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PESTICIDES FOR EVALUATION AS CANDIDATE TOXIC AIR CONTAMINANTS

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Staff Report

Pesticides for Evaluation as Candidate Toxic Air Contaminants

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DISCLAIMER

The mention of commercial products, their source, or their use in connection with material reported herein is not to be construed as either an actual or implied endorsement of such products.

EXECUTIVE SUMMARY

PURPOSE

This report identifies pesticidal active ingredients (AI) which the Department of Pesticide Regulation (DPR) will investigate for their potential to be toxic air contaminants (TAC), and ranks these pesticides based on toxicological properties, physical/chemical properties, and the amount sold or used in California. The ranking scheme presented here is a first-order approximation for prioritizing monitoring efforts. The presence or absence of a pesticide in this evaluation does not reflect that pesticide's potential to be a TAC. Furthermore, this report does not identify which pesticides are TACs, nor which pesticides may subsequently be found to be TACs. The relative ranking and priority status assigned to pesticides do not imply that there is any significant difference in physical/chemical or toxicological parameters, or sales and use data between pesticides.

The identification and ranking of candidate TACs are subject to the following limitations: 1) the use and sales of any given pesticide varies yearly; 2) for some pesticides, some or all of the physical data used for this prioritization scheme may not be available; 3) following application, the AI may undergo environmental reactions leading to by-products with toxicity different from the parent compound; 4) new pesticides are registered while others are withdrawn; and 5) the regulatory status of individual pesticides is dynamic with respect to application rate, commodities which may be treated, pre- and postharvest intervals, etc. For these reasons, this report will be periodically updated.

BACKGROUND

In 1983 and 1984, the California Legislature enacted Assembly Bills 1807 and 3219 establishing a regulatory framework for the identification and control of TACs. This framework is listed in Article 1.5, Sections 14021-14027 of the Food and Agricultural Code, mandating the California Department of Food and Agriculture to evaluate pesticides (in their pesticidal uses) for their potential to be TACs. Authority for implementing AB 1807/3219 was transferred to the newly created DPR within the California Environmental Protection Agency (Cal/EPA) as part of the Governor's reorganization of 1991.

Initially, a list of candidates is created through evaluations of pesticide information, as specified in the law, including: 1) risk of harm to public health; 2) amount, manner, and area of usage of the pesticide in California; 3) environmental fate and physical and chemical properties; and 4) ambient concentrations (and persistence) in the community. These data are obtained from a variety of sources including registrant data packages, the State Office of Environmental Health Hazard Assessment (OEHHA), researchers at the University of California and California State Universities, the Occupational Safety and Health Division of the State Department of Industrial Relations, health agencies, environmental organizations, and private industry. Based on this information, candidates for evaluation as TACs are identified.

The investigation of a specific candidate begins with an inclusive literature search which becomes the basis of a health effects document (HED). After initiation of the literature search, DPR requests the State Air Resources Board (ARB) to monitor for the candidate pesticide, recommending appropriate monitoring sites and, in many cases, sampling duration and frequency, and analytical guidelines. Additionally, a summary of the pesticide's physical and chemical properties, toxicity, types and usage of available products, whether or not the pesticide is a restricted material, and a list of the target pests are provided to ARB. Upon receipt and evaluation of monitoring data, DPR begins the report writing process which includes an evaluation of the physical/chemical properties of the pesticide, an evaluation of the environmental fate and airborne concentrations of the pesticide, an assessment of human exposures to these air concentrations, and a risk assessment and risk characterization of the pesticide. Following completion, the report is then reviewed by ARB, OEHHA, and the public prior to its presentation to a nine-member scientific review panel (SRP). The SRP acts as a review panel to determine the scientific validity and scope of the information contained within the health effects report. The SRP formalizes its findings on the validity of the report and presents them to the Director of DPR.

Following the completion of the HED and receipt of the SRP's findings, the Director is required to prepare a public hearing notice for proposed regulations for those pesticides to be declared TACs. Upon completion of the regulatory process, the Director, in consultation with local Agricultural Commissioners, the Air Pollution Control Districts, and Air Quality Management Districts, assesses the need and options for mitigation.

This report provides an explanation of the ranking scheme used by DPR to prioritize the 134 pesticides which have been identified for evaluation as candidate TACs.

RESULTS

Pesticides were ranked according to point scores received in each of six criteria; criteria were based on toxicology, physical characteristics, and sales or use data . The toxicological criteria used were: 1) acute toxicity, 2) U.S. Environmental Protection Agency's and/or the National Toxicity Program carcinogenicity category, and 3) the chronic No-Observed-Effect Level. The physical characteristics used were: 4) vapor pressure and 5) Henry's Law Constant. For these five criteria, variances within the data were resolved by using the most conservative data–the data which produced the highest score for each criterion. The sixth criterion was the amount of the pesticide sold or used in California. For this criterion, use or sales figures for the years 1990 through 1993 were averaged, and points were assigned based on these averages. Again, points were assigned based on the greater score derived from sales or use averages.

Three other ranking criteria discussed in this document were not used in the final ranking scheme because they did not materially affect the actual ranking of the candidates. The first criterion, application method, was rejected because 79 percent of the candidates are aerially applied or are soil fumigants (and would have received the maximum points [four] for this criterion). Use of this criterion would have inflated scores without affecting a candidate's rank. Two other criteria, physical state and water solubility, were considered. Physical state was

ultimately rejected because it is correlated with vapor pressure. Water solubility was rejected because it is correlated with vapor pressure and is a component of Henry's Law Constant.

A list of all pesticides included in this report and their status in the AB 1807/3219 process (with respect to Senate Bill 950 [the Birth Defects Prevention Act of 1994] Proposition 65 [the Safe Drinking Water and Toxic Enforcement Act of 1986]) is presented in the section entitled *Status Of Senate Bill 950 and Proposition 65 Pesticides in the Assembly Bill 1807 Process* below. This section also identifies those pesticides which have been declared TACs, those pesticides for which the ARB has conducted air monitoring studies, and those pesticides for which monitored studies have been requested but not completed.

CONCLUSIONS

DPR will use this ranking to prioritize the evaluation of pesticides as candidate TACs. DPR will request ARB to perform monitoring studies of these pesticides following their general order as ranked. This ranking scheme will be re-evalated in the year 2000. The report will be reprinted every two years. Ranking of individual pesticides may be changed as new information becomes available. This will allow DPR to focus resources on the pesticides and their practices that pose the highest potential risk of unacceptable human exposure.

STATUS OF PESTICIDES IDENTIFIED IN THE BIRTH DEFECT PREVENTION ACT (SB 950) AND THE SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65) IN THE ASSEMBLY BILL 1807/3219 PROCESS

Chemical Name	ARB Air Monitoring	AB 1807 Status[1]
Acephate		
Aciflurofen		
Acrolein		HAPTAC
Alachlor		
Aldicarb	Requested	
ADAC*		
Allethrin		
Aluminum Phosphide		
Amitraz		
Arsenic Pentoxide	Data Complete	HAPTAC
Arsenic Trioxide	Data Complete	HAPTAC
Atrazine		
Azinphos-methyl	Data Complete	In Evaluation
Bendiocarb		
Benomyl	Data Complete	In Evaluation
Bentazon, Sodium Salt		
o-Benzyl-p-Chlorophenol + Salts		
Boric Acid		
Bromacil		
Bromoxynil Octanoate	Data Complete	
Captan	Data Complete	HAPTAC
Carbaryl		HAPTAC
Carbofuran	Data Complete	In Evaluation
Carboxin		
Chlorine		HAPTAC
Chloroneb		
Chloropicrin	Data Complete	
Chlorothalonil	Data Complete	In Evaluation
Chlorpyrifos	Data Complete	
Chlorsulfuron		
Chlorthal-Dimethyl		
Coumaphos		
Creosote		
Cryolite		
Cyanazine	Requested	
Cyanuric Acid, Monosodium Salt		
Cycloate		
2,4-D salts and esters	Data Complete	HAPTAC
Daminozide		

1 In Evaluation: Pesticide is being evaluated.
HAPTAC: Pesticide is a Hazardous Air Pollutant Toxic Air Contaminant
TAC: Pesticide declared a TAC via review and evaluation.

* ADAC = Alkyl (50% C12, 40% C14, 10%C16) Dimethylbenzyl Ammonium Chloride

STATUS OF PESTICIDES IDENTIFIED IN THE BIRTH DEFECT PREVENTION ACT (SB 950) AND THE SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65) IN THE ASSEMBLY BILL 1807/3219 PROCESS (CONTINUED)

Chemical Name	ARB Air Monitoring	AB 1807 Status[1]
DEET		
DEF (S,S,S-Tributyl phosphorotrithioate)	Data Complete	In Evaluation
Diazinon	Requested	
Dicamba, salts and esters		
Dichlobenil		
p-Dichlorobenzene		
1,3 Dichloropropene	Data Complete	HAPTAC
Dichlorvos (DDVP)	Data Complete	HAPTAC
Diclofop Methyl		
Dicofol		
Didecyl Dimethyl Ammonium Chloride		
Diethatyl-Ethyl		
Dimethoate		
DiphaciCandidate		
Diphenylamine		
Dipropyl Isocinchomeronate		
Diquat Dibromide		
Diuron		
Endosulfan	Requested	
Endothall, Mono (N,N,-Dimethylamine salt)		
EPTC	Requested	
Ethalfluralin		
Ethephon		
Ethofumesate		
Ethoprop		
Ethyl Alcohol		
Ethyl Parathion	Data Complete	TAC
Ethylene Glycol, Monomethyl Ether		
Ethylene Oxide		HAPTAC
Fenamiphos		
Fenarimol		
Fenthion		
Ferbam		
Fluvalinate		
Folpet		
Formaldehyde	Data Complete	HAPTAC
Glyphosate, Isopropylamine		
Hydrogen Chloride		HAPTAC
Imazalil		
Iprodione		

1 In Evaluation: Pesticide is being evaluated.
HAPTAC: Pesticide is a Hazardous Air Pollutant Toxic Air Contaminant
TAC: Pesticide declared a TAC via review and evaluation.

