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## Multiple Chemical Sensitivities

Dr. Barbara A Sorg, Neuroscientist, WSU

Multiple chemical sensitivity (MCS) is a phenomenon whereby individuals report an increased sensitivity to chemicals in the environment and attribute their sensitivities to prior chemical exposure. Multiple chemical sensitivity has been reported in several groups of individuals, including those serving in the Persian Gulf War (Gulf War Syndrome) and those exposed to pesticides, "sick buildings," and solvents involving volatile organic compounds (VOCs). Among the most common symptoms reported in MCS are extreme fatigue, headache, gastrointestinal problems, muscle and joint pain, depression, memory and concentration difficulties, irritability, dizziness, anxiety, and upper airway irritation.<sup>1-4</sup> Additional reported symptoms are shown in Table 1 (page 2). Complaints involving multiple systems (cardiovascular, gastrointestinal, dermatologic, etc.) are common; in fact, multi-system symptoms may be a defining feature of MCS.<sup>5</sup>

The development of MCS has been described as a dual-phase process.<sup>1,6,7</sup> The *initiation phase* is thought to be the stage during which either repeated exposure to

chemicals, a high-level chemical exposure (such as that occurring during a chemical spill), or other stressful life events initiate the process of later sensitivity to chemicals. The subsequent experience of symptoms at very low levels of exposure is called the *elicitation phase*; also known as *triggering*.<sup>1</sup> It is during this second phase that individuals report exquisite sensitivity to odors and feelings of illness from chemical exposures encountered at the home and workplace. A wide variety of chemicals seem to initiate MCS, but an even wider variety seem to function as symptom triggers.<sup>1</sup>

Some reports indicate the prevalence of severe MCS (resulting in greatly reduced quality of life for the patient) in the United States is approximately 5%.<sup>8,9,10</sup> Less severe problems with chemical exposures have been reported in approximately 15–30% of the population.<sup>9,11,12</sup> Approximately four times more women are affected than men, and the average age of onset is the fourth decade.<sup>13</sup> Political, social and economic pressure to find a case definition for MCS is increasing. MCS patients visit their

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## Multiple Chemical Sensitivity, cont.

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health care provider an average of 23 times per year.<sup>2</sup> The costs to society are also incurred through lost productivity and disability payments.

Despite the prevalence of MCS reports in the U.S. population, its origins and its very existence are intensely debated for several reasons. First, myriad symptoms have been attributed to MCS (see Table 1), and no single case definition has been agreed upon. Second, objective and consistent physical signs have not been found. Third, extremely low levels of chemicals have been reported to elicit symptoms. Fourth, double-blind chemical challenge studies are difficult to conduct due to odors associated with various chemicals, therefore a cause-effect relationship has been difficult to establish. Finally, symptoms strongly overlap those of other disorders, including somatoform disorder, chronic fatigue syndrome, fibromyalgia, panic disorder and posttraumatic stress disorder.

A patient with MCS generally experiences a reproducible constellation of symptoms, but symptoms can change with time, and often vary between patients.<sup>1</sup> As many as 80% of MCS sufferers report intolerance to various foods.<sup>14</sup> In addition, individuals reporting MCS are often intolerant of the effects of alcohol and other drugs, including medications, making conventional drug therapies problematic.

MCS patients are often frustrated by lack of control over chemicals in their environment, by fears about an unknown course of illness, and by the general lack

of acknowledgment of MCS within the medical community. Some physicians treating MCS have suggested that returning a sense of control to the patient should be part of the treatment strategy.

The number of individuals with MCS is growing. We don't know whether the increase is due to greater public awareness of MCS or to the greater number of new chemicals in use each year. Over 1000 new chemicals are introduced each year,<sup>15</sup> and relatively

few of the approximately 40,000 chemicals and two million mixtures currently on the market have been tested for behavioral effects.<sup>16</sup>

Typically, those with MCS complain of ill effects from chemicals present in very low concentrations in the environment. This suggests that *amplification* has occurred: either the direct effects of the chemicals or the perception of illness from the chemicals has been exaggerated. Bell et al.<sup>7</sup> have described a mechanism by which

amplification of chemical effects may occur. They have noted that MCS has many parallels with the phenomenon of neural sensitization in rodents. Neural sensitization is a type of learning whereby measurable behavioral and neurochemical changes<sup>17, 18</sup> (heightened sensitivity) occur after repeated exposure to chemical or life stressors. A model based on this hypothesis was developed recently in my laboratory, and the findings provide some evidence to support a role for central nervous system sensitization after repeated chemical exposure.

<b>NEUROLOGIC</b>	<b>CARDIOVASCULAR</b>
Headache, Fatigue, Irritability, Dizziness, Cognitive dysfunction, Loss of motivation, Decreased attention span, Loss of concentration and memory, Anxiety, Confusion, Depression, Mood swings, Sleep disturbances, Neurasthenia, Numbness, Paresthesia, Hyperactivity, Shortness of breath, Tingling/numbness in fingers/toes	Palpitations, Irregular heartbeat
	<b>RESPIRATORY</b>
	Dyspnea, Cough, Rhinorrhea, Chest pain & tightness, Shortness of breath, Nasal and eye burning, Pharyngeal irritation
<b>DERMATOLOGIC</b>	<b>GASTROINTESTINAL</b>
Skin irritation	Dyspepsia, Diarrhea, Nausea
<b>GENITOURINARY</b>	<b>MUSCULOSKELETAL</b>
Dysmenorrhea, Urinary frequency, Ovarian cysts	Myalgia, Weakness, Muscle tension, Arthralgia, Dyskinesia

**Table 1: Presenting symptoms in MCS patients.**

(Sources 19–23)

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## Multiple Chemical Sensitivity, cont.

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We do not yet understand how low-level chemicals can cause the many and varied symptoms of MCS, or if MCS is indeed a single illness state. But the symptoms experienced by MCS patients are real. Our lack of understanding should not provide a rationale to dismiss symptoms purely as part of a belief system. Instead, the absence of knowledge should provide impetus to initiate rigorous, scientific studies to help verify or refute claims that chemical exposures initiate/trigger MCS illness. Continued exploration of animal models that mimic aspects of MCS should focus on changes occurring within the brain and its interactions with the immune system. 

Dr. Sorg's work is supported by the Wallace Research Foundation and PHS Grants DA 08212 and ES 09135. For further information, contact her at [barbsorg@vetmed.wsu.edu](mailto:barbsorg@vetmed.wsu.edu).

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# Pesticide Sensitive Registry in Washington and Other States

Dr. Catherine Daniels, Pesticide Coordinator, WSU

Pesticides are only one group of compounds that make up an extensive list of chemicals implicated in multiple chemical sensitivity. But because of public perception of pesticides, as compared to other more ubiquitous compounds such as petroleum-based solvents, "public health protection" measures have been enacted in some form in several states. One of these measures was the establishment of a registry of pesticide-sensitive individuals in Washington State.

## **What is the Pesticide Sensitive Registry?**

The Pesticide Sensitive Registry (PSR) was signed into law in 1992 and amended in 1994 as part of the public right-to-know campaign. Pesticides used in home, lawn, structural, or other pest control may have serious health complications for those with either specific pesticide sensitivities or multiple chemical sensitivities. The PSR is a list of individuals (registrants) who have sent an application form to WSDA along with a physician's verification that they are sensitive to pesticides. Registrants must reapply yearly to remain on the list (physician's verification is required with initial application only). Applicants identify the address of their residence (Sensitive Persons Information List) and of the properties adjacent to their residence (Adjacent Properties List) along with the names and phone numbers of the adjacent properties' owners. These two lists together identify the notification area for that registrant. To qualify as an adjacent property, the land must physically border the registrant's property; properties across the street are not considered part of the notification area.

Certified pesticide applicators must consult both the Sensitive Persons Information List and the Adjacent Properties List to determine notification areas before making applications. Certified pesticide applicators making a landscape or right-of-way application must notify an affected registrant at least two hours in advance of application, except in the event of an emergency application. In the case of an immediate service call requested by their client, the applicator

will notify the PSR registrant at the time of the application. Notifications can be in writing, in person, or by telephone.

WSDA's Compliance Branch compiles and maintains these lists and distributes them twice a year to all certified pesticide applicators. In 1997 over 2,000 copies of the list were distributed.

## **What Do Other States Do?**

As part of a policy study, several Evergreen State College graduate students under the direction of Dr. John Perkins reviewed the PSR in all states that had such a registry. The following information on PSRs in other states is excerpted from that report.<sup>1</sup> The full report will be reviewed in an upcoming issue of the *AENews*.

Eight states have legislated PSRs, and therefore mandatory notification for registrants. Data for these are shown in the following table.

State	Number of Registered Pesticide-Sensitive Individuals per Million
Colorado	8.5
Connecticut	42.8
Florida	66.6
Maryland	23.8
Michigan	8.2
Pennsylvania	41.4
Washington	16.2
West Virginia	25.7

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## ...Pesticide Sensitive Registry, cont.

