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Lompoc Pesticide Air Monitoring
Executive Summary of the
Multiple-Pesticide Sampling and Analysis Plan

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What is the purpose of the air sampling that the Department of Pesticide Regulation (DPR) plans to conduct?
The Department of Pesticide Regulation (DPR) plans to measure air concentrations of as many of the pesticides as possible listed in Tables 1 and 2, depending on methods development. These pesticides will be monitored during the spring, summer, and fall. Using multiple-pesticide analysis of single samples, this sampling and analysis plan is designed to measure concentrations of these pesticides for three to ten weeks. DPR will then use the measured data to determine if acute and subchronic screening levels have been exceeded. The design is to collect data for acute and subchronic exposures, not chronic exposures; however, DPR will qualitatively compare data to chronic screening levels. (Note: Acute exposure is an exposure for a short time, usually 24 hours or less. Subchronic exposure is an exposure for an intermediate period of time, generally one to three months. Chronic exposure is an exposure for extended periods of time, usually for a significant portion of a lifetime.)

The study is part of a two-phase monitoring program to measure pesticide air concentrations in the Lompoc area. The primary objective of the two-phase pesticide air monitoring program is to gather information to answer three main questions: (1) Are Lompoc residents exposed to pesticides in air? (2) If so, which pesticides, and in what amounts? (3) Do these levels exceed human health standards?

Why is DPR conducting this air sampling?
In 1997, DPR formed the Lompoc Interagency Work Group (LIWG) to help investigate residents' concerns first voiced in 1992 about potential pesticide exposure from drift of pesticides during and following agricultural applications. The LIWG is composed of staff from federal, state, and county agencies as well as community representatives. The LIWG formed several subgroups to develop recommendations to address health concerns, to conduct a pesticide air monitoring program, and to consider potential exposures from environmental factors, such as crystalline silica, radon, meteorological conditions, and pollen and mold. Other agencies plan or have done monitoring to measure levels of crystalline silica, radon, and meteorological conditions.

The pesticide exposure subgroup (now called the Technical Advisory Group) developed a work plan that recommended comprehensive air monitoring in Lompoc during the growing season to investigate potential pesticide exposure to residents from pesticides applied to agricultural fields that may migrate by air to adjacent residential areas. This subgroup developed a list of priority pesticides, 12 of which were tested for in 1998 (see Phase 1 below, Table 3).

The Governor's 1999-2000 budget allocated funds to DPR for monitoring pesticide air concentrations in the spring, summer, and fall 2000 in Lompoc. This document describes the monitoring planned for pesticides during the months of late May through early August (Table 1) and in September 2000 (Table 2) using multiple-pesticide analysis of single samples. DPR plans to sample for up to 23 pesticides and 5 breakdown products (Table 1) during late May through early August. University of California Davis' Trace Analytical Laboratory (UCD) has developed methods to analyze these samples. In September, DPR will collect and analyze samples for as many of the compounds listed in Table 2 as methods development allows. Battelle's Atmospheric Science and Applied Technology Department (Batelle) is in the process of developing analytical methods for the chemicals listed in Table 2.

What other pesticide air sampling has DPR done in Lompoc?

For four weeks during August and September 1998, DPR conducted a monitoring study that was intended to test pesticide sampling and analysis methods and to determine if a subset of the total pesticides in use in the area could be measured in air (Phase 1). With some exceptions, these goals were achieved. This test study provided the basis for the multiple-pesticide sampling and analysis approach this plan follows. However, due to the limited nature of the 1998 sampling, these results are not appropriate for risk assessment. For more information about this sampling, go to our website at <www.cdpr.ca.gov>, click on Programs and Services, then Lompoc Project, Update on Lompoc, "Phase 1 Results."

