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Atmospheric Concentrations of Agricultural Chemicals in the Lower Fraser Valley 1996

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Atmospheric Concentrations of Agricultural Chemicals in the Lower Fraser Valley

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I. Abstract

Many different chemicals are used in agriculture to control pests and improve crop yields including herbicides, pesticides and soil fumigants. Typically, their use is at specific times of the year when needed to enhance crop production. Some of the agricultural chemicals developed decades ago have come into disfavour because of their toxicity. After decades of non-use some of these chemicals still exist in the atmosphere. These semi-volatile organics have the ability to be volatilized in warmer equatorial climates and be carried by winds to cooler climates where they condense and are deposited in a 'leap-frog' transport phenomenon. Their presence and concentration in the atmosphere in the agricultural area of the lower Fraser Valley in British Columbia has not been previously assessed. This lack of knowledge prompted an assessment of the atmospheric concentrations and their potential deposition to the environment. This report examines the data from a year-long sampling program with respect to temporal and spatial concentrations at two sites in the lower Fraser Valley of British Columbia. Twenty eight chemicals were found in the dry air and eight chemicals were found in the rainfall at one site; some of these are no longer in use in Canada, indicating long range transport.

Résumé

De nombreux produits chimiques différents, dont des herbicides, des pesticides et des fumigants de sol, sont utilisés en agriculture pour lutter contre les nuisibles et améliorer le rendement des cultures. Ces produits sont normalement utilisés à des moments bien précis au cours de l'année pour améliorer la production agricole. Certains des produits chimiques agricoles mis au point il y a plusieurs décennies déjà ne sont plus utilisés maintenant en raison de leur toxicité. Bien qu'ils n'aient pas été utilisés depuis des décennies, certains de ces produits sont toujours présents dans l'atmosphère. Ces produits organiques semi-volatils peuvent se volatiliser dans les régions équatoriales plus chaudes, puis être transportés par les vents vers des régions plus froides où ils se condensent et se déposent suivant le phénomène de transport qualifié de «saute-mouton». On n'a pas encore évalué leur présence et leur concentration dans l'atmosphère de la région agricole de la vallée inférieure du fleuve Fraser, en Colombie-Britannique. C'est cette lacune en matière de données qui nous a incités à procéder à une évaluation des concentrations atmosphériques et du risque de dépôt de ces produits dans l'environnement. Dans ce rapport, on examine les données obtenues dans le cadre d'un programme d'échantillonnage d'une durée d'un an, qui portait sur les concentrations à différents moments et à différents endroits à deux sites dans la vallée inférieure du fleuve Fraser, en Colombie-Britannique. À un site, on a décelé 28 produits chimiques dans l'air sec et 8 produits chimiques dans l'eau de pluie; comme certains de ces produits ne sont plus utilisés au Canada, leur présence à cet endroit serait le résultat de leur transport à grande distance.

II. Introduction

The United Nations Environmental Program (UNEP) Governing Council initiated an investigation into twelve specific persistent organic pollutants (POPs) in 1995. The twelve chemicals of concern included: DDT, aldrin, dieldrin, endrin, chlordane, heptachlor, hexachlorobenzene, mirex, toxaphene, polychlorinated biphenyls and dioxins and furans. POPs are halogenated and are characterized by their low water solubility and high lipid solubility resulting in bio-accumulation in fatty tissues. They are also semi-volatile and can be transported great distance in the atmosphere from their source before being deposited. Typically, the halogenated compounds have molecular weights between 200 and 500 atomic mass units (a.m.u.) and vapour pressures less than 1000 Pa. Concern about the toxic capability of these chemicals is based upon the fact that low level exposures have been associated with chronic non-lethal effects including immuno-toxicity, dermal effects, impairment of reproductive performance and actual carcinogenicity. The ability to bio-accumulate may result in achieving toxicologically relevant concentrations even though discrete exposure may be limited. Some of the chemicals in the UNEP program have been measured in the LFV area.

The lower Fraser Valley (LFV) area (Canadian and U.S.) occupies about 281,000 hectares; about two thirds of this is in agricultural use. This agricultural area is used for both crops and animal husbandry. In order to improve crop production it is standard practice to use chemicals to control pests such as insects and non-desirable weeds.

The use of these chemicals has been restricted by government legislation, and guided by specific handling procedures. Some chemicals have been in commercial use for years and have since been determined to be hazardous. They have become banned from use in this and other countries. However, some of these chemicals persist in the environment long after they have ceased to be manufactured or locally used. The reasons for their continued presence is that some chemicals are long-lived and do not readily break down in the environment. Some chemicals have unique physical features that allow them volatilize from the soil, be transported via the air and then re-deposited in other colder areas. Typically, when volatilized POPs are transported into cooler areas, the there is a transformation from the vapour to the suspended particulate phase due to the vapour-solid partitioning function of these chemicals; particles are more readily transportable in the atmosphere and tend to keep the POP concentration from being dispersed, as would happen in the gas phase (Ritter *et al.*, 1995). This ‘leap frog’ effect has been observed with chemicals used in equatorial countries and subsequently found in Arctic areas. Because of the large number of chemicals in the atmosphere, sampling for a general selection of organo-chlorine (OCs), organo-phosphate (OPs), solvent soluble herbicides (SSHs) and soil sterilants was established which included fifty seven chemicals (Table 1). Thirty-five OCs, seven herbicides, sixteen OPs and two soil sterilants were included in the chemical assessment package.

Two sampling sites were selected in the Fraser Valley at Agriculture Canada research stations located at Agassiz and Abbotsford (Figure 1 Lower Fraser Valley sampling area).

III. Sites

The Agriculture Canada sites at Agassiz and Abbotsford were selected because they were previously established secure facilities with power and nearby meteorological stations. The Agassiz site was at the eastern-most end of the Fraser Valley where two mountain ranges converge. This area has mostly crop production and little animal husbandry. The Abbotsford site was in the middle of the Fraser Valley in an area with intensive pig and chicken production as well as extensive berry crops. These two sites were expected to provide a picture of nearby source contributions to the atmosphere as well as the background concentrations over the course of the year-long sampling program.

IV. Meteorology and Geography

The lower Fraser Valley has the Pacific Range mountains to the north, running west-to-east for about 100 km to Hope, where they meet the Cascade Mountains, running south-west to the coast (Figure 1 Lower Fraser Valley sampling area). This forms a river delta triangle area where half the population of British Columbia live and work. The mountains in this unique geographical area supports a reversing flow of air up and down the river valley, especially during diurnal flow patterns. Air quality can become poor in the Fraser Valley when periods of stagnation occur and air masses are stationary allowing collection and atmospheric reaction of pollutants.

Meteorological data for the Agassiz site were obtained from an Environment Canada climate station at the site. Data for the Abbotsford site were obtained from instrumentation installed at the site; this was augmented with data from a nearby meteorological station at the Abbotsford airport. Wind data were obtained with an R. M. Young anemometer (model 05103), temperature and relative humidity from a Campbell Scientific probe (model 207) and atmospheric pressure from a Setra (Model SBP270).

Meteorological equipment was sited and operated in accordance with accepted standards (Environment Canada, 1994; EPA, 1989). Data was collected from a datalogger system and stored in an Environment Canada computer archive.

V. Sampling Equipment and Methods

Rainfall was collected in an MIC sampler similar to those used in the Integrated Atmospheric Deposition Network (IADN) for the Great Lakes (Environment Canada, 1994). The sampler was designed to collect organic material in rainfall. The sampler collected precipitation in a square Teflon funnel and was channeled through a Teflon tube containing XAD-2 resin to capture the organics. The sampler was activated by a moisture sensor so that the collector was only open to the atmosphere when precipitation occurred.

Dry air samples were collected in a high volume sampler containing a sampling head with filter, polyurethane foam and XAD-2 resin (PUF). The sampler was operated at a flow rate of about 5.0 liters per minute (l/min). Sampling procedures were similar to those described in EPA Method TO-4 (EPA, 1988).

The sampling program was intended to cover a full year and operated from February 1996 to March 1997. Sampling was stopped for a short period in May 1996 due to operational constraints. Samples were collected on a weekly basis, from Tuesday to Tuesday at approximately 9 am local time. At the end of the sampling period samples were immediately taken to the laboratory for analyses to minimize any sample degradation. The purpose of this sampling program was to determine generally what agricultural chemicals could be found in the atmosphere of the Lower Fraser Valley. Sampling on a weekly basis provided this function, but it limited the ability to determine source-receptor assessment. Sampling on a smaller time scale would have been more adaptable to the normal 2-3 day synoptic weather patterns used for back trajectory plots to determine sources.

VI. Laboratory Analyses Methods

The contract laboratory, Analytical Services Laboratory (ASL), was responsible for sample media preparation and sample analyses. As well, they prepared lab and field blanks and spiked samples to assess field, laboratory and analytical procedures. Samples submitted for analyses included rainwater samples collected on XAD-2 resin columns and dry-air samples taken on high volume filters and polyurethane foam plugs with an XAD-2 resin backup (HV/PUF).

The preparation and extraction of the sampling media was carried out based on the procedures described in the U.S. EPA Compendium Method TO-4, Method for the Determination of

Organochlorine Pesticides and Polychlorinated Biphenyls in Ambient Air, April 1984, and Environment Canada's draft method for the Determination of Semi-Volatiles Collected by PUF and/or XAD-2, 1991.

The adapted methodology included the Soxhlet extraction of the HV/PUF and XAD resins with dichloromethane (DCM). This extract was then concentrated and extracted with 0.1M potassium carbonate to extract the acidic compounds (Acid-extractable herbicides). The alkaline portion contained the acidic compounds while the DCM solvent retained the neutral and hydrophobic compounds (organochloride pesticides (OCPs), organo-phosphate pesticides (OPPs), and soil sterilants (SS)).

The alkaline fraction was acidified to pH <3 and back extracted into DCM, evaporated to near dryness and esterified with diazomethane. The first DCM fraction was evaporated to near dryness and solvent exchanged to acetone. For clean-up the acetone fraction was passed through a carbon/ celite column and eluted with an acetonitrile/ toluene mixture. This was then solvent exchanged back into acetone for analyses.

The two fractions were then recombined and spiked with an internal standard (d_{10}-pyrene) and the final volume adjusted to 1 milliliter with acetone. Analyses were carried out on a capillary column gas chromatograph with an electron capture detector (GC/ECD) for the organo-chlorine pesticides and acid extractable herbicides. The organo-phosphorus and soil sterilant compounds were analyzed on a capillary column gas chromatograph with a nitrogen-phosphorus detector (GC/NPD).

