STANDARD OPERATING PROCEDURE
Planning, Conducting and Documenting Small-Scale Groundwater Monitoring Studies

KEY WORDS

Four-section survey, Z-study, N-memos, legal agricultural use, well site selection, suitable well, FAC section 13149, FAC section 13150

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1.0 INTRODUCTION

1.1 Purpose

To establish a standard approach for conducting small-scale groundwater monitoring studies, referred to as a "four-section surveys" or "Z-studies", in response to pesticide and degradate detections by DPR or reported to DPR by external agencies.

1.2 Definitions

1.2.1 Section/Township/Range: Public Land Survey System units. These location data are also referred to as COMTRS (County/Meridian/Township/Range/Section).

1.2.2 Meridian: California has three base meridians (Humboldt, Mount Diablo, and San Bernadino). The north-south line is the principal meridian, the east-west line is the base line. These points intersect in the three locations in California.

1.2.3 Township: A standard township contains 36 sections. Townships are arranged in horizontal rows numbered north or south of one of the three base meridian lines.

1.2.4 Range: A range is a vertical column of townships. These columns are numbered (east or west) from one of the three base meridians.

1.2.5 Section: A standard section is a one-square-mile block of land typically containing 640 acres.

2.0 MATERIALS

2.1 Ground Water Protection Area Shapefiles
2.2 California's Township/Range/Section Shapefiles
2.3 Maps
2.4 Well Inventory Database (WIDB) internal interface
2.5 SOP QAQC005 Preparation of Sample Containers for Groundwater Monitoring
2.6 SOP QAQC002 Requests for Method Development and the Laboratory Specifications Form
2.7 SOP FSWA001 Obtaining Well Water Samples
2.8 SOP ADMN006 Creating and Completing a Chain of Custody Record
2.9 SOP ADMN007 Preparing and Approving Study Memoranda and Reports

3.0 BACKGROUND

Food and Agricultural Code (FAC) §13152(c) of the Pesticide Contamination Prevention Act (PCPA) requires all agencies to submit well sampling results for pesticides and pesticide degradates to DPR for upload into the Well Inventory Database (WIDB). DPR's Groundwater Protection Program (GWPP) uses well water sample data from the WIDB to assess the detections and prevent groundwater pollution from the legal agricultural use of pesticides. The initial assessment includes evaluating whether a reported detection is considered actionable or not actionable (Ganapathy, 2022). When a detection is considered actionable, GWPP conducts a small-scale groundwater monitoring study to (1) assess the reporting agencies' sampling results and (2) determine if the detections resulted from non-point sources such as legal agricultural pesticide applications, or point sources such as manufacturing, repackaging, spills, or accidents. The GWPP calls these small-scale studies four-section surveys or Z-studies. The Well Inventory Database (WIDB) manager initiates a Z-study by sending an email to the GWPP management team. The study number is designated by a "Z" followed by a consecutively assigned number as outlined in Ganapathy, 2022.

DPR regulates the use of pesticides listed in Title 3, California Code of Regulations (3CCR) 6800(a) in areas vulnerable to leaching or runoff called Ground Water Protection Areas (GWPAs). DPR utilizes detections of these pesticides, or their degradates, outside of current GWPAs to establish new GWPAs.

If DPR detects a pesticide or degradate that has not been formally reviewed according to FAC §13150(c), DPR will determine if the detection is from legal agricultural use of the pesticide and if DPR should initiate the formal review process according to FAC §13150(c).

4.0 PROCEDURES

4.1 Establishing Follow-Up Monitoring Goals

It is DPR's goal to conduct timely follow-up monitoring. GWPP management and the project team review pesticide detections reported to DPR by other public agencies to determine the need for and feasibility of follow-up monitoring. Feasibility is determined by the availability of adequate analytical methods, laboratory resources, and wells to sample. If analytical methods are not available, GWPP management will determine the priority and meet with the contract laboratory to plan for method development. If wells are not available in the four-section area it may not be possible to monitor. The project team uses online mapping to find domestic or agricultural wells near the detections, especially if the original detection was from a monitoring well. With this information, GWPP management approves the monitoring goals and assigns a project leader to plan and conduct the monitoring study.

