Appendix J. The HED Chapter of the Reregistration Eligibility Decision Document (RED) for Phosmet (Case Number 0242, Chemical Number 059201)

III. Summary of Phosmet Risk Assessment

Following is a summary of EPA's revised human health and ecological risk findings and conclusions for the organophosphate pesticide phosmet, as fully presented in the documents, "Phosmet (Chemical ID No. 059201/List A Reregistration Case No. 0242). HED Revised Human Health Risk Assessment for the Reregistration Eligibility Decision Document (RED). DP Barcode No. D262365," dated February 9, 2000; "Phosmet: Revised Occupational Post-Application Exposure and Risk Calculations [DP Barcode D268141, Chemical Code 059201, Case 818976]", dated August 15, 2000; and "Environmental Fate and Effects Division RED Chapter for Phosmet," dated April 24, 1998. The purpose of this summary is to assist the reader by identifying the key features and findings of these risk assessments, and to better understand the conclusions reached in the assessments.

These risk assessments for phosmet were presented at a February 10, 2000 Technical Briefing, which was followed by an opportunity for public comment on risk management for this pesticide. The risk assessments summarized here form the basis of the Agency's risk management decision for phosmet only; the Agency must consider the cumulative assessment of the risks of all the organophosphate pesticides before any final decisions can be made.

A. Human Health Risk Assessment

EPA issued its preliminary risk assessments for phosmet on January 15, 1999, (Phase 3 of the TRAC process). In response to comments and studies submitted during Phase 3, the risk assessments were updated and refined. Major revisions to the human health risk assessment are based on the following data: USDA Pesticide Data Program; FDA Surveillance Monitoring Program Data; 21-day dermal toxicity study; the sub-chronic neurotoxicity study, a recalculation of restricted entry intervals based on new data from the Agricultural Reentry Task Force (ARTF) and inclusion of a worker risk assessment for the liquid formulations.

The Agency has reviewed all toxicity studies submitted and has determined that the toxicity database is complete, and that it supports an interim reregistration eligibility determination for all currently registered uses. Further details on the toxicity of phosmet can be found in the February 9, 2000, Human Health Risk Assessment.

Cancer Risk

Based on all available data for phosmet, the HED Cancer Assessment Review Committee (CARC) concluded that phosmet should be classified as having "suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential". In a mouse carcinogenicity study, phosmet caused increases in liver carcinomas/adenomas in males and increased mammary gland tumors in females. Phosmet was not carcinogenic in rats. The CARC conducted a weight-of-evidence evaluation of the mutagenicity and carcinogenicity data for phosmet (in accordance with the 1997 draft Cancer Guidelines) on September 1, 1999.

Additional data regarding tumor counts in the mouse carcinogenicity study were discussed along with additional mutagenicity data submitted by the registrant. The CARC recommended against completing a quantitative cancer risk assessment for phosmet. This recommendation is consistent with the previous recommendation to use the reference dose (RfD) approach, in which chronic risks assessed using the RfD are considered to be protective of any carcinogenic effect, in addition to systemic or other chronic effects.

Human Data

The Agency is currently evaluating an acute (ascending single oral dose) study with phosmet in humans that was conducted by Inveresk Research in Scotland in 1999. The following observations can be made on the potential impact of these data on the phosmet risk assessment. Because the study is a single oral dose, it could be used in a weight-of evidence approach to inform the selection of the inter-species uncertainty factor for acute risk assessments. That is, assuming it was conducted according to appropriate scientific and ethical standards, the acute human study could be compared to existing acute animal data to determine if the full ten-fold inter-species uncertainty factor is needed to account for variation between species in the acute dietary assessment for phosmet and could provide a basis for reduction of the uncertainty factor for acute dietary risk. However, because of its limited duration, the human study would not likely be appropriate for use in short-term or intermediate-term assessments, such as those used to estimate worker risk from phosmet use, nor would it be appropriate for the chronic dietary assessment.

1. Dietary Risk from Food

a. Toxicity

A brief overview of the studies used for the dietary risk assessment is outlined in Table 2 below.

b. FQPA Safety Factor

The FQPA Safety Factor was reduced to 1 X. The toxicity database includes an acceptable two-generation reproduction study in rats and acceptable prenatal developmental toxicity studies in rats and rabbits. These studies show no increased sensitivity to fetuses as compared to maternal animals following acute in utero exposure in the developmental rat and rabbit studies and no increased sensitivity to pups as compared to adults in a multi-generation reproduction study in rats. There was no evidence of abnormalities in the development of the fetal nervous system in the pre/post natal studies. Adequate actual data, surrogate data, and/or modeling outputs are available to satisfactorily assess dietary and residential exposure and to provide a screening level drinking water exposure assessment. The assumptions and models used in the assessments do not underestimate the potential risk for infants and children. Therefore, the 10X factor as required by FQPA was reduced to 1, for both acute and chronic risk

assessments for all subpopulations. A developmental neurotoxicity study (DNT) study has been required and is considered confirmatory.

c. Population Adjusted Dose (PAD)

The PAD is a term that expresses the dietary risk of a chemical, and reflects the Reference Dose, either acute or chronic, that has been adjusted to account for the FQPA safety factor (i.e., RfD/FQPA safety factor). In the case of phosmet, the FQPA safety factor is 1; therefore, the acute or chronic RfD is equal to the acute or chronic PAD. A risk estimate that is less than 100% of the acute or chronic PAD does not exceed the Agency's risk concern.

Table 2. Summary of Toxicological Endpoints and Other Factors Used in the Human Dietary Risk Assessment of phosmet

Assessment	Dose	Endpoint	Study	UF	FQPA Safety Factor	PAD
Acute Dietary	LOAEL of 22.5 mg/kg/day NOAEL of 4.5 mg/kg/day	Red blood cell, plasma and brain cholinesterease inhibition and decreased motor activity	Oral Acute Neurotoxicity Study on Rats	100	1	0.045 mg/kg/day
Chronic Dietary	LOAEL of 1.8 mg/kg/day NOAEL of 1.1 mg/kg/day	Red blood cell, and serum cholinesterease inhibition	Oral Chronic Toxicity/ Carcinogenicity Study on Rats	100	1	0.011 mg/kg/day

d. Exposure Assumptions

Revised acute and chronic dietary risk analyses for phosmet were calculated using the Dietary Exposure Evaluation Model (DEEM™). The regulated residues consist of parent phosmet and its metabolite, phosmet oxygen analog (oxon). For the revised phosmet risk assessment, the Agency conducted highly refined (Tier 3) acute (probabilistic) and chronic dietary exposure analyses which were based almost entirely on the available monitoring data, and incorporated additional refinements such as processing and cooking factors and percent of crop treated. Typically, the Agency cannot use monitoring data which do not include all residues of toxicological concern. Although both the PDP and FDA monitoring programs reported data for parent phosmet only, these data have been used in the revised risk assessment for the following reasons: (i) field trial data indicate that oxon residues, when detected, are generally an order of magnitude lower than parent residues; (ii) residues in both PDP and FDA monitoring samples were significantly less than tolerance-level residues; and (iii) phosmet oxon is relatively unstable in numerous commodities. Using the monitoring data in acute and chronic dietary exposure analyses is not expected to underestimate risk.

The acute dietary risk analyses for phosmet were calculated using a probabilistic analysis (Monte Carlo), incorporating percent crop treated data, USDA's Pesticide Data Program data (PDP monitoring data), the Food and Drug Administration's monitoring data, residue field trial data, cooking study data, and processing factors, where available, and consumption information from USDA's Continuing Surveys of Food Intakes by Individuals (CSFII) from 1989 to 1991. Chronic dietary risk was calculated by using the average consumption and residue values for foods.

e. Food Risk Characterization

Generally, a dietary risk estimate that is less than 100% of the acute or chronic Population Adjusted Dose does not exceed the Agency's risk concerns. The phosmet acute dietary risk from food is well below the Agency's level of concern; that is, less than 100% of the acute PAD is utilized. For example, for the most exposed population subgroups, children (1-6 years) and infants (<1 year), the % acute PAD values are 7.5% and 6.5%, respectively, at the 99.9th percentile of exposure.

The chronic dietary risk from food alone is well below the Agency's level of concern. For the most exposed population subgroup, children (1 - 6 years), the % chronic PAD value is 0.7%.

The Agency has refined the dietary analyses to the extent currently possible.

2. Dietary Risk from Drinking Water

Drinking water exposure to pesticides can occur through ground water and surface water contamination. EPA considers both acute (one day) and chronic (lifetime) drinking water risks and uses either modeling or actual monitoring data, if available, to estimate those risks. In the case of phosmet, only limited monitoring data for either ground or surface water were available; therefore, modeling was used to estimate drinking water risks from these sources.