VII. Quality Assurance

A. Field Data

Meteorological data were subject to standard Environment Canada procedures for quality assurance (Environment Canada, 1994; EPA, 1989). The field data for temperature and pressure were used for air sample volume corrections. The rain gauge data were used for wet deposition calculations.

B. Lab Data

An extensive quality assurance program was routinely incorporated with the sample analyses. This included procedures to assess precision, accuracy and contamination control. Procedures included method blanks, sample replicates, certified and standard reference materials and analyte or matrix spikes. The lab routinely used triphenyl phosphate, tetrachloro m-xylene, PCB 209 and 2,4-Dichlorophenyl acetic acid as laboratory surrogates. These compounds were added to the samples prior to their extraction, and the percentage recovery was used to assess the performance of the laboratory extraction and analyses procedures.

A field surrogate of 2-fluor-9-fluorenone was added to the cleaned sample media prior to shipping to the field where sampling was performed. The percent recovery of this surrogate was used to assess the performance of the entire procedure from field sampling to analyses.

For the Agassiz site, all field and lab blanks for rainfall were reported with values less than the detection limit. Only azinphos had a positive value for the 'method blank', and that was at the detection limit. The internal standards, used to assess overall field and lab processed had poor recoveries for 2,4-D and tetrachloro-m-xylene had some weeks with poor recoveries, but overall average spike recoveries were between 71 and 108%.

For dry air at Agassiz, all the filed and lab blanks were reported with values less than the detection limit. Only azinphos-methyl had a positive value for the 'method blank', and that was at the

detection limit. The internal standards, used to assess overall field and lab processed had poor recoveries for 2,4-D and tetrachloro-m-xylene had some weeks with poor recoveries, but overall average spike recoveries were between 72 and 112%.

VIII. Data Analyses and Discussion

A. Field Data

The detailed meteorological data for temperature and atmospheric pressure were reduced to weekly averages, to be used in adjusting sampled air volumes to standard temperature and pressure. The weekly rainfall data was used to calculate wet deposition values.

The Agassiz site dry air sampling program operated from February 1996 through to March 1997, except for a short period in May-June 1996. Through this period forty-six weekly samples were taken and analyzed. Sampler operation was inhibited only by sample pump malfunction at approximately 4-6 week periods when the motors quit functioning. The motor for the Graesby Andersen HV/PUF normally operates for 24 hour periods, and was not intended to be used in the continuous fashion used in this sampling program.

The Abbotsford site operated through a similar sampling period and forty-seven samples were taken and analyzed. Sample operation was similarly limited by motor failure at this site.

Rainfall sample amounts at Agassiz were quite varied with the effects of temperature and seasonal storms. Freezing weather in the winter periods caused frozen samples, which may have resulted in lower concentrations (and deposition) of these chemicals.

Rainfall samples at Abbotsford also had seasonal freezing, but not as frequently as at the Agassiz site, even though they were only about 55 km apart.

B. Calculations

The lab data was reported in terms of micrograms (μg) of chemical extracted from the sample submitted. For dry air samples, the data was then converted to concentrations in micrograms per cubic meter of air sampled (μg/m^3). The volume of air sampled was derived from measurements taken on a dry gas meter (Rockwell), the weekly average for ambient temperature and pressure at the site, and then adjusted to standard temperature and pressure (20°C and 760 Torr).

$$V_s = \left(\frac{T_s}{P_s}\right) * \left(\frac{P_m}{T_m}\right) * V_m$$

Equation 1: Standard volume calculation

$$C_i = \left(\frac{W_i}{V_s}\right)$$

Equation 2: Dry air concentration calculation

where: "V" is volume, "P" is pressure, "T" is temperature, "W_i" is weight of the individual chemical, "s" indicates standard, "m" indicates measured and "C_i" indicates the concentration of the individual chemical.

For rainfall samples, the data was converted to concentrations in micrograms per liter (μg/l) by dividing by the rainfall volume during the sampling period. The rainfall volume was calculated from the product of the surface area of the sampler and the rain gauge measurements.

$$C_i = \left(\frac{W_i}{A * R_g}\right)$$

Equation 3: Rain concentration calculation

where: "R_g" indicates Rain gauge measured in mm rainfall, "A" is the surface area of the sampler and "C_i" indicates the concentration of the individual chemical.

Deposition data for dry air was determined by the use of an average deposition velocity of 0.1 cm/sec (Slinn *et al.*, 1980) and the ambient air concentration for the sampling period.

$$D_r = \left(\frac{V_d * C_i}{t} \right)$$

Equation 4: Dry air deposition calculation

where: "D_r" indicates Deposition rate in μg/m^2/day, "V_d", is the deposition velocity in cm/sec, "C_i" indicates the concentration of the individual chemical in μg/l and "t" is the sampling period in days.

Deposition data for the rainfall was calculated from the measured weight of the chemical divided by the area of the sampler and the time sampled.

$$D_r = \left(\frac{W_i}{A * t} \right)$$

Equation 5: Rainfall deposition calculation

where: "D_r" indicates Deposition rate in μg/m^2/day, "W_i" is weight of the individual chemical, , "A" is the surface area of the sampler and "t" is the sampling period in days.

C. Dry Air

Data for Agassiz and Abbotsford samples are shown in Appendix 1: Dry air data for Agassiz. and Appendix 2: Dry air concentrations at Abbotsford. At Agassiz 16 OCs, 3 herbicides, 8 OPs and one soil sterilant were found in the dry air samples. At Abbotsford, 14 OCs, 3 herbicides, 8 OPs and one soil sterilant were found in the dry air samples. The statistical data for those chemicals found is shown in Table 2: Dry air concentration statistics for the Agassiz site and in Table 3: Dry air concentration statistics for the Abbotsford site.

1. Agassiz

The samples at Agassiz showed concentration peaks (Figure 2: Dry air concentrations at Agassiz) from June through September, with the exception of an unusually high 2,4-D peak in February, which may have been due to local usage at or near the site. Captan appears to be the most widely used OC followed by dieldrin and hexachlorobenzene.

The predominant chemicals are 2,4-D, atrazine, dichlorvos, captan, dieldrin endosulfan, 2,4,5-TP and hexachlorobenzene at the Agassiz site.

Hexachlorohexane (HCH) or hexachlorobenzene (HCB), are two interchangeable terms used to describe a mixture of nine stereo-isomers of 1,2,3,4,5,6-hexachlorocyclohexane, is one of the most common organochlorine pesticides found in the environment (WHO, 1991). HCH formulations include pure Lindane (γ-HCH) and technical HCH, containing 55-80% α-, 5-14% γ-, 2-16% δ- and 3-5% ε-HCH). HCB is a fungicide and a known impurity in several pesticide formulations. It is a banned substance in many countries. The International Agency for Research on Cancer (IARC) has classified HCB as a possible human carcinogen (Group 2B). Lindane, or γ-hexachlorocyclohexane, is ubiquitous and has been found in the Arctic. It is toxic to fish and aquatic organisms and also has a high chronic toxicity to mammals. IARC has classified γ-HCH as a possible human carcinogen (Group 2B) and is listed in the Canadian Environmental Protection Act, Part II (Toxic Substances Requiring Export Notification) (CEPA, 1992).

Hexachlorobenzene (HCB) and lindane were measurable (April through October) during the year long sampling program with a summer-time maximum at 1.96 ng/m^3 (average 0.47 ng/m^3) and 0.49 ng/m^3 (average 0.34 ng/m^3) for lindane. In a similar sampling program at Villeroy, Quebec (Poissant and Koprivnjak, 1996) reported ambient average concentrations of 0.032 ng/m^3 for α-HCH and 0.038 ng/m^3 for γ-HCH, which were a factor lower in concentration than those in the

Fraser Valley. Because γ-HCH is the common form used in North America, and breakdown products include the α-HCH form, then it appears that the HCH measured is from an aged air mass transported from elsewhere.

The herbicides 2,4-D, dicamba and Silvex were infrequently present and may indicate localized usage. Organo-phosphate pesticides parathion-methyl and dichlorvos were present in the winter through early summer periods. Diazinon, fonofos and malathion were present in the summer months. The soil sterilant atrazine was only present in summer months.

Dry deposition at Agassiz was calculated using an average deposition velocity of 0.1 cm/sec, for fine airborne particles (<0.1 μm diameter) (Slinn & Slinn, 1980). Deposition rates are shown in Table 4 and Figure 8: Dry Deposition at Agassiz. The deposition rates vary between the detection limit and 1.4 $\mu g/m^2$/day. The highest values are for 2,4-D, atrazine, dichlorvos and captan. There does appear to be a summer peak in deposition for most chemicals, except for dichlorvos and 2,4-D.

2. Abbotsford

The highest ambient concentrations measured at the Abbotsford site were diazinon, malathion, mevinphos, dichlorvos, captan, dinoseb, 2,4-D and endosulfan, respectively.

The Abbotsford site showed a concentration pattern (Figure 3: Dry air concentrations at Abbotsford) similar to that for Agassiz, for presence of chemicals with the exception of the 2,4-D peak in February. Total chemical concentrations peaked in the June-July period, with their presence diminishing greatly by September.

For the OC family of chemicals, captan and endosulfan I were the most common, and measured only in the summer months. For herbicides, dinoseb, 2,4-D and Silvex were the only chemicals measured in dry air, with 2,4-D in the winter months and Silvex and dinoseb in the summer (April through August) periods. OPs were present in the spring and summer months with diazinon and malathion as the most measured chemicals. Atrazine, a soil sterilant, was detected once in July.

Dry depositions were calculated with the average deposition velocity and are shown in Table 5: Annual Dry Deposition at Abbotsford and Figure 9: Dry Deposition at Abbotsford. Deposition rates vary from the detection limit to 3.5 $\mu g/m^2$/day with the maximum value for diazinon. Most deposition values were about 0.5 $\mu g/m^2$/day. Again, a summer maximum was observed.

D. Precipitation

Rainfall concentrations at Agassiz are shown in Appendix 3. Data for the Abbotsford site are shown in Appendix 4. The Agassiz site had only seven measurable chemicals. The decrease in the number of compounds measured was a function of the solubility of the compound in water (see Table 1). The Abbotsford site had a similarly reduced number of measurable compounds, only six chemicals.

