to humans at the levels at which humans are currently exposed." (Health Canada, 2019). Health Canada also states that dietary (food and drinking water) exposure associated with the use of glyphosate is not expected to pose a risk of concern to human health and that occupational and residential risks associated with the use of glyphosate are not of concern, provided that updated label instructions are followed. However, it is important to note that full compliance with labels, such as through wearing personal protective equipment (PPE), does not occur occupationally. A randomized control trial of education for farmers did not substantially increase the use of full personal protective equipment, which was already below 60% (Perry et al. 2003).

More recently, after the most recent judicial verdict in the United States, Vietnam (2019) decided to ban the import of glyphosate, and the Austrian parliament has voted in favor of a ban (Austria, 2019). The Hazardous Substances Committee of Thailand voted in October to ban glyphosate as well as paraquat and chlorpyrifos, which they announced they will implement on December 1st (Thailand, 2019). Additionally, on September 5, Germany announced a phase-out and ban of glyphosate with a ban in 2023 due as part of the insect conservation program because of concerns about insects and bees (Germany, 2019). In addition, as a result of its IARC Group 2A classification, glyphosate was automatically added to the State of California's Proposition 65 list of carcinogens.[10] Glyphosate continues to be registered for use as an herbicide in California and the United States.

Since the outcome of the IARC evaluation was reported, additional studies have been published, both supporting an association between glyphosate and cancer or concluding that the evidence is inadequate to reach such as conclusion. Some notable examples are outlined below.

Human Studies

- Chang and Delzell (2016) in a study sponsored by Monsanto, performed a systematic review and meta-analysis of the association between glyphosate exposure and lymphohematopoietic cancers. They found elevated risk with risk levels ranging from 0% increase to 60% increase in cancer from the meta-analysis for any use of glyphosate and a risk of NHL (meta-RR = 1.3, 95% confidence interval (CI) 1.0–1.6, based on six studies).
- In an update to the large prospective cohort Agricultural Health Study involving 54,000 pesticide applicators, Andreotti et al. (2018) observed no increase in NHL. There was some

[10] Glyphosate was added to Proposition 65 with a No Significant Risk Level (NSRL) for daily lifetime exposure of 1100 µg/day based on life-time exposures (extrapolated from studies in animals) and 1 in 100,000 risk (OEHHA, 2019). Studies have not been conducted in children. EPA often regulates to 1 in a million and the NSRL is used for enforcement of Proposition 65 for notification.

evidence of an increase in acute myeloid leukemia among the most highly exposed workers, which the authors noted needed confirmation.

- Similarly, Zhang et al. (2019) conducted a new meta-analysis of the results of five earlier case-control studies plus the updated Agricultural Health Study focusing on the NHL risks of those with the highest exposure level in each study. They reported that the overall relative risk for NHL among the highly exposed individuals was increased by 41% (meta-RR = 1.41, 95% CI: 1.13–1.75).
- Leon et al. (2019) performed a pooled analysis on the incidence of NHL using data from over 300,000 agricultural workers and farmers participating in three prospective cohort studies, the Agricultural Health Study from the United States, the AGRICAN study from France, and the CNAP study from Norway. Many different pesticides were evaluated, and suggestive increases were seen for several. No association between glyphosate was seen for NHL as a group (Hazard Ratio = 0.95, 95% CI: 0.77–1.18). However, when subtypes of NHL were analyzed separately, one sub-group (chronic lymphocytic leukemia/small lymphocytic lymphoma) showed no change, two subgroups (follicular lymphoma; multiple myeloma/plasma-cell leukemia) showed modest decreases and one, diffuse large B-cell lymphoma found a Hazard Ratio of 1.36 (95% CI: 1.00–1.85).
- NHL currently represents 4.2% of new cancer cases in the United States. While increases were seen between 1975 and 1995, the incidence of NHL in the United States has not appreciably changed over the past 20 years, and has been decreasing by about 1% per year over the past 10 years (NCI, 2019).
- NHL has increased among children (ages 0-19 years) with incidence rates increasing from eight per million in 1995-1998 to 11 per million in 2013-2017 (USEPA, 2019).

Other studies

- Ford et al. (2017) showed that at high doses, glyphosate can be metabolized in mice to glyoxylate, a reactive and potentially genotoxic metabolite.
- Wang et al. (2019) reported that glyphosate induced benign monoclonal gammopathy and promoted multiple myeloma progression in a transgenic mouse model, providing a possible mechanism by which glyphosate could induce multiple myeloma and possibly other B-cell cancers.
- Due to its ability to inhibit the shikimate pathway present in some bacteria, concern has been raised about the potential for glyphosate and its formulation products to interfere with the homeostasis of intestinal microbial communities in humans, livestock, and other species. Recent studies have reported that at elevated dietary levels, glyphosate and/or Roundup can alter the composition of gut microflora in livestock, honey bees, and experimental animals (e.g., JMPR, 2016; Nielsen et al., 2018; Blot et al., 2019). However, it is not clear at this time whether similar effects will occur at the low levels of glyphosate residues present in human diets.

A review of human epidemiologic studies evaluating glyphosate and reproductive related health outcomes identified 12 studies published up until May 2015. Studies covered birth defects, birthweight and preterm delivery, miscarriage, and metrics of fertility/fecundability (de Araujo, 2016). One study evaluated ADHD and other respiratory outcomes (persistent cough/bronchitis, asthma, allergies). The studies did not use biomonitoring measures of exposure and relied on questionnaires or distance to pesticide use. In general, the database did not find many positive associations (with the exception of ADHD), but there are many limitations to the studies. Two additional studies published after the review using better metrics of exposure (biomonitoring and more refined exposure modeling of pesticide exposures) found: a relationship between maternal exposures to glyphosate and shorter gestation in a small population of pregnant women in a relatively small sample of women (n=71) (Parvez, 2018). The other was a large study of almost 3,000 cases of autism found glyphosate use within 2,000 meters of the house during pregnancy and found an association with an elevated risk of autism (Odds ratio = 1.16; 95% CI 1.06-1.27 note: this is one of many analyses presented) in the children after controlling for other pesticide and environmental exposures (von Ehrenstein et al., 2019).

As seen in the evaluations of IARC and the other governmental agencies as well as the more recent literature highlighted above, there continues to be major differences in scientific opinion about the carcinogenicity of glyphosate and its formulation products. In almost all studies, both animal and human, the associations between glyphosate and cancer are modest in magnitude. Given the modest strength of the associations, the variability seen between studies, errors stemming from multiple comparisons, and the difficulty of demonstrating no effect in cancer studies (i.e., proving a negative), it is not surprising that experienced scientists can evaluate the evidence and reach different conclusions. At this time, there is continued disagreement about the carcinogenicity of glyphosate and ongoing concerns regarding its reproductive and neurodevelopmental toxicity.

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Ecological Hazards

Glyphosate is a non-selective, systemic herbicide that has been widely used since the 1970s, according to the U.S. Environmental Protection Agency (US EPA, 2019). As indicated above, it is the world's most widely used herbicide (Benbrook, 2016). Glyphosate is used to control weeds predominantly in agricultural settings, although because of its non-selective nature, it is used for weed control in landscaping as well.

Glyphosate is classified by the Weed Science Society of America as a Group 9 herbicide and is the only commercialized herbicide active ingredient in this group (WSSA MOA). In susceptible plants, glyphosate inhibits one enzyme (5-enolpyruvylshikimate-3-phosphate synthase, or EPSPS). This enzyme is present in plants, fungi, and bacteria but not in animals (Kishore et al., 1988). The EPSPS enzyme catalyzes an important reaction in the shikimate pathway, which is a key step in the synthesis of aromatic amino acids (e.g., phenylalanine, tyrosine, and tryptophan). This, in turn, ultimately stops the production of several hormones, critical plant metabolites, secondary compounds, enzymes, and other proteins that are subsequently built from these amino acids. Inhibiting the production of these important plant biochemicals leads to plant death.

Glyphosate is applied to the surface of leaves and other above-ground plant tissues where it is absorbed relatively rapidly, primarily through diffusion. Although glyphosate can be absorbed by roots, this is uncommon in terrestrial weeds rooted in soil, but exposed non-woody roots can be a pathway for absorption. Biophysically, because it is adsorbed to soil particles, glyphosate is not available for uptake by plant roots and therefore is not considered to be a soil-active herbicide. It does not impact germinating seeds (Shaner, 2014).

In U.S. agriculture, glyphosate is often used in conjunction with genetically modified crops, such as varieties of corn and soybeans, which were developed to tolerate glyphosate. When glyphosate is applied to these crops, they are not impacted, and only the weeds are killed. Glyphosate spray drift in agriculture has been linked to crop damage when glyphosate lands on non-genetically modified (and non-targeted) crops nearby (Cederland, 2017). Corn and soybeans are not significant crops in California (CDFA, 2019). In California, glyphosate is used in agriculture primarily for weed control, such as in perennial crops, as stated above (CDPR, 2019). Glyphosate is commonly used in agriculture, and researchers have detected residues of glyphosate in many types of food (Bai and Ogbourne, 2015).

According to the International Survey of Herbicide Resistant Weeds, 311 weeds worldwide are resistant to glyphosate. Several weeds in California have evolved resistance to glyphosate due to the selection pressure from reliance on a single method of weed management (Heap, 2019). The evolution of pesticide resistance is not unique to glyphosate and is reported for many herbicides, insecticides,

fungicides, and bactericides. Sole reliance on herbicides for weed management has been linked to a decrease in biodiversity (Schütte et al., 2017).

In April 2019, the EPA released its "Glyphosate: Proposed Interim Registration Review Decision" for public comment. In it, the EPA stated its review did not contain a "complete endangered species finding," including effects on "designated critical habitat" (US EPA 2019). EPA also noted that "additional data may be necessary to fully evaluate risks to non-target terrestrial invertebrates, especially pollinators" (US EPA, 2019). The impact of glyphosate on honeybees is uncertain and is an area of current research. For example, recent studies debate whether exposure of honeybees to certain levels of glyphosate can impact their gut bacteria, potentially making them more susceptible to certain diseases and mortality (McArt and Wixted, 2019; Motta et al., 2018). Another study has documented that honeybee exposure to glyphosate may impair their spatial recognition and ability to navigate (Balbuena et al., 2015). Weed management, with glyphosate or any other methods, also reduces the number of flowering weeds and therefore reduces the food sources for pollinators. Additionally, researchers have found that glyphosate can be toxic to certain aquatic organisms, including snails and worms, depending on the concentrations they have been exposed to (Omran and Salama, 2016; Perez et al., 2010). Some glyphosate formulations contain surfactants (soap-like chemicals) that are harmful to birds, fish, and aquatic vertebrates (USGS, 2018). The surfactants are included in the formulated product to increase the absorption of glyphosate into plant tissues in order to increase its efficacy. EPA has suggested measures to reduce spray drift to minimize risk to aquatic organisms, pollinators, and non-targeted plant species, and around weed resistance (US EPA, 2019).

Glyphosate is not listed by the California Department of Pesticide Regulation as a potential groundwater contaminant. Although it is soluble in water (Shaner, 2014), glyphosate binds to soil and, thus, is considered unlikely to leach into groundwater or run off significantly to surface waters. Geisy et al. (2000) relayed the results of a three-year study that found less than 1% of applied glyphosate ran off-site, and 99% of this occurred in the first significant rain event before soil binding was complete. Other authors indicate some potential for glyphosate to move in soil via macropores and mass flow but suggested this was not common outside special circumstances (Borggaard and Gimsing, 2008). Degradation of glyphosate in water is generally attributed to microbial activity (Geisy et al., 2000). Due to degradation processes and adsorption to suspected particulate matter, glyphosate half-life in aquatic systems was estimated at 7-14 days. In aquatic systems, glyphosate was degraded to AMPA, which had a half-life comparable to that of glyphosate.

Despite the aforementioned properties, glyphosate has been detected in a variety of waterways, including 59% of surface water and in more than 50% of solid and sediment samples, as well as ditches and drains, according to data analyzed by the USGS of 3,732 environmental samples collected between 2001 and 2010 from 38 states (USGS, 2014). USGS data also shows "chronic low-level exposure" to glyphosate through water. Additionally, glyphosate has been detected in seawater, and its degradation depends on factors such as light and temperature (Mercurio et al., 2014).

The California Department of Pesticide Regulation does not consider glyphosate to be a toxic air contaminant. The vapor pressure of the glyphosate acid and its common salt formulations is in a range that is considered to be low volatility under normal conditions (Shaner, 2014). Thus, glyphosate losses from soil or plant surfaces via vaporization from treated surfaces is negligible (Geisy et al., 2000).