The PRZM-EXAMS model was used to estimate surface water concentrations, and SCI-GROW was used to estimate groundwater concentrations. Both models are considered to be screening models, with the PRZM-EXAMS model being somewhat more refined than SCI-GROW.

Phosmet oxon is the only degradate of toxicological concern and was identified in a number of environmental fate studies conducted. Phosmet oxon appears to be less mobile than phosmet, as evidenced by its absence in leachates in the aged and unaged mobility study. In addition phosmet oxon was limited to the upper soil layer in the field studies while phosmet was detected as low as the 10.5-inch soil layer. Phosmet was found to be moderately mobile to mobile in four different soil classes.

The estimated concentrations for drinking water are for phosmet only. Phosmet oxon, which has been included in the tolerance expression, is not included in the modeling due to the absence of fate information. Considering the limited presence of phosmet oxon in the laboratory and field studies (soil extract of the mobility study and upper 0 - 3-inch soil layer in the field dissipation studies), phosmet oxon should not add appreciably to the concentration of parent compound in ground or surface water in most use areas.

a. Surface Water

A Tier II PRZM-EXAMS screening model was used to estimate the upper-bound concentrations of phosmet in drinking water derived from surface water. This model, in general, is based on more refined, less conservative assumptions than the Tier I GENEEC screening model.

Phosmet can contaminate surface water via runoff if runoff-producing rain events occur within the first few days to weeks post application. Phosmet's water solubility (25 mg/l) and its partition coefficient (K_{ads}= 1.17 - 15.8) suggest that it will enter surface water via runoff. It appears that the persistence of phosmet in surface water may be limited by its susceptibility to biodegradation especially in water with moderate to high microbial activity and by abiotic hydrolysis under neutral to alkaline conditions. In flowing water, its persistence is limited by the flow rate of the system more than by either metabolism or hydrolysis. However, its persistence in lakes and reservoirs will be greater and controlled more by metabolism and hydrolysis.

Limited monitoring data indicate that phosmet has been detected in surface water in known use areas. However, these data suggest that phosmet concentrations do not exceed the very low ppb range, well below the DWLOC. The three crops with the highest phosmet surface water concentrations are pears, kiwi and cotton applied at 5, 2 and 1 lb a.i./A, respectively. The EECs range from 0.4 ppb for application to apples at the western-low rate (1.5 lb a.i./A) to 140 ppb for application to pears (5 lb a.i./A).

b. Ground Water

A Tier I screening model, SCI-GROW, was used to estimate the upper-bound drinking water concentrations of phosmet in ground water. The SCI-GROW model is based on the fate properties of the pesticide, the annual application rate, and the existing body of data from small-scale ground water monitoring studies. The model assumes that the pesticide is applied at its maximum rate in areas where ground water is particularly vulnerable to contamination. In most cases, a considerable portion of any use area will have ground water that is less vulnerable to contamination than the areas used to derive the SCI-GROW estimates. The estimated maximum concentration derived using these modeled estimates should be considered a high-end to bounding estimate of acute and chronic exposure.

The maximum concentration (acute and chronic) for parent phosmet estimated using

SCI-GROW is approximately 0.4 ppb. No phosmet residues were reported in ground water monitoring data at concentrations above the detection limits of 0.1 and 10 ppb. Phosmet is not expected to pose a threat to ground water resources.

c. Drinking Water Levels of Comparison (DWLOCs)

To determine the maximum allowable contribution of water-containing pesticide residues permitted in the diet, EPA first looks at how much of the overall allowable risk is contributed by food (and if appropriate, residential uses) then determines a "drinking water level of comparison"(DWLOC) to determine whether modeled or monitored levels exceed this level. The Agency uses the DWLOC as a surrogate to capture risk associated with exposure from pesticides in drinking water where sufficient water monitoring data are not available. The DWLOC is the maximum concentration in drinking water which, when considered together with dietary exposure, does not exceed a level of concern.

The results of the Agency's drinking water analysis are summarized here. Details of this analysis, which used screening models, are found in the Environmental Fate and Effects Assessment, dated April 24, 1998, and the Human Health Risk Assessment, dated February 9, 2000.

For acute risk, the potential drinking water exposure derived from either ground or surface water is not of concern for all populations. The table below presents the calculations for the acute drinking water assessment.

Table 3. Summary of DWLOC Calculations for Phosmet Acute Risk

Population Subgroup	Ground Water EECs (ppb) (SCI-GROW)	Surface Water EECs (ppb) (PRZM-EXAMS)	DWLOC (ppb)
U.S. Population	0.4	3 - 140	1523
Females 20+	0.4	3 - 140	1308
Children 1-6	0.4	3 - 140	416

For chronic risk, potential exposure to drinking water derived from either groundwater or surface water is not of concern for all populations. The table below presents the calculations for the chronic drinking water assessments.

Table 4. Summary of DWLOC Calculations for Phosmet Chronic Risk

Population Subgroup	Ground Water EECs (ppb) (SCI-GROW)	Surface Water EECs (ppb) (PRZM-EXAMS)	DWLOC (ppb)
U.S. Population	0.4	1	384
Children 1 - 6	0.4	1	110
Females 13 - 19	0.4	1	330

3. Occupational and Residential Risk

Occupational workers can be exposed to a pesticide through mixing, loading, and/or applying a pesticide, or re-entering treated sites. Residents or homeowners can be exposed to a pesticide through mixing, loading, or applying a pesticide, or through entering or performing other activities in treated areas. Occupational handlers of phosmet include: individual farmers or growers who mix, load, or apply pesticides, and professional or custom agricultural applicators. Residential handlers include homeowner applicators treating their own home garden or their dogs. Risk for all of these potentially exposed populations is measured by a Margin of Exposure (MOE) which determines how close the occupational or residential exposure comes to a No Observed Adverse Effect Level (NOAEL). Generally, MOEs greater than 100 do not exceed the Agency's risk concern.

a. Toxicity

The toxicity of phosmet is integral to assessing the occupational and residential risk. All risk calculations are based on the most current toxicity information available for phosmet, including a 21-day dermal toxicity study in rats. An acceptable dermal absorption study conducted in rats indicates a dermal absorption factor of 10 percent is appropriate for the phosmet risk assessment. The toxicological endpoints, and other factors used in the occupational and residential risk assessments for phosmet are listed in Table 5a.

In the preliminary risk assessment for phosmet, the Agency selected a LOAEL of 1.5 mg/kg/day established in the subchronic oral neurotoxicity study in rats for the intermediate-term dermal and inhalation exposures of >30 days in duration. In this study, a NOAEL was not established at the termination of the study. Therefore, the Agency used the LOAEL in the risk assessment and added an uncertainty factor of 3. The use of this uncertainty factor established the target MOE of 300 for these assessments and lead to a value (0.5 mg/kg/day) lower than the one used for the chronic dietary RfD (1.1 mg/kg/day). Based on a consideration of the entire toxicity database, EPA determined that the 0.5 mg/kg/day value was not a representative subchronic endpoint. For this reason, the Agency selected the chronic rat study with a NOAEL of 1.1 mg/kg/day for the intermediate term >30 days exposure in the risk assessment. This is appropriate because the same endpoint (cholinesterase inhibition) was observed in both studies in the same species (rat) and the LOAEL of 1.5 mg/kg/day in the subchronic study is comparable to the LOAEL of 1.8 mg./kg/day in the chronic study.

Table 5a. Summary of Toxicological Endpoints and Other Factors Used in the Human Occupational and Residential Risk Assessments for Phosmet

Assessment	Dose	Endpoint	Study	Absorption Factor
Short-term dermal (Up to 7 days)	NOAEL = 15 mg/kg/day	Cholinesterase Inhibition [brain (females), plasma (males)] at the LOAEL of 22.5 mg/kg/day	21-Day Dermal Toxicity in Rats	Not Relevant
Intermediate-term dermal (>7 and #30 days)	NOAEL = 15 mg/kg/day	Cholinesterase Inhibition [brain (females), plasma (males)] at the LOAEL of 22.5 mg/kg/day	21-Day Dermal Toxicity in Rats	Not Relevant
Intermediate-term dermal (>30 days)	NOAEL = 1.1 mg/kg/day	Cholinesterase Inhibition (RBC and Serum) at the LOAEL of 1.8 mg/kg/day	Oral Chronic Toxicity/ Carcinogenicity in Rats	10%
Short-term inhalation (Up to 7 days)	NOAEL= 4.5 mg/kg/day	Cholinesterase Inhibition (Plasma, RBC, Brain) and Decreased Motor Activity at the LOAEL of 22.5 mg/kg/day	Oral Acute Neurotoxicity in Rats	100 %
Intermediate - term inhalation (>7 and # 30 days)	NOAEL= 1.5 mg/kg/day (At 3 week interval)	Cholinesterase Inhibition [brain (females), plasma (males)] at the LOAEL of 2.7 mg/kg/day	Oral Subchronic Neurotoxicity in Rats	100 %
Intermediate - term inhalation (>30 days)	NOAEL= 1.1 mg/kg/day	Cholinesterase Inhibition (RBC and Serum) at the LOAEL of 1.8 mg/kg/day	Oral Chronic Toxicity/ Carcinogenicity in Rats	100 %
Non-dietary ingestion - Acute (children)	NOAEL = 4.5 mg/kg/day	Cholinesterase Inhibition (Plasma, RBC, Brain) and Decreased Motor Activity at the LOAEL of 22.5 mg/kg/day	Oral Acute Neurotoxicity in Rats	Not Relevant
Non-dietary ingestion - Intermediate-term (children)	NOAEL = 1.1 mg/kg/day	Cholinesterase Inhibition (RBC and Serum) at the LOAEL of 1.8 mg/kg/day	Oral Chronic Toxicity/ Carcinogenicity in Rats	Not Relevant

In acute toxicity studies, phosmet exhibits severe toxicity via the oral and inhalation routes of exposure. Phosmet is not acutely toxic in rats via the dermal route, is non-irritating to the skin, and is not an eye irritant in the rabbit.

