STANDARD OPERATING PROCEDURE
Ambient Urban Monitoring Methodology for Surface Water Protection

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KEY WORDS

Urban, areas of interest, pesticide, benchmark exceedance, toxicity

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to describe Surface Water Protection Program's methodology for ambient urban monitoring.

1.2 Definitions

AOI	Area of interest
CDPR	California Department of Pesticide Regulation
HUC	Hydrological unit code
POC	Pesticide of concern
POI	Pesticides of interest
PUR	Pesticide use reporting
SWMP	Surface Water Monitoring Prioritization Model
SWPP	Surface Water Protection Program
TU	Toxicity unit

2.0 MATERIALS

2.1 SWMP
(http://cdpr.ca.gov/docs/emon/surfwtr/sw_models.htm)

2.2 Data reporting template and associated documents (DATA001)
(http://cdpr.ca.gov/docs/emon/pubs/sopmethdta.htm)

3.0 PROCEDURES

3.1 Urban monitoring objectives

There are nine overarching objectives for the urban monitoring program.

3.1.1 Assess status of pesticide concentrations and detections in California urban surface waters;

3.1.2 Evaluate spatial distribution of pesticide concentrations and detections;

3.1.3 Evaluate temporal trends in pesticide concentrations;

3.1.4 Determine primary sources of pesticide contamination in urban runoff;

3.1.5 Assess effects of storm water on pesticide transport;

3.1.6 Evaluate risk of pesticide concentrations to aquatic ecosystem health;

3.1.7 Assess emerging technology and sample collection methodology to deliver reliable monitoring data to qualitatively or quantitatively identify pesticides in surface waters;

3.1.8 Determine if monitoring data support management level decision making or regulatory action;

3.1.9 Evaluate effectiveness of regulatory action or voluntary mitigation measures or best management practices.

3.2 Procedures for meeting the overarching objectives.

The procedures for meeting the nine overarching objectives are stated in this section.

3.2.1 Monitoring areas.

Compile a list of potential monitoring areas of interest (AOIs) using SWMP (Luo et al., 2017).

3.2.1.1 SWMP incorporates the population density, pesticide use data, and toxicity values to compile AOIs where pesticide detection in surface waters is expected. This targeted monitoring approach can reveal higher levels of pesticides in surface water, allowing for a conservative approach to pesticide analysis, mitigation, or regulation.

3.2.1.2 Top ranked mainstem and tributary creeks and rivers in selected AOIs will be considered for monitoring (receiving water sites).

3.2.1.3 Discharges from storm drain outfalls will be considered for monitoring. Data collected from these source identification locations provide pesticide fate and transport information specific to land use patterns. These sites are not specifically identified by SWMP, but are located within watersheds of high pesticide use or have associated monitoring data with a high frequency of pesticide detections. Source sites will comprise up to 50% of selected monitoring sites.

3.2.1.4 Designate selected sites from 3.2.1.2 and 3.2.1.3 as long-term monitoring sites. Long-term monitoring sites will be selected based on previous monitoring data and will be monitored across years. Data collected at long-term monitoring sites are used to evaluate

trends in pesticide concentrations and to determine mitigation and regulation effectiveness.

3.2.1.5 Alternate sites may be established based on local needs, professional judgement, or to conduct special studies to fulfill objectives 3.1.7, 3.1.8, or 3.1.9.

3.2.2 Monitored pesticides. Determine pesticides of interest (POIs) using SWMP.

3.2.2.1 For a specific monitoring region as defined by Luo et al. (2017), pesticides with a “TRUE” recommendation and a final score > 9 will be prioritized for monitoring. Final decision to monitor will be based on sampling logistics, previous monitoring data, budget constraints, and laboratory analytical capabilities. Repeatedly ranked pesticides with no analytical method will be recommended to management for analytical method development.

3.2.2.2 The numeric target allows for a conservative approach for identifying high risk pesticides. Pesticides with very high toxicity may be selected with low use whereas pesticides with lower toxicity would only be selected with higher use. The rationale for this is that lower use of a highly toxic pesticide could reach threshold levels. Conversely, a pesticide with lower associated aquatic toxicity may only reach threshold concentrations with a higher use pattern.

3.2.2.3 Alternate POIs may be selected based on professional judgement, analytical screens, or to conduct special studies to fulfill objectives 3.1.7, 3.1.8, or 3.1.9.

