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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

In re: Emergency suspension Orders for 2,4,5-T and Silvex	)	FIFRA Docket Nos. 409, 410

REBUTTAL COMMENTS OF RESPONDENT ENVIRONMENTAL PROTECTION AGENCY

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April 4, 1979

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April 4, 1979

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INTRODUCTION

On February 28, 1979, the Administrator issued emergency orders suspending certain uses of the pesticides 2,4,5-T and silvex. The Administrator's decision documents totaled nearly 200 pages and they were supported by an administrative record approximately 40,000 pages long. The Administrator's orders provided for the filing of counterstatements of position by 2,4,5-T and silvex registrants. On March 26, 1979, the Dow Chemical company filed its comments on the Administrator's emergency suspension orders; several other registrants filed considerably shorter counterstatements.

The Administrator's orders also give respondent Environmental Protection Agency an opportunity to file a rebuttal. EPA's rebuttal submission begins with discussions of the regulatory history and of the burden of proof. The main body of the rebuttal is divided into four sections. Section I reaffirms that the suspension orders were based on a vast body of toxicological, medical, and environmental evidence indicating that the uses of 2,4,5-T and silvex pose a serious health threat to humans and not just on the Alsea Study. */ Section I focuses with particular attention on the lack of a reproductive no-effect level for TCDD and on the primate studies which indicate health effects comparable to those experienced by the Alsea, Oregon, women.

*/ Report of Assessment of a Field Investigation of Six-Year Spontaneous Abortion Rates in Three Oregon Areas in relation to Forest 2,4,5-T Spray Practices (hereinafter "Alsea II" or "Alsea Study"). This report was prompted by letters from eight Oregon women complaining of miscarriages shortly after 2,4,5-T use. The Agency's preliminary assessment of the eight women's experience is referred to as Alsea I.

Section II concerns the validity and significance of the Alsea Study. Although circumstantial evidence of actual and potential adverse human health effects has long existed, the Alsea Study's demonstration of a statistically significant correlation between human miscarriages and the use of 2,4,5-T in the Alsea area provided special new information confirming the predictions of the animal test data and demonstrating that the isolated experiences of individual women occurred in larger groups of women as well. We show in Section II that Dow's analysis of the Alsea Studies is based on unnecessary and unrealistic expectations regarding scientific methods and unsupported claims and erroneous interpretations of the data.

Section III deals with Dow's effort to meet its burden of proof by attempting to show that human exposure to 2,4,5-T is negligible. It should be noted that neither Dow nor other registrants have provided data or other information which refute the Agency's assumption that women who live and work in areas where 2,4,5-T is used may be exposed to the pesticide. Section III presents information developed since the February 28 decisions consisting principally of case histories showing that use of 2,4,5-T may result in the distribution of this chemical (and presumably TCDD) to sites of human habitation and work. The same considerations would, of course, be applicable to silvex.

Section IV shows that the Administrator adequately assessed the benefits of the suspended 2,4,5-T and silvex uses during the two-year period for cancellation proceedings. We show that

Dow s criticisms of the Agency's analysis is highly speculative and to a considerable degree is marred by misinterpretation of the EPA analyses and by factual or analytical errors. Dow relies heavily on a report entitled "The Biologic and Economic Assessment of 2,4,5-T," which was prepared by the USDA-EPA-States RPAR Assessment Team. That report focused on impacts which could result from a permanent cancellation, not a short-term suspension. In several instances, Dow has overlooked this important limitation on the Report's pertinence to this case. Moreover, on March 1, 1979, Assistant Secretary of Agriculture Cutler announced cessation of the use of 2,4,5-T for forest management and stated that "the Department fully supported EPA's review of possible risks and benefits associated with the use of 2,4,5-T." The Administrator's findings of relatively minor impacts of the suspended 2,4,5-T and silvex uses are sound.

REGULATORY HISTORY

During the past decade scientific and public concern has steadily mounted over the threat to human health posed by TCDD (a form of dioxin) and by pesticides such as 2,4,5-T and silvex which contain TCDD. In 1969 the Mrak Commission, composed of distinguished scientists, issued a report to the Secretary of Health, Education and Welfare recommending that use of 2,4,5-T should be "immediately restricted to prevent risk of human exposure." */ In 1970 the United States Department of Agriculture (which at that time administered the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)) suspended the registration of 2,4,5-T for aquatic and home uses.

As Dow points out, an advisory committee of the National Academy of Sciences did find in a May 1971 report that insufficient evidence of hazard from very low concentrations of TCDD had been established. **/ But the committee went on to note "existing deficiencies in information relative to possible accumulation in the soil and possible magnification in the food chain of the dioxin TCDD. . . ." Advisory Committee Report at 67. And the Committee was sufficiently concerned to recommend that 2,4,5-T formulations used around the home and in recreational areas bear the warning "This compound may be dangerous to pregnant women and animals and its use must be such as to reduce the possibility of exposure to an absolute minimum."

*/ Report of the Secretary's Commission on Pesticides and Their Relationship to Environmental Health, U.S. Govt. Printing Office (1969) at 657-58.

**/ Report of the Advisory Committee on 2,4,5-T to the Administrator of the Environmental Protection Agency (1971) at 64.

Advisory Committee Report at 67. Moreover, it is important to note that studies on animals showing adverse reproductive and carcinogenic effects from TCDD when administered at extremely low dose levels first became available subsequent to issuance of the Advisory Committee Report. For example, the studies showing reproductive and carcinogenic effects at dose levels as low as one billioneth of a gram (per kilogram of body weight per day) are very recent. These studies are discussed in some detail later in this memorandum.

The Decisions and Emergency Orders are responsive to the new data which has accumulated concerning the toxicity of TCDD at low dose levels in animals and to the very recent Alsea data which indicates a relationship between spraying of 2,4,5-T and incidence of miscarriages. The Administrator has explained why the actions taken are appropriate and candidly set forth the reasons why he has taken these actions now. See Decision and Emergency Order (2,4,5-T) at 48-52. */ As will be explained further below, the decisions that were made were fully in accord with the Administrator's responsibilities and with all applicable requirements of law.

*/ In Environmental Defense Fund v. EPA (Aldrin/Dieldrin), 510 F.2d 1292, 1299-1300 (D.C. Cir. 1975), plaintiffs charged that EPA's two prior refusals to suspend the registrations of aldrin and dieldrin undermined its decision to take such action subsequently. The court firmly rejected that argument, noting that "what changed here was not EPA s policy but the nature of the evidence." Id. The same is true here.

THE BURDEN OF PROOF IN SUSPENSION PROCEEDINGS

The most fundamental principle of FIFRA is that proponents of the use of a pesticide--manufactures and user groups--bear the burden of proof that the benefits of the chemical outweigh the risks which may result as a result of use of the pesticide. Environmental Defense Fund v. EPA, 548 F2d. 998, 1004 (D.C. Cir. 1976); Environmental Defense Fund v. EPA, §10 F2d. 1292, 1297 (D.C. Cir. 1975); Dow Chemical Co. v. Ruckelshaus, 477 F2d. 1317, 1324 (8th Cir. 1973); Stearns Electric Co. v. EPA, 461 F2d. 293, 303 (7th Cir. 1972). The central consequence of this principle and its sound foundation in public policy cannot be grasped without appreciating that chemical regulation is a discipline characterized fundamentally by uncertainty. The statute requires the Agency to balance risks and benefits; however, it is hardly ever possible to know what the risks and benefits of a pesticide in fact are with the kind of precision which responsible men normally desire to achieve on matters so fundamental and important.

This is because the facts are almost always incomplete, the scientific theories unproven, and both the facts and the theories in hot dispute. A few examples are illustrative: a chemical may have been shown to produce liver effects in mice. The chemical is one which is widely used, and as a consequence, a wide varity of groups of people are exposed to the chemical. Leaving aside the questions about the benefits of the chemical (i.e., questions relating to the value of the chemical as a tool to man), the regulation involves, at a minimum, issues about the reliability of the study; whether the animal data is

a reliable predictor of human illness of man if exposed; what groups of people may be exposed and in what ways and in what amounts? Great uncertainties will be encountered in the attempt to answer each of these questions. The response of an academician to those uncertainties is usually easy to predict--conduct other study, to get more information. While in some situations that answer is an acceptable one, in most situations it is not, for the public policy reasons which are fundamentally sound and reasonable. The reason that "wait and see" is not generally an acceptable answer is precisely because the chemical will continue to be used during any period of further inquiry; consequently, the possibility that uncertainties may be resolved after further information gathering in favor of higher, rather than lower, estimates of risk cannot responsibly be ignored.

This is not to say that the regulator must regard risks that are not known with certainty as infinite; the fundamental point is that responsible regulatory policy will not permit ignoring respectable hypothesis of risk which are consistent with the incomplete information which exists and is relevant to the problem. Thus, the approach which must be taken to risk--and the fundamental meaning of the burden of proof concept under FIFRA--is that the Agency must resolve uncertainties on the risk side of the regulatory equation reasonably in favor of the higher estimates of risk which are consistent with the available data. Registrants and others meet their "burden of proof" by proving that the Agency's assessment of the existing information is flawed, or by performing additional studies to

produce more information which will eliminate or narrow uncertainties, and thereby justify the Agency in acting on the assumption that the chemical to is less risky than it earlier estimated.

Risk considerations alone, as we have pointed out before, do not produce decisions under FIFRA; instead, the Agency is required to regulate "unreasonable" risks -- which is defined to mean those risks which are found to exceed the economic, social and environmental benefits of use. The burden of proof concept discussed above with respect to risks requires a similar analytical approach to benefits questions. In the end, regulatory decisions turn on policy laden, legislative decisions on whether the risks exceed the benefits. */

While there can be considerable disagreement among reasonable men as to how the component parts of a risk/benefit analysis are put together for any given chemical, no one seriously can dispute the fundamental soundness of the approach, or the wisdom of a reasonable allocation of the risks of uncertainty to proponents of the use of a chemical. In summary, this approach is essentially grounded in the judgment that society at large can soundly require people who wish to use a poisonous materal to persuade a regulatory agency that its value as a tool is worth the price which society may have to pay--including the price in injury and illness which can reasonably be hypothesized, if uncertainties in the information available are resolved in

*/ Ethyl Corp. v. EPA., 541 F2d. 124 (D.C. Cir. 1976); Society of Plastics Industry, Inc. v. OSHA 509, F2d. 1301 (2d Cir), cert. denied 421 U.S. 992 (1975).

favor of higher, rather than lower risks. In the context of this decision, this approach boils down to a simple question--are these chemicals valuable enough as tools for man over the two years to justify subjecting people to risks of reproductive failure and cancer which reasonably can be hypothesized to exist, based upon the existing scientific data? The Agency, of course, answers these questions in the negative.

The suspension provision is FIFRA's precautionary tool for safeguarding public health before serious harm results. It permits prophylactic action, pending more definitive resolution of the issues. "The function of a suspension decision is to make a preliminary assessment of evidence and probabilities, not an ultimate resolution of difficult issues" Environmental Defense Fund v. EPA, supra, §510 F2d. at 1298. A lesser degree of certainty is required for suspending a pesticide, than for taking it off the market permanently.

> It is not necessary to find "conclusively" that actual harm to man will occur if the use of the pesticide in question is continued; rather the findings required is that continued use in the cancellation proceedings is "likely" to result in any "unreasonable risk" to man or the environment.....[T]he propriety of suspension turns upon an analysis in which the risks are balanced against the benefits, rather than from an analysis of risks or benefits alone... [T]he mere fact that the evidence on either of these issues (risks or benefits) is not complete, or that more evidence may be expected to be developed in the cancellation proceedings, is not a reason to deny suspension.

In re Velsicol Chemical Corporation et. al., Decision of the Administrator on the Suspension of Heptachlor/Chlordane, 41 Fed. Reg. 7552, 7574 (February 19, 1976).

ENVIRONMENTAL PROTECTION AGENCY REBUTTAL POSITION

I. The Administrator's suspension order is based in large part on animal toxicity data which corresponds to the effects observed in the Alsea Study.

A. Introduction

Dow contends that the Administrator's suspension analysis is based almost entirely on the Alsea Study. However, the examination of the suspension documents and Administrative Record serves to rebut this contention. These documents unequivocably establish that the decision to suspend was based in part on the studies on animal toxicity and exposure detailed in the notices and listed in the Administrative Record. Specifically, the suspension notices open with statements that 2,4,5-T, silvex and TCDD cause reproductive and oncogenic effects in test animals, 2,4,5-T Order at 1, Silvex Order at 1, and continue with the Administrator's finding that "the occurrence of [fetotoxic, teratogenic, and carcinogenic] effects in test animals indicates that humans who are exposed to TCDD and/or 2,4,5-T and silvex may experience comparable effects." 2,4,5-T Order at __, Silvex Order at __. Further, in the detailed statement of findings, the Notice devotes more than twelve pages to a review of data showing that silvex, 2,4,5-T and/or their common dioxin contaminant, TCDD, produce terotogenic, fetotoxic and carcinogenic effects in test animals. 2,4,5-T Order at 22-34, Silvex Order at 27-36. Further, a discussion of the exposure potential of the uses of 2,4,5-T and silvex fills ten pages of the notice. 2,4,5-T Order at 47-52, 56-61, Silvex Order at 47-52, 54(a)-61. By contrast,

the detailed discussion of the Alsea study occupies six pages. 2,4,5-T Order at 34-42, Silvex Order at 36-43. Thus, although the Alsea study is clearly a crucial element in the decision to suspend these pesticides, the suspension actions were not based exclusively or even primarily on the Alsea study, as Dow contends. Rather, these actions were based on a combination of three interlocking elements which together indicated that the uses of the pesticide presented an imminent hazard to humans who might be exposed to these pesticides if use continued during the coming months.

The Alsea study added to the long-standing scientific data and information on the toxic effects and exposure potential of these pesticides, new data showing a correlation between the use of 2,4,5-T in Alsea, Oregon and an excess of spontaneous abortions in that area compared to a control population. Because Dow has chosen to regard the suspension actions as based mainly on the Alsea II study and, notwithstanding the extensive and detailed discussions of other issues in the suspension notices, have based their challenge to these actions almost exclusively on the Alsea study, the Agency responds with corresponding emphasis on the Alsea study in Section II of this memorandum.