Phase 2 consists of two sampling and analysis projects. In addition to the multiple-pesticide sampling and analysis, the other part of this second phase is sampling and analysis for fumigants, a subset of pesticides whose use has historically been highest in fall and winter. DPR collected samples for that project in January and February 2000 and will collect the remainder in fall/winter 2000. For more information, go to our website at <www.cdpr.ca.gov>, click on Programs and Services, then Lompoc Project to find DPR's "Lompoc Pesticide Air Monitoring Fumigant Sampling and Analysis Plan."

How were the pesticides selected?

Since few methods exist at this time for air monitoring where single samples can be collected and analyzed for multiple pesticides at the low concentrations required to estimate inhalation exposure, methods development work was required to most efficiently use available resources to monitor as many pesticides of potential concern as possible. During this past year, the TAG reviewed the pesticides used in Lompoc (1996-1998), developed a ranking scheme based on the most current information for use, toxicity, and vapor pressure (volatility), and prioritized the chemicals for which to request methods development (Table 3). This list was further refined,

eliminating chemicals due to analytical difficulties or low toxicity. The TAG then identified potential laboratories (UCD and Battelle) to develop methods for and conduct multi-pesticide analysis of single samples. Tables 1 and 2 show the final lists of prioritized candidate compounds.

How many sites will DPR monitor and where will the sites be located?
Ambient air monitoring will be conducted at four sites within the city limits of Lompoc. DPR based its site selection primarily on proximity to agricultural area, wind patterns, and U.S. Environmental Protection Agency siting criteria. Three of the four air sampling sites were selected based on nearness to pesticide application sites and predominant wind patterns during that time of year. The fourth site, near the center of Lompoc, was selected to be representative of pesticide concentrations that might be found closer to the center of the city.

What is the sample collection plan?
Pesticides will be monitored in two groups. One group of pesticides will be monitored late May through early August (Table 1), historically months when their use has been higher than other months in the year. Ambient air samples will be 24 hours in duration, collected four days per week for 10 consecutive weeks. The other group (Table 2) will be monitored during September when their use has been historically high. Samples will be 24 hours in duration, collected four days per week for three consecutive weeks.

What air sampling methods will be used?
Sorbent cartridges with XAD-4 resin will be used to collect air samples. Samples will be stored on dry ice and then delivered to the analyzing laboratory. UCD will analyze samples collected in late May to early August to measure concentrations of compounds listed in Table 1, and Battelle will analyze the samples collected in September to measure concentrations of the compounds listed in Table 2, using methods each of these laboratories has developed (or is in the process of developing) as part of this project.

What quality assurance and quality control procedures will be used?
To ensure sample validity and quality, appropriate quality control and quality assurance procedures will be used along the entire sampling and analysis process: in the field, during sample collection and storage, and in the laboratory during sample analysis. In addition, an independent, multi-agency quality assurance team will audit the laboratories participating in this study.

What are DPR screening levels?
Since enforceable human health standards for ambient air concentrations for these pesticides do not exist, DPR and a subcommittee of the LIWG's TAG plan to develop final health screening levels for these pesticides to place results in a health-based context.

TAG has developed preliminary screening levels. These preliminary screening levels were generated using generally conservative assumptions to ensure that the analytical methods' detection limits will be lower than the final health screening levels (Tables 1 and 2).

Although not regulatory standards, DPR will use final health screening levels to evaluate the results and take actions as needed. Published U.S EPA risk assessments will be used as the basis for these final screening levels. In addition, completed DPR risk assessments, in the form of Risk Characterization Documents, will be used. These final health screening levels are not legal health standards and should not be viewed as such. The final health screening levels represent the first tier in a risk evaluation and provide a context in which to view measured levels of the pesticides monitored in this project.

What are the lowest levels of pesticide air concentrations that these methods detect?
The lowest preliminary screening level is 20 nanograms per cubic meter (ng/m^3) (Tables 1 and 2). The 1998 test study (Phase 1) maximum air concentrations of the quantifiable samples for the pesticides that will also be monitored in this plan ranged from 5.3 to 760 ng/m^3. UCD has predicted estimated quantitation limits of 3 to 9 ng/m^3 for the compounds listed in Table 1; Battelle has predicted estimated quantitation limits of 5 ng/m^3 for the compounds listed in Table 2.