Table 5b. Acute Toxicity Profile for Phosmet

Guideline No.	Study Type	MRIDs #	Results	Toxicity Category
870.1100/§81-1	Acute Oral - rat	00046189	LD_{50} = 113 mg/kg	II
870.1200/§81-2	Acute Dermal - rabbit	00046190	LD_{50} >5000 mg/kg	III
870.1300/§81-3	Acute Inhalation - rat	00063197	LC_{50} >0.152 mg/L	II
870.2400/§81-4	Primary Eye Irritation	00046192	moderate eye irritant	III
870.2500/§81-5	Primary Skin Irritation	00046191	not a skin irritant	IV
870.2600/§81-6	Dermal Sensitization	no study		N/A
870.6100/§81-7	Delayed Neurotoxicity	44587601	unsteadiness, subdued behavior, recumbency, salivation; no ataxia; no decreases in brain or spinal cord NTE; brain ChE decreased 63%; no neuropathology. [All hens were dosed at 600 mg/kg by oral gavage]	N/A
870.6200/§81-8	Acute Neurotoxicity	44673301	NOAEL 4.5 mg/kg LOAEL 22.5 mg/kg, based on cholinesterase inhibition [plasma, RBC, brain] and decreased motor activity in both sexes.	N/A

b. Exposure

Chemical-specific exposure data for pesticide handling activities were not submitted to the Agency for phosmet. Therefore, daily dermal and inhalation handler doses were calculated using the Pesticide Handlers Exposure Database (PHED), Version 1.1. The database contains exposure values for over 1,700 monitored exposure events, which have been evaluated by the Agency in order to characterize the quality of the data.

The post-application risk assessment for phosmet has been developed using chemical-specific dislodgeable foliar residue data on pears and grapes. In addition, the Agency used chemical-specific exposure data for homeowner exposures resulting from tending and harvesting treated pear trees.

Residential Exposure

Phosmet may be used for direct animal treatments on dogs. Dogs may be treated by either a dust or a dip solution. For the dog dust, the application rate is 0.5 grams of formulated dust per kilogram of animal body weight. For the dog dip, the application rate is 0.0076 lb a.i. per gallon of dip solution.

For homeowner application, the rates are: 0.0098 lb a.i. per gallon and 10 gallons of water per fruit and nut tree; 0.012lb a.i. per 100 square feet for vegetables; 0.0075 lb a.i. per gallon on ornamental plants; and 0.009 lb a.i. per square foot of fire ant mound. In addition, dogs may be treated by homeowners; for the dust, the application rate is 0.5 grams of formulated

dust per kilogram of animal body weight and for the dog dip, the application rate is 0.0076 lb a.i. per gallon of dip solution.

Because phosmet is used in a residential setting, post-application exposure could occur. Homeowners, other adults or children could be exposed to phosmet by entering treated areas, harvesting or maintaining fruit or nut trees, or gardens. In addition, toddlers and others could be exposed to phosmet after coming in contact with a treated dog.

Agricultural Exposure

The quality of the data and exposure factors represent the best sources of data currently available to the Agency for completing these kinds of assessments; the application rates are derived directly from phosmet labels. In addition, typical use rates are also represented in the assessment. The exposure factors (e.g., body weight, amount treated per day, protection factors, etc.) are all standard values that have been used by the Agency over several years, and the PHED unit exposure values are the best available estimates of exposure. Some PHED unit exposure values are high quality while others are considered low quality, but all are the best available data. The quality of the data used for each scenario assessed is discussed in the Revised Human Health Risk Assessment for Phosmet, dated February 9, 2000, which is available in the public docket.

Anticipated use patterns and application methods, range of application rates, and daily amount treated were derived from current labeling and information on common practices, as provided by Gowan Company and various growers and research organizations. Application rates specified on phosmet labels range from 0.7 to 6 pounds of active ingredient per acre in agricultural settings. For agricultural applications, the Agency typically uses acres treated per day values that are thought to represent 8 solid hours of application work for specific types of application equipment. Phosmet may be used for direct animal treatments on livestock. The application rates for the farm animal spray range from 0.4 to 2.0 lb a.i. per 100 gallons. For the cattle backrubber, the application rate is 1 lb a.i. per 50 gallons of fuel oil.

Occupational handler exposure assessments are conducted by the Agency using different levels of personal protection. The Agency typically evaluates all exposures with minimal protection and then adds additional protective measures using a tiered approach to obtain an appropriate MOE (i.e., going from minimal to maximum levels of protection). The lowest tier is represented by the baseline exposure scenario, followed by, if required (i.e., MOEs are less than 100), increasing levels of risk mitigation (personal protective equipment (PPE) and engineering controls (EC)). The levels of protection that formed the basis for calculations of exposure from phosmet activities include:

- Baseline: Long-sleeved shirt and long pants, shoes and socks.
- Label: Long-sleeved shirt and long pants, waterproof gloves, shoes plus socks, chemical resistent headgear for overhead exposure, and dust/mist filtering respirator (most labels).

- Minimum PPE: Baseline + chemical resistant gloves and a PF 5 respirator (dust mist).
- Maximum PPE: Coveralls over long-sleeved shirt and long pants, chemical resistant gloves, chemical-resistent footwear plus socks, chemical resistant headgear for overhead exposures, and a PF 10 respirator (OV) if risk is driven by inhalation.
- Engineering controls: Engineering controls such as a closed cab tractor for application scenarios, or a closed mixing/loading system such as a closed mechanical transfer system for liquids or a packaged based system (e.g., water soluble packaging for wettable powders). Some engineering controls are not applicable for certain scenarios (e.g., for handheld application methods there are no known devices that can be used to routinely lower the exposures).

In addition to the tasks and activities associated with pesticide application and post-application exposures, the Agency considers the expected duration and route of exposure and the associated potential toxic effects as determined in the required toxicity testing. Based on the phosmet use pattern, short-and intermediate-term exposures are expected to occur. For the phosmet risk assessment, short-term exposures are from one to seven days; intermediate-term exposures were separated into two distinct time-frames of between eight and thirty days and greater than thirty days in duration. The reason for these distinctions is that the results of the toxicity testing indicate that effects associated with exposure to phosmet become more severe over time (greater than 30 days).

For the residential handler risk assessment, all application of phosmet by homeowners to fruit and nut trees, ornamental plants, vegetable plants, fire ant mounds and dogs is considered to be short-term, and assumes that no protective clothing is used. The Agency does not require protective clothing for residential handlers because there is no mechanism to ensure that the protective clothing is cleaned and maintained appropriately or that it would routinely be used.

Post-application exposure is a term used to describe those individuals who can be exposed to pesticides after entering areas previously treated with pesticides and performing certain tasks or activities. As with handler risk assessment, the Agency believes that there are distinct tasks that occur in areas previously treated with phosmet in addition to non-work related activities, e.g., children playing with a companion animal, that may contribute to exposure. The Agency also believes that the resulting exposures can vary depending upon the specifics of each task or activity and the levels of chemical residue available in the environment. The nature of the treated area such as the type of foliage on the plant or tree and the duration of activity can also cause exposure levels to differ in a manner specific to each setting considered. For occupational uses, the following post-application scenarios are assessed: adults harvesting tree fruits and nuts; adults harvesting and maintaining nuts;

c. Occupational & Residential Handler Risk Summary

Based on the phosmet use pattern, a total of **23** occupational handler scenarios were identified. No chemical-specific handler exposure data were submitted for phosmet, and therefore daily dermal and inhalation handler doses were calculated using data from the *Pesticide Handlers Exposure Database (PHED), Version 1.1*. The database contains exposure values for over 1,700 monitored exposure events, which have been evaluated by the Agency in order to characterize the quality of the data.

