COOPERATIVE EXTENSION
Washington State University

Agrichemical and Environmental News

Agrichemical & Environmental News
Issue No. 151
November 1998
Page 1

In This Issue

For comments regarding the newsletter, please contact Catherine Daniels at the WSU Pesticide Information Center, 2710 University Drive, Richland, WA 99352-1671
Phone: 509-372-7495
Fax: 509-372-7460
E-mail: cdaniels@tricity.wsu.edu

The newsletter is available from the Internet via the Pesticide Information Center Web page at http://picol.cahe.wsu.edu

Anatomy of a Risk Assessment Under the FQPA: the Azinphosmethyl (Guthion) Case

Dr. Allan S. Felsot, Environmental Toxicologist, WSU

Before any pesticide is registered, the EPA must approve a tolerance for each crop use. A tolerance is the maximum amount of chemical residue legally permitted on or in the crop. The pesticide manufacturer or registrant proposes the tolerance based on the magnitude of residues at harvest. Before the Food Quality Protection Act (FQPA), the EPA validated a registrant's proposed tolerance guided by the mandate to "protect the public health." Residues in food were the sole consideration for determining public exposure to pesticides. The EPA could also balance the benefits of a specific pesticide use against any health risks.

The FQPA redefined a valid tolerance as one that would be safe. A safe tolerance ensures "a reasonable certainty that no harm will result from aggregate exposure." Aggregate exposure refers to exposure from residues in drinking water and residences in addition to food. The EPA has determined that approximately 80% of pesticide residue exposures come from food, 10% from drinking water, and 10% from residential use, which includes interior and exterior pest control applications.

The Road to Safety

Being reasonably certain that no harm will come from legally permitted pesticide residues is an expensive proposition. Manufacturers usually cite figures hovering around 70 million dollars to successfully register a pesticide. A significant portion of this money funds the experimental studies that provide the data EPA needs to validate a tolerance. The whole exercise is called a risk assessment.

Risk assessments for protection of human health have two components: toxicology and environmental chemistry. The toxicology portion involves experiments, usually with rodents and dogs, that define the relationship between dosage of the pesticide and measurable adverse effects. The environmental chemistry provides information about potential exposures. Analytical chemistry is employed to quantitate residues in food, water, air,

...continued on next page

…Azinphosmethyl (Guthion), cont.

and soil. The risk of harmful effects (or no effects) is a function of the pesticide dose (associated with effects) and the magnitude of exposure.

Toxicological Studies Determine Relationship Between Dose and Response

EPA requires over twenty different toxicology studies to determine the highest dose that causes no adverse effect (i.e., the No Observable Effect Level, NOEL). One reason that so many toxicological studies are required is that the NOEL may vary according to the route of exposure (i.e., dermal, oral, or inhalational), duration of exposure, and the species tested. The effects, which are also called endpoints, could range from outright signs of toxicity, e.g., vomiting, to subtle signs, e.g., weight loss. Effects may not be observable unless tissues are dissected or functional enzymes are measured. For example, the endpoint considered most predictive of organophosphate (OP) insecticide toxicity is inhibition of a group of enzymes called cholinesterases that are present in the brain, nerves, muscles, and blood. All signs and symptoms of OP insecticide poisoning are preceded by inhibition of these enzymes. Because inhibition of cholinesterases is the most sensitive endpoint caused by the lowest OP doses, it is used to establish the NOEL. *(See related article in this issue, pp. 12–14.)*

Two basic categories of studies are conducted: acute and chronic. Acute exposure studies administer single doses of a pesticide in patches attached to the skin, in the food or water, or in the air. The studies are short-term and the doses are usually high enough to cause serious adverse effects. Acute toxicity testing generates the LD_{50}, the dose lethal to 50% of the test organisms, usually rats or mice.

The chronic exposure studies are designed to determine the risk over a lifetime of exposures. Rats and/or dogs are fed different pesticide doses daily for 90 days, one year, and two years. Overt signs of toxicity are recorded during the study, and at the end the animals are sacrificed to measure enzyme activities and tissue pathologies.

The FQPA requires special attention be paid to the possibility that infants and children may have enhanced susceptibility to a pesticide compared to adults. This requirement is met by studying neurotoxicological, developmental, and reproductive effects. The neurotoxicological studies examine everything from effects on posture and gait to alterations in normal behavior. In the developmental studies, pregnant rats and newborns are fed different doses to determine potential abnormal growth and defects in organs and bones. The reproductive toxicology studies involve feeding adult rats different doses of pesticide, allowing them to mate, and then examining the viability of offspring and their potential for successful mating.

Environmental Chemistry Determines the Potential for Exposure

Monitoring the amounts of chemical residues in the environment is a fundamental activity of environmental chemistry and is essential for exposure assessment. Residues in food, water, air, and soil will be highly variable depending on environmental conditions during and after the application of a pesticide.

EPA is currently using mathematical simulation models to predict pesticide residues in water and air, but reliable models are not available to predict residues in food. Therefore, residues in food, especially after preparation by the consumer, would need to be measured for an accurate exposure assessment. Instead, EPA typically starts an assessment by assuming all residues are equal to the tolerance, which is always going to be much higher than actual residues. These unrealistic assumptions are modified when residue data from field studies are submitted by the registrant. EPA will also assume 100% treatment of all acreage of the crop for which a registration is requested, unless the actual number of acres treated is known.

The companion element to monitoring is determining quantities of specific foods eaten. The EPA obtains this information from the USDA National Food Consumption Surveys (NFCS). These surveys record the amounts of different foods eaten for up to three days by individuals of different ages. For exposures related to residential use of pesticides (e.g., termite and cockroach treatments, lawn and garden use), human behavior in and around the house help determine contact time with residues and the potential for the residues to be transferred to the skin or respired. EPA is especially interested in studies that simulate the play behavior of infants as they crawl around the house and touch various surfaces.

Combining the NOEL and the Exposure to Estimate Acute Exposure Risk

Actual exposure, which is expressed in the same units as the NOEL—micrograms of pesticide (μg) per kilogram of

Dr. Allan S. Felsot, Environmental Toxicologist, WSU

body weight (kg) per day (d)—is determined by multiplying the residues in food and water by the amounts consumed in a day. The result, micrograms of pesticide, is then divided by the body weight of different age classes. For example, a two-year-old child is assumed to weigh 10 kg and a male adult is assumed to weigh 70 kg.

EPA separately estimates the risk of harm from acute (single high-end) and chronic (average daily) exposure. For each type of exposure, the specific residue and food consumption inputs differ greatly and thus influence the risk assessment outcome. For the acute exposure risk, EPA first assumes that residues in food are at the level of the tolerance and all acres of crops are treated. This type of assessment is called the Theoretical Maximum Residue Contribution (TMRC). Alternatively, EPA can adjust the theoretical residue levels downward for already registered pesticides by factoring in the actual percentage of acres treated. The agency could also substitute the theoretical levels with the highest levels found in field trials. In a number of recently released OP risk assessments, EPA seems to rely solely on the TMRC method to generate food residue numbers.

Potential exposure to the high-end residues is estimated using the distribution of food intake available from the USDA NFCS. The NFCS represents over 90,000 individual dietary habits per day. The highest residue in each food item is multiplied by each of the 90,000 potential daily diets to yield a distribution of exposures for each classified age group. Statistical analysis of this distribution yields for the US population a high-end exposure that comprises 99.9% of all exposures.

To estimate the acute dietary and drinking water risk, EPA compares the highest theoretical level of exposure generated in the TMRC to the NOEL, usually measured in an acute exposure study. The NOEL is divided by the theoretical exposure to calculate a Margin of Exposure (MOE). If this MOE is greater than 100, then EPA will conclude that the theoretical acute exposure is of no concern. EPA will also factor in potential exposure in drinking water based on child (one liter per day) and adult (two liters per day) consumption patterns to determine if it significantly changes the MOE. Any residential exposure could also be incorporated into the MOE, but standard methods for obtaining these data are less developed than for food exposures.