STATUS OF PESTICIDES IDENTIFIED IN THE BIRTH DEFECT PREVENTION ACT (SB 950) AND THE SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65) IN THE ASSEMBLY BILL 1807/3219 PROCESS (CONTINUED)

Chemical Name	ARB Air Monitoring	AB 1807 Status[1]
Isopropyl Alcohol		
Lindane		HAPTAC
Linuron		
Lithium Hypochlorite		
Malathion		
Maleic Hydrazide, Potassium Salt		
Mancozeb	Data Complete	HAPTAC
Maneb		HAPTAC
Mefluidide, Diethanolamine Salt		
Metaldehyde		
Metam-Sodium/MITC	Data Complete	In Evaluation
Methidathion	Data Complete	
Methomyl	Data Complete	
Methyl Bromide	Data Complete	HAPTAC
Methyl Parathion	Data Complete	In Evaluation
Methylene Bis (Thiocyanate)		
Metolachlor		
Metribuzin		
Molinate	Data Complete	In Evaluation
MSMA		
N-Octyl Bicycloheptenedicarboxamide		
Naled	Data Complete	In Evaluation
Napropamide		
Nicotine		
Nitrapyrin		
Norflurazon		
o-Phenylphenol + Salts		
Oryzalin		
Oxadiazon		
Oxamyl		
Oxydemeton-methyl	Data Complete	
Oxyfluorfen		
Oxythioquinox		
Paraquat Dichloride	Data Complete	In Evaluation
Pebulate		
Pendimethalin		
Pentachloronitrobenzene		HAPTAC
Pentachlorophenol		HAPTAC
Permethrin		
Petroleum Distillates		

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STATUS OF PESTICIDES IDENTIFIED IN THE BIRTH DEFECT PREVENTION ACT (SB 950) AND THE SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65) IN THE ASSEMBLY BILL 1807/3219 PROCESS (CONTINUED)

Chemical Name	ARB Air Monitoring	AB 1807 Status[1]
Phenothrin		
Phorate		
Phosmet		
Phosphoric Acid		
Pine Oil		
Piperonyl Butoxide, Technical		
Prometryn		
Propargite		
Propoxur		HAPTAC
Propylene Oxide (Gas)		
Propyzamide		
Pyrethrins		
Resmethrin		
RoteCandidate		
Simazine		
Streptomycin		
Sulfur		
Sulfur Dioxide		
Sulfuryl Fluoride		
Tetrachlorvinphos		
Tetramethrin		
Thiabendazole, Hypophosphate		
Thiobencarb		
Thiophanate-Methyl		
Thiram		
Triadimefon		
Tributyltin Benzoate		
Tributyltin Oxide		
Trichloro-S-Triazinetrion		
Trichlorophon		
Triclopyr		
Trifluralin		HAPTAC
Triforine		
Vinclozolin		
Warfarin		
Ziram	Data Complete	

1 In Evaluation: Pesticide is being evaluated.
HAPTAC: Pesticide is a Hazardous Air Pollutant Toxic Air Contaminant
TAC: Pesticide declared a TAC via review and evaluation.

PREFACE

Assembly Bills 1807 and 3219 (AB 1807/3219) established sections 14021 through 14027 of the Food and Agricultural Code (FAC) which outline procedures for the identification and control of toxic air contaminants (TACs) in California. Under these laws, the Department of Pesticide Regulation (DPR) is responsible to determine if pesticides may be toxic air contaminants (TACs). Two procedures are outlined in section 14021(b) and in sections 14022 through 14023(d).

The first procedure outlined in FAC section 14021(b), requires the Director to summarily declare as TACs, those pesticides identified as hazardous air pollutants (HAPs) pursuant to Section 7412 of the United States Code [42 U.S.C. 7412 sec 112(b). These pesticides are referred to as hazardous air pollutant toxic air contaminants (HAPTACs).

A second procedure for declaring pesticides TACs is specified in FAC sections 14022 through 14023(d). This procedure requires that pesticides be evaluated for: 1) factors related to the risk of harm to public health; 2) amount or potential amount of emissions; 3) manner of usage of the pesticide in California; 4) persistence in the atmosphere; and 5) ambient concentrations in the community. These evaluations provide the basis for the Director's decision to designate a pesticide a TAC [FAC § 14023(d)], and the subsequent listing as such in the California Code of Regulations.

Once listed, FAC section 14023(e) requires the Director to determine appropriate control measures:

> The Director shall determine, in consultation with the office (*of Environmental Health Hazard Assessment*), the State Air Resources Board, the air pollution control districts or air quality management districts in the affected counties, the need for and appropriate degree of, control measures for each pesticide listed as toxic air contaminants pursuant to subdivision 14023(d).

Although the statutes do not specify any required activities for pesticides identified as HAPTACs, the Director, under the statutory authority of FAC sections 11456 and others, will pursue mitigation of pesticides identified as HAPTACs. Mitigation will be based on factors such as the amount or potential amount of emissions, the manner of usage of the pesticide, and the risk of harm to the public health. If necessary, monitoring of ambient air concentrations may be conducted to characterize exposure levels. Mitigation measures will be developed in consultation with the Office Environmental Health Hazard Assessment, the State Air Resources Board, the air pollution control districts or air quality management districts in the affected counties.

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GLOSSARY

Abbreviation	Definition
AB 1807/3219	Assembly Bills 1807 and 3219. Enacted in 1983 and 1984 respectively, these bills provided the regulatory framework and mandates to assist DPR in the evaluation of pesticides as toxic air pollutants. These bills added Article 1.5, sections 14021 through 14027 to the Food and Agricultural Code, and sections 33001 through 3330 to the Health and Safety Code
ARB	Air Resources Board.
ADAC	Alkyl (50% C12, 40% C14, 10%C16) Dimethylbenzyl Ammonium Chloride
DPR	Department of Pesticide Regulation.
FAC	Food and Agricultural Code.
g	grams.
HAP	Hazardous air pollutant. Substances (including pesticides) declared to be air pollutants pursuant to section 7412 of the United States Code [42 U.S.C. 7412 sec 112(b)].
HAPTAC	Toxic Air Contaminant Identified via Section 14021(b) FAC.
IARC	International Agency for Research on Cancer.
K_H	Henry's Law Constant. Air/water partition coefficient.
LD_{50}/LC_{50}	Median Lethal Dose or Lethal Concentration. Amount of a pesticide which causes death in 50% of test animals.
LOEL	Lowest-Observed-Effect-Level. The lowest dose level in a toxicological study at which an effect is observed.
mg	10^{-3} grams, milligrams.
mPa	10^{-3} Pascals, milliPascals.
ng	10^{-9} grams, nanograms.
nPa	10^{-9} Pascals, nanoPascals.
NOEL	No-Observed-Effect Level. The highest dose level in a toxicological study at which no effect wasobserved.
OEHHA	State Office of Environmental Health Hazard Assessment.
Pa	Pascals. 1 Pa equals 133.32 millimeters of Hg.
RfD	Reference Dose. An estimated daily oral dose for the human population that is likely to be without an appreciable risk of deleterious (nononcogenic) effects during a lifetime.
TAC	Toxic Air Contaminant. Pesticide designated by the Director of DPR in regulation to be an air pollutant pursuant to sections 14023(d) FAC.
μg	10^{-6} grams, micrograms.
μPa	10^{-6} Pascals, microPascals.
U.S. EPA	United States Environmental Protection Agency.
VP	Vapor Pressure

EVALUATION OF PESTICIDES AS CANDIDATE TOXIC AIR CONTAMINANTS

HISTORY OF ASSEMBLY BILLS 1807 AND 3219

In 1983 and 1984, Assembly Bills 1807 and 3219 (AB 1807/3219) were enacted, establishing a regulatory framework for the identification and control of toxic air contaminants (TACs). AB 1807/3219 created Article 1.5, Sections 14021-14027 of the Food and Agricultural Code (FAC), which mandates the Department of Pesticide Regulation (DPR) to evaluate pesticides, in their pesticidal uses, as possible TACs. DPR is also required to request from the State Air Resources Board (ARB) monitoring information on pesticides under evaluation, and to list as TACs, in regulation, pesticides that are found to be hazardous air pollutants (HAPs) by the United States Environmental Protection Agency (U.S. EPA).

Section 14022(e) (FAC) lists five types of information the department must consider in prioritizing pesticides for evaluation as potential TACs:

- Factors related to the risk of harm to public health.
- Amount or potential amount of emissions.
- Manner of usage of the pesticide in California.
- Persistence in the atmosphere.
- Ambient concentrations in the community.

From 1985 through 1987 the Department identified 14 pesticides as candidates for review under the mandate of AB 1807/3219. These pesticides were determined to have the potential to be found in air (based on application method), and found to have a potential for adverse health effects. Of the 14 pesticides listed, seven were applied by air, with the remaining seven applied as soil fumigants (3) or stored products fumigants (4). For each of these pesticides, monitoring requests and recommendations (suggesting season and location for monitoring, and listing target pest, commodity(s) and application rates) were submitted to ARB. As monitoring was completed for several candidate pesticides and other pesticides were canceled by U.S. EPA or voluntarily withdrawn for use by the registrant, there was a need to modify and update the candidate TAC list.

In 1989, the document *Modifications and Additions to the Candidate TAC List* was published. This document provided an update of the prior candidate TAC list, and provided health effects summaries for the pesticides under consideration as candidates for evaluation as TACs. Six pesticides were removed from the prior list because they were no longer registered for use, and nineteen new pesticides were added. ARB has been provided with monitoring recommendations for 24 of these candidate pesticides. For 17 pesticides, monitoring has been completed and reports submitted to DPR, and monitoring for the remainder should be completed December 1996. Monitoring recommendations for two pesticides were withdrawn due to changes in their regulatory status, and recommendations for the remaining three candidates were scheduled to be made within the next year.

In 1990, 189 substances were listed as hazardous air pollutants (HAPs) in section 112(b) of the federal Clean Air Act Amendments of 1990. Section 14021(b) of the Food and Agricultural Code requires that the Director list as TACs (by regulation) pesticides which are designated as HAPs. As a result, DPR listed 33 pesticidal HAPs (in 1995) as TACs. Seven of these hazardous air pollutant toxic air contaminants (HAPTACs) were candidates proposed for evaluation as candidate TACs in the *Modifications and Additions to the Candidate TAC List* document. Since these candidates were summarily declared TACs, and since there were few pesticides left to request monitoring recommendations for, DPR needed to develop a new candidate TAC list.

THE PURPOSE OF THIS DOCUMENT, AND LIMITATIONS ON INTERPRETING THE DATA AND USE OF THE RANKING SCHEME

This document creates a prioritized list of candidate pesticides that the Department of Pesticide Regulation (DPR) will evaluate for their potential to be TACs. DPR has chosen five pesticides listed as reproductive toxicants under the Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65), and 200 pesticides under evaluation pursuant to the Birth Defect Prevention Act of 1984 (SB 950) as the initial group of pesticides to be considered as candidates. Of these 205 pesticides, 50 are no longer registered for use. Of the remaining 155 pesticides, 21 are listed in the Clean Air Act Amendments of 1990 as HAPs. These pesticides have been listed as TACs pursuant to Section 14021(b) of the Food and Agricultural Code (see Appendix A). The remaining 134 pesticides have been prioritized for evaluation. The ranking scheme and the process of prioritizing candidates will be re-evaluated periodically.

The process of evaluating individual pesticides consists of the following steps. First, DPR submits a monitoring request and monitoring recommendation (which includes appropriate monitoring sites, a summary of the pesticide's physical/chemical properties and toxicity, the types and usage of available products, and whether or not the candidate pesticide is a restricted material) to the ARB. The ARB conducts ambient air monitoring and monitoring of air off-site, following an application, and submits the monitoring data to DPR. Using this data, and other relevant information from literature sources, DPR conducts an environmental fate analysis of the candidate, and assesses the reliability and relevance of air monitoring data. Following this analysis, air monitoring data and use patterns for the pesticide are assessed, and the actual and potential human exposures to airborne concentrations of the pesticide determined. Finally, a risk assessment and risk characterization (included determination of the Margin-of-Exposure for measured air concentrations) are developed. The evaluation process is consistent for all pesticides to be evaluated as candidate TACs.