Once in the soil, glyphosate is primarily degraded by biological processes (Mensink et al., 1994; Geisy et al., 2000). The Weed Science Society of America, Herbicide Handbook (Shaner, 2014) describes glyphosate as "moderately persistent" in soil with an average soil half-life of 47 days. Glyphosate has a highly variable soil half-life ranging from three days to 174 days, which is likely driven by soil and environmental parameters that drive the rate of biological degradation by soil microbes (Bento et al., 2016; Mensink et al., 1994). Similarly, Giesy et al. (2000) reported soil half-life values ranging from one to 197 days in their review paper.

The primary route of glyphosate degradation in the soil is by bacteria (Geisy et al., 2000). The major degradation pathway breaks the glyphosate molecule to glyoxylic acid and aminomethylphosphonic acid (AMPA). Geisy et al. (2000) reported that while AMPA typically is degraded more slowly than glyphosate (76 to 240-day half-lives), that is likely due to its relatively greater binding of AMPA to soil compared to glyphosate.

The presence of glyphosate in the soil may be changing soil microbial communities, including decreasing numbers of those which are beneficial to plant growth (Van Bruggen et al., 2018; Newman et al., 2015). As bacteria are reacting to glyphosate concentrations, researchers are examining potential links between glyphosate and the evolution of antibiotic-resistant bacteria (Van Bruggen et al., 2018).

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Legal Analysis

This section is found in Appendix G, which has been removed from the public version of the report to maintain attorney-client privilege.

Charge 3: Revisions to use exceptions detailed in the President's temporary suspension of glyphosate-based herbicides

Some locations requested clarification of the scope of the suspension. The Task Force provided recommendations to the President to clarify certain elements of the temporary suspension of glyphosate use that entered into effect on June 1, 2019. The Task Force also recommended that the President clarify for UC locations the existing glyphosate-based herbicide suspension and provide specific details regarding requests for a tailored exception. The President accepted that recommendation and sent a letter to UC locations on August 12, 2019 (attached as Appendix C), that explained the following:

> "First, general weed control in landscaped areas of the main campus, parking lots, street medians, etc. should not be considered "agricultural use" within the scope of the four enumerated exceptions to the temporary suspension. Should a UC location believe that it requires a specially tailored exception for such applications of glyphosate, that location should submit a specific request, as detailed below.
>
> Second, the production of timber for harvest is considered an "agricultural use" for the purposes of the enumerated exceptions.
>
> Third, the temporary suspension does apply at public-private partnership ("P3") projects, unless specific contractual terms between the University and third-party developers prevent the University from exercising control over pesticide applications. If such contractual terms do exist, University staff should nonetheless describe the temporary suspension and seek the third party's voluntary adherence.
>
> Fourth, if any UC location desires to propose a specially tailored exception for consideration by the system-wide Task Force, that location should provide the following information with respect to the proposal: (1) proposed location, quantity, frequency, and timing of glyphosate use; (2) demonstrated need for weed control; (3) alternatives to glyphosate attempted or considered; (4) reasons for not adopting an alternative means of weed control; (5) personal protective equipment to be worn by applicator(s) and proof of relevant certification/licensure/training for applicator(s); (6) potential for herbicide contact by persons other than the applicator(s); and (7) any environmental resources (water bodies, wildlife, non-target plants, etc.) that could be affected by the application of glyphosate."

Recommendations

The Task Force has already recommended that the President clarify for UC locations the existing glyphosate-based herbicide suspension and provide specific details regarding requests for a specially tailored exception. The President accepted that recommendation and sent a letter to UC locations on August 12, 2019.

Charge 4: Research and recommend long-term glyphosate-based herbicide application and management practices

Research Glyphosate-Based Herbicide Management Practices

List of Colleges and Universities with Pesticide-Use Restrictions

The Task Force did not locate a central repository with a current list of colleges and universities that have bans or restrictions on the use of glyphosate. The Task Force's search was further complicated by the fact that some higher education institutions are phasing out pesticides like glyphosate, but have not made formal or public announcements about these actions (and instead, members of the Task Force learned about these through word of mouth with staff on impacted campuses).

The following information about colleges and universities with restrictions on glyphosate use was collected through word of mouth, internet searches, looking at "Bee Campuses[11]," and queries to higher education email lists.

In its search, the Task Force did not find any college or university that completely bans any specific pesticide that is currently available on the market. Those institutions that have addressed pesticide use instead have various degrees of limitations on pesticide use and emphasis on non-toxic and organic pest management. The limitations vary in scale and scope and range from strict pesticide-free management of specific and small numbers of campus spaces to Integrated Pest Management (IPM) programs that impact every campus location. Many colleges and universities consulted have trained existing staff or hired new staff or consultants that are specialists in alternative pest management strategies (such as horticulturalists, gardeners, and arborists) to manage spaces without pesticides.

Table 4 contains details about higher education institutions with restrictions on pesticide use. Note that there are currently 82 "Bee Campuses." As such, this table is not meant to serve as a comprehensive comparative list of colleges and universities with restrictions on pesticides. Rather, the table contains a summary of information about pesticide use restrictions from universities that the Task Force found helpful when crafting its recommendations.

[11] https://www.beecityusa.org/current-bee-campuses.html

Table 4: Selected List of Higher Education Institutions with Restrictions on Pesticide Use.

Institution	Summary of Findings
University of Colorado (CU) Boulder[12]	The University of Colorado-Boulder (CU Boulder) is gradually eliminating all pesticides after it started with glyphosate in Housing Facilities. It does not use chemicals for weed management. Note that other University of Colorado locations do not have a similar policy. "CU Boulder has recently completed its report and recommendations, which call for a graduated pesticide reduction leading to pesticide elimination over a six-year period for campus turf and grass spaces, with similar reductions of pesticide applications to shrub, bush, and parking lots. The plan focuses on reductions in the highest student use areas first and will significantly reduce chemical exposure to students, faculty, and staff in its first year of implementation, with substantial environmental and ecosystem benefits, realized within the first five years of the program. The complete report is currently being approved by the E-Center, FM and HDS leadership, and will be posted for public review in the near future."
Harvard University[13]	Harvard University in Massachusetts has an "organic maintenance program" for its landscaping. Eighty-five acres of Harvard's 300-acre campus is managed organically. What is not included in these 85 acres: ● The Business School ● Athletic fields (most are synthetic turf) ● Ag spaces (Harvard does not have any) ● Roadsides and medians (Harvard does not have many). The city of Cambridge, however, where Harvard is based, is looking into these with Environmental Design ● Note that Harvard has no ag spaces and has minimal medians and roadsides. "Organic" is defined as non-toxic pesticides and minimal use of fertilizers (synthetic chemical and other). "Our [organic] program uses only non-toxic methods for treating and preventing pests and disease by relying on the following processes and techniques:

[12] Source: https://www.colorado.edu/ecenter/about-us/cusg-environmental-board. Presentation from David Lawson's visit to UC 7/25/2019.
[13] http://www.energyandfacilities.harvard.edu/facilities-services/landscape-maintenance/organic-maintenance-program. Conservation with Eric Fleisher of Environmental Design on 7/26/2019.

	• Aerating to reduce plant stress • Monitoring moisture because inadequate moisture levels can weaken plants and make them susceptible to pest problems. • Applying compost teas to suppress powdery mildew. • Introducing and cultivating beneficial insects that prey on destructive insects. • Manually removing infected tree and shrub branches. • Manually removing weeds."
Pepperdine University[14]	Pepperdine University in California has eliminated rodenticides, and some campus spaces are managed without synthetic chemical pesticides, including a Division 1 Soccer Field. The University uses native vegetation to "eliminate the need for fertilizer, irrigation, and pesticides while reducing air pollution, minimizing erosion, and improving water quality." A portion of the Malibu campus that is actively managed by Facilities is maintained completely organically or without fertilizers, pesticides, and other chemicals. In May of 2014, Pepperdine phased out the use of rodenticides in favor of a poison-free pest management system. Raptor perches were installed throughout the campus to encourage natural predation by birds of prey in the local Santa Monica Mountains, including owls and hawks.
Yale University [15]	Yale has introduced pesticide-free, edible gardens to four of its residential colleges. It is now looking to plant pollinator gardens around campus.
Willamette University[16]	Willamette University in Oregon no longer uses petroleum-based fertilizers or pesticides. It is certified organic (by Oregon Tilth).
American University[17]	"The grounds crew confirmed that they had instituted a temporary ban on products that contain glyphosate." No public announcement was made.

[14] https://www.pepperdine.edu/sustainability/current-practices/native-vegetation.htm. Task Force presentation with Chip Osborne and Jay Feldman of Beyond Pesticides on 8/5/2019.
[15] https://sustainability.yale.edu/news/yale-explores-edible-plants-and-pollinator-gardens)
[16] http://willamette.edu/offices/facilities/pdf/dean-powerpoint.pdf
[17] From email correspondence with Sapna (8/2019)

Pesticide Applicator Training

The Task Force survey results regarding current policy and practices indicate that while some training is being provided to UC staff who apply pesticides, the specific personnel required to be trained, training methods, training content, facilitation of training, and specific pesticides included in the training vary considerably and is a key area for potential improvement. Currently, no standard policy exists within the UC to guide its administration on how to govern the use of pesticide applications. Additionally, no UC standards have been set for training parameters such as who needs to be trained, what subjects and skills need to be taught, and who should provide the training.

The Task Force recognizes that safe use of pesticides requires a strong commitment from the primary stakeholder, the University of California, to ensure that its pesticide applicators are adequately trained and provided the correct personal protective equipment. A thorough understanding of and commitment to safety on the part of all team members are essential for the safe and effective application of pesticides. This is best achieved through comprehensive and integrated training. The challenge of training pesticide applicators is to provide integrated training with consistent content.

The Task Force notes that a nationally recognized pesticide applicator training program has operated within UC since 1988. The UC ANR Pesticide Safety Education Program (PSEP) and the Office of Pesticide Information and Coordination (OPIC) program are currently funded by EPA, CDPR, UC ANR, training fees, and study guide sales and provided training to over 2,500 people in 2017 from across the state, including personnel from academic, government, and commercial sectors. While most of this training is post-license/certification training for continuing education hour requirements, PSEP has the knowledge required to develop training material for pre-license/certification preparation.

There are established, California Department of Pesticide Regulation requirements and standards for annual training of anyone who handles or applies pesticides. As part of the preparation for the examination to qualify as a California licensed or certified applicator, the applicant is expected to be knowledgeable of laws, regulations, and basic principles of safe and effective pesticide use. An outline of these knowledge expectations is included in Appendix D. Applicants for certification must demonstrate competence in the use and handling of pesticides by successfully passing an examination.

Practical demonstration through direct mentoring or close monitoring of trainees is strongly recommended before personnel are approved for independent pesticide applications. Training must also require proficiency demonstration for the essential activities, including reading and understanding pesticide labels, development of SOPs for Personal Protective Equipment (PPE) donning and doffing, spill decontamination, waste management, and if necessary, emergency procedures. Appendix E provides a summary table of PPE requirements for pesticide handlers and field workers in agricultural use of glyphosate-based herbicides.

Recommendations

The Herbicide Task Force recommends that the President:

3. **Require, within 1 year, all pesticides at UC be applied only by California licensed/certified applicators.** (By Nov. 2020) UC, by the IPM Policy, would not allow non-licensed or non-certified applicators to apply pesticides even if under direct supervision by a licensed individual.

4. **Provide UCOP support for QAL/QAC initial qualification training to all UC pesticide applicators.** That training should be funded by OPRS. The financial responsibility for examination and the fees for continuing education should be the responsibility of the local department.

Charge 5: Review and approve/deny location-specific glyphosate-based herbicide exception requests

As part of the President's initial communication (issued on May 14, 2019) announcing the temporary suspension of glyphosate-based herbicides effective June 1, 2019, there were four noted exceptions listed:

1. Agricultural operations;
2. Fuel-load management programs to reduce wildfire risk;
3. Native habitat preservation or restoration activities, and;
4. Research that requires glyphosate-based herbicides.

Also included in the President's communication was a statement that if a location determined an alternative solution was either technically infeasible or ineffective and the proposed glyphosate-based herbicide use did not fall within one of the four prescribed suspension exceptions already noted, that location could submit a tailored exception request to the Herbicide Task Force.

Although the initial communication from the President provided information about the suspension and outlined how to request a tailored exception, a follow-up announcement was provided on August 12, 2019, that clarified what information would need to be submitted as part of requesting a tailored exception to the glyphosate-based herbicide suspension. Those details included:

1. The proposed location, quantity, frequency, and timing of glyphosate use;
2. Method of application;
3. Demonstrated need for weed control;
4. Pre-application notices, if any, to be sent and to whom;
5. Pesticide use recording and reporting mechanism/process;
6. Alternatives to glyphosate attempted or considered;
7. Reasons for not adopting an alternative means of weed control;
8. Personal Protective Equipment to be worn by applicator(s);
9. Proof of relevant certification/licensure/training for the applicator(s);
10. Potential for herbicide contact by persons other than applicator(s), and;
11. Any environmental resources (water bodies, wildlife, non-target plants, etc.) that could be affected by the application of glyphosate.