However, the observed correlation between 2,4,5-T use in the Alsea area and the excess incidence of miscarriages in that area was first investigated and later deemed to be important precisely because the effects observed in the women residents

of Alsea are analagous to the effects observed in test animals. That is, when test animals are exposed to 2,4,5-T, silvex, and/or TCDD, the animals exhibit several different forms of reproductive failure such as fetal death, or animals with birth defects such as cleft palate and abnormal kidneys. 2,4,5-T Order at 22; Silvex Order at 27.

Moreover, these fetotoxic and teratogenic effects are observed in test animals at very low dose levels and because no-effect levels for these effects have not been conclusively established, it is not possible to predict a "safe" level for humans. Thus, the actions suspending 2,4,5-T and silvex were based on animal toxicity data and information on exposure potential, as well as on the Alsea study.

The discussion to follow reviews these data in two parts. Subsection B summarizes the animal toxicity data, referring particularly to the data which tend to be specifically predictive of the adverse reproductive effects observed in the Alsea area residents. Section III reviews information on the potential for biologically significant exposure to humans.

B. Fetotoxic teratogenic and carcinogenic effects have occurred in test animals as a result of exposure to 2,4,5-T, silvex and/or TCDD.

The Agency's analysis of studies in experimental animals had led to the firm conclusion that maternal exposure to 2,4,5-T, silvex and/or TCDD leads to excess incidences of birth defects, such as cleft palate and abnormal kidneys, stillborn animals and

reduced survival among the offspring of these animals. Exposure to these substances had also resulted in carcinogenic responses. Because of the consistency and reproducibility of these adverse effects, the Agency chose only to cite representative studies in the suspension order documents. The results of these studies are briefly reviewed below. Of special significance are the primate studies, which indicate effects comparable to those seen in the women of Alsea, Oregon.

(1) Spontaneous abortions have occurred in non-human primates exposed to 2,4,5-T and/or TCDD.

Reproductive studies in rhesus monkeys indicate that maternal exposure to 2,4,5-T and/or TCDD*/ results in an increased incidence of early spontaneous abortions and reproductive difficulties. Long-term exposure to even minute quantities of TCDD resulted in a marked increase in the first third of the gestational period even where there was no evidence of maternal toxicity by clinical observation or biomedical testing. Monkeys exposed 50 ppt TCDD (2.5 ng/kg/day) before and during pregnancy had a total fetal loss of 67% (50% by abortion and 17% as stillbirth) and fertility rate of 75%, compared with 0% and 100% in the controls.

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*/ In its comments, Dow indicates the existence of an unspecified monkey study using silvex. Comments at 28. The Agency is unaware of such a study.

**/ Total TCDD intake at time of breeding (7 months) was 0.35 ug/kg body weight. It is worth nothing that after 20 months of dietary treatment (total intake - 0.9 ug/kg/ body weight), the females were exhibiting signs of systemic toxicity, indicating that a no NOEL had been established for subchronic toxicity.

Attempts to re-breed one of the aborters resulted in an additional early abortion. ARI R-9 and personal communications. When animals were treated with a higher dose, the fertility rate dropped to 25%, with one of the two animals aborting in the first third of gestation. Irregularities in menstrual cycles, anovulation, and reduction in the reproductive hormones, progesterone and estrogen, were among the toxic effects seen at the higher dose. The investigators concluded that the reproductive abnormalities were most probably the result of hormone imbalance, and were apparently the result of the TCDD treatment, rather than general toxicity, because the hormonal alterations were observed before the animals became obviously ill (Allen et al., 1977; Barsotti et al., in press).

Early abortions have also been observed in monkeys where exposure has only been for a short period of the pregnancy. An accumulated dose of 1 ug/kg (1000 ppt) of TCDD over a 3 week period resulted in a 75% abortion rate, compared with 0% in the controls. All abortions in the treated animals were during the first third of the gestational period and the only evidence of maternal toxicity was slight chloracne in one animal, observed months later. The viable offspring produced at this dose had abnormal palate develoment, and thre of the four at a lower dose had debatable abnormal development in the same orofacial region. ARI R-39 and personal communications.

Dow regrets that "the agency did not take into consideration the value of primate data prior to the issuance of an emergency cancellation [sic]," and contends that exposure to 2,4,5-T does not result in teratogenic or fetotoxic effects in monkeys, citing two additional studies to support its position. Gehring Affidavit, Appendix (b) (hereinafter "Analyses") at 5. The primate studies using TCDD were discounted because of "significant toxic manifestations" in the pregnant monkeys. Id. at 7.

The Agency agrees with Dow's assertion that special emphasis should be placed on the primate studies, because the rhesus monkey is the animal of choice for evaluating the potential for human reproductive effects. Analyses, Ref. #3; Wilson, 1973. This preference is based upon fundamental similarities between the reproductive systems of man and the monkey. Physically, the monkey uterus, placenta and fetal supportative structures are comparable to those in man; implantation of the ovum and major organogenesis follow similar time courses, occuring in the first third of the gestational period. In addition, the monkey's hormonal balance of estrogen and progesterone is almost identical to the human system, both in the menstrual cycle and in pregnancy. The ability of the placenta to take over from the ovaries and continue the production of the hormones necessary to maintain pregnancy is common to both. In man, the placenta is able to produce the necessary progesterone and estrogen after the third month, and alteration in maternal levels of these hormones prior

to that time could result in an abortion. Progesterone drops in man have been associated with abortions and the untimely onset of menstruation.*/

The studies cited by Dow were designed to focus primarily on teratogenic effects. In the first, pregnant monkeys were administered 2,4,5-T, containing 0.05 ppm TCDD, "at dose levels approximating human exposure." No maternal toxicity or fetal abnormalities were observed. The authors concluded that 2,4,5-T was not teratogenic at the levels tested. However, a close analysis of the study indicates that there may be other evidence of fetotoxicity in the form of increased abortions. In light of the TCDD studies cited above, the apparent doubling of the abortion rate observed in this study should be considered a possible effect. Sufficient experimental details regarding the second "study" are not available in the cited reference to allow for an adequate assessment of the study.**/ However, evidence of abortion, lowered birth weight and incomplete ossification were indicated. In analyzing the TCDD studies, Dow chose to ignore data included in the Record for this action (see above), which demonstrate fetotoxic effects in monkeys at doses where no maternal toxicity was observed prior to the abortion.

*/ A common comment seen among the response to the 2,4,5-T RPAR, is of women experiencing episodes of untimely vaginal bleeding after reportedly being exposed to spray. See e.g., Responses [30000/26] ##263, 356 and 2187.

**/ For example, information regarding dioxin contamination of the 2,4,5-T, method of dosing and methods of analysis were not included.

(2) Reproductive failure is common in other mammalian species exposed to 2,4,5-T, silvex and/or TCDD.

Studies in rodents have clearly demonstrated that prenatal exposure to 2,4,5-T, silvex and/or TCDD results in toxicity to the offspring of treated animals. Adverse effects from exposure to TCDD have been observed at doses as low as 0.3 ug/kg in mice, 0.01 ug/kg in rats and 2.5 ng/kg in monkeys. The most commonly observed effects are increased fetal mortality and higher incidences of birth defects, such as cleft palate, intestinal bleeding, kidney and cardiovascular anomalies and reduced skeletal ossification. Reduced neonatal survival has also been observed. In all species tested, there is evidence of increased fetal wastage, in the form of resorptions, abortions and stillbirths. 2,4,5-T Order at 22; Silvex Order at 27.

Dow contends that "2,4,5-T and TCDD are weakly teratogenic and embryolethal agents which are confined to rodents (primarily mice)...." In support of this contention, Dow claims that the teratogenic effects have only been observed in the mouse which is extremely susceptible to cleft palate, and that other anomalies, such as kidney malformations, are really only retardations in development rathr than true birth defects. The observed fetal lethality is summarily discounted as the result of maternal toxicity, or of a completely different mechanism of action, since rodent fetal death occurs at a different time in pregnancy than the spontaneous abortions observed in Alsea.

Many of Dow's arguments become moot with the realization that for regulatory purposes the important concern is total impact on quality of life, rather than discrete mechanisms of action. Therefore, whether a reproductive failure is the direct result of fetal toxicity or is secondary to maternal toxicity is not a critical determinant for regulation, since the end-result is the same. See Analyses at 3; Comments at 28. This is also true of the distinction made by Dow between studies showing in-utero death and those showing reduced neonatal survival. Analyses at 4. The important factor is that a life is shortened. Similar reasoning applies to the line drawn by Dow between retardation and "true" teratogenesis. Analyses at 1. The life of an infant born with retarded mental or physical development is certainly disadvantaged and possibly subject to increased risk during his "catch-up" period, even though the handicap may ultimately be overcome.

Dow's contention that teratogenicity had only been observed as cleft palate in susceptible strains of mice is unfounded. Cleft palate has also been seen in rats, and palate abnormalities in monkeys. Other types of teratogenic effects which have been observed due to 2,4,5-T, silvex and/or TCDD exposure are cardiovascular anomalies, intestinal disorders and kidney abnormalities. (Some of these observations have been made in Dow sponsored experiments.) Use of a susceptible strain has the advantage of making the experimental system more sensitive. Any baseline

effects due to environmental factors should be nullified through the use of adequate controls.

Finally, Dow's argument about time of response does not take into consideration a very basic physiological factor. Dow's Comments at 128-29. The susceptible stages of pregnancy occur at different times in different species. Therefore, the same type of response to a given stimulus could be expected to occur at different times. For example, in mice and rats, the susceptible period of organogenesis is in the middle third of the gestational period, whereas in man it is early in the first trimester. Therefore, it is reasonable to assume that a toxin which elicits fetal death in the middle third of mouse or rat gestation would be likely to have the same effect in the first trimester of man or animals having comparable developmental schemes, such as the rhesus monkey.

(3) Exposure to TCDD or 2,4,5-T and/or silvex contaminated with TCDD poses a potential carcinogenic risk for man.

Long-term feeding studies have shown that TCDD at very low levels is a carcinogenic agent in mice and rats. TCDD has also been found to be mutagenic in the Ames test without the metabolic activation system. Conversely, there is no significant evidence to indicate that either 2,4,5-T or silvex per se is carcinogenic in test species. However, these apparently negative conclusions do not negate the cancer-causing potential of commercially produced 2,4,5-t and silvex, because of their TCDD contamination.

Although Dow "recognizes" that carcinogenic effects from TCDD exposure have been shown in test animals, it contends that human exposure to the TCDD in 2,4,5-T and silvex is so low as to pose no substantial risk. Dow argues that since studies using 2,4,5-T or silvex*/ have given negative results, the small amount of TCDD they contain cannot be sufficient to pose a significant problem to man. Dow Comments at 31.

The Agency's Carcinogen Assessment group (CAG) concluded that TCDD was carcinogenic at exceedingly low doses; therefore the low amount contained in 2,4,5-T (or silvex) is of concern. The lack of statistically significant tumor incidences from the 2,4,5-T (or silvex) exposure may be attributed to the extremely low levels of TCDD in the product relative to the levels at which it produces observable carcinogenic effects in rodent bioassays using relatively small numbers of animals. However, since TCDD is a strong carcinogen, 2,4,5-T (or silvex) products containing TCDD at any detectable levels can be considered human carcinogenic hazards. CAG, 1979.

Dow argues that a "reproducible carcinogenic effect has been observed only with a higher toxic dose in excess of 1000 ppt (TCDD)." Dow Comments at 30. The CAG has reviewed a recent study conducted by Dow Chemical Company and has concluded that

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*/ Dow mentions five long-term studies in rats or mice using silvex. The Agency is aware of only two of these studies designed to test the oncogenic potential of silvex. However, from the available information, it appears that silvex *per se* is not carcinogenic in test species.

the combined incidence of hepatocellular carcinoma and hepatocellular hyperplastic nodules in rats is statistically significant at both the 2200 and 220 ppt levels. Also, a recent communication to CAG from the National Cancer Institute indicated that in their as yet incomplete study, TCDD appears to be as carcinogenic and potent as was observed in the Dow study.

Dow further alleges that "the negative animal data has [sic] been confirmed by recent and extensive epidemiological studies of humans exposed by phenoxy herbicides." The Agency is unaware of such studies."

Finally, Dow contends that it will show that the carcinogenic risk to man from the TCDD in 2,4,5-T and silvex is "considerably less than for . . . eating peanut butter." Since the obvious reference here is to the possibility of exposure to the extremely potent carcinogen, aflatoxin, it seems appropriate to note that recent calculations indicate that TCDD is even more potent as a carcinogen than aflatoxin.

C. Any exposure to TCDD must be regarded as a potential reproductive hazard.

(1) TCDD is fetotoxic at doses as low as 0.001 ug/kg/day.

Dow has also challenged the Agency's failure to adopt the TCDD no-effect level of 0.03 ug/kg/day upon which the RPAR was based as a no-effect level for teratogenic and fetotoxic effects. This challenge ignores, with good reason in terms of Dow's interests, new data, developed in Dow's own laboratories showing

that TCDD has fetotoxic effects effects at doses as low as 0.001 ug/kg/day.

After the RPAR was issued in April of 1978, the Agency received new data establishing that TCDD has adverse reproductive effects as doses lower than 0.03 ug/kg/day. Specifically, in the RPAR notice the Agency reported that the Dow Chemical Company had submitted a letter summarizing preliminary results from a new study on the effects of TCDD in rats over three generations. Record at R-1, p. 17131. At that time, Dow did not provide the underlying data, but stated that fetotoxic effects were observed at 0.01 ug/kg/day in some generations. Because Dow described the report as preliminary, and because little data was presented in the letter, the Agency used data from the published literature showing that 0.03 ug/kg/day was a no-effect level, rather than using information from plaintiff's letter.