Assumptions regarding the application rate and acres treated (including an assumption of an 8-hour workday for occupational scenarios) were used in conjunction with the PHED unit exposure values to determine phosmet handler exposures. For agricultural handler scenarios, the number of acres treated per day assumed in the phosmet risk assessment are those typically used in risk assessments. For pet handler exposures (vets and professional groomers), the Agency assumed that a maximum of 8 dogs/day are dipped/dusted; risks were calculated for a range of dog body weights (5-120 lbs). In addition, it was assumed that 10% of the active ingredient applied during dipping/dusting represented the total dose; this is a standard assumption taken from the 1997 *Draft Standard Operating Procedures (SOPs) for Residential Exposure Assessment*. The average body weight of an adult handler was assumed to be 70 kg, which is standard for these risk assessments. The hose-end sprayer data were used to assess exposures associated with the fire ant mound treatment scenario. Since there were no data to assess potential handler exposure associated with "charging" the cattle backrubber, data for open mixing of liquids were used; however, the Agency believes this approach may underestimate exposure, based on information submitted about the operation of the cattle backrubber by the registrant, Schering-Plough Animal Health Inc. about the operation of the cattle backrubber.

(1) Occupational Handler Risk

The occupational handler scenarios are listed below:

<u>Mixing/Loader</u>
(1a) mixing/loading liquid formulations for high pressure handwand applications;
(1b) mixing/loading liquid formulations for airblast sprayer application;
(1c) mixing/loading liquid formulations for groundboom sprayer;
(1d) mixing/loading liquid formulations for aerial application;
(2) mixing/loading wettable powders for treating pine seedlings
(2a) mixing/loading wettable powders for aerial application and chemigation;
(2b) mixing/loading wettable powders for groundboom application
(2c) mixing/loading wettable powders for airblast sprayer application;
(2d) mixing/loading wettable powders for high pressure handwand applications;

<u>Applicator</u>
(3) applying sprays with an airblast sprayer
(4) applying sprays with a groundboom sprayer;

(5) aerial application of sprays with a fixed wing aircraft (fixed wing aircraft also accounts for helicopter pilot exposure);
(6) applying using a high-pressure handwand;
(7) applying using a right-of-way sprayer;
(8) dipping pine seedlings;

Mixer/Loader/Applicator
(9) mixing/loading/applying with dusting equipment;
(10) dusting a dog;
(11) dipping a dog;
(12) use of a cattle backrubber;
(13a) mixing/loading/applying liquids with a backpack sprayer;
(13b) mixing/loading/applying wettable powders with a backpack sprayer;
(14a) mixing/loading/applying liquids with a low pressure handwand;
(14b) mixing/loading/applying wettable powders with a low pressure handwand;
(15) mixing/loading/applying soluble concentrates for sprinkling; and

Flagger
(16) flagging for aerial spray application.

The Agency completes occupational handler assessments using different levels of personal protection. Minimal protection is assumed at first, and a tiered approach to adding protective measures is used until an appropriate MOE is obtained, or until all options are exhausted. The lowest tier is defined as the baseline exposure scenario; higher tiers include measures such as personal protective equipment (PPE, e.g., gloves, extra clothing, and respirators) and engineering controls (e.g., closed cabs and closed loading systems). The most practical option for risk reduction is generally considered to be the minimal level of protection adequate to address the risks identified in the risk assessment. MOE calculations are shown in the table below. The footnotes describe the level of PPE used in the assessment. The last column of the table indicates the level of PPE or engineering controls required on labels.

Table 6. Occupational Uses: Risk Concerns (combined dermal & inhalation MOEs)

Exposure Scenario	Crop Type or Target	Acres Treated or Gallons per Application	Application Rate (lbs a.i./A)	Combined MOEs (dermal and inhalation)			Necessary level of PPE or Engineering Controls
				Short Term < 7 days	Intermediate Term < 30 days	Intermediate Term > 30 days	
Occupational Mixer/Loader Estimates for MOE 100 or Highest Achievable MOE							
(1a) mixing/loading liquid formulations for high pressure handwand applications	livestock	1000 gal	0.004	9722[1]	7500[1]	5500[1]	Baseline + Gloves
	livestock	1000 gal	0.02	1994[1]	1500[1]	1100[1]	Baseline + Gloves
	ornamentals	400gal	0.008	121[1]	120[1]	7333[1] + gloves	Baseline + Gloves
(1b) mixing/loading liquid formulations for airblast sprayer application	ornamentals	50	0.06	121[1]	120[1]	7333[1] + gloves	Baseline + Gloves
(1c) mixing/loading liquid formulations for groundboom application	blueberries	80	0.47	1034[1] + gloves	798[1] + gloves	585[1] + gloves	Baseline + Gloves
	blueberries	80	0.94	517[1] + gloves	399[1] + gloves	293[1] + gloves	Baseline + Gloves
	potatoes, alfalfa, cotton	80	1.02	477[1] + gloves	368[1] + gloves	270[1] + gloves	Baseline + Gloves
	alfalfa	80	0.78	623[1] + gloves	481[1] + gloves	353[1] + gloves	Baseline + Gloves
(1c) mixing/loading liquid formulations for groundboom application	alfalfa	200	0.78	249[1] + gloves	192[1] + gloves	141[1] + gloves	Baseline + Gloves

1 Baseline PPE which represents typical work clothing with no respiratory protection. No chemical-resistant gloves are included in this scenario.
2 Minimum PPE which represents the baseline scenario with the use of chemical-resistant gloves and a dust/mist respirator with a protection factor of 5.
3 Maximum PPE which represents the baseline scenario with the use of an additional layer of clothing, chemical-resistant gloves, and an air purifying respirator with a protection factor of 10.
4 Engineering controls which represent the use of an appropriate engineering control such as a closed tractor cab or closed loading system for granulars or liquids. Engineering controls are not applicable to handheld application methods.

Exposure Scenario	Crop Type or Target	Acres Treated or Gallons per Application	Application Rate (lbs a.i./A)	Combined MOEs (dermal and inhalation)			Necessary level of PPE or Engineering Controls
				Short Term < 7 days	Intermediate Term < 30 days	Intermediate Term > 30 days	
	alfalfa, cotton	200	1.02	191[1] + gloves	147[1] + gloves	108[1] + gloves	Baseline + Gloves
	Cotton	80	0.23	2114[1] + gloves	1630[1] + gloves	1196[1] + gloves	Baseline + Gloves
	Cotton	200	0.23	845[1] + gloves	652[1] + gloves	478[1] + gloves	Baseline + Gloves
(1d) mixing/loading liquid formulations for aerial application and chemigation	Blueberries	350	0.47	236[1] + gloves	182[1] + gloves	134[1] + gloves	Engineering Controls
	Blueberries	350	0.94	118[1] + gloves	126[2]	115[2] + double layer	Engineering Controls
	Potatoes, Cotton, Alfalfa	350	1.02	109[1] + gloves	116[2]	106[2] + double layer	Engineering Controls
	Alfalfa	350	0.78	143[1] + gloves	110[1] + gloves	111[2]	Engineering Controls
	Alfalfa	1200	0.78	126[4]	119[4]	87[4]	Engineering Controls
(1d) mixing/loading liquid formulations for aerial application and chemigation	Alfalfa, Cotton	1200	1.02	97[4]	91[4]	67[4]	Engineering Controls

1 Baseline PPE which represents typical work clothing with no respiratory protection. No chemical-resistant gloves are included in this scenario.
2 Minimum PPE which represents the baseline scenario with the use of chemical-resistant gloves and a dust/mist respirator with a protection factor of 5.
3 Maximum PPE which represents the baseline scenario with the use of an additional layer of clothing, chemical-resistant gloves, and an air purifying respirator with a protection factor of 10.
4 Engineering controls which represent the use of an appropriate engineering control such as a closed tractor cab or closed loading system for granulars or liquids. Engineering controls are not applicable to handheld application methods.