Pesticides will move through this process based on the hierarchy established by the point system. Air monitoring will be scheduled based on the amount of pesticide use or sales and the availability of methodologies to detect and quantify the presence of the pesticide in air. Monitoring will not be conducted for pesticides with little use, or for pesticides which cannot be reliably analyzed (analytical methodologies do not exist or are insufficiently quantitative). However, these pesticides will remain candidates, and they will enter the monitoring phase of the evaluation process when use increases or when improvements in analytical methodology occur.

On occasion, other factors may arise which may postpone (or eliminate) the continued evaluation of a candidate pesticide. Such factors include: 1) that use of the candidate pesticide has been canceled, phased-out, or significantly reduced by U.S. EPA; 2) that air monitoring does not establish the presence of the pesticide in air; 3) that use or sales of the pesticide decreases due to actions on the part of the manufacturer; 4) that new toxicological data becomes available to the department which may affect the overall ranking of the candidate; and 5) that measured air concentrations present a significant and immediate risk to public health (whereby the Director will use his authority to immediately suspend use or to require modifications of use to reduce this risk).

When air concentrations of a candidate pesticide are not detected, and airborne concentrations reported in the scientific literature are absent or unreliable, evaluation of the candidate pesticide will not proceed further. For these pesticides, a short report explaining the lack of data available will be published. However, the pesticide will remain a candidate and its evaluation may be re-initiated upon the development of new detection and/or analytical methodologies. If a pesticide is detected in air, and the Director determines that exposure to these measured air concentrations will pose an immediate and significant risk to public health, the Director may use other statutory authorities to address the matter. When air concentrations are measurable, and the Director determines that exposure to these air concentrations would not present an immediate and significant risk to public health, the pesticide will continue through the formal AB 1807/3219 processes as described above.

Finally, there may be changes in the regulatory status a pesticide that may result in its cancellation, or in withdrawal or severe modification of its use. These changes may affect the status of a pesticide already in the AB1807/3219 evaluation process. These pesticides will remain candidates in the evaluation process, until such time as they are formally canceled. DPR will not continue to evaluate candidates which are calcelled or whose use has been withdrawn or severely curtailed. If the candidate is re-registered or if the restrictions on its use are withdrawn, the evaluation may be re-initiated.

CRITERIA FOR PRIORITIZING PESTICIDES

CHEMICALS INCLUDED IN THE PROPOSED RANKING SYSTEM.

This report outlines a method for ranking pesticides as candidates for evaluation for their potential to be TACs, explains the criteria chosen for the purpose of ranking these and potentially all other pesticides as candidates, and presents a list of candidate pesticides. Of the original 200 SB 950 pesticides and five Proposition 65 pesticides, 50 are no longer registered for use (either canceled by U.S. EPA or voluntarily withdrawn by registrant). Of the remaining 155 pesticides, 21 are designated by U.S. EPA to be hazardous air pollutants and DPR has adopted regulations (section 6860(b) Titles 3 and 26, California Code of Regulations) listing these pesticides as TACs (Appendix A). Pesticides designated as HAPTACs, including methyl bromide, and 1,3-dichloropropene are not included in this evaluation, but are instead, listed in Appendix A of this report. The remaining 134 candidates were evaluated, using the six criteria presented below.

A. TOXICITY CRITERIA.

I. Acute Toxicity (oral, dermal, inhalation)

Warnings and precautionary statements concerning toxicological hazards, including human hazards are required for pesticide active ingredients and formulated products (Code of Federal Regulation Part 40, section 156.10). Toxicity Categories (Category I to IV) are assigned based on the acute LD_{50}/LC_{50} for each route of exposure. Toxicity Categories are determined by toxicologists in the Medical Toxicology Branch at DPR during their review of the acute toxicity data submitted to support the registration of pesticidal active ingredients. Toxicity categorization for acute systemic toxicity follows the scheme summarized in Table 1.

Table 1. Toxicity Categories for Various Routes of Exposure

	Toxicity Categories			
Hazard Indicator	Category I	Category II	Category III	Category IV
Oral LD_{50}* (mg/kg)	≤50	>50 - ≤500	>500 - ≤5,000	>5,000
4-hr Inhalation LC_{50} (mg/L)	≤0.05	>0.05 - ≤0.5	>0.5 - ≤5	>5
Dermal LD_{50} (mg/kg)	≤200	>200 - ≤2,000	>2,000 - ≤5,000	>5,000

* LD_{50} values are primarily for rat species

Points for ranking pesticides by Toxicity Categories were assigned according to the following scheme. Values for Toxicity Categories are based on systemic toxicity through one of the three routes of exposure (Appendix B1). A Toxicity Category based on inhalation is given the greatest weight, followed by the Toxicity Category based on dermal exposure. A Toxicity Category based on oral exposure is used only in the absence of adequate inhalation or dermal information.

Point were assigned according to the following scheme:

Points	Acute Toxicity (Inhalation, Dermal, Oral)
4	Toxicity Category I
3	Toxicity Category II
2	Toxicity Category III
1	Toxicity Category IV

II. U.S. EPA/NTP Oncogenicity Category

U.S. EPA Guidelines for Carcinogen Risk Assessment (U.S. EPA, 1986) categorize chemicals into five categories (A through E) based on the overall weight of evidence for human carcinogenicity. The categorization of evidence based on animal and human data is summarized in Table 2.

Table 2. Oncogenicity Categorization

	Animal Evidence				
Human Evidence	Sufficient	Limited	Inadequate	No data	No evidence
Sufficient	A	A	A	A	A
Limited	B1	B1	B1	B1	B1
Inadequate	B2	C	D	D	D
No data	B2	C	D	D	E
No evidence	B2	C	D	D	E

Applying the categorization scheme, the Health Effects Division of the Office of Pesticide Programs at U.S. EPA issues an evaluation summary for the carcinogenic potential of pesticides. This summary contains the carcinogenicity categorization determined by different peer-review groups such as the Health Effects Division, the FIFRA Scientific Advisory Panel, the Scientific Advisory Board, the Cancer Assessment Group and the Office of Research and Development. This summary is updated approximately once a year (U.S. EPA, 1994a). In the summary, category C, *Possible Human Carcinogen*, is further subdivided into C and C_q, where C_q denotes chemicals for which a non-threshold quantitative approach to estimate oncogenic risk should be taken. For category C chemicals, a threshold approach to risk assessment based on reference dose (RfD) should be used.

In addition to the U.S. EPA list, the 1994 annual report from the US Department of Health and Human Services' National Toxicology Program (NTP) was also used to identify chemicals that are potential carcinogens. The NTP report lists chemicals that are either known to be carcinogens (with evidence showing causal relationship between exposure and human cancer) or which may be reasonably anticipated to be carcinogens (with limited evidence of carcinogenicity in humans or sufficient evidence of carcinogenicity in experimental animals). By definition, the first group of chemicals would be in Class A of U.S. EPA's classification and the second group in Class B1/B2.

Points for ranking pesticides by U.S. EPA/NTP Oncogenicity Category were assigned according to the following scheme:

Points	U.S. EPA Oncogenicity Classification
5	Category A (Human Carcinogen)
4	Category B1/B2 (Probable Human Carcinogen)
	Category C (Possible Human Carcinogen)
3	Category C_q
1	Category C
0	Category D (Not Classifiable as to Human Carcinogenicity
0	Category E (Evidence of Non-Carcinogenicity for Humans)

When more than one classification was given in the U.S. EPA list, and/or when the NTP has a different classification than U.S. EPA, the classification resulting in the highest point score was used.

III. Chronic and/or Subchronic NOELs

For a pesticide to be registered for use in California, registrants are required to submit a full set of valid manditory chronic health effects studies regarding the chronic toxicity, oncogenicity, reproductive toxicity, teratogenicity, and genotoxicity of the pesticide. Occasionally, chronic health effects studies regarding the neurotoxicity of the pesticide may be required. Following submission, these studies are reviewed by toxicologists in the Medical Toxicology Branch at DPR. These reviews include determining if data requirements are met and if adverse effects can be identified. Following this review, a *Summary Of Toxicology Data* is compiled for each pesticide. The summary may be revised as new studies are received and upon review, new information is identified. In the review, the NOEL (No-Observed-Effect Level) and/or the LOEL (Lowest-Observed-Effect Level) of the toxicological endpoint(s), including the most sensitive endpoint identified in a study, is highlighted.

In addition, the Office of Pesticide Programs at USEPA also publishes a *Reference Dose Tracking Report* that contains the chronic or subchronic NOELs which form the basis of the reference dose determination (USEPA, 1994b). The report is revised on an approximate semi-annual basis.

Points for ranking pesticides by Chronic/Subchronic NOELs were assigned according to the following scheme. The chronic/subchronic NOELs that appear in the DPR *Summary Of Toxicology Data* are used for the ranking. When a chronic/subchronic NOEL from the DPR database is not available, the NOEL from the USEPA *Reference Dose Tracking Report* is used. In assigning numerical rankings, the categorization of NOELs is designed with the consideration of the spread of the NOELs for all the pesticides of interest (Appendix B1). Points were assigned according to the following scheme:

Points	Chronic/Subchronic NOELs
4	≤ 0.10 mg/kg/day
3	>0.10 to ≤1.0 mg/kg/day
2	>1.0 to ≤10.0 mg/kg/day
1	>10.0 mg/kg/day

B. PHYSICAL/CHEMICAL CRITERIA.

The physical/chemical values relied upon to prioritize TAC candidates are presented in Appendix C. Appendix C contains both calculated and literature values for water solubility, vapor pressure and Henry's Law Constants .

I. Vapor Pressure

For a liquid or solid, the vapor pressure (VP) is the pressure of the vapor in equilibrium with its liquid or solid phase. VP is dependent on temperature and increases or decreases with corresponding increases or decreases in temperature. Pesticides with high VPs are very volatile, and therefore most likely to be found in air. VPs are measured in Pascals (Pa), a pressure of 1 Newton per square meter, where 1 Pa equals approximately 10^{-2} mm Hg. If the VP for a pesticide was not found in the literature, the VP was calculated by the methods outlined below.

Lyman *et al.* (1990) recommends that the Modified Watson Correlation method be used for calculating the VP of pesticides whose physical state (at environmental temperatures and conditions) is either a liquid or a solid, and where VP would range from 10^5 Pa to 10^{-5} Pa. This method is preferred because: 1) its minimal requirement for corroborative experimental data; and 2) its relatively low error rate. Errors in the calculated VPs for solids or liquids when using this method average approximately 2.5% for VPs between 10^5 to 10 Pa, 38.7% for VPs between 10 Pa to 10^{-1} Pa, and 46.9 % for VPs between 10^{-1} to 10^{-5} Pa. Such error rates were considered to be incidental when compared to the thousand-fold range of pressures which comprise each category.

Points for ranking pesticides by vapor pressure were assigned according to the following scheme (Appendix B2):

Points	Vapor Pressure
4	>1 Pascal
3	1 mPa - 1 Pa
2	1 μPa - 1 mPa
1	<1 μPa
0	Not Volatile at Room Temperature

II. Henry's Law Constant

Henry's Law Constant (K_H), sometimes referred to as the air-water partition coefficient (Montgomery, 1993), is defined as the ratio of the partial pressure of a compound in air to the concentration of the compound in water at a given temperature under equilibrium conditions. Thus, K_H is essentially the measure of a chemical's vapor pressure divided by the chemical's water solubility, indicating the tendency of a chemical in solution to move into the vapor phase. Chemicals whose $K_H < 10^{-7}$ atm·m^3/mol are less volatile than water, and tend to remain in solution. Chemicals where K_H is between 10^{-7} and 10^{-3} show increasing preference for the vapor phase and chemicals exhibiting $K_H > 10^{-3}$ readily move into the vapor phase (Lyman *et al.*; 1990).