Subsequently, Dow has published an abstract of some of the data and has submitted a data report to the Agency. Record at R-8. In these reports, Dow itself recognized 0.01 ug/kg/day as an effect level. Thus, although Dow's use of the 0.03 ug/kg no-effect level used in the RPAR is understandable, this value would be unsound both as a matter of science and of policy. Moreover, the Agency's review of these data indicates that adverse reproductive effects are observed at 0.001 ug/kg/day. 2,4,5-T Order at 26. Silvex Order at 31.

Thus, the 0.03 ug/kg/day used in the RPAR is not the applicable no-effect level.

Because the Agency explained in the emergency orders that "exposure to 0.001 ug/kg/day . . . resulted in statistically significant increases in the percentage of pups dead at birth or dying before the end of three weeks of life in some generations," Id., Dow's statement that the suspension decisions and the RPAR conclusions were based on "virtually identical animal research reports" is totally erroneous.

(2) No reproductive no-effect level has been established for TCDD. Therefore, any exposure must be regarded as posing potentially significant risk.

The suspension decisions are based in part on a Dow study showing that TCDD produces adverse reproductive effects in test animal at doses as low as 0.001 ug/kg/day (hereinafter "Dow study"). However, Dow interprets this data as showing that no effects were observed at 0.001 ug/kg, over three generations. Record at R-8. Because the injunction in Dow v. Costle, Civil Action No. 76-10087, arguably precludes EPA from disclosing data from this study, EPA presented a summary, but not the actual data, in the decisions and orders suspending these pesticides. 2,4,5-T Order at 26; Silvex Order at 30. EPA regards this study as critically important to the Agency's determination that an imminent hazard exists, and regrets that the injunction prevents

the disclosure of the data that substantiate and illuminate the basis for the Agency's determination that there are fetotoxic effects at 0.001 ug/kg. the lowest dose tested in any TCDD study. Although the inconsistencies between EPA's and Dow's interpretations of the data can be evaluated only if the actual data can be disclosed, the basis for EPA's position is detailed below.

The Dow study shows that adverse reproductive effects occur in test animals exposed to doses of TCDD as low as 0.001 ug/kg/day. However, Dow's summaries of the data state that there are generally no adverse effects at this dose level, and create the impression that 0.001 is a "no-effect" level.

Generally a no-effect level is viewed as a toxicological endpoint, marking a level of exposure in animals which is "safe" because there are no observable adverse effects.*/ Toxicologists generally assume that the animal no-effect level can serve as a base for estimating exposure levels which would be "safe" for humans. The "safe" level for humans is set at some level lower than the animal no-effect level to provide a "margin-of-safety" that takes into account differences in senstivities between animals and humans, and differences in sensitivities among humans. This "margin-of-safety" does not represent an infallible

*/ The discussion of "no-effect levels" is irrelevant to the estimation of potential cancer risk. See discussion at _____, supra.

indicator of potential hazard to humans. Error could be introduced because man is more sensitive than the test species by a greater factor than normally allowed, or by the incorrect choice of a no-effect level. The thalidomide tragedy is probably the best known example of error in predicting human safety from animal data. There, although testing indicated that exposure to the drug produced no abnormal effects in animals, when humans used the drug it became clear that the medically prescribed dose assumed to be safe when considered in terms of the animal test data was, in fact, dangerously toxic to the human fetus.

The lowest level at which TCDD has no-observable effects in test animals is crucial to the Agency's determination of the risk potential of 2,4,5-T and silvex. TCDD is present in these pesticides as a low-level contaminant and thus will be present in the environment at low levels whenever and wherever these pesticides are used. If there truly is a no-effect level in animals it is possible at least to begin to estimate a possible "safe" level for humans and to assess the possible risk to humans by relating this assumed "safe" level to the level of pesticide that may be in the environment, if that level is known. Consequently, if there is no no-effect level, any use of 2,4,5-T and silvex would result in potentially significant expsure to TCDD,

because there is no minimum level upon which to estimate a a margin-of-safety.*/

It is the Agency's position that no reproductive no-effect level has been demonstrated for TCDD. In a September 1977 preliminary report to the Agency, Dow described observations in the animals exposed to 0.001 ug/kg/day only in terms that implied that there was no adverse effects at this dose level. Record at R-1. Dow later published an abstract of this study in which it added experimental details and new data, without further elaboration. Specifically, they said:

- "At 0.001 ug/kg/day, no deleterious effect on fertility was seen in any generation."
- "Among litters of rats receiving 0.001 ug/kg/day no-effect on litter size at birth or neonatal growth was observed in any generation."
- "In summary, the reproductive capacity of rats ingesting of 0.01 and 0.1 ug/kg/day, but not at 0.001 ug/kg/day, through three successive generations."
- "Statistically significant increases and decreases in survival were seen at 0.001 ug/kg/day." Record at R-8.

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*/ It is questionable whether the traditional margin-of-safety calculation used in establishing tolerances, which uses a factor of 100, would be appropriate for TCDD. The factor of 100 under this approach is derived by assuming that a factor of 10 adequately compensates for possible variation in susceptibility within a species, and that a second factor of 10 adequately compensates for differences between species (i.e., between the animal test species and man). There is some reason to doubt whether a safety factor of 10 adequately compensates for the variability in susceptibility of human beings. Even if this were not the case, however, the wide variability in susceptibility of different animal species to TCDD raises great doubt as to the justification for using only a factor of 10 to adjust for possible variations in susceptibility between an animal species and man.

In contrast to Dow's descriptions of no effects at 0.001 ug/kg/day, EPA's review of this study indicates that the following adverse reproductive effects were observed at 0.001 ug/kg/day:

- statistically significant decreases in neonatal survival in the first litter of the first generation at 24 hours, 7 days, and 21 days.
- a significant decrease in the gestation survival index and the 7 and 14 day survival indices in the second generation literature. Record at R-8, Confidential.

These observations mean that there were statistically significant increases in the number of stillborn pups and that a larger than normal proportion of the animals that were born alive did not survive the first two weeks of life. Although EPA acknowledges that adverse effects do not appear in all generations ingesting 0.001 ug/kg/day, it cannot accept the premise that the effects which do appear should be ignored.

II. The Alsea Study indicates that there is a relationship between the use of 2,4,5-T for forest management in Alsea and spontaneous abortions among Alsea residents.

The Agency's review of the relation between the use of 2,4,5-T and the occurrence of spontaneous abortions in the Alsea area includes three closely related but separate phases. The first phase, or Alsea I in Dow's terminology, was a case history review of the occurrence of miscarriages among a group of eight women who reported an unusually high proportion of miscarriages in their group and that the miscarriages generally followed by approximately two months the annual use of 2,4,5-T in their area. The women questioned whether there might be a relation between the spraying of 2,4,5-T each spring and the occurrence of eight of their miscarriages in June. Alsea I constitutes the Agency's investigation and conclusions relating to the miscarriage experience of these eight women. As the history of this action clearly shows, no regulatory action was taken on the basis of the Alsea I data. Further, except for establishing the initial hypothesis, the examination of these case reports was not utilized to support the decision to suspend these pesticides. Accordingly, the data relating to the eight women have little bearing on the suspension action and Dow's challenges to these data have little relevance.

In Alsea II, the Agency investigated the hypothesis which arose from Alsea I and the experimental animal data by studying a large cohort of births and miscarriages among Alsea residents.

Alsea II constitutes the second stage in the Agency's investigation of the relation between the uses of 2,4,5-T and the occurrence of reproductive failure in the Alsea area and it is this study, and only this study, which serves as a basis for the Agency's action suspending 2,4,5-T and silvex. 2,4,5-T Order at 2; Silvex Order at 2. As developed more fully in subsection A below, Alsea II shows that a comparison of the hospitalized spontaneous abortion indices in the Alsea area in relation to a comparable index for women living in areas where 2,4,5-T is not used shows an increased incidence of spontaneous abortions in the Alsea area relative to the control area, that an increase in spontaneous abortions in the study area occurs approximately two months after the area was sprayed with 2,4,5-T and that there is a close correlation between the amount of 2,4,5-T sprayed and the increase in the in the incidence of abortions by months.

The third aspect of the study includes supplementary data on spontaneous abortions in a neighboring urban area and supplementary analyses of the core conclusions by other statistical methods. Each of these supplementary methods was employed to test the validity of the core data or to refine, complete and supplement the basic analyses and conclusions. These supplementary aspects were included solely as routine checks on the basic analysis or, as in the case of analyses of the urban area, because the data were generated while gathering data on the study area, and were not used in the explanation of the

basis for the Administrator's action. Accordingly, although the complex supplementary analyses support and confirm the correlation between the use of 2,4,5-T and the occurrence of miscarriages in Alsea, the complexity of these analyses must not be allowed to obscure and complicate the essential simplicity of the study as a whole.

Dow contends that the Alsea study is faulty in design, that it does not show an increase in the spontaneous abortion index in the study area in June, and that invalid statistical methods invalidate the study's conclusions. Dow Comments at 16-20, 22-24.

In the discussion to follow, we will show that Dow's challenges are based on mistaken, unsupportable, and sometimes unreasonable assumptions which do not withstand simple scientific and logical scrutiny. The discussion is presented in four parts. In subsection A we summarize the Alsea II findings, issues and analyses upon which the decisions to suspend 2,4,5-T and silvex were based. In subsections B, C, and D, we discuss Alsea I and other corrollary data and statistical analyses which relate to the Alsea Study but which are clearly secondary aspects of the suspension decisions.

A. The Alsea Study is a simple and direct analysis of the relation between the forest use of 2,4,5-T and reproductive failure in humans who live in the area where the pesticide is used.

The Agency's preliminary analysis of the data generated through the Alsea study indicated that the spontaneous abortion index (hospitalized miscarriages per 1,000 births) for the Alsea Study area where 2,4,5-T was used was significantly greater than the index for the control area where there was little or no known use of 2,4,5-T.

A dramatic increase in the spontaneous abortion index for the study area relative to the control area occurred in June and July following, by approximately two or three months, a period in March and April when 2,4,5-T was used to control vegetation in the forested study area.

Statistical analyses of these data indicated that there was a significant relationship between the amounts of 2,4,5-T used in the study area and the subsequent increase in the spontaneous abortion index in the study area.

Thus, the Agency's systematic survey of the occurrence of spontaneous abortions in an area of 2,4,5-T use indicated that there was an unusually high number of spontaneous abortions in that area, compared to a representative control area and that the incidence of spontaneous abortions may reasonably be related to the use of 2,4,5-T in the area. The protocol and results, and Dow's challenges to the protocol and results are summarized below.

(1) The spontaneous abortion index was based on hospitalized spontaneous abortions, the most certain means of obtaining a uniform data base for the study and control areas.

The validity of any epidemiologic investigation is dependent upon the validity of information on the event under study. For the Alsea study, data on the occurrence of spontaneous abortions was critical. However, the reporting of spontaneous abortions, particularly those occuring early in pregnancy is influenced by many factors. In the first instance, many women do not know that they have had a spontaneous abortion, interpreting the uterine bleeding simply as delayed menses. In other cases, a woman may seek medical attention for something that both she and her physician interpret as a menstrual problem, not necessarily as a possible abortion. In still other cases, a physician may identify the problem as a spontaneous abortion and treat the patient in his office. Other patients are hospitalized.

The Alsea study is based on hospitalized spontaneous abortions because these data are the most readily available indicators of the occurrence of spontaneous abortions. While it is true that all spontaneous abortions are not hospitalized or even noticed by a woman, it is reasonable to assume that the factors influencing the occurrence, awareness and hospitalization of spontaneous abortions are comparable between the control and study areas. It is also reasonable to assume that these factors are comparable throughout the year within an area.

Dow contends that there would be more hospitalized spontaneous abortion patients in the study area than in the control area and that for this reason the number of hospitalized miscarriages cannot be used as a reliable measure of the total number of miscarriages in a population sample. Dow Comments at 18. Dow bases this contention in part on the assumption that practices regarding the hospitalization of spontaneous abortion patients differ in the control and study areas.

Dow offers no data in support of this assertion that the sample is biased, and miscalculates the data available in the Alsea Report. For example, Dow describes the Alsea Report as stating that "most general practitioners hospitalize over three-fourths of the spontaneous abortion cases that they treat as compared with only 10% hospitalization of the cases treated by obstetrical and gynecological specialists." Dow Comments at 18-19. However, contrary to Dow's assertion that "most" general practitioners hospitalize over 75% of their spontaneous abortion patients, in fact only half of the general practitioners referenced in Table 23 of the Alsea report had admission rates in excess of 75%.

But more importantly, measurement of the impact of hospitalization on the spontaneous abortion index for the study area must be based on the number of patients who are sent to hospitals, not on the number of physicians who send their patients to hospitals. That, is, the critical information is

the proportion of patients who are treated by general practitioners and who also are hospitalized for spontaneous abortions. Using the data in Table 23 it can be estimated that 57.5% of the spontaneous abortion cases which are seen first by general practitioners are hospitalized,*/ not 75% as Dow contends.

Furthermore, Dow appears to wrongly assume that none of the study area women were treated by obstetrical specialists at the Corvallis hospitals in the urban area. In fact, 45 of the 188 study area women were treated at the Good Samaritan Hospital -- a Corvallis hospital. Indeed, the primary reason for including the hospital in the study was that it was expected that study area women would be treated there. Treatment by the specialists at the hospital would not generally involve hospitalization. The Agency does not dispute Dow's statement that 10% of the spontaneous abortion patients who see specialists in obstetrics and gynecology are hospitalized.