Dr. Catherine Daniels, Pesticide Coordinator, WSU

Two states, Louisiana and Idaho, have voluntary notification. Florida is the only state to charge a fee for registration. Medical verification and periodic renewal is required in eight states. Colorado requires renewal of signature of a state-licensed doctor every two years. Michigan is the only state where the doctor is asked to estimate within what distance from the patient's residence the pesticide applications should be subject to notification. Five of the states limit notifications to certain types of applications such as lawn, turf, and ornamentals; four other states require notification for nearly all commercial, non-agricultural applications. Pennsylvania, the only state allowing more than one notification area per registrant, allows up to four different locations per registrant: primary residence, place of employment, school, and vacation residence.

### Where Do I Get More Information?

In Washington State, copies of the registration form or fact sheet summarizing the provisions of the PSR are available by calling the WSDA Compliance Branch at (360) 902-2040. The legislative language can be accessed electronically at <http://www.mrsc.org/> by searching for RCW 17.21.420 and 430. 

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<sup>1</sup>Carl E. Camenzind, Pamala M. Meacham, Michael D. Menefee, Harald M. Mezger, and Dr. John Perkins. "The Pesticide Sensitive Registry: A Report to the Washington State Department of Agriculture." May 1998, The Evergreen State College, Olympia, WA.

## Chemical Induced Illness Bill Introduced in State Senate

The topic of chemical sensitivity came before the Washington State legislature on January 25 with the introduction of Senate Bill 5470. "Chemically related illnesses and injuries" focuses on Alaska Airlines flight attendants' claims of illnesses after working in MacDonal Douglas 80 airplanes with leaky hydraulic fluid. Fumes from the fluid were circulated throughout the aircraft's air conditioning system, thus exposing and allegedly sickening attendants. Eighty-four industrial insurance claims from these attendants to Labor & Industries (L&I) have been made and denied. At present there is no legal definition in Washington State as to what criteria can be used to judge chemically related (sensitivity) illnesses or injuries or settle claims. The bill would require a study of industrial insurance claims filed by workers who have suffered chemically related illness or injuries from 1995 to 1998. A final report would be due

December 1, 2000. The study would be made by an outside contractor and would be paid out of L & I's operating budget.

The issue of Multiple Chemical Sensitivity (MCS) involves a broad spectrum of chemical types and exposure situations. While Washington State Senate Bill 5470 was brought about as a result of a specific, non-agrichemical incident, those associated with the agrichemical industry would be well advised to pay attention to such legislation and its outcomes. Specific language of the bill refers to "perceived growth in the number of chemically related illnesses and injuries suffered by workers and...workers with multiple chemical sensitivities created by work-related exposures." Full text of the bill can be seen on-line at [ftp://ftp.leg.wa.gov/pub/billinfo/1999-00/senate/5450-5474/5470\\_01251999](ftp://ftp.leg.wa.gov/pub/billinfo/1999-00/senate/5450-5474/5470_01251999). 

# Worker Exposure and the FQPA: It's In The RED!

Dr. Allan S. Felsot, Environmental Toxicologist, WSU

Lurking beneath the surface of the 1996 Food Quality Protection Act (FQPA), an act ostensibly focused on protecting infants, children, and consumers from harmful levels of pesticide residues in food, is a hidden agenda: worker protection. At first glance, FQPA seems to have overlooked the protection of workers, the group universally acknowledged as the most exposed and therefore the most at risk for adverse health effects from chemical exposure. But a close inspection of tolerance reassessment methodology reveals that worker exposures are indeed, inadvertently or otherwise, addressed as EPA works toward its goal of reassessing all tolerances by the year 2006.

## *It's in the REDs*

The FQPA mandates EPA to ensure that tolerances are safe, with "safe" now statutorily defined as "a reasonable certainty that no harm will result from aggregate exposure to the pesticide chemical residue, including all anticipated dietary exposures and all other exposures for which there is reliable information." During the process of validating the safety of tolerances, the EPA conducts detailed risk assessments for effects on both human health and the environment. The human health risk assessments have always included estimates of exposure and risk to consumers *and* workers. The results of these assessments and final decisions regarding registration are published as Registration Eligibility Decision Documents (REDs). The publication of the REDs is announced in the Federal Register. EPA has now released preliminary REDs for twenty-eight organophosphate (OP) insecticides (available on the Internet at <http://www.epa.gov/oppsrrd1/op/>).

## *NOELs in the REDs*

The preliminary REDs are comprised of separate chapters from the EPA Health Effects Division (HED) and Environmental Fate and Effects Division (EFED). Each division scours pesticide registrant's data to characterize product use, toxicology, and environmental chemistry. The RED starts with an overview of the pesticide—how is it used, target pests, and subject crops. The toxicology information includes the results

from all required and supplemental studies with rats, dogs, wildlife, and fish. EPA determines which adverse effect for each study is the most sensitive endpoint for determining hazard. Focusing on this endpoint, EPA then chooses the No Observable Effect Level (NOEL, in milligrams per kilogram body weight per day, mg/kg/d) from studies of the relationship between dose and effects. Exposure information is obtained from the pesticide residue data generated during registrant field studies. Despite the availability of field residue data, as well as dietary monitoring studies, EPA initially assumes that all crop residues are at the tolerance level and 100% of crop acreage encompassing the intended registration is treated.

Using the NOEL, EPA can determine whether exposure of any population group is acceptable. For daily consumption of residues in food over a theoretical 70-year lifetime (i.e., chronic dietary exposure), the EPA assumes the safe level of exposure would not exceed the dose equivalent to the NOEL divided by 100. This benchmark dose is called the Reference Dose (RfD).

Sometimes a toxicology study fails to define the NOEL because only a small number of doses are actually tested. In this case, the lowest observed effect level (LOEL) is used, but the RfD is adjusted by an extra threefold, elevating the overall safety factor to 300. The FQPA also mandates EPA to include an extra safety factor of 10 if infants and children seem more sensitive than adults. Thus, the safety factor could rise to 1000 or even 3000, making the acceptable "safe" level of exposure even lower.

To calculate the risk of exceeding the "safe" level of exposure, the EPA divides the estimated exposure by the RfD. EPA considers exposures safe when they do not exceed 100% of the RfD.

## *The MOE Factor*

EPA also determines risk for acute exposures. Acute dietary exposures represent what an individual would eat or drink in a single day. Risk is determined by dividing the NOEL by the estimated exposure. To be considered safe, the resulting ratio must exceed 100,

## ...It's In The RED, cont.

Dr. Allan S. Felsot, Environmental Toxicologist, WSU

which represents the margin of exposure (MOE). If human data are available, the MOE may be as low as 10, as is the case for the stored grain insecticide, pirimiphos-methyl (Actellic). Concerns about infant and child sensitivity or lack of adequate data could raise the MOE to 1000 or more, as is the case for methyl parathion (PennCap-M). The higher the assigned MOE number, the lower the permissible exposure.

### **Worker NOELs and Exposure**

To estimate occupational risk, EPA first attempts to derive the NOEL from short-term (about 7 days) and intermediate-term (14–21 days) studies where rats are exposed via dermal or inhalational routes. If appropriate studies are unavailable or inadequate, subchronic (90-day) and occasionally chronic (1–2 year) dietary studies are used with the assumption that 100% of the pesticide is absorbed through the skin or lungs. The NOEL determined by this default absorption factor will be more conservative than a NOEL determined from an actual dermal or inhalational toxicity study.

Once the NOEL is in hand, EPA divides worker activities into distinct categories based on typical or proposed pesticide use patterns. For each activity, three scenarios of exposure are addressed with regard to protective clothing and equipment:

- ◆ Baseline—long pants, long-sleeved shirt, no gloves, and an open cab or tractor;
- ◆ Additional Personal Protective Equipment (PPE)—double layer of clothing and gloves;
- ◆ Engineering Controls—closed application and mixing systems, and low exposure formulations (e.g., water soluble bags, microencapsulation)

Sometimes adequate studies are available from registrants to determine actual chemical-specific exposure of workers, but for older compounds like the organophosphates, data have been inadequate or lacking. In these cases, EPA has been using median data from the Pesticide Handlers Exposure Database

(PHED). The PHED is derived from studies representing over 2000 monitored exposure events with diverse pesticides. Generic exposure factors (i.e., not chemical-specific) are applied to the various categories of worker exposure. Use of the PHED assumes that exposure potential is largely dependent on the physical aspects of the worker activity (i.e., the physics of the sprayer, repetitive behaviors, etc.) rather than on the specific chemistry of the pesticide.

In addition to the typical mixing/loading/application scenarios for different pesticide uses, exposure from post-application fieldwork is assessed with respect to restricted entry intervals. Exposure is estimated by assuming only a small proportion of leaf or fruit residues (i.e., the dislodgeable foliar residues) are available for transfer to the skin.

