M E M O R A N D U M

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SUBJECT: CRITERIA FOR ESTABLISHING GROUND WATER PROTECTION AREAS

PURPOSE

The purpose of this memorandum is to consolidate and describe in one document the criteria the Department of Pesticide Regulation (DPR) uses to establish ground water protection areas (GWPAs). These criteria are currently described in three separate documents (Goh, 1992; Sanders, 1994; and Troiano et al., 2000) and are based on criteria used by DPR to establish Pesticide Management Zones (PMZs) in effect prior to ground-water regulation revisions implemented in 2004. Added to these criteria are ones that rely on the CALVUL modeling process (Troiano et al., 2000) which formed the basis for the revised regulations in 2004.

GROUND WATER PROTECTION AREA IDENTIFICATION CRITERIA

DPR will establish new GWPAs based on the following criteria:

1) Identification of vulnerable areas using the CALVUL modeling approach; or
2) Detections of active ingredients (AIs) listed in the Title 3, Code of Regulations (3 CCR) section 6800(a) or their degradation products in:
   a) One well in a section that is adjacent to a GWPA; or
   b) Two or more wells within a four section area that is not adjacent to an existing GWPA.

BACKGROUND

The Pesticide Contamination Prevention Act (PCPA) was enacted in 1985 to prevent further pollution of ground water from the legal agricultural use of pesticides. The PCPA established a process to review the continued use of pesticide AIs or their degradation products detected in ground water due to agricultural use (Food and Agricultural Code section 13149). This process is triggered by the detection of pesticide AIs above a specified reporting limit or by detection of degradation products of pesticide AIs or "other specified ingredients" of pesticides at levels that pose a health threat. During this review, the Director of DPR may determine that agricultural use of the detected pesticide can be modified so there is a high probability that it will not pollute the ground waters of the state.

The Groundwater Protection List (3 CCR section 6800) includes pesticides that have undergone formal review following verified ground water detections where DPR's Director determined that use could be modified to prevent ground water pollution (3 CCR section 6800[a]). DPR implements the required use modifications through the Restricted Materials permit program (3 CCR section 6400 et seq.) that is carried out by the California Agricultural Commissioners. Currently, 3 CCR section 6800(a) includes seven pesticide AIs: atrazine, bentazon, bromacil, diuron, norflurazon, prometon, and simazine

PESTICIDE MANAGEMENT ZONES – 1992 THROUGH 2004

From 1992 through 2004, DPR implemented use modifications for six of the seven pesticide AIs listed in 3 CCR section 6800(a) in AI-specific PMZs. A PMZ was a square mile section of land, as defined by the U.S. Public Lands Survey, which was sensitive to ground water pollution as indicated by detections of one or more AIs listed in 3 CCR section 6800(a) (Goh, 1992). Use of the seventh pesticide, bentazon, could not be modified in rice so its use was also regulated statewide (3 CCR section 6457).

In the early 1990s, two atrazine degradation products, deethylatrazine and deisopropylatrazine, were detected in well water samples at higher concentrations and also at a higher frequency of detection than the parent compounds (Troiano and Nordmark, 2002). This led to a decision by DPR to include detection of breakdown products of AIs on the 3 CCR section 6800(a) list as a basis for identification of a vulnerable PMZ (Sanders, 1994).

DPR established AI-specific PMZs according to the following criteria (Goh, 1992; Sanders 1994):

1) The AI was listed in 3 CCR section 6800(a); and
2) The analytical results met verification requirements in the PCPA (Biermann, 1989); and
3) The detected AI was registered for agricultural use; and
4) Sites were present in the section containing the detection where registered pesticide products could have been applied; and
5) Where one or more AIs listed in 3 CCR section 6800(a) or their degradation products were detected in:
   i) At least two wells within a four section area that was not adjacent to an existing PMZ; or
   ii) One well in a section of land that was adjacent to a PMZ for that AI; or
   iii) One well within a PMZ.

In the absence of wells to sample within a section of land that is adjacent to a PMZ, the section could be designated a PMZ based on similar land use patterns as compared to the PMZ.

GROUND WATER PROTECTION AREAS – 2004 THROUGH PRESENT

During the 1990s, research by DPR scientists significantly improved our understanding of the mechanisms of pesticide movement to ground water. By 2000, an empirical model was developed that identified areas vulnerable to pesticide movement to ground water. Management practices to mitigate pesticide movement to ground water were also developed that were specific to the pathway for movement to ground water identified for that geographic location.