To date, the Herbicide Task Force has received two formal requests to apply glyphosate-based herbicides under a tailored exception during the suspension. The first request was received from the UC San Diego Capital Programs Management unit, and the second request was from the UC Berkeley Landscape Architecture and Environmental Planning department. Both requests were carefully reviewed by the Task Force and involved follow up discussions and requests for additional information or clarification.

The UC San Diego Capital Programs Management group submitted their request on July 17, 2019, which was unfortunately in advance of the President's clarification letter outlining details that would need to be provided for such a consideration. Although this resulted in several rounds of communication, the Task Force felt confident that relevant details were provided to allow a robust review of this particular request, and that ultimately, the proposal included the necessary details. Worth noting, UC San Diego was seeking a response to their exception request by August 1, which would be in advance of students returning to campus. This timing would help limit disruptions to campus operations and would also limit student foot traffic near the project area.

The specific exception request from UC San Diego was to use glyphosate-based herbicides in support of turf-grass removal for a campus stormwater utility project, an overall effort to remove high-water use turf areas, build bioswales (to filter stormwater), and modernize irrigation systems. The two main types of turf-grass to be removed included Kikuyugrass and Bermudagrass. Both of these grasses are very prolific growers, difficult to kill, and in some locations are considered an invasive species. The use of glyphosate was going to involve a single application of product early in the morning, which would allow it to dry prior to any type of allowed foot traffic. One week post-application, the turfgrass was going to be cut out and removed from the project area.

After several weeks of in-depth evaluation and follow up, while awaiting necessary additional information from the requesting unit, the Task Force was informed by UC San Diego that due to timing constraints of the project, they had to proceed with using alternative chemical herbicides and were effectively withdrawing their exception request to use glyphosate-based herbicides. The project management team noted the campus would deal with the maintenance issues and the return of turf-grass weeds in the future. The alternative herbicides used were a combination of Fusilade II, a systemic selective herbicide that targets grasses, followed up with a treatment of Lifeline, a broad-spectrum herbicide. Although the Task Force did not ultimately deliver an approval or denial with respect to this particular request, the process of reviewing the information and interacting with the requesting unit highlighted the many nuanced considerations that are part of these requests as well as the overall challenge of weighing the various pros and cons of such considerations.

The UC Berkeley Landscape Architecture and Environmental Planning unit submitted an exception proposal to the Task Force on August 23, 2019, requesting the use of glyphosate-based herbicide to control poison oak at the Blake Garden property. The proposed use of glyphosate involved using 53.8% RoundUp Custom sprayed as a 2% solution or applied as a formulated product by painting onto cut stumps. On September 16, 2019, after careful consideration and deliberation, the Task Force approved the use of glyphosate-based herbicide for the control of poison oak at the Blake Gardens as it felt poison oak presented a significant risk to human health and well-being in this case. Along with the approval, there were several noted conditions including details on the approval use period (date of issuance to November 1, 2019), requirements regarding notifications (all entrances posted 24-hours in

advance of application and for at least 72-hours thereafter), and personal protective equipment to be worn by the applicator.

Table 5: Summary of Glyphosate-Based Herbicide Exception Requests

UC Location	Department	Request Date	Proposed Use	Task Force Decision
UC San Diego	Capital Programs Management	7/17/19	Requested exception to use glyphosate-based herbicides in support of turf-grass removal efforts associated with a stormwater utility improvement project.	Exception request was withdrawn on 8/12/19. Alternative chemical herbicides used to meet the time-constraint and project schedule.
UC Berkeley	Landscape Architecture and Environmental Planning	8/23/19	Requested exception to use glyphosate-based herbicides to control poison oak on the Blake Gardens property.	Exception request approved by the Herbicide Task Force on 9/16/19 with noted conditions of the approval period, notification requirements, and applicator PPE use.

Continuation of the Glyphosate Suspension

Given the complexity of evaluating glyphosate use considerations and the timing of implementing key recommendations within this report, the Herbicide Task Force believes that the President should continue the glyphosate suspension until a UC IPM Policy is implemented and locations have implemented its local IPM Committee (IPMC) and plan. Further, the Herbicide Task Force is willing to continue to serve by reviewing and approving location exception requests until local Integrated Pest Management Committees can be formed, and local IPM plans are developed.

Recommendations

The Herbicide Task Force recommends that the President:

5. **Continue the glyphosate suspension until a Presidential IPM Policy is implemented and locations complete their IPM plans, as detailed in recommendation number 7.**

6. **Continue to charge the Herbicide Task Force with reviewing and approving location-specific glyphosate-based herbicide exception requests until the location has implemented its local IPM Committee (IPMC) and plan.**

Charge 6: Strategy for evaluating the sustainable use of pesticides

To support human and ecosystem health, ensure that UC is modeling a science-based approach to pest management, establish UC as a leader in ecological practices, and ensure that any use of pesticides (including herbicides) is responsible, the Task Force believes that a Presidential IPM Policy should be promulgated.

This policy would require UC to practice Integrated Pest Management (IPM), and establish a set of control measures to ensure that its use of pesticides is in accordance with federal and state laws and regulations.

Integrated Pest Management Policy

Definition of Integrated Pest Management

UC Statewide IPM Program[18] defines Integrated Pest Management (IPM) as "an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines,[19] and treatments are made with the goal of removing only the target organism. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment."

IPM allows pest managers to use pesticides only after careful and thoughtful considerations of alternatives. IPM stresses the use of non-chemical control methods, such as exclusion or trapping, before chemical options. It was noted that the escalating IPM treatment options (e.g., biological control, cultural controls, mechanical and physical controls, and finally, chemical controls) do not happen sequentially in time. Instead, the pest problem can be analyzed in its entirety, and the best approach to managing it can be determined before applying a treatment. IPM calls for pesticide use only after the consideration of applicable risks to human and ecosystem health, and determination, based on careful and thorough evaluation, that other alternatives are not feasible.

The goal of an IPM program is to minimize the negative human health and ecological impacts of both pests and pest management practices. This includes reducing UC's dependence on pesticides and chemical interventions by focusing on prevention and ecosystem-based management. The Task Force's vision of IPM is to facilitate long-term management of university lands and landscapes to create an environment that supports human and ecological health and places where our students, staff, and faculty can thrive.

[18] https://www2.ipm.ucanr.edu/What-is-IPM/
[19] Interpreted for UC to be either the Presidential IPM Policy or the UC locations adopted IPM plan.

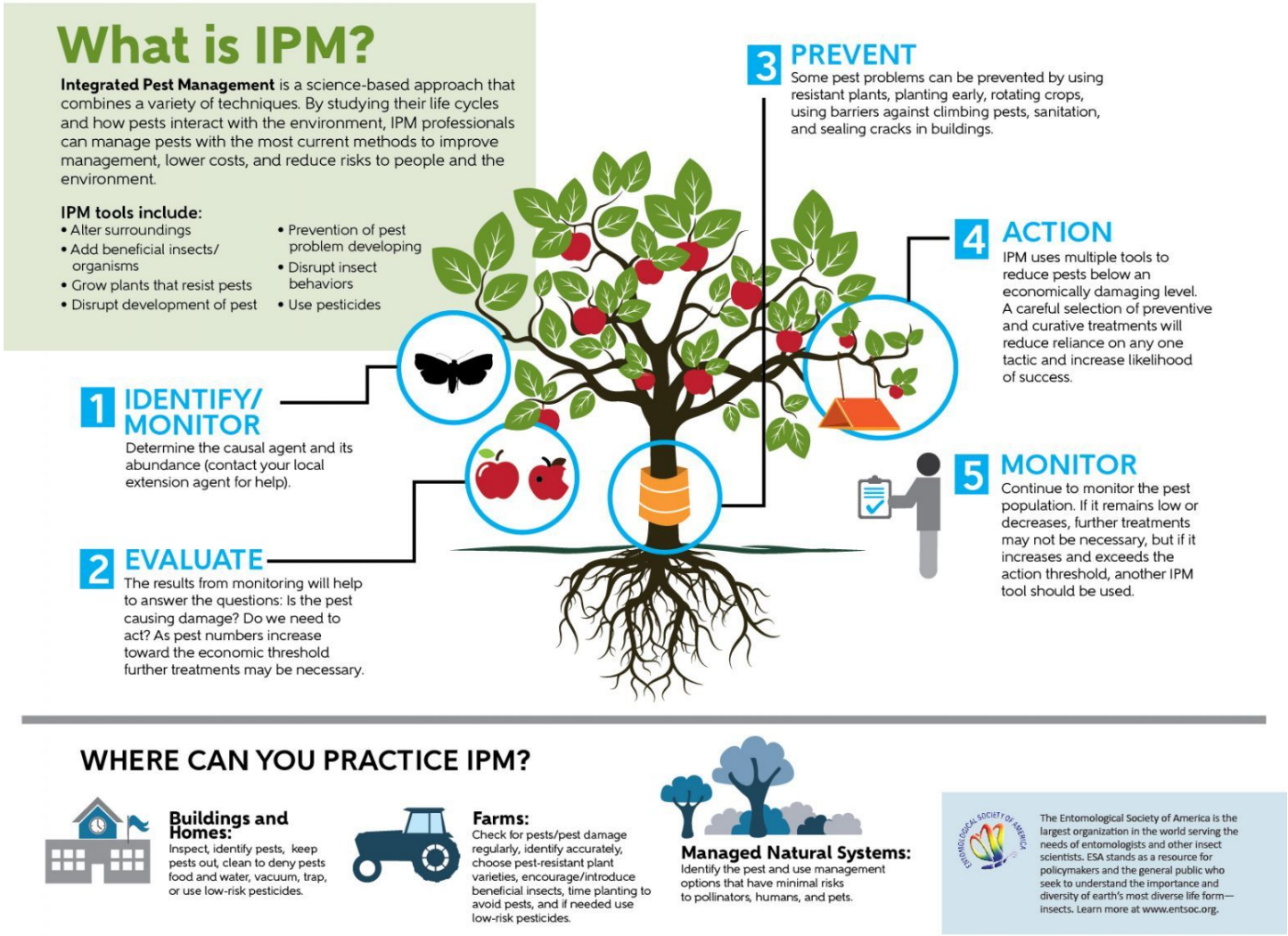

Figure 2: Infographic on "What is IPM?" from the Entomological Society of America[20].

IPM Policy Key Elements

The IPM Policy would:

- Address all pesticide use, not just herbicide use.
- Apply to all UC locations and operations (e.g., campus core, agriculture, forestry, natural reserves, etc.) with the exception of privately-owned residences on UC property, to the extent possible.

[20] http://www.entsoc.org/sites/default/files/files/Science-Policy/ESA-Factsheet-IPM-weblarge.jpg

- Require each location to develop and implement an IPM plan (see definition at the end of section) that would be updated on a periodic timeframe (e.g., every three years).
    - The Task Force recognizes that IPM plans for ANR agricultural research locations would likely be very different from campus and health system IPM plans.
    - The IPM Policy could encourage locations to pursue third-party recognition and certification. (e.g., Bee Campus, USDA Organic, Green Shield, ECOwise, GreenPro, etc.) *Note: IPM points are available in LEED certification of green buildings[21] if there is Green Shield or ECOwise certification.*
    - UC location IPM plans would conform to this IPM policy and should follow its accompanying guidelines.
- Mandate use of a standardized Pesticide Use Authorization (PUA) software (as detailed in Charge 1) for recording all UC uses of pesticide applications (both internal applications and contracted vendor applications).
- Require each UC location to notify the appropriate community ahead of pesticide applications for common use areas where contact with the applied area is possible (e.g., common glades, lawns, lounges, etc.).
    - The notification should try to include all groups that are likely to be affected or that interact with the treated area. The location should use the best communication methods available. (e-mail, posting, etc.). An exception to the pre-application notification requirement should be allowed for emergent vector-borne health risks or mission-critical pesticide applications.
- Establish a Systemwide Pesticide Oversight Committee (SPOC) as outlined in the next subsection.
- Require each UC location to create an Integrated Pest Management Committee (IPMC) as detailed in a subsection below.
    - The research use of pesticides would be categorically excluded from the IPMC oversight.
- Require each UC location to identify an IPM Coordinator who would:
    - Serve as the primary contact for students and employees and the pest control staff and contractors for two-way communication of any pest problems.

[21] UC Sustainable Practices Policy requires minimum LEED Silver for all new construction.

- Ensure that pest management practices carried out are consistent with the IPM policy.

Systemwide Pesticide Oversight Committee (SPOC)

A Systemwide Pesticide Oversight Committee (SPOC), would provide overall coordination and oversight of UC's pesticide use. The SPOC would enable system-wide consideration of issues confronting pesticide use, and it would allow for the sharing of resources and the avoidance of redundant efforts to address these issues. For example, standardized training materials and requirements could be developed and updated by this committee. A representative from UCOP should attend these meetings to keep the office informed of UC's IPM challenges and to facilitate the resolution of new problems.