To support the contention that there is bias in the reporting of spontaneous abortions, Dow further states that there are eight obstetrical/gynecology specialists in the urban area, one specialist in the control area and none in the study area, and,

*/ This can be estimated from the data in Table 23 by (1) multiplying the proportion of spontaneous abortion cases that are hospitalized by the annual mean number of abortion cases treated for each of the 13 GP's for which both kinds of information are available, and then (2) summing both this product and the annual mean number of abortion cases treated to obtain 72.3 cases treated annually and 41.6 hospitalized for the 13 GP's. This is an estimate of 41.6/72.3 = 57.5 percent hospitalized among abortion cases seen by GP's.

that the specialist in the control area is responsible for one-half of the obstetrical care in that area. Dow comments at 19. Accepting for the sake of argument Dow's estimate that half of the cases in the control area are treated by a specialist, this result does not differ significantly from the Agency's estimation that a roughly comparable percentage of the study area women who had abortions were treated by an ob/gyn specialist. The reasons for the Agency's estimate will be developed at the Hearing. Seen in this light, Dow's unsupported claim becomes meaningless.

The Agency is aware of no data -- and Dow provides none -- other than that developed in the Alsea Study which estimates the spontaneous abortion rate for the Alsea area. Absent such data, Dow's change that the hospitalized spontaneous abortions are an "unrepresentative data base," Dow Comments at 16, is only unsupported speculation.

(2) The spontaneous abortion, birth and spray data used for 1972-1977, were aggregated to increase the reliability of the rates being estimated.

The statistical analyses underlying the Alsea Study are based in part on aggregated spontaneous abortion data and birth data for the six-year period from 1972-1977. Such aggregation of data over time is a common statistical practice which is used to increase the power of resolution when the event rate is low. This practice is especially necessary for data such as

these where the expected number of miscarriages per month in many of the areas investigated could range from 1 to 4. In this case, even a 20% increase in the rate could not be found in monthy or perhaps even yearly data, but could be found when the data are aggregated over a number of years.

Dow characterizes the Agency's use of the sums of all births and all hospitalized spontaneous abortions over aggregated periods as an "improper statistical technique" or "bunching" which obscures annual variation. Dow Comments at 22.

Dow's objections suggest familiarity with this basic approach to vital statistics. The data on abortions, births and spraying over a period of years were summed in order to produce the large numbers and more stable results that are essential for the analyst to detect trends in the data and increase the power of statistical tests so that effects that are only moderate can nevertheless be detected. Dow may prefer year-by-year analysis because reducing the sample size can make it virtually impossible to discover a real effect unless that effect is truly overwhelming.

Moreover, combining data across years to produce total rates by month, as here, rather than summing across months to produce yearly rates as Dow proposes, Id., is appropriate because the variation in spray pattern between different months is much greater than the variation between different years. Because spraying is a seasonal event, there are seven months with no

spraying in any year but there are no years in which spraying did not occur. If Dow's proposal were adopted, the apparent yearly average for the months in which spraying occurred would be reduced by the "zeros" for the months in which there was no spraying. Thus, yearly averages would give lower than actual monthly spray data for the months in which spraying occurred.

(3) A statistically significant increase in the overall hospitalized spontaneous abortion index for the study area relative to the control area indicates that such abortions occur more often among women who live in the area where 2,4,5-T is sprayed.

The Alsea study was planned to develop data which would allow the Agency to determine whether the miscarriages were related to the use of 2,4,5-T in the area. To test this hypothesis, the Agency gathered data on hospitalized spontaneous abortions occurring in the 1,600 square mile Alsea basin and compared these data to comparable data from a control area where 2,4,5-T was not used. This comparison showed that the overall hospitalized spontaneous abortion index for the study area was greater than that for the control area and that the difference was statistically significant. 2,4,5-T Order at 35; Silvex Order at 39.

When the data were analyzed to determine whether the increase in study area spontaneous abortions was insignificant because it was within the normal range of random fluctuation or whether there was a real increase in the incidence of miscarriages among the women residents of the study area in relation to the control area, the difference between the study area and

control area was found to be statistically significant when analyzed by several different tests. Report at 46-71.

Dow's claim that "there is no statistically significant difference between the overall hositalized spontaneous abortions index" for the study and control areas, Dow Comments at 20, totally disregards the evidence in the record.

First, when the mean values for the study and control area are compared by Duncan's Multiple Range Test, the means are significantly different from one another using a two-tailed test ($p < 0.05$). Report at 46. Because the original hypothesis was that exposure to 2,4,5-T increases the isk of miscarriage and because there is no reason to suspect that the pesticide can prevent miscarriages, EPA judges a one-tailed test to be appropriate. Using this test, the result reaches twice the level of statistical significance ($p < .025$).

Further, the number of abortions occurring in June in the study area is significantly greater than the number that would be expected either on the assumption that the number of abortions were uniform across all months or that the abortion index was uniform for all months.*/ Report at 52.

*/ This conclusion is based on the following calculations:

number of abortions = 24

number expected on uniform number assumption

$= \frac{188}{12} = 15.7$

$\chi^2 = 4.39 \quad p = 0.02$ (one-tailed)

(CONTINUED)

This result confirms the hypothesis by showing a statistically significant increase in the study area spontaneous abortions relative to those occurring in the control area. To test the hypothesis, it was not necessary to show a significant increase in June in the study are compared to the control area since both an overall excess in the study area compared to the control area and an increase in June in the study area above the overall rate in the study area have been shown. However, in the interest of more fully inspecting the available data, the investigators analyzed the data further and showed that women in the control and urban areas do not experience an increased incidence of miscarriages in June. See tables and figures in Report at pp. 42, 44, 45.

Moreover, another test contained in the Report confirms this result. This is the test showing a correlation between the monthly pattern of spraying 2,4,5-T in months and the abortion index in the study area two and three months following the spraying. This analysis shows a significant correlation ($p < .01$) between the use of 2,4,5-T and the abortion indices two months and three months after the spraying. Report at pp. 63, 67.

*/ (Footnote continued from previous page)

number expected on uniform index assumption

$$= \frac{80.8}{1{,}000} \times 184 = 14.9$$

$$x^2 = 5.56 \quad p = .01 \text{ (one-tailed)}$$

These would also be significant at .05 on the basis of a two-tailed test.

(4) The statement in the Alsea report that "correlation does not mean causation," re-states a basic principle of statistical analysis and in no way negates the biological significance of the observed relation between the use of 2,4,5,-T and miscarriages in the Alsea area.

Philosophers, legal scholars, and scientists have long debated the concept of causality, but few expect conclusively to establish cause and effect relationships. For this reason, thoughtful epidemiologists avoid the term "causal" and seek evidence of association between increases in risk which are temporally and geographically associated with potential exposure to suspected etiologic agents. In particular, descriptive studies such as the Alsea study can and do provide suggestive evidence of increases in risk, but they are not designed to "prove" a "cause and effect" relationship.

Dow repeatedly states that the Alsea Report "expressly concedes that this analysis is a correlational analysis, and correlation does not necessarily mean causation." Dow Comments at 15. Dow's characterization of this statement as a concession implies that the Agency itself faults the study on this basis. Again, however, this is simply an honest, scientific appraisal of the meaning of the data, and it is fully consistent with the Agency's conclusion that the data suggests a relationship between the use of 2,4,5-T and miscarriages in the Alsea area.

Moreover, correlation between miscarriages and 2,4,5-T is not an isolated observation, a product of statical "manipulation." Dow Critique at 1. Rather, the observed relationship

between the use of 2,4,5-T and spontaneous abortion is alarmingly consistent with a vast scientific literature which unequivocably demonstrates that when pregnant test animals are exposed to 2,4,5-T, silvex and/or TCDD, dead and damaged offspring are produced. 2,4,5-T Order at 22, Silvex Order at 27. In view of this extremely strong experimental data, the observed correlation as biological as well as statistical significance.

Other more complex analyses reinforcing the fundamental conclusions developed using these methods are discussed in Subsection C.

(5) There was a statistically significant correlation between the amount of 2,4,5-T used in the Alsea area in March, April and May and the increased incidence of abortions in the study area in June.

To test the level of interaction between the spray data and the abortion data, a cross-correlation was computed between the abortion index for the study area and the monthly pattern of spraying 2,4,5-T in pounds per month. This analysis showed a statistically significant ($p < .01$) correlation between abortion indices for the study area and the spray pattern after lags of two ($r = .70$) and three ($r = .76$) months. Report at 63.

Dow acknowledges that the seasonal variations in the abortion index for each of the three areas are possibly common biological phenomena, but cautions that factors other than herbicide spraying account for the variations. Dow Comments at 21.

Because of a concern for factors other than herbicide spraying, the authors of the Alsea Report viewed the cyclic variation as "noise" in the data to be removed, much as seasonal adjustments are made to economic indicators, before comparisons are made. For this reason, an analysis of the cyclic variation was performed, and showed that cyclic trends accounted for nearly all of the variation in the control area but did not remove the seasonal June peak in the study area. Further, the time-course of variation was different in the study area than the control area. Thus, after accounting for cycle variation, the seasonal variation in miscarriages is seen to be quite separate from the remaining variation after removing its effects from the study area data. This residual variation was found to be associated in time with the level of 2,4,5-T sprayed.

(6) Dow's argument that there is a June peak of miscarriages in Midland, Michigan actually supports the conclusios of the Alsea Report, and its attempts to discredit the Alsea conclusions by pointing to a June peak in Miami fails because the Miami data is based on induced abortions, not spontaneous abortions.

The Alsea study demonstrates that there was a statistically significant increase in the incidence of miscarriage among Alsea area women in June and that this increase was correlated with the use of 2,4,5-T in the area for forest management, approximately two months earlier.

Dow contends that the June peak observed in Alsea is comparable to June peaks observed in other urban areas, particularly Midland, Michigan, and Miami, Florida. Gehring Affidavit at 6, ¶ 15. Dr. Gehring argues that the finding of June peaks in Miami and Midland "undermines, if not refutes altogether," the Agency's assessment of the Alsea data. Gehring affidavit at 6.

Dow's proposal that the Miami and Midland data refute the Alsea data misuses the available information in one case and fails to consider relevant information in the other. First, and quite simply, the Miami data in the Alsea Report, Report at Appendix B, upon which Dow based its conclusion related to therapeutic abortions, not spontaneous abortions. Clearly on increase in elective abortions cannot refute an assessment based on spontaneous abortions.

The argument based on the Midland data is similarly unscientific. Dow presents no data or analyses such as those presented in the Alsea Report. Rather, Dow attempts to make its point using only a graph which appears to show a June peak in Midland that is higher than in Alsea. Critique attached to Gehring Affidavit, (hereinafter "Dow Critique" or "Critique")

In 1978, Dow submitted three studies on TCDD's to EPA under Section 8(e) of the Toxic Substances Control Act. An EPA status report, concluded that TCDD's "appear to be widespread contaminants of the Tittabawassee and Saginaw Rivers (and

possibly Saginaw Bay) downstream from Midland." Kover, 1979. Caged rainbow trout accumulated TCDD after 7 days when held in Dow's tertiary waste treatment effluent and after 30 days in flowing waters about six miles downstream of Dow's plant, indicating downstream movement of TCDD from the plant. The status report went on to characterize Dow's plant discharge as "the major (if not the only) source" of TCDD contamination in the area and concluded that "the levels of TCDDs identified in Midland soil and dust samples indicate that this area represents a definite TCDD "hot spot."

Data prepared by the Michigan Department of Health showed that the Midland County rate for all malformation was more than twice the rate for the entire state for the period 1970-1974 and in each individual year after 1970. Infante, 1979. In two years, 1972 and 1973, this county's rate was the highest in the state. Michigan contains at least two other counties where the presence of a university mdeical center, located in Ann Arbor and Detroit, would suggest the identification and recording of anomalies at birth to be at least as thorough and accurate as in Midland County.

The Michigan Department of Health also provided data on specific types of malformations and calculated the number of cases of malformation which would be expected for Midland County

if the rate there were comparable to statewide rates. */ Infante, 1979. However, when the actual number of malformation cases was compared to the number expected assuming that Midland was like the rest of the state, a clear excess of urogenital abnormalities, cleft lip and palate, and heart defects was found for babies born in Midland County. Bailor, 1967.

Whether there is a relationship between the high rates of congenital malformations in Midland County and Dow's monitoring data showing the area to be a TCDD "hot spot" has not been determined. However, cleft lip and palate and urogenital abnormalities are in clear excess in Midland County, as they are among the defects frequently observed in litters of test animals exposed to 2,4,5-T, silvex and/or TCDD during pregnancy, 2,4,5-T Order at 22; Silvex Order at 27.

(7) The results support the hypothesis that the occurrence of spontaneous abortions in Alsea is related to the use of 2,4,5-T.

The study was planned and conducted to test the suggestion of a relation between miscarriages and the use of 2,4,5-T in the

*/ These data were presented within th context of a discussion of possible reproductive hazards of vinyl chloride exposure. The discussants were careful to avoid attributing an etiologic connection in the absence of exposure data and in light of the knowledge that a number of substances are manufactured or processed at Dow's Midland plant. In 1977, a study published by Dow scientists found little evidence of a teratogenic or fetotoxic effect of vinyl chloride in either of three species: mouse, rat or rabbit. John, 1976.

Alsea area, and the study confirmed that miscarriages were likely to occur there more often than in the control area where 2,4,5-T was not used.

Dow's denunciation of the confirmed hypothesis as a "preconceived conclusion," Gehring affidavit at 4, disregards a fundamental principal of the scientific method. To test a hypothesis and to avoid charges of fishing the investigator must know what question he is asking and plan the test accordingly. In the case of the Alsea II study, the eight women had reported that they had experienced what seemed to them to be an unusual number of miscarriages. This observation was then applied to develop the hypothesis that there should be different incidences between the Alsea area and areas where 2,4,5-T was not used, and there should be an increased incidence of miscarriages approximately two months after the annual spring spraying season in the Alsea basin. As developed above these elements of the hypothesis were tested and confirmed in Alsea II.

B. Valid conclusions concerning human exposure to suspected chemical agents do not depend on the availability of chemical residue data and are not limited by the lack of such data.