Sections of land were determined to be vulnerable if pesticide residues had been detected in ground water as a result of nonpoint source agricultural applications. Known contaminated sections were compared to detailed soils data. This comparison resulted in the identification of two important vulnerable soil conditions and corresponding pathways to ground water: (1) a coarse-textured soil condition where leaching is the predominant contamination pathway (Troiano et al., 1993) and (2) a hardpan soil layer condition where runoff from the application site into dry wells or into areas with high infiltration rates is the predominant contamination pathway (Braun and Hawkins, 1991). Depth to ground water was added as another variable when it was discovered that detections were more frequent in areas of shallow ground water (Troiano et al., 1999).

Based on the data generated by the model, DPR implemented regulations in 2004 that increased the area under regulation from 313,000 acres to about 2.4 million acres. The new GWPAs were identified in regulation as sections of land classified into either coarse-textured or hardpan soils that had a ten-year spring-averaged annual estimated depth to ground water of 70 feet or less. Sections that were previously established as PMZs were automatically classified as a GWPA. Users of a 3 CCR section 6800(a) listed pesticide AI who are located in a GWPA are required to

modify their pesticide use practices based on predominant soil properties of the GWPA. Although many GWPAs had a history of pesticide detections, the majority were established based on soil vulnerability classification and depth to ground water.

In 2004, GWPAs for leaching or runoff pathways were established based on the following criteria (Troiano et al., 2000; Marade and Troiano, 2000):

1) If the section had an estimated depth to ground water of 70 feet or less and it was classified as a coarse soil it was identified as a leaching GWPA. If the section had an estimated depth to ground water of 70 feet or less and the soil contained a hardpan layer then it was identified as a runoff GWPA; or
2) If the section had both leaching and runoff characteristics (coarse-textured soil with a hardpan layer), it was identified as a leaching GWPA if the mean hardpan depth was greater than 48 inches and as a runoff GWPA if the mean hardpan depth was less than 48 inches; or
3) A section previously identified as a PMZ but that did not meet the above criteria was classified as a leaching or runoff GWPA as follows:
    a) If the predominant soil in the section was coarse-textured then it was classified as a leaching GWPA, otherwise the section was classified as a runoff GWPA; or
    b) If the PMZ lacked soil survey data then it was assigned a GWPA pathway based on information provided by local agencies as to the predominant soil conditions in the section. DPR also assessed agronomic practices in the section to determine whether leaching or runoff was the apparent pathway for recharge of water to ground water.

Appendix 1 provides a comparison between the criteria used to establish a PMZ and a GWPA, in tabular form.

<u>Ground Water Protection Areas Exempted from the 2004 Regulations</u>

In recognition of the limitations in the methodology to identify vulnerable areas, DPR scientists assessed counties where only a few GWPAs were identified and where they were not contiguous (Troiano and Marade, 2003). DPR exempted sections that were proposed as a GWPA from regulation if they:

- Were proposed based solely on modeled information; and
- Had never been a PMZ or proposed as one; and
- They were noncontiguous with only a few sections identified within a county's borders.

This exclusion did not apply to counties with noncontiguous PMZs, which DPR established because of verified pesticide detections. DPR will modify this determination if better data or geographical tools indicate a need to include these areas.

CONCLUSION

The criteria used by DPR to establish GWPAs is based on the criteria used to establish PMZs prior to 2004 and the CALVUL modeling approach used to transition from PMZs to GWPAs in 2004. DPR will establish new GWPAs based on the following criteria:

1) Identification of vulnerable areas using the CALVUL modeling approach; or
2) Detections of AIs listed in 3 CCR section 6800(a) or their degradation products in:
   a) One well in a section that is adjacent to a GWPA; or
   b) Two or more wells within a four section area that is not adjacent to an existing GWPA.

REFERENCES

Biermann, H. 1989. Definition of 'Second Analytical Method' for the Purposes of AB2021. Environmental Monitoring Branch, Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, California. (Available at: <http://www.cdpr.ca.gov/docs/emon/grndwtr/polprocd/policy21.pdf>, verified August 4, 2011).

Braun, A. and L. S. Hawkins. 1991. Presence of Bromacil, Diuron, and Simazine in Surface Water Runoff from Agricultural Fields and Noncrop Sites in Tulare, California. Environmental Monitoring Branch, Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, California. (Available at: <http://www.cdpr.ca.gov/docs/pestmgt/pubs/pm9101.pdf>, verified August 24, 2011).