Exposure Scenario		Crop Type or Target	Acres Treated or Gallons per Application	Application Rate (lbs a.i./A)	Combined MOEs (dermal and inhalation)			Necessary level of PPE or Engineering Controls
					Short Term < 7 days	Intermediate Term < 30 days	Intermediate Term > 30 days	
		cotton	350	0.23	483[1] + gloves	373[1] + gloves	273[1] + gloves	Engineering Controls
		cotton	1200	0.23	141[1] + gloves	109[1] + gloves	110[2]	Engineering Controls
(2)	mixing/loading wettable powders for high pressure handwand application	pine seedlings	100	0.35	151[2]	117[2]	103[2] + respirator	Engineering Controls
(2a)	mixing/loading wettable powders for aerial application and chemigation	various nut trees	350	5.95	23[4]	22[4]	16[4]	Engineering Controls
		pears	350	5	28[4]	26[4]	19[4]	Engineering Controls
		apples	350	4	34[4]	32[4]	24[4]	Engineering Controls
		fruit & nuts	350	3	46[4]	43[4]	31[4]	Engineering Controls
		grapes, fruit trees & vegetables	350	1.5	92[4]	86[4]	63[4]	Engineering Controls
(2a)	mixing/loading wettable powders for aerial application and chemigation	grapes, & fruit trees	350	1	138[4]	128[4]	94[4]	Engineering Controls
		cotton	1200	0.4	100[4]	94[4]	69[4]	Engineering Controls

1 Baseline PPE which represents typical work clothing with no respiratory protection. No chemical-resistant gloves are included in this scenario.
2 Minimum PPE which represents the baseline scenario with the use of chemical-resistant gloves and a dust/mist respirator with a protection factor of 5 (dust-mist respirator).
3 Maximum PPE which represents the baseline scenario with the use of an additional layer of clothing, chemical-resistant gloves, and an air purifying respirator with a protection factor of 10 (OV respirator).
4 Engineering controls which represent the use of an appropriate engineering control such as a closed tractor cab or closed loading system for granulars or liquids. Engineering controls are not applicable to handheld application methods.

Exposure Scenario		Crop Type or Target	Acres Treated or Gallons per Application	Application Rate (lbs a.i./A)	Combined MOEs (dermal and inhalation)			Necessary level of PPE or Engineering Controls
					Short Term < 7 days	Intermediate Term < 30 days	Intermediate Term > 30 days	
		forestry	1200	1	40[4]	37[4]	27[4]	Engineering Controls
(2b)	mixing/loading wettable powders for groundboom application	noncrop/ field perimeters	10	2	168[1] + gloves	205[2]	150[2]	Engineering Controls
		grapes, vegetables	80	1.5	401[4]	374[4]	274[4]	Engineering Controls
		grapes, vegetables	80	1	602[4]	561[4]	411[4]	Engineering Controls
		cotton	200	0.4	602[4]	561[4]	411[4]	Engineering Controls
(2c)	mixing/loading wettable powders for airblast sprayer application	various nut trees	40	5.95	202[4]	189[4]	138[4]	Engineering Controls
		pears	40	5	241[4]	224[4]	165[4]	Engineering Controls
		apples	40	4	301[4]	280[4]	206[4]	Engineering Controls
(2c)	mixing/loading wettable powders for airblast sprayer application	fruit & nut trees	40	3	401[4]	374[4]	274[4]	Engineering Controls
		grapes, fruit trees & vegetables	40	1.5	110[2] + double layer	101[3]	548[4]	Engineering Controls
		grapes, tree fruit	40	1	132[2]	103[2]	111[3]	Engineering Controls

1 Baseline PPE which represents typical work clothing with no respiratory protection. No chemical-resistant gloves are included in this scenario.
2 Minimum PPE which represents the baseline scenario with the use of chemical-resistant gloves and a dust/mist respirator with a protection factor of 5.(dust-mist respirator).
3 Maximum PPE which represents the baseline scenario with the use of an additional layer of clothing, chemical-resistant gloves, and an air purifying respirator with a protection factor of 10.(OV respirator).
4 Engineering controls which represent the use of an appropriate engineering control such as a closed tractor cab or closed loading system for granulars or liquids. Engineering controls are not applicable to handheld application methods.

Exposure Scenario		Crop Type or Target	Acres Treated or Gallons per Application	Application Rate (lbs a.i./A)	Combined MOEs (dermal and inhalation)			Necessary level of PPE or Engineering Controls
					Short Term < 7 days	Intermediate Term < 30 days	Intermediate Term > 30 days	
		ornamentals	50	0.06	1117[1] + gloves	583[1] + gloves	428[1] + gloves	Engineering Controls
(2d)	mixing/loading wettable powders for high pressure handwand applications	ornamentals	400	0.008	1117[1] + gloves	583[1] + gloves	428[1] + gloves	Engineering Controls
Occupational Applicator Estimates								
(3)	applying sprays with an airblast sprayer	various nut trees	40	5.95	215[4]	188[4]	138[4]	Engineering Controls
		pears	40	5	256[4]	223[4]	164[4]	Engineering Controls
		apples	40	4	320[4]	279[4]	205[4]	Engineering Controls
		fruit & nuts trees	40	3	427[4]	372[4]	273[4]	Engineering Controls
(3)	applying sprays with an airblast sprayer	grapes, fruit trees & vegetables	40	1.5	854[4]	745[4]	546[4]	Engineering Controls
		grapes & tree fruit	40	1	103[1] + gloves	105[2]	819[4]	Engineering Controls
		ornamentals	50	0.06	933[1]	864[1]	634[1]	Engineering Controls

1 Baseline PPE which represents typical work clothing with no respiratory protection. No chemical-resistant gloves are included in this scenario.
2 Minimum PPE which represents the baseline scenario with the use of chemical-resistant gloves and a dust/mist respirator with a protection factor of 5.(dust-mist respirator).
3 Maximum PPE which represents the baseline scenario with the use of an additional layer of clothing, chemical-resistant gloves, and an air purifying respirator with a protection factor of 10.(OV respirator).
4 Engineering controls which represent the use of an appropriate engineering control such as a closed tractor cab or closed loading system for granulars or liquids. Engineering controls are not applicable to handheld application methods.

Exposure Scenario		Crop Type or Target	Acres Treated or Gallons per Application	Application Rate (lbs a.i./A)	Combined MOEs (dermal and inhalation)			Necessary level of PPE or Engineering Controls
					Short Term < 7 days	Intermediate Term < 30 days	Intermediate Term > 30 days	
(4)	applying sprays with a groundboom sprayer	noncrop/ field perimeters	10	2	3188[1]	2453[1]	1799[1]	Baseline
		grapes, fruit trees & vegetables	80	1.5	531[1]	409[1]	300[1]	Baseline
		grapes & vegetables	80	1	797[1]	613[1]	450[1]	Baseline
		cotton	200	0.4	797[1]	613[1]	450[1]	Baseline
		blueberries	80	0.47	1696[1]	1305[1]	957[1]	Baseline
		blueberries	80	0.94	848[1]	653[1]	479[1]	Baseline
		potatoes, alfalfa, cotton	80	1.02	781[1]	601[1]	441[1]	Baseline
		alfalfa	80	0.78	1022[1]	786[1]	577[1]	Baseline
		alfalfa	200	0.78	409[1]	315[1]	230.6	Baseline
(4)	applying sprays with a groundboom sprayer	alfalfa, cotton	200	1.02	313[1]	241[1]	176[1]	Baseline
		cotton	80	0.23	3466[1]	2667[1]	1956[1]	Baseline
		cotton	200	0.23	1386[1]	1067[1]	782[1]	Baseline

1 Baseline PPE which represents typical work clothing with no respiratory protection. No chemical-resistant gloves are included in this scenario.
2 Minimum PPE which represents the baseline scenario with the use of chemical-resistant gloves and a dust/mist respirator with a protection factor of 5.(dust-mist respirator).
3 Maximum PPE which represents the baseline scenario with the use of an additional layer of clothing, chemical-resistant gloves, and an air purifying respirator with a protection factor of 10.(OV respirator).
4 Engineering controls which represent the use of an appropriate engineering control such as a closed tractor cab or closed loading system for granulars or liquids. Engineering controls are not applicable to handheld application methods.

Exposure Scenario	Crop Type or Target	Acres Treated or Gallons per Application	Application Rate (lbs a.i./A)	Combined MOEs (dermal and inhalation)			Necessary level of PPE or Engineering Controls
				Short Term < 7 days	Intermediate Term < 30 days	Intermediate Term > 30 days	
(5) aerial application of sprays with a fixed wing aircraft (fixed wing aircraft also accounts for helicopter pilot exposure)	various nut trees	350	5.95	97[4]	89[4]	65[4]	Engineering Controls
	pears	350	5	115[4]	106[4]	78[4]	Engineering Controls
	fruit & nut trees	350	3	191[4]	176[4]	129[4]	Engineering Controls
	grapes, fruit trees & vegetables	350	1.5	383[4]	352[4]	258[4]	Engineering Controls
	grapes & fruit trees	350	1	574[4]	528[4]	387[4]	Engineering Controls
	cotton	1200	0.4	418[4]	385[4]	282[4]	Engineering Controls
	forestry	1200	1	167[4]	154[4]	113[4]	Engineering Controls
	blueberries	350	0.47	1221[4]	1124[4]	824[4]	Engineering Controls
(5) aerial application of sprays with a fixed wing aircraft (fixed wing aircraft also accounts for helicopter pilot exposure)	blueberries	350	0.94	611[4]	562[4]	412[4]	Engineering Controls
	potatoes, alfalfa, cotton	350	1.02	563[4]	518[4]	380[4]	Engineering Controls
	alfalfa	350	0.78	736[4]	677[4]	497[4]	Engineering Controls

1 Baseline PPE which represents typical work clothing with no respiratory protection. No chemical-resistant gloves are included in this scenario.
2 Minimum PPE which represents the baseline scenario with the use of chemical-resistant gloves and a dust/mist respirator with a protection factor of 5.(dust-mist respirator).
3 Maximum PPE which represents the baseline scenario with the use of an additional layer of clothing, chemical-resistant gloves, and an air purifying respirator with a protection factor of 10.(OV respirator).
4 Engineering controls which represent the use of an appropriate engineering control such as a closed tractor cab or closed loading system for granulars or liquids. Engineering controls are not applicable to handheld application methods.