If the Henry's Law Constant was not found in the literature, K_H was calculated by dividing the Vapor Pressure (in atmospheres) by the water solubility (moles/m^3) (Lyman *et al.*; 1990). For some pesticides water solubility is presented as qualitative values instead of quantitative (sparingly soluble *vs.* 500 mg/l), rendering calculations of K_H impossible. When qualitative

values were given, quantitative values were assigned according to the scheme presented in Table 3, and used for the purposes of calculating K_H.

Table 3. Qualitative description of water solubility and the quantitative values assigned for purposes of calculating Henry's Law Constants.

Qualitative Value	Assigned Value
Insoluble	500 μg/l
Practically Insoluble	50 mg/l
Sparingly Soluble	500 mg/l
Soluble	5 g/l
Freely (very) Soluble	500 g/l
Miscible	1000g/l

These values tend to be supported by cross-referencing water solubility values between the Agrochemicals Handbook (1993), Montgomery (1993), and information supplied to DPR by registrants during the pesticide registration process. Although quantitative values were necessary for ranking pesticides, qualitative values are supplied in the tables of physical characteristics (Appendix C).

When estimating K_H, a complication arises in that both the water solubility and vapor pressure of the compound are needed. However, in cases where one or both of these values are unavailable, Henry's constants may be empirically derived through examination of the structure of the compound, and determination of qualitative structure-activity relationships. These relationships are: 1) connectivity indices (based on molecular topology); 2) polarizability (based on atomic contributions); and 3) the ease and extent of hydrogen bond formation by the compound. Henry's Constants may also be estimated by using the "bond contribution method" developed by Hine and Mookergee (1975).

Points for ranking pesticides by Henry's Law Constant K_H were assigned according to the following scheme (Appendix B2):

Points	Henry's Constant K_H
4	$> 10^{-3}$ atm.mol/m^3
3	10^{-6} TO 10^{-3} atm.mol/m^3
2	10^{-9} TO 10^{-6} atm.mol/m^3
1	10^{-12} TO 10^{-9} atm.mol/m^3
0	$< 10^{-12}$ atm.mol/m^3

C. SALES/USE DATA.

The volume of sales for all pesticides sold for use in the State of California is required to be reported to the Department; whereas, pesticide use reports are only required for active ingredients used in an agricultural setting, for those applied by licensed applicators, or for pesticides listed in section 6800 (Title 3, California Code of Regulations) used in industrial or institutional settings. Among the information generally required in use reports are: 1) the county, the township, range, and section in which the pesticide was applied, (township, range, and section information not required for rights-of-way applications); 2) the date of application; 3) the product name and the product registration number; 4) the amount of the pesticide product applied; and 5) the commodity or site to which the pesticide was applied. Certain pesticide products may contain the same AI used for agricultural purposes, but are registered for non-agricultural uses (i.e., registered for use by the general public). For these products use reports are not required, and sales data may provide a more accurate estimate of the amount of the AI used both agriculturally and non-agriculturally.

Appendix D contains information on the sales and use of pesticides for the years 1990, 1991 and 1992. Sales information for AIs produced by three or fewer manufacturers is regarded as confidential "Trade Secret" information and is not listed in the values table. For these active ingredients, sales information (when used) is presented in ranking tables as the appropriate point value.

Points were derived from either sales or use information depending on which produced the most conservative (higher) point score. Points for ranking pesticides by average sales/use data were assigned according to the following scheme (Appendix B2):

Points	Average Sales/Use
4	> 500,000 lbs
3	100,001 to 500,000 lbs
2	10,001 to 100,000 lbs
1	101 to 10,000 lbs
0	< 100 lbs

D. OTHER CRITERIA.

Three other physical/chemical criteria for ranking candidates were considered during the development phase of this report. These criteria were application method, physical state, and water solubility, were considered during the evaluation and ranking phases. They are not included in the final report because their presence or absence provided little resolution of the candidates. These criteria, how they were applied, and the reasons for not including them in the final analysis are discussed below.

I. Application Method

Application method was originally considered because pesticides may exist in the air as 1) vapors and gases; 2) aerosols; 3) fine particulates; and 4) dusts. The application method criterion and point schedule were developed with the following assumptions. First, pesticides applied by aircraft would have a greater potential to be found in air than pesticides applied by ground-based equipment. Second, pesticides applied by certain ground-based equipment where spray nozzles are directed above the horizontal plane [e.g., air blast sprayers, dusters, foggers], would have a greater potential to be found in air than those pesticides applied by ground equipment where spray nozzles are directed below the horizon. Finally, pesticides applied by the above methods should have a greater potential to be found in air than pesticides which are soil incorporated or are used for seed treatments, livestock/pet collars etc. Fumigants, due to their extreme volatility, were ranked with aerially applied pesticides. The scheme for assigning points for application method was:

Points	**Application Method**
4	Aerial application (application made by aircraft), or fumigation.
3	Application made by ground based equipment [e.g.: air blast sprayers, pesticide dust applicators, spray equipment with nozzles directed above the horizontal plane] so that the pesticide becomes airborne during or following application.
2	Ground application where nozzles are directed below the horizon.
1	Other application methods (tags, collars, baits, etc.).

The Pesticide Use Report and Label Database were queried for application method for the candidate pesticides. Label language for 79% (106/134) of the candidates indicated that they could be applied by air or are fumigants. Three percent are not applied by air but are foggers or sprays which are directed above the plane of the horizon. These candidate pesticides received three points. Ten percent (14/134) of the candidates may be applied as sprays but label language indicates that they are applied are below the plane of the horizon. These candidates received two points. The final 8% (10/134) are applied by other application methods, and received one point.

Since 79% of the pesticides discussed in this report may be aerially applied or are soil fumigants, the authors felt that the use of this criterion did not enhance the resolution of pesticide rankings. In fact, only one pesticide in the top 51 pesticides and only seven in the top 100 have label language specifically prohibiting aerial application. For these reasons, application method was not considered a useful criterion.

II. Physical State.

A similar evaluation was made using the actual physical state of the chemical. It was reasoned that pesticides which were gasses would have a greater potential to be found in air, than pesticides which were liquids or solids. Using this criterion, pesticides were scored with respect to the following:

Points	Physical State
4	Gas, or Liquid with Volatility > 1 Pascal (Pa)
3	Liquid, and volatility 1 Pa to 1 m Pa
2	Liquid, and volatility < 1 mPa
1	Solid

Physical state was rejected, as a criterion, because this characteristic was directly related to vapor pressure (gases have higher vapor pressures than solids), thus they would rank higher than solids. This criterion inflated scores but provided no gain in resolution.

III. Water Solubility

Water solubility is a component of Henry's Constant. Henry's Constant is essentially the air/water partition co-efficient and is the driving force for the movement of chemicals from water into air. Point scores for this criterion mimicked those for Henry's Constant, inflating but not resolving the ranking scheme.

RESULTS AND DISCUSSION.

Candidate pesticides involved in the SB 950 or Proposition 65 review processes were prioritized for future evaluation. These criteria give priority to the evaluation of pesticides based on factors related to the risk of harm to public health, the amount or potential amount of emissions, manner of usage of the pesticide in California, persistence of the pesticide in the atmosphere, and ambient concentrations in the community when evaluating pesticides as TACs. The results of the evaluation and ranking are presented as Table 4.

One hundred thirty-four pesticides were ranked according to six criteria: three criteria are based on toxicity, two criteria are based on physical/chemical properties and one criterion is based on sales/use data. The toxicity factors were: 1) acute toxicity (inhalation, dermal, or oral); 2) U.S. EPA and NTP oncogenicity classification; and 3) chronic/subchronic NOELs (No-Observed-Effect Levels). The physical/chemical factors were: 1) vapor pressure; and 2) Henry's Law Constant. The final criteria was sales or use of the pesticide. In many cases, several values for each criterion were found. When this occurred, the value which produced the greater score was used. For the sales/use criterion, the value producing the highest score was used.

Three other criteria were considered, but not used. The first criteria, application method, did not help the ranking because 79% of these pesticides are aerially applied or are soil fumigants. These pesticides would have received four points for this criterion, with the net result of inflating total point scores without affecting the actual rank-order of the candidates. Two other criteria, physical state, and water solubility, were considered and are not included in the final report because their presence or absence did not help in the ranking of the candidates. Physical state was ultimately rejected because it is correlated with vapor pressure. Water solubility was rejected because it is correlated with vapor pressure and is a component of Henry's Law Constant.

Pesticides were assigned values for each criterion according to the scheme in Appendix B with the exception of metam-sodium and MITC. Since both chemicals are registered active ingredients in their own right, and since MITC is the breakdown product of metam-sodium and the actual active component of both pesticides, the Department felt it would be more appropriate to evaluate them together. Therefore, for metam-sodium and MITC, the numerical values which provided the higher score, were used. For all other pesticides, breakdown (activation) products were not evaluated because: 1) physical and chemical characteristics do not exist for many breakdown products, 2) toxicological effects of breakdown products are generally assessed during routine toxicology evaluations; 3) very few breakdown products are registered active ingredients in their own right; and 4) the number of possible breakdown products is astronomical, and any meaningful inclusion of them would prevent the completion of this report. Again, the purpose of this document is to provide DPR with a reasonable list of pesticides to examine for their potential to be TACs, and not to provide a definitive analysis of the physical and toxicological properties of pesticides or of their breakdown products.

In the final ranking, pesticides were ordered by total points. If a rank contained more than one pesticide, subsequent order was determined by total toxicity, and then by sales/use information. Pesticides with identical total score, identical score for toxicity, and identical sales/use score were then ranked alphabetically. Zero point scores were awarded to certain pesticides for certain criteria. Zero point scores were assigned for properties which fell within the range for zero points, based on the above ranking scheme. In cases where information for any given property was not available, NA (not available) was used (Appendix A), and rank could not be assigned. Although, NA equates to zero points in the ranking scheme, the authors did not feel that assigning average scores would be justified. This document, and the status and ranking of the candidate pesticides will be reviewed and updated periodically.