Estimating Chronic Exposure Risk

Chronic exposure risks use average food consumption data and realistic food residue values, known as the anticipated residue concentrations (ARC). The average exposure is calculated and then compared to the reference dose (RfD). The RfD is actually the NOEL from chronic feeding studies divided by an uncertainty factor of 100, sometimes called a safety factor. The safety factor accounts for uncertainties in extrapolating the rat or dog NOEL to humans and in extrapolating effects from adults to children. If children are deemed to be more susceptible than adults, then up to an additional tenfold factor might be incorporated into the RfD calculation.

EPA feels that any exposure that does not exceed the RfD has a reasonable certainty of causing no harm over an individual's 70-year lifespan. If the MOE and RfD are exceeded for aggregate exposures, then EPA may require a registrant to mitigate the exposure. Mitigation could come in the form of lowering tolerances, changing maximum application rates, changing use practices, or in the case of occupational exposures, requiring certain protective garments.

The Azinphosmethyl (Guthion) Risk Assessment—Consumer Exposures

EPA has been focusing its post-FQPA risk assessments on already registered OP insecticides; it recently released preliminary re-registration eligibility decision documents (REDs) for sixteen compounds. The REDs represent the results of the risk assessment process employing the principles previously presented. In addition to answering the questions posed by the mandates of the FQPA, the REDs also include a risk assessment for workers. A preview of what might be expected for widely used OP insecticides is contained in the azinphosmethyl RED.

Azinphosmethyl, heavily used on apples and pears, represents a simple case for aggregate exposure assessment because the compound has no registered residential uses. Thus only exposures for food and water needed aggregation. Water exposures, however, were a tiny fraction of dietary exposure; aggregating them to calculate acute and chronic risk did not change EPA's conclusions.

In the RED, EPA first defined the NOELs used for acute and chronic dietary risk. The NOELs were based on the lowest dose causing statistically significant inhibition of blood cholinesterase. The acute NOEL could not be determined from the appropriate acute single dose study,

...continued on next page

…Azinphosmethyl (Guthion), cont.

but the lowest observed effect level (LOEL) was 1000 µg/kg/d. For calculation of the acute MOE risk, EPA applied a benchmark of 300 (instead of 100) to make up for the lack of a NOEL.

The NOEL for chronic risk was 150 µg/kg/d based on a one-year feeding study using dogs. The EPA concluded that children were not likely to be more susceptible to azinphosmethyl than were adults; thus, no extra safety factor was needed to calculate the RfD. Also, azinphosmethyl was negative in carcinogenicity tests. The RfD was calculated to be 1.5 µg/kg/d.

To estimate acute dietary risk, the EPA used the TMRC approach. As a result, the calculated MOEs, ranging from 3 for children to 17 for males older than 13 years, failed the test for safety. EPA concluded "azinphosmethyl in the diet represents a serious risk concern for acute exposure both for existing and proposed uses."

Azinphosmethyl passed the tests for chronic exposure risk with flying colors. Infant exposure was estimated to be 54% of the RfD, while exposure to the general population was only 13% of the RfD. EPA concluded there was no risk concern with average daily consumption of azinphosmethyl residues.

Azinphosmethyl and Worker Exposure

Risk to workers was projected for fourteen different applicator exposure scenarios (including mixing and handling) and for post-application activities (propping, thinning, harvesting). The NOELs from dermal and inhalation exposure studies were used to predict occupational risk. The resulting MOEs, aggregated for dermal and inhalation exposures, failed to meet the EPA safety benchmark, even when personnel protective equipment was used. Protective equipment was considered to be gloves and double layered clothing. Post-harvest activities, even with consideration of the current reentry intervals, all failed to meet the MOEs. EPA's detailed analysis of worker exposure will be discussed in a future issue of AENews

Reality Check—What Does It All Mean?

While consumer and worker exposures to azinphosmethyl are estimated to be below the NOEL for all scenarios, EPA becomes very concerned if MOE is not greater than 100. An MOE of 100 is equivalent to the RfD, and only chronic exposure meets this safety benchmark. One could argue that because occupational exposures are voluntary, an MOE greater than the NOEL but less than 100 is acceptable.

Exposures to consumers are involuntary, so the risk managers at EPA seem most comfortable with a very large MOE. It is clear from EPA's analysis, however, that unacceptable acute exposure resulted solely from use of unrealistic residue inputs. Granted, it seems logical to want to know how many consumers might be exposed to the highest possible level of pesticide residues on any one day. But the reality of potential exposure, as determined from USDA pesticide use surveys and food residue monitoring studies, definitively prove that 100% of all crop acres are not treated, and nearly 95% of crop samples contain residues less than 10% of the tolerance levels. Thus, failure to meet the 100-fold safety benchmark using unrealistic input data is overcome by the reality of the daily exposure, even considering high-end exposures.

The bottom line on resolving the issue of acute exposure risk is determining a realistic and appropriate high-end exposure. Industry has the power to affect a solution. In two words—MORE DATA.

"A synonym is a word you use when you can't spell the word you first thought of."
—Burt Bacharach

We at the PIC and FEQL have been blithely mixing our metaphors and generally playing havoc with the English language since early this summer with the departure of our former editor. We are VERY happy to report that we have a new editor on board, Sally O'Neal Coates, who has already taken us firmly in hand and steered us back on the right path. Sally can be reached at **(509) 372-7378** or **scoates@tricity.wsu.edu** should you have any questions about your newsletter subscription. Welcome Sally!

Pesticide Training Courses Scheduled

PLEASE NOTE:
Some dates changed since last newsletter

Pesticide pre-licensing and recertification courses will be conducted on the following dates. The registration fee for either type of course is $30 early (postmarked 14 days prior to the program), otherwise $45 per day. For information contact: Cooperative Extension Conferences: 509-335-2830 or pest@cahe.wsu.edu. Information is also available on-line at http://pep.wsu.edu. WSU Recertification Courses offer 6 credits per day.

1998 Recertification Programs

Eastern Washington		Western Washington	
Okanogan	November 3	Tacoma	November 19 & 20
Pasco	November 9 & 10		
Pasco (Spanish)	November 10		

1999 Recertification Programs

Eastern Washington		Western Washington	
Spokane	January 13 & 14	Vancouver & PCO Workshop	January 6 & 7
Yakima	January 21 & 22	Tacoma	January 13 & 14
Pasco	January 26 & 27	Edmonds	January 21 & 22
Moses Lake	January 28 & 29	Port Orchard	January 28 & 29
Pullman	February 3 & 4	Olympia	February 1 & 2
Wenatchee	February 17 & 18	Highline	February 4 & 5
Spokane (Agriculture)	February 19	Mt. Vernon	February 10 & 11
		Tacoma	February 24 & 25
		Seattle	March 4 & 5
		Bellingham Insect Workshop	March 12

Washington State University annually conducts pre-license training for pesticide applicators, consultants, and dealers. Washington State Department of Agriculture offers all exam categories at the end of the training. Anyone preparing for pesticide licensing exams will benefit from the training programs offered; however, this training will be most useful to those preparing for the following license exams: Weed Control (Agric., Turf & Ornamental, Rights-of-way); Private Applicator Exam; Insect and Disease Control (Agric., Turf & Ornamental); Dealer Manager Exam; Aquatic (January 26 in Pasco only); and Laws & Safety.

1999 Pre-License Programs

Eastern Washington		Western Washington	
Spokane	January 12, 13, 14	Vancouver	January 5, 6, 7
Yakima	January 20, 21, 22	Tacoma	January 12, 13, 14
Pasco	January 25, 26, 27	Mt. Vernon	February 9, 10, 11
Pullman	February 2, 3, 4	Tacoma	February 23, 24, 25
Wenatchee	February 16, 17, 18	Puyallup	March 23, 24, 25

New Dealer/Manager Training Programs Recognized in 1998 by Governor Gary Locke

1999 Dealer/Manager Programs

Richland	February 22	Wenatchee	February 24
Yakima	February 23	Spokane	February 25

1999 Specialty Workshops

PCO Workshop Vancouver	January 7	Landscape Insect Workshop Bellingham	March 12

First FEQL Advisory Board Meeting

The first meeting of the newly established Food and Environmental Quality Laboratory advisory board was held on September 22, 1998. Preparing for the event seemed a combination of anticipating the first visit by the in-laws (is the top of the refrigerator clean?) and getting ready for a blind date (what if we don't *like* each other?)