The Herbicide Task Force should continue as the inaugural Systemwide Pesticide Oversight Committee (SPOC) until its charter and membership can be established and would support the development of the Presidential IPM Policy discussed above.

The SPOC would be responsible for:

- Oversight of and revisions to the Presidential IPM Policy.
- Maintaining a library of all the UC location-specific IPM plans for reference by the IPMCs.
- Reviewing the location-specific IPM plans for consistency with the IPM Policy.
- Curating a methodology to classify pesticides into a series of tiered hazard bands (high-red, medium-yellow, low-green) based upon determinations of authoritative bodies and periodically revising that hazard tier classification system using the policy framework discussed below.
    - Using that methodology, the SPOC could maintain a quick look-up list of commonly used pesticide products at UC and their assigned hazard band for easy reference.
- Preparing an annual review of UC's pesticide use using data collected through the PUA software and other methods.
    - That report should include the pests afflicting UC, alternative methods utilized, and a summary campus community comments and concerns received. The report should include successful prevention and alternative activities for dissemination within UC as best practices as part of their charge.

IPM Committee (IPMC)

At the location or campus level, a local IPM Committee (IPMC) develops a location-based IPM plan, to be submitted to the SPOC, and approves pesticide use authorizations. The IPMC would be

responsible for determining the level of review and the protective controls needed based on the details of the requested pesticide application and the hazard tier the pesticide.

The local IPMC (or an existing committee delegated with this responsibility) would be responsible for:

- Development and implementation of the IPM plan at their location in conformance with the systemwide IPM Policy.
- Reviewing and approving all high-red tier pesticide applications at their location.
- Identifying the key personnel requiring applicator training for licensure or state qualification.

Restrict Certain Pesticides

The IPM Policy should not ban any specific chemicals or registered pesticides. Pesticides can pose risks to human health and the environment. It is recognized that pesticides can cause adverse health effects in humans; examples include cancer, neurological disruption, birth defects, genetic alteration, reproductive harm, immune system dysfunction, endocrine disruption, or acute poisoning.

In the IPM Policy proposed, pesticides would be classified into a series of tiered hazard bands (high-red, medium-yellow, low-green) using a scheme based on the City and County of San Francisco hazard tier classification schema. Pesticides of higher concern would require more rigorous controls and approval. Refer to Appendix F for a copy of the City and County of San Francisco's SF Environment *Guide to San Francisco's Reduce Risk pesticide List* hazard tier process. This document details a hazard assessment methodology to classify pesticide products into three tiers based on their physical, health, and ecological hazards.

This "high-red" "medium-yellow" "low-green" approach is termed "control banding". The systemwide IPM Policy would stipulate that high-red pesticides require a more rigorous review for approval and greater protective equipment and administrative controls.

The Task Force is recommending that the SPOC adopt the City and County of San Francisco hazard sorting methodology (i.e., only the Step 1 algorithm) as a starting point for control banding. The City and County of San Francisco use three steps to approve pesticides. Step 1 Hazard Assessment, Step 2: Exposure Assessment, and the final, Step 3: Placement on a Pesticide List. The Task Force does not recommend that the SPOC perform individual exposure assessments nor adopt San Francisco's Reduced Risk Pesticide List as an authoritative body list. Instead, the Task Force recommends that the approval of a PUA be granted after evaluation by the local IPMC.

The Task Force recommends that the University **restrict** the use of high-red tier pesticides, anywhere within UC, until the local IPMC has reviewed the specific pesticide use application and performed an evaluation following the IPM methodology outlined in their IPM plan. For example, for such pesticides, standardized questions could be asked via the PUA software to evaluate what prevention

and, minimally, at least two alternative approaches were considered and why they were determined not to be preferred compared to the high-red tier pesticide. For the high-red tier pesticides, the IPM Policy would require the approval of the local IPMC following the local IPM plan before the pesticide is used. This would have the added effect of ensuring that the IPM plan remains a living document.

IPM Plans

An IPM plan is basically a written program description describing how that UC location will manage pests through prevention, monitoring, and safe control methods. The IPM plan should establish specific objectives regarding pests and the use of pesticides following the IPM methodology and definition described above. Such plans should reflect that location's specific needs and likely will differ between locations.

Many UC locations currently have IPM plans. However, there is inconsistency across the UC system in terms of the development, maintenance, and access to Integrated Pest Management policies and plans. The IPM Policy would be accompanied by a more in-depth guidelines document that would provide recommended elements for the IPM plans.

Recommendations

Choice of Authoritative Body and the Minority Report

As described below, the Task Force recommends that the pesticides be grouped into three tiers based on hazard. For carcinogenicity, a pesticide would be placed in the high-red tier (most hazardous) if **any** one of five authoritative bodies identifies the pesticide as a carcinogen. Those authoritative bodies are: U.S. Environmental Protection Agency (EPA), U.S. Food and Drug Administration (FDA), National Institute for Occupational Safety and Health (NIOSH), the National Toxicology Program (NTP) of the US Department of Health and Human Services, and the International Agency for Research on Cancer (IARC). Under this approach, because of IARC's categorization of glyphosate as a probable human carcinogen, glyphosate would be placed in Tier 1 (high-red; discussed below). Adopting this strategy is a scientific, health-protective approach to ensuring that UC identifies potentially toxic pesticides for more restricted scrutiny and use.

Two of the Task Force members feel that the California Department of Pesticide Regulation and USEPA should be used as the primary authoritative bodies for making the hazard classification. The two committee members believe that these agencies have access to a large number of studies that, because of their confidential nature, are not available to other groups such as the San Francisco City and County or IARC. For these two committee members, these latter groups could be used as secondary resources, but for pesticides, they should not be considered authoritative sources. The use of the California Department of Pesticide Regulation or USEPA as authoritative bodies would likely change the hazard ranking for glyphosate from Tier 1 (high-red; discussed above) to Tier 2

(medium-yellow) or Tier 3 (low-green). The two Task Force members recommended that if significant differences in ratings occur between the various sources, the Systemwide Pesticide Oversight Committee (SPOC) should confer with experts, do its own review, and make an evaluation.

Other committee members feel that a pesticide should be placed in the high-red tier for carcinogenicity or reproductive toxicity if **any** authoritative body determines the pesticide falls within one of those categories. This approach is consistent with the process for placing chemicals on the Proposition 65 List. The process is protective, administratively efficient, and clear. In 2018, a California appeals court upheld that process in the face of a legal challenge brought by Monsanto against the inclusion of glyphosate on the Proposition 65 List. *Monsanto Co. V. Office of Environmental Health Hazard Assessment*, 22 Cal. App. 5th 534 (2018).

The Herbicide Task Force recommends that the President:

7. **Adopt a Presidential Integrated Pest Management (IPM) Policy that enacts the recommendations that were accepted by the President.** (By Nov. 2020). **The IPM Policy would:**

    a. **Require that all UC pesticide use follow IPM practices.**

    b. **Restrict the use of all Tier 1 (high-red banded) pesticides and permit their use only after a local IPM Committee (IPMC), as defined by the local IPM plan, has reviewed and approved its specific use application following an IPM-based assessment.**

    c. **Provide that lower-tier classified pesticides (medium-yellow, low-green) be subject to limitations of use and review as determined by the IPMC.**

    This Policy should apply to all UC locations and all UC pesticide applications, whether applied by UC personnel or contracted pesticide applicator vendors. The Policy would limit the categorical exemption to only research. The requirement for complying with the Policy should be included in new relevant contracts (e.g., leases, partnerships, etc.) requiring adherence to the Policy. The Task Force has drafted an outline of the IPM Policy based on a review of best practices and input from Integrated Pest Management experts.

    Note: Glyphosate is classified in the San Francisco hazard classification scheme as a Tier 1 pesticide, as are other known or probable carcinogens, many of which are widely used in California.

8. **Appoint a Center of Excellence (CoE) on IPM to coordinate activities systemwide and advise locations on implementing these recommendations as well as to provide training.** (By Feb 2020) This CoE should be funded by OPRS.

9. **Direct OP Risk Services to regularly convene a Systemwide Pesticide Oversight Committee (SPOC).** (By Nov. 2020)

    a. Continue the Herbicide Task Force as the inaugural SPOC until its charter and membership can be established.

    b. The SPOC should collect and maintain a library of all the location-specific IPM plans for reference by the IPMCs. The SPOC would review the location-specific IPM plans for consistency with the IPM Policy.

    c. The SPOC would facilitate best practices sharing among the locations.

    d. The SPOC should collect data through the PUA software and other methods to report IPM practices within UC annually. These reports should include a summary of pests affecting UCs, alternative methods utilized, public comments, and a review of annual pesticide use.

    e. The SPOC would be responsible for supporting the development of and revising the Presidential IPM Policy.

10. **Task the SPOC to curate a methodology to classify pesticides into a series of tiered hazard bands (high-red, medium-yellow, low-green) using existing authoritative bodies.** (By Nov. 2021) The classification methodology should use methods similar to those that have been adopted and successfully used by other entities that are based on authoritative bodies. As an initial classification methodology, the SPOC should use the *City and County of San Francisco Reduced Risk Pesticide List* hazard tier classification system.

11. **Direct each UC Location to establish or designate an existing committee as a local IPM Committee (IPMC)**. (By Nov. 2021) The IPMC would provide the coordination necessary to ensure proactive review and advisement on the location's Integrated Pest Management plan. The IPMC would:

    a. Develop a location-based IPM plan;

    b. Solicit stakeholder engagement as part of the IPM plan development and revision process;

    c. Review and approve pesticide use authorizations. The IPMC would be responsible for determining the controls for safe pesticide applications based on the proposed or anticipated use and the hazard tier of that pesticide. The IPMC should evaluate the

Pesticide Use Authorization following requirements set forth in the location-specific IPM-based assessment.

Glossary

IARC International Agency for Research on Cancer

Integrated Pest Management (IPM) UC Statewide IPM Program[22] defines IPM is "an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment"

Integrated Pest Management Committee (IPMC) A location-based IPM committee that develops and approves a location-based IPM plan and approves pesticide use authorizations. They are responsible for determining how to implement and what controls or review is needed based on the application and what hazard tier the pesticide is classified at.

OPRS Office of The President, Risk Services

Pest Any animal, plant, fungi, bacteria, or virus, which may interfere with the site-specific purposes, operations, or management objectives; or that jeopardize human health or safety.

Pesticide Any substance or mixture of substances intended to be used for preventing, destroying, repelling, or mitigating any fungi, bacteria, virus, plant, or animal which may infest or be detrimental to humans, vegetation, animals, buildings, or facilities, or be present in the environment. This term includes acaricide, bactericide, insecticide, fungicide, rodenticide, herbicide, growth regulator, defoliant, desiccant, and adjuvant. It is also intended to cover poisons or repellents for amphibians, reptiles, birds, fish, mammals, and invertebrate animals. *Note: For the Task Force surveys, pesticide excluded antimicrobials such as sanitizers and disinfectants.*

PUA Pesticide Use Authorization

SPOC Systemwide Pesticide Oversight Committee

[22] https://www2.ipm.ucanr.edu/What-is-IPM/

Appendices

Appendix A: Task Force Roster

Mr. Jarrod Colvin UC Santa Barbara Groundskeeper **Dr. David Eastmond** UC Riverside Professor and Toxicologist **Dr. Jim Farrar** UC ANR Program Director, UC Integrated Pest Management **Ms. Bridget Gustafson** UC Berkeley Undergraduate Student in Molecular Environmental Biology **Professor Timothy Malloy** UC Los Angeles School of Law **Ms. Nurit Katz** UC Los Angeles Executive Officer of Facilities Management and Chief Sustainability Officer **Mr. Ken Smith, CIH CHP** Office of the President Executive Director for EH&S **Dr. Sapna Thottathil** Office of the President Associate Director, Sustainability **Dr. Cheryl Wilen** UC ANR Area IPM Advisor UC IPM and UC Cooperative Extension **Dr. Tracey Woodruff** UC San Francisco Professor and Environmental Health Scientist	Non-Voting: **Mr. Brent Cooley CIH CSP** Office of the President EH&S Deputy Director **Ms. Veronica Nelson** Office of the President Enterprise Risk Management Analyst Assigned Legal Counsel: **Mr. Barton Lounsbury** Office of the General Counsel Senior Counsel Report Sponsor: **Ms. Cheryl Lloyd** Office of the President Acting VP Systemwide Human Resources and Associate VP, Chief Risk Officer

Appendix B: Herbicide Applicator Focus Group

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HERBICIDE FOCUS GROUP PROJECT

UNIVERSITY OF CALIFORNIA

SEPTEMBER 17 AND 18, 2019

Completed by:

Allen M. Gilley, CIH, CSP, ARM, ALCM
Managing Director
Marsh Risk Consulting

Jonathan Olsen, ASP
Risk Consultant
Marsh Risk Consulting

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Executive Summary

A focus group study was conducted at University of California Berkeley (UCB) in Berkeley, California on September 17, 2019 and University of California Santa Barbara (UCSB) in Santa Barbara, California on September 18, 2019 to solicit and document respondents' attitudes, beliefs, experiences, and perceptions associated with the use of herbicides on University of California (UC) grounds.