Detection and measurement of chemical residues of a suspected etiologic agent in human tissues and fluids are not prerequisites for finding that humans are exposed to the suspected agent. Indeed, most, if not all, of the twenty or so chemicals which are now widely recognized as human carcinogens were confirmed as such through epidemiologic studies which did not include, much less require, physiologic residue analyses. In studies providing conclusive evidence of the carcinogenicity of substances such as asbestos, vinyl chloride, chromium and bis(chloromethy) ether, the only method of confirming human exposure was the simple fact that the exposed group worked at a given occupation and the control group did not. Perhaps the most striking example of an etiologic agent which would not be identified as such if measurement of chemical residues in human tissues were viewed as a sine qua non of exposure is sunlight, an established carcinogenic agent which could not be detected in human tissues by customary chemical analyses.

Rather, a key test of epidemiologically established associations is their biologic pluasibility. Part of this plausibility depends on whether the study group was actually exposed to the substance. Depending on the level or certainty needed, evidence of exposure can be as strong as a lung

cancer patient's admission that he smoked forty cigarettes a day for twenty years or as speculative as information that a mesothelioma patient lived in the same household as an asbestos worker. In cases where, as here, absolute certainty is not required (See Section --, infra.), the suspect chemical is highly toxic and there is a definite opportunity for exposure, the fact that there is a potential for exposure can reasonably be regarded as adequate evidence of the actual occurrence of exposure to the chemical.

Dow contends that the "study is deficient because there are no data establishing any pesticide exposure levels for the women who experienced miscarriages." Dow Comments at 24. Dow further claims that "measurements made elsewhere in humans and animals exposed to 2,4,5-T and TCDD indicate that the maximum amount of 2,4,5-T and TCDD which could possibly have been absorbed into the body, if any, by the residents of Alsea, Oregon would be far too low to cause any adverse health effects." Gehring Affidavit at 7.

Because Dow has supplied no data of any kind or any other information on the measurements to which they refer, the Agency cannot fully evaluate this statement. However, in view of Dow's criticism of the Agency for failure to provide residue data in support of its finding of probable exposure of the Alsea area residents, it is surprising that Dow itself neither provides the measurements to which they

refer nor any other data showing that human tissue residues are biologically insignificant. Furthermore, even if such data were available, because there is no known no-effect level in humans or animals for fetotoxic or carcinogenic, effect there is no basis for Dow's statement.

This inconsistency in Dow's approach to this question illuminates the problem facing both Dow and the Agency. The pesticidal uses of 2,4,5-T and silvex necessarily result in the distribution of these pesticides to the environment and thereby create a potential for human exposure. However, because the available analytical methods can at best detect TCDD only down to 1-10 ppt, if TCDD is present at 1-10 ppt or lower, it would not be detected. As a result, Dow and the Agency can determine that there is no more than --ppt in a particular sample, but neither party can make supportable statements as to the actual residues of TCDD in any environmental or human sample. The Agency's approach, consistent with its obligation to protect the public health, is to view the data on toxicity in animals, and the opportunity for human exposure as indicating that the Alsea residents (and other persons living and working in areas where 2,4,5-T and silvex are used) may be exposed to injurious amounts of the chemical.

C. In connection with the suspension orders, Alsea I was utilized only to develop the hypothesis, later confirmed through Alsea II, that there was a relation between the use of 2,4,5-T and the occurrence of an excess incidence of miscarriages in Alsea.

In issuing the suspension order, the Agency explained that eight women residents of Alsea, Oregon had reported that as a group they had experienced an unusually large number of miscarriages and they thought that their miscarriages mights be related to the use of 2,4,5-T because the miscarriages generally followed the annual spring spraying of 2,4,5-T in the forests near their homes. 2,4,5-T Order at 34; Silvex Order at 37-8. EPA conducted a study of these women to determine if there was any validity to their suggestion of a relation between their miscarriages and 2,4,5-T use.

A clear distinction must be recognized and maintained between the studies now identified as "Alsea I" and Alsea II." Alsea I comprised an intensive, health questionnaire study of nine rural women residing within a 12-mile radius of Alsea, Oregon, who had experienced a total of thirteen miscarriages between 1973 and 1978 which they associated in time and proximity with forest spraying of 2,4,5-T. The questionnaire asked for detailed information on the women's pregnancy and medical histories and on pregnancy outcomes of their sisters. It also included questions on diet, environmental aspects, occupations, household pesticide usage, and educational background.

The purpose of Alsea I was to rspond rapidly to a concerned citizenry to determine hether or not the miscarriages could be explained by causes other than potential exposure to forest herbicides and to examine the degree of association between conception-to-miscarriage of periods and locations, dates and rates of forest herbicide applications.

The Alsea I cohort of nine women was recognized as being too small and potentially biased to establish more than the possibility of correlation between forest spraying and miscarriages.

Because it was anticipated that medical cause of these miscarriages could not be positively identified, and were not, and because of the apparent seasonal relationship between spray and conception-to-miscarriages of 20 weeks duration or less, the Agency decided to investigate miscarriage rates in an expanded forest area centered about the Alsea area and in a comparable control area in Oregon. Plans for the expanded investigation were developed prior to the completion of Alsea I, the actual decision to conduct the study being dependent on the outcome of Alsea I.

The study of miscarriage rates in the expanded study area and the comparable control area, reported February 20, 1979, has become identified as Alsea II. It is a retrospective study of records of hospitalized miscarriages in the study and control areas relative to the number of births in those areas, and compares seasonal miscarriage patterns with 2,4,5-T

spray patterns. It is not a continuation of Alsea I and is virtually independent of that study with the exceptions that the miscarriages of the nine women maybe included in total miscarriages for the entire Alsea area and the spray data assembled for Alsea I were utilized in the Alsea II cross-correlationanalyses.

EPA neither took any regulation action nor prepared to take regulatory action based solely on the data from the nine women. Rather, EPA interpreted that data as indicating that there was a possibility that other Alsea area women might also have an unusual incidence of miscarriage and that the data suggested serious enough consequences that further investigation was necessary to determine whether action to protect the public health was necessary. This decision was consistent with the views of the reviewers who, consistent with customary epidemiologic caution, indicated that the data did not indicate a cause and effect relationship but was inconclusive and that further analysis was necessary.

(1) The reviewers inability to find a "causual" relationship between 2,4,5-T and miscarriages in Alsea I is not surprising and has no bearing on the results reported for Alsea II.

We have previously explained that epidemiologists generally avoid the term "causation" because the of the inexact nature of cause and effect relationships. Alsea I was a retrospective study of the miscarriage experience of a self-selected group of eight women, all personally concerned about those experiences.

Scientists would not reasonably expect the study to provide evidence of causation.

Despite the obvious limits on finding a cause and effect relationship from this data, Dow repeatedly emphasizes that the specialists who reviewed Alsea I reported that they found "no evidence of a causal relationship." Dow Critique at 2.

Cautious interpretation of the Alsea I data, based only on questionnaries and medical records of only nine women, was fully consistent with thgouthtful epidemiologists' careful avoidance of drawing etiological inferences on the basis of case histories alone. Rather, they seek to identify populations and to estimate the relative incidence of death and disability. Thus, the Alsea I reviewers reasonably and responsibly explained that they could find none on the basis of the information supplied by eight women in reponse to a questionnaire.

For this reason, it is difficult to understand plaintiffs' contention that the Agency should have followed the advice of the reviewer who, on the basis of nine case reports, concluded that further study would "be a waste time and fund." To the contrary, the Agency would have been derelict in its statutory obligation to determine whether the use of pesticides may cause unreasonable adverse effects had the Agency not pursue this indication in Alsea I that there was a relation between the use of the pesticide and the increased incidence of miscarriages in areas where the pesticide was used.

D. The data on the spontaneous abortion index for a neighboring urban area and the spectral analysis data which were included in the Alsea Report were supplementary in character and were not part of the data used to derive pertinent findings concerning use of 2,4,5-T

In Subsection A we isolated and summarized the fundamental objectives, results, and conclusions of the Alsea Study. During the course of the Alsea Study, as in most scientific investigations, the investigators considered information, methods and analyses that were peripheral to those considerations which formed the center of the study. These corollary features included analysis of spontaneous abortion data from Corvallis, an urban area near Alsea, and use of a statistical technique designed to determine whether the seasonal characteristics of the spontaneous abortion index in the Study area could be attributed solely to the apparent cyclic variations in each of the areas.

In challenging the suspension decisions, Dow has frequently cited alleged defects in these corollary data and analyses as indicators of error or invalidity in the Alsea Study. Dow's emphasis on these features obscures the central nature and strength of the Study and even creates false issues. In this section of the memorandum, we again explain the nature and relevance of each of these corollary features and respond to Dow's changes.

(1) The data and analyses relating to the occurrence of spontaneous abortions in the urban area have no bearing on the differences in the spontaneous abortion indices in the control and study areas.

Many of the women residents of the study area use hospitals in Corvallis, an urban area adjacent to the study area. For this reason, Corvallis hospital records were examined to obtain spontaneous abortion data for study area residents who had been treated in the urban area hospitals at the time of their miscarriages.

These records also provided spontaneous abortion data relating to urban area residents and these data were analyzed along with data from the study and control area. The data on miscarriages among urban area women were of interest because 2,4,5-T is not used in the urban area, but they had limited utility because many spontaneous abortions were treated at clinics which had no counterparts in the study and control areas. Because the clinics were not fully investigated, the hospitalized spontaneous abortion index for the urban area under reports the spontaneous abortions for which medical treatment is given. Significantly, if study area women use the urban area clinics as well as urban area hospitals, the spontaneous abortion index for the study area probably underestimates the abortion rate for the study area because urban clinic abortion data were not included in the data for the study area. Because there are no such clinics in the control

area, the spontaneous abortion index there would not be underestimated for that reason.

Dow mistakenly treats the data and analyses relating to the spontaneous abortion index in the urban area as information wnich negates the observations of an increased incidence of spontaneous abortions in the study area. See e.g. Dow Comments at 19.

The urban area data in no way influence the Agency's conclusion that there is an increased abortion rate in the study area in the time period following the spray or our conclusion that the abortion rate in the study area exceeds that in the control area. 2,4,5-T Order at 35; Silvex Order at 39.

The urban data are unrelated to the simple and specific hypothesis which the Alsea II Study was designed to test. The urban area data were carried along in the analysis because the records of the urban area hospital had to be used to provide data on the study area abortions and because, in the event that there was a June increase, the urban area data might be useful in providing a measure of monthly and seasonal trends in abortion frequencies in a nearby area. Report at 19.

More specifically, Dow charges that the Alsea Report "capriciously combines the obviously lower values from the urban area with those from the control area for many of the subsequent analyses." Dow Critique at p. 9.

In fact, even a cursory review of the study shows that no such combination of urban and control area data was made in testing the major hpothesis and reaching the conclusion that there was an increased incidence of spontaneous abortions in the study area relative to the control area. Rather, consistent with a more thorough testing of the initial results showing a significant June trend, such combinations were made to determine if the observed June peak might be accounted for by seasonal trends. Moreover, whenever the urban and control data were combined for these analyses, the same analysis was conducted for the control area data alone. Report at _____. Therefore, contrary to Dow's contentions, combinations of urban and control area data did not bias the results.

(2) The complex spectral analysis in the Alsea Study was performed solely to determine whether or not the June peak in incidence of spontaneous abortions in the Study area could reasonably be attributed to innate periodic variations in the data.

Dow has alleged that the spectral analysis used in the Alsea Study was "a manipulation of the data to devise a desired result." Critique at 13-14. Such a statement reflects a fundamental misunderstanding of the reasons why the spectral analysis was performed. The objective of this complex collateral analysis was not to demonstrate the existence of a June peak in the incidence of spontaneous abortions in the study area, which had already been independently established, but rather to determine whether or not

the observed June peak might simply reflect a cyclical tendency in such data which had never before been reported in the scientific literature or spontaneous abortions.

The spectral analysis was designed to test the hypothesis that tne June peak in the abortion index for the Study area merely reflected a cyclic variation of unknown origin which might be common to all the areas studied but which, for equally unknown reasons, might differ between areas in its correspondence to months of the year. To test this highly speculative possibility, an attempt was made to fit the spontaneous abortion data for the Study area with that for the Control Area, in order to determine whether or not a significant similarity between the observed patterns could be established by shifting the phase relationship. Even after apparent cyclic variations in the two areas had been synchronized, the June peak in the Study area remained and could not be reconciled with Control Area data.

The spectral analysis was a supplementary evaluation of the basic Alsea data and in no way altered or manipulated tne data base upon which the authors of the Study and the Agency ultimately relied. Rather, the spectral analysis demonstrates that the authors of the Alsea Study were sensitive to and considered even highly speculations alternative explanations of the origin of the June peak in the Study area.

(3) The alternative statistical treatments proposed by Dow do not contradict the basic findings of the Alsea Study.

The petitioner has employed certain alternative statistical approaches which were not utilized by the authors of the Alsea Study, in an attempt to demonstrate that the data base does not support the findings of the Alsea Study. Dow alleges that the demonstrated correlations between monthly spraying and the monthly abortion index in the Study area are "correlation" between monthly spraying in the Study area and the monthly hospitalized abortion index in the Control Area. Dow Comments at 23. In addition, Dow suggests that a "simple statistical Chi square test" may be used to demonstrate that there was no statistically significant increase in the hospitalized spontaneous abortion index for the Study Area, as compared to the Control Area. Dow Critique at 9, 12.

Both of Dow's criticisms are without merit. The allegation of a "correlation" between spraying in the Study Area and abortions in the Control Area comparable to the correlation between spraying in the spring and June abortions found in the Study area is irrelevant. Moreover, even though use of a Chi-square test in the manner suggested by Dow is of questionable theoretical validity, the results of such calculations nevertheless corroborate the basic conclusions of the Alsea Study.

(a) The alleged "correlation" between monthly spraying of 2,4,5-T in the Study Area and the hospitalized spontaneous abortion index in the Control Area is irrelevant.

The petitioner's allegation that there is a significant correlation between the amount of 2,4,5-T sprayed on the Study Area and the spontaneous abortion index for the Control Area is of highly questionabel relevance. If Dow is contending that it is possible to find a coincidentally "significant" correlation somewhere if you do enough independent tests using unrelated variables, respondent agrees. However, it is entirely illegitimate to suggest as Dow does that the results of such an abstract experiment can be meaningfully compared to a calculation expressly designed to test the validity of a specific hypothesis.