Board Composition

The composition of the board, as well as the requirement for its formation, is contained in the legislation that established the FEQL. The current board members, the legislated seat they fill (indicated in italics), and their affiliations are shown at the bottom of page 7.

The meeting got off to a rousing start with the unexpected presentation to the FEQL of an environmental excellence award by the Department of Ecology for our analytical work on dinoseb well water contamination (AENews, issue 146). The meeting continued more sedately along the lines of the planned agenda, with our primary goal to inform the board about FEQL personnel, history, activities, and aspirations.

Establishment of the FEQL

James Zuiches, Dean of the College of Agriculture and Home Economics, opened the meeting with a history of the events leading up to establishment of the FEQL. To enhance existing pesticide analytical and research facilities at Oregon State University and the University of Idaho, and to establish a facility at Washington State University, the three universities sought and obtained a large grant from the US Department of Agriculture. This grant provided funds for renovation of laboratory space at the WSU Tri-Cities campus, as well as for purchase of laboratory equipment and supplies. The Washington State legislature in turn provided funding for two faculty and three staff positions, with WSU providing funding for one additional faculty position as well as for one program administrator. The current faculty/program administrators are: Catherine Daniels, Pesticide Information Center administrator and state Pesticide Impact Assessment Program (PIAP) liaison; Allan Felsot, toxicology/environmental chemistry; Carol Weisskopf, laboratory research director; Doug Walsh, state IR-4 liaison/agrichemical and environmental issues; and Ron Wight, field research director for IR-4.

The legislation establishing the FEQL also established its responsibilities. These are: 1) Evaluating regional requirements for minor crop registration through the federal IR-4 program; 2) Providing a program for tracking the availability of effective pesticides for minor crops, minor uses, and emergency uses in this state; 3) Conducting studies on the fate of pesticides on crops and in the environment, including soil, air, and water; 4) Improving pesticide information and education programs; 5) Assisting federal and state agencies with questions regarding registration of pesticides which are deemed critical to crop production; and 6) Assisting in the registration of biopesticides, pheromones, and other alternative chemical and biological methods.

Past Year Activities and Accomplishments

Our activities to date have focused on establishing programs to ensure that these responsibilities are met. It was clear from the first advisory board meeting that one outcome of our interactions with the board will be an expansion of FEQL activities beyond the legislated boundaries as FEQL matures. The meeting continued with a presentation of activities and accomplishments over the past year, many of which have been reported in the AENews.

The Pesticide Notification Network (PNN), which is a program to provide information on pesticide registrations and label changes to users through primary contacts, is completing its second year of operations. The PNN has established contacts for 135 of the most important agriculture-related pesticide use sites (individual crops, roadside vegetation, or mosquito management, etc.) among 246 identified sites. Notifications are transmitted only to contacts representing groups affected by the change. In 1997, 424 notices were distributed via 8753 transmittals to contacts. Year-to-date notification total reported at the session was 200, in 2554 transmittals. (Ed. Note: Totals as of October 2, 1998, were 217 notifications in 2753 transmittals.)

Laboratory activities include completion of the fifth year of continuing research on atmospheric transport of sulfonylurea herbicides and the second year of a multi-year study of plant uptake, soil distribution, and crop residues of the insecticide imidacloprid applied to hops through drip irrigation. We also examined two herbi-

Dr. Carol Weisskopf, Analytical Chemist, WSU

cides used in cranberry production to determine whether reported poor efficacy was caused by enhanced biodegradation in bog soil. The lab completed five IR-4 registration projects and the field group completed twenty-five trials this year.

Our accomplishments also include more than fifty presentations to grower, consumer, pesticide applicator, and commercial groups about pesticide behavior, toxicology, chemical analysis, and other issues during the past year. The combined audience for these presentations was more than 5,000. We accounted for two percent of the grant revenue for the college, and somehow Allan Felsot and I managed to get eleven journal articles or book chapters written in our spare time. The AENews has 734 subscribers to the hard copy version, and the free-of-charge web version has had 5,391 hits in the past year. (Renew your hard copy version now! You will get twelve issues in 1999 for the same $15 that got you eleven issues in 1998. Such a deal! See p. 20.)

We are currently a little low on graduate students. This can be considered a success, as many recently graduated and obtained good positions in academia, industry, or government. It also indicates a deficiency in scheduling abilities, as all of mine ended up graduating within six months of each other.

Moving Forward

By the end of the first FEQL advisory board meeting, members had been informed, sometimes in excruciating detail, exactly who we are, what we do, and where we think we are headed. The next meeting, to be held sometime before the end of the year, will be the board's chance to determine who they are and what they will be doing. We look forward to the meeting with anticipation but less anxiety. Who cares what the top of the refrigerator looks like, and we already decided that we like them. Not bad for a first date.

FEQL Advisory Board

Donald Abbot
Washington State Department of Ecology

Dr. Wally Ewart
Marketer, Northwest Horticulture Council

Dr. Jeffrey Jenkins
Oregon laboratory
Oregon State University

Matthew Keifer
Human toxicologist/health professional knowledgeable in worker exposure to pesticides, University of Washington
PNW Agricultural Safety and Health Center

Dan Locke
Washington State Department of Labor and Industries

Scott McKinnie
Chemical and fertilizer industry
FarWest Fertilizer and Agrichemical Association

Dr. Gregg Möller
Idaho laboratory
University of Idaho, Holm Research Center

Dr. Paul Monihan
Farm labor, Yakima Valley Farm Workers Clinic

Barbara Morrissey
Washington State Department of Health

Laura Mrachek
Privately owned Washington analytical laboratory
Cascade Analytical, Inc.

Marilyn Perkins
Consumers, League of Women Voters of Washington

Royal Schoen
Washington State Department of Agriculture

Craig Smith
Food processors, NW Food Processors

John Wiskerchen
Federal regional pesticide laboratory
US Food and Drug Administration

Dr. James Zuiches
WSU research administrator
Dean, College of Agriculture and Home Economics

Study Finds Risks Low for Careful Users of Organophosphate Pesticides

As most farmers, dealers, applicators, and others who handle agricultural chemicals know, many pesticides, especially insecticides, are toxic to the nervous system. Some of the most potent of these are methyl parathion and other organophosphates (OP). Acute overexposure to these chemicals can cause fatigue, headache, nausea, blurry vision, tremor, confusion, and, in very severe cases, coma and death. In certification classes in Washington, applicators are taught that a single drop of concentrated methyl parathion in a person's eye can be fatal.

Studies have also found that some people who recover from the initial symptoms of acute organophosphate poisoning appear to have measurable deficiencies in motor skills and changes in personality traits compared to people who have not been exposed to high levels of these pesticides. What was not known, however, was whether long-term, low-level exposure to organophosphate pesticides produced changes in personality or measurable deficiencies in memory, concentration, language skills, and coordination.

Dr. Richard Fenske, director of the Pacific Northwest Agricultural Safety and Health Center at the University of Washington, conducted a study in New Jersey in an attempt to answer that question. At the New Jersey Agricultural Experiment Station at Rutgers University, Dr. Fenske studied 57 tree fruit producers who had used organophosphate pesticides for many years, but had no history of acute poisoning. Fenske and his colleagues gave these tree fruit growers a battery of tests to evaluate concentration, visual-motor skills, memory, language, and mood, as well as complete physical exams focusing on neurologic function. The same tests were given to blueberry growers, cranberry growers, and hardware store owners who had no history of organophosphate pesticide exposure.

The findings of the study, which were published in the American Journal of Industrial Medicine, surprised Fenske and his colleagues: "We did not see a meaningful difference between lifetime applicators of OP pesticides and other farmers in the region. We also compared the applicators to local hardware store owners and again found no differences. This is good news for anyone who handles these chemicals as a part of their work, and underscores the importance of treating these compounds with respect. Avoiding overexposure to these compounds is critical."