What actions will DPR take based on the results?
Acute exposure: If the maximum 24-hour air concentration at any site is significantly below the final acute health screening level, no immediate action will be taken. If the maximum 24-hour air concentration is below the screening level, but not significantly below it, DPR may still consider further analysis (e.g., further monitoring, and/or a more detailed analysis of the health effects data). However, if the maximum 24-hour air concentration is greater than the final acute health screening level, then DPR will respond immediately with interim regulatory action or the development of a plan for further analysis, or both. Regulatory actions could consist of one or more of the following: permit conditions for restricted materials (e.g., buffer zones), statewide regulations, label changes, suspension, and/or cancellation. The selection and implementation of any regulatory actions are outside the scope of this study.

Subchronic exposure: If the maximum 14-day average air concentration is significantly below the screening level, no immediate action will be taken. If the maximum 14-day average air concentration is below the screening level, but not significantly below it, DPR may consider further analysis (e.g., further monitoring, and/or a more detailed analysis of the health effects data). If the maximum 14-day average air concentration is greater than the final subchronic health screening level, then DPR will respond immediately with interim regulatory action or the development of a plan for further analysis, or both. Regulatory actions could consist of one or more of the following: permit conditions for restricted materials (e.g., buffer zones), statewide regulations, label changes, suspension, and/or cancellation. The selection and implementation of any regulatory actions are outside the scope of this study.

Chronic exposure: If the estimated annual average concentration is below the final chronic health screening level, no immediate action will be taken. If the estimated annual average air concentration is above the screening level, DPR will conduct further analysis (e.g., further monitoring, and/or a detailed analysis of the health effects data).

What the sampling and analysis plan can and cannot do.
The goal of the sampling and analysis plan is to provide data to answer questions about the highest concentrations of these pesticides that occur over a short period of time. However, we will have no way of ensuring that we have monitored the "highest" concentrations (e.g., the highest concentration of a pesticide could occur on a day we do not monitor) or under worst-case conditions (for similar reasons). Toxicologists use these values to determine potential exposure and to characterize the risk from these exposures. These data will be used to assess the risk to human health due to acute and subchronic exposures. However, this sampling and analysis plan has not been designed to answer questions about chronic exposures to these pesticides, but will provide a starting point for further analysis.
For a variety of reasons (e.g., meteorological conditions, location of applications relative to air samplers), maximum concentrations may occur at times other than when monitoring occurs. However, DPR will compare the monitoring results at different sites with daily pesticide use and meteorology data to assess the representativeness of the data.

The plan will provide information to estimate inhalation exposure; however, community exposure to pesticides by ingestion, dermal absorption, or other potential routes will not be measured. For these pesticides, the major route of exposure is expected to be through inhalation.

Some concentrations of pesticides may be too low to quantify given the current state of technology for chemical analysis. Data below the limit of quantitation will be reported as trace levels. Data below the method detection limit will be reported as none detected. However, when used for calculations (e.g., calculations of average concentrations), data below the limit of quantitation will be set equal to the mid-point between the limit of quantitation and the method detection limit while results below the method detection limit will be set equal to one-half the method detection limit.

The multiple-pesticide analysis of single samples will allow for identification and quantification of the pesticides listed in Tables 1 and 2, for which analytical methods have been developed. (Note: UCD has developed methods for all compounds in Table 1; Battelle soon will begin work on compounds listed in Table 2 and plans to develop methods for as many of them as possible.) However, the analysis may show compounds that are not on these lists. It is beyond the scope of this project to routinely identify compounds that are not listed in Tables 1 or 2.

Following applications, pesticides (other than those applied as dusts) move away from the target field by drift and post-application volatilization in two forms: gaseous and adsorbed onto airborne particulates. This monitoring study does not address this latter component. However, although the sample analysis does not account for all the particulate, we believe that the fraction we may be missing is a small percentage. Samples for particulates may be collected to estimate the missing fraction.