1. Agassiz

These chemicals appear to be present mostly in the late winter, spring and early summer months. The highest Agassiz rainfall concentrations were for captan, dichlorvos, 2,4-D, diazinon and malathion, in descending concentrations. There was no apparent repeating pattern. Captan appeared mainly in the summer (possibly from potato crop treatment) and the other chemicals had winter/ spring peaks (Figure 4: Concentrations in Rain at Agassiz).

Wet deposition was a function of rainfall amounts and had peak values for captan, dichlorvos, 2,4-D, diazinon and dieldrin. Dichlorvos appeared throughout the year with a peak in the summer. Smaller rainfall events in the summer periods had significant concentrations in the smaller rainfall

volumes (Figure 5: Rainfall Deposition at Agassiz) compared to heavier rainfall periods in the fall and winter.

2. Abbotsford

The Abbotsford site had high concentrations of captan and 2,4-D in rain water. Captan was as high as 6.2 µg/l in one rainfall sample taken in May (Figure 6: Concentrations in Rain at Abbotsford). High concentrations near 1.2 µg/l occurred through the summer period, likely indicating nearby usage. High concentrations were also associated with low rainfall events. The 2,4-D was only observed once in February near the start of the sampling program and may have been due to weed control at the sampling site.

Deposition values were influenced by rainfall amounts. 2,4-D had the maximum deposition value at about 7 µg/m^2/day in February. Captan had the second highest value at about 5.2 µg/m^2/day in August (Figure 7: Rainfall Deposition at Abbotsford).

IX. Summary Discussion

The United Nations Environmental Program (UNEP) Governing Council initiated an investigation into twelve specific persistent organic pollutants (POPs) in 1995. The twelve chemicals of concern included: DDT, aldrin, dieldrin, endrin, chlordane, heptachlor, hexachlorobenzene, mirex, toxaphene, polychlorinated biphenyls and dioxins and furans. Several of these compounds (aldrin, dieldrin, chlordane, heptachlor, hexachlorobenzene) were found in this sampling program.

A. Climate

Climate conditions at the two sites during the sampling period were somewhat different than the historical average. Mean temperatures were near average (30 year period 1961 - 1990) at both sites. However, one event in February 1996 occurred when temperatures reached 17.5°C. In May, September, November and December cooler temperatures than normal were recorded. The highest increased difference occurred in July when average temperatures were nearly two degrees warmer than normal and daily temperatures exceeded 30°C for a record six consecutive days (at Abbotsford).

During the sampling period the average total precipitation was much higher than normal (+9.1% at Agassiz and +19.0% at Abbotsford). However, this was the average of a mixture of monthly data that were below normal (February, March, June, July, August 1996 and February 1997) and also much higher than normal (April, May, September through January 1997). The cool November and December temperatures combined with increased precipitation produced record snowfalls at the eastern end of the LFV. Agassiz had a record one-day 48 cm snowfall on November 16. Abbotsford received 77.8 cm of snow in December, compared to an average of 23.9 cm. The period October 1996 to February 1997 were the wettest five months on record, even though February was drier than normal. In general, wetter than average climate conditions existed that could have influenced wet deposition.

This observed increase in rainfall would also tend to dilute any chemical concentrations (Capel, 1991) that were widespread (from transport); Capel reported that herbicide concentrations are higher during small rainfall events (≤ 20 mm).

B. Chemicals

Total deposition is the sum of both the wet and dry deposition parts. This sampling program operated on the basis of week-long sample periods. During that week it was often possible to have periods of wet and dry deposition. At Agassiz, malathion, dichlorvos, diazinon, dieldrin and captan were found in both fractions. There was no observable wet to dry relationship, but on average about 85% was in the dry form. At Abbotsford, malathion, dichlorvos, diazinon, 2,4-D,

cis-chlordane and captan were found in both fractions. Again, the wet to dry relationship was similar to Agassiz, except for captan which was present mostly in the rain.

Several of these chemicals are known or suspected carcinogens or cholinesterase inhibitors. Their presence in the atmosphere, even in small quantities may be cause for concern. None of the concentrations measured were over the maximum acceptable limits, threshold limit or permitted exposure levels (MAK/ TLV/ PEL) in the literature (Table 1).

Relatively little is known on a regional or temporal scale about the occurrence and deposition patterns for these agricultural chemicals, or how these deposition amounts relate to amounts applied directly to crop land or how much is in stream runoff. The data from these two sites indicates that there are agricultural chemicals in the air and rain. Two sites only provide a small picture of the impact on the Fraser Valley area.

Aldrin, chlordane, dieldrin, fonofos and 2,4,5-TP have been discontinued in the U.S. and aldrin, dieldrin and chlordane(1985) have been discontinued in Canada, and 2,4,5-TP has never been registered in Canada; however they exist in the atmosphere and other media, such as fish; concentrations of aldrin, chlordane dieldrin, and other OCs have been measured in Peamouth chub at nearby locations in the Fraser River (Raymond, 1997). These chemicals be in illegal usage locally or may be transported by winds from remote sources.

Atrazine is used as a herbicide in corn growing areas. Atrazine was measured at both sites in the summer time, but only once at Abbotsford, and never in the rainfall. Dry, or total, deposition at Agassiz was 3.35 $\mu g/m^2$/year for atrazine. A study in the mid-western and northeastern United States (Goolsby, 1997) reported that the concentration of atrazine in rainfall was 0.2-0.4 µg/l, and had deposition rates at 240 $\mu g/m^2$/year in mid-west to 10 $\mu g/m^2$/year in the east. It was also noted by Goolsby that atrazine deposition to Great Lakes was 12-63 $\mu g/m^2$/year. The persistence of atrazine in the atmosphere has been attributed to its long half-life in soil (~15 days) and the consequentially longer period that it has to volatilize to the atmosphere, contributing to lower concentrations, but over a longer period of time. Deposition rates at Agassiz are well below those to the mid-west corn belt and that to the Great Lakes area. Most herbicides are relatively soluble in water and more than two dozen agricultural pesticides have been measured in precipitation and fog in the United States (Glotfelty *et al.*, 1987, Richards *et al.* 1987, Capel, 1991, Nations *et al.*, 1992, Majewski *et al.*, 1995) Canada (Waite *et al.*, 1995) and Europe (Buser, 1990, Trevisan *et al.*, 1993). A recent U.S. Geological survey report (Goodbred, 1997) states that water-soluble pesticides such as atrazine have possible endocrine disrupter affects in fish - a surprising result as these pesticides do not bio-accumulate in fish, as organochlorine compounds do.

Chlordane in dry air was mainly observed at the Agassiz site with very little measured at the Abbotsford site. Concentrations ranged from about 0.08-0.50 ng/m^3 at Agassiz for cis-chlordane and about 0.08-0.72 ng/m^3 trans-chlordane. This would tend to indicate local usage of the chemical in the Agassiz area for broad-spectrum insecticide control. Usage (except for termite control) was supposed to have been discontinued in Canada in 1990 and all supplies disposed of by 1995. Chlordane in soil has a half-life of about 3.3 years, and previous usage in the Agassiz area combined with hotter summer temperatures may result in re-volatilization into the local atmosphere. Chlordane is a controlled substance listed in Part II of CEPA ("List of Prohibited Substances Requiring Export Notification from Canada"). Chlordane is considered to be a chemical subject to long range transport, and has been measured in the Great Lakes area at 0.67-76. pg/m^3 cis-chlordane and MDC-75 pg/m^3 trans-chlordane - about two orders of magnitude lower than that observed in LFV (Hoff *et al.*, 1992). A useful transport diagnostic tool is the ratio of the chlordane cis- and trans-isomers (TC/CC=1.26) found in technical grade chlordane. The vapour pressure of the trans-isomer is greater than that for the cis-isomer and this would allow greater mobility of the trans form. Increased summer-time temperatures would increase the atmospheric concentration of the trans-isomer. This technique was used by Hoff *et al.* and showed a winter-time equivalence to this ratio; elsewhere, the ratio was less (near 1:1) than that

for the technical chlordane. In the LFV the reverse picture was observed with summer-time ratios near 1.26 and winter-time ratios near unity. The reason for this difference is not immediately obvious.

Dieldrin was measured in dry air at Agassiz (0.1-2.66 ng/m^3) and Abbotsford (0.05-0.07 ng/m^3) even though pesticide registration in Canada was discontinued in 1990. Re-volatilization or long range transport of chemicals is a likely source. Measurements in the Lake Erie area (Eisenreich *et al.*, 1981, Bidelman, 1988) report lower values (0.01 ng/m^3). In rainfall, dieldrin values were 53 ng/l at Agassiz and 42 ng/l at Abbotsford, compared to 1.5 ng/l at Lake Erie (Eisenreich *et al.*, 1981; Murphy, 1984; Strachan, 1985; Strachan and Eisenreich, 1985). Measurements in southern Ontario, Canada (Hoff *et al.*, 1992) reported maximum concentrations of approximately 0.2 ng/m^3; a value in the lower range of measurements in the LFV.

Endosulfan is a widely used miticide and insecticide. The technical grade is composed of 2 isomers (α-endosulfan and β-endosulfan). It is acutely toxic to freshwater fish and invertebrates. The α-endosulfan is the most common form (Agassiz) and occurred from April through November while the β-form was only measured in the warmer months of June through October; concentration patterns of the α and β forms were consistent between sites implying transport from remote sources. Dry air concentrations of endosulfan I at 0.06-2.63 ng/m^3 and 0.05-2.31 ng/m^3 were measured at Agassiz and Abbotsford. Dry air concentrations of endosulfan II at 0.07-0.55 ng/m^3 and 0.04-0.65 ng/m^3 were measured at Agassiz and Abbotsford. Total endosulfan values of almost 4.0 ng/m^3 were reported by Hoff *et al.* for measurements of dry air in southern Ontario (comparable to totals of 3.0 and 3.2 ng/m^3 at the Abbotsford and Agassiz sites (respectively). In a 1975-1976 Canadian study (Brooksbank, 1983) α-endosulfan and β-endosulfan were reported in rainfall samples at 1-30 ng/L and 1-30 ng/L with the highest values measured in the Vancouver area. However, in this sampling program endosulfan was not detected in rainfall samples.

The chlorinated cyclic compounds hexachlorobenzene compounds (C_6Cl_6 or HCB) and hexachlorocyclohexanes ($C_6H_6Cl_6$ or HCH) were both measured in this sampling program.