Why is this study relevant to Northwest farmers? "Tree fruit farming in southern New Jersey is very similar to farming here. Our subjects were owner-operators and lifetime farmers. The same products and application techniques are used in both parts of the country. This means the results would apply to fruit producers in Idaho, Oregon, and Washington," Fenske explains.

At the start of the study, a number of comparisons were made between the fruit growers and the berry farmers and hardware store owners who served as the control group. There were no significant differences in age between the two groups. The control group was more educated and had significantly higher reading skills, differences which were taken into account when the data were analyzed.

Both groups were subjected to detailed medical histories, with emphasis on head trauma, medications used, neurologic diseases, and alcohol and drug use. The physical exams included neurologic function, and urine and blood analyses, including a check of red blood cell cholinesterase levels. Farmers were asked if they had ever had an acute organophosphate exposure that caused them to see a physician. Blood tests (cholinesterase) confirmed that the farmers were free of any effects of such an exposure when they were tested.

The study results indicated a statistically significant slowing of reaction time in tree fruit producers who used organophosphates regularly over several years, compared to the control group. However, this difference was not as clearly observed when farmers were classified into high and low exposure groups based on lifetime exposure adjusted for work activities and the use of protective equipment. In summary, the study found long-term occupational use of organophos-

Norm Herdrich, Pacific Northwest Agricultural Safety and Health Center

phates "did not result in impressive deficits in neurobehavioral performance or alternations in personality or emotional status."

What did it all prove? "Basically, that farmers who have used organophosphate insecticides carefully, and, because of this, have not suffered an acute poisoning incident, are not much different from hardware store owners," says Fenske. "There were no dramatic findings."

Fenske cautions that the test results are relevant only for adults who may receive chronic, low-level exposure to organophosphates, and should not be extended to children whose neurological systems are not fully developed, and which may be affected in ways not seen in adults.

The Pacific Northwest Agricultural Safety and Health Center (PNASH), funded by NIOSH (National Institute of Occupational Safety & Health), 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 509-926-1704, or email him at normh@u.washington.edu.

Minor Crop Registration Workshop III

The Washington State Department of Agriculture's (WSDA) Pesticide Management Division and WSU's Food and Environmental Quality Laboratory are jointly sponsoring the Minor Crop Registration Workshop III on December 2, 1998. The all-day workshop will be held in the main auditorium of the WSU Tri-Cities campus, and will focus on how to obtain Section 18 (emergency exemptions) and Section 24c (special local needs) registrations, as well as highlighting available resources for obtaining these registrations. A significant amount of time will be dedicated to breakout sessions where actual examples will be used as models.

DRAFT AGENDA	
7:45-8:15 AM	Registration
8:15-8:30 AM	Introductory Remarks
8:30-9:00 AM	Pesticide Information Center On-Line Pesticide Notification Network
9:00-9:30 AM	Washington State IR-4 Program
9:30-9:45 AM	Break
9:45-10:15 AM	WA State Commission on Pesticide Registration
10:15-12:00 PM	Intro to Obtaining Sec. 18 and 24(c) Registrations
12:00-1:00 PM	Lunch
1:00-3:30 PM	(Break out sessions) Work Through One Example; Obtain Existing Data; Generate New Data
3:30-4:00 PM	Concluding Remarks and Adjournment

This workshop is structured to provide education and assistance to individuals involved in minor crop pesticide issues, specifically, consultants, growers and/or associations and educators. Any individual or group who desires to learn more about how to obtain these registrations is encouraged to attend this free workshop. Advance registration is encouraged although on-site registrations will be accepted. To register, contact Catherine Daniels, WSU Tri-Cities, at (509) 372-7495 or email cdaniels@tricity.wsu.edu. **For information on workshop content please contact Joel Kangiser, WSDA, at (360) 902-2030.**

Metabolism of Pesticides in Plants and Livestock

This article was originally printed in Chemistry International*, 1997, Vol. 19, No. 4, pp. 120–121. Reprinted here with author's permission*

The use of pesticides to control pests and disease is important for the production of sufficient quantities of safe and affordable food. However, the use of these agents sometimes leaves residues (the pesticide or its degradates) in/on plant parts used as human food or animal feed commodities. These residues may enter the human food chain either directly (through the consumption of treated foods, e.g., grain or fruit) or indirectly (through the transfer of residues to milk, eggs, and meat products). To answer the question "What is the nature of the chemical residue in/on food or feed items resulting from the use of the pesticide?", plant and animal metabolism studies are carried out. This paper describes the aims and conduct of these studies.

Use of Radiolabeled Pesticides

The term metabolism generally refers to the chemical transformation of the pesticide that results from natural (metabolic) processes in the biological system under investigation. To measure the total residue, and to provide a means of selectively tracing products derived from the pesticide in the presence of biological material, the studies are carried out using radiolabeled pesticides. The radiolabel, usually carbon-14 or hydrogen-3, is incorporated into a metabolically stable portion of the compound. The use of the radiolabel requires that studies are carried out in controlled areas; for plants this can be either in small field plots or pots housed in suitable growing environments. This restriction in scale implies that these studies are qualitative and, at best, a semi-quantitative estimate of the fate of pesticides under large-scale field conditions.

Plant Metabolism

In plant studies, the term "metabolism" is used in a wider context, to include the formation of all products (degradates) of the pesticide in or on the plant, regardless of whether they result from internal plant metabolic processes, from chemical reactions (hydrolysis and photolysis), or from biological processes which occur outside the plant (e.g., microbiological degradation in soil). A plant metabolism study is usually carried out on crops typical of those to which the pesticide will be applied. If the metabolism of the pesticide is the same in plants from three different crop groups—e.g., root, cereal, top fruit—then no further studies are conducted. If different metabolic routes are revealed, then studies in a wider range of crops will be initiated. The radiolabeled chemical is formulated and applied to the crop in a similar manner to that used in actual agricultural practice. To define the amount and nature of residues that may be found in rotated crops grown in soil where a previous crop was treated with the pesticide, crop rotation studies are carried out. In these studies, the soil is treated with the radiolabeled pesticide and crops sown 30, 120, and 365 days after treatment. The crops are harvested at maturity and other intervals appropriate to normal agricultural practices, e.g., immature cereals, which are fed to livestock as forage or silage.

Livestock Metabolism

Studies are carried out in agricultural livestock whenever a pesticide is applied directly to animals or when treated plant commodities are used for animal feed. Typically, the most important species in agriculture are ruminants and poultry, however if the use pattern of the pesticide targets other species then studies would be carried out accordingly. Metabolism studies are carried out in representative species from these groups; usually lactating goats or cows and laying hens are the species of choice. Treatment is carried out to closely approximate expected exposure.

◆ For ingested residues, oral dosing is usually carried out over a period of several days to allow the residues in tissues, milk, and eggs to reach a steady state. The dosing (test) material should reflect the major component of the terminal residue in treated crops. This is frequently the parent compound; however, where the parent is not the major component of the residue the test material may consist of a single

Dr. Michael W. Skidmore, Zeneca Agrochemicals, Berkshire, UK

metabolite, a synthetic mixture of metabolites, or plant material resulting from the metabolism studies.

◆ For dermal applications, the radiolabeled chemical is applied formulated in a way that reflects the proposed use pattern.

The size of the dose given to the animals is often more than that expected from normal agricultural practice to facilitate the detection, isolation, and characterization of metabolites. Samples of milk, eggs, and excreta are taken throughout the dosing period. The animals are usually sacrificed within 24 hours after the final dose and tissues are taken post mortem.

Animal and plant studies must be carried out according to Good Laboratory Practice (GLP) principles.

Measurement and Characterization of the Residue

In the case of compounds with a complex structure, it may be necessary to conduct two or more metabolism studies with the radiolabel located in different parts of the compound. The use of radiolabeled materials facilitates monitoring of the distribution of the residue throughout the system and provides an estimate of the total residue. By linking radioactive detection with chromatographic separation systems and spectral analysis, the individual components of the residue can be isolated, characterized, and identified. From this information, the fate of the compound in the test system (i.e., the biotransformation pathway) can be defined.