TABLE 4. PESTICIDES RANKED FOR MONITORING AND EVALUATION

Relative Rank	CHEMICAL NAME	TOTAL SCORE	Vapor Pressure	Sales/Use Data 90-94	Henry's Constant	Acute Toxicity (Route)[1]	ONCO	NOEL
1	Propargite[4]	21	4	4	4	4 (I)	4	1
2	Chlorothalonil[5]	19	4	4	2	3 (I)	4	2
3	Metam-Sodium/MITC	19	4	4	3	4 (I)	0	4
4	DEF[5]	18	3	4	3	4 (D)	0	4
5	Endosulfan[3]	18	4	4	3	4 (D)	0	3
6	p-Dichlorobenzene[2,3,4]	17	2	4	2	3 (O)	4	2
7	Cyanazine	17	1	3	4	3 (D)	3	3
8	Fenamiphos	17	3	3	3	4 (D)	0	4
9	Phorate[4]	17	3	3	3	4 (I)	0	4
10	Chlorpyrifos	17	3	4	3	3 (D)	0	4
11	Chloropicrin[4,5]	17	4	4	4	4 (I)	0	1
12	Alachlor	16	3	2	2	2 (O)	4	3
13	Dimethoate	16	3	4	1	3 (D)	1	4
14	Molinate	16	3	4	1	2 (D)	3	3
15	Aldicarb	16	3	3	2	4 (O)	0	4
16	Linuron	16	3	3	2	2 (O)	3	3
17	Methidathion[5]	16	3	3	2	4 (D)	1	3
18	Diazinon	16	3	4	2	3 (D)	0	4
19	EPTC	16	4	4	3	3 (D)	0	2
20	Simazine	15	1	4	2	2 (D)	3	3

TABLE 4. PESTICIDES RANKED FOR MONITORING AND EVALUATION

Relative Rank	CHEMICAL NAME	TOTAL SCORE	Vapor Pressure	Sales/Use Data 90-94	Henry's Constant	Acute Toxicity (Route)[1]	ONCO	NOEL
21	Benomyl[4,5]	15	2	3	2	3 (I)	3	2
22	Ethoprop	15	3	2	2	4 (D)	0	4
23	Azinphos-Methyl[3,5]	15	2	4	2	4 (D)	0	3
24	Oryzalin[4]	15	2	4	2	2 (O)	3	2
25	Oxyfluorfen[3,4]	15	2	4	2	1 (D)	3	3
26	Oxydemeton-Methyl	15	3	3	2	3 (I)	0	4
27	Folpet[3,4]	15	3	2	3	1 (O)	4	2
28	Naled[4,5]	15	3	3	3	3 (D)	0	3
29	Pebulate	15	4	3	3	2 (D)	0	3
30	Oxadiazon	14	2	2	1	2 (D)	4	3
31	Amitraz[4]	14	2	1	2	3 (D)	3	3
32	Diclofop Methyl[4]	14	2	2	2	2 (O)	3	3
33	Propylene Oxide (Gas)[2,4]	14	2	2	2	1 (I)	4	3
34	Bromoxynil Octanoate[4,5]	14	2	3	2	2 (D)	3	2
35	Dichlobenil[3]	14	2	2	3	3 (D)	1	3
36	Fenthion[4]	14	3	1	3	3 (D)	0	4
37	Carbofuran	14	3	3	2	3 (D)	0	3
38	Methyl Parathion[4,5]	14	3	3	2	3 (D)	0	3
39	Oxamyl	14	3	2	3	4 (I)	0	2
40	Sulfuryl Fluoride[4]	14	3	4	2	4 (I)	0	1

TABLE 4. PESTICIDES RANKED FOR MONITORING AND EVALUATION

Relative Rank	CHEMICAL NAME	TOTAL SCORE	Vapor Pressure	Sales/Use Data 90-94	Henry's Constant	Acute Toxicity (Route)[1]	ONCO	NOEL
41	Aciflurofen[3,4]	13	2	1	2	2 (D)	4	2
42	Dicofol[4]	13	0	4	2	1 (D)	3	3
43	Permethrin[5]	13	2	3	1	2 (D)	3	2
44	Atrazine	13	2	2	2	2 (O)	3	2
45	Bendiocarb	13	2	2	2	4 (O)	0	3
46	Daminozide[3,4]	13	3	2	1	1 (D)	4	2
47	Tetrachlorvinphos[4]	13	2	2	2	2 (D)	3	2
48	Diuron	13	2	4	2	2 (D)	0	3
49	Methomyl[5]	13	3	4	1	3 (I)	0	2
50	Phosmet	13	3	3	2	3 (I)	0	2
51	Cycloate	13	3	2	3	2 (O)	0	3
52	Nitrapyrin	13	3	1	4	3 (D)	0	2
53	Malathion	13	3	4	2	1 (I)	0	3
54	Thiobencarb	13	4	3	2	2 (D)	0	2
55	Chlorthal-Dimethyl	13	3	4	3	2 (I)	0	1
56	Coumaphos[3,4]	12	2	1	2	3 (D)	0	4
57	Rotenone[4]	12	2	1	3	3 (O)	0	3
58	Metolachlor[3]	12	3	3	2	2 (I)	0	2
59	Ethyl Alcohol[3]	12	4	4	3	1 (D)	0	NA
60	Aluminum Phosphide[4]	11	NA	3	0	4 (I)	0	4

TABLE 4. PESTICIDES RANKED FOR MONITORING AND EVALUATION

Relative Rank	CHEMICAL NAME	TOTAL SCORE	Vapor Pressure	Sales/Use Data 90-94	Henry's Constant	Acute Toxicity (Route)[1]	ONCO	NOEL
61	Paraquat Dichloride[4,5]	11	0	4	0	4 (O)	0	3
62	o-Phenylphenol +Salts[3,4]	11	0	3	1	2 (O)	4	1
63	Acephate[5]	11	2	3	0	2 (O)	1	3
64	Oxythioquinox	11	3	1	2	2 (D)	0	3
65	Diethatyl-Ethyl[3,4]	11	2	3	2	2 (O)	0	2
66	Iprodione	11	2	3	2	2 (D)	0	2
67	Norflurazon[4]	11	2	3	2	1 (D)	1	2
68	Prometryn	11	2	3	2	2 (D)	0	2
69	Thiophanate-Methyl[4]	11	2	3	2	2 (I)	0	2
70	Dicamba, salts and esters	11	3	2	2	2 (D)	0	2
71	Fenarimol	11	2	2	3	2 (O)	0	2
72	Fluvalinate[3,4]	11	3	2	2	1 (D)	0	3
73	Allethrin[3,4]	11	3	1	3	2 (O)	0	2
74	Sulfur Dioxide[3]	11	4	4	NA	3 (I)	0	NA
75	Pendimethalin	11	3	3	2	1 (D)	1	1
76	Propyzamide	11	3	3	2	1 (O)	0	2
77	Ethylene Glycol, Monomethyl Ether[3]	11	4	2	2	3 (D)	0	NA
78	Didecyl Dimethyl Ammonium Chloride[3]	10	NA	3	NA	4 (O)	0	3
79	Nicotine[2,4]	10	1	1	1	4 (O)	0	3
80	Carboxin	10	2	2	1	3 (D)	0	2

TABLE 4. PESTICIDES RANKED FOR MONITORING AND EVALUATION

Relative Rank	CHEMICAL NAME	TOTAL SCORE	Vapor Pressure	Sales/Use Data 90-94	Henry's Constant	Acute Toxicity (Route)[1]	ONCO	NOEL
81	Ethephon[4]	10	2	4	0	1 (D)	0	3
82	Bromacil[3]	10	2	3	1	2 (O)	0	2
83	Ethofumesate[4]	10	2	2	2	3 (D)	0	1
84	Triadimefon[5]	10	2	2	2	2 (D)	0	2
85	Mefluidide, Diethanolamine Salt	10	3	1	2	2 (D)	0	2
86	Napropamide	10	2	3	2	2 (D)	0	1
87	Piperonyl Butoxide, Technical[3]	10	2	3	2	2 (D)	0	1
88	Ethalfluralin[4]	10	2	2	3	1 (O)	0	2
89	Chloroneb[4]	10	3	2	3	1 (O)	0	1
90	Sulfur[4]	10	2	4	3	1 (D)	0	NA
91	Tributyltin Oxide[3]	9	NA	2	NA	3 (D)	0	4
92	Diquat Dibromide[3,5]	9	0	3	0	3 (D)	0	3
93	ADAC[3]	9	NA	4	NA	3 (D)	0	2
94	Creosote[3]	9	NA	4	NA	1 (O)	4	NA
95	Pyrethrins[4]	9	0	2	2	3 (D)	0	2
96	Metaldehyde[3,4]	9	0	3	2	2 (O)	0	2
97	Imazalil[3]	9	2	2	1	2 (D)	0	2
98	Metribuzin	9	2	2	1	2 (D)	0	2
99	Triclopyr[4]	9	2	2	1	2 (O)	0	2
100	Bentazon, Sodium Salt[4,5]	9	2	1	2	2 (O)	0	2

TABLE 4. PESTICIDES RANKED FOR MONITORING AND EVALUATION

Relative Rank	CHEMICAL NAME	TOTAL SCORE	Vapor Pressure	Sales/Use Data 90-94	Henry's Constant	Acute Toxicity (Route)[1]	ONCO	NOEL
101	Tetramethrin[3,4]	9	2	1	2	2 (O)	1	1
102	Triforine[4]	9	2	2	2	1 (D)	0	2
103	Vinclozolin[4]	9	2	2	2	1 (O)	0	2
104	Endothall, Mono (N,N-Dimethylamine Salt)[4]	8	0	2	0	4	0	2
105	Pine Oil[3]	8	NA	4	NA	3 (D)	0	1
106	Ziram[4,5]	8	0	4	1	1 (D)	0	2
107	Trichlorophon[3]	8	2	2	1	1 (D)	0	2
108	Phenothrin[3,4]	8	2	1	2	1 (D)	0	2
109	Resmethrin	8	2	1	2	2 (D)	0	1
110	Glyphosate, Isopropylamine[4]	8	0	4	2	1 (D)	0	1
111	Warfarin[4]	7	NA	0	NA	3 (I)	0	4
112	Methylene Bis (Thiocyanate)[3]	7	NA	2	NA	2 (D)	0	3
113	Boric Acid[3]	7	0	3	0	2 (O)	0	2
114	MSMA[4]	7	0	3	0	2 (O)	0	2
115	Thiabendazole, Hypophosphate[3,4]	7	0	2	1	2 (O)	0	2
116	Cryolite	7	NA	4	NA	2 (O)	0	1
117	Thiram[3,4]	7	0	3	1	1 (D)	0	2
118	Tributyltin Benzoate[3]	6	NA	1	NA	2 (D)	0	3
119	Diphenylamine[3]	6	NA	2	NA	2 (O)	0	2
120	Chlorsulfuron[4]	6	1	1	0	2 (D)	0	2

TABLE 4. PESTICIDES RANKED FOR MONITORING AND EVALUATION

Relative Rank	CHEMICAL NAME	TOTAL SCORE	Vapor Pressure	Sales/Use Data 90-94	Henry's Constant	Acute Toxicity (Route)[1]	ONCO	NOEL
121	Diphacinone[4]	6	1	0	1	4 (O)	0	NA
122	o-Benzyl-p-Chlorophenol + Salts[3]	6	NA	3	NA	2 (I)	0	1
123	Cyanuric Acid, Monosodium Salt[3]	6	NA	4	NA	1 (D)	0	1
124	Petroleum Distillates	6	NA	4	NA	2 (D)	0	NA
125	Phosphoric Acid[3]	6	NA	4	NA	2 (D)	0	NA
126	Trichloro-S-Triazinetrion[3]	6	NA	4	NA	1 (D)	0	1
127	Maleic Hydrazide, Potassium Salt[4]	5	0	2	0	2 (O)	0	1
128	N-Octyl Bicycloheptene-dicarboxamide[3]	5	NA	2	NA	2 (I)	0	1
129	Streptomycin	5	NA	2	NA	1 (O)	0	2
130	DEET[3]	5	NA	3	NA	1 (D)	0	1
131	Isopropyl Alcohol[4]	5	NA	4	NA	1 (D)	0	NA
132	Dipropyl Isocinchomeronate[3]	4	NA	1	NA	1 (D)	0	2
133	Lithium Hypochlorite[3]	4	NA	2	NA	2 (Ip)	0	NA
134	Ferbam[4]	3	0	0	1	2 (O)	0	NA

1/ Route of Administration;
O=Oral
D=Dermal
I=Inhalation
Ip=Interperitoneal.
2/ Vapor pressure calculated.
3/ Sales data used.
4/ Henry's Law Constant calculated.
5/ Pesticide previously identified as a candidate for monitoring and evaluation.