The information provided in this report is based on the feedback and opinions of the individuals interviewed as part of this process and does not represent overall conclusions of Marsh and/or the Herbicide Task Force.

Focus Group participants were invited via an initial email to contacts at UCSB and UCB, all invitees were requested to forward the information and invitation to their staff.

For UCB:
The Associate Director of Facilities Operation responded to the original email and reserved a room for the focus group. He then sent an email to "key players" within UCB who work in Housing, Athletics and the Reserve and invited them to attend the focus group meeting.

For UCSB:
The Refuse, Recycling & Water Efficiency Manager responded to the original email. He then provided names of people within Residential Operations which included: Cheadle Center for Biological & Ecological Restoration and UC Santa Barbara Natural Reserve System. Additional email invitations were sent to these departments.

Participants appeared appreciative of the opportunity to express their opinions and concerns and an excellent degree of participation was exhibited at both campuses. All names within this document have been withheld for confidentiality purposes but the focus groups included the following:

UC Berkeley

- Student representative (1)
- Herbicide Applicator (1)
- Landscaper and grounds supervisor (1)
- Environmental protection representative (1)
- Grounds keeping and irrigation representative (1)
- Fire prevention representative (1)
- No agriculture or athletic department participants (0)

UC Santa Barbara

- Groundskeepers / applicators (8)
- Land and resource stewards in the research reserves (3)
- Restoration coordinator in habitat restoration (1)
- No agriculture or athletic department participants (0)

Initial discussions revealed two opposing perspectives regarding herbicide application on campus grounds and habitats. The consensus of the majority of participants was that the benefits of chemical herbicide application greatly outweigh the disadvantages. Any alternatives would require a larger workforce and expanded budget, develop a greater potential for wildfires, and potentially introduce new ergonomic concerns. Without chemical herbicides the campus will be overgrown with weeds and become aesthetically unpleasing. A student representative attending the focus group discussion opted for increased use of alternatives such as sheet mulching and hand weeding to reduce the need for chemical herbicides.

All applicators that participated in the focus group study were satisfied with the current application process. The consensus was that if adequate personal protective equipment (PPE) and signage is utilized, chemical herbicides are the best solution to remove unwanted weeds and non-native species.

It is noted that compliance with occupational safety and health and environmental regulations is by law the responsibility of the employer, and this survey was neither designed nor intended to assume responsibilities under any such regulations.

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Results

University of California Berkeley

General Information

The common herbicides used at UC Berkeley are Triclopyr, Glyphosate, Turflon Ester, Fusilade, Ranger Pro, Quick Pro, and Snapshot. Herbicides are applied using a paint brush method or a backpack and wand method. No vehicles or aircrafts are used in herbicide application. Applicators at UC Berkeley check the weather before deciding what herbicide activities will be performed each day. They will not apply herbicide if wind conditions for the day are over 10 miles per hour or if there is a possibility of rain. The landscape of herbicide application at UC Berkeley can vary from flat glades to steep hills. Herbicide applicators mix the chemicals from concentrate in the workstation. The amount that is mixed is calculated based on the size of the designated area for the day. There is very little herbicide application in the winter months because of increased rainfall. Herbicide is used as needed in the dryer months to control non-native species, reduce the risk of brush fires, and maintain an aesthetically pleasing campus.

Training and Signage

The only Qualified Applicator Certificate (QAC) licensed herbicide applicator on campus was in attendance for the focus group discussion. To maintain a QAC license an applicator must receive 20 hours of continuing education training every 2 years. According to the herbicide applicator the supervisor provides information regarding pesticides through Material Safety Data Sheets (MSDS), material labels, and hazard communication (HAZCOM) programs. The HAZCOM training is either a "robust online training or one on one training out on the field".

Applicators are often in the public eye so the grounds keeping department enforces a "triple signage" rule. The three signs used are a label on the container, a sign on the applicator's back, and signs in the applicator's pocket that are available to hand out to anyone with a question. Applicators will also rope off and place signage around the affected area for the entire day. Additionally, the herbicide applicator maintains a binder that records a history of chemical herbicide application with the date and chemical that was used.

Personal Protective Equipment (PPE)

Required PPE consists of clothing that will prevent skin contact, chemical resistant gloves, and safety glasses/goggles. There is never a circumstance in which applicators will forego PPE. One of the participants asked, "are there really places where employees don't wear their PPE?"

Safety Practices

It was stated there are washing facilities to rinse chemicals off skin as well as an eyewash station in the truck in the event of accidental herbicide exposure. The herbicide applicator also stores a change of clothes at work in the event he has to change his clothes. One of the participants noted that in his 17 years of working with herbicides he has never experienced any problems during or following a period of application. There are usually no residual pesticides leftover, because the

quantity for each area is carefully calculated in square footage. The herbicide applicator will spray any remaining mixture on the designated area and then rinse the container. There is no repository for unused herbicide but one is not considered necessary.

Alternatives

A large component of the discussion about alternatives to herbicides was focused on the inability to achieve the same results without a significant increase in budget and staffing. One participant noted that in addition to funding, it is an "aesthetic decision" as well because the campus would not look as aesthetically pleasing without the use of chemical herbicides. There would also be a significant increase in weeds and non-native plant species. The members that are responsible for reducing the risk of brush fires stated that an abundance of undergrowth will increase the risk of uncontrollable fires. One of the participants had litigation concerns and stated, "If there is a fire, everyone who lost something will sue". It is important to note that hand weeding is labor intensive. There are also health risks associated with hand weeding such as ergonomic/repetitive motion injuries and some of the steep hills around campus are too dangerous to hand weed.

The one participant who supported finding alternatives to chemical herbicides suggested a compromise of not necessarily 100% herbicide-free. The task force could recognize areas where chemical herbicide is required for safety reasons and areas where it is required for aesthetics and try alternatives where possible.

Some non-chemical alternatives are viable options but they would require more frequent applications to maintain the same results and would be more expensive. Alternative methods such as thermal burning, corrosive chemicals, steam/foam and grazing animals were mentioned, and as previously discussed, accepting a less-manicured appearance could be an option.

Risk Perception

Each participant stated they felt comfortable applying pesticides the way they are doing it now. The applicators and supervisors "think critically" about how frequently to apply and how much herbicide to mix.

Conclusion

The participants were asked what they would like the task force to consider as it moves forward. One participant urged the task force to check the science and reinvestigate the decision to ban Glyphosate and stated, "I would like science to drive this discussion and not emotion or the fear of litigation". Due to the anticipated increase in forceful exertions, non-neutral postures and repetition associated with hand weeding as well as the associated increased frequency of musculoskeletal injuries, one participant suggested that the task force research ergonomic studies on manual hand weeding and brush removal pertaining to repetitive motion/ strain injuries.

University of California Santa Barbara

General Information

The UC Santa Barbara focus group discussion was attended by applicators from habitat restoration and grounds keeping. No agriculture or athletic department participated, and it was reported that an outside contractor is responsible for herbicide management of the athletic facilities. The common herbicides used at UC Santa Barbara are Triclopyr and Glyphosate. Grounds keeping was affected the most by the ban on Glyphosate, one participant stated, "We need it here". Habitat restoration currently has special permission to apply Glyphosate in select University of California natural habitats. Grounds employees apply herbicide using a backpack and wand or skid mounting which is when they mount a 25-gallon container of herbicide on the back of their all-terrain vehicle (Gator), herbicides are sprayed in designated areas while one person drives. The landscape is mostly flat with some hills, but the vehicle can reach most areas as it is equipped with a 25-foot hose. Herbicides are mixed from concentrate in the workshop. Herbicide is sprayed up to 8 hours a week – usually on a Saturday when there are fewer people walking around campus. Habitat restoration applies herbicide seasonally, but there are several weeks of the year during which spraying is conducted every day of the week due to the size of the habitats. The consensus was herbicide application accounts for around 5% of their duties when using chemical herbicides.

Training and Signage

Only two employees in the room had a license or certificate for pesticide application, but anyone who doesn't have a license works under direct supervision of someone who does. The university reimburses the training required for licenses and there is internal training every year for employees who are not licensed. This training is around 3 hours in length with a competency test at the end. It was noted that EH&S is not as involved with safety training as the participants would like. The supervisors provide information regarding pesticides through Safety Data Sheets (SDSs) and material labels.

Grounds keeping personnel have laminated labels for each herbicide which they zip tie to the truck and container when applying. The local hospital has a complete chemical inventory list and a first aid response sign is always with the applicators. None of the applicators noted that affected areas are marked or roped off during an application session. Habitat restoration does not use labels to mark what chemicals they are spraying. Habitat restoration will contract out herbicide application of large areas when needed.

PPE

The grounds keeping department uses half face and full face respirators, Tyvek suits with hoods and boots, eye protection, and chemical resistant gloves when mixing and applying pesticides. Habitat restoration wears safety goggles or glasses, long sleeves, long pants, boots, and chemical resistant gloves. There is reportedly never a circumstance in which applicators will forego PPE.

Safety Practices

Habitat restoration always carries a 5-gallon bucket of water with soap as well as a portable eyewash in the event of an accidental herbicide exposure. Grounds keeping also carries an eye wash and they are closer to washing facilities on campus which are available if needed. There is a policy that requires applicators to change clothing if contaminated. Groundskeepers do not store a change of clothing on campus because they wear a uniform while on the job. In the event that

pesticides get in someone's eyes or on their skin they are required to visit the local hospital for an evaluation. In the past one groundskeeper's eyes were exposed to a pesticide. He was sent to the hospital but returned to work. There are usually no residual pesticides leftover because the quantity for each area is carefully calculated in square footage. All residual pesticides are diluted and sprayed on weeds or non-native species, the containers are rinsed and the rinse water is sprayed on the designated area.

Alternatives

The group listed the following as alternatives to chemical herbicides: Control irrigation to impede plant growth, hand weeding and brush removal, sheet mulching larger areas, thermal steam/foam blanketing, backpack burners, application of black plastic, and acceptance of natural appearance. The problem with some of the alternatives is they are not selective. Everything within the treated area will die, including the native plants and species. Participants also noted ergonomic concerns with hand weeding. In the past there was a program for special-needs volunteers to hand weed certain areas of campus but that is not considered an effective long term solution. One participant from habitat restoration stated, "Some weeds we would simply give up on fighting. There is no economic alternative on the scale of control we need." Another participant stated there are "natural herbicides" but they are not systemic and the species will regrow. The consensus of the group was that alternative methods will require a significant increase in budget and staff. A member of habitat restoration noted that "We do not care about aesthetics, a lot of these species reduce biodiversity of native plants and insects. We are trying to do what we think is the most ecologically acceptable thing." Grazing animals were used in the habitat restoration areas in the past. They utilized grazing goats with mobile electric fencing. The use of grazing animals would entail the need for management of the herds which would increase cost and administrative burden.

Risk Perception

Every participant agreed that they felt comfortable applying pesticides the way they are doing it now. It was stated, "We have the power to refuse applying herbicide if we ever feel unsafe". Some participants feel less safe with the current alternative to Glyphosate, which is called Suppress. Suppress has a "warning" identification label compared to the "caution" label of Glyphosate. Participants were confused why one of the safer herbicides was banned, with one participant stating, "The usual process for deciding what is safe or unsafe has been suspended with this ban."

Conclusion

The participants were asked what they would like the task force to consider as it moves forward. One participant stated he believed that the fear of litigation rather than protecting the applicators and the environment is driving the controversy and that based upon current knowledge, Glyphosate is safer than the alternatives. Another participant felt that alternatives to chemical herbicides are either unsafe or economically unviable. A habitat restoration participant who was exempt from the Glyphosate ban expressed the need for a transition period to find an adequate alternative if the task force decides to remove that exemption. Finally, the group agreed that chemical herbicides are an effective tool for controlling unwanted vegetation and Glyphosate was the "safest" chemical herbicide available.

Common Findings

The most common opinion within each of the focus groups was that the ability to achieve the same results is nearly impossible without chemical herbicide application. If the ban on Glyphosate is continued there would have to be a compromise in either budget, safety, or appearance.

