Assessment Team, a DPRA Inc. Benefits Assessment (a private source of benefits information), and Preliminary Benefits Assessments (PBAs) by EPA. If specific site assessments were not available, then state recommendations, specimen label guides, the 1992 Insect Control Guide, and the EPA Index to Pesticide Chemicals provided information about the primary pests and alternative chemical controls for each site.

USDA completed a benefits assessment for dichlorvos in early 1990, based on survey data and expert opinion, that estimates the average annual benefit to be at least \$120 million. This estimate was based on data from the mid-80's when usage was much higher than it is now. EPA estimates that dichlorvos usage has declined from approximately 2 million pounds annually at the time of the PD 1 (1985 data) to about 250,000 to 500,000 pounds per year at present. In addition, Amvac has requested voluntary deletion of several uses, which account for some of the current usage. Therefore, the use deletions will reduce usage even further.

In conducting the benefits assessment, each site was analyzed to determine the impacts that would result if dichlorvos were canceled for that site, (See Table 3 in this Unit). Comparative performance data were not available; therefore, the analyses were based on comparative cost assessments under the assumption that sufficient products were available which would provide adequate control of the pests.

The alternatives to dichlorvos include carbamates, organophosphates, natural pyrethrins and synthetic pyrethroid compounds. EPA has identified the following insecticides as likely alternatives to dichlorvos: bendiocarb, carbaryl, chlorpyrifos, diazinon, malathion, naled, phosmet, propoxur, permethrin, pyrethrins, resmethrin, and tetrachlorvinphos. In addition, nonchemical alternatives were also identified where information was available. In most cases these nonchemical alternatives help control insect populations which may result in a decrease in the frequency of chemical treatments. It is unlikely that these nonchemical alternatives would replace dichlorvos to the extent that a chemical alternative would.

E. Individual Sites

Table 3 in Unit III.F. of this document lists detailed information on the benefits for each site.

1. In and around domestic buildings. Dichlorvos is used in and around domestic buildings primarily as an aerosol treatment to control a variety of insects. It is also used in foggers and impregnated resin pest strips. A variety of chemical alternatives are available. In the absence of efficacy data, EPA is assuming that the alternatives would provide similar levels of control. Nonchemical alternatives are also available. EPA estimates that less than 1 percent of total dichlorvos is used in the home; however, it is unknown how much of this is applied by commercial applicators.

2. Pets. Dichlorvos is used to control fleas and ticks on dogs and cats through the use of impregnated plastic flea and tick pet collars. There are a variety of alternative chemicals available to dichlorvos, some of which have had reports of tick and flea resistance. Due to the lack of comparative efficacy and resistance data, EPA assumes that collars with and without dichlorvos have equal efficacy. There are also nonchemical alternatives available which can reduce the frequency of pesticide treatment, including: sanitation, vacuuming pet living and sleeping quarters, and washing or replacing bedding. EPA estimates that pet collars represent 3 percent of total dichlorvos usage. EPA does not expect the economic impact from cancellation of dichlorvos to be significant, because dichlorvos is not one of the major insecticides used in cat and dog collars.

Mushroom houses. Dichlorvos is used only as a space spray to control the adult mushroom fly complex after surface sprays and larvacides no longer provide adequate control; therefore, only permethrin is considered an actual alternative (Ref. 57). Non-chemical controls include black light traps to monitor fly emergence and quantify fly influx. There may be some pest resistance to both dichlorvos and permethrin; however, due to the lack of comparative efficacy or resistance data, EPA assumes that acceptable levels of control would be provided by both chemicals. EPA estimates that 2 percent of total dichlorvos is used on mushrooms. The Agency has information that suggests dichlorvos is primarily used as an emergency treatment if larval treatments fail. Economic impacts to the mushroom industry cannot be accurately assessed due to the limited usage data available regarding the use of the alternative chemicals. Based on limited information, some impacts are possible; however, economic impacts are not expected to be significant if dichlorvos is not available.

4. *Greenhouses*. Dichlorvos is used primarily as a space spray for control of a variety of insects on both food and nonfood greenhouse plants. The major

direct alternatives, used as space sprays, aerosols, bombs, or pressure fumigators (smoke generators) include nicotine, pyrethrins, and resmethrin. There are also a variety of other alternatives used as greenhouse surface treatments and direct application to plants. There are reports that some whitefly species may be resistant to resmethrin; however, in the absence of comparative efficacy or resistance data EPA assumes that similar levels of control would be provided by the alternatives. Nonchemical mitigation measures to reduce pesticide applications include: sticky board traps, good sanitation practices and the use of insect free transplants. Total usage in greenhouses is less than 2 percent of total dichlorvos usage; however, available usage data do not separate food and non-food use of dichlorvos in greenhouses. If the number of applications is assumed to be equal for dichlorvos and the alternatives, then economic impacts resulting from the loss of dichlorvos are not expected to be significant.

5. Direct application to animals and animal premises. Dichlorvos is applied directly to domestic food and non-food animals primarily to control flies. Other insects are also controlled with dichlorvos (See Table 3 in Unit III.F. of this document). There are various alternatives available, which vary somewhat for each type of livestock and poultry. There are reports that flies are resistant to permethrin; however, in the absence of comparative efficacy or resistance data, EPA assumes that all products would perform similarly. Nonchemical control measures include the use of parasitic and predatory wasps that have not gained much commercial acceptance; upgraded/improved sanitary conditions involving manure management, trapping insects, and the introduction of bacteria and viruses that are pathogenic to the pests. Most uses on animals make use of some type of automatic method rather than hand-held application, therefore the loss of handheld application should not result in a significant impact on users.

Dichlorvos is used as a space spray, animal spray, residual treatment, or bait in controlling flies in animal premises. There are a variety of chemical alternatives available. There are reports that flies are resistant to permethrin; however, in the absence of comparative efficacy or resistance data, EPA assumes that all products would perform similarly. Non-chemical controls include improved manure management, use of parasites, traps, sanitation, and electrocutors. EPA estimates the total usage for direct animal treatment and premise treatment for all domestic