We do not believe that Dow intended to test the hypothesis that abortions in the Control Area are related to spraying in the Study Area. Even if a significant 'correlation" could be found between these essentially unrelated variables, this finding would have absolutely no relevance to the reliability of a separate test of a single well-defined hypothesis. No doubt the laws of chance would enable Dow to identify by experimentation many "significant" correlations between 2,4,5-T spraying and totally unrelated variables, but such data would have no probative value here. Regardless of which figures Dow's allegation is based on, it should be apparent that Dow's

selection of a single example from a series of equally implausible alternative hypotheses is a meaningless exercise designed to obfuscate the real issues.

(b) Even though the suggested use of a Chi-square test to determine whether or not the incidence of hospitalized spontaneous abortions in the Study Area was greater than the incidence of such abortions in the Control Area is of questionable theoretical validity, such a test nevertheless confirms the basic findings of the Alsea Study.

The petitioner alleges that use of a "simple statistical Chi-square test" demonstrates that there is no significant difference between the incidence of spontaneous abortions in the Study Area and the incidence of spontaneous abortions in the Control Area. Since Chi-square represents a type of distribution and may be used in many different ways, Dow's naked assertion does not provide a definitive basic for identification of the exact test Dow used. However, the most reasonable assumption is that Dow used the Chi-square test for binomial proportions.

Use of this Chi-square test involves an implicit assumption that the error variance of the distribution of hospitalized spontaneous abortion indices is binomial variance. This assumption is of questionable validity because the indices are not actually binomial proportions. */

*/ See Chiang, E. L., Standard Error of the Age-Adjusted Death Rate, Vital Statistics Special Reports, Vol. 47, No. 9, for a discussion of this problem.

In contrast, the authors of the Alsea Study estimated the error variance directly by using three-way interaction terms from the available empirical data.

Even if we assume that application of a Chi-square test to this type of data is appropriate, the results are consistent with the conclusions of the Alsea Study. The Chi-square test indicates that the hospitalized spontaneous abortion index in the Study Area is significantly (p .05) greater than the hospitalized spontaneous abortion index in the Control Area. **/ Perhaps Dow concluded that the difference is not significant by use of a two-tailed test. However, since the alternative hypothesis to be tested here is whether or not the spraying was associated with an increase in spontaneous abortions, ***/ the one-tailed test is clearly the more appropraite one. If the validity of the Chi-square method suggested by Bow is accepted, it can also be used to demonstrate that the difference between the June abortion index for two areas is highly significant (p = .01). Thus, corroborates the findings of the Alsea Study.

**/ If the 188/2344 abortion rate in the Study Area is compared to the 109/1666 abortion rate in the Control Area and Yataes' ccorrection for continuity is applied, x = 2.89 and p = .04 (one-tailed).

***/ The Alsea Study was not designed to determine whether or not 2,4,5-T could prevent spontaneous abortions.

III. The Suspended Uses of 2,4,5-T and Silvex result in direct exposure to humans through aerial drift and/or through chemical contamination of vegetation food and water which humans use or consume.

A. Introduction

As the Administrator acknowledged in his 2,4,5-T and Silvex suspension decisions, a chemical cannot pose a risk to human health if no one is exposed to it. The Administrator then provided to analyze carefully the questions of exposure. He concluded as follows:

> In my judgment, the information which as recently come to my attention as a result of the Alsea study constitutes a dramatic and troubling new point of departure for analysis of TCDD exposure concerns. As indicated above, these data show a striking relationship between 2,4,5-T use and increased incidences of spontaneous abortions among women residing in the use area. As further developed above, this effect is an effect which one would have predicted as a likely outcome of human exposure, based upon a body of animal data of almost unprecedented conclusiveness. The Alsea study, to be sure, contained no data showing actual exposure. However, concern for the health of humans who may be exposed to TCDD, and therefore, to 2,4,5-T or silvex contaminated with TCDD, is heightened because scientists have not demonstrated that there is a level of exposure that has no adverse effects in humans. Thus, in the face of the highly significant relationship which the study showed, and the animal data, I conclude it is reasonable and in the public interest to assume that the women in Alsea study were exposed to TCDD.
>
> Moreover, I also conclude that it is prudent that individuals who frequent or live in areas where 2,4,5-T or silvex are used may be exposed to TCDD in wasy and under conditions which may cause these indivicduals to be exposed in ways qualitatively similar to those experienced by the Study area women. 2,4,5-T Order at 50-51; Silvex at 50-51.

As developed above chemical regulation inevitably involves uncertainty which must be dealth with by framing prudent assumptions which are consistent with the available data, and which reflect the situations as it may exist, if the uncertainties were resolved in favor of higher, rather than lower risks. The Agency's position is that the Administrator's exposure assumptions are fully consistent with this approach.

We will show below that Dow attempts to meet its burden of proof in this area by rebutting the Administrator's exposure analysis are unpresuasive, and that the Administrator's exposure concerns, as set out in this suspension decisions, remain unanswered. In addition, we will present additional information developed since the Administrator's February 28 decisions which is consistent with, and therefore corroborates, the exposure analysis set out in those decisions. This information consists, for the most part, of case histories showing that uses of 2,4,5-T and silvex result in distribution of these chemicals (and presumably TCDD as well) to sites of human work and habitation.

B. The Use of 2,4,5-T and/or silvex leads to direct human exposure to these chemicals and to TCDD

The current methods of application of 2,4,5-T and silvex necessarilly result in the distribution of these chemicasls to the environment. In the first instance, the application methods are specifically designed to direct the pesticide to a site that includes not only target brush and weeds but also includes a wide

variety of non-target organisms and environmental media. That is, any target site necessarily includes in addition to the target brush and weeds, other non-target vegetation, the soil substrate, surface water and ground water, and, of course, the surrounding air.

Thus, the intended and actual use of the pesticide unavoidably and invariably leads to the presence of 2,4,5-T, silvex, and TCDD at each and every site of affication. This fact is indisputable and even if none of the facts discussed below influenced the environmental distribution of these chemicals, the use of these chemicals clearly leads to contamination of the living and non-living organisms and materials at the site of application.

In addition, although regulations and/or industry practice, generally prohibit use of these chemicals in areas of human work hibitation, if persons are present at the site of application, these persons would also be directly exposed to the pesticide. Thus, even assuming full conforming with all regulations in the part of applicators, the applicators themselves are necessarily present at the place and time of application and therefore are directly exposed. Any other person inadvertently or unknowningly present at an application site would also be exposed.

Further, because normal difffusion though air and water, as well as wind and currents distributes the pesticide beyond the site of application, any persons, plants and animals, water, soil and other environmental media which lie in the path of chemical-bearing drift or water will aslo be exposed to these chemicals.[*] For example, in a November 1978 letter to the Administrator, the Chief of the Forest service explained that contamination of water was unavoidable:

> Most applications of 2,4,5-T in forest ... situations necessarily involve water to some extent, and although we have very stringent criteria for preventing unnecessary water contamination, it is not possible to to completely avoid it. We are becoming increasingly aware of this with improvements in analytical detection capabilities.
>
> Our goal in respect to 2,4,5-T residues in water has been not to exceed the maximum contaminant level of 10 parts per billion (ppb) established for silvex, a very closely related herbicide (40 CFR 141). Almost all of our water samples taken on site immediately after application projects show no 2,4,5-T residues, but some do--usually less than 1 ppb, and in almost every case less than 10 ppb.

Together these factors conclusively establish the use of these pesticides leads to exposure of persons, plants and animals, and environmental media to these chemicals.

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[*] Research on the subject of spray drift indicates that exposure due to drift is likely. For example, Oregon State Univerisity staff conducted spraying experiments in an area 20 miles northwest of Alsea, Oregon. They reported that between 60 and 75% of the 2,4,5-T sprayed from aircrafc did not reach the target areas. Norris, 1967 .

Dow contends that current technology permits precise application of 2,4,5-T and silvex, thereby eliminating spray drift as a source of human exposure. Comments at 32.

The error of this statement is readily demonstrated through simple discriptions of actual exposure incidents which have been reported to the Agency. Drawing from the Agency's Pesticide Episode Reporting System (PERS), the 2,4,5-T RPAR rebuttal file, and other sources, the Agency has selected several case histories which rebut Dow's contention that the use of the pesticide does not result in exposure. Each case was selected on the basis of the following criteria:

1. 2,4,5-T was the pesticide used.
2. The use resulted in injury or damage to humans, animals, or vegetation.
3. The site of injury was some distance away from the site of application.
4. The incident was the subject of a contemporaneous report.

As the discussion to follow demonstrates, the use of these chemicals does lead, directly and indirectly, to human exposure.

1. Use of these pesticides results in direct exposure to bystanders.

During the spring of 1976 the area near the home of Patricia Clary (Candrian) in Milo, Oregon was sprayed with 2,4,5-T as well as other chemicals. During this period Ms. Clary suffered from uterine hemorrhaging. Her case was sufficiently severe so as to require transfusions of eight pints of blood and five pints of plasma. Her health returned to normal during the summer after the spraying. The next spring spraying resumed as did Ms. Clary's health problems. She experienced abnormal and heavy "spotting," extremely extended menstrual periods and dizziness and nausea. In September of the same year (1977) spraying with 2,4,5-T was undertaken again, this time within several yards of her home. Analysis of water from a nearby spring by the Oregon Department of Agriculture revealed residues of 2,4,5-T at concentrations of 0.8 ppm. For the week following this spraying incident, Ms. Clary, her husband and two children as well as a visitor suffered drowsiness, nausea, and diarrhea. Once again Ms. Clary's menstrual cycle was abnormal. Finally, in February of 1978 an area 1/2 mile away

from the Clary house was sprayed. Ms. Clary and her son experienced nausea and diarrhea for 4-5 days after the spraying. Ms. Clary's menstrual cycle was again abnormal. (Exhibit 3)

A parallel case history was related by Barbara Buckett also of Milo, Oregon. During the same spring, 1976 spraying operations described by Ms. Clary, the 16 year old daughter of Ms. Burkett also experienced unexplained hemorrhaging, as well as severe headaches and backaches. In September of 1977 the area was again sprayed with 2,4,5-T. Ms. Burkett stated, "The drift was heavy enough to bring this spray across highway 227 and onto our property. The spray could be seen, left (sic) and smelt and tasted. At the time of the spraying I received a very sore throat." (Exhibit /)

Eloise Cromwell of Pope, Arkansas, related the following incident, "During the spring of 1972, our immediate neighbors sprayed the chemical 2,4,5-T on land directly above our spring and into our watershed. Since the spraying, there have been seven pregnancies among the women living on our farm. Three of the babies were miscarried, one visibly deformed. One baby died at age three months of crib death, no medical explanation." (See, also, RPAR rebuttals #139A [3000/26]; #264 [3000/26]; O'Hagan Affidavit; Weber Affidavit) (Exhibit 2)

The foregoing incidents demonstrate that spray operations result in direct human exposure. Furthermore, the evidence strongly suggests that these airborne exposures occur at levels

sufficient to cause severe adverse effects in exposed humans. The Agency is currently collecting more reports of incidents similar to those described above. These will be presented in the suspension hearing.

2. Use of these pesticides results in direct exposure to applicators.

Pilots, ground spray crews, mixers and loaders of the pesticides, and flaggers are all exposed during the application process. See 2,4,5-T Decision and Order at 60; Silvex Decision and Order at 57-58. Their exposure can occur throughout a work day and for succeeding days and weeks during the spray season. These workers inhale pesticide spray, and some of them have direct skin contact with concentrated formulatives or with spray. Moreover, the spray or concentrate can adhere to clothing, causing exposure to last during one or several days.

Dow contends that applicator exposure is insignificant. They argue that if the Agency had not ignored data submitted by them during the 2,4,5-T RPAR, the Agency would have agreed with them that "exposure to applicators to 2,4,5-T and silvex, with their trace contaminant TCDD, cannot cause the kinds of toxic effects claimed in the Administrator's decisions." Dow's comments at 36. From these contentions, Dow constructs the argument that, for the general population, "the margins of safety are of course many orders of magnitude greater." Id.

The data which Dow and others claim the Agency failed to consider are the results of a Dow-National Forest Products Association field test to determine actual exposure of forestry applicators exposure to 2,4,5-T and TCDD.*/ These data demonstrate that application workers are exposed to 2,4,5-T in amounts ranging from 0.51 mg per hour to 6,75 mg per hour.**/ Despite the difficulties of detecting TCDD, the NFPA study also reported that two samples contained TCDD. Conceding that actual exposure occurs, Dow's pegs their argument that this level of exposure is safe to the fact that the data from the NFPA Study demonstrates exposure to be substantially lower than no-adverse effect level presented in the 2,4,5-T RPAR. Record at 1; Dow comments p. 35.

The flaw in Dow's argument is that it assumes that the Agency's tentative conclusions with respect to a no-effect level, presented for comment in April, 1978, were definite conclusions. The probable no-effect level calculated a year ago was based on animal studies available at the time and on the basis of assumed inter-species variations in sensitivity. Since the issuance of Posicion Document No. 1, additional animal data and the Alsea

*/ RPAR Rebuttal #I023H.

*/ Exposure data are presented in terms of milligrams per hour of spray operation. Corrections have been made for efficiency of excretion. The estimates presented here are the upper range figures reported in the study; the Agency believes these are the most appropriate figures.

Study have become available; these new data necessitated revision in the Agency's tentative conclusions with respect to exposure levels that may be deemed to be safe for humans. Animal data now available show that fetotoxic effects occur in animals at doses of TCDD as low as one hundred millionth of a gram, substantially lower than the doses at which effects occurred in the studies previously available. Moreover, the Alsea Study shows the likelihood that either human exposure is greater than either EPA calculations or the NFPA Study indicates, or that human sensitivity to the fetotoxic effects of these chemicals bears a different relationship to animal sensitivity than the Agency originally believed. In any event, the new data leads to the conclusion that, even though actual exposure appears to be lower than the Agency had estimated in issuing the RPAR, exposure poses serious fetotoxic risks to humans.