How the Data Are Used

Once the amount of the total radioactive residues has been determined and the structures of the major metabolites are known, the toxicological significance of the residues can be assessed. If the plant metabolism data indicate that the metabolites formed are both qualitatively and quantitatively similar to those formed in mammals, the plant metabolites may be considered to have been tested in animals in the same studies as those performed on the parent compound. If significant qualitative or quantitative differences are found between plant and animal metabolites, additional toxicological data concerning the plant metabolites in animals may be required. The nature and extent of the additional toxicity studies will depend on the nature of the metabolite involved. Using the information from the radiolabeled studies, analytical methods are developed to determine as much of the terminal residue as possible, particularly for those components considered to be of toxicological interest. The development of analytical methods is facilitated using samples from the metabolism studies to optimize the efficiency of the extraction and clean-up procedures.

Conclusions

It is essential that metabolism studies provide an accurate description of the composition of the terminal residues in food and feed items. The nature of the individual components of the terminal residue must be defined before analytical methods, residue levels, and toxicity data can be generated. An adequate metabolism study fulfills at least three main purposes:

◆ to identify the composition of the terminal residue in all plant commodities and livestock tissues, milk, and eggs.

◆ to indicate the distribution of the residues, i.e.,
- in plants, whether the residues are absorbed through roots and foliage or are entirely surface residues, and whether the residues are translocated;
- in livestock, to indicate the distribution of residues in tissues, eggs, and milk, and to provide evidence of storage or accumulation in tissues.

◆ to provide a basis for determining the efficiency of extraction and clean-up procedures used in the development of analytical methodologies.

Michael W. Skidmore is with Zeneca Agrochemicals, Jealotts Hill, Bracknell, Berkshire RG42 6ET, UK; email mike.m.w.skidmore@gbjha.zeneca.com

The Aggregate Risk Assessment of Chlorpyrifos

FQPA Changes the Rules for the Risk Assessment of Pesticides

The Food Quality Protection Act (FQPA) has dramatically changed the way pesticides are regulated in the US. Among other things, the new law requires EPA to determine that "there is 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." In other words, the law now mandates EPA to consider all routes of exposure, including drinking water and residential (home and garden) use in addition to residues in food.

The importance of other non-dietary exposures is illustrated by the statistics on residential pesticide use. For example, most families (98%) apply pesticides at least once throughout the year. Pesticides may be used in many ways, including in the home (about 80% of families), for yard weeds (57% of families), or for flea and tick control on pets (50% of families) (Davis et al., 1992). In fact, due to variability in the diet and daily behavior, each individual will have a personal pattern of pesticide exposure that will differ from day to day and season to season.

The EPA and the pesticide industry have been struggling to comply with the FQPA requirement for aggregate risk assessment. When the FQPA was passed, there was no established and well-accepted methodology for aggregating risks for a pesticide. Reliable non-dietary exposure data were scarce for many pesticides, and the EPA Office of Pesticide Programs had no experience in regulating based upon aggregate risk. Pre-FQPA risk assessments for pesticides were typically conducted on a use-by-use basis. Although years of safe use may suggest that a problem does not exist, carefully conducted studies that meet the requirement for reliable data are most often only available to predict residue levels in food and to assess worker exposure. Prior to FQPA, regulatory officials were willing to assume that if a chemical was of little toxicological concern, as is the case for most of the pesticides used in and around the home, exposure assessment was not necessary.

Chlorpyrifos As a Prototype for Aggregate Risk Assessment

The organophosphate insecticide chlorpyrifos is one of the most widely used pesticides in the world and has an extensive toxicology and exposure database. The depth and breadth of reliable information available for chlorpyrifos allows a more accurate determination of risk than is normally the case for a pesticide. Furthermore, chlorpyrifos is one of the few insecticides that has widespread residential use in addition to agricultural use. Thus, the aggregate risk assessment for chlorpyrifos will be one of the first to be conducted under the FQPA and will likely serve as a prototype for future risk assessments of pesticides and other chemicals to which consumers are exposed.

Determining the No Observable Effects Level (the NOEL)

The first objective of any risk assessment is to determine the NOEL, a level of exposure that causes no adverse effects. The chlorpyrifos NOEL was determined from a full battery of animal studies and several clinical studies in humans. These studies were conducted according to EPA guidelines and have been accepted by regulatory agencies throughout the world. The most sensitive toxicological effect and one of greatest concern is the inhibition of acetylcholinesterase, an enzyme responsible for the breakdown of the neurotransmitter acetylcholine. The excessive accumulation of acetylcholine at the junctions between nerves (the synaptic clefts) and between nerves and muscles (the neuromuscular junctions) results in a variety of clinical signs including excessive salivation, diarrhea, and extreme constriction of the eye's pupils (miosis). Symptoms include nausea, headache, and a tightness in the chest. The inhibition of acetylcholinesterase and a related enzyme, butyrylcholinesterase, collectively called cholinest-

Dr. Gary Burin, Toxicologist, Technology Sciences Group, Inc.

erases, has been measured in the blood of humans after single and repeated doses of chlorpyrifos. Clinical effects are only observed at exposures greater than those that inhibit blood cholinesterases. Thus, the NOEL is the dose of chlorpyrifos causing no inhibition of blood cholinesterases. This level has been determined in a single-dose study in humans to be 100 micrograms (μg) per kilogram of body weight (kg) per day (d).

Determining the Potential for Human Exposure

The next objective in a risk assessment is to determine the potential for human exposure. Major uses of chlorpyrifos to which the consumer may be exposed include termiticide, crack-and-crevice, and lawn care applications. The routes of exposure may be oral (from hand-to-mouth contact), dermal, or inhalational. Studies with humans (biomonitoring) have been conducted under actual use conditions to provide estimates of absorbed chlorpyrifos dose from all possible routes of exposure. In most cases consumers are exposed by inhalation or incidental dermal contact to very low levels of residues present in a home after professional treatment for termites or other pests. The aggregate exposure to chlorpyrifos is determined by combining estimates of total absorbed dose with a background level of dietary exposure.

The aggregate risk assessment for chlorpyrifos has focused only on those people who could be considered as "users," defined operationally as persons exposed following termiticide, crack-and-crevice, or lawn care applications over the course of a year. Aggregate integrated daily exposure to chlorpyrifos for the average adult user and child residing in a home receiving treatment and the very highly exposed individual (adult and child) were calculated and are shown in the table. The highly exposed individual represents the 97.5th percentile of exposure. In other words, 98 out of every 100 persons classified as users would be expected to have less exposure than 1.4 μg/kg/d. Because users represent less than 1% of the population, fewer than two out of every 10,000 individuals would have this exposure over the course of a year.

Integrated Daily Chlorpyrifos Exposure of an Average and Highly Exposed Adult and Child

	Average (μg/kg/day)	Highly Exposed (μg/kg/day)
Adult	0.24	1.4
Child	0.41	1.7

The exposure estimates shown in the table represent selected days of the year, for example, when lawn treatment would be expected to occur. Exposure on most days of the year would be less, even for that percentage of the population classified as highly exposed users.

Placing Exposures in Perspective

These exposure estimates can be placed into perspective by comparing them with the NOEL. The average exposure to chlorpyrifos for an adult is about 416 times less than the level shown, in a study in humans, to have no adverse effects on the most sensitive endpoint: inhibition of the blood enzyme butyrylcholinesterase (an enzyme of no known biological significance).

FQPA emphasizes the protection of infants and children. However, even the most highly exposed child would receive a maximum exposure that is 59 times less than a level shown to have no adverse effects in humans. Put another way, no effect on the most sensitive indicator of toxicity, despite its uncertain biological significance, is expected to be observed in the most highly exposed of that small fraction of the US population classified as chlorpyrifos users. Aggregate daily exposure for an average user is several orders of magnitude less than a level that would be of toxicological concern. Exposure of the average non-user is only from residues in the diet and thus would be even less than the exposure of users.

...continued on next page

…Risk Assessment of Chlorpyrifos, cont.