4.2 Developing Study Plans

4.2.1 The project leader will identify high priority and alternate study areas using the following procedure:

4.2.1.1 Plot the location of the original well with the detection on a map using the GWPA and township/range/section shapefiles (See Materials at 2.1 and 2.2).

4.2.1.2 Divide the section with the original well into quadrants. In Figure 1, the original well is in Section 1 and the dotted lines delineate the quadrants. The heavy lined boxes represent one-square-mile sections. Lines dividing the sections into quadrants have been added to illustrate the selection of the four sections based on the location of the original well.

4.2.1.3 Identify the three sections immediately adjacent to the quadrant with the original well (Figure 1). If correctly mapped, the original well will

be in one of the center four quadrants of the 16-quadrant, 4-section study area.

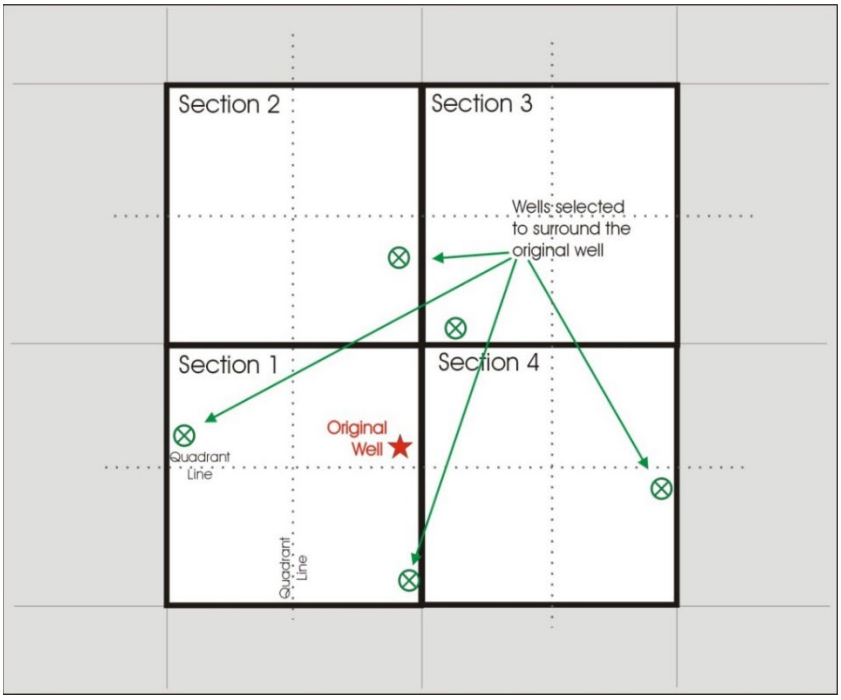

Figure 1. Diagram of a typical four-section survey study area.

4.2.1.4 Identify and prioritize alternate sampling areas based on reported pesticide use, historical well availability, and/or vulnerability to groundwater contamination. Use the alternate sampling areas if suitable wells are not available in the highest priority sampling areas. Typically, the alternate sampling areas will be partial sections within one mile of the original well. (Figure 2).