Hexachlorobenzene was commonly used as a seed dressing to prevent fungal diseases until 1972 when it was discontinued. HCB is widely distributed throughout Canada because it is mobile and resistant to degradation. HCB has a high chronic toxicity and is a known animal carcinogen (IARC). HCB has been declared “toxic” under CEPA controls. In measurements at Abbotsford and Agassiz, dry air data HCB (hexachlorobenzene) measurements averaged 0.190 ng/m^3 (range 0.058-1.024 ng/m^3) and 0.474 ng/m^3 (range 0.068-1.959 ng/m^3), respectively. Surveys in the Arctic (UNEC LRTAP, 1994) have reported levels averaging 0.15 ng/m^3. Hoff *et al* report values ranging from 0.4-640 pg/m^3 in southern Ontario, which is similar to values in the LFV. HCB was measured at the LFV sites during all times of the year in similar concentration patterns and levels; this supports the observation that it is ubiquitous throughout the world. Current atmospheric sources are as a contaminant from other pesticides, or as a long range transported chemical.

Hexachlorocyclohexane (HCH, BHC or benzene hexachloride) exists in the α, β, γ and δ isomer forms for the technical product. γ-HCH is commonly referred to as lindane. BHC, like HCB, is also a commonly used seed dressing chemical in Canada. It has a high vapour pressure and volatilizes readily, and is ubiquitous. Lindane has an estimated atmospheric lifetime of about 17 days and can therefore be transported great distances before it is removed from the air. Lindane has a high acute toxicity for fish and a relatively high chronic toxicity for mammals. The α-, β- and δ-BHC isomers were not found in this sampling program. Only the γ-BHC form (lindane) was measured in dry air in this study at: Abbotsford, where measurements averaged 0.213 ng/m^3 γ-BHC (range 0.154-0.346 ng/m^3); and Agassiz where measurements averaged 0.338 ng/m^3 γ-BHC (range 0.154-0.490 ng/m^3). Measurements in southern Ontario by Hoff *et al* were at 4-820 pg/m^3 γ-HCH, covering the range measured in this work. The measurements patterns were different at the two sites with episodes in spring, summer, fall and winter; this may indicate local sources of

lindane. Because lindane is soluble in water or rain (7 mg/l) and deposition to the land and water is likely in the LFV, it's high toxicity to fish is a potential problem for areas like the Fraser Valley where fisheries are present. The technical grade is 5-80% α and 8-15% γ (Metcalf, 1955). A ratio of the α/γ forms for the technical grade HCH should be about 3.6-10. The γ form is the active ingredient and is the most depleted with time and aerial transport, as shown in the Arctic where the α/γ ratio is about 12 (Hargrave *et al.*, 1989). The ratio in the LFV samples is approximately 1.0 for most of the samples, which may indicate nearby usage or transport into the area of the γ form, and thus reducing the ratio.

α-BHC was only measured once in rainfall at the Agassiz site (0.038 μg/l) and there was no corresponding dry air sample for the same time period.

C. Sources

Possible sources of these agricultural chemicals are from local applications to farm land in the LFV. Another possibility is that long range transport occurred depositing these chemicals in the LFV area. It is difficult to match 7-day measurement events with typically 3-5 days synoptic events. However, if an assumption is made that a period with an extended dry period and a measurement event coincide, then it may be possible to use a back-trajectory program to evaluate possible sources. Environment Canada uses a trajectory program (TRAJPLOT) to project five day forecast and backcast trajectories. This was employed in a special event when a period of unusually warm air invaded the LFV in winter time (February 17, 1996) and there was a peak in 2,4-D at both sampling sites. 2,4-D is not commonly used during this period and therefore unusual. A back trajectory (Figure 10) shows a two level plot for 1000 millibars (mb) (ground level) and 850 mb (~1000 meters). The ground level plot appears to come from the direction of the Imperial Valley in southern California, which is where it would also be logical to expect a supply of warmer air. Agriculture Canada (Bowen, 1997) reports that it is common practice in California in February to treat seeds with 2,4-D before early planting. Although there is some room for discussion, the two events seem to indicate that long range transport of chemicals can occur.

X. Conclusions

Agricultural chemicals are present in the atmosphere of the lower Fraser Valley in both dry air and in rainfall. There is a summer-time increase in concentrations at both of the sampling sites, but there are some differences in the types and amounts of chemicals at each site. These chemicals may be in local use, or may have been transported there from other locations, possibly at great distances via a 'leap frog' evaporation and condensation effect. Twenty eight chemicals were found in the dry air and eight chemicals were found in the rainfall at one site. Some of these chemicals may be present in concentrations of concern to aquatic and insect life: seven are suspected carcinogens; two are known carcinogens; seven are known cholinesterase inhibitors.

These chemicals are also important because there is international concern (UNEP) about several of the agricultural chemicals found in this sampling program. Five (aldrin, dieldrin, chlordane, heptachlor, hexachlorobenzene) of the twelve chemicals of concern were measured in this sampling program.

Long range transport of pollutants to the LFV appears to be possible.

XI. Acknowledgments

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XII.

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XIII.

Tables

Table 1: Properties of Agricultural Chemicals.

Chemical	Ref.	Molecular Wt	Vapour Press(20C)	Melting Point	Solubility Water	LD50 oral male rat (mg/kg)	Carcinogen	Choline. Inhibitor	MAK /TLV /PEL (mg/m3)	Note
2,4,5-T	8999 TAA100	255.49		151.0	235 ppm	300	suspected	-	10/ 10/ 10	Poison, mutation data reported; EPA banned 1985
2,4-DB	2828 DGA000	249.09		117.0	46 ppm	700		-		mod tox; exp. teratogen.
2,4'-DDD	CDN000	320.04								chlodithane;ingestin systemic effects
2,4'-DDE	3424-82-6	318		88.0						
2,4'-DDT	BIO625	354.48								exp. teratogen
2,4-Dichlorophenoxy Acetic acid	2802 DAA800	221.04		138.0	890 ppm	375	**suspected**	-	10/ 10/ 10	poison; exp. teteragen
4,4'-DDD	BIM500	320.04					Known			poison, mutagen
4,4'-DDE	BIM750 72-55-9	318.02	6.50E-06	88.4	0.12 ppm	880	**suspected**			p,p'-DDE
4,4'-DDT	DAD200	354.48		108.5	0.1 ppm	87	Known		1/ 1/ 1	p,p'-DDT
Aldrin	219 AFK250	364.93	7.50E-05	104.0	0.1 ppm	39		-	0.25/ 0.25/ 0.25	exp. teratogen; Discontinued in USA
Atrazine	886 ARQ725	215.68		171.0	70 ppm	672		-	2/ 5/ 5	mod. toxic; exp. teratogen
Azinophos methyl	926 ASH500	317.34	2.20E-07	74.0	29 ppm	7		Known	0.2/ 0.2/ 0.2	poison; exp. teteragen
BHC, a-	BBQ000	290.82			0.1 ppm	177	**Known**	-	0.5/ --/ --	
BHC, b-	BBR000	290.82				6000		-	0.5/ --/ --	
BHC, d-	BFW500	290.82				1000		-		
BHC, g- (Lindane)	5379 BBQ500	290.85	9.40E-06	112	7.3 ppm	76	**Known**	-	0.5/ 0.5/ 0.5	teratogen, mutagen
Captan	1771 CBG000	300.57		178.0	5.1ppm	9000		-	--/ 5/ 5	
Carbophenothion	1827	342.85			Insol.	30		Known		

Chlordane (a), cis-	2079 CDR675	409.8	1.3 mPa @25C	106.0	0.1 ppm	500	**suspected**	-	0.5	EPA cancel use; toxic by ingestion
Chlordane, trans- (g)	CDR575	409.8		104.0	0.1 ppm				0.5	toxic by ingestion
Chlorpyrifos	2190 CMA100	350.57	0.0000187 (25)	41.0	0.4 ppm	82		-	--/ 0.2/ 0.2	poison; exp. teteragen
Dacthal	TBV250	331.96			0.5 ppm					
Diazinon	2978 DCM750	304.36	1.40E-04	dec 120	60 ppm	66		**Known**	1.0/ 0.1/ 0.1	poison, exp. teratogen
Dicamba	3026 MEL500	221.04	0.00375 (100)	114.0	vssol	1040		-		mod. toxic, some mutation data
Dichlorprop	3068 DGB000	235.05		117.0	350 ppm	800	suspected	-		poison; exp. teratogen pre+post emergence herbicide
Dichlorvos	3069 DGP900	220.98	1.20E-02		1g/100ml	25		**Known**	0.1/ 0.1/ 1.0	poison, exp. teratogen
Dicofol	3075 BIO750	370.47		77.0	1.0 ppm	575		-		Poison, some mutation data
Dieldrin	3093	380.93	3.10E-06	150.0	0.1 ppm	46		-	0.25/ 0.25/ 0.25	Discontinued in USA; exp teratogen
Dimethoate	3209 DSP400	229.28		52.0	39,800 ppm	60		**Known**		deadly human poison; systemic/ contact
Dinoseb	3282 BRE500	240.22		38.0	2,200 ppm	25		-		poison, mutagen data reported
Endosulfan I	3529 EAQ750	406.95	1.70E-07	106.0	0.32 ppm	43		-	--/ 0.1/ 0.1	a-endosulfan; poison; exp. teratogen
Endosulfan II		406.95		212.0	0.33 ppm					b-endosulfan
Endosulfan Sulfate		422.9		181.0						
Endrin	3533 EAT500	380.93	0.0000002 (25C)	dec 245		3		-	0.1/ 0.1/ 0.1	Discontinued in USA; poison; exp. teratogen
Endrin Aldehyde										
Fenitrothion	3922 DSQ000	277.25	6.00E-06		Insol.	250		Known		poison, mutation effects reported
Fensulfothion	3943 FAQ800	308.35				**2**			--/ 0.1/ 0.1	poison; nematocide on golf courses
Fenthion	3945 FAQ900	278.34	3.00E-05		4.2 ppm	180		Known	0.2/ 0.2/ 0.2	poison, mutation effects reported
Folpet	4142 TIT250	296.58		177.0		7540		-		
Fonofos	4147 FMU045	246.32			16.9 ppm	**3**		**Known**	--/ 0.1/ 0.1	poison