The U.S. EPA is currently developing methods to address the risks from exposure to multiple pesticides. These and/or other methods will be used in an effort to evaluate multiple pesticide exposure, in addition to the pesticide-by-pesticide evaluation.

When will the report be completed?
In the effort to have data be as complete and accurate as possible, and to ensure adequate time for all appropriate review and comment, it is not possible to specify a time the final report will be completed. However, DPR anticipates that these steps will be completed in time to release a final report by the end of 2001.

For a complete copy of the sampling and analysis plan or for more information about this project, please contact Randy Segawa in writing at the Environmental Monitoring and Pest Management Branch of DPR, by telephone at (916) 324-4137, or by e-mail at <rsegawa@cdpr.ca.gov>.

Table 1. Group 1—List of Candidate Compounds for a Multi-residue Air Sampling Scheme (analysis by gas chromatography at UCD). Monitoring is planned for late May through early August 2000.

Pesticide (Active Ingredient)	**Breakdown product**	**Detection Limit (ng/m^3)**	**Limit of Quantitation (ng/m^3)**	**Preliminary Screening level (ng/m^3)**
Chlorpyrifos	Chlorpyrifos oxon	0.76	4	1,000
Chlorthal-dimethyl		0.28	1	4,700
Chlorthalonil		1.4	7	2,300
Cycloate		1.8	9	16,000
Diazinon	Diazinon oxon	0.72	4	300
Dicloran		1.3	6	82,000
Dicofol		1.3	7	3,900
Dimethoate	Dimethoate oxon	0.56	3	330
EPTC		0.62	3	41,000
Ethalfluralin		0.60	3	79
Fonofos	Fonofos oxon	0.66	3	6,600
Iprodione		1.5	8	160
Malathion	Malathion oxon	0.82	4	4,600
Mefenoxam		0.60	3	200,000
Metolachlor		0.58	3	250,000
Naled		0.96	5	6,600
Oxydemeton-methyl*				410
PCNB		0.84	4	27
Permethrin		1.4	7	380
Propyzamide		1.7	8	450
Simazine		0.60	3	58
Trifluralin		1.5	8	910
Vinclozolin		0.38	2	39,400

*Oxydemeton-methyl cannot be analyzed as part of this multi-pesticide analysis since it requires a separate analysis. Therefore, separate samples will be collected the last two weeks of this sampling period and analyzed for oxydemeton-methyl using a separate single-pesticide analytical method.

Table 2. Group 2—List of Candidate Compounds for Multi-residue Air Sampling Scheme (analysis by liquid chromatography/mass spectroscopy at Battelle). Monitoring is planned for September 2000.

Pesticide (Active Ingredient)	**Breakdown product**	**Target limit of quantitation (ng/m3)**	**Preliminary screening level (ng/m3)**
Acephate		5	800
Acephate	Methamidophos*		160
Anilazine		5	1,300
Benomyl		5	1,700
	DDVP (from Naled)	5	20
Ethephon		5	59,000
Maneb		5	160
Methomyl		5	26,000
Oxamyl		5	660
Thiodicarb		5	370
Thiophanate-methyl			3,400

*Methamidophos is also a pesticide active ingredient that is applied in the Lompoc area.

Table 3. List of pesticides and breakdown products the TAG reprioritized in 1999-2000 for air monitoring in Lompoc. These were chosen from the pesticides for which at least 90 reported pounds were applied in the Lompoc area for 1996-1998. Each pesticide on the initial list was separately ranked for pounds applied, vapor pressure, and toxicity. The top 17 from each of the three categories were combined to make up the list below. Status on the TAG 1998 priority list and status of monitoring activities in Phases 1 and 2 are also shown.