The aggregate exposure estimates shown in the table are supported by dietary exposure estimates prepared by scientists working for the California Department of Pesticide Regulation (Cochran et al., 1995) and by limited biomonitoring studies in the general population. The estimated exposures do not include all possible uses of chlorpyrifos, and it has been noted that exposure depends upon the method of application and the assumptions used regarding residue transfer and behavior patterns. For example, certain discontinued chlorpyrifos uses such as aerosol foggers have been reported to result in significantly greater exposures (Lu and Fenske, 1998).

Conclusions

The requirement of the FQPA for the determination of aggregate exposure has forced a significant change in risk assessment methodology. The calendar year approach to determine the aggregate risk for chlorpyrifos only considers selected days of exposure. However, it represents an approach that can address the requirement for determination of daily aggregate exposure.

The aggregate risk assessment of most chlorpyrifos uses indicates no health concern for either the general population or for those individuals who are classified as the most highly exposed. Chlorpyrifos benefits from having an unusually strong foundation of data in the areas of both exposure and toxicity. This data reduces the need to apply the many conservative, worst-case assumptions that are typically used in risk assessment. The risk assessment for chlorpyrifos is based on "real world" exposure data, and the estimated "safe level" of exposure to chlorpyrifos has been determined from an extensive battery of studies in laboratory animals and humans. Chlorpyrifos serves as a prototype of aggregate risk assessment methodology for compounds with extensive toxicological and exposure databases.

Gary Burin is with the toxicology division of Technology Sciences Group, Inc., 1101 17th St. NW, Suite 500, Washington, DC 20036, email gburin@tsgusa.com.

References:

Cochran, R.C., J. Kishiyama, C. Aldous, W.C. Carr, and K.F. Pfeifer. 1995. Chlorpyrifos: Hazard Assessment Based on a Review of Short-Term and Long-Term Exposure in Animals and Humans. Food Chem. Tox. 33:165–172.

Davis, J.R., R.C. Brownson, and R. Garcia. 1992. Family Pesticide Use in the Home, Garden, Orchard, and Yard. Arch. Environ. Contam. Toxicol. 22(3):260–266.

Lu, C., and R.A. Fenske. 1998. Air and Surface Chlorpyrifos Residues Following Broadcast and Aerosol Pesticide Applications. Env. Sci. Tech. 32:1386–1390.

PICOL Database Now FREE

The Pesticide Information Center On-Line (PICOL) Tolerance and Label Databases are now available free of charge. The label database contains searchable information on crop, pest, active ingredient, product name, type of pesticide, formulation, application method, toxicity warning word, EPA number, Special Local Needs number, and whether a ground water warning statement is on the label. Washington and Oregon registered labels, both commercial and homeowner, are in the label database in a coded format; the labels are NOT scanned so some information such as rates/acres, plantback restrictions, grazing restrictions, tank mixing instructions, etc. are not listed. The database is to be used as a guide for determining which labels you need to read in order to locate one for the specific use intended. The tolerance database contains listings of pesticide tolerances for crops grown in the Pacific Northwest. Both databases have moved from a previous URL, so we recommend setting your bookmarks for the main PICOL page at http://picol.cahe.wsu.edu and clicking the section on databases to access the database of choice. A new sign-in page has been added to help us determine the demographics and interests of our users. In the upcoming months we will be revising the help sections and on-line user instructions. Meanwhile, if you have questions on using the database, feel free to contact us at (509) 372-7492.

Dear Aggie

Providing answers to the questions you didn't know you wanted to ask

In contrast to the usually more sober contributors to the Agrichemical and Environmental News, Dear Aggie deals lightheartedly with the peculiarities that cross our paths and helps decipher the enigmatic and clarify the obscure. Questions may be emailed to Dear Aggie at dearaggy@tricity.wsu.edu. Opinions are Aggie's and do not reflect those of WSU.

I've read in the newspapers that wine can actually be very beneficial to health, perhaps reducing the risk of heart disease or maybe even fighting cancer. Is there anything good about beer other than as a relaxant for Sunday afternoon football games?

Unless you like the peace and quiet of not having your husband around while he turns into a couch potato on Sundays, Aggie isn't quite sure about beer's health-promoting capabilities. However, an interesting tidbit about the flower bracts from hop cones appeared recently. Dried cones are used in the brewing process to give beer its characteristically bitter flavor. The bracts contain biochemicals called polyphenols. Polyphenols are known to prevent tooth decay bacteria from binding to glass. Interference with the bacteria's adhesion to glass is a common test for cavity-fighting capabilities. In Japan, chocolate and chewing gum are fortified with polyphenols from tea to prevent cavities. The polyphenols from hops were more effective than those from tea. The Japanese are now considering using the polyphenols from hop bracts, and they may even use them in mouthwash. So, if you can't floss after every meal, maybe pop open a can of Miller Lite®. (Source: *Chemical & Engineering News*, 1998, vol. 76, issue 34, p. 34)

I am teaching a nutrition class and one of the students asked, "Since the soil these days doesn't have as many nutrients as it did in the past, are the vegetables also lacking in specific nutrients?" She wondered, for example, if tomatoes contained as much vitamin C as they used to. I was lecturing on vitamins and the fact that if people eat a well balanced diet and are in good health they do not need to take vitamin supplements. What do you think?

Who says that soils today do not have as many nutrients as they used to? Plants take up thirteen different mineral elements from the soil to use as nutrients. These nutrients are then used by the plant to synthesize the vitamins, carbohydrates, and proteins we need. Of the nutrients taken up by a plant, six are taken up in fairly large quantities and seven in very small quantities. Those taken up in larger quantities are generally supplied to the soil in the form of fertilizers, which ensure an ample supply for the growing plant. The ones taken up in small quantities are rarely depleted and generally are supplied to the soil as impurities in fertilizers. Please note that a plant does not care if the minerals it takes up from the soil are from the soil itself or from added fertilizer (either "chemical" or "organic"), as long as enough nutrients are available. If insufficient nutrients are available, quite frankly, the plants will not grow and will not produce the vegetables we eat. Conversely, supplying too much of a nutrient could prevent the plant from growing and producing the edible portion. For example, adding too much nitrogen to soil will prevent tomatoes from setting fruit. (Source: Dr. Joan Davenport, Soil Scientist, Department of Crop & Soil Sciences, Washington State University)

Organophosphate (OP) insecticides are known to cause poisoning by affecting the nervous system. I understand they actually block the enzyme called acetylcholinesterase that is important for proper transmission of nerve impulses. Are there any compounds in nature that also do this?

Funny you should ask. Aggie just came across two interesting studies from a university in Japan. The scientists were interested in new anti-acetylcholinesterase compounds because they may be useful for treating Alzheimer's disease. Acetylcholinesterase is also found in muscle and blood in addition to nerve tissue. The scientists found that certain essential oils extracted from mint plants could significantly inhibit the acetylcholinesterase in red blood cells. Interestingly, inhibition of this acetylcholinesterase in blood cells is the most sensitive toxicological effect that EPA is currently using to assess exposure risk from OP insecticides. Aggie wonders when the EPA will want to start regulating exposure of kids to that yummy cool mint gel toothpaste. (Miyazawa, M. et al. Journal of Agricultural & Food Chemistry, 1998, vol. 46, pp. 3431-3434)

Tolerance Information

Tolerance Information						
Chemical (type)	**Federal Register**	**Tolerance (ppm)**	**Commodity (raw)**	**Time-Limited**		
				Yes/No	**New/Extension**	**Expiration Date**
acrylic acid terpolymer, partial sodium salts (inert ingredient)	9/9/98 page 48109	exempt	see comment	N/A	N/A	N/A
Comment: This exemption was established in response to a request by BF Goodrich and applies when acrylic acid terpolymer, partial sodium salts are used as inert ingredients (dispersant) in pesticide formulations applied to growing crops, raw agricultural commodities after harvest, and animals.						
fenpropathrin (insecticide)	9/9/98 page 48113	15.00	currants	Yes	Extension	6/30/00
Comment: This time-limited tolerance is extended in response to EPA granting a Section 18 for use of fenpropathrin to control currant borer and stem girdler in Washington currants.						
HOE-107892 (inert ingredient)	9/9/98 page 48116	0.10	barley, flour & straw	Yes	New	2/1/00
		0.40	barley, bran			
		0.05	barley, grain			
		0.50	barley, hay			
		1.00	barley, pearled			
Comment: These temporary tolerances are issued in response to EPA granting a Section 18 for the use of fenoxaprop, formulated with the herbicide safener HOE-107892, on barley.						
Bacillus sphaericus	9/11/98 page 48594	exempt	all food commodities	N/A	N/A	N/A
Comment: This exemption is established in response to a petition submitted to EPA by Abbott Laboratories.						
cypermethrin (insecticide)	9/11/98 page 48579	6.00	onions, green	No	N/A	N/A
esfenvalerate (insecticide)	9/11/98 page 48607	5.00	mustard greens	No	N/A	N/A
		0.50	kiwifruit			
		1.00	artichoke, globe			
		2.00	kohlrabi			
metolachlor (herbicide)	9/11/98 page 48586	0.20	grass, hay	Yes	New	12/31/99
		10.00	grass, forage			
Comment: These temporary tolerances are established in response to EPA granting a Section 18 for the use of metolachlor to control weeds in grass seed crops in Oregon.						