### **MOE Risk for Workers**

The quantitative estimate of worker exposure (as mg/kg/d) is divided into the NOEL to calculate the MOE. The MOE for dermal exposure is calculated separately from inhalational exposure, but these are added together to determine the total MOE. In truth, dermal exposure accounts for nearly all worker exposure. For example, ethoprop (MoCap) has a comparatively moderate vapor pressure suggesting a reasonable chance of inhalational exposure. Yet, EPA estimated that mixing, loading, and applying a liquid formulation with a backpack sprayer would result in 100 mg per day of dermal exposure compared to only 1.2 mg from inhalational exposure.

OP insecticides display a diversity of toxicological potencies (Table 1). Of the 11 compounds shown, the NOELs ranged from a low of 0.025 mg/kg/d (methyl parathion) to a high of 12 mg/kg/d (acephate). All OP insecticides are considered to have the same common mode of toxicity, namely inhibition of the enzyme cholinesterase. Nearly all the NOELs were derived from cholinesterase activity in plasma or red blood cells. The NOELs differ among compounds mainly for two reasons—the cholinesterase enzyme has different sensitivities to different OPs, and different chemicals are detoxified at different rates.

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With a few exceptions, most MOEs were set to 100. MOEs greater than 100 reflect data gaps or concerns about enhanced sensitivity of children.

ethoprop, whether as a granule or liquid, could not be mitigated below the levels of concern (MOE <5).

TABLE 1

**Toxicological Endpoint NOELs and Risk Assessment Factors for Dermal Exposure of Workers to Selected OP Insecticides**

Pesticide Active Ingredient	Short-term Exposure		Intermediate Term Exposure	
	NOEL (mg/kg/day)	Benchmark MOE	NOEL (mg/kg/day)	Benchmark MOE
Acephate	12	100	12	100
Azinphos-methyl	0.56	100	0.36	100
Dimethoate	2	100	0.06	100
Disulfoton	0.4	100	0.03	100
Ethoprop	0.1	100	0.1	100
Methamidophos	1	100	1	100
Methyl parathion	0.025	1000	0.02	1000
Oxydemeton-methyl	5	100	0.3	100
Phorate	0.05	300	0.05	300
Phosmet	1.1	300	1.1	300
Pirimiphos-methyl	0.25	10	0.25	30

### MOE Failure

When the calculated MOE for each compound (the ratio of the NOEL to the estimated exposure) exceeds the MOE in the table, then the EPA considers the risks associated with the specific worker activity to be tolerable (i.e., safe). All OP insecticides shown in the table **failed** to exceed the benchmark MOE for most worker exposure scenarios considered at the baseline, i.e., without PPE. When PPE and/or engineering controls were factored in, more exposure scenarios exceeded the MOE, thus dropping selected activities from EPA's concern.

For some compounds, however, even engineering controls failed to reduce estimated exposure to desired levels of safety. For example, ethoprop can be applied to soil as a granular formulation by tractor drawn spreader or as a liquid by ground boom sprayer and chemigation. EPA estimated that the mixing and loading activities with engineering controls would not be of concern (MOE of 290), but use of the liquid formulation would pose an unacceptable risk (MOE <5). Furthermore, actual application of

When estimated worker exposure scenarios fail to rise above the benchmark MOE, EPA will move to reduce exposure and mitigate risk. The specific mechanism for such risk mitigation is unknown, but changes in label language are likely.

### Is Experience a Teacher?

Growers who have been using OP insecticides for decades may be quite surprised at the risk they now seem to face. Their experience begs the ques-

tion of whether or not EPA's exposure estimates are valid and whether using the specific MOEs to judge safety is realistic. Is it possible to use experience to test the validity of EPA's risk estimates?

Pertinently, the REDs contain poisoning incident data when available. Information for some of the OP insecticides has been collated from the EPA Office of Pesticide Programs (OPP) Incident Data System, nationwide poison control centers, and reports to the California Department of Food and Agriculture (now the Department of Pesticide Regulation, CDPR). EPA anecdotally reports the data from these sources but seems reticent to use it to temper their worker exposure risk assessments.

Here is a hypothesis concerning EPA's risk estimates. If risk as represented by the calculated MOEs have merit, then for compounds where the MOE was close to or less than one (i.e., the estimated exposure equals or exceeds the NOEL), one would predict a high incidence of worker poisoning reports. Using methyl parathion, the OP with the lowest NOEL (0.025

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## ...It's In The RED, cont.

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mg/kg/d), we can test the hypothesis. Methyl parathion is a good subject for this test because numerous mixer/loading/applying scenarios with methyl parathion resulted in MOEs of <1, even with PPE and engineering controls. Such estimates would predict significant worker poisoning incidents.

First, we might ask how often have workers been poisoned by methyl parathion? Between 1985 and 1992, 102 cases of occupational exposure to methyl parathion were reported to poison control centers, and 75% of these had associated symptoms of poisoning. Between 1982 and 1995, 18 cases of methyl parathion exposure were reported to the CDPR, with only 7 cases having confirmed symptoms. Thus, nationally about 15 incidences with methyl parathion have been reported per year, but in California, a state with the greatest use, only 1.4 cases per year were reported.

Depending on your perspective the numbers of incidents per year may be high or low, but more important is the number of poisoning incidents relative to the number of applications. In other words, if a material is highly hazardous, one would expect the number of incidences of poisoning to increase as the number of applications increased. As shown in Table 2, the incidences of methyl parathion exposure and/or poisoning reports in California are extremely low, despite nearly 46,000 applications. Indeed, EPA stated in a report accompanying the methyl parathion RED that the pesticide had "an unusually good record for an organophosphate insecticide, suggesting that worker practices in place in California from 1982 through 1989 were both safe and effective."

### **The Issue is Safety**

Lest I be interpreted as not concerned about worker exposure, I will state that if I have any concerns about pesticides, worker exposure is the primary one. One poisoning incident is one too many. However, growers have been using these compounds with only infrequent incidents for a very long time. They have a

pretty good safety record as even the EPA admits. In any industry, accidents will happen, and everyone tightens up their management to make sure they don't

**TABLE 2**  
**Methyl-Parathion-Induced Poisonings per 1000 Applications in California, 1982-1989**

Worker Activity	Poisonings Per 1000 Applications (Methyl Parathion Alone)	Poisoning Per 1000 Applications (Chemical Mixture)
Pesticide Handler	0.04	0.09
Field Worker	0.00	0.04
<b>Total Incident Rate</b>	0.04	0.13

happen again. After all, the 1994 Worker Protection Standard was a management response to further worker safety.

FQPA as an instrument of worker protection is a bit of a shell game. Upon peeking under the first shell, we see that, indeed, worker exposure is assessed, almost by default, under current tolerance reassessment activities. Yet are 40-plus years of actual human field experience to remain hidden under the next shell? Paper data is a useful tool, but it might be better still to uncover all the data at our disposal when evaluating an issue as critical as worker safety. 

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### **"Chemicals, the Environment and Disease" Seminar**

The Western Washington Area Health Education Center is co-sponsoring "Chemicals, the Environment, and Disease: A Research Perspective." This full-day seminar will cover indoor air quality, pesticide disorders, multiple chemical sensitivity, and occupational pulmonary disease, and is appropriate for healthcare professionals, industrial hygienists, toxicologists, governmental policy makers, and other interested individuals. Cost is \$150 before April 23, \$200 after. For more information, call WWAHEC at (206) 441-7137.

**Seattle, May 7, 1999**

# No Nerve Damage Seen in Single-Season OP Exposure Study

Norm Herdrich, Pacific Northwest Agricultural Safety and Health Center

Although the neurotoxic effects of acute organophosphate (OP) poisoning are well documented, little is known about how organophosphate insecticides affect nerves when exposure is at a persistent low level. A study was conducted by researchers associated with the Pacific Northwest Agricultural Safety and Health Center in Seattle to determine if neurophysiological abnormalities occurred in a group of farm workers after a season of low-level OP exposure. The study also sought to determine any relationship between motor and sensory nerve abnormalities and extent of exposure.

## **Subjects**

The study population consisted of 67 orchard workers in the Wenatchee area who were working as apple thinners. Apple thinners were chosen because they are routinely exposed to foliar OP residues and can experience systemic absorption even in the absence of related symptoms. The workers included both males and females who ranged in age from 16 to 49 and had thinned apples for 80 or more hours during the current season.

The control population consisted of local workers from sewing factories, food processors, fruit-packing operations, recreational areas, restaurants, and bakeries, and were comparable to the study population in terms of age, ethnicity, and gender.

In the study group, 55 reported doing farm work prior to the thinning season, while 45 of those in the control group had done farm work in the past. Also, 47 of those in the study group reported doing other non-thinning farm work during the study season, as compared to 15 workers in the control group.

In the study group, 29 were females who reported performing significantly fewer hours of thinning than did males, and they also started and ended earlier in the thinning season. Females in the study were less likely to have engaged in other farm work. They also reported washing their clothes more frequently than did the males in the study. Both genders bathed with about equal regularity.