In fact, as discussed above, the best evidence now available to the Agency indicates that it is not possible to establish a no-effect level for TCDD-induced fetotoxic effects. Accordingly, although actual exposure appears to be lower than that originally estimated, the more significant fact is that effects appear to occur at levels of exposure substantially below those that the Agency had believed would cause these effects. Accordingly, the Agency cannot give credence to Dow's argument,

which are based on the assumption that the Agency adheres to the view that a probable no-effect level exists at the level indicated in the RPAR.*/

3. Home Uses of silvex result in direct exposure to family members

Silvex products are used for weed control on home lawns and gardens, and the application techniques create the potential for exposure to users. Home users apply these products with small tank sprayers, hose-end diluters, and aerosol cans for spray applications, and mechanical spreaders for granular formulations. Exposure is likely to result from applications by some or all routes: splashing and low-distance drift of droplets from tank sprayers, hose-end diluters, and aerosol

*/ Of course, even if the data justified adherence to the Agency's position at the beginning of the RPAR process on the "no-effect level" for reproductive effects, it still would not follw that the TCDD human exposures which are likely to occur would be "safe." This is because TCDD is a carcinogen, and it is recognized by EPA and other federal regulation agencies involved in protecting public health that no level of exposure to a carcinogen can be considered safe. See e.g., Health Risk and Economic Impact Assessments of Suspected Carcinogens, Interim Procedures and Guidelines, 41 FR 21402 (1975) Dow appears to concede this point, and argues instead that the level of risk would be insignificant. In light of data which has come to the Agency's attention since the beginning of the RPAR process showing that TCDD is a more potent carcinogen than the Agency originally believed it to be, this assertion is troublesome. (This data show that doses as low as one billioneth of a gram of TCDD cause marked carcinogenic effects in animals.) In any event, as we point out above, absolute level of risk has no meaning under FIFRA; under FIFRA, decisions turn on whether a given level of risk is greater than the economic, social, or environmental benefits of the use of the pesticide posing the risk.

containers; direct skin contact and dust particle drift from granular application. **/ Persons who are bystanders could also receive exposure to silvex by accidental splashing or drift, or low-level drift of droplets and/or dust particles.

Hose-end diluters create a high potential for dermal exposure to both applicators and bystanders because the spray arising from these devices is dispersed over a wide range. The coarseness of the spray, however, probably precludes any significant inhalation exposure or drift away from the site of treatment.

Preparing liquid concentrates for use exposes home users. While the concentrate is diluted with large volumes of water, the concentrate may spill or splash onto exposed skin. Additional exposure is likely to occur dueing spraying, mixing, and cleanup of equipment. Householders are not likely to exercise the ame caution as the certified experienced operator, and may, for example spray upwind, thus receiving an unduly high amount of drift on face, hands, and other unprotected parts of the body. In addition, home-users are likely to exceed label instructions in regard to application rates and number of applications.

*/ Some home and garden applications of silvex are made by lawn care professionals, who work much more extensively with this herbicide that would a single homeowner. These professionals are likely to exercise more care during the use of pesticide chemicals; thus, the risks of dermal exposure, resulting from spills is lower to them than to home users generally.

C. Use of these pesticides results in contamination of food and water and thereby presents indirect exposure to humans

Even in the absence of direct exposure during application, there are indirect routes through which individuals can be exposed to 2,4,5-T, silvex, and/or TCDD. Once a herbicide is applied, subsequent environmental factors play an important role in determining its human accessibility. For example, animals used for food may eat the treated foliage, thereby providing a source of dietary contamination, treated; treated soil run-off could contaminate water supplies; and weather conditions favoring persistence of the chemical could prolong possible exposure. Monitoring studies have detected these substances in water and animals, indicating a very real source of indirect human exposure and possibly explaining the residues detected in human urine. In the following section, sources of indirect exposure to 2,4,5-T, silvex, and/or TCDD are discussed.

1. Chemical residues of 2,4,5-T, Silvex, and/or TCDD are detected in environmental media and human and animal tissues.

The EPA and other Federal agencies support numerous programs which monitor 2,4,5-T, Silvex, and TCDD in environmental samples. For example, EPA monitors urine, air, surface water, sediment, and soils. Other agencies have similar programs which are appropriate to their needs, i.e., the Bureau of Land Management has done water monitoring for Silvex in connection with its herbicide spray projects on BLM forested land.

Dow contends that environmental monitoring has failed to reveal any significant TCDD residues and that studies fail to demonstrate the presence of TCDD as a residue in the American food supply. They contend that this is because the short half-lives of 2,4,5-T, silvex and TCDD prevent a significant contamination of environmental media.

Doubt is cast upon these claims by the evidence. Monitoring studies done by EPA indicate that 2,4,5-T and/or silvex are present in human urine, ambient air and surface waters. Recent preliminary results from a national urine survey show trace amounts of 2,4,5-T in 3 of 1085 samples, quantifiable silvex residues in 4 samples, and trace amounts of silvex in an additional 13 samples. During the period May, 1976 - August, 1978, 2,4,5-T was detected in 6 of 1350 whole water samples; silvex was detected twice. Ambient air monitoring of agricultural areas from 1970-1971 shows residues of 2,4,5-T ranging from 0.5 ng/m^3 to 36 ng/m^3.

The U.S. Forest Service has done some limited monitoring studies in connection with herbicide spray projects on National Forest Lands in the Pacific Northwest. Analyses were only done for 2,4,5-T since Silvex is generally not used by the Forest Service. Some of those analyses were positive for 2,4,5-T. The Bureau of Land-Management analyzed a limited number of Oregon water samples for silvex only, since 2,4,5-T is not usually used by the Bureau. Silvex was detected within 72 hours after treatment. Data collected by the U.S. Geological Survey for 1968 - 1971 showed that 2,4,5-T was the most commonly detected herbicide in western streams.

In 1974, the Agency, Dow, United States Department of Agriculture, and the Environmental Defense Fund joined together to form the Dioxin Implementation Plan, which was organized to develop the analytical methodology for detecting TCDD in the low parts per trillion range (ppt), to conduct monitoring for TCDD in environmental samples, and to support research on the toxicological effects of TCDD. Record at R-74. As a part of the Plan, samples of birds and mice from forest areas in Oregon which had been collected in 1973 and analyzed using earlier, less reliable, techniques, were re-analyzed in 1976 using improved gas chromatography/high resolution mass spectroscopy techniques. Three of five samples which had originally been analyzed as positive showed detectable levels of TCDD, although exact qualification varied between laboratories. Therefore, although precise quantification is not available, it appears from qualitative standpoint that TCDD was present in some of the Oregon forest samples collected in 1973. Record at R-63 and 73.

Three beef fat samples out of 67 collected in 1975 from areas where 2,4,5-T was probably used were also found to be positive (one at 60 ppt and two at 20 ppt). In addition, some other samples showed the possibility of TCDD, but levels were at or below the detection limit of 10 ppt. Record at R-66.

Studies on the environmental movement of 2,4,5-T and Silvex indicate that run-off from sites of application is a likely means of environmental transport. These herbicides are usually applied

as a dilute spray, forming a thin film on foliage and soil. They are thus accessible to rainfall that occurs subsequent to application. Both are fairly soluble in water and are transported in run-off largely in solution rather than by adsorption to suspended sediments. Numerous studies have documented run-off transport of 2,4,5-T under different situations. For example, 2,4,5-T levels of at least 7.2 ppb were foundd in a fish hatchery, 4000 feet downstream from a forest treatment site, six days after treatment Norris, 1978 . (Exhibit 7). For pasture and range land use, concentrations of 2,4,5-T from 15 to 3,300 ppb were found in surface run-off waters collected at the edge of the treated plots.

In sum, monitoring programs have demonstrated the presence of 2,4,5-T, silvex and TCDD in water, air, and foodstuffs. Proof that human exposure is actually taking place is demonstrated by the presence of 2,4,5-T and silvex in urine samples.

2. Contamination of food and water with 2,4,5-T results in indirect exposure to humans

Numerous documented incidents establish that, despite inconclusive or apparently negative results in many residue analyses samplings, use of 2,4,5-T results in contamination of food or water at considerable distances for the site of application and that such contamination causes damage and causes indirect human exposure. Dow contends that the environmental fate of 2,4,5-T is such that "stream contamination is negligible" and that "Residues of 2,4,5-T rarely occur in meat, milk and other agricultural products under current registrations." (Dow comments, p. 37) Dow also implies that TCDD does not

contaminate food and water: ". . . TCDD is not mobile in soil and residues have not been found in vegetation or water after application of 2,4,5-T. Significantly, environmental monitoring has failed to reveal any significant TCDD residues." Id. Dow's position overlooks incidents such as those described below.

The selection criteria used in collecting these incidents involving indirect exposure are the criteria used for collecting reports of direct exposure.

1. 2,4,5-T was the pesticide used.
2. The use resulted in damage.
3. The iste of injury was some distance away from the site of application
4. The incident was the subject of a contemporaneous report.

The incidents selected are drawn from RPAR rebuttal submission and PERS Reports. The Agency is in the process of collecting reports of additional incidents for use in the administrative hearing.

In March 1975, 2,4,5-T was applied by air on timberland near Roseburg, Oregon, at a time when snow was present on the ground. Subsequent melting of the snow caused contamination of a creek that supplies water to residents of the area. Tap water analysis for one household revealed the presence of 0.0003 ppm of 2,4,5-T.

In March 1975, 2,4,5-T was applied by equipment to clear brush along a logging road in Lecombe, Oregon. Contamination of a ditch alongside the unwanted foliage caused dairy cattle to become ill. Analyses of milk sampled five and eight days

after the spraying showed that 2,4,5-T was present at levels of 0.03 ppm and 0.002 ppm, respectively. Two hundred and forty gallons of milk generated by the sick cows had to be discarded. (Exhibit 5).

In June 1973, 2,4,5-T was applied in a municipal shop maintenance area in West Linn, Oregon. Gardens and surrounding foliage and trees suffered damages including contamination of food crops. (Exhibit 6).

In June 1973, application of 2,4,5-T along a right-of-way caused damage in a garden 150 yards from the right-of-way. Visible chemical damage occurred on beans, tomatoes, and peas. In the area surrounding the garden, visible damage occurred to grapes, apples, clover and foliage. (Exhibit 7).

In March 1978, 2,4,5-T was applied along a power line right-of-way in Gandeeville, West Virginia. The owner of property through which the right-of-way ran testified before a local commission that the spray caused a "brown-out" which damaged vegetation, bushes, fruit trees and a creek in the area near the spray site. (Exhibit 8).

In September 1977, 2,4,5-T was applied aerially on a power right-of-way about 30-40 feet from a school near Kermit, West Virginia, just after children had been dismissed from school. The teacher of the school testified in a court proceeding that spray fell both on the schoolyard and on adjacent areas, including a pasture, where children walk and play. Vegetation including berries customarily eaten by the school children, was contaminated. A well supplying water for the school was close to the spray site and may have been contaminated. (Exhibit 9).

3. The environmental persistence of TCDD allows for exposure after the actual use-time.

While 2,4,5-T and silvex are not environmentally persistent chemicals, TCDD is capable of great persistence. Helling et al. (1973) concluded that this persistence is not surprising since it is an insoluble, non-polar, chlorinated molecule, devoid of biologically labile functional groups. The half-life in soil has been estimated to be about one year in two different soils (Kearney et al., 1972). Of 100 strains of micro-organisms which have the capability to degrade other persistent pesticides, only five showed some ability to degrade TCDD (Matsumura and Benezet, 1973). Matsumura (1978) found that TCDD was stable in lake sediments and had a half-life of about 600 days.

TCDD usually first appears in the environment at a very low concentration in a thin film on foliage or soil, as a result of spraying. The extent of its persistence depends upon the current environmental circumstances. Under certain conditions, including principally the presence of a hydrogen-donating solvent and adequate sunlight intensity, photodechlorination of TCDD to lower chlorinated dioxins can take place.

Dow contends that TCDD has a short half-life in the environment when "on vegetation in the presence of a hydrogen donor and that photochemical degradation also occurs in soil." Dow Comments at 37. However, these conditions are clearly not always available. As noted by Crosby (1977), breakdown would be expected to be slower in the shade even if efficient hydrogen donors were available. Much of the forest area in the Northwest is subject to long periods

of cloudiness and rain so that sunlight may not be adequate. TCDD which reaches the soil may not be accessible to sunlight; in such a case, the photodegradation process would not occur. "No actual measurements of dioxin dissipation from herbicide treated forest appear to have been made" Crosby, 1977 .

In the most intensive case of environmental contamination with TCDD, in Seveso, TCDD was observed to dissipate very slowly even though adequate sunlight was available in this case "effective contact with photochemical H donors was minimal" Crosby, 1977 . Thus,it is clear that, while TCDD photodegration is possible and might be rapid under certain circumstances, its likelihood of TCDD being destroyed by ths process under actual field conditions is unknown and may be low.

D. Summary

The implications for human health of the data on animal toxicity and the results of the Alsea study depends on the extent to which humans are esposed to toxicologically significant levels of 2,4,5-T silvex and/or TCDD. In view of the data from Alsea and the foregoing instances a human exposure, Dow's unsupported assertion that "the actual patterns of use in the Alsea basin should not reasonably be expected to produce more than negligible exposure to 2,4,5-T and silvex," Dow Comments at 24, simply cannot stand.

The uses of 2,4,5-T and silvex result in distribution of these chemicals to sites of human work and habitation. These chemicals and TCDD are present in environmental media and human tissues. There are no data establishing a no effect level in animals or humans for fetotoxic effects, and even if there were are no data

on an acceptable margin of safety or actual environmental levels of these chemicals. Together these factors indicatae that the uses of these chemicals create an imminent hazard.