...continued on next page

Tolerance Information						
Chemical (type)	Federal Register	Tolerance (ppm)	Commodity (raw)	Time-Limited		
				Yes/No	New/Extension	Expiration Date
sulfosate (herbicide)	9/11/98 page 48597	210.00	aspirated grain fractions	No	N/A	N/A
		0.10	fat; cattle, goat, hogs, horses, & sheep			
		1.00	mbyp; cattle, goat, hogs, horses, & sheep			
		0.20	meat; cattle, goat, hogs, horses, & sheep			
		0.10	corn; field, forage			
		0.20	corn; field and pop, grain			
		0.30	corn; field and pop, stover			
		0.02	eggs			
		0.10	grape			
		0.20	milk			
		0.05	poultry; fat, liver, & meat			
		0.10	poultry; mbyp			
		0.20	prune			
		0.20	raisin			
		0.05	stone fruit group			
		0.05	tree nut group			
Comment: This permanent tolerance replaces the recently-expired time-limited tolerance previously established for these commodities.						
desmedipham (herbicide)	9/16/98 page 49469	0.20	red beet roots	Yes	Extension	8/31/99
		15.00	red beet tops			
Comment: These temporary tolerances are extended in response to EPA granting a Section 18 for the use of desmedipham for weed control on New York beets.						
myclobutanil (fungicide)	9/16/98 page 49472	1.00	pepper	Yes	New	7/31/00
		0.02	asparagus			
		1.00	artichoke			
Comment: These time-limited tolerances are established in response to EPA granting Section 18's for the use of myclobutanil on peppers, artichoke, and asparagus in California; asparagus in Michigan; and peppers in New Mexico.						
propyzamide (herbicide)	9/16/98 page 49479	0.05	cranberries	Yes	New	12/31/99
		0.50	grass hay			
		1.00	grass forage			
Comment: These time-limited tolerances are established in response to EPA granting Section 18's for use of propyzamide (proanamide) on grass grown for seed in Oregon and for dodder control in Massachusetts cranberries.						

...continued on next page

…Tolerances, cont.

Tolerance Information						
Chemical (type)	**Federal Register**	**Tolerance (ppm)**	**Commodity (raw)**	**Time-Limited**		
				Yes/No	**New/Extension**	**Expiration Date**
Trichoderma harzianum strain T-39	9/16/98 page 49466	exempt	see comment below	N/A	N/A	N/A
Comment: EPA has exempted residues of Trichoderma harzianum strain T-39 from the requirement for a temporary tolerance when used in accordance with experimental use permit 11678-EUP-1. This exemption applies to strawberries and grapes (wine and table).						
imidacloprid (insecticide)	9/18/98 page 49837	0.50	sugar beet top	No	N/A	N/A
		0.05	sugar beet root			
		0.30	sugar beet molasses			
		0.05	barley grain			
		0.50	barley; straw & hay			
		0.05	wheat grain			
		7.00	wheat forage			
		0.50	wheat; straw & hay			
		0.05	cereal grain group, grain			
		2.00	cereal grain group, forage			
		3.00	cereal grain group, straw			
		6.00	cereal grain group, hay			
		0.30	cereal grain group, stover			
		0.05	sweet corn			
		0.05	safflower seed			
		0.50	safflower meal			
		0.30	legume vegetable group, seed			
		2.50	legume vegetable group, foliage			
		0.50	soybean meal			
flufenacet (herbicide)	9/23/98 page 50784	0.10	clover; forage & hay	Yes	New	4/30/03
		0.10	alfalfa; forage, hay, & seed			
		0.10	cereal grains (Crop Group 15)			
		0.10	cereal grains; forage, stover, & hay (Crop Group 16)			
		0.10	grass; forage & hay (Crop Group 17)			
Comment: This temporary tolerance is for indirect or inadvertent residues on these crops resulting from the application of flufenacet to field corn and soybeans.						
isoxaflutole (herbicide)	9/23/98 page 50773	0.20	field corn; grain	No	N/A	N/A
		0.50	field corn; fodder			
		1.00	field corn; forage			
		0.20	fat; cattle, goats, hogs, horses, poultry, and sheep			
		0.50	liver; cattle, goats, hogs, horses, and sheep			
		0.20	meat; cattle, goats, hogs, horses, poultry, and sheep			
		0.10	mbyp; cattle, goats, hogs, horses, and sheep			
		0.01	eggs			
		0.02	milk			
		0.30	liver; poultry			

...continued on next page

Tolerance Information

Chemical (type)	Federal Register	Tolerance (ppm)	Commodity (raw)	Time-Limited		
				Yes/No	New/Extension	Expiration Date
mepiquat chloride	9/29/98 page 51841	1.00	grapes	Yes	New	3/1/00
(plant growth regulator)		6.00	raisins			
Comment: These time-limited tolerances are established in response to the issuance of crisis exemptions for the use of mepiquat chloride to minimize frost damage on grapes in New York, Ohio, and Pennsylvania.						
Acrylic acid, styrene, <greek-a>-methyl styrene copolymer, ammonium salt (inert ingredient)	9/29/98 page 51835	exempt	See Comment	N/A	N/A	N/A
styrene, 2-ethylhexyl acrylate, butyl acrylate copolymer (inert ingredient)						
Comment: EPA has exempted these compounds from the requirement for a tolerance when used as inert ingredients (encapsulating agent, dispensers, resins, fibers and beads) in pesticide formulations applied to growing crops, raw agricultural commodities after harvest, and animals.						
carfentrazone-ethyl (herbicide)	9/30/98 page 52174	0.10	soybean seed	No	N/A	N/A
		0.10	wheat, grain			
		1.00	wheat, forage			
		0.30	wheat, hay			
		0.20	wheat, straw			
		0.10	field corn; grain, forage, & fodder			
fluroxypyr 1-methylheptyl	9/30/98 page 52160	0.10	milk	No	N/A	N/A
ester (herbicide)		0.5	grain; wheat, barley, & oats			
		12.00	straw; wheat, barley, & oats			
		12.00	forage; wheat, barley, & oats			
		20.00	hay; wheat, barley, & oats			
		0.60	aspirated grain fractions			
		0.10	meat; cattle, goats, horse, hog & sheep			
		0.10	fat; cattle, goats, horse, hog & sheep			
		0.10	mbyp; cattle, goats, horse, hog & sheep			
		0.50	kidney; cattle, goats, horse, hog & sheep			
tebufenozide (insecticide)	9/30/98 page 52169	0.5	cranberries	Yes	New	9/30/99
Comment: This time-limited tolerance is established in response to EPA granting Section 18's for the use of tebufenozide to control blackheaded fireworm and lepidops in cranberries in New Jersey, Massachusetts, and Washington.						