## **Methodology**

The researchers used surface electrodes to examine nerve conduction in each subject's right upper and lower limbs. Sensory nerve conduction was assessed using the sural (calf of the leg) nerve, while motor nerve function was examined in the ulnar (forearm) nerve. To test neuromuscular junction function, the tester performed five repeated stimulations of the ulnar nerve.

## **Findings**

The study found mean cholinesterase activity was lower in the exposed group than in the control population; the difference was slight, yet statistically significant. It was not sufficiently specific to judge individual exposures. Among exposed subjects, researchers observed a (non-significant) trend between number of thinning hours and cholinesterase activity, even when examined by gender, although the effect was in the expected direction (more hours, lower cholinesterase levels) in both cases.

Time since start of thinning, time since end of thinning, number of days work clothes were worn between washings, and bathing pattern were determined to be non-significant.

In the nerve conduction tests, differences between thinners and non-thinners, and between exposure groups among thinners, were small and not statistically significant compared to the normal variability of these measures.

Researchers noted that the thinners in the study were clearly exposed to OP insecticides. This was supported by both the cholinesterase trend noted above and the results of a concurrent occupational hygiene investigation that included urine testing for Guthion metabolites.

A surprising number of abnormalities were observed on the repetitive stimulation of the ulnar nerve, but this phenomenon did not appear to be associated with pesticide exposure. "In fact," stated researchers, "the

## ...Single-season OP Study, cont.

**Norm Herdrich, Pacific Northwest Agricultural Safety and Health Center**

prevalence of this phenomenon in thinners was slightly lower than in the control population." They add that this finding was also not related to a history of farm work or prior pesticide handling.

### Conclusions

In the final analysis, exposure to these low levels of OP insecticides over the course of one season did not appear to impair peripheral neurophysiological function. Blood cholinesterase activity shows marked variation between individuals and may show some variability in the same individual at different times. Without a baseline value for an individual, it is generally not possible to know whether a low level is due to the person's normal level being low or due to OP-induced cholinesterase inhibition. According to the researchers, "In this study, cholinesterase activity was not predictive of neurophysiological function." However, researchers caution that these findings may not

apply to other settings, such as in developing countries or among pesticide mixers, loaders, or applicators, for which pesticide exposures may be substantially higher. 

*The Pacific Northwest Agricultural Safety and Health Center, funded by NIOSH, is one of eight such centers in the United States. The Center's mandate is to study occupational health and safety issues in farming, forestry and fishing in the four Region X states of Idaho, Washington, Oregon and Alaska. Dr. Richard Fenske is the Center Director, Dr. Matthew Keifer is Co-Director, and Sharon Morris is Associate Director. Adrienne Hidy is the Center's Administrator.*

*This article was prepared by Norm Herdrich, PNASH Outreach Coordinator. To obtain additional information, contact him at [normh@u.washington.edu](mailto:normh@u.washington.edu) or (509) 926-1704.*

### The researchers involved in this study were:

Lawrence S. Engel, Department of Epidemiology  
University of Washington (UW)

Harvey Checkoway, faculty member in the UW departments  
of Epidemiology and Environmental Health

Lawrence R. Robinson, Department of Rehabilitation Medicine  
Harborview Medical Center, Seattle

Matthew Keifer, Associate Professor of Occupational and  
Internal Medicine from the departments of  
Medicine and Environmental Health, UW,  
and co-director of PNASH

Thomas L. Vaughan, Division of Public Health Sciences  
Fred Hutchinson Cancer Research Center  
and Department of Epidemiology, UW

## Pesticide Training Courses Scheduled

Washington State University annually conducts pre-license training for pesticide applicators, consultants, and dealers. Washington State Department of Agriculture offers exams at the end of the training sessions. The university also offers recertification courses, which provide 6 credits per day of training, or 3 for half a day. The registration fee for either type of course is \$30 per day early (postmarked 14 days prior to the program), otherwise \$45 per day. For information contact Cooperative Extension Conferences at (509) 335-2830 or [pest@cahe.wsu.edu](mailto:pest@cahe.wsu.edu). Information is also available on-line at <http://pep.wsu.edu>. A few dates remain on this spring's schedule; watch this newsletter or the web page for future training dates.

**Pre-license Training**  
Puyallup  
March 23–25

**Recertification Course**  
Seattle  
March 4 & 5

**Specialty Workshop**  
Landscape Insects  
Bellingham, March 12

# Spinosad: A Lethal Brew for Pest Insects

Dr. Doug Walsh, Agrichemical & Environmental Education Specialist, WSU

Many of us can tip our cup to those historic pioneers who, through trial and error (and many a morning headache), developed fermentation to the practice and science of today. Besides providing a pleasant diversion, fermentation contributes significantly to the economic vitality of Washington State via the hop and wine grape industries.

Be aware that not all fermentation products are brewed to fill mugs, steins or glasses for human consumption. Microbiologists at Dow AgroSciences have developed and are currently fermenting a new class of biological insecticides collectively classified as spinosyns. Spinosyns are metabolites of the actinomycete soil bacterium *Saccharopolyspora spinosa* (Mertz & Yao 1990). *S. spinosa* is an aerobic, gram-positive, non-acid-fast, non-motile, filamentous bacterium. In soil, *S. spinosa* differentiates into substrate and aerial hyphae. The substrate hyphae are the "business end" of the organism, feeding on organic matter in the soil, while the aerial hyphae are the reproductive structure exposed to the environment. The organism's name "spinosa" in Latin refers to the spiny appearance of the reproductive spores on the aerial hyphae (Thompson et al. 1997). In nature, *Saccharopolyspora spp.* compete in a microbiological biochemical arms race for resources against other soil scavengers.

"Brewers" at Dow AgroSciences feed *S. spinosa* a media of vegetable flours, oils, and sugars and the bacteria releases spinosyns as an exotoxin. Most of the insecticidal activity from fermentation of *S. spinosa* (Figure 1) is produced from a combination of spinosyn A and spinosyn D (Boeck et al. 1990). Collectively they have been assigned the common name "spinosad."

When a susceptible insect imbibes a bit too much spinosad, it doesn't get a DUI, it winds up DOA. As with many other commercial insecticides, the actual mode of action of spinosad is poorly understood. However, results of laboratory tests indicate that spinosad depolarizes insect neurons by activating nicotinic receptors (Salgado 1997). This results in generalized nervous system hyperactivity and leads to involuntary muscle contractions and tremors. Spinosad-treated insects can also exhibit other symptoms of excitation including wing beating and abdominal bloating caused by swallowing air. Following a period of extended excitation, death results from neuromuscular fatigue.

Biologically derived products like spinosad cut to the center of an ongoing entomological/ecological debate. Classic biocontrol specialists conclude that spraying a biologically derived fermentation exotoxin is not

"biocontrol" in the same sense of direct ecological phenomena like predation, parasitism, or infection. Applied insect toxicologists tend to broaden the definition for biocontrol to include phenomena like pest mortality resulting from exposure to biologically derived toxins.

Spinosad is remarkably selective in the range of organisms it poisons (Bret

et al. 1997). Commercial pest control products available in Washington State containing spinosad have been developed and registered primarily to suppress pest insects from several insect orders including the Lepidoptera (caterpillars/worms) and Diptera (flies/maggots, mosquitoes). A partial list of these insects is shown in Table 1. Other laboratory and field studies have demonstrated that spinosad can also suppress pest species within the Thysanoptera (thrips) and Coleoptera (beetles) orders (Bret et al. 1997). Spinosad is toxic to Hymenopterans (bees and

...continued on next page

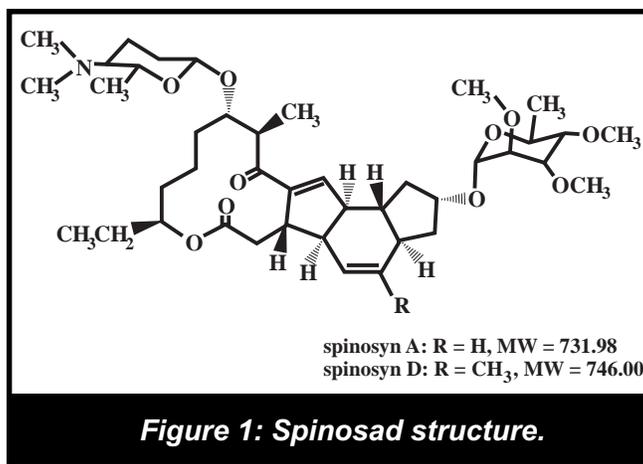


Figure 1: Spinosad structure.