3.2.3 Sampling and measurement. Sample type, collection method, and measurements defined

3.2.3.1 Sample type

Samples may be collected in two different matrixes:

1) Water samples for all selected POIs.
2) Sediment samples for pyrethroids and other potentially highly toxic and highly hydrophobic pesticides.

3.2.3.2 Sample collection method

3.2.3.2.1 Water samples.

During the dry season, discrete (grab) samples will be collected. During rain events, composite samples integrated over time or flow using autosamplers will be collected. Where not feasible to use autosamplers due to safety, inadequate environmental conditions for installation of field equipment, or logistical considerations, discrete (grab) samples will be collected.

3.2.3.2.2 Sediment samples.

Sediment samples will be collected as discrete (grab) samples or integrated over time utilizing sediment traps (Budd et al., 2009)

3.2.3.2.3 Sampling methods

Samples will be collected according to CDPR SOPs available at http://cdpr.ca.gov/docs/emon/pubs/sopfield.htm.

3.2.3.3 Water quality measurements

In situ measurements: dissolved oxygen, pH, temperature, and specific conductivity will be measured.

Laboratory measurements: total organic carbon (water and sediment), dissolved organic carbon (water), and suspended sediment (water) will be measured.

Water quality measurements will be conducted according to CDPR SOPs available at http://cdpr.ca.gov/docs/emon/pubs/sopequip.htm and http://cdpr.ca.gov/docs/emon/pubs/sopmethdta.htm.

3.2.3.4 Sample measurements

Three types of samples measurements may be analyzed:

1) chemical concentration;
2) toxicity, 96-hour acute tests using species appropriate for protocol objectives, within budget constraints or external contracts.

3) Alternative sampling: Alternative sampling methodologies investigated as feasible and adopted with management approval to fulfill objective 3.1.7.

3.2.4 Temporal characterization: sample collection timing (see Appendix 1).

3.2.4.1 Monitor seasonally

Rational: Adopting a seasonal monitoring regime provides data to evaluate annual temporal trends in pesticide concentrations and effects of seasonality.

3.2.4.2 Monitor dry season runoff

Timing: One monitoring event in early dry season (May – June) and one late season dry event (August – September).
Rationale: Annual pesticide loading can be greater in dry season than during storm events (Bale et al., 2017; Budd et al., 2015). In early dry season, there is very slight chance of rainfall and the irrigation demand is increasing (Appendix 1). In late dry season, irrigation demands stay high due to hot weather while no rainfall is expected.

3.2.4.3 Monitor storm runoff

Timing: First rain event of the water year (first flush rain event) and a late winter storm event.
Rational: First flush has the potential to transport residual pesticide concentrations that have built up over the course of the dry season. Studies have shown this event can have the highest pesticide concentrations or detections of a monitoring program (Bale et al., 2017; Budd et al., 2013, Ensminger et al., 2011). Late season storm sampling typically has fewer pesticide detections than a first flush rain event likely due to constant scouring of rain events between November and February or due to lower use. Late season storm sampling can give information about pesticides that remain on urban landscapes after several rain events prior to the dry season.

Only storms that generate a minimum of 0.1 inch rainfall with a 10-day antecedent dry period will be monitored. Generally, at minimum of 0.1 inch of rainfall is required to generate runoff. Due to potentially long inter-event times in California's rainy season (Driscoll et al., 1989), a 10-day antecedent dry period ensures monitoring a unique storm event.

Unusual circumstances may call for the need for additional rainstorm sampling to meet the monitoring objectives. Management approval would be required for any additional monitoring.

4.0 REPORTING REQUIREMENT

4.1 Annual study report

An annual study report will be submitted to management which will include a brief description of the monitoring protocol, detection frequency, and comparisons to toxicity thresholds (as defined in CDPR SOP DATA001). Tracking of benchmark exceedances will be included in the data reporting template. A POI will be characterized as a POC based on toxicity threshold exceedances.

4.2 Comprehensive data analysis

General guidelines for an additional data analysis are detailed in Appendix 2. Additional data analysis will be conducted when a pesticide is detected with: 1) greater than 10% exceedance of the lowest US EPA aquatic life benchmark for three consecutive years, or 2) greater than one median sediment TU for three consecutive years. The additional data analysis will include documenting any potential need for additional monitoring, mitigation, or regulatory action. A detailed report to management will be submitted on the additional analysis.