Goh, K. April 8, 1992. Identification of Pesticide Management Zones. Environmental Monitoring Branch, Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, California.

Marade, S.J. and J. Troiano. 2000. Sections of Land Requiring Special Assignment as Runoff or Leaching Ground Water Protection Areas. EH 00-07. Environmental Monitoring Branch, Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, California. (Available at: <http://www.cdpr.ca.gov/docs/emon/pubs/ehapreps/eh0007.pdf>, verified August 24, 2011).

Sanders, J. April 19, 1994. Creating Pesticide Management Zones (PMZs) Based on Detections of Degradation Products of Pesticide Active Ingredients in Ground Water. Environmental Monitoring Branch, Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, California. (Available at: <http://www.cdpr.ca.gov/docs/emon/grndwtr/polprocd/policy16.pdf >, verified August 4, 2011).

Troiano, J., and C. Nordmark. 2002. Revised 2004. Distribution of Triazine Residues in Wells in Relation to Current and Proposed Maximum Contaminant Levels (MCLs). Environmental Monitoring Branch, Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, California. Analysis Memorandum available at (<http://www.cdpr.ca.gov/docs/emon/pubs/ehapreps/120402m.pdf>, verified August 4, 2011).

Troiano, J. and J. Marade. 2003. Update of Ground Water Protection Areas. EH 03-05. Environmental Monitoring Branch, Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, California. (Available at: <http://www.cdpr.ca.gov/docs/emon/grndwtr/eh0305update.pdf>, verified August 4, 2011).

Troiano, J., J. Marade, and F. Spurlock. 1999. Empirical Modeling of Spatial Vulnerability Applied to a Norflurazon Retrospective Well Study in California. J. Environ. Qual. 28:397-403. (Available at: <http://www.cdpr.ca.gov/docs/emon/pubs/ehapref/norstdy.pdf>, verified August 24, 2011).

Troiano, J., F. Spurlock, and J. Marade. 2000. Update of the California Vulnerability Soil Analysis for Movement of Pesticides to Ground Water: October 14, 1999. EH 00-05. Environmental Monitoring Branch, Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, California. (Available at: <http://www.cdpr.ca.gov/docs/emon/pubs/ehapreps/eh0005.pdf>, verified August 24, 2011).

Troiano, J., C. Garretson, C. Krauter, J. Brownell, and J. Hutson. 1993. Influence of Amount and Method of Irrigation Water Application on Leaching of Atrazine. J. Environ. Qual. 22: 290-298. (Available at: <http://www.cdpr.ca.gov/docs/emon/pubs/ehapref/atrzne.pdf>, verified August 24, 2011).

Approved by: *Original signed by* *August 30, 2011*
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Appendix 1. Comparison of criteria used to establish PMZs and GWPAs.

PMZ Identification	Proposed GWPA Identification
By Monitoring	
Detection of a *specific* currently registered AI listed in 3 CCR section 6800(a) or *its* degradation product(s), singly or in combination, in at least two wells in a four-section area.	Detection of *any* currently registered AI listed in 3 CCR section 6800(a) or their degradation product(s), singly or in combination, in at least two wells in a four-section area.
Unequivocal analytical method or detection by a second method or a second lab and at a reporting limit acceptable to DPR management.	Same
Based on a section or partial section of land as described in the Public Lands Survey System	Same
Reported historical or current agricultural use of the currently registered AI in vicinity of detection or presence of agricultural use sites to which the AI could have been legally applied.	Same
Detection from a sound well	Same
No evidence of point source	Same
By Preponderance of Evidence	
Detection in one well in a section adjacent to a current or recommended PMZ for the same AI or its degradation product(s).	Detection of any currently registered 3 CCR section 6800(a) AI or their degradation products, singly or in combination, in one well in a section adjacent to a current or recommended GWPA identified based on pesticide detections or the CALVUL Model.
Detection in one well in a current or recommended PMZ where that AI had not been previously detected.	Not Applicable (N/A)
Absence of sound wells available for sampling in a section adjacent to more than one current or recommended PMZ and where pesticide use patterns are similar.	N/A
By Modeling	
N/A	Predominant soil properties and section mean depth to ground water govern identification as a GWPA (CALVUL). No monitoring or detection history is required for inclusion.