## ...Spinosad, cont.

Dr. Doug Walsh, Agrichemical &amp; Environmental Education Specialist, WSU

**Table 1: Partial list of pest insects controlled by spinosad**  
(Source: PICOL 1999)

APPLE PANDEMIS  
ARMYWORM  
BAGWORM  
BEET ARMYWORM  
CABBAGE LOOPER  
COLORADO POTATO BEETLE  
CUTWORM  
DIAMONDBACK MOTH  
DIPTEROUS LEAFMINER  
EUROPEAN CORN BORER  
FALL WEBWORM  
FALL ARMYWORM  
FLEA  
GYPSY MOTH  
HORNWORM  
IMPORTED CABBAGEWORM  
LEAFROLLER  
MIDGE  
OBLIQUE BANDED LEAFROLLER  
SAWFLY  
SOD WEBWORM  
TENT CATERPILLAR  
THRIPS  
TOMATO FRUITWORM  
TOMATO PINWORM  
TUSOCK MOTH  
YELLOWNECKED CATERPILLAR

**Table 2a: Crops on which spinosad is registered in Washington State.**  
(See label for application parameters)

APPLE  
BROCCOLI  
BRUSSELS SPROUT  
CABBAGE  
CAULIFLOWER  
CELERY  
CHINESE BROCCOLI  
CHINESE CABBAGE  
COLLARD  
DANDELION  
EGGPLANT  
ENDIVE  
FENNEL  
KALE  
KOHLRABI  
LETTUCE  
MUSTARD  
ORNAMENTALS  
PARSLEY  
PEPPER  
RHUBARB  
SPINACH  
SWISS CHARD  
TOMATILLO  
TOMATO  
TURFGRASS  
WATERMELON

**Table 2b. IR-4 spinosad projects pending, in process, or submitted to EPA**

BASIL  
BEANS (DRY)  
CHIVES  
CHERRY  
GRAPES  
LIME  
MINT  
MUSTARD GREENS  
ONION (DRY BULB)  
ONION (GREEN)  
PEACH  
PEANUT  
PEAR  
STRAWBERRY  
TURNIP  
TURNIP GREENS  
WATER CRESS

wasps) but is much less disruptive to honeybees and Hymenopteran parasitoids than many pyrethroid, carbamate, and organophosphate insecticides currently applied for pest control in production agriculture (Bisabri 1998).

EPA has categorized spinosad as a reduced risk biopesticide. Full registrations of commercial products have been granted on specific crops in the Pacific Northwest (Table 2a), and the Interregional Research Project Number 4 (IR-4) program is developing the data required for registration of spinosad for other minor crop uses (Table 2b, page 14). Because spinosad is selective in the range of organisms it kills, and is nontoxic to mammals and other non-target organisms at field doses it has a better chance for registration in today's regulatory environment. Spinosad offers effective pest control with high margins of

safety for pesticide applicators, farm workers, birds, fish, and aquatic invertebrates. Spinosad has great potential as a crop protection tool in many agroecosystems where softer chemistries are sought (Brunner & Bisabri 1998).

I tip my cup to the researchers at Dow AgroSciences and affiliated laboratories for discovering spinosad and for developing it as a commercial product. However, I prefer to partake from the more traditional fermentation products of the Yakima Valley and leave the spinosad for the bugs. 🍎

*Dr. Doug Walsh is the Agrichemical & Environmental Education Specialist at WSU's Irrigated Agriculture Research & Extension Center in Prosser. He can be reached at [dwalsh@tricity.wsu.edu](mailto:dwalsh@tricity.wsu.edu) or (509) 786-9287.*

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## CTAG Report Now Available On-Line

In last month's issue of *AENews*, Carol Ramsay, WSU Extension Pesticide Education Coordinator, explained the current move toward standardizing pesticide safety education, certification, and training programs ("C&T programs") in various states. The Certification and Training Assessment Group (CTAG) was formed to facilitate this process. Their preliminary report has been released, and can be seen on the Internet at

<http://aapse.ext.vt.edu/ctag/index.html>

The purpose of the preliminary report is to provide recommendations (ideas) for improving the certification and training programs (especially from a federal perspective). CTAG wants stakeholders to carefully consider the report and provide frank and candid comments on the its recommendations. CTAG will also solicit new ideas not contained in the report.

## National IR-4 Specialist on Board Soon

The National Interregional Research Project Number 4 (IR-4) is in the process of hiring an extension communications specialist. Working closely with IR-4 headquarters at Rutgers University in New Jersey, this individual will interface with state IR-4 liaisons and minor crop constituents with the goal of providing effective communication on IR-4 programs and minor crop issues. The new hire will be housed at Michigan State University.

IR-4 is a national program for registration of pesticides and biopesticides for use on minor crops. This process involves field trials and residue analyses.

The new position was created to facilitate education about IR-4 and raise its visibility to affected groups (growers, commodity organizations, university/extension personnel, industry). The initial application deadline was February 15, 1999, so the new hire should be on board early this spring. The position is full-time and temporary, lasting one year from date of hire. Continued funding and positive response to the position may extend its duration.

Questions about IR-4 may be answered by accessing its website at, <http://deal.unl.edu/pesticide/>. Washington State's IR-4 liaison is Dr. Doug Walsh, [dwalsh@tricity.wsu.edu](mailto:dwalsh@tricity.wsu.edu) or (509) 786-9287.

# The Lasting Legacy of Lead Arsenate

Dr. Allan S. Felsot, Environmental Toxicologist, WSU

With passage of the Food Quality Protection Act and consequent rumors of cancellation of certain pesticides, one would think we face a national health crisis as a result of modern crop protection technology. Perhaps we yearn for the good old days. In the good old days (prior to the 1950s), we doused our apples and numerous other crops with lead arsenate, innocent of the hazards of lead to children. Lead arsenate was finally banned in the 1960s, but its legacy lives on. In contrast to modern registered pesticides that break down within short periods into harmless substances, lead arsenate essentially remains unaltered in the topsoil.

***In the good old days, we doused our crops with lead arsenate...***

The chickens of "the good old days" came home to roost in Washington State last month with newspaper stories about carrots in a bag of mixed vegetables destined for market. Finding unacceptably high lead levels in the carrots, the Food & Drug Administration clamped an embargo on the product. Coming on the heels of last year's brouhaha over metals in fertilizers, the incident does not encourage confidence in food safety. But further investigation revealed the carrots were grown in a field that was formerly an old apple orchard. The fertilizer was fine, but the soil was contaminated by old residues of lead arsenate.

Washington State is spending a lot of money to study crop uptake of nonessential heavy metals, including lead, that might be in fertilizer. More money is being spent to analyze fertilizers and soils for dioxins, the collective term for a group of over 70 different highly chlorinated organic chemicals. All this activity was precipitated by a perception that some tainted fertilizer in Quincy, Washington, had injured some crops. Yet no evidence has been turned up to validate these perceptions. Indeed, the courts have thrown out any lawsuits related to land contamination

by fertilizers. Concerning dioxins, we now know these compounds are naturally produced in combustion process, have been around for a long time, and are ubiquitously distributed throughout the environment at unimaginably minuscule levels (see *AENews* Issue No. 142, February 1998, "An Update on Metals in Fertilizer," and Issue No. 152, December 1998, "Digging for Dioxins").

In contrast to the phantom hazards of metals and dioxins in soils resulting from the use of fertilizers, lead arsenate poses a reality-based concern. Lead arsenate was used heavily in our state and what little data we have tells us it remains in our soils at extremely high levels. As old orchard land is switched to other crops and to housing subdivisions, the prospect of lead uptake by plants is real. Yet the scientific literature provides very little information that allows us to make a proper assessment of hazards, especially to consumers with backyard gardens. Judging by the number of phone calls I received following the leaded carrots story, people are a lot more concerned about eating veg-

etables from their gardens that may contain lead than they are about modern pesticide residues, dioxins, and metals in fertilizer.

With limited resources for solving problems that might cause harm, priority should be given to areas of excessively high con-

tamination rather than to background levels of naturally occurring substances. The state, and the consumer public, would be better served by conducting a proper assessment of old lead arsenate contamination rather than wasting its money on needles in a haystack.

*Dr. Allan S. Felsot is an Environmental Toxicologist with WSU. He can be reached at (509) 372-7365 or [afelsot@tricity.wsu.edu](mailto:afelsot@tricity.wsu.edu)*



# Free Secret Decoder Ring Inside!

Dr. Carol Weisskopf, Analytical Chemist, WSU

After all the mystery, the leaks, and the cloak-and-dagger, the new EPA consumer brochure has been released. For those who haven't yet seen it, a copy is enclosed for your reading pleasure (if someone got to this issue before you, check out the on-line version at <http://www.epa.gov/pesticides/food/>). EPA did not tread the fine line between those who consider pesticide-treated food as toxic waste and those who never met a pesticide they didn't like; EPA placed itself firmly on the mesa of innocuousness. Pathogens as well as pesticides are described as a reason for washing food. The language extolling the virtues of organic produce is considerably muted from previous drafts. Concerns regarding increased sensitivity of children to adverse effects from pesticide exposure are mentioned. It acknowledges, without being alarming, that many foods have detectable pesticide residues.