Pesticide	**Breakdown Product**	**TAG list in 1998?**[1]	**Monitored in Phase 1?**	**Candidate for Phase 2 monitoring?**	**Why not a candidate for Phase 2?**
Acephate[2]		Yes	No	Yes	
Acephate	*Methamidophos*	No	No	Yes	
Anilazine		No	No	Yes	
Benomyl		Yes	No	Yes	
Benomyl	**Methyl 2-benzimidazole carbamate (MBC)** [3]	No	No	No	Single method
Chlorothalonil[4]		Yes	Yes	Yes	
Chlorpyrifos		Yes	Yes	Yes	
Chlorpyrifos	Oxygen analog	No	Yes	Yes	
Chlorthal-dimethyl		Yes	No	Yes	
Chlorthal-dimethyl	**Monomethyl and tetrachloroterephthalic acid (TPA, MTP)**	No	No	No	Single method
Cycloate		No	Yes	Yes	
Diazinon		Yes	Yes	Yes	
Diazinon	Oxygen analog	No	Yes	Yes	
Dicloran		No	No	Yes	
Dicofol		No	No	Yes	
Dimethoate		Yes	Yes	Yes	
Dimethoate	Oxygen analog	No	No	Yes	
Disulfoton		Yes	Yes	No	Single method
Disulfoton	**Oxygen analog**		No	No	Single method
EPTC		No	No	Yes	
Ethalfluralin		No	No	Yes	

[1] Alachlor, chloropicrin and femaniphos were listed as priority pesticides by the TAG in 1998, but are not included in this list the TAG reprioritized. Chloropicrin, along with methyl bromide and MITC, has been included as a compound for monitoring in the fumigant and sampling plan. Alachlor and fenamiphos were not included in this reprioritized list because they no longer were among the top 17 chemicals when ranked by use, toxicity or vapor pressure (volatility).
[2] Battelle will attempt methods development for compounds shown in italics in this Phase 2 monitoring.
[3] Compounds shown in bold were not included in the list of prioritized compounds for methods development.
[4] UCD has developed methods for compounds shown in regular type in this Phase 2 monitoring.

Ethephon		No	No	Yes	
Fonofos		Yes	Yes	Yes	
Fonofos	Oxygen analog		No	Yes	
Fosetyl-Al		Yes	No	No	Difficult method, low toxicity
Glyphosate		No	No	No	Single method, low toxicity
Iprodione		Yes	No	Yes	
Malathion		No	No	Yes	
Malathion	Oxygen analog	No	No	Yes	
Mancozeb		Yes	No	No	Difficult method
Mancozeb	**Ethylene thiourea**	Yes	No	No	Difficult method
Maneb		Yes	No	Yes	
Maneb	**Ethylene thiourea**	Yes	No	No	Difficult method
Mefenoxam		No	No	Yes	
Metam sodium	MITC	Yes	Yes	Yes/Fumigant sampling	
Methyl bromide		Yes	Yes/Analysis by UN Reno	Yes/Fumigant sampling	
Methomyl		Yes	No	Yes	
Metolachlor		No	No	Yes	
Naled		No	No	Yes	
Naled	*DDVP (dichlorvos)*	No	No	Yes	
Oxamyl		No	No	Yes	
Oxydemeton-methyl		Yes	Yes	Yes	
PCNB		No	No	Yes	
Permethrin		Yes	Yes	Yes	
Propyzamide		Yes	No	Yes	
Simazine		No	No	Yes	
Simazine	**Deethyl simazine, diaminochlorotriazine**	No	No	No	Single method
Sulfur		Yes	No	No	Single method, low toxicity
Sulfuryl fluoride		No	No	No	Single method, study design does not include its residential structural uses

Thiodicarb		No	No	Yes	
Thiophanate-methyl		No	No	Yes	
Thiophanate-methyl	**Methyl 2-benzimidazole carbamate (MBC)**	No	No	No	Single method
Trifluralin		No	No	Yes	
Vinclozolin		No	No	Yes	