Exposure Scenario		Crop Type or Target	Acres Treated or Gallons per Application	Application Rate (lbs a.i./A)	Combined MOEs (dermal and inhalation)			Necessary level of PPE or Engineering Controls
					Short Term < 7 days	Intermediate Term < 30 days	Intermediate Term > 30 days	
		alfalfa	1200	0.78	215[4]	198[4]	145[4]	Engineering Controls
		alfalfa	1200	1.02	164[4]	151[4]	111[4]	Engineering Controls
		cotton	350	0.23	2496[4]	2296[4]	1684[4]	Engineering Controls
		cotton	1200	0.23	728[4]	670[4]	491[4]	Engineering Controls
		cotton	1200	1.02	164[4]	151[4]	111[4]	Engineering Controls
(6)	applying using a high-pressure handwand	livestock	1000	0.004	127[1]	101[1]	135[1] + gloves	Use Canceled
		livestock	1000	0.02	127[2] + double layer	101[2] + double layer	88[3]	Use Canceled
		ornamentals	400	0.008	170[1]	135[1]	188[1] + gloves	Baseline + Gloves
(7)	applying using a right-of-way sprayer	ornamentals	400	0.008	267[1]	261[1]	192[1]	Baseline
(8)	dipping pine seedlings	pine seedlings	100	0.35	no data	no data	no data	Maximum
Occupational Mixer/Loader/Applicator Estimates								
(9)	mixing/loading/applying with a dusting equipment	sweet potatoes	no data	0.013lb/a.i./ bushel	no data	no data	no data	Maximum
(10)	dusting on animal	dog	8 animals	0.003	468,750[1]	468,750[1]	343,750[1]	Use Canceled

1 Baseline PPE which represents typical work clothing with no respiratory protection. No chemical-resistant gloves are included in this scenario.
2 Minimum PPE which represents the baseline scenario with the use of chemical-resistant gloves and a dust/mist respirator with a protection factor of 5.(dust-mist respirator).
3 Maximum PPE which represents the baseline scenario with the use of an additional layer of clothing, chemical-resistant gloves, and an air purifying respirator with a protection factor of 10.(OV respirator).
4 Engineering controls which represent the use of an appropriate engineering control such as a closed tractor cab or closed loading system for granulars or liquids. Engineering controls are not applicable to handheld application methods.

Exposure Scenario		Crop Type or Target	Acres Treated or Gallons per Application	Application Rate (lbs a.i./A)	Combined MOEs (dermal and inhalation)			Necessary level of PPE or Engineering Controls
					Short Term < 7 days	Intermediate Term < 30 days	Intermediate Term > 30 days	
		dog	8 animals	0.066	19,886[1]	19,886[1]	14,583[1]	Use Canceled
(11)	dipping a dog	dog	8 animals	0.0076	172,697[1]	172,697[1]	126,645[1]	Use Canceled
(12)	use of a cattle backrubber	cattle	50 animals	0.02	362[1]	361[1]	264[1]	Baseline
(13a)	mixing/loading/applying liquids with a backpack sprayer	livestock	100 animals	0.004	26,250[1]	8750[1]	6417[1]	Baseline
		livestock	100 animals	0.02	5250[1]	1750[1]	1283[1]	Baseline
		ornamentals	40	0.008	35,000[1]	11,667[1]	8556[1]	Baseline
(13b)	mixing/loading/applying wettable powders with a backpack sprayer	ornamentals	40	0.008	35,000[1]	11,667[1]	8556[1]	Baseline
(14a)	mixing/loading/applying liquids with a low pressure handwand	livestock	100	0.004	4953[1]	3596[1]	2637[1]	Baseline + Gloves
		livestock	100	0.02	991[1]	719[1]	527[1]	Baseline + Gloves
		ornamentals	40	0.008	6604[1]	4795[1]	3516[1]	Baseline + Gloves
(14b)	mixing/loading/applying wettable powders with a low pressure handwand	ornamentals	40	0.008	285[1]	179[1]	131[1]	Baseline + Gloves
(15)	mixing/loading/applying soluble concentrates for sprinkling	fire ants	24	0.009	158[1]	158[1]	115[1]	Baseline
Occupational Flagger Estimates								
(16)	flagging for aerial spray application.	various nut trees	350	5.95	2072[4]	1739[4]	1275[4]	Engineering Controls

1 Baseline PPE which represents typical work clothing with no respiratory protection. No chemical-resistant gloves are included in this scenario.
2 Minimum PPE which represents the baseline scenario with the use of chemical-resistant gloves and a dust/mist respirator with a protection factor of 5.(dust-mist respirator).
3 Maximum PPE which represents the baseline scenario with the use of an additional layer of clothing, chemical-resistant gloves, and an air purifying respirator with a protection factor of 10.(OV respirator).
4 Engineering controls which represent the use of an appropriate engineering control such as a closed tractor cab or closed loading system for granulars or liquids. Engineering controls are not applicable to handheld application methods.

Exposure Scenario	Crop Type or Target	Acres Treated or Gallons per Application	Application Rate (lbs a.i./A)	Combined MOEs (dermal and inhalation)			Necessary level of PPE or Engineering Controls
				Short Term < 7 days	Intermediate Term < 30 days	Intermediate Term > 30 days	
	pears	350	5	2466[4]	2069[4]	1517[4]	Engineering Controls
	fruit & nut trees	350	3	4110[4]	3448[4]	2529[4]	Engineering Controls
	grapes, fruit trees & vegetables	350	1.5	164[1]	138[1]	101[1]	Engineering Controls
	grapes & fruit trees	350	1	247[1]	207[1]	152[1]	Engineering Controls
	cotton	1200	0.4	180[1]	151[1]	111[1]	Engineering Controls
	forestry	1200	1	3596[4]	3017[4]	2213[4]	Engineering Controls
	blueberries	350	0.47	525[1]	440[1]	323[1]	Engineering Controls
(16) flagging for aerial spray application.	blueberries	350	0.94	262[1]	220[1]	161[1]	Engineering Controls
	potatoes	350	1.02	242[1]	203[1]	149[1]	Engineering Controls
	alfalfa	350	0.78	316[1]	265[1]	195[1]	Engineering Controls
	alfalfa	1200	0.78	4610[4]	3868[4]	2837[4]	Engineering Controls

1 Baseline PPE which represents typical work clothing with no respiratory protection. No chemical-resistant gloves are included in this scenario.
2 Minimum PPE which represents the baseline scenario with the use of chemical-resistant gloves and a dust/mist respirator with a protection factor of 5.(dust-mist respirator).
3 Maximum PPE which represents the baseline scenario with the use of an additional layer of clothing, chemical-resistant gloves, and an air purifying respirator with a protection factor of 10.(OV respirator).
4 Engineering controls which represent the use of an appropriate engineering control such as a closed tractor cab or closed loading system for granulars or liquids. Engineering controls are not applicable to handheld application methods.

Exposure Scenario	Crop Type or Target	Acres Treated or Gallons per Application	Application Rate (lbs a.i./A)	Combined MOEs (dermal and inhalation)			Necessary level of PPE or Engineering Controls
				Short Term < 7 days	Intermediate Term < 30 days	Intermediate Term > 30 days	
	alfalfa	350	1.02	242[1]	203[1]	149[1]	Engineering Controls
	alfalfa	1200	1.02	3525[4]	2958[4]	2169[4]	Engineering Controls
	cotton	350	0.23	1072[1]	900[1]	660[1]	Engineering Controls
	cotton	1200	0.23	313[1]	262[1]	192[1]	Engineering Controls
	cotton	350	1.02	242[1]	203[1]	149[1]	Engineering Controls
	cotton	1200	1.02	3525[4]	2958[4]	2169[4]	Engineering Controls

1 Baseline PPE which represents typical work clothing with no respiratory protection. No chemical-resistant gloves are included in this scenario.
2 Minimum PPE which represents the baseline scenario with the use of chemical-resistant gloves and a dust/mist respirator with a protection factor of 5.(dust-mist respirator).
3 Maximum PPE which represents the baseline scenario with the use of an additional layer of clothing, chemical-resistant gloves, and an air purifying respirator with a protection factor of 10.(OV respirator).
4 Engineering controls which represent the use of an appropriate engineering control such as a closed tractor cab or closed loading system for granulars or liquids. Engineering controls are not applicable to handheld application methods.