Heptachlor	4576 HAR000	373.35	0.0003 (25C)	95.0	ssol	40	**suspected**	-	0.5/ 0.5/ 0.5	Reg'n cancelled in USA; except termite control
Heptachlor Epoxide	EBW500	389.3				47	**suspected**			human mutat'n data reported
Hexachlorobenzene	4600 HCC500	284.8	1.09E-05	231.0	Insol.	10000	**suspected**	-	--/(0.025) proposed/ --	Poison
Malathion	5582 MAK700	330.36	0.00004 (30)		130 ppm	290		**Known**	15/ 10/ 5	poison, exp. teratogen
Methoxychlor	5913 MEI450	345.65		78.0	0.1 ppm	5000	suspected	-	?/15/10	
Mevinphos	6089 MQR750	224.16			600,000 ppm	**3**		**Known**	0.01/ 0.01/ 0.01	poison
Mirex	6126 MQW500	545.59		dec 485	Insol.	235	Known	-		poison; exp. teratogen fire retardant in plastics, etc
Nonachlor, cis-	39766-80-5	444.23				500				in tech. chlordane
Nonachlor, trans-		444.23								
Oxychlordane										
Parathion	6983 PAK000	291.27	3.78E-05		24 ppm	**2**		Known	0.1/ 0.1/ 0.1	Deadly poison; exp. teratogen
Parathion Methyl	MNH000	263.22		37.0	60. ppm	**6**			0.2/ 0.2/ 0.2	poison; exp. teratogen
Permethrin, c-	7132 AHJ750	391.29	<1.0E-6	35.0	<1ppm	410		-		Ambush
Permethrin, t-	7132 AHJ750	391.29	<1.0E-6	35.0	<1ppm	410		-		Ambush
Phosmet	7311 PHX250	317.32	0.001 (50)	71.9	20 ppm	92.5		-		human poison; exp. teratogen
Silvex (2,4,5-TP)	8483 TIX500	269.53		181.6	2.5 ppm	650	**suspected**	-		poison; exp. teratogen permit cancelled in USA
Simazine	8485 BJP000	201.67		226.0	6.2 ppm	971		-		mod. toxic; exp. teratogen
Terbufos	9088 BSO000	288.41			5 ppm	**1.6**		**Known**		deadly poison

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Table 2: Dry air concentration statistics for the Agassiz site

Agassiz Site	Concs (ng/m3)	Maximum	Minimum	Average
Organochlorine Pesticides	**Captan**	4.242	0.148	1.448
	cis-Chlordane (a)	0.492	0.063	0.226
	trans-Chlordane (g)	0.730	0.054	0.260
	Dacthal	0.848	0.136	0.363
	4,4'-DDE	0.139	0.139	0.139
	Dicofol	0.337	0.337	0.337
	Dieldrin	2.657	0.103	1.010
	Endosulfan I	2.629	0.061	0.708
	Endosulfan II	0.548	0.075	0.253
	Heptachlor	0.148	0.148	0.148
	Heptachlor Epoxide	0.662	0.080	0.288
	Hexachlorobenzene	1.959	0.068	0.474
	Lindane (g-BHC)	0.490	0.154	0.338
	cis-Nanochlor	0.184	0.184	0.184
	trans-Nanochlor	0.645	0.054	0.217
	Oxychlordane	0.763	0.123	0.278
Herbicides	**2,4-Dichlorophenoxy Acetic acid**	15.729	1.962	6.646
	Dicamba	1.708	1.708	1.708
	Silvex (2,4,5-TP)	2.182	1.947	2.065
	Chlorpyrifos	1.264	0.170	0.612
	Diazinon	1.186	0.136	0.484
	Dichlorvos	10.689	0.556	2.990
	Dimethoate	0.340	0.340	0.340
	Fonofos	2.643	0.170	0.957
	Malathion	3.398	0.305	1.963
	Parathion Methyl	0.158	0.156	0.157
	Turbufos	0.741	0.305	0.512
Sterilants	**Atrazine**	14.458	1.676	5.529

Table 3: Dry air concentration statistics for the Abbotsford site

Abbotsford Dry Air	Concentrations (ng/m3)	Maximum	Minimum	Average
Organochlorine Pesticides	**Aldrin**	0.246	0.246	0.246
	Captan	6.556	0.128	1.823
	cis-Chlordane (a)	0.253	0.123	0.188
	trans-Chlordane (g)	0.102	0.102	0.102
	Dacthal	1.024	0.202	0.478
	Dieldrin	0.072	0.049	0.062
	Endosulfan I	2.309	0.050	0.620
	Endosulfan II	0.652	0.035	0.184
	Heptachlor	1.024	1.024	1.024
	Heptachlor Epoxide	0.184	0.077	0.131
	Hexachlorobenzene	1.024	0.058	0.190
	Lindane (g-BHC)	0.346	0.154	0.213
	trans-Nanochlor	0.077	0.077	0.077
	Oxychlordane	0.430	0.111	0.244
Herbicides	**2,4-Dichlorophenoxy Acetic acid**	4.571	0.719	2.301
	Dinoseb	6.413	3.127	4.770
	Silvex (2,4,5-TP)	1.242	1.242	1.242
Organophosphate Pesticides	**Chlorpyrifos**	1.518	0.197	0.666
	Diazinon	42.688	0.072	4.664
	Dichlorvos	6.556	0.233	1.172
	Fonofos	0.128	0.128	0.128
	Malathion	11.385	0.196	3.688
	Mevinphos	8.654	2.458	5.556
	Parathion Methyl	0.607	0.229	0.418
	Terbufos	3.783	0.232	1.246
Sterilants	**Atrazine**	2.622	2.622	2.622

Table 4: Annual Dry Deposition at Agassiz

Yearly Dep'n ug/m2/yr	Agassiz 1996-1997
2.048	**Captan**
0.480	**cis-Chlordane (a)**
0.551	**trans-Chlordane (g)**
0.330	**Dacthal**
0.014	**4,4'-DDE**
0.034	**Dicofol**
3.471	**Dieldrin**
1.788	**Endosulfan I**
0.358	**Endosulfan II**
0.015	**Heptachlor**
0.611	**Heptachlor Epoxide**
1.818	**Hexachlorobenzene**
0.137	**Lindane (g-BHC)**
0.019	**cis-Nanochlor**
0.438	**trans-Nanochlor**
0.394	**Oxychlordane**
2.014	**2,4-Dichlorophenoxy Acetic acid**
0.173	**Dicamba**
0.417	**Silvex (2,4,5-TP)**
0.495	**Chlorpyrifos**
0.636	**Diazinon**
6.042	**Dichlorvos**
0.034	**Dimethoate**
0.580	**Fonofos**
1.388	**Malathion**
0.032	**Parathion Methyl**
0.259	**Turbufos**
3.352	**Atrazine**

Table 5: Annual Dry Deposition at Abbotsford

Yearly Dep'n ug/m2/yr	Abbotsford 1996-1997
0.023	**Aldrin**
3.597	**Captan**
0.035	**cis-Chlordane (a)**
0.010	**trans-Chlordane (g)**
0.135	**Dacthal**
0.017	**Dieldrin**
1.223	**Endosulfan I**
0.207	**Endosulfan II**
0.096	**Heptachlor**
0.025	**Heptachlor Epoxide**
0.517	**Hexachlorobenzene**
0.080	**Lindane (g-BHC)**
0.007	**trans-Nanochlor**
0.069	**Oxychlordane**
0.649	**2,4-Dichlorophenoxy Acetic acid**
0.896	**Dinoseb**
0.117	**Silvex (2,4,5-TP)**
0.376	**Chlorpyrifos**
10.957	**Diazinon**
3.194	**Dichlorvos**
0.012	**Fonofos**
2.079	**Malathion**
1.044	**Mevinphos**
0.079	**Parathion Methyl**
0.585	**Terbufos**
0.246	**Atrazine**

Table 6: Precipitation Data Summary and Regulations

Data Summary

	Rainfall					
	Abbotsford			Agassiz		
Concentrations (ug/L)	**Maximum**	**Minimum**	**Average**	**Maximum**	**Minimum**	**Average**
a-BHC	ND	ND	ND	0.038	0.038	0.038
Captan	6.254	0.006	0.830	0.114	0.032	0.062
Dieldrin	0.042	0.042	0.042	0.055	0.052	0.053
2,4-Dichlorophenoxy Acetic acid	5.283	1.029	3.156	0.878	0.878	0.878
Diazinon	0.189	0.014	0.066	0.076	0.008	0.042
Dichlorvos	0.107	0.020	0.049	0.089	0.002	0.032
Malathion	0.021	0.021	0.021	0.041	0.014	0.023

Regulations

	Drinking Water			Freshwater			Livestock
	U.S. EPA	**Other**	**Canada**	**Canada**	**U.S. EPA**	**Note**	**Canada**
Concentrations (ug/L)	ug/l	ug/l	ug/l	ug/l	ug/l		ug/l
a-BHC							
Captan	15				0.44	advisory	10
Dieldrin	0.000071	0.03 WHO		0.004			
2,4-Dichlorophenoxy Acetic acid			1000 MAK 100 Interim	4			100
Diazinon			14 MAK	0.1	0.08		14
Dichlorvos		0.002 Netherland					
Malathion	7	0.008 Australia	190	0.1	0.01		