The brochure is not particularly helpful for those who have not already decided how they feel about pesticides in food. Perhaps to make up for lack of content, URLs (web addresses) for additional and equally benign information on regulation of pesticides, tolerances, children's sensitivity, IPM and organic practices are given. For non-webheads, EPA, USDA, FDA and the National Pesticide Telecommunications Network toll-free telephone numbers are also given.

If consumers decide to browse the Internet, they can find extraordinary volumes of information regarding pesticides in food ranging from the sublime to the ridiculous. Our own newsletter has dealt extensively with these issues. Of particular pertinence is Allan Felsot's article "Pesticides, Children, and the FQPA" (Issue No. 153, January 1999) and my series on detections, residues, and tolerances (including "Now You See It, Now You Don't," Issue No. 148, August 1998; "Detection Limits and the FQPA: How Low Can You Go?" Issue No. 140, October 1998; "Free? Unlikely," Issue No. 152, December 1998; and "No Detected Pesticide Residues®," Issue No. 154, February 1999). (Ed. Note: These issues can be accessed from our on-line index at [www2.tricity.wsu.edu/aenews/](http://www2.tricity.wsu.edu/aenews/).)

In a no-win situation, bland is best. Perhaps FQPA's consumer right-to-know mandate could have been met with a sticker on the market door (like the one about alcohol):

**Eat your veggies.  
Wash your food.  
Good luck on the rest.**

Dr. Carol Weisskopf, Analytical Chemist and Laboratory Research Director for WSU's Food & Environmental Quality Lab, can be reached at [cpw@owt.com](mailto:cpw@owt.com) or (509) 372-7464.

## PNN Update

Jane M. Thomas, Pesticide Notification Network Coordinator, WSU

The PNN is operated by WSU's Pesticide Information Center for the Washington State Commission on Pesticide Registration. The system is designed to distribute pesticide registration and label change information to groups representing Washington's pesticide users. The material below is a summary of the information distributed on the PNN in the past month.

Our office operates a web page called PICOL (Pesticide Information Center On-Line). This provides a label database, status on registrations and other related information. PICOL can be accessed on URL <http://picol.cahe.wsu.edu> or call our office, (509) 372-7492, for more information.

### Federal Issues

#### Label Changes

Dow has revised the label for its herbicide Treflan TR-10. The label changes include:

- Removing wild oat from the list of controlled weeds.
- Deleting use directions for forage legumes (alfalfa use directions remain in effect).
- Adding dry bulb onion use directions.
- **Deleting potato use directions.**

...continued on next page

## ...PNN Update, cont.

Jane M. Thomas, Pesticide Notification Network Coordinator, WSU

### **Supplemental Labels and Use Recommendations**

Dow has issued another supplemental label for its herbicide Treflan TR-10. This labeling provides directions for preplant incorporation of Treflan TR-10 for preemergent control of weeds in direct seeded alfalfa.

Dow has issued revisions to two supplemental labels previously issued for Treflan HFP. The supplemental labels allow for weed control in eggplant and for preplant incorporation in direct seeded Chinese cabbage and kohlrabi. The revised supplemental labels now include precautions stating that eggplant, Chinese cabbage, and kohlrabi tolerance to Treflan HFP is marginal and the labels list cultural practices and application directions to follow for best results.

Du Pont has issued a supplemental label for its insecticide Asana XL. The supplemental label provides directions for use on sugarbeets.

Du Pont has issued a supplemental label for its fungicide Benlate SP. The supplemental label provides use direction for the control of Swiss needle case disease in Douglas-fir plantations.

Du Pont has revised all of its previously issued Assure II supplemental labels for post emergence grass control in lentils, canola and crambe, beans, sugarbeets, and peas. All have been revised to allow for higher application rates for annual and perennial grass control and to add a precaution about applying Assure II to crops under stress. In addition, the supplemental label previously issued only for use on dry peas has been revised and now includes use directions for succulent peas.

### **Miscellaneous Regulatory Information**

In the December 16 Federal Register, EPA announced that the Reregistration Eligibility Decision (RED) for dicofol was available for review and comment. Major provision of the risk mitigation measures proposed by EPA are as follows:

■ All residential uses have been eliminated from labels and will be voluntarily canceled.

- Mixers/loaders/applicators must wear additional personal protective equipment (PPE), and use enclosed cabs and cockpits.
- All wettable powder formulations produced after December 31, 1998 must be placed in water soluble packaging.
- Application with handheld equipment is eliminated for liquid formulations.
- Liquid formulations produced after December 31, 1998 must bear labeling requiring closed mixing systems for dry beans.
- A revised Restricted Entry Interval (REI) will be set, based on Dislodgeable Foliar Residue (DFR) data submitted in October, 1998, and on the dermal toxicity study being submitted in December, 1998.
- Dicofol applications are limited to no more than one per year. Previously, for some uses, the number of applications was either unrestricted or limited to 2 or 3 applications per year.
- Dicofol applications on strawberries will not exceed 2 lbs/ai/A per year. This has been reduced from 2.4 lbs/ai/A per year.
- A spray drift and Runoff Caution Statement is being added to the label. Also, a statement prohibiting application directly to water is being added to the label.

Additionally, as a result of previous agreements with the registrants, applications will not exceed:

- 3 lbs/ai/A for apples and pears (reduced from 4 lbs/ai/A);
- 2 lbs/ai/A for pecans and walnuts (reduced from 4 lbs/ai/A);
- 1.3 lbs/ai/A for grapes (reduced from 1.5 lbs/ai/A);
- 0.6 lbs/ai/A for cucurbits (reduced from 1.5 lbs/ai/A);

...continued on next page

## ...PNN Update, cont.

**Jane M. Thomas, Pesticide Notification Network Coordinator, WSU**

- 0.75 lbs/ai/A for tomatoes and peppers (reduced from 0.8 lbs/ai/A);
- 1.5 lbs/ai/A for stonefruits;
- 1.5 lbs/ai/A for beans; and
- 0.55 lbs/ai/A for nonresidential lawns and ornamentals.

Dicofol is the active ingredient in 10 products currently registered in Washington. The commercial products are Dicofol 4EC and various Kelthane formulations. The homeowner products are Greenlight Red Spider Spray and High Yield Kelthane Spray. Dicofol is registered for use on the following PNN-related sites: Apple, bean, blackberry, cantaloupe, Christmas tree plantation, crabapple, cucumber, cucurbit, filbert, flower, grape, greenhouse nursery, greenhouse ornamental, hop, lima bean, melon, mint, nursery, ornamental, ornamental tree, pear, pepper, pumpkin, quince, raspberry, squash, strawberry, tomato, turf, walnut, and watermelon.

In the December 16 Federal Register, EPA announced that the RED for triclopyr was available for review and comment. Major provision of the risk mitigation measures proposed by EPA are as follows:

- The maximum application rate permitted on pasture and rangeland and all other sites where cattle can be grazed will be 1 lb/ae/A per year; for forestry applications the maximum will be 6 lbs/ae/A; for all other sites the maximum allowed rate will be 8 lbs/ae/A for the butoxyethyl ester (BEE) formulation and 9 lbs/ae/A for the triethylamine salt (TEA).
- Labels must include best management practices for spray drift.
- A label statement warning users of the potential of triclopyr to leach to ground water in certain situations is required.
- A restriction against grazing lactating dairy animals until the following season is required. All conflict-

ing grazing instructions must be removed. Labels must specify a 14 day preharvest interval (PHI) for grass hay, and retain the existing pre-slaughter interval of 3 days.

- An REI of 48 hours for triclopyr TEA, and 12 hours for triclopyr BEE is established for uses within the scope of the Worker Protection Standard; early entry PPE consisting of coveralls, chemical resistant gloves, protective eyewear—for TEA formulations, and shoes+sox) is required.

- Homeowner reentry is restricted until sprays have dried and dusts have settled.

Triclopyr is the active ingredient in Access, Confront, Cool Power, Crossbow, Garlon 4, Horsepower, Pathfinder II, Redeem and the Turflon products. It is registered for commercial use on the following PNN-related sites: Christmas tree plantation, CRP lands, ditch bank, fence row, farm building area around, forest, forest conifer release/site preparation, golf course, grass, grass hay, industrial site, lawn, noncrop agricultural area, noncrop non-agricultural area, pasture, rangeland, rights-of-way, recreation area, and turf.

In the December 16 Federal Register, EPA announced that the RED for propachlor was available for review and comment. In Washington propachlor is registered for use as Monsanto's Ramrod Flowable Herbicide and is registered for use on corn seed crops, field corn, sorghum, and onion seed (via an SLN).

Because EPA had concerns for the occupational risk to mixers and loaders of the dry flowables, the registrant has agreed to voluntarily cancel their formulation of the dry flowable product. Note that the product registered for use in Washington is a liquid formulation.