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Appendix

Focus Group Questions for Applicators

Objectives:
Obtain input from front-line applicators on their practices applying herbicides and obtain their risk perception. Since the safe use of a potentially toxic herbicide is dependent on the amount of exposure that the applicator has, questions will be asked to determine the level of assurance on the use of proper controls. *Please note, these questions are not to evaluate overall work performance or any one person's job performance, but are rather part of a larger effort to gather feedback from pesticide applicator's on routine practices in the system. Individual's participating in this interview process will remain anonymous.*

Introduction:
The Herbicide Task Force is considering policies about pesticide use at UC properties. Below are a series of questions to help the task force better understand current herbicides or other pesticides use.

Questions:

1. General Info
   - 1.1. What are the common pesticides you use?
     - 1.1.1. If you don't remember the name, what are you trying to treat? (probe)
   - 1.2. What are the different ways you apply pesticides?
   - 1.3. Where do you apply them, describe the landscape?
   - 1.4. Do you or your crew mix pesticides from concentrate? (probe)
   - 1.5. How many days a week or month do you apply herbicides? (probe)
   - 1.6. What portion of your job is pest management? (probe)

2. Training
   - 2.1. Do you hold a Qualified Applicator License or Certificate (QAL/QAC) for pesticide applications?
   - 2.2. Describe the training you received for applying pesticides.
   - 2.3. How often are you trained?
   - 2.4. What information does your supervisor provide about the pesticides that you apply?
     - 2.4.1. Do you understand the information you are given? (probe)
     - 2.4.2. Where else can you go to get information? (probe)
   - 2.5. How do you know what is in your containers?
     - 2.5.1. Do your containers have labels? (probe)

3. Personal Protective Equipment (PPE)
   - 3.1. What types of PPE do you wear during mixing and application?
   - 3.2. Are there times when you do not use PPE?
     - 3.2.1. When would you not wear PPE?
     - 3.2.2. How often does this happen? (probe)

4. Safety Practices
   - 4.1. Do you have access to washing facilities if you get it on your skin?
   - 4.2. Do you change clothes and/or wash after applying pesticides?

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4.3. What do you do if you get pesticides on your skin or if you breath it in?
4.4. Have you ever experienced any problems during or following an application?
4.4.1. (Redirect if a response is not health-related.)
4.5. After finishing an application what do you do with leftover pesticides?

5. Alternatives
5.1. If we didn't use chemical pesticides, what are some options?
5.2. What is your experience with using alternatives?
5.3. What do you think about non-chemical alternatives, pros and cons?
5.4. What additional skills, training, or resources would you need to successfully use non-chemical alternatives?

6. Risk Perception
6.1. Do you feel comfortable applying pesticides the way you are doing it now?
6.1.1. If not, why not?
6.1.2. If not, what would make you more comfortable?
6.2. Are some pesticides worse than others, name them?
6.2.1. If yes, can you explain more?

7. Conclusion
7.1. What sorts of things would you like the task force to know about or consider as it moves forward?

Appendix C: Clarification regarding temporary suspension of the use of glyphosate-based herbicides

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August 12, 2019

CHANCELLORS
VICE PRESIDENT HUMISTON
DIRECTOR WITHERELL
MEDICAL CENTER CEOS

SUBJECT: Clarification regarding temporary suspension of the use of glyphosate-based herbicides

Dear Colleagues:

I write to provide clarification with respect to certain elements of the temporary suspension of glyphosate use that entered into effect on June 1, 2019.

First, general weed control in landscaped areas, parking lots, street medians, etc., should not be considered "agricultural use" within the scope of the four enumerated exceptions to the temporary suspension. Should a UC location believe that it requires a specially tailored exception for such applications of glyphosate, that location should submit a specific request, as detailed below.

Second, the production of timber for harvest is considered an "agricultural use" for the purposes of the enumerated exceptions.

Third, the temporary suspension does apply at all University-owned and -operated properties, including public-private partnership (P3) projects, unless specific contractual terms between the University and third-party developer prevent the University from exercising control over pesticide applications. If such contractual terms do exist, University staff should nonetheless describe the temporary suspension and seek the third party's voluntary adherence.

Fourth, the temporary suspension does not "grandfather" existing glyphosate applications, unless those applications fall into one of the listed exceptions.

Fifth, if any UC location desires to propose a specially tailored exception for consideration by the systemwide task force, that location should provide the following information with respect to the proposal: (1) proposed location, quantity, frequency, and timing of glyphosate use; (2) method of application; (3) demonstrated need for weed control; (4) pre-application notices, if

any, to be sent and to whom; (5) pesticide use recording and reporting mechanism/process; (6) alternatives to glyphosate attempted or considered; (7) reasons for not adopting an alternative means of weed control; (8) personal protective equipment to be worn by applicator(s); (9) proof of relevant certification/licensure/training for applicator(s); (10) potential for herbicide contact by persons other than the applicator(s); and (11) any environmental resources (water bodies, wildlife, non-target plants, etc.) that could be affected by the application of glyphosate. Please submit any such requests to the task force through email to ehs@ucop.edu.

Thank you for your continued attention to this important matter.

Yours very truly,

Janet Napolitano
President

cc: Executive Vice President Stobo
General Counsel Robinson
Acting Vice President Lloyd
Interim Vice President Leasure
Director Fiedler
UC Herbicide Task Force

Appendix D: Exam Knowledge Expectations for Qualified Applicator Certificate & Qualified Applicator License.

Exam Knowledge Expectations for
Qualified Applicator Certificate & Qualified Applicator License
R - Laws, Regulations, and Basic Principles of Safe and Effective Pesticide Use (Core Exam)

Use these knowledge expectations (KEs) to help study the suggested material, *The Safe and Effective Use of Pesticides* (2016 Edition).
Knowing the information from all of the KEs should prepare you for taking the exam.
The core exam will also include information from the *Laws and Regulations Study Guide* (2011 Edition).

Chapter 1 Pest Management

A. Define Integrated Pest Management (IPM).
B. Differentiate among key pests, occasional pests, and secondary pests.
C. Define prevention, suppression, and eradication of pests.
D. Describe the methods used to achieve prevention, suppression, and eradication of pests.
E. Define economic injury/treatment thresholds and describe what happens when these are reached.
F. Describe monitoring and explain why it is important.
G. Identify the five major components common to all IPM programs.
H. Describe IPM methods.
I. Explain the importance of site-specific variables; pest, host, and natural enemy populations; and pest life stage in pest management planning.
J. Explain the importance of evaluating pest management results.

Chapter 2 Pest Identification

A. Explain why understanding pest biology is important when managing pests.
B. Explain why identifying pests correctly is important.
C. List the main groups of common pests.
D. Explain how pests are organized and identified using scientific names.
E. List and describe the types of resources and references available for identifying pests, symptoms of infestation, and damage caused by pests.
F. Distinguish between damage caused by pathogens and abiotic factors.
G. List examples of common pests in California from each main group, and describe the damage they cause.

Chapter 3 Pesticides

A. Define a pesticide.
B. Explain the concepts of hazard, exposure, and toxicity and how they relate to one another.
C. List pesticide toxicity categories and signal words, and explain what each category means in terms of a pesticide's effects on humans and animals.
D. List groups of pesticides according to pest target and describe the functions of each group.
E. List major chemical families and describe the particular hazards associated with each one.
F. Define mode of action and provide examples of the different modes.
G. Explain how contact and systemic pesticides control pests differently.

Exam Knowledge Expectations for
Qualified Applicator Certificate & Qualified Applicator License
R - Laws, Regulations, and Basic Principles of Safe and Effective Pesticide Use (Core Exam)

Use these knowledge expectations (KEs) to help study the suggested material, *The Safe and Effective Use of Pesticides* (2016 Edition).
Knowing the information from all of the KEs should prepare you for taking the exam.
The core exam will also include information from the *Laws and Regulations Study Guide* (2011 Edition).

H. Explain how various modes of action influence pesticide selection.
I. Define a pesticide formulation.
J. List the various formulations available and the advantages and disadvantages of each.
K. Identify factors that should be considered when selecting pesticides.
L. Explain the role of adjuvants in pesticide applications.

Chapter 4 Environmental Hazards

A. Explain the potential environmental hazards associated with pesticides.
B. Describe pesticide chemical and physical characteristics and how these characteristics indicate the potential for pesticides to move offsite.
C. List the types of offsite movement of pesticides.
D. Describe factors that influence offsite movement of pesticides.
E. Distinguish between point-sources and non-point-sources of environmental contamination by pesticides.
F. Define pesticide residue, identify conditions that affect the buildup of residue, and explain how to avoid creating hazardous residues.
G. List features of a given site, including soil type and geology, which influence the potential for a pesticide to reach surface or groundwater.
H. Describe ways that pesticides can impact nontarget organisms.

Chapter 5 Human Hazards

A. Describe the ways people get exposed to pesticides and the routes of entry.
B. Describe how offsite movement of pesticides endangers human health.
C. Name conditions at the application site that may change and influence the hazards associated with pesticide application.
D. List the tasks most often associated with accidental pesticide exposure and explain why these tasks are hazardous.
E. Explain how each of the following can contribute to human hazards associated with pesticide use:
   a. incorrect dosage
   b. incorrect application timing
   c. incorrect pesticide product application
F. Explain the human hazards associated with pesticides.
G. Describe the potential effects of acute and chronic pesticide exposure on people.

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H. Define heat stress and describe how people develop heat stress.

Chapter 6 Personal Protective Equipment (PPE)

A. Explain how PPE and engineering controls can protect a person from hazards associated with pesticides.
B. Describe safety training provided to field workers and pesticide handlers.
C. Describe the employer's responsibility to provide PPE for mixing, loading, applying, and storing pesticides to employees.
D. List various PPE and engineering controls that pesticide handlers use to protect themselves from pesticide exposure.
E. Explain how to select the most effective PPE for the job.
F. Describe how to wear, clean, maintain and store reusable PPE, and how to dispose of worn or single-use person protective equipment.
G. Describe how to prevent or mitigate heat stress.
H. Explain the importance of selecting, fit testing, and wearing respiratory devices.
I. Identify the limits of PPE to protect pesticide handlers.
J. List the different kinds of engineering controls and explain when these are used.

Chapter 7 Safe Use

A. Explain why and in which situations it is important to communicate with neighbors and others in the area before making a pesticide application.
B. Describe ways in which applicators ensure the public's safety before, during, and after pesticide applications.
C. Describe how to restrict access to areas where pesticides are in use or have been used.
D. List procedures and safety precautions for transporting pesticides in a vehicle.
E. List the components of a proper storage area.
F. Describe techniques for mixing and loading pesticides safely, including the equipment, location and procedures used in the process.
G. Describe the proper weather conditions for the safe application of pesticides.
H. Describe how to identify potentially sensitive areas that could be adversely affected by pesticide application, mixing and loading, storage, disposal, and equipment washing.
I. Explain how to properly process all types of pesticide containers for disposal.
J. Describe the procedures to follow for safe, effective cleanup after handling pesticides, including cleaning application equipment, as well as personal decontamination.

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K. Describe how pesticide records can contribute to pesticide safety.

Chapter 8 Application Equipment

A. List the types of application equipment and describe the advantages and limitations of each type.
B. List the types of application equipment used to apply liquids, and describe the situations in which each should be used.
C. List components of liquid application equipment, explain how they work together, and identify which components work best with which pesticide formulations.
D. Describe how to recognize wear in various components.
E. Describe the various nozzles available, including design, size, angles, and output.
F. List the important factors to consider when selecting nozzles for a given application.
G. List types of chemigation systems, and describe the situations in which they can be used.
H. List the types of application equipment used to apply dusts, and describe the situations in which each should be used.
I. List the types of application equipment used to apply granules, and describe the situations in which each should be used.
J. List types of bait application equipment and explain how they work.
K. Name the parts of application equipment that can be switched out or adjusted to accommodate changing conditions and formulations (such as nozzles or psi).
L. Describe how to maintain different kinds of equipment (liquid, dust, and granule).
M. Describe safe and effective practices for cleaning application equipment.
N. Describe how to properly store application equipment.

Chapter 9 Calibrating

A. Define calibration and explain why accurate calibration is essential to safe, effective pest control.
B. List the tools needed for calibration activities.
C. List the variables that must be measured to calibrate a sprayer.
D. Describe how to calibrate liquid sprayers, and be able to calculate speed, gallons/minute (for low and high pressure sprayers), and nozzle output using formulas.
E. Describe how to determine the correct amount of pesticide needed for a particular application.
F. Describe methods used to determine how much pesticide to put into the hopper or tank for a specific application rate over the total area of the application site.
G. Describe the best way to change the output of various pesticide application equipment and the consequences of each change.

Exam Knowledge Expectations for
Qualified Applicator Certificate & Qualified Applicator License
R - Laws, Regulations, and Basic Principles of Safe and Effective Pesticide Use (Core Exam)

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Knowing the information from all of the KEs should prepare you for taking the exam.
The core exam will also include information from the *Laws and Regulations Study Guide* (2011 Edition).