(2) Post-Application Occupational Risk

The post-application occupational risk assessment considered exposures to workers entering treated sites in agriculture. All of the post-application risk calculations completed in this assessment are included in the human health risk assessment and the August 15, 2000, update entitled “Phosmet: Revised Occupational Post-Application Exposure and Risk Calculations (DP Barcode D268141, Chemical Code 059201, case 818976)”, which takes into account the most recent revisions of the policy on agricultural transfer coefficients and information recently collected by the Gowan Company with regard to post-application exposures.

Based on the phosmet use pattern, there is potential for both short-and intermediate-term (< 30 days) post-application exposure to phosmet residues for workers. Only dermal exposures were considered in the post-application assessment, since the physical properties of phosmet suggest post-application inhalation exposures would be minimal.

Agricultural post-application scenarios assessed for phosmet consist of adults harvesting and maintaining fruit trees, grapes, field and vegetable crops. The MOEs were calculated using chemical specific residue dissipation data for pears and grapes. All of the chemical-specific data generated for post-application exposure and risk assessment included residues of phosmet and the oxygen analog metabolite, which were assumed to be equivalent in terms of toxicity. The results of the revised post-application assessment are summarized in Tables 7 through 13, this assessment reflects the updated transfer coefficients as established in the *HED Science Policy for Exposure 3.1: Agricultural Transfer Coefficients*, dated August 7, 2000. These calculations indicate a concern for workers reentering treated fields following the 24-hour REI on current labels for some scenarios. In addition, in the memorandum titled "Phosmet : Further Revisions to the Occupational Exposure and Risk Calculations [DP Barcode D277160, Chemical Code 059201, Case 818976]", dated August 20, 2001**,** the Agency discusses an additional change to the transfer coefficients used to calculate post-application exposure to workers performing thinning on fruit trees.

It should be noted that the transfer coefficient being used for calculating exposure for fruit tree thinners is the same as that used for calculating fruit tree harvester exposure. However, the Agency does not believe, at this time, that fruit tree thinner data should be grouped with harvester data to calculate an overall weighted average transfer coefficient, as proposed by the ARTF and Bayer.

(3) Occupational Reentry Risk Estimates for Phosmet

Table 7: Low Berry Transfer Coefficient Group:

Post-application Risks For Phosmet On Low Bush Blueberries and Cranberries				
Days After Treatment (DAT)	Dislodgeable Foliar Residue Source	Pre-Harvest Interval on Current Label (days)	MOEs (100 target)	
			Low Exposure Activities: scouting, hand weeding, irrigation (early season, low foliage), hand pruning (early season, low foliage), and thinning (early season, low foliage)	High Exposure Activities: hand pruning (late season, full foliage) and hand harvesting.
Low Bush Blueberries and Cranberries				
0	Grape data at 1 lb a.i./acre, not adjusted for application rate	Blueberries - 3 Cranberries - 14	193	52 (blueberries only)
10				102 (blueberries only)
Cranberries				
0	Grape data at 1 lb a.i./acre, adjusted for application rate of 4 lb a.i./acre	Cranberries - 14	48	Not Applicable
11			102	Not Applicable

Table 8: Field/Row Crop Transfer Coefficient Group (low/medium height):

Post-application Risks For Phosmet on Alfalfa, Cotton and Peas					
Days After Treatment (DAT)	Dislodgeable Foliar Residue Source	Pre-Harvest Interval on Current Label (days)	MOEs (100 target)		
			Low Exposure Activities: irrigation and scouting of immature plants	Medium Exposure Activities: irrigation and scouting of mature plants	High Exposure Activities: hand harvesting
0	Grape data at 1 lb a.i./acre, not adjusted for application rate	Alfalfa 7 - 14 Cotton - 21 Peas - 7	772	52	31
10				102	61
18					105

Table 9: Deciduous Tree Fruit Transfer Coefficient Group:

Post-application Risks For Phosmet On Deciduous Tree Fruit Transfer Coefficient Group						
Crop	Days After Treatment (DAT)	Dislodgeable Foliar Residue Source	Pre-Harvest Interval on Current Label (days)	MOEs (100 target)		
				Very Low Exposure Activities: propping	Low Exposure Activities: irrigation & scouting	High Exposure Activities: hand harvesting, & hand thinning
Pears	0	Pear data at 5 lb a.i./acre, not adjusted for application rate	7	260	26	9
	21				105	
	37					101
West Coast Apples	0	Pear data at 5 lb a.i./acre, adjusted for application rate of 4 lb a.i./acre	7	325	33	11
	17				100	
	34					103
Apricots, nectarines, peaches, plums/prunes	0	Pear data at 5 lb a.i./acre, adjusted for application rate of 3 lb a.i./acre	Apricots - 14 Nectarines - 14 Peaches - 14 Plums - 7 Prunes - 7	434	43	15
	13				103	
	30					105
East Coast Apples	0	Pear data at 5 lb a.i./acre, adjusted for application rate of 1.5 lb ai/acre	7	868	87	29
	3				106	
	19					102

Table 10: Evergreen Tree Transfer Coefficient Group:

Post-application Risks For Phosmet On Christmas Trees, Evergreen Trees and Pine Seed Orchards				
Days After Treatment (DAT)	Dislodgeable Foliar Residue Source	Pre-Harvest Interval on Current Label (days)	MOEs (100 target)	
			Low Exposure Activities: Irrigation, scouting, hand weeding, thinning small trees	Medium Exposure Activities: pruning, thinning, cone pruning, cone harvesting, hand harvesting, shaking, topping, training
0	Pear data at 5 lb a.i./acre, adjusted for application rate of 1 lb a.i./acre	Not Specified	130	43
13				103

Table 11: Tree Nut Transfer Coefficient Group:

Post-application Risks For Phosmet on Tree Nut Transfer Coefficient Group					
Crop	Days After Treatment (DAT)	Dislodgeable Foliar Residue Source	Pre-Harvest Interval on Current Label (days)	MOEs (100 target)	
				Low Exposure Activities: irrigation and scouting	High Exposure Activities: hand harvesting, poling, pruning
Beech nut, brazil nut, butternut, cashew, chestnut, macadamia, walnuts	0	Pear data at 5 lb a.i./acre, adjusted for application rate of 5.95 lb a.i./acre	14	44	9
	13			104	
	37				101
Almonds, pistachios, pecans	0	Pear data at 5 lb a.i./acre, adjusted for application rate of 3 lb a.i./acre	Almonds - 30 Pistachios - 14 Pecans - 14	87	17
	3			106	
	27				104

Table 12: Root Vegetable Transfer Coefficient Group:

Post-application Risks For Phosmet On Potatoes and Sweet Potatoes					
Days After Treatment (DAT)	Dislodgeable Foliar Residue Source	Pre-Harvest Interval on Current Label (days)	MOEs (100 target)		
			Low Exposure Activities: irrigation and scouting of immature plants	Medium Exposure Activities: irrigation and scouting of mature plants	High Exposure Activities: hand harvesting only for sweet potatoes
0	Grape data at 1 lb a.i./acre, not adjusted for application rate	Potatoes - 7	257	52	31
10				102	
18					105

Table 13: Vine/trellis Transfer Coefficient Group:

Post-application Risks For Phosmet On Highbush Blueberries, Grapes, Kiwi, and Trellised Sweet Peas						
Days After Treatment (DAT)	Dislodgeable Foliar Residue Source	Pre-Harvest Interval on Current Label (days)	MOEs (100 target)			
			Low Exposure Activities: hedging, irrigation, scouting blueberries, hand weeding, training/tying blueberries	Medium Exposure Activities: grape/kiwi scouting, training grapes, tying kiwi	High Exposure Activities: hand harvesting, thinning, pruning, training/tying grapes	Very High Exposure Activities: grape girdling and cane turning
0	Grape data at 1 lb a.i./A, not adjusted for application rate	Blueberries 3 Grapes 7 - 14 Kiwi 21 Sweet Peas 7	154	77	15	8
4				101		
28					104	
38						103

(4) Residential (Homeowner) Handler Risk

- The Agency is concerned about exposures associated with treatment of dogs because the majority of the serious cases reported in the incident data involved systemic illnesses to pet owners, groomers and veterinary assistants.

- EPA's comparative analysis of incident data shows that residential exposures to phosmet are more likely to result in treatment in a health care facility than other organophosphate insecticides; phosmet ranked third for hospitalizations, and first for admission to intensive care units.