XIV. Figures

Figure 1 Lower Fraser Valley sampling area

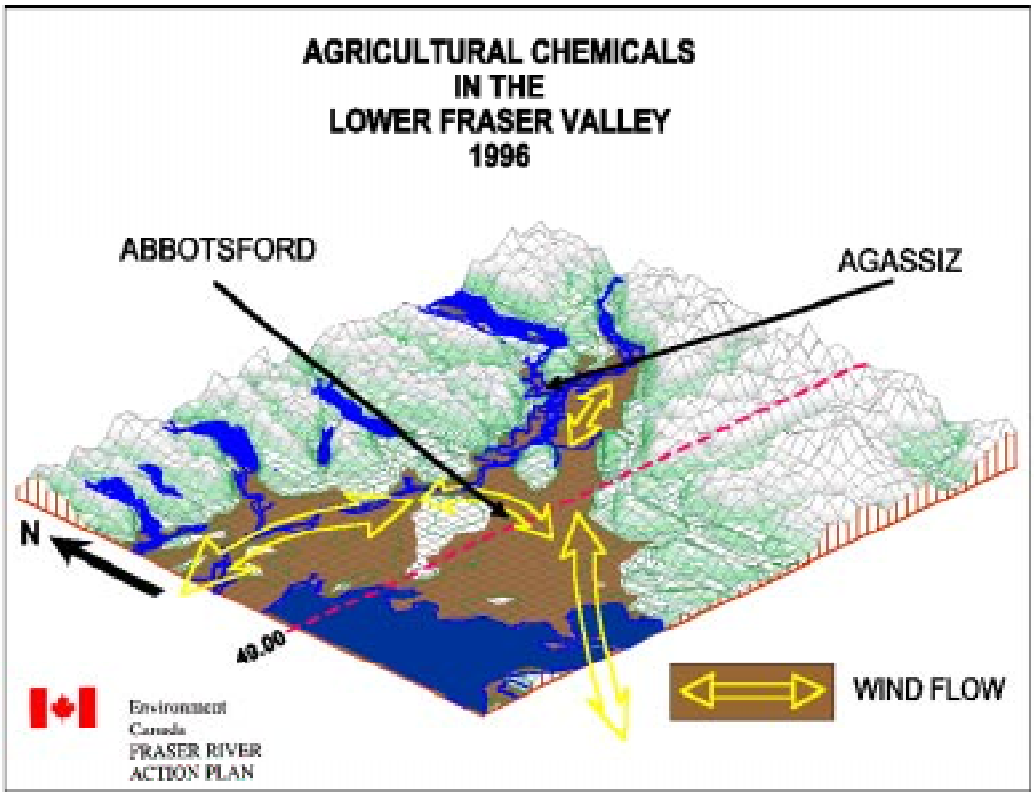


Figure 2: Dry air concentrations at Agassiz

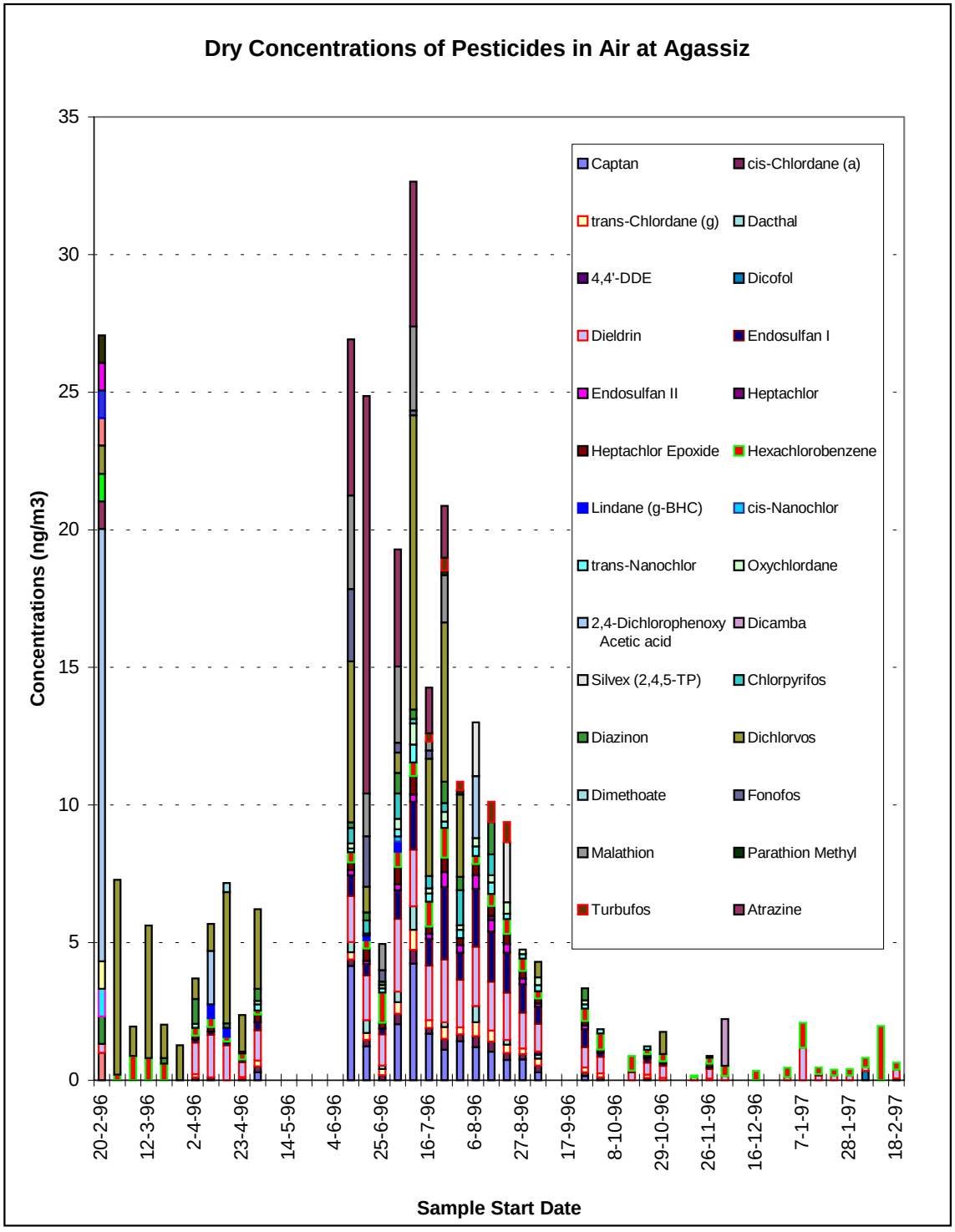


Figure 3: Dry air concentrations at Abbotsford

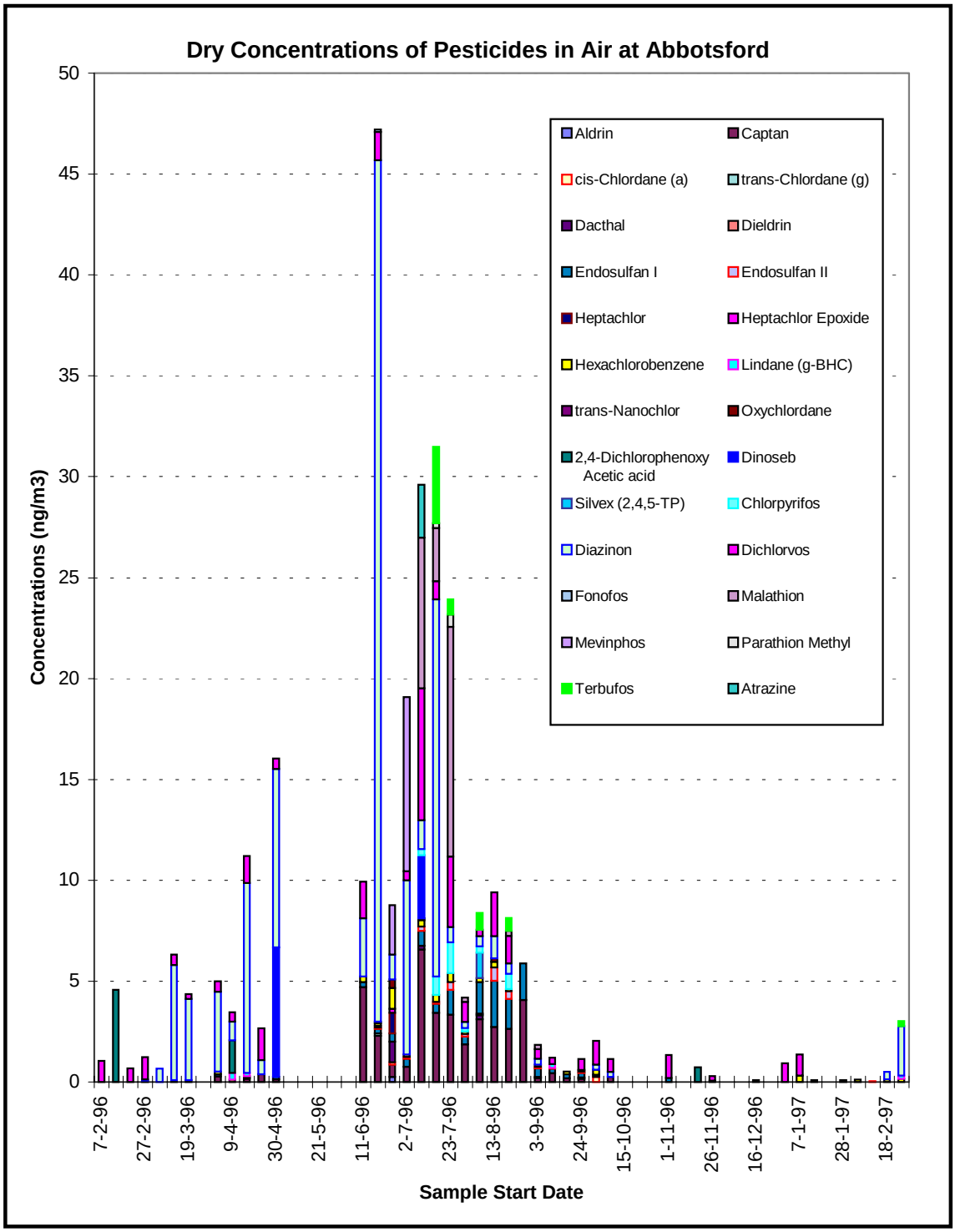


Figure 4: Concentrations in Rain at Agassiz