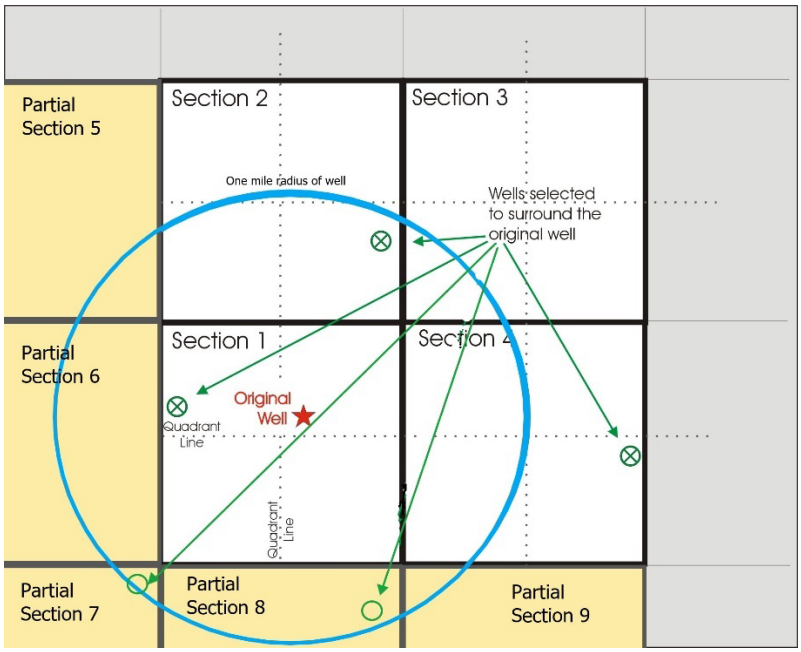

Figure 2. Diagram of an expanded four-section survey study area.

4.2.2 The project leader will determine the number of wells to sample using the following guidance:

4.2.2.1 Usually, the project leader plans to sample six wells in the four-section study site, including the well with the reported detection. Occasionally up to ten wells will be sampled. Additional wells will be sampled depending on need and based on well availability, well locations, reported pesticide use, or positive sampling results.

4.2.2.2 If available, sample the original well. Doing so allows DPR to assess the reported results and provides a valuable ‘starting point’ for study plan development.

4.2.2.3 If DPR previously sampled the original well using a DPR-approved laboratory or analytical method for the reported pesticide, sampling the original well is not necessary unless one or more of the following conditions apply:

- Sampling occurred more than 5 years ago
- An improved analytical method is available

- The original detection was deemed unusual (e.g., high concentration, unlikely contaminant, no reported use, etc.)
- Additional data are needed to assess concentration changes that may have occurred since the previous sample

4.3 Implementing Study Plans

4.3.1 At least two to six months prior to sampling:

4.3.1.1 The project leader will discuss analytical needs with the Branch or Program laboratory liaison. Follow SOP QAQC001 to initiate method development, method validation, or storage stability studies, as needed.

4.3.1.2 GWPP management will approve the written analytical method and the unequivocal determination memo. The lab liaison and project leader will provide a laboratory specifications sheet (SOP QAQC002) and a tentative sampling schedule for the laboratory before any sampling takes place.

4.3.2 At least a week prior to sampling:

4.3.2.1 The project leader will discuss the study plan (both high priority and alternate sample areas) with the project team, provide maps, and review relevant sampling SOPs to ensure sample integrity.

4.3.2.2 The project team will prepare sample containers according to SOP QAQC005.

4.3.2.3 Update the lab liaison of any changes to the sampling schedule and the expected day of your return. This allows the lab liaison to schedule sample delivery and to prepare blind spikes, as applicable.

4.4 Conducting the Field Study

4.4.1 In the field, the project team will drive around the sections to survey the study area to locate the original well and additional wells that may be suitable for sampling (see SOP FSWA001 Obtaining Well Water Samples for a description of a suitable well).

4.4.2 After surveying the available wells, select five to ten wells that give the

best spatial representation of the highest priority sampling areas surrounding the original well. It is best practice to not sample a well that is less than 0.25 miles away from a well that was sampled as part of the study. This practice ensures sufficient spatial representation of the 4-section area.

4.4.3 If the study plan includes the original well but it cannot be sampled, the project team will identify and attempt to sample the nearest well as a replacement for the original well.

4.4.4 If the minimum number of wells required by the sampling plan is not available in the highest priority sections, the project team will expand the sampling area based on the alternate sample plan.

4.4.5 The total sample area should not exceed nine sections and the furthest sampled well should be not more than one mile from the original well (Figure 2).

4.4.6 The project team will document any significant SOP and/or study plan deviations in the study memo.

4.5 Results Assessment and Study Completion

4.5.1 The study is complete when you have sampled the required number of wells or eliminated all potential wells within the four-section study area as candidates due to well condition or the inability to obtain permission to sample.