4.3 Special studies

Upon the completion of any special studies conducted to meet objectives 3.1.7, 3.1.8, or 3.1.9, a report will be submitted to management.

5.0 REFERENCES

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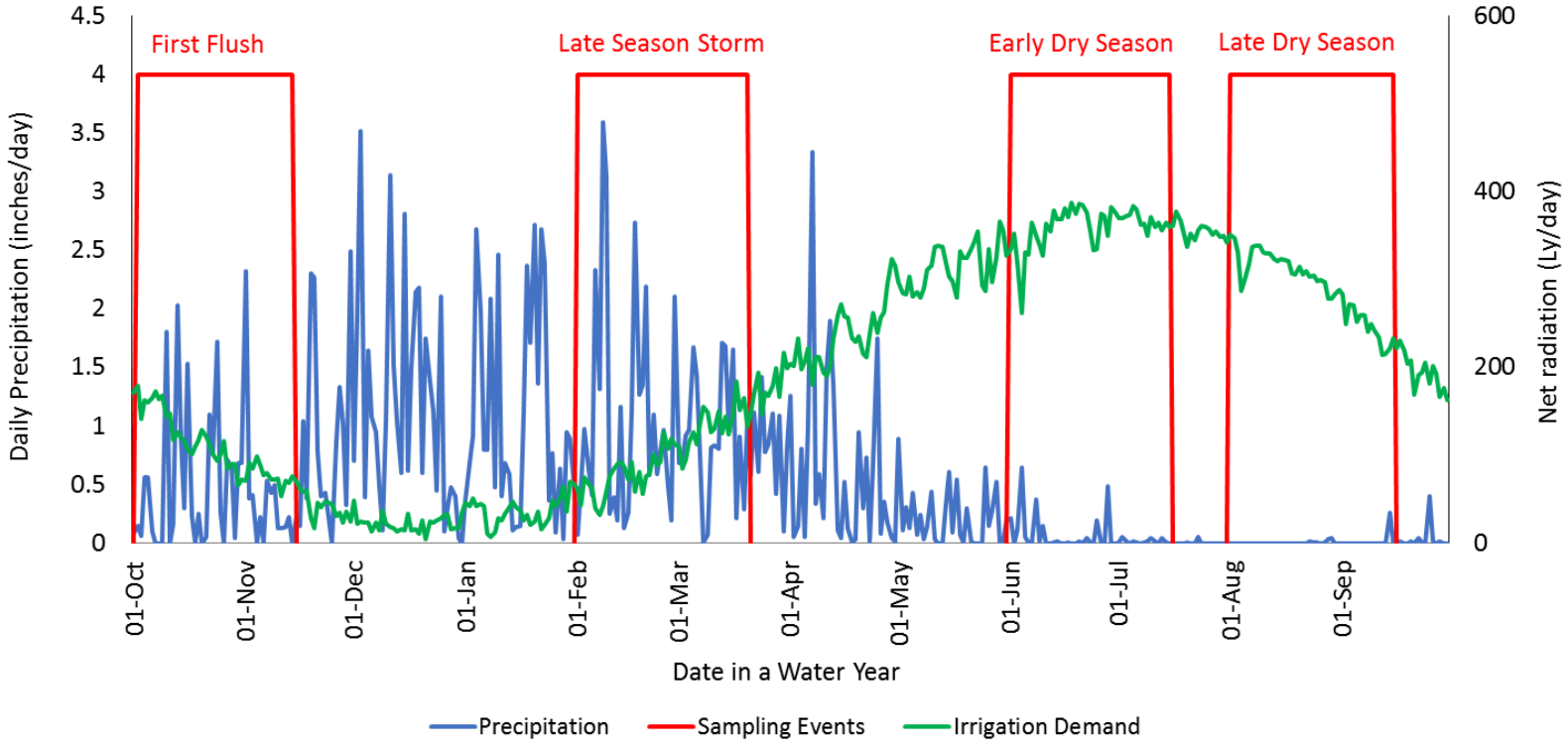
6.0 APPENDICES

Appendix 1. Example of a sampling scheme for urban monitoring



Appendix 2. Flow chart for POC determination

Flow chart to determine if a POI warrants additional data analysis, data report, or recommendation for management action. Additional action raises a POI to a POC.