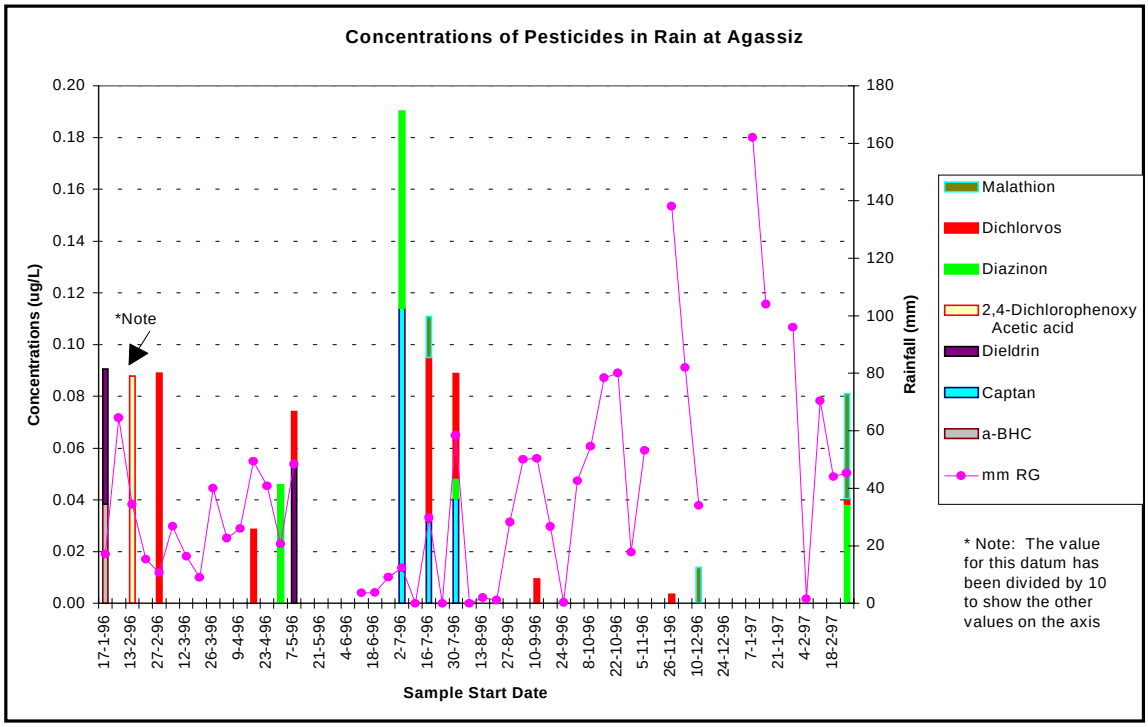


Figure 5: Rainfall Deposition at Agassiz

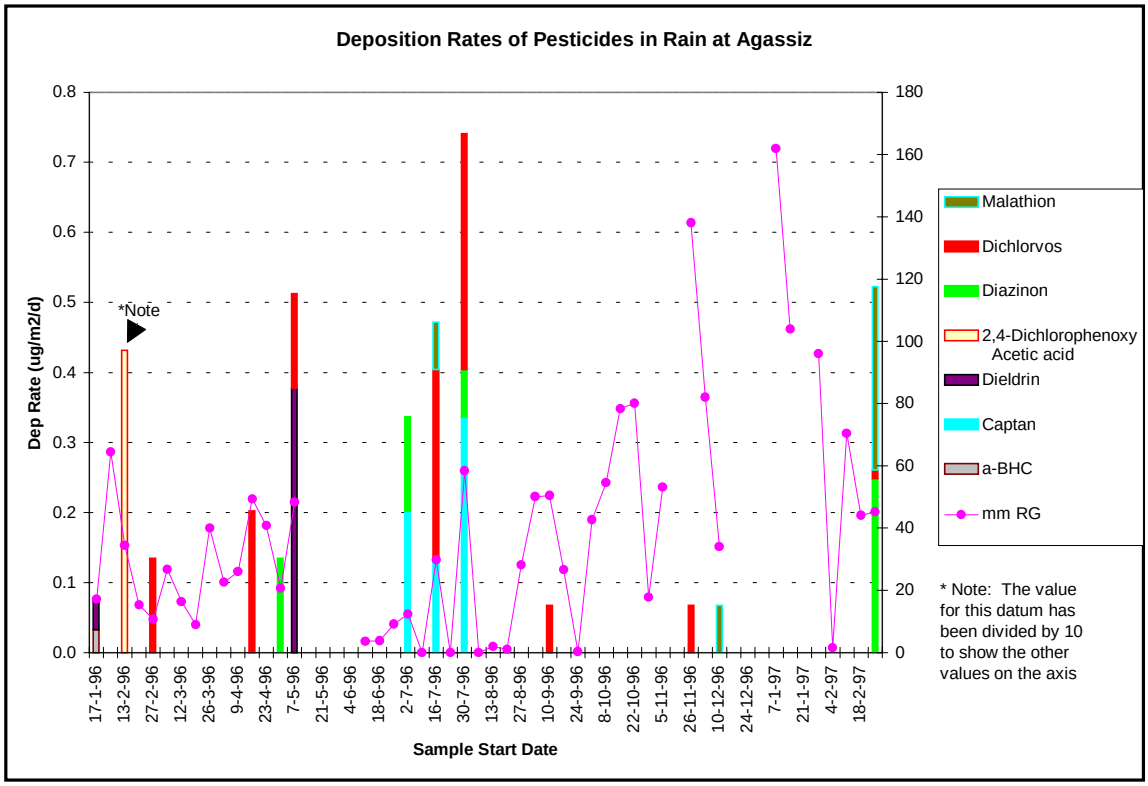


Figure 6: Concentrations in Rain at Abbotsford

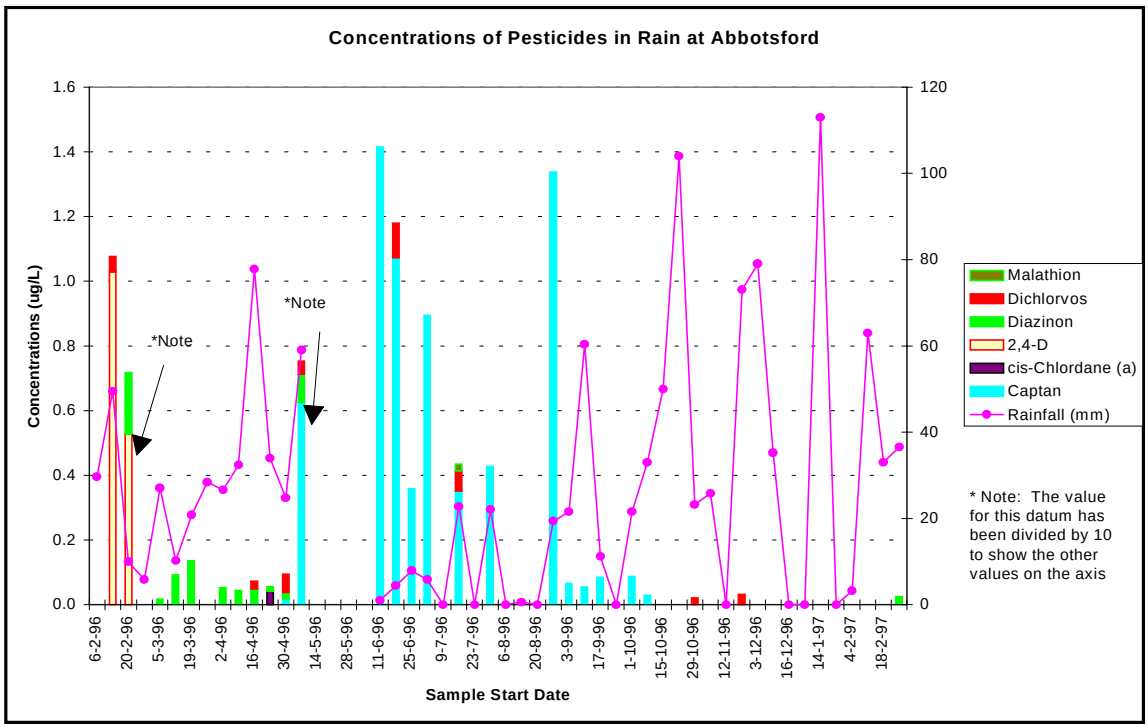


Figure 7: Rainfall Deposition at Abbotsford

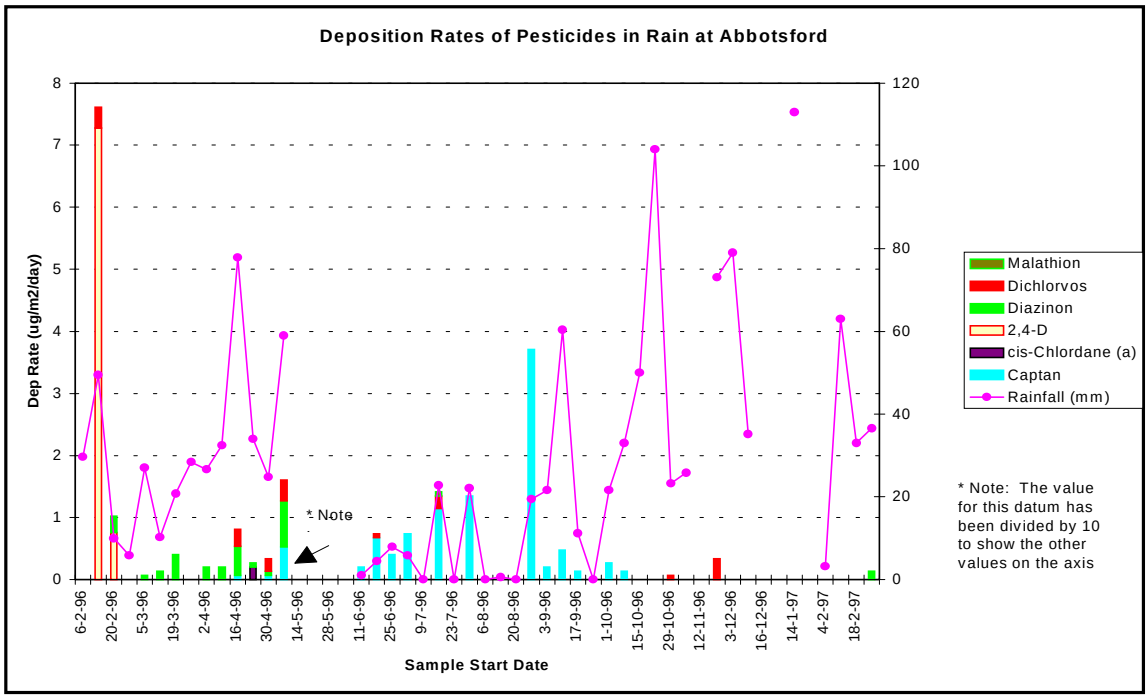


Figure 8: Dry Deposition at Agassiz