H. Describe how to calibrate dry applicators.
I. Describe what you need to know before you can dilute a pesticide correctly.
J. Be able to calculate the active ingredient concentration of pesticides using formulas.
K. Calculate the area of various shapes (circle, square, rectangle, triangle, and irregular shapes).
L. Explain how system controllers can impact the calibration of equipment and calculations necessary to apply pesticides effectively.
M. Explain the importance of properly calibrating sensors that are part of a system controller.

Chapter 10 Effective Use

A. Describe the goals of pesticide applications and how to achieve them.
B. Explain how pest identification, scouting, monitoring, and economic threshold data influence pesticide use decisions.
C. Provide examples of common pest monitoring methods used before applying pesticides.
D. List the factors to consider when selecting and using a pesticide so that the application is maximally effective and hazards associated with its use are reduced.
E. Describe how to select the most appropriate pesticide for a particular application.
F. Describe the factors that control a pesticide's selectivity.
G. Describe how to evaluate spray coverage and adjust application variables to change coverage as needed.
H. Explain how a GPS unit can impact the effectiveness of pesticide applications.
I. Explain how to determine whether two or more pesticides will be compatible for tank mixing.
J. Describe mixing procedures for
   a. a single pesticide
   b. two or more pesticides
K. Explain why pesticide resistance is a problem.
L. List the factors that contribute to pesticide resistance.
M. Describe the different types of drift, including factors that can affect the occurrence of each type of drift.
N. Describe ways to prevent other types of offsite movement of pesticides.
O. Describe procedures, additives, formulation types, and conditions that help keep pesticides on target.
P. Describe how to implement a follow-up monitoring program to assess the effectiveness of a pesticide application.

Exam Knowledge Expectations for
Qualified Applicator Certificate & Qualified Applicator License
R - Laws, Regulations, and Basic Principles of Safe and Effective Pesticide Use (Core Exam)

Use these knowledge expectations (KEs) to help study the suggested material, *The Safe and Effective Use of Pesticides* (2016 Edition).
Knowing the information from all of the KEs should prepare you for taking the exam.
The core exam will also include information from the *Laws and Regulations Study Guide* (2011 Edition).

Chapter 11 Label

A. Identify the information found in the different parts of the label and associated labeling information.
B. Explain the legal requirement to read, understand, and follow directions on a pesticide label.
C. Describe how an employer can assure that labels and Safety Data Sheets (SDS) are readily available.
D. Describe the type of safety information provided by pesticide labeling and SDS for the pesticide used.

Chapter 12 Emergencies

A. Define first aid.
B. Explain the procedures to follow in getting emergency medical treatment for exposure episodes.
C. Describe how to set up and execute an emergency response plan.
D. Describe pesticide poisoning/over-exposure symptoms.
E. Distinguish between symptoms of pesticide over-exposure and symptoms of common illnesses and heat stress.
F. Describe how to identify heat stress and give first aid.
G. Describe where to find information about first aid for a person involved in a pesticide incident and explain what to do if
    a. you get pesticides on your clothing or skin
    b. you get pesticides in your eyes
    c. you inhale pesticides
    d. you swallow pesticides
H. List the contents of a well-equipped decontamination facility, including components specific to different formulations.
I. List the contents of a pesticide spill kit, including components specific to different formulations.
J. Describe what to do when faced with a pesticide leak or spill.
K. Describe what to do when faced with a pesticide fire.
L. Describe what to do when a pesticide product has been stolen.
M. Describe how to respond to the misapplication of pesticides.
N. Explain why any incident should be reviewed.

Appendix E: Personal Protective Equipment (PPE) Requirements for Applicators of Glyphosate-based Herbicides.

The following table is a summary of PPE requirements for pesticide handlers and field workers in agricultural use (production and non-production) of glyphosate-based herbicides.

PPE Category; Regulatory Reference[23]	Minimum PPE Requirements[24]			Notes
	Pesticide Handling[25]	Entry to the treated area		
		DURING the REI[26]	AFTER the REI	
Minimum work clothing	Long pants, long-sleeved shirt, shoes, and socks.	Long pants, long-sleeved shirt, shoes, and socks.	Long pants, long-sleeved shirt, shoes, and socks.	Mandatory minimum work clothing is NOT considered personal protective equipment. The use of dedicated footwear for fieldwork is recommended as a best practice to avoid the potential for transport of pesticide residue, plants, or soil to personal vehicles or home.

[23] 3 CCR unless otherwise noted.
[24] i.e., Employee who is licensed, certified, or trained to handle pesticides.
[25] See 3 CCR 6000 for the definition of "Handle"
[26] Restricted Entry Interval see 3 CCR 6772 .

Protective eyewear **§6734** **§6738.1** **§6738.2** **§6738.4** **§6746**	Required when mixing, loading, or applying pesticides by hand or ground rig, or when exposed to application equipment that contains or is contaminated with pesticide. Must be available (not required to wear) when using an enclosed cab tractor or vehicle-mounted or towed equipment with spray nozzles that are located below the employee and directed downward.	Required if eyewear is required by the pesticide product labeling for early-entry workers (refer to the Agricultural Use Requirements section).	Not required unless specified by the label.	Must conform to ANSI Z87.1 – 2010 and be compatible with prescription lenses. Unless otherwise specified, safety glasses that provide front, brow, and temple protection, goggles, face shield, or full-face respirator (fit-tested) will satisfy eye protection requirements.
Chemical Resistant Gloves **§§6734, 6738, 6738.1, 6738.3, 6738.4**	Required when mixing, loading, or applying pesticides by hand or ground rig, or when exposed to application equipment that contains or is contaminated with pesticide.	Required.	Not required unless specified by the label.	Refer to label for specific glove types allowable. If no specific glove type is required by label, follow requirements as described in §§6738, 6738.1(b), 6738.3, and 6738.4. Gloves must be minimum 14 mil thickness (or barrier laminate and polyethylene materials of any thickness).
Chemical Resistant Footwear **§6738.1**	If required by the label.	Not required.	Not required.	Use of chemical-resistant footwear for pesticide handling is recommended as a best practice to avoid the potential for transport of pesticide residue, plants, or soil to personal vehicles or home. Unless specified on the pesticide product labeling, chemical-resistant shoes, chemical-resistant boots, or chemical-resistant coverings worn over shoes or boots meet this requirement.

Protective outerwear (Coveralls, chemical-resistant apron, chemical resistant suit) **§§6734, 6738.1, 6738.4**	Coveralls required when handling of “DANGER” and “WARNING” pesticides.	Coveralls required unless the label specifies more protective option.	No protective outerwear required.	Coveralls may be fabric unless otherwise specified. See §6738 for requirements pertaining to laundry and availability of coveralls. Chemical resistant suit or apron required if specified by the label. The use of impermeable outerwear may raise heat illness risk.
Respiratory protection **§§6738.4, 6739**	If specifically required by label, regulation, or employer policy.	No respiratory protection required by the label.	No respiratory protection required by the label.	Respirator use must be supported by a respiratory protection program that meets the requirements specified in §6739. Voluntary use of an N95 mask may be allowed by employees if supported by employer policy and procedures for respirator use. The use of a respirator may raise heat illness risk.

Appendix F: Guide to San Francisco's Reduced Risk Pesticide List

Included in this appendix is a copy of the City and County of San Francisco's SF Environment *Guide to San Francisco's Reduce Risk pesticide List.* This document details a hazard tier assessment methodology to classify pesticide products into three hazard tiers based on their physical, health, and ecological hazards.

Note: A current list of common pesticides products and their assigned hazard tier classification according to SF Environment hazard assessment methodology can be accessed at *https://sfenvironment.org/sites/default/files/fliers/files/sfe_th_reduced_risk_pesticide_list_092419.pdf*

SF Environment
Our home. Our city. Our planet.
A Department of the City and County of San Francisco

Guide to San Francisco's Reduced Risk Pesticide List

Revised September 1, 2013

Introduction

The City of San Francisco Department of the Environment's (SFE) Reduced-Risk Pesticide List is the result of a multi-step process that involves both environmental scientists and pest managers. The first step is a hazard assessment of both the active ingredients and the formulated product. The second step is a consideration of the potential human and environmental exposure that may result from use of the product in the particular application proposed by San Francisco City staff. This informal exposure assessment is done by SFE staff in conjunction with the Integrated Pest Management Technical Advisory Committee (IPM-TAC). The third and final step combines the results of the hazard and exposure assessments into a decision by staff and the TAC as to whether a product should be added to the List, and if so, whether it requires an "least restricted, (formerly denoted as "Approved (A)"), "more restricted" (formerly "Limited Use (L)"), and "most restricted" categorization (formerly "Limited Use-Special Concern (L*)". Approval for use in the San Francisco IPM program is determined on the basis of the need for the product, the availability of alternatives, the Hazard Tier, and the exposure potential.

Application to Certified Green Buildings

The U.S. Green Building Council's 2009 LEED for Existing Buildings Operations and Maintenance (LEED-EBOM) refers to San Francisco's Hazard Tier System in its reference manual. For LEED-certified buildings, building managers are not required to provide universal notification of pesticide applications if those pesticides would qualify as Tier III (lowest hazard). LEED users should refer to the "Hazard Tier Review Process" section below for guidance on how to categorize their products themselves. Lists of products that San Francisco has categorized are posted on the www.sfenvironment.org/ipm website, but are neither comprehensive nor necessarily up to date. [1].

Step 1: Hazard Assessment

San Francisco summarizes the hazards associated with pesticide products and places the products into Hazard Tiers (Table 1) based on the toxicity of the active ingredient(s) and the other ingredients (if they are identified) in the product. The specific hazards assessed are described in Table 2 and the ingredients in the product are evaluated for each category and ranked as high, moderate or low hazard, according to the criteria in Table 3.

Step 2: Exposure Assessment

The hazard review and tier ranking process is only the first step toward placing a pesticide on the Reduced-Risk Pesticide List. A critical second step is review by the San Francisco IPM Technical Advisory Committee (IPM TAC), which is composed of IPM Coordinators from the largest City departments (SF Public Utilities Commission, SF Dept. of Recreation and Parks, SF Dept. of Public Works, SF Port, SF MUNI, SF International Airport, SF Dept. of Public Health). The Committee discusses each proposed addition/deletion

to the list and reviews:

- *The potential for human exposure or environmental release for each proposed product.* Products such as containerized baits, for example, use very small amounts of active ingredient encased in a protective covering. These would therefore pose less exposure potential than, say, aerosol spray products.
- *The effectiveness of each proposed product.* Does the product work as intended?
- *The need for the product.* Is this kind of pest management action truly necessary? If so, is this the least-hazardous product available for the task?

Step 3: Placement on Reduced-Risk Pesticide List

The IPM TAC makes recommendations for additions/deletions to the list. These recommendations are then reviewed by SFE. If the decision is made to list a product, it is categorized in one of three ways:

Least Restricted (formerly "Approved" or "A"). These products are generally the least hazardous pesticides on the list.
More Restricted (formerly "Limited Use" or "L"). These products include specific restrictions on allowable situations.
Most Restricted (formerly "Limited Use – Special Concern" or "L*"). These are pesticide products that pose the greatest health or environmental concerns, but which are nevertheless considered the least-hazardous chemical alternative for a particular purpose. Use of "Most Restricted" products must be justified at an annual public hearing.

The SFE proposes a new Reduced-Risk Pesticide List annually, and holds a public hearing (generally in January) to obtain public comments and suggestions. The list is then submitted for final approval by the SF Commission on the Environment.

Exemptions

For special, unforeseen, or emergency situations, City Departments must be granted a formal exemption from SFE to use products not found on the Reduced Risk Pesticide List. Most exemptions granted are for pilot testing new, safer products.

Hazard Tier Review Process

Pesticide products are assigned a hazard tier ranking after evaluating the hazard indices listed in the following section. The product is assigned a ranking as High, Moderate, or Low for each characteristic based on the ranges or values shown in Table 3 below. If any of the criteria are in the High category, the product is placed in Tier 1. If the chemical does not have any criteria in the High category, but does have at least one criterion in the Moderate category, the product is placed in Tier 2. Products with criteria only in the Low category are placed in Tier 3. See Table 1 for a summary of rankings, and Table 2 for a summary of data sources.

Table 1: Tier Rankings Derived from Hazard Screening

Tier	Definition
Tier 1	Highest concern. At least one criterion in Table 3 placed in highest hazard category.
Tier 2	Moderate concern. At least one criterion in Table 3 placed in the moderate hazard category.
Tier 3	Lowest concern. No criteria flagged for Tier 1 or Tier 2.