In addition, EPA is requiring that propachlor labeling now include the following:

- Ground water, surface water, spray drift, and skin sensitization advisory language must be placed on all propachlor labels.

## ...PNN Update, cont.

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- Advisory statement for the Environmental Hazards of toxicity to terrestrial and aquatic plants, fish and aquatic invertebrates for both manufacturing use and end use products.
- Advisory statement for toxicity to non-target organisms for granular products.
- The PPE for mixers/loaders for all liquid products must include chemical resistant gloves.
- The PPE for mixers/loaders of granular products must include: long-sleeved shirt, long pants, chemical-resistant apron, chemical resistant footwear, chemical resistant gloves.
- PPE for applicators for all propachlor granular products must include: long-sleeved shirt, long pants, chemical resistant apron, chemical resistant footwear, chemical resistant gloves.
- Labels referring to the engineering controls for application of all liquid formulations must specify a closed system.
- Labels for all products must contain User Safety Requirements for the cleaning and maintenance of Personal Protective Equipment.
- An Environmental Hazard Statement for granular formulations must be included requiring that spilled granules must be covered or incorporated.
- Rotational crop label amendment stating that only crops for which there are registered propachlor uses may be rotated to treated fields.
- A 48 hour REI is required based on the acute toxicity of the active ingredient. The PPE required for early entry is protective eyewear.

In the December 16 Federal Register, EPA announced that the RED for dichlobenil was available for review and comment. In Washington, commercial dichlobenil products are registered for use on the following crops/usage sites: apple, asphalt/cement,

blackberry, blueberry, building adjacent area, cherry, cranberry, deciduous/shade tree, evergreen tree, farm building area around, fencerow, filbert, forest, forest nursery/seed orchard, grape, impounded water, industrial site, nectarine, non-bearing apple, non-bearing berry, non-bearing cherry, non-bearing filbert, non-bearing grape, non-bearing nectarine, non-bearing peach, non-bearing pear, non-bearing plum, non-bearing prune, nursery, ornamental, ornamental tree, peach, pear, plum, prune, raspberry, recreation area, right-of-way, rose, sewer, and shrub.

In the RED, EPA announced it is requiring the following risk mitigation measures for continued dichlobenil registration:

- Ground water advisory.
- Application rate reduction to 10 lbs/ai/A.
- Soil incorporation of 10% Granular formulation.
- Soil incorporation of granular formulations applied to ground in liners in which ornamental stock placed.
- Ventilation requirements for application of sewer products in inhabited buildings.
- Reentry Interval of 24 hours for horticultural/nursery use sites, unless the product is soil incorporated or soil injected.
- Restricted entry until granules are thoroughly watered in and treated soil has dried for uses on ornamentals, residential and commercial landscaping, and all products intended primarily for home use.
- Changes to various PPE requirements.

In the January 13, 1999, Federal Register, EPA announced that the RED for bromoxynil is available for review and comment with written comments due to EPA by March 15, 1999.

In Washington, bromoxynil is registered for use as Broclean, Bromac, Bromox, Bronate, Butracil, and Moxy 2E and is labeled for use on the following sites:

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## ...PNN Update, cont.

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alfalfa, alfalfa seed, barley, brassica seed crops, CRP lands, corn, flax, garlic, grass, grass hay, grass seed, mint, oat, onion, rye, sorghum, triticale, turf, and wheat.

In the RED, EPA is requiring two changes the effect use of this pesticide in Washington. First, handlers of bromoxynil products must wear chemical resistant gloves and aprons. Second, EPA is establishing a 26 day REI for turf grown on sod farms.

### **State Issues**

#### **New Registrations**

WSDA has registered Dow's insecticide Success for use. This product is registered for use on the following PNN-related sites: apple, broccoli, Brussels sprout, cabbage, cauliflower, celery, Chinese broccoli, Chinese cabbage, collard, dandelion, eggplant, endive, fennel, kale, kohlrabi, lettuce, mustard, parsley, pepper, rhubarb, spinach, Swiss chard, tomatillo, tomato, and watermelon.

WSDA has registered Du Pont's fungicide Curzate 60DF for use. The fungicide is labeled for late blight control in potatoes.

#### **Section 24c Registrations**

WSDA has issued a new SLN and revised to two others all providing for the use of Imidan products on blueberries to control blueberry maggots and leafrollers. Both existing SLN's, WA-950015A for the use of Imidan 70WP and WA-950016 for Imidan 70WSP, were revised via the addition of a pollinator protection statement and the deletion of the expiration date. A new SLN, WA-950015B, was also issued for the same type of use of Imidan 70W.

#### **Section 24c Cancellations**

WSDA has issued a letter canceling SLN WA-940003. This SLN was previously issued for the use of Lorsban 4E to control cutworms in non-bearing grapes. While no reason was given for the cancellation, note that SLN WA-970008 also provides for the use of Lorsban 4E to control both cutworms and mealybugs in grapes.

WSDA has issued a letter canceling SLN WA-800030. This SLN was previously issued for the use of Dow's Treflan EC for weed control at layby in onions. While no reason was given for the cancellation, note that the Section 3 main label now includes directions for use of this product on dry bulb onions.

WSDA has issued a letter canceling the following SLN's: WA-950011 and WA-950012 for the use of Imidan 70WP and Imidan 70WSB for the control of European pine shoot moth in pine trees, and WA-950013 and WA-950014 for the use of Imidan 70WP and Imidan 70WSB to control insects in shade and ornamental trees. The SLN's are being cancelled by Gowan because these uses have been added to the Section 3 main label either via the issuance of a supplemental label or via a label revision.

WSDA has issued a letter canceling SLN WA-950018. This SLN was previously issued for the use of Cryolite Bait (EPA# 10163-41) to control black vine weevils in cranberries. The SLN is being cancelled because Gowan has added these use directions to the label for Gowan Cryolite Bait (EPA# 10163-225).

#### **Section 24c Revisions**

On December 17, 1998, WSDA issued revisions to two SLN's that provide for the use of Vineland Formaldehyde Solution on daffodil and iris bulbs. The two SLN's are: WA-980006 issued to Holland America Bulb Farms, and WA-980007 issued to the LeFeber Bulb Company. The expiration dates have been removed from both SLN's and each now carries a statement saying that the SLN must be in the possession of the user at the time of the application.

WSDA has issued a revision to SLN WA-980001. This SLN was previously issued to Gowan for the use of its Cryolite Bait to control weevils on blueberries, raspberries, and strawberries. The revision is limited to the removal of the expiration date.

WSDA had issued revisions to two SLN's previously issued to Gowan for the use of its insecticide Metasystox-R. SLN WA-950005 provides for use to

## ...PNN Update, cont.

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control aphids and leafminers on Christmas trees and field grown nursery stock. WA-950004 allows for use to control aphids on strawberries. The revisions included removing the expiration dates from both SLN's.

WSDA has issued revisions to two SLN's previously issued for the use of Sencor DF. The SLN's are WA-930003 for use on tall fescue and bluegrass seed crops and WA-940041 for use on timothy hay. Both SLN's now carry a statement requiring that applicators follow all applicable directions and precautions on the Sencor DF main label.

### **Miscellaneous Regulatory Information**

Detectable residues of the slug/snail bait metaldehyde were observed in recent tests. Prior to these tests it was assumed that metaldehyde would not leave detectable residues. However, the rates used for these tests were far in excess of typical field applications. Metaldehyde's registrant, Lonza, has made a request to EPA that the tests be redesigned and rerun at more realistic rates. Should EPA decline this request, Lonza has stated it will only support use on leafy Brassica vegetables, tomato, citrus, artichoke, and strawberry.

If EPA denies Lonza's request further residue testing will be required to retain metaldehyde for use on the crops not supported by Lonza. IR-4 is requesting that individuals or groups wanting to retain metaldehyde for use on nonsupported crops submit Pesticide Clearance Request Forms (PCR) to develop supportive residue data. The contact person for the PCR forms is the Washington IR-4 representative, Doug Walsh. He may be reached at: Doug Walsh, State Liaison IR-4 Project; Agrichemical and Environmental Education Specialist, Food and Environmental Quality Laboratory; Washington State University, Prosser; 24106 N. Bunn Rd.; Prosser, WA, 99350 Phone: 509-786-9287; Fax: 509-786-9370; E-mail: [dwalsh@tricity.wsu.edu](mailto:dwalsh@tricity.wsu.edu)

Metaldehyde is currently registered for commercial use on the following crops: alfalfa, alfalfa seed, apple, apricot, asparagus, barley, barley seed, bean,

bean seed, beet, beet seed, blackberry, blueberry, boysenberry, broccoli, Brussels sprout, buckwheat, bulb, cabbage, cabbage seed, carrot, carrot seed, cauliflower, celery, cherry, clover, clover seed, collard, collard seed, corn, corn seed, cucumber, currant, dill, dewberry, eggplant, flower, flower seed, garlic, ginseng, gooseberry, grape, grass, grass hay, grass seed, greenhouse, various greenhouse vegetable crops, herb, horseradish, kale, kale seed, kohlrabi, kohlrabi seed, leek, lentil, lentil seed, loganberry, melon, millet, mint, mustard, mustard seed, nectarine, nursery, oat, oat seed, okra, onion, orchard floor, ornamental, parsley, parsnip, pea, pea seed, peach, pear, pepper, plum, pimento, potato, potato seed, prune, pumpkin, radish, radish seed, raspberry, rhubarb, rose, rutabaga, rye, shallot, sorghum, soybean, spinach, spinach seed, squash, sweet potato, Swiss chard, Swiss chard seed, triticale, turnip, turnip seed, walnut, watermelon, wheat, and wheat seed.