In 1996 several mitigation measures were implemented in an attempt to reduce the number of incidents to homeowners, veterinary workers and pets, associated with the use of phosmet. Specifically, product labels were amended to discourage application to certain dog breeds, and to smaller dogs and specifically exclude use on cats.

For homeowner handler exposure assessments, the Agency does not believe a tiered mitigation approach like that used for assessing occupational handler risk is appropriate. Homeowners often lack access to personal protective equipment (PPE) and also do not possess expertise in the proper use of PPE. As a result, homeowner handler assessments are completed using a single scenario based on the use of short-sleeved shirts and short pants (i.e., common homeowner attire during the pesticide application season). In addition, only short-term exposures were assessed, as the Agency does not believe homeowners who apply phosmet will be exposed for more than 7 days. The exposure scenarios are:

Residential (homeowner) Direct Animal Treatments:
(1) dusting a dog;
(2) dipping a dog;

Residential (homeowner) Use on Terrestrial Crops:
(3b) mixing/loading/applying wettable powders with a backpack sprayer;
(4b) mixing/loading/applying wettable powders with a low pressure handwand sprayer;
(5b) mixing/loading/applying wettable powders with a hose-end sprayer;

Residential (homeowner) Treatments on Ornamental Plants:
(3a) mixing/loading/applying liquids with a backpack sprayer;
(3b) mixing/loading/applying wettable powders with a backpack sprayer;
(4a) mixing/loading/applying liquids with a low pressure handwand sprayer;
(4b) mixing/loading/applying wettable powders with a low pressure handwand sprayer;
(5a) mixing/loading/applying liquids with a hose-end sprayer;
(5b) mixing/loading/applying wettable powders with a hose-end sprayer; and
(6) mixing/loading/applying soluble concentrates to fire ant mounds.

Combined dermal and inhalation MOEs for mixing/loading/applying phosmet to fruit trees and ornamentals using a low pressure handwand were of concern (42 and 83, respectively). Very

limited data were available to assess exposure risks for handlers for the direct application to dogs scenario (dip/dust); therefore, data and procedures specified in the 1997 SOPs for Residential Exposure Assessment were used. The SOPs assume combined dermal and inhalation exposure of 10% of the amount applied. This assessment estimated that handler risks for direct application to dogs (dip/dust) were not a concern.

Table 14. Homeowner Uses:

Phosmet MOEs Attributable to Combined Short-term Homeowner Handler Dermal and Inhalation Exposures						
Scenario	**Scenario Description**	**Assumptions Used in Assessment**	**Crop Type or Target**	**Dermal MOEs (Target 100)**	**Inhalation MOEs (Target 100)**	**Combined MOEs (Target 100)**
1	Dusting an Animal	1 dog/day	Dog	3,750,000	No Data	No Data
		1 dog/day	Dog	159,091	No Data	No Data
2	Dipping a Dog	1 dog/day	Dog	1,381,579	No Data	No Data
3a	Mixing/loading/applying Liquids With a Backpack Sprayer	5 gallons	Ornamentals	5,490	280,000	5,385
3b	Mixing/loading/applying Wettable Powders With a Backpack Sprayer	5 gallons	Ornamentals	4,118	210,000	4,038
		150 ft^2	Peas	11,438	583,333	11,218
		250 ft^2	Potatoes	11,438	583,333	11,218
		10 gallons	Fruit Trees	2,101	107,143	2,060
4a	Mixing/loading/applying Liquids With a Low Pressure Handwand	5 gallons	Ornamentals	280	280,000	280
4b	Mixing/loading/applying Wettable Powders With a Low Pressure Handwand	5 gallons	Ornamentals	84	5,727	83
		150 ft^2	Peas	233	15,909	230
		250 ft^2	Potatoes	233	15,909	230
		10 gallons	Fruit Trees	43	2,922	42
5a	Mixing/loading/applying Liquids With a Garden Hose-End Sprayer	5 gallons	Ornamentals	933	884,211	932
5b	Mixing/loading/applying Wettable Powders With a Garden Hose-End Sprayer	5 gallons	Ornamentals	700	663,158	699
		150 ft^2	Peas	1,944	1,842,105	1,942
		250 ft^2	Potatoes	1,944	1,842,105	1,942
		10 gallons	Fruit Trees	357	338,346	357
6	Mixing/loading/applying Soluble Concentrates For Sprinkling	20 gallons (5 - 2 ft^2 mounds at 4 gallons per mound)	Fire Ants	389	368,421	388

(5) Residential Post-Application Risk

Phosmet can be used on residential fruit and nut trees, home gardens, ornamental plants, and dogs where exposure to adults and children may occur. Exposure may result from entering the treated garden; maintaining fruit or nut trees; harvesting fruits, nuts or vegetables; or petting treated dogs. As a result, both toddler and adult risks were considered in the risk assessment.

Residential post-application scenarios assessed for phosmet consist of adult homeowners and children (aged 10-12) harvesting and maintaining pears and apples at maximum application rates, and toddlers after dermal contact with treated dogs, including incidental hand-to-mouth transfer. There are concerns for continuous post-application exposure to adults and youth in residential settings over an extended period of time (greater than 30 days); however, there is little information to determine if such extended exposures actually occur. There are also concerns for short-term post-application exposure to adults and youths harvesting and maintaining fruit trees. In addition, there are significant risk concerns for toddlers exposed to phosmet residues following contact with treated dogs, regardless of the duration of exposure.

For short- and intermediate-term (less than 30 days) exposures to adults and youths harvesting and maintaining apples and pears in home gardens, the MOEs were less than 100 on the day of phosmet application, with the exception of apples treated at 1.5 lb a.i./A. An MOE greater than 100 was achieved 4-8 days after application for adults and 3-6 days after application for youths. For this residential post-application scenario, the Agency assumes that home gardening activities would take place for 0.67 hours per day. The Agency does not have enough information to determine if intermediate-term (more than 30 days) exposures to phosmet occur in home gardens. However, empirical dissipation data suggest that phosmet residues persist, and that it may be possible for individuals to be exposed over an extended period of time.

The Agency has concerns for short- and immediate-term (less than 30 days) post-application risk for toddlers exposed to phosmet through dermal contact with treated dogs, as well as through non-dietary ingestion of residues associated with hand-to-mouth behaviors. For this assessment, the Agency has assumed that toddlers would engage in hand-to-mouth activity for 2 hours per day. The Day 0 MOEs calculated for petting small and large dogs ranged from <1 to 8, with the target MOE being 100. An MOE of more than 100 was not achieved even after 30 days, when re-treatment could occur. For toddler mouthing behaviors, as well as for combined exposure to dogs (i.e., dermal + hand-to-mouth exposures), Day 0 MOEs were 1 or less than one after contact with small and large dogs, and did not go above 100 after 30 days. Intermediate-term (more than 30 days) aggregate (i.e., dermal + hand-to-mouth) MOEs calculated for toddlers following contact with treated dogs were <1.

4. Aggregate Risk

An aggregate risk assessment looks at the combined risk from dietary exposure (food and drinking water routes) and residential exposure (dermal exposure, inhalation exposure for homeowner applicators, and incidental oral exposure for toddlers who pet treated dogs and engage

in hand-to-mouth activities). The aggregate dietary (food and water) risks are not of concern. Generally, all risks from these exposures must have MOEs of greater than 100 to be not of concern to the Agency.

Results of the aggregate risk assessment are summarized here, and are discussed extensively in the HED chapter, dated February 9, 2000. Aggregate risks including food, water, and residential exposure were not of concern except for the following residential scenarios: toddler contact with treated dogs; harvesting from home gardens treated at higher application rates; and homeowners applying wettable powder to ornamentals and fruit trees using low-pressure handwand sprayers.

5. Incident Data Review

Incidents involving exposure to phosmet are reported in the four sources reviewed; OPP's Incident Data System (IDS), Poison Control Centers (PCC), California Department of Pesticide Regulation (CDPR), and the National Pesticides Telecommunications Network (NPTN). In addition, the EPA has reviewed several literature studies, two of which describe an exposure incident in detail, and one which consists of a telephone survey of animal groomers/veterinary workers to determine the type of products used, PPE used, and incidents associated with exposure to flea control products.

- The Agency is concerned about exposures associated with treatment of dogs because the majority of the serious cases reported in the incident data involved systemic illnesses to pet owners, groomers and veterinary assistants.

- EPA's comparative analysis of incident data shows that residential exposures to phosmet are more likely to result in treatment in a health care facility than other organophosphate insecticides; phosmet ranked third for hospitalizations, and first for admission to intensive care units.

In 1996 several mitigation measures were implemented in an attempt to reduce the number of incidents to homeowners, veterinary workers and pets, associated with the use of phosmet. Specifically, product labels were amended to discourage application to certain dog breeds, and to smaller dogs and specifically exclude use on cats.