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APPENDIX A

PESTICIDES LISTED AS TOXIC AIR CONTAMINANTS PURSUANT TO SECTION 14021(B) FOOD AND AGRICULTURAL CODE

PESTICIDES LISTED AS TOXIC AIR CONTAMINANTS PURSUANT TO SECTION 14021(b) FOOD AND AGRICULTURAL CODE

1,3 Dichloropropene[a]
2,4-Dichlorophenoxyacetic acid (2,4-D) salts and esters[a]
Acrolein
Arsenic Pentoxide[a]
Arsenic Trioxide[a]
Captan[a]
Carbaryl
Chlorine
Dichlorvos (DDVP)
Ethylene Oxide[a]
Formaldehyde
Hydrogen Chloride
Lindane
Mancozeb[a]
Maneb[a]
Methyl Bromide[a]
Pentachloronitrobenzene (PCNB)
Pentachlorophenol (PCP)
Propoxur
Trifluralin

[a] Previously identified as a candidate toxic air contaminant.

APPENDIX B

NUMERICAL RANKING CRITERIA : TOXICITY, PHYSICAL/CHEMICAL DATA, AND SALES/USE DATA.

APPENDIX B1

Numerical Rankings of Toxicity Criteria
(Maximum points: 13)

Acute Toxicity (Inhalation, Dermal, Oral)	Points
Toxicity Category I	4
Toxicity Category II	3
Toxicity Category III	2
Toxicity Category IV	1

USEPA Oncogenicity Classification	Points
Category A (Human Carcinogen)	5
Category B1/B2 (Probable Human Carcinogen)	4
Category C (Possible Human Carcinogen)	
Category C_q	3
Category C	1
Category D (Not Classifiable as to Human Carcinogenicity	0
Category E (Evidence of Non-Carcinogenicity for Humans)	0

Chronic/Subchronic NOELS[a]	Points
≥0.10 mg/kg/day	4
>0.1 to ≤1.0 mg/kg/day	3
>1.0 to ≤10.0 mg/kg/day	2
>10.0 mg/kg/day	1

[a] No-Observed-Effect Levels

APPENDIX B2:

Numerical Rankings of Physical/Chemical and Sales/Use Criteria
(Maximum points: 12)

Vapor Pressure:	Points
> 1 Pascal	4
1 mPa - 1 Pa	3
1 μPa - 1 mPa	2
< 1 μPa	1
Not Volatile at Room Temperature	0

Henry's Constant K_H.	Points
> 10^{-3} atm.mol/m^3	4
10^{-6} to 10^{-3} atm.mol/m^3	3
10^{-9} to 10^{-6} atm.mol/m^3	2
10^{-12} to 10^{-9} atm.mol/m^3	1
< 10^{-12} atm.mol/m^3	0

Average Sales/Use for 1990 through 1993:	Points
> 500,000 lbs	4
100,001 to 500,000 lbs	3
10,001 to 100,000 lbs	2
101 to 10,000 lbs	1
< 100 lbs	0

APPENDIX C

TAC Candidate Pesticides and Some of Their Properties

APPENDIX C: TAC CANDIDATES AND SOME OF THEIR PROPERTIES

CHEMICAL NAME	MW	Water Solubility	Units	Temp °C	VP	Units	Temp °C	Henry's Constant (Calculated)	Henry's Constant (Literature)
Aciflurofen	361.70	120	mg/l	24	0.13	mPa	20	3.96E-09	
ADAC									
Alachlor	269.77	242	mg/l	25	2.90	mPa	25	3.19E-08	6.12E-08
Aldicarb	190.27	6	g/l	25	13.00	mPa	20	4.07E-09	1.45E-09
Allethrin	302.40	0.2	mg/l	20	16.00	mPa	30	2.39E-04	
Aluminum Phosphide	57.96								
Amitraz	293.40	1	mg/l	23	51.00	uPa	20	1.48E-07	
Atrazine	215.69	28	mg/l	20	40.00	uPa	20	3.04E-09	
Azinphos-methyl	217.33	21	mg/l	20	1.00	mPa	20	1.02E-07	7.50E-09
Bendiocarb	223.23	40	mg/l	20	0.66	mPa	25	3.64E-08	3.60E-06
Benomyl	290.62	2.8	mg/l	25	4.97	uPa	25	5.09E-09	0.00E+00
Bentazon, Sodium Salt	240.28	500	mg/l	20	0.46	mPa	20	2.18E-09	
Boric Acid	61.84	55.56	g/l	20					
Bromacil	261.10	815	mg/l	25	33.00	uPa	25	1.04E-10	
Bromoxynil Octanoate	397.07	80	ug/l	25	0.10	mPa	25	4.90E-05	
Carbofuran	221.26	375	mg/l	30	2.70	mPa	33	1.57E-08	
Carboxin	235.31	170	mg/l	25	25.00	uPa	25	3.42E-10	3.40E-10
Chloroneb	207.10	8	mg/l	25	400.00	mPa	25	1.02E-04	
Chloropicrin	164.39	2.3	g/l	25	3.20	kPa	25	2.26E-03	
Chlorosulfuron	257.80	27.9	g/l	25	3.00	nPa	25	2.74E-16	
Chlorothalonil	265.92	0.6	mg/l	25	1.30	Pa	40	5.69E-03	
Chlorpyrifos	350.62	2	mg/l	25	2.50	mPa	24	4.33E-06	4.16E-06
Chlorthal-Dimethyl	331.99	0.5	mg/l	25	33.00	mPa	25	2.16E-04	2.20E-06
Coumaphos	262.50	1.5	mg/l	20	13.00	uPa	20	2.25E-08	
Creosote									
Cryolite	209.97								
Cyanazine	240.70	171	mg/l	25	200.00	nPa	20	2.78E-12	2.78E-02

* PI. Practically Insoluble in water.
** NRT. Volatility Negligible at Room Temperature
*** NVRT. Not Volatile at Room Temperature

APPENDIX C: TAC CANDIDATES AND SOME OF THEIR PROPERTIES

CHEMICAL NAME	MW	Water Solubility	Units	Temp °C	VP	Units	Temp °C	Henry's Constant (Calculated)	Henry's Constant (Literature)
Cyanuric Acid, Monosodium Salt									
Cycloate	215.37	75	mg/l	20	830.00	mPa	25	2.35E-05	2.40E-05
Daminozide	160.20	100	g/l	25	22.70	mPa	23	3.59E-10	
DEET	191.26	PI*		25					
DEF	314.52	<2.3	mg/l	20	213.00	mPa	20	2.87E-04	
Diazinon	304.35	40	mg/l	20	37.00	mPa	20	2.78E-06	1.13E-07
Dicamba	221.04	6.5	g/l	25	4.50	mPa	25	1.51E-09	1.20E-09
Dichlobenil	341.20	18	mg/l	18	73.00	uPa	20	1.37E-08	6.60E-06
Diclofop Methyl	370.51	3	mg/l	22	34.00	uPa	20	4.14E-08	
Dicofol	370.51	0.8	mg/l	25	NRT**			2.29E-09	
Didecyl Dimethyl Ammonium Chlorid	362.08								
Diethatyl-Ethyl	311.80	105	mg/l	25	0.43	mPa	30	1.26E-08	
Dimethoate	229.28	25	g/l	21	1.10	mPa	25	9.96E-11	2.63E-11
Diphacinone	340.38	0.3	mg/l	25	13.70	nPa	25	1.53E-10	
Diphenylamine	169.20	Insoluble							
Dipropyl Isocinchomeronate									
Diquat Dibromide	344.06	700	g/l	20	NRT		20	2.43E-15	6.30E-14
Diuron	233.10	42	mg/l	25	0.41	mPa	50	2.25E-08	1.46E-09
Endosulfan	406.96	0.32	mg/l	22					5.00E-05
Endothall (N,N-Dimethylamine Salt)	186.20	100	g/l	20	NRT		20	9.19E-15	
EPTC	189.32	375	mg/l	25	4.70	Pa	30	2.34E-05	1.10E-05
Ethalfluralin	333.30	0.2	mg/l	25	0.11	mPa	25	1.81E-06	
Ethephon	144.50	1000	g/l	20	< 10	uPa	20	1.43E-14	
Ethofumesate	286.30	110	mg/l	25	65.00	uPa	25	1.67E-09	
Ethoprop	242.30	700	mg/l	20	46.50	mPa	26	1.59E-07	1.50E-07
Ethyl Alcohol	46.07	Miscible							
Ethylene Glycol, Monomethyl Ether	76.09	Miscible							

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*** NVRT. Not Volatile at Room Temperature

APPENDIX C: TAC CANDIDATES AND SOME OF THEIR PROPERTIES

CHEMICAL NAME	MW	Water Solubility	Units	Temp °C	VP	Units	Temp °C	Henry's Constant (Calculated)	Henry's Constant (Literature)
Fenamiphos	303.40	700	mg/l	20	12.00	mPa	20	5.13E-08	9.50E-05
Fenarimol	331.20	13.7	mg/l	25	13.00	uPa	25	3.10E-09	5.49E-06
Fenthion	278.33	9.3	mg/l	20	4.00	mPa	20	1.18E-06	
Ferbam	416.50	130	mg/l	20	NRT		20	1.58E-11	
Fluvalinate	502.00	2	ug/l	25	< 13	uPa	25	3.22E-05	
Folpet	296.56	1	mg/l	20	1.30	mPa	20	3.80E-06	
Glyphosate	169.08	12	g/l	25	1.00	mPa	25	1.39E-10	1.39E-10
Imazalil	297.18	1.4	g/l	20	9.30	uPa	20	1.95E-11	
Iprodione	330.17	13	mg/l	20	0.13	mPa	20	3.33E-08	3.30E-08
Isopropyl Alcohol	60.09	Azeotrope							
Linuron	249.10	81	mg/l	25	2.00	mPa	24	6.07E-08	6.10E-08
Lithium Hypochlorite	23.95								
Malathion	330.36	145	mg/l	25	5.30	mPa	30	1.19E-07	4.89E-09
Maleic Hydrazide, Potassium Salt	150.10	400	g/l	25	NVRT***		25	1.85E-18	
Mefluidide, Diethanolamine Salt	310.29	180	mg/l	23	< 10	mPa	25	1.70E-07	1.70E-07
Metaldehyde	176.20	230	mg/l	25	Low RT		25	3.78E-09	
Metam-Sodium	107.20	722	g/l	20	NVRT		30	7.33E-19	
Methidathion	302.33	240	mg/l	20	186.00	mPa	20	2.31E-06	2.20E-09
Methomyl	162.21	57.9	g/l	25	6.65	mPa	25	1.84E-10	6.40E-10
Methyl Parathion	283.21	57.5	mg/l	25	1.30	mPa	20	6.32E-08	
Methylene Bis (Thiocyanate)									
Metolachlor	283.80	530	mg/l	20	1.70	mPa	20	8.98E-09	9.20E-09
Metribuzin	214.29	1.05	g/l	20	5.80	uPa	20	1.17E-11	1.20E-10
MITC	73.11	8.2	g/l	20	2.70	kPa	20	2.38E-04	2.40E-04
Molinate	187.32	880	mg/l	20	746.00	mPa	25	1.57E-06	1.60E-10
MSMA	162.00	1400	g/l	20	NVRT		20	5.71E-19	
N-Octyl Bicycloheptenedicarboximide									