WSDA has issued a preproposal notification for chapter 17.21 RCW: Washington Pesticide Application Act. WSDA is soliciting input on a proposal that would require orchard managers to remove all bloom on the orchard floors and from surrounding areas prior to applying pesticides with residual activity. According to Eric Johansen, WSDA's intent would be to require bloom removal when insecticides with a long residual activity (1 day or greater) are to be applied. The purpose of issuing this preproposal notice is to get feedback from interested parties on this idea for enhanced pollinator protection. Note that because this is a preproposal notification (as opposed to a notice of proposed rulemaking), some details (the definition of surrounding area and specifics as to what pesticides this applies to) are missing. Questions may be addressed to Cliff Weed (360) 902-2036 or Erik Johansen (360) 902-2078.

On January 19, 1999, Abbott Labs reported to WSDA a total of 16 incidents of fruit spotting following the use of their product Retain Plant Growth Regulator. Abbott believes that all of the incidents occurred when high rates of organosilicone surfactant were used in conjunction with extreme heat.



# Tolerance Information

Jane M. Thomas, Pesticide Notification Network Coordinator, WSU

Tolerance Information						
Chemical (type)	Federal Register	Tolerance (ppm)	Commodity (raw)	Time-Limited		
				Yes/No	New/Extension	Expiration Date
copper-ethylenediamine complex	1/4/99 page 41	exempt	potato	No	N/A	N/A
Comment: EPA had determined that when copper-ethylenediamine is used on potatoes in accordance with good agricultural practices as a desiccant/harvest aid this use is exempt from the requirement for a tolerance.						
picloram (herbicide)	1/5/99 page 418	4.00	aspirated grain fractions	Yes	New	12/31/00
			0.30 sorghum grain			
			0.20 sorghum grain, forage			
			0.50 sorghum grain, stover			
Comment: This tolerance is established for indirect or inadvertent residues of picloram resulting from use on barley, fallow cropland, oats, and heat.						
dicamba (herbicide)	1/6/99 page 759			No	N/A	N/A
new tolerances			2.00 barley, hay			
			3.00 field corn, forage and stover			
			3.00 popcorn, stover			
			5.00 cottonseed meal			
			125.00 grass (Crop Group 17), forage			
			200.00 grass (Crop Group 17), hay			
			80.00 oat, forage			
			20.00 oat, hay			
			80.00 wheat, forage			
			20.00 wheat, hay			
revised tolerances			5100.00 aspirated grain fractions			
			13.00 soybean hulls			
			6.00 barley grain			
			15.00 barley, straw			
			3.00 cottonseed			
			2.00 wheat grain			
			30.00 wheat, straw			
			4.00 asparagus			
			10.00 soybean seed (prev. grain)			
revoke - being replaced by Crop Group 17			40.00 grasses; hay, pasture, and rangeland			
tebuconazole (fungicide)	1/7/99 page 1132	5.00	grape	No	N/A	N/A
			8.00 grass, forage			
			25.00 grass, hay			
			55.00 grass, seed screenings			
			30.00 grass, straw			
			0.10 milk			
			0.20 cattle, goat, horse, and sheep mbp			
imidacloprid (insecticide)	1/20/99 page 3037	0.10	strawberries	Yes	New	6/30/00
			1.00 legume vegetables (Crop Group 6)			
Comment: These time-limited tolerances are being established in response to EPA granting Section 18's for the use of imidacloprid to control silverleaf whitefly in Florida legume vegetables and in California strawberries.						
propiconazole (fungicide)	1/20/99 page 2995	1.00	blueberries	Yes	New	12/31/99
			1.00 raspberries			
Comment: These time-limited tolerances are being established in response to EPA granting Section 18's for the use of propiconazole to control mummyberry on blueberries in various states and to control yellow rust in Oregon and Washington raspberries.						
diflufenzopyr (herbicide)	1/28/99 page 4301	0.05	field corn, forage, stover, and grain	No	N/A	N/A
azoxystrobin (fungicide)	1/29/99 page 4572	10.00	strawberries	Yes	New	7/30/00
Comment: This time-limited tolerance is being established in response to EPA granting a Section 18 for the use of azoxystrobin to control anthracnose on strawberries in Florida.						
fenbuconazole (fungicide)	1/29/99 page 4577	0.01	meat and mbp of cattle, goat, hogs, horse, and sheep	Yes	New	6/30/00
Comment: These time-limited tolerances are being established in response to a crisis exemption being granted for the use of fenbuconazole to control greasy spot on Florida grapefruit.						

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## ...Tolerance Information, cont.

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Tolerance Information						
Chemical (type)	Federal Register	Tolerance (ppm)	Commodity (raw)	Time-Limited		
				Yes/No	New/Extension	Expiration Date
lambda-cyhalothrin (insecticide)	1/29/99 page 4584	0.20	barley, bran	Yes	New	12/31/00
		0.05	barley, grain			
		2.00	barley, hay			
		2.00	barley, straw			
		0.10	canola, seed			
		0.10	flax, seed			
Comment: These time-limited tolerances are being established in response to several crisis exemptions being issued for the use of lambda-cyhalothrin to control grasshoppers in flax, Russian wheat aphid in barely, and for flea beetle control in canola.						

## Federal Register Excerpts

In reviewing the January postings in the Federal Register, we found the following items that may be of interest to the readers of *Agrichemical and Environmental News*.

In the January 4 Federal Register, EPA announced that the following documents are available for comment: "A User's Guide to Available OPP Information on Assessing Dietary (Food) Exposure to Pesticides," "Dietary (Drinking Water) Exposure Estimates," "Standard Operating Procedures (SOPs) for Residential Exposure Assessment," and "Framework for Assessing Non-Occupational, Non-Dietary (Residential) Exposure to Pesticides." In addition, EPA announced the availability of the National Pesticide Residue Data Base as well as Use and Usage Matrices for Organophosphates. Comments on the draft science policy papers should be submitted to EPA by March 5, 1999. (1/4/99 page 162)

In the January 8 Federal Register, EPA announced the availability of preliminary risk assessments for five organophosphates: acephate, disulfoton, methamidophos, oxydemethon methyl, and pirimiphos methyl. Comments on these documents should be submitted in writing on or before March 9, 1999. (1/8/99 page 1199)

In the January 13 Federal Register, EPA announced the availability of the RED for bromoxanil. Written comments on the RED must be submitted by March 15, 1999. (1/13/99 page 2216)

In the January 15 Federal Register, EPA announced that it had received a request from Bayer to terminate all registrations for its products containing isofenphos. Bayer is proposing a three-step, 12-month cancellation process. Written comments on this proposed action should be submitted to EPA on or before March 16, 1999. (1/15/99 page 2642)

In the January 15 Federal Register, EPA announced the availability of RED-related documents. These are the preliminary human health risk assessment for chlorethoxyfos and tetrachlorvinhos, the ecological risk assessment for azinphos methyl, and the human and ecological risk assessments for ethyl parathion, methidathion, phosmet, and propetemphos. Written comments on these assessments must be submitted on or before March 16, 1999. (1/15/99 page 2644)

In the January 22 Federal Register, EPA announced that it has granted requests from DuPont and Griffin to amend the terms of their cyanazine registrations to allow use at a maximum rate of 3.0 lbs/ai/A in 1999, in place of the 1.0 lbs/ai/A as currently required. EPA is granting this request in response to special weather conditions and does not anticipate that this will impact the original cancellation order that phases out cyanazine use by 2002. (1/22/99 page 3511)

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## ...Federal Register Excerpts, cont.

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In the January 28 Federal Register, EPA announced that it was withdrawing an order revoking tolerances for residues of cryolite on apricots, blackberries, boysenberries, dewberries, kale, loganberries, nectarines, and youngberries. This withdrawal is due to EPA inadvertently overlooking comments made by Gowan. The tolerances are being retained because Gowan was supporting the apricot and nectarine tolerances using peach data and the kale tolerance

using collard data. In addition IR-4 had filed an objection to the final rule because IR-4 had informed EPA that it supported cryolite use on blackberry, boysenberry, dewberry, loganberry and youngberry via data it was developing on raspberries. IR-4 plans to use the raspberry data to support a caneberry tolerance via a crop group approach. (1/28/99 page 4308) 