Table 2: Hazards Evaluated and Data Sources Used

Hazard	Source(s) of Information Used
Acute toxicity	Product label: Signal word (Caution, Warning or Danger)
Restricted use	Product label: Use restricted to professional applicators
Cancer	Cancer classification of ingredient by US EPA, State of California (Proposition 65 list)[20], National Toxicology Program (Report on Carcinogens)[21], or the International Agency for Research on Cancer (IARC Monographs)[22]
Reproductive or Developmental Toxicity	Designation of ingredient by the State of California (Proposition 65 list[20]), US EPA on the Toxics Release Inventory list[1]
Endocrine disruption	Designation of ingredient by the European Commission[2] or included in the book *Environmental Endocrine Disruptors* by Lawrence H. Keith[3]
Water pollution potential	Ingredient listed under Clean Water Act Section 303(d).[4]
Hazard to birds	Product label or MSDS: Presence and wording of bird hazard statement or LD_{50} or LC_{50} of product (if available).
Hazard to aquatic life	Product label or MSDS: Presence and wording of fish hazard statement or LC_{50} of product (if available).
Hazard to bees	Product label or MSDS: Presence and wording of bee hazard statement or LD_{50} or LC_{50} of product (if available).
Hazard to wildlife	Product label or MSDS: Presence and wording of wildlife hazard statement or LD_{50} or LC_{50} of product (if available).
Soil mobility	Soil mobility score (Groundwater Ubiquity Score or GUS) calculated from physical properties or CA DPR's assessment of groundwater contamination potential using physical properties. Physical property data available in the OSU Pesticide Properties Database,[5] CA DPR Pesticide Contamination Prevention Act Status Reports,[6] or the EU Footprint Pesticide Properties database.[7]
Persistent, Bioaccumulative, Toxic substances (PBTs)	US EPA Waste Minimization priority chemical[8] or listed by the European Union as fulfilling PBT or Persistent Organic Pollutant (POP) criteria.[9]

Table 3: Criteria for San Francisco Hazard Tier Ranking

Hazard	High	Moderate	Low
Signal word	Danger	Warning	Caution or none
Restricted use	Yes	–	No
Cancer (see Table 1)	Known or Probable	Possible	Unclassifiable, Not Likely, Not Listed
Reproductive or Developmental Toxicity	Listed	–	Not listed
Endocrine disruption	EC category I or II	–	EC category III or not listed
Water pollution	303(d) listed	–	Not listed
Hazard to birds	"Extremely toxic" or "Highly toxic" according to product label, or high product toxicity based on LC_{50} or LD_{50} (see above)	"Toxic" according to product label, or moderate product toxicity based on LC_{50} or LD_{50} (see above)	No warning on product label, or low product toxicity based on LC_{50} or LD_{50} (see above)
Hazard to aquatic life	"Extremely toxic" or "Highly toxic" according to product label, or high product toxicity based on LC_{50} (see above)	"Toxic" according to product label, or moderate product toxicity based on LC_{50} (see above)	No warning on product label, or low product toxicity based on LC_{50} (see above)
Hazard to bees	"Extremely toxic" or "Highly toxic" according to product label, or high product toxicity based on LD_{50} (see above)	"Toxic" according to product label, or moderate product toxicity based on LD_{50} (see above)	No warning on product label, or low product toxicity based on LD_{50} (see above)
Hazard to wildlife	"Extremely toxic" or "Highly toxic" according to product label, or high product toxicity based on LC_{50} or LD_{50} (see above)	"Toxic" according to product label, or moderate product toxicity based on LC_{50} or LD_{50} (see above)	No warning on product label, or low product toxicity based on LC_{50} or LD_{50} (see above)
Soil mobility	--	GUS ≥2 or DPR classifies AI as exceeding SNVs	GUS <2 and Not listed by DPR as exceeding SNVs.
PBT	Listed	–	Not listed

Below are details on the hazard indices used in the evaluation:

❖ *Acute Toxicity*

EPA assigns every pesticide product to a hazard category based on the results of acute toxicity testing of the full product including inert ingredients. The testing includes the single dose required to cause death in test animals via ingestion, inhalation, and skin absorption. The testing also considers the degree of skin and eye irritation or damage. Based on the results of these tests, EPA assigns the product to a hazard category and requires a signal word such as Caution, Warning, or Danger to be placed on the label. Danger indicates the highest hazard, Warning indicates moderate hazard, and Caution indicates a lower hazard.

❖ *Restricted Use*

Some pesticides are restricted to use only by certified pesticide applicators and are not available to the general public because of high toxicity, particularly hazardous ingredients, or environmental hazards. Pesticides designed as restricted use are so indicated on the product label.

❖ *Cancer (known ingredients only)*

Various state, federal, and international organizations evaluate or list chemicals for carcinogenicity, their potential to cause cancer.[19, 20, 21, 22] Due to the expense and difficulty of such evaluations, not all agencies have reviewed the same chemicals and not all reach the same conclusions on a given chemical. For this reason, we use the ratings of several agencies whenever possible. These ratings indicate the strength of the scientific evidence that a particular chemical can cause cancer in humans, but they do not consider the potency of the chemical, i.e. the number of cancers that will result from a standard level of exposure to a population. The various agencies use different words to describe the strength of evidence, such as possible, probable, likely, known, etc. In order to simplify the rating, we have assigned the various phrases used by the different agencies to a standard phrase used in the Hazard Tier assessment (see Table 4). The tier rating is based on the highest likelihood assigned by any agency that has evaluated the chemical.

Table 4: Standardized Cancer Rankings Used in Hazard Tier Assessment

Organization	Organization Rating	Standardized Rating for SF Hazard Tier
US EPA[19]	Group A: Known Human Carcinogen	Known or Probable
	Known/Likely	Known or Probable
	Likely to be Carcinogenic to Humans	Known or Probable
	Group B: Probable Human Carcinogen	Known or Probable
	B1: Sufficient evidence of carcinogenicity from animal studies with limited evidence of carcinogenicity from epidemiologic studies in humans	
	B2: Sufficient evidence of carcinogenicity from animal studies with inadequate or no data from epidemiologic studies in humans	
	Group C: Possible Human Carcinogen	Possible
	Likely to be Carcinogenic to Humans at High Doses, but Not Likely at Low Doses	Possible
	Suggestive Evidence of Carcinogenicity to Humans	Possible
	Group D: Not classifiable as to human carcinogenicity	Unclassifiable
	Data are inadequate for an assessment of human carcinogenic potential	Unclassifiable
	Group E: Not Likely to be Carcinogenic to Humans	Not Likely
IARC[22]	Group 1: Carcinogenic to Humans	Known or Probable
	Group 2A: Probably Carcinogenic to Humans	Known or Probable
	Group 2B: Possibly Carcinogenic to Humans	Possible
	Group 3: Unclassifiable as to Carcinogenicity to Humans	Unclassifiable
	Group 4: Probably not Carcinogenic to Humans	Not Likely
NIH/NTP[21]	Known to be a Human Carcinogen	Known or Probable
	Reasonably Anticipated to be a Human Carcinogen	Known or Probable
	Reviewed but not listed	Not Listed
Proposition 65[20]	Known to the State of California to Cause Cancer	Known or Probable

❖ *Reproductive/Developmental Toxicants (known ingredients only)*

Known ingredients in the products are screened against the State of California lists of known reproductive and developmental toxicants,[20] the US EPA Toxics Release Inventory (TRI) chemical hazard list,[32] or the list from the National Toxicology Program's Health Assessment and Translation (formerly the Center for Evaluation of Risks to Human Reproduction).[33]

❖ *Endocrine Disruptors (known ingredients only)*

Under the Food Quality Protection Act, the EPA is required to screen pesticide ingredients for endocrine system effects. Until that screening is done, a comprehensive list of endocrine disruptors will not be available. For purposes of this screening, we used the list of endocrine disruptors compiled by the European Commission[24] and in the book *Environmental Endocrine Disruptors* by Lawrence Keith.[25] Chemicals on the EU list are classified for both humans and wildlife as Category I: evidence for endocrine disruption in living organisms, Category II: evidence of potential to cause endocrine disruption, or Category III: low exposure concern, no scientific basis for inclusion, or insufficient information. The list of endocrine disruptors will likely be expanded at a later date, when US EPA publicizes the results of the Endocrine Disruptor Screening Program.

❖ *Water Pollution (known ingredients only)*

Section 303(d) of the federal Clean Water Act requires states to compile a list of water bodies with excessive contamination. The list of impaired water bodies in the area where the product will be used (available from the US EPA 303(d) web site[34]) is searched for pesticide active ingredients. Based on a site-specific analysis of the water bodies, products are assessed as to whether they contain priority 303(d) pollutants for that area.

❖ *Hazards to Birds, Aquatic Life, Bees, and Other Wildlife*

The US EPA requires particular hazard warning statements on pesticide product labels depending on the toxicity of the active ingredients and the formulated product to particular off-target species, evidence that adverse effects have occurred, and the use for which the product is intended. The hazard assessment is based on whether such warnings appear on the specific product label or the acute toxicity of the product as described in the MSDS. This toxicity is expressed as an LC_{50} (or LD_{50}) that is the lethal concentration (or dose) to 50% of the test organisms in a laboratory test. The criteria for defining toxicity for different species are shown in Table 5 below.

Table 5: Toxicity Reference Values for Terrestrial and Aquatic Wildlife

Category	Mammal and Bird LD_{50} (mg/kg)[35]	Mammal and Bird LC_{50} (mg/kg of food)[36]	Aquatic LC_{50} (mg/L)[36]	Bee LD_{50} (g/bee)[37]
High Toxicity	< 50	< 500	< 1	< 2
Moderate Toxicity	50–500	500–1,000	1–10	2–11
Low Toxicity	> 500	> 1,000	> 10	> 11

❖ *Mobility in Soil (known ingredients only)*

The potential for ground-water or surface-water pollution by pesticides is dependent on many factors, including persistence of the ingredients, water solubility, soil binding, amount of rainfall or irrigation, soil properties, amount and frequency of applications, soil slope, vegetation present, proximity to ground- or surface-water, etc. The hazard assessment only considers the properties that relate strictly to the pesticide itself. The potential for a pesticide moving to surface water or groundwater is thus assessed in one of three ways:

1) The Ground-water Ubiquity Score (GUS) is an empirically derived index that relates pesticide persistence and soil binding to mobility. The GUS index is defined mathematically as:

$$GUS = \log_{10}(\text{half-life}) \times [4 - \log_{10}(K_{oc})]$$

where K_{oc} is the soil sorption coefficient and half-life is the soil half-life in days. Information on pesticide K_{oc} values can be found in the OSU Pesticide Properties database,[27] the California Department of Pesticide Regulation groundwater Status Reports,[28] or in the EU Footprint Pesticide Properties database.[29]

A pesticide movement rating ranging from "extremely low" to "very high" has been assigned to the numerical values by the researchers in the OSU Extension Pesticide Properties Database.[27] The values are shown in Table 6.

Table 6: Pesticide Mobility in Soil as a Function of Groundwater Ubiquity Score

GUS Value	Pesticide Movement Rating
<2	Low
>2.0–3.0	Moderate
>3.0	High

2) The California Department of Pesticide Regulation (DPR) lists pesticide active ingredients as potential groundwater contaminants when physical properties exceed Specific Numeric Values (SNVs). In order for a chemical to be listed, one of the following must be true:

Water solubility: > 3 ppm (mg/L), or
Soil adsorption coefficient (Koc): < 1,900 cm^3/g

AND one of the following must be true

Hydrolysis half-life: > 14 days, or
Aerobic soil metabolism half-life: > 610 days, or
Anaerobic soil metabolism half-life: > 9 days

The list of pesticides that exceed SNVs is available from DPR's annual Groundwater Status Reports.[28]

3) In addition to the GUS index and DPR's assessment, information on pesticide water contamination potential is noted from product label warnings. EPA requires two levels of warnings for products with characteristics that have been determined to result in likely contamination of groundwater from use as labeled. A lower level of warning is required if no actual detections have occurred or no field studies have been done. A higher level of warning is required if detections have occurred or field studies have shown that the chemical leaches. For purposes of the initial screening, the presence of either warning is considered an indication that the chemical has high mobility. In rare cases where a label ground-water advisory occurs but the GUS index or DPR assessment did not indicate high mobility, the label advisory is given priority.

Pesticides that have high soil mobility according to the criteria above, but are not otherwise toxic or bioaccumulative are classified as Tier 2.

❖ *Persistent, Bioaccumulative, Toxic Chemicals (PBTs)*

In recent years much attention has been paid to toxic chemicals that persist in the environment and bioaccumulate. PBTs pose a serious threat because they can build up in ecosystems, wildlife, and humans even when deposited slowly. Many organizations including the United Nations, International Joint Commission on the Great Lakes, U.S. EPA, and Washington State Department of Ecology have proposed strategies to reduce or eliminate them. The list used for this evaluation is EPA's Waste Minimization Priority Chemicals list or listed by the European Union as fulfilling PBT or Persistent Organic Pollutant (POP) criteria. New lists will be added as more information becomes available.

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Appendix G: Legal Analysis

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