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*** NVRT. Not Volatile at Room Temperature

APPENDIX C: TAC CANDIDATES AND SOME OF THEIR PROPERTIES

CHEMICAL NAME	MW	Water Solubility	Units	Temp °C	VP	Units	Temp °C	Henry's Constant (Calculated)	Henry's Constant (Literature)
Naled	380.84	10	mg/l	20	260.00	mPa	20	9.77E-05	
Napropamide	271.36	73	mg/l	20	0.53	mPa	25	1.94E-08	2.90E-08
Nicotine	162.23	1000	g/l	25	5.50	mPa	25	8.81E-12	
Nitrapyrin	230.90	40	mg/l	22	370.00	mPa	23	2.11E-05	2.13E-03
Norflurazon	303.67	0.39	mg/l	20	<10	uPa	20	7.68E-08	3.40E-10
o-Benzyl-p-Chlorophenol + Salts									
o-Phenylphenol	170.20	0.7	g/l	25	NRT			1.20E-12	
Oryzalin	246.36	2.5	mg/l	25	13.00	uPa	30	1.26E-08	
Oxadiazon	245.23	0.7	mg/l	20	133.00	uPa	20	4.60E-07	6.50E-10
Oxamyl	219.36	280	g/l	25	31.00	mPa	25	2.40E-10	2.60E-06
Oxyfluorfen	361.70	0.1	mg/l	20	26.00	uPa	25	9.28E-07	
Oxythioquinox	243.29	PI							
p-Dichlorobenzene	147.01	PI							
Paraquat Dichloride	257.20	700	g/l	20	NRT		20	1.81E-15	
Pebulate	203.36	60	mg/l	20	9.00	Pa	30	3.01E-04	1.15E-04
Pendimethalin	281.31	0.3	mg/l	20	4.00	mPa	25	3.70E-05	8.56E-07
Permethrin	391.28	0.2	mg/l	20	45.00	uPa	25	8.69E-07	4.80E-08
Petroleum Distillates, Aliphatic/Aromatic									
Phenothrin	350.50	2	mg/l	30	0.16	mPa	20	2.77E-07	
Phorate	260.38	50	mg/l	25	110.00	mPa	20	5.65E-06	
Phosmet	317.33	25	mg/l	25	133.00	mPa	50	1.67E-05	9.40E-09
Phosphoric Acid	98.00	Soluble							
Pine Oil		Insoluble							
Piperonyl Butoxide	338.43	14.3	mg/l						
Prometryn	241.37	48	mg/l	25	0.13	mPa		6.45E-09	4.90E-09
Propargite	350.50	0.5	mg/l	25	400.00	Pa		2.77E+00	
Propylene Oxide (Gas)	58.08								

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APPENDIX C: TAC CANDIDATES AND SOME OF THEIR PROPERTIES

CHEMICAL NAME	MW	Water Solubility	Units	Temp °C	VP	Units	Temp °C	Henry's Constant (Calculated)	Henry's Constant (Literature)
Propyzamide	256.13	15	mg/l	25	11.30	mPa		1.90E-06	1.90E-07
Pyrethrins	347.11	1	mg/l		Very Low			1.71E-07	
Resmethrin	338.45	<1	mg/l	30	1.50	uPa		5.01E-09	
Rotenone	394.43	PI			<1	mPa		3.89E-04	
Simazine	201.66	5	mg/l	20	810.00	nPa		3.22E-10	3.40E-09
Streptomycin	581.60	>20	g/l	28					
Sulfur	32.06	PI			0.53	mPa		1.68E-05	
Sulfur Dioxide	64.07								
Sulfuryl Fluoride	102.10	750	mg/l	25	1.70	mPa		2.28E-09	
Tetrachlorvinphos	365.97	11	mg/l	20	5.60	uPa		1.84E-09	
Tetramethrin	331.42	4.6	mg/l	30	944.00	uPa		6.71E-07	
Thiabendazole, Hypophosphite Salt	201.25	<50	mg/l	22	NRT			1.99E-11	
Thiobencarb	257.80	30	mg/l	20	2.20	Pa		1.87E-04	
Thiophanate-Methyl	342.40	26.6	mg/l	20	<10	uPa		1.27E-09	
Thiram	240.44	30	mg/l	25	NRT			3.95E-11	
Triadimefon	293.76	260	mg/l	20	<0.1	mPa		1.12E-09	
Tributyltin Benzoate									
Tributyltin Oxide									
Trichloro-S-Triazinetrione									
Trichlorophon	257.44	120	g/l	20	0.21	mPa		4.45E-12	
Triclopyr	256.48	440	mg/l	25	0.17	mPa		9.66E-10	
Triforine	434.97	6	mg/l	25	27.00	uPa		1.93E-08	
Vinclozolin	286.11	3.4	mg/l	20	16.00	uPa		1.33E-08	
Warfarin	308.22	17	mg/l	20	9.00	Pa		1.61E-03	
Ziram	205.81	65	mg/l	25	NRT			1.56E-11	

* PI. Practically Insoluble in water.
** NRT. Volatility Negligible at Room Temperature
*** NVRT. Not Volatile at Room Temperature

APPENDIX D

SALES AND USE OF PESTICIDES

APPENDIX D: SALES AND USE OF PESTICIDES (Pounds Active Ingredient). Sales and Use figures are from the 1990 through 1994 Pesticides Sold in California: Annual Reports, and Presticide Use Reports Annual respectively.

CHEMICAL NAME	1990 Use	1991 Use	1992 Use	1993 Use	1994 Use	Average Use	Average Sales	1994 Sales	1993 Sales	1992 Sales	1991 Sales	1990 Sales
Acephate	409,498	361,225	431,946	337,850	398,804	387,865	447,811	470,829	419,952	506,215	281,585	560,474
Aciflurofen	1	0	17	6	1	5						
ADAC	4,487	701	864	1,107	1,508	1,733	587,524	705,398	534,600	727,405	552,771	417,445
Alachlor	97,489	88,585	82,046	44,957	42,854	71,186						
Aldicarb	473,305	192,763	168,569	237,734	231,655	260,805						
Allethrin	117	164	232	184	176	175	8,154	11,220	5,975	13,400	5,767	4,406
Aluminum Phosphide	84,502	125,797	112,224	171,522	99,647	118,738	95,723	155,589	92,421	76,789	51,144	102,672
Amitraz	9,454	5,831	8,953	4,877	71,153	20,054						
Atrazine	60,562	55,720	50,880	46,850	48,978	52,598						72,005
Azinphos-methyl	517,544	484,884	523,384	492,424	432,165	490,080						
Bendiocarb	17,487	16,314	20,417	9,808	4,433	13,692	10,124		209	16,671	10,319	13,297
Benomyl	233,465	123,799	145,983	580,927	151,974	247,230	163,538		178,384	145,397	121,059	209,310
Bentazon, Sodium	126	1,101	864	1,017	1,175	857						
Boric Acid	58,596	145,404	240,155	235,324	190,766	174,049	290,344	486,050	34,117	489,510	274,123	167,920
Bromacil	95,562	110,540	112,151	117,848	192,406	125,701	116,527	52,715	199,370		162,968	167,582
Bromoxynil Octanoate	156,076	89,079	117,661	114,551	141,769	123,827						
Carbofuran	345,175	326,758	316,104	295,223	283,399	313,332						
Carboxin	19,150	4,523	28,527	14,219	13,153	15,914						20,854
Chloroneb	25,648	24,166	37,826	34,163	31,600	30,681						43,689
Chloropicrin	2,248,654	2,364,244	2,641,040	2,124,423	2,484,388	2,372,550	3,301,571	5,764,262	2,810,448	2,439,428	2,857,277	2,636,440
Chlorothalonil	511,462	666,068	81,253	1,095,651	861,604	643,208	1,111,514	1,256,911	1,205,229	1,297,809	915,346	882,276
Chlorpyrifos	2,464,802	2,097,264	2,592,463	2,378,208	3,055,228	2,517,593	2,972,195	6,202,088	2,432,497	2,474,245	2,412,629	1,339,516
Chlorsulfuron	890	740	2,013	1,110	1,228	1,196						
Chlorthal-Dimethyl	703,029	807,828	849,074	660,449	571,325	718,341	1,000,721	1,445,630	606,766	924,937	1,194,043	832,231
Coumaphos	1				0	0	2,676		18	5,161	3,111	2,415
Creosote	84,200	314,131	300,194	472,140	871,469	408,427	2,913,888		2,664,226	4,164,366	6,439,750	1,301,097
Cryolite	2,659,174	2,530,727	3,600,509	2,798,871	2,636,646	2,845,185	2,279,928		3,475,021	3,536,400	1,917,285	2,470,934
Cyanazine	383,164	288,415	348,645	508,205	532,752	412,236						
Cyanuric Acid, Mono Sodium Salt					0	0						
Cycloate	60,330	45,638	59,367	51,715	57,837	54,977						
Daminozide	8,847	10,446	13,110	8,396	7,199	9,600						
DEET	3	1	0	0	21	5	332,549	202,769	387,650	854,887	125,752	91,687
DEF	1,007,013	812,562	769,838	979,019	913,668	896,420						
Diazinon	1,177,135	1,007,052	1,347,402	1,491,710	1,387,854	1,282,231	2,562,989	4,886,051	1,917,635	2,665,135	1,875,919	1,470,207
Dicamba, salts & esters	46,761	31,374	58,392	54,231	59,099	49,971	44,448	68,661	20,234			
Dichlobenil	5,648	4,995	2,416	2,573	3,598	3,846	32,097	34,593	37,268	32,000	22,700	33,922
Diclofop Methyl	53,804	12,021	30,616	23,082	38,276	31,560						
Dicofol	1,004,462	583,653	532,011	589,668	600,466	662,052	6,909,548	11,569,310	5,273,871	5,036,195	5,866,867	6,801,498
Didecyl Dimethyl Ammonium Chloride	279	466	209	61	466	296	210,408	296,928	247,675	233,939	145,525	127,975
Diethatyl-Ethyl	109,672	78,721	91,531	76,377	37,227	78,706						
Dimethoate	880,402	1,218,762	699,691	611,387	691,680	820,384	739,546	650,381	657,773	748,079	762,321	879,178

APPENDIX D: SALES AND USE OF PESTICIDES (Pounds Active Ingredient). Sales and Use figures are from the 1990 through 1994 Pesticides Sold in California: Annual Reports, and Presticide Use Reports Annual respectively.