4.5.2 If the targeted pesticide is detected in a well sampled during the study, additional samples may be taken in the vicinity of the detection(s) to determine the extent of the impacted area. The project leader will discuss initial results with GWPP management to develop further sampling plans.

5.0 DOCUMENTING RESULTS

5.1.1 Study results should be documented in a study memo or study report within six months of study completion.

5.1.2 Depending on the study complexity and outcome, the project leader may either document the study results using the attached “Z-memo”

template (See Appendix 1) or use the most recent memo as a template. A study report per SOP ADMN007 Preparing and Approving Study Memoranda and Reports may be required by GWPP management.

5.1.3 Electronic copies of the "Z-memos" are maintained on the internal DPR website and on the Groundwater network drive. Hard copies are archived in the respective study files. Study reports are posted to the EM Branch Study Reports web page and are archived with the study files on the Groundwater network drive.

5.1.4 Analytical results and well location data will be provided to the WIDB steward in a spreadsheet format for upload into the WIDB by April of the following year for inclusion in the annual data upload. The Z-study memo number is associated with the data.

6.0 REFERENCES

Ganapathy, C. 2022. Summary of Program Policies and Documentation Specifying the Response to Detections Reported to the Department of Pesticide Regulation (Z-Study and N-Memo). May 16, 2022.

7.0 APPENDICES

Appendix 1: Z-memo template

Appendix 1: Z-memo template

Department of Pesticide Regulation

Name
Director

Name
Governor

Name
Secretary for Environmental Protection

M E M O R A N D U M

TO: Groundwater Management
Staff title
Environmental Monitoring Branch

FROM: Staff name
Staff title
Environmental Monitoring Branch
Staff phone number

DATE:

SUBJECT: Z(number): COMPLETION OF THE SURVEY FOR (number) DETECTIONS OF (pesticide or degradate) IN (name) COUNTY AND DETERMINATION WHETHER RESIDUES IN THE ORIGINAL POSITIVE WELL RESULTED FROM LEGAL AGRICULTURAL USE

SUMMARY

(Agency) has reported detections of (pesticide or degradate) in (number) wells in (county name) County. A summary of the detections follows.

Table 1: Sampling results for wells located in section (COMTRS) in (number) County sampled during (date).

Well Key	Section	Sample Date	Concentration (ppb)	Reporting Limit (ppb)

Summarize the conclusion.

BACKGROUND

Describe when the original well was sampled.

MATERIALS AND METHODS

Summarize the number of wells sampled, the different types of samples collected, and the analytes the laboratory analyzed. Include a citation for the analytical method and whether it was deemed unequivocal.

Table 2: Study Z(number). Concentrations of pesticides[a] and degradates in well water samples.

County	Township/ Range- Section	Well Location	Concentration (ppb) Analyte	Analyte	Analyte

[a] All well samples were analyzed for X, X, and X. Only compounds detected are shown.

RESULTS

WELL CONDITION:

Summarize the results of the investigation of the original well including an evaluation of the well condition, including the depth, depth to water, issues with the well pad, casing, potential surface contamination, type of agriculture and pesticide use nearby, and other notable data.

LAND AND PESTICIDE USE INFORMATION:

Summarize the land use and pesticide use history around the wells with data obtained from the Pesticide Use Database and other resources. Include a map.

DISCUSSION

Summarize the sampling results, the type of analytical method used, pesticide and land uses in the vicinity of the well(s), and whether there was any evidence of point source contamination. If pesticides were detected in more than one well within the study area, discuss whether there is adequate evidence to determine the source and if more monitoring is or is not needed.

If there are other Z-studies or DPR monitoring studies for the same pesticide(s), discuss the results, if applicable.

CONCLUSION and RECOMMENDATIONS

Summarize conclusions regarding the source(s) of detections, if there is enough information and further recommended actions (e.g., more monitoring, entering pesticide into Pesticide Detection Response Process, etc.). If the pesticide is not detected or degradates do not exceed a health level, include appropriate recommendations.

Approved: _____ Date: _____

Groundwater Management, Title

REFERENCES

Properly format memo according to current DPR standards.