IV. The Suspension of the Contested Uses of 2,4,5-T And Silvex Will Not Result in Substantial Adverse Economic Impacts

A. Introduction

In its comments, Dow attempts to demonstrate that where 2,4,5-T and Silvex are used they are essential. Thus, they argue, the suspension of these compounds for the uses at issue here will result in substantial economic losses where alternative control methods are not available or are less economical or efficacious. There are two general answers to these contentions. First, the Agency believes that for every use there is a practical alternative available to replace 2,4,5-T and Silvex. In some cases these alternatives may prove more costly than 2,4,5-T and/or silvex. For these, the increased cost has been calculated and reported in the Administrator's Decision and Order. In no instance are these increased cost substantial in the context of the overall economy or the particular industry involved.

The second response to Dow's argument is that the timing of treatments with 2,4,5-T and Silvex is very flexible, such that a delay in treatment of 1 to 2 years is often feasible. None of the 2,4,5-T uses at issue here involve yearly treatments. Generally, treatments are spread over 5 to 10 year cycles. There is no evidence to indicate that a one or two year delay in treatments will result in substantial impacts either immediately or over the 2 year suspension period. Thus, for example, release treatments in conifer forests can

be undertaken quite readily in any year between the second and tenth year after planting. 44 FR 15888 . This type of flexibility is the rule rather than the exception for 2,4,5-T and silvex herbicidal treatments. Former users of these compounds not only have the option of using a variety of alternative control methods, but in many instances the users can simply delay treatment during the pendency of the suspension without experiencing substantial adverse economic impacts.

Dow bases its analysis entirely upon the document entitled, "The Biologic and Economic Assessment of 2,4,5-T," February 1979 ("USDA Report"). This document was originally intended as a cooperative effort of the USDA, EPA and State officials to be used as a major input into the benefits analysis phase of the RPAR process. In fact, EPA had a very limited role in drafting this report.*/ The Agency was never afforded an opportunity to review and approve the final document.**/ There are portions of the document which the

*/ Of the 43 members of the Assessment team, only 5 were from EPA. USDA Report, V-IX, et seq.

**/ A memorandum of Understanding between the USDA and EPA (signed November 26 and December 2, 1976) and a subsequent supplement (signed October 14 and 18, 1977) established the mechanism for a joint USDA, EPA, States benefits analysis. The Memorandum of Understanding provides for a cooperative effort on an equal basis for all phases of the undertaking. The supplement at P. 6 requires that the participants will be afforded an opportunity to review and comment on the final document prior to issuance of the report. This provision was not complied with when USDA issued the report before EPA has an opportunity to review and comment upon it.

Agency does not concur with; accordingly, the Agency has not and cannot adopt all portions of the report as reflecting the Agency position on the matters discussed therein.***/

There is useful information contained within the USDA Report. However, it must be kept in mind that the USDA Report was designed and directed at assessing the impact of a permanent cancellation of 2,4,5-T and not a short term 2 year suspension. Basic information (e.g., use data reported on a yearly basis), in the Report was used by the Agency in assessing short term impacts, however, much care was exercized by Agency staff in identifying and employing these data to avoid using data only applicable to long term impacts. Dow has failed in many instances to exercize similar care in using the data from the USDA Report. As a consequence, many of the citations in Dow's comments are to data which are applicable only to long term economic impacts. In the following discussion these errors as well the more serious allegations made by Dow and Chevron in their comments are dealt with in detail.

B. Rights-of-Way

The Dow comments on the rights-of-way use attempt to create an impression that 2,4,5-T is an essential tool for maintenance of many rights-of-way acres. In fact, a large number of acres receive no vegetation management of any

***/ The Agency used portions of the USDA Report which it felt it could appropriately rely upon. In the context of the emergency conditions surrounding the preparations and promulgation of the Decisions and Orders in this matter, it was sometimes necessary to rely upon benefits data in the USDA Report which the Agency may ultimately want to supplant with more reliable data.

type. 44 FR 15889 . For those acres under vegetation management, chemical control is the exception rather than the rule. Id. . The suspension of 2,4,5-T for rights-of-way use will not cause significant economic impacts because a variety of efficacious alternatives are available, including manual, mechanical and several chemical control methods. Id. . In some instances, these alternatives are less expensive than 2,4,5-T. Most of the chemicals (Dicamba, 2,4-D, dichloroprop, and picloram) are less expensive for aerial, selective basal and stump sprays which account for the majority of annual treatments by acreage. Id . Thus, to the extent that these chemicals might have a shorter active life than 2,4,5-T, they partially, compensate for this with lower initial application costs.

The weakness of Dow's position on rights-of-way uses is further illustrated by their misuse of cited materials. Thus, for example, Dow claims that 2,4,5,-T does not cause adverse environmental effects. Dow Memo, p. 48 . The accompanying citation is to the USDA Report. The USDA report does contain several comments regarding the relative persiscence of 2,4,5-T and its alternatives. However, the Report does not state nor infer, as Dow suggests, that no environmental hazards are posed by use of 2,4,5-T. Perhaps more importantly, the use of the USDA Report to support any statements about environmental impacts must be questioned. The USDA Report was intended to collect, evaluate and document data needed by the Agency to evaluate the economic

significance of 2,4,5-T use. It was not designed nor does it direct itself to an assessment of broad environmental issues.

Dow relies on the USDA Report to support its statement that dicamba is less effective than 2,4,5-T for control of several weed species on rights-of-ways. The USDA Report (at 3-50) does suggest that dicamba is not effective for these pests, but it does not provide any basis for this statement. There is no indication that any form of scientific or formal observation was relied upon as the basis for this conclusion. As such, the Agency properly chose not to rely upon this statement.

Dow claims that the annual increased costs of utilizing alternatives in place of 2,4,5-T for rights-of-way use would amount to $32 million per year rather than the $1.3 million estimated by EPA. This is erroneous. The $32 million figure, taken from the USDA Report, is excessive for purposes of assessing the impact arising during a 2 year suspension because the USDA figure assumes a permanent cancellation. The EPA figure cited by Dow -- $1.3 million -- is an estimate based on a two year suspension. A major reason for the relatively slight short term impact is the substantial flexibility in the timing of 2,4,5-T rights-of-way treatments. In fact, on the average, 2,4,5-T is only used once every four years. 44 FR 15339 . In many cases treatment can be postponed for some time with little or no economic impact. Thus, a 2 year suspension would have a quantitatively lesser impact

than a permanent suspension. In addition, on those acres for which immediate treatments are desired, treatment can be undertaken with any one of a number of efficacious and economical alternatives Id. .

C. Forestry

It is Dow's position that serious economic impacts will be experienced as a result of the suspension of 2,4,5-T for forestry uses. For site preparation activities Dow claims that alternatives are more costly than 2,4,5-T. For release treatments there are no chemical alternatives and the manual alternative is very expensive and often impractical. Thus, for release treatments on those acres where manual methods are feasible there will be a substantial cost increase. Dow further alleges that there will be production losses on those acres where manual methods are not feasible. These contentions are incorrect. */

The Agency has found that 2,4,5-T is not an essential tool for forest management. 44 FR 15888 . It is used on only 0.23% of all U.S. commercial acreage. Id. . This level of use does not suggest that the chemical is essential to the entire industry. Furthermore, there are a variety of alternatives available for site preparations. In addition to manual and mechanical methods there are a variety of efficacious and economical chemicals which are registered

*/ The USDA agrees with the Agency that the short term economic impacts on forestry management arising from the suspension will be minor. Thus, the Assistant Secretary of Agriculture, M. Rupert Cutler recently stated, "... the emergency suspension of 2,4,5-T for forest management uses would have no short-term impacts on the national forest timber harvest program." USDA News, "USDA to Suspend Use of 2,4,5-T in Forest Management" 3/1/79. USDA 494-79.

and available for use this season. Id. . It is important to note that site preparation does not require a selective method of treatment. Selectivity is the primary special quality claimed by Dow for 2,4,5-T. Rather, site preparation involves the suppression of all types of vegetative growth in the site. Thus, a variety of compounds other than 2,4,5-T are widely used for this purpose as well as mechanical clearing techniques.

Release treatments require a selective method which will not harm the young conifers. In addition to 2,4,5-T, fosamine and glyphosphate provide selective control of indigenous pest plants and are registered in Washington and Oregon for this use. Manual treatments provide the most selective and effective release treatments, albeit at a greater cost. However, both Dow and USDA overestimate the cost and underestimate the cost effectiveness of manual release methods. The Agency will adduce evidence in the suspension hearings which will demonstrate that manual treatments are currently in use in commercial forests. These operations have been successful both economically and biologically.

Notwithstanding the availability of a variety of alternatives, the Agency believes that for many managers the most likely course of action during the suspension will be to delay release treatments temporarily. The timing of release activities is very flexible. Release is generally undertaken at almost any time during a 2 to 10 year period after planting. Id. . The growth dynamics of a newly planted forest are such that the timing of treatments within

after planting. Id. . The growth dyanamics of a newly planted forest are such that the timing of treatments within this 8 year "window" often permit delays of a year or two and would not have measureable effects on overall production.

Finally, Dow has assumed that current practices, particularly for release treatments, have been cost effective. There is evidence to indicate that the effectiveness of current 2,4,5-T treatment techniques has been substantially overestimated. The Agency intends to present evidence in the hearings which will demonstrate that 2,4,5-T is frequently applied to acres which cannot or do not benefit from its use; that many applications are needless; and that 2,4,5-T can and does have phytotoxic effects on conifers.

D. Pasture

Dow states that the suspension of 2,4,5-T for pasture weed control will result in "substantial" economic impacts Dow Memo p. 53 . However, there is no mention of actual figures. This is not unexpected in view of the actual figures. Approximately 1% of all range and pasture acres were treated with all herbicides in 1976.*/ USDA, ESCS, 1973, p. 7 . Of the total quantity of herbicides used, 2,4-D accounted for 93.8%. Ibid., p. 12 . All other pesticides including those which account for as little as 0.02% of the remaining use were listed; 2,4,5-T did not even appear

*/ The Decision and Order at 44 FR 15890 incorrectly states that 2,4,5-T is used on 1% of all acres. The statement should have indicated that all chemical herbicides combined are used on only 1% of all acres.

on the list. Thus, to the extent that any chemical herbicides are used on pasture acreage, 2,4,5-T appears to be one of the least, if not the least, favored of the available materials. It cannot be said on the basis of the foregoing data that the suspension of 2,4,5-T for pasture use will result in "substantial" economic impacts.

Dow makes a number of statements, which on closer inspection are without support. Thus, for example, Dow states that, ". . . authorities have estimated as much as 5% of U.S. livestock die each year from grazing on poisonous plants". Dow Memo p. 52 . This statement is footnoted with a reference to B. Day, "The Phenoxy Herbicides" published by the Council for Agricultural Science and Technology (CAST). The CAST report does contain a statement supporting Dow's statement. However, the relied upon CAST allegation is unsupported by reference to any type of documentary or factual support. It is also unattributed, thus making it impossible to investigate the source of the claim. It is worthy of note that a similar statement also appears in the USDA Report (at p. 2-118). Here too, the statement appears without support or attribution. In addition, it is explicitly limited to Western rangelands, a use not challenged in this proceeding. There is no indication that the same rate of poisoning is thought to occur on pasture acres. In a similar vein, Dow alleges that, "undesireable vegetation on all grazing land in the U.S. causes losses of almost $2 billion per year" Dow Memo, p. 52 . This estimate is apparently drawn from

the USDA Report at 2-8 where it states, "Annual losses from weeds and brush on rangeland and cost of control are conservatively estimated at $1.7 billion". In addition to being excessively rounded off, Dow's use of the $2 billion figure is inappropriate because the USDA estimate is again limited to rangeland. It does not encompass pasture land, the only type grazing land at issue in this proceeding.

Finally, Dow argues that taken individually the available alternatives are not as broadly effective as 2,4,5-T. Although it may be true that no single chemical alternative will replace 2,4,5-T in all areas of the country for all uses, there are effective chemical, manual and mechanical methods available to control all of the pest species in all parts of the country. 44 FR 1590 . Picloram, dicamba, 2,4,-D and hand labor can generally provide the same level of control as 2,4,5-T although at higher rates of application and/or higher cost.

On those acres where the use of alternatives will cost more than scheduled 2,4,5-T treatments, treatment may be delayed, dispensed with altogether or the more expensive alternative employed. Since treatments with 2,4,5-T are generally scheduled for 5 to 10 years intervals, the timing of subsequent treatments is largely optional. Therefore, delay during the suspension period may be practical for many of the acres now scheduled for treatment. Treatment may be entirely dispensed with on acres scheduled for 2,4,5-T treatment which only marginally require such treatment. 44 FR 15390 .

E. Silvex

The Agency agrees with Dow that, "to the extent that 2,4,5-T and Silvex are interchangeable in use on rights-of-way, forestry and pastures, the above discussion concerning 2,4,5-T applies" Dow Memo, p. 54 . Similarly, to the extent that Dow has failed to rebut the Agency's positions on 2,4,5-T uses, they have also failed with regard to the same uses of silvex.

Chevron is the only Registrant other than Dow which submitted comments on the benefits of either silvex or 2,4,5-T. Chevron's comments were limited solely to the home and garden uses of silvex. Chevron argues that each of the three alternatives to silvex for this use have limited effectiveness. Thus, they allege that dicamba can adversely affect nearby shrubs when it is applied to lawns. MCPP is said to be less effective than silvex if it is applied to lawns or gardens during cool periods. Finally, some species of lawn pests are said to be resistant to 2,4-D. None of these claims are substantiated by Chevron in their submission. However, even if it were assumed, arguendo, that the claims were accurate, Chevron has not succeeded in demonstrating that adequate alternatives are not available to replace silvex for lawn and garden use. The alleged limitations of the alternatives are mutually exclusive. Accordingly, at least one of the compounds would be effective in virtually any situation. Thus, the homeowner will not be left without an effective alternative. It follows that the impacts stemming from the suspension of this use will be negligible. 44 FR 15919 .

CONCLUSION

EPA trial counsel will present evidence at the hearing which will show that continued use of 2,4,5-T and silvex during the period required to complete cancellation proceedings would result in an imminent hazard.

Respectfully submitted,

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