CHEMICAL NAME	1990 Use	1991 Use	1992 Use	1993 Use	1994 Use	Average Use	Average Sales	1994 Sales	1993 Sales	1992 Sales	1991 Sales	1990 Sales
Diphacinone	31	54	35	44	90	51	63	67	67	64	52	66
Diphenylamine	3,403	1,397	5,444	4,087	5,410	3,948						
Dipropyl Isocinchomeronate	1	0	10	0	2	3	4,661	4,560	5,093	5,723	3,267	4,660
Diquat Dibromide	105,649	133,121	88,999	73,356	96,166	99,458	144,495	92,405	70,657	214,902	146,117	198,395
Diuron	734,472	1,085,865	932,257	1,090,684	1,330,908	1,034,837	1,136,605	1,304,155	1,335,812	1,027,549	1,039,293	976,214
Endosulfan	511,724	339,581	382,950	366,008	475,742	415,201	849,389	2,604,009	432,499	381,737	317,747	510,952
Endothall (N,N-Dimethylamine Salt)	87,033	61,178	72,091	75,841	66,106	72,450						
EPTC	897,647	752,422	667,112	714,355	794,772	765,262	1,193,626	1,268,287	1,232,192	936,766	1,180,505	1,350,381
Ethalfluralin	49,783	41,953	39,885	34,405	46,976	42,600						
Ethephon	704,569	824,921	644,725	897,658	897,467	793,868		928,949				
Ethofumesate	12,441	9,531	9,068	6,504	13,499	10,209						
Ethoprop	38,364	77,274	41,512	62,143	51,270	54,113						
Ethyl Alcohol	652	46	470	201	558	385	3,119,554	4,315,912	1,605,596	2,441,010	4,904,776	2,330,476
Ethylene Glycol, Monomethyl Ether						0						
Fenamiphos	151,523	184,707	186,403	235,043	182,855	188,106						
Fenarimol	35,788	25,091	25,842	22,754	26,439	27,183						
Fenthion	1,858	1,298	1,087	146	186	915					418	4,488
Ferbam	115	0	21	0	0	27						
Fluvalinate	7,809	9,484	9,676	4,285	6,160	7,483	23,991	7,150	6,849	46,136		35,828
Folpet	924	3	1	3	3	187	97,895	24,476	54,640	20,387	25,039	364,932
Glyphosate, Isopropylamine Salt	2,761,039	2,876,827	3,390,281	3,913,727	3,725,637	3,333,502	6,391,746	12,659,194	4,943,484	5,742,377	4,455,230	4,158,444
Imazalil	9,468	20,304	11,394	11,778	12,542	13,097	77,328	22,179	14,833	14,866	13,699	321,064
Iprodione	417,975	458,094	412,406	685,681	462,268	487,285						
Isopropyl Alcohol	236,413	249,289	318,028	368,640	382,966	311,067	742,166	637,967	559,601	517,373	509,938	1,485,949
Linuron	68,920	99,276	139,230	230,827	80,986	123,848						
Lithium Hypochlorite						0	80,037	77,570	78,093	90,017	87,754	66,750
Malathion	1,896,106	900,043	792,464	716,926	782,434	1,017,595	11,676,692	39,855,925	247,925	3,681,607	5,754,776	8,843,229
Maleic Hydrazide, K Salt	38,776	31,337	26,721	29,622	17,442	28,780						
Mefluidide, Diethanolamine Salt	4,635	2,384	4,073	6,130	2,952	4,035						
Metaldehyde	42,873	39,910	62,294	54,465	55,489	51,006	378,894	457,266	453,499	482,476	119,127	382,103
Metam-Sodium	5,934,082	4,887;334	8,566,076	8,589,017	11,173,565	7,830,015	16,428,666	19,308,803	16,276,966	22,204,686	13,665,839	10,687,038
Methidathion	351,960	326,179	394,918	453,164	370,087	379,262						
Methomyl	881,749	632,243	790,132	604,129	793,207	740,292	803,046	908,233	1,080,859	607,773	548,833	869,530
Methyl Parathion + OR	106,712	74,554	106,542	175,482	140,670	120,792	151,061	135,333	279,873	126,628	128,338	85,134
Methylene Bis (Thiocyanate)	1	0	0	0	0	0	81,675	31,356	214,982	102,911	31,754	27,371
Metolachlor	193,689	155,069	142,130	165,457	160,638	163,397						
Metribuzin	29,391	24,367	56,962	19,853	25,548	31,224						
Molinate	1,529,586	1,147,766	1,387,628	1,533,104	1,540,144	1,427,646						
MSMA	145,075	94,347	125,780	94,114	142,240	120,311	341,183	526,039	263,031	271,249	261,479	384,118

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CHEMICAL NAME	1990 Use	1991 Use	1992 Use	1993 Use	1994 Use	Average Use	Average Sales	1994 Sales	1993 Sales	1992 Sales	1991 Sales	1990 Sales
N-Octyl Bicycloheptene-dicarboximide	8,091	7,704	9,527	9,121	9,035	8,696	90,015	108,735	71,295			
Naled	452,785	176,871	164,905	180,041	909,844	376,889	324,089	545,047	279,258	309,034	218,001	269,103
Napropamide	281,376	197,955	155,966	190,505	164,748	198,110						315,978
Nicotine	3,566	3,599	1,284	603	486	1,908				169	7,576	
Nitrapyrin	394	672	369	194	166	359	4					
Norflurazon	128,660	144,530	187,586	174,440	164,806	160,004	0					
o-Benzyl-p-Chlorophenol + Salts	3,109	1,744	1,772	2,532	1,199	2,071	105,706	66,602	139,100	61,473	67,805	193,550
o-Phenylphenol + Salts	90,539	38,287	76,181	71,122	58,108	66,847	354,707	425,488	308,426	322,010	159,384	558,225
Oryzalin	677,196	609,835	693,769	725,522	704,405	682,145	548,500	951,767	234,313	775,074	547,980	233,368
Oxadiazon	17,040	17,380	18,273	19,269	20,495	18,491	47,052		52,107	60,855	43,614	31,633
Oxamyl	50,478	59,220	71,186	71,575	74,699	65,432						
Oxydemeton-methyl	168,380	119,767	118,984	120,142	121,418	129,738						
Oxyfluorfen	448,864	295,659	340,124	419,086	368,036	374,354	3,255,931		3,975,682	3,436,635	2,355,477	
Oxythioquinox	5,578	4,433	5,446	5,391	3,109	4,791						
p-Dichlorobenzene	40	108	82	37	3	54	1,010,819	1,175,354	1,241,169	1,010,115	748,329	879,130
Paraquat Dichloride	509,784	559,276	657,388	715,212	735,064	635,345						
Pebulate	403,348	382,252	222,616	191,640	235,690	287,109						
Pendimethalin	287,955	259,488	282,022	452,592	329,581	322,328	331,424		356,131	493,002	391,895	416,093
Permethrin	203,842	364,388	268,377	252,471	273,398	272,495	234,937	329,324	293,339	207,915	163,961	180,145
Petroleum Distillates, Aliphatic/Aromatic	4,055,028	2,283,868	2,895,120	3,289,081	2,253,106	2,955,241	4,995,088	6,688,465	4,083,072	4,012,183	4,224,031	5,967,687
Phenothrin	35	20	19	15	13	20	7,027	9,895	7,800	9,279	3,630	4,531
Phorate	125,753	175,127	204,949	147,626	161,700	163,031	161,209		126,777	242,645	143,524	131,888
Phosmet	257,268	286,123	265,391	229,157	206,528	248,893	203,232	240,541	229,009	242,858	8,376	295,374
Phosphoric Acid	225,205	201,297	235,760	264,429	255,816	236,501	2,093,915	2,274,769	1,721,269	1,954,995	1,624,979	2,893,562
Pine Oil	145	118	108	79	161	122	4,681,940	3,447,484	4,352,304	5,267,228	5,590,402	4,752,281
Piperonyl Butoxide	88,748	66,520	56,773	81,803	167,259	92,221	237,197	268,701	301,696	215,860	208,310	191,417
Prometryn	284,272	202,327	193,258	227,573	226,013	226,689	256,573	307,727	305,378	250,355	198,757	220,647
Propargite	2,066,452	1,392,713	1,873,729	1,691,678	1,833,525	1,771,619						
Propylene Oxide (Gas)	41,624	111,919	131,091	36,236	41,815	72,537						
Propyzamide	178,509	120,918	111,221	111,027	118,507	128,036						
Pyrethrins	52,795	9,588	8,774	9,778	18,727	19,932	38,145	51,587	42,674	30,495	30,200	35,770
Resmethrin	2,652	3,754	1,670	1,722	1,114	2,182	9,449	9,109	12,959	8,235	7,157	9,785
Rotenone	1,583	12,900	4,836	1,720	568	4,321	3,295	2,438	1,591	4,294	2,763	5,387
Simazine	1,183,497	829,264	941,741	1,129,947	897,587	996,407	1,105,583	1,198,453	1,296,116	1,129,400	804,896	1,099,051
Streptomycin	9,455	11,047	14,350	11,659	9,378	11,178	7,936			10,526	4,490	8,793
Sulfur	55,494,372	49,489,823	61,752,078	73,528,072	70,537,081	62,160,285	81,577,128	81,894,560	100,341,778	85,239,479	67,384,605	73,025,220
Sulfur Dioxide	262,906	275,431	1,149,988	275,826	285,038	449,838						
Sulfuryl Fluoride	1,136,713	1,244,657	1,448,692	1,502,091	1,734,437	1,413,318						
Tetrachlorvinphos	15,103	18,953	27,357	8,324	10,058	15,959	27,326	36,449	39,405	35,890	13,700	11,188
Tetramethrin	1	1	1	0	1	1	9,037	10,437	9,776	12,388	7,038	5,545

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Thiabendazole, Hypophosphite Salt	26	1	6	18	6	11	24,720		28,088	36,655	14,904	19,232
Thiobencarb	99,186	73,164	187,733	263,899	411,085	207,013						
Thiophanate-Methyl	80,060	85,459	93,071	107,757	163,646	105,999	114,253	196,171	116,950	96,819	88,260	73,064
Thiram	71,150	86,353	126,607	171,881	165,544	124,307	180,418	210,228	199,794	197,032	194,060	100,978
Triadimefon	53,590	81,709	176,500	30,928	28,579	74,261	44,960	29,536	32,863	56,861	56,038	49,501
Tributyltin Benzoate						0						
Tributyltin Oxide	1	96	91	48	44	56	72,783	103,821	148,310	60,339	16,899	34,544
Trichloro-S-Triazinetrione	8,768	1,769	831	3,584	487	3,088	11,252,618	11,864,304	11,568,715	10,640,856	9,898,046	12,291,170
Trichlorofon	11,846	7,090	4,233	5,607	4,275	6,610	14,363	7,586			14,304	21,199
Triclopyr	58,843	68,939	11,354	10,018	27,200	35,271						
Triforine	22,365	19,324	30,500	56,904	41,147	34,048	74,291		70,892	97,483	61,363	67,424
Vinclozolin	41,614	44,889	50,736	39,586	33,674	42,100						
Warfarin	1	1	1	1	0	1	19		18	25	21	13
Ziram	934,672	2,028,906	1,815,507	1,771,370	1,027,380	1,515,567	1,846,002	1,175,208	2,365,847	3,076,140	1,408,200	1,204,617