Miscellaneous Information

On September 9, EPA announced that it had issued an updated policy concerning waivers of fees associated with filing objections to tolerance actions. The document is available upon request and is titled "Waiver of Fees Associated with Tolerance Objections." The document is also available on the internet on EPA's home page. (9/9/98 page 48218)

On September 9, EPA announced that it had completed preliminary risk assessments for the following organophosphates: cadusafos, dimethoate, ethoprop, fenthion, sulfotepp, temephos, and tribuphos. The agency has opened a 60-day public comment period. Comments are due November 9,1998. (9/9/98 page 48213)

PNN Update

The PNN is operated by WSU's Pesticide Information Center for the Washington State Commission on Pesticide Registration. The PNN 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.

State Issues

New Registrations

WSDA has issued a registration to National Sanitary Supply for its product Blitz Airborne Liquid Insecticide. This product is registered for use on the following PNN-related sites: food processing area and poultry buildings/yard.

WSDA has registered FMC's product Dragnet SRF Termiticide/Insecticide. This product is registered for use on the following PNN-related sites: dairy building, evergreen tree, conifer tree, deciduous shade tree, farm building, manure, non-dairy livestock building, ornamental, ornamental tree, poultry building/yard, and shrub.

WSDA has issued a registration to Unisource for its product Allstar Multipurpose Insecticide. This product is registered for use on the following PNN-related sites: dairy buildings and food processing areas.

WSDA has issued a registration to United Laboratories for its herbicide United 385 Emulsifiable Vegetation Killer Concentrate. This product is registered for use on ditch banks as well as other sites.

WSDA has registered several Whitmire Micro-Gen insecticides for greenhouse and nursery use. The products and their active ingredients are listed below:

- Prescription Treatment Duraplex TR: cyfluthrin & chlorpyrifos
- Prescription Treatment 1100 Pyrethrum TR: pyrethrins & piperonyl butoxide
- Prescription Treatment Duraguard ME: chlorpyrifos
- Prescription Treatment Duration: chlorpyrifos
- Prescription Treatment Preclude: fenoxycarb

WSDA has registered three Micro-Gen insecticides for agricultural use. The products and their PNN-related usage site are listed below:

- Prescription Treatment ULD BP-100: agricultural production building, agricultural container, cattle, grain storage building, horse, manure.
- Prescription Treatment ULD BP-300: agricultural production building, agricultural container, food processing area, grain storage building, manure.
- Prescription Treatment ULD BP-50: agricultural production building, agricultural container, food processing area, grain storage building.

Section 18 Crisis Exemptions

On September 28, 1998, WSDA issued a Section 18 crisis exemption for the use of Goal 2XL to control weeds in perennial ryegrass grown for seed. This exemption is for use on 1,000 acres in Skagit, Snohomish, and Island counties and expires January 15, 1999.

Section 24c Registrations

On August 25, 1998, WSDA issued an SLN, WA-980029, to Elf Atochem for the use of its product Desicate II as a harvest aid on alfalfa grown for seed. This new registration is required because Elf Atochem is replacing the old formulation of endothall, Des-I-Cate, with a new, more concentrated formulation in Desicate II. The older formulation is registered for this use via SLN WA-

870036. Note that because of the different ingredient concentrations in the two formulations, the usage rates for the two SLN's are very different. Because SLN WA-980029 is intended as an eventual replacement for SLN WA-870036, it has been issued without an expiration date.

Section 24c Revisions

On September 2, 1998, WSDA issued a revision to SLN WA-950001. This SLN had previously been issued to Du Pont for the use of its insecticide Asana XL to control leafrollers, aphids, and root weevils on caneberries. The revision adds a pollinator protection statement that, among other directions, prohibits use at the highest application rate when berries are blooming.

Miscellaneous Regulatory Information

The PNN distributed the following WSDA message regarding the status of SLN WA-820041 and the use of Furadan 4F on grapes.

> The registration cited above was cancelled in early 1996 by request of the registrant, FMC Corporation. It has come to the attention of this department that Furadan may have been distributed with this SLN label in 1998. Once an SLN registration has been cancelled by either EPA or WSDA, the product can no longer be legally distributed for that particular use. Any Furadan 4F that was purchased with this particular SLN registration prior to cancellation, may be legally used by the grower/applicator until it is depleted. A federal tolerance remains in effect for carbofuran (the active ingredient in Furadan) on grapes. Therefore, there is no concern about illegal residues for the alleged 1998 incident if the product was used according to the SLN label. This department anticipates no further action regarding the alleged incident. However, involved parties should be aware that further distribution is a violation of pesticide law and may be subject to penalty under state and/or federal law.

The PNN also distributed copies of a technical assistance fact sheet. This information was prepared by WSDA to answer questions that have arisen since EPA issued a Section 18 specific exemption for the use of Zinc Phosphide Oat bait to control meadow voles in timothy, timothy/alfalfa, timothy/clover hay as well as in timothy seed crops. The majority of the fact sheet is presented below:

> On July 23, 1998 the EPA issued a specific exemption under Section 18 FIFRA for the emergency use of ZP to control meadow vole on Timothy and Timothy/legume mixtures produced for hay and Timothy produced for seed. The exemption expires July 23, 1999. The exemption allows for 2 applications to be made, "one in the spring and one in the fall", while the Timothy and/or the Timothy/legume mixture is dormant. **The exemption specifically prohibits application to actively growing Timothy or Timothy/legume mixtures.** In addition to the "fall" and "spring" designated application periods, EPA further stipulated that use-directions and restrictions on WSDA's Section 18 application must be followed. One of those directions specifies that "the treatment period will be October 15, 1998 through April 15, 1999". Two interpretation questions have arisen that are addressed in this technical assistance fact sheet:
>
> **Question 1**
> Since the treatment period of October 15th to April 15th does not precisely coincide with the timing of "fall and spring", and neither of these time periods will precisely coincide with the actual physiological dormancy period of Timothy and/or Timothy/legume mixtures, what does WSDA and EPA consider to be the "legal" period for application under this Section 18?
>
> **Answer**
> Regarding the actual legal use period WSDA Pesticide Registration staff consulted with EPA's Emergency Response Team. EPA has indicated that "As long as our authorization (the specific exemption), which states one application in the fall…is observed, the precise dates indicated (October 15th to April 15th) are not binding." WSDA's interpretation is the same as EPA's. Therefore, a fall application could be legally made prior to October 15th and a spring application could be legally made after April 15th **as long as all of the other provisions of the specific exemption are met.** Applicators must be aware that this exemption only allows the use on dormant Timothy and Timothy/legume mixtures, and specifically prohibits use on actively growing Timothy and/or Timothy/legume mixtures.

...continued on next page

…PNN Update, cont.

Question 2
(This second question is related to the first)
Since no more use of the crop will occur until the following spring, can Timothy and Timothy/legume mixtures be considered dormant and not actively growing immediately after the last cutting occurs (assuming no grazing will occur) in late summer?

Answer
The reason that the specific exemption is limited to "dormant" and "not actively growing" Timothy and Timothy/legume mixtures is a concern that a non-dormant, actively growing Timothy or legume plant may take up residues of ZP. Those residues may not be degraded within the plant over the winter, thus, unacceptable residues may be present at the time of harvest the following spring. Regardless of whether this phenomenon is occurring, there is no data that shows the contrary. Therefore, EPA cannot grant the use when the plant is actively growing. Therefore, WSDA interprets "dormancy" to be an actual physiological dormancy where the plant is no longer actively growing. ZP can be applied immediately after the last cutting only if this dormancy has occurred.

1999 SUBSCRIPTION REMINDER

This is the time of year to start thinking about renewing your subscription for the 1999 *Agrichemical and Environmental News.* The subscription fee remains at $15 per year and will include 12 issues of fascinating information and riveting reading. Please **make the check out to WSU**, and mail it to:

Pesticide Information Center
WSU Tri-Cities
2710 University Drive
Richland WA, 99352-1671

As before, the subscription fee merely covers the costs of printing and mailing the newsletter. Web access remains free; the URL is http://picol.cahe.wsu.edu. But don't take too long thinking about it, as **we must have your check by December 15, 1998**, in order to mail you the January 1999 issue. If your check arrives after December 15, we will make all efforts to include you in the January mailing, but if you're late we will only guarantee that you will begin 1999 with the February issue. If you have any questions or comments please direct them to Sally O'Neal Coates at (509) 372-7378, or email scoates@tricity.wsu.edu.