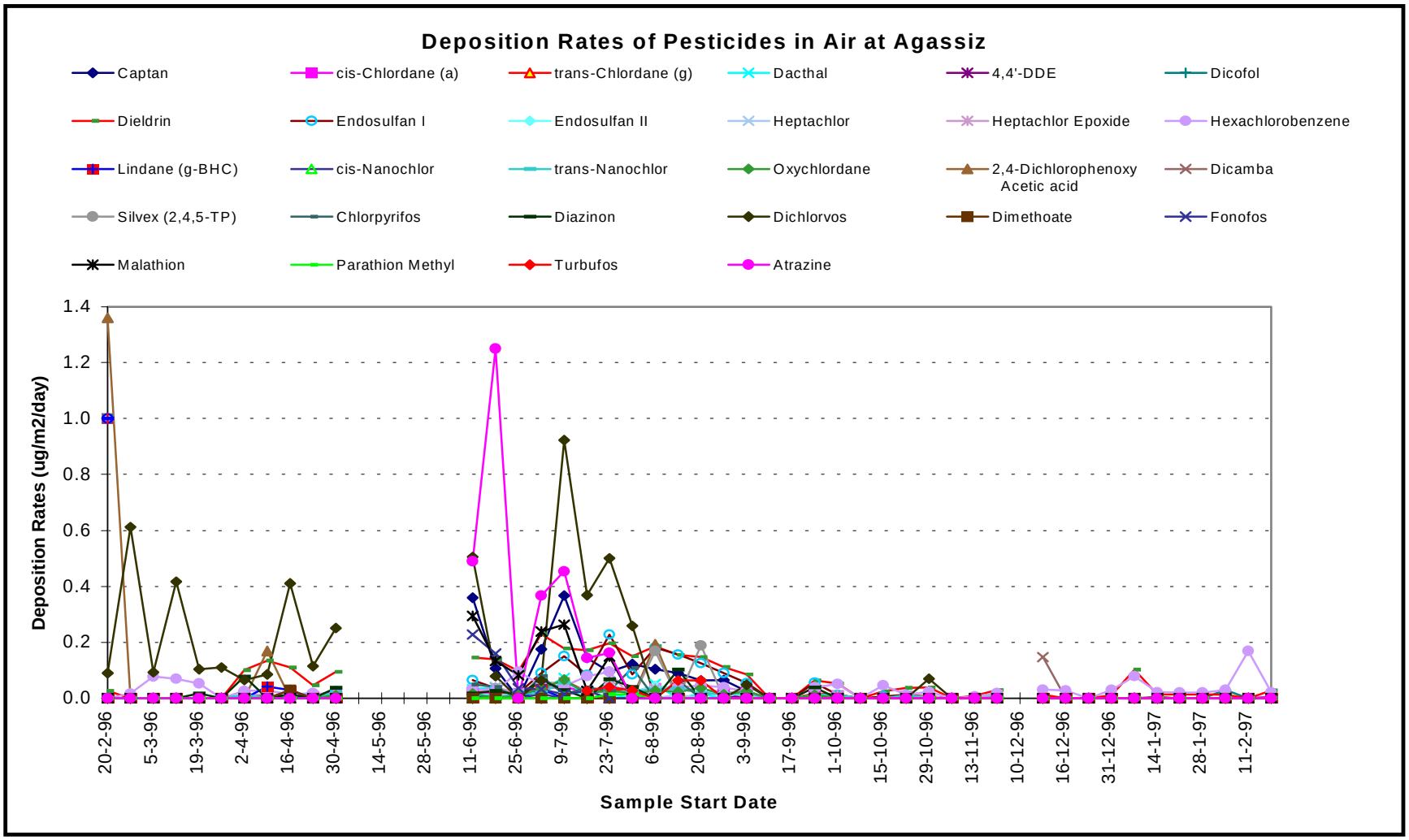


Figure 9: Dry Deposition at Abbotsford

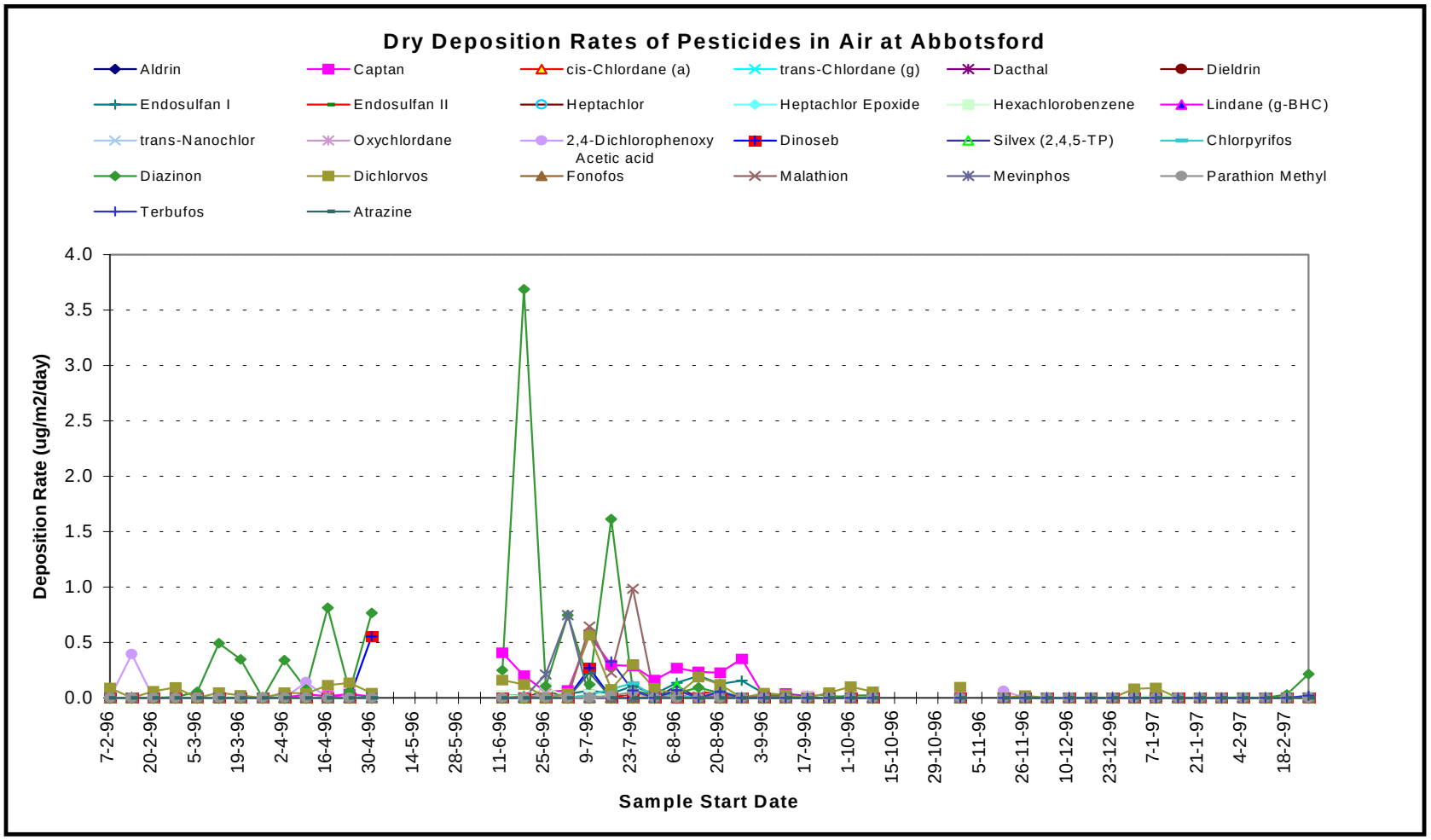
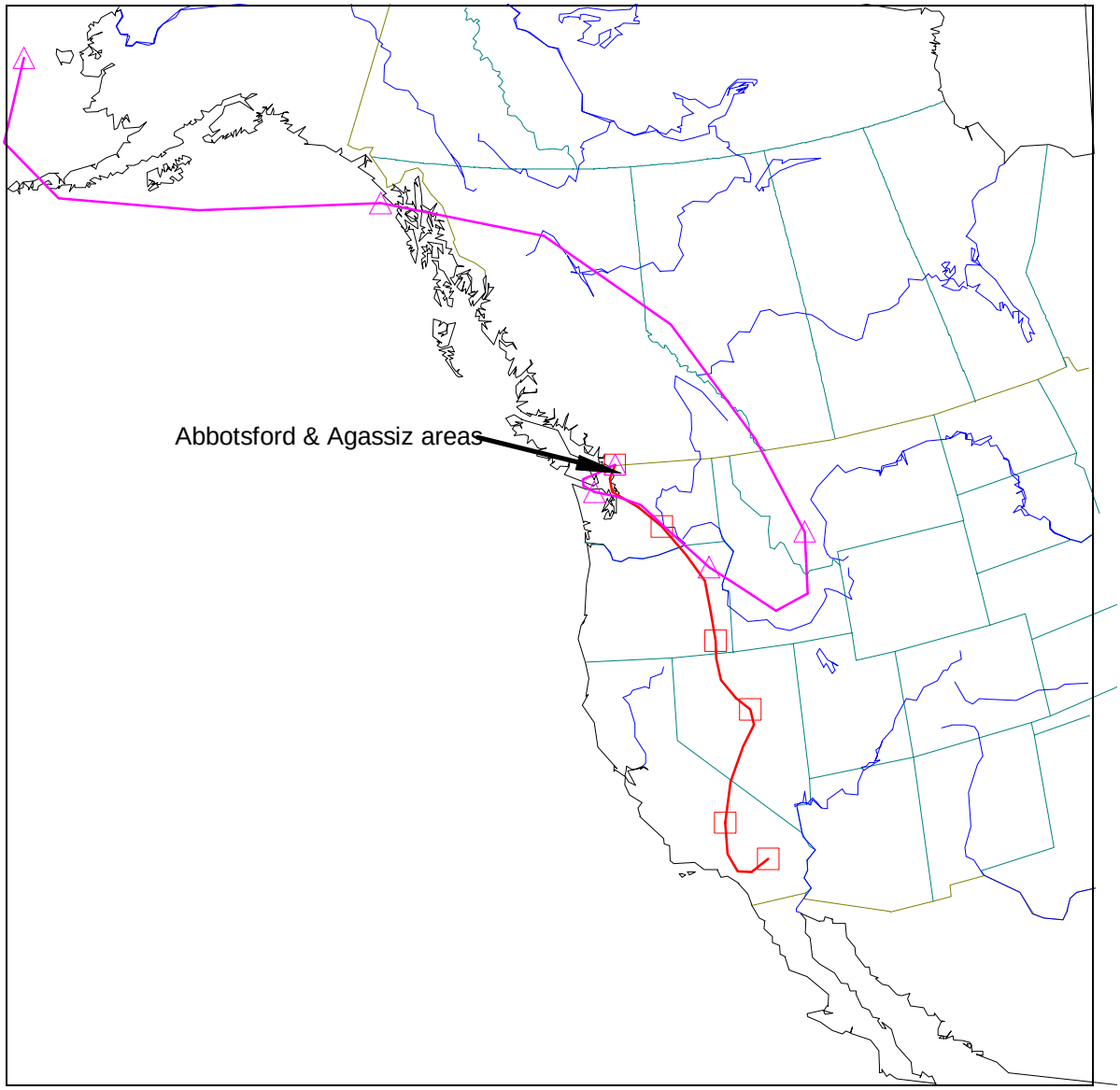


Figure 10: Back-trajectory plot at 1000 mb □, and 850 mb Δ



XV. Appendices

Appendix 1: Dry air data for Agassiz

Agassiz - Pesticides
HV PUF Data

	Head ID	EC008	EC005	EC009	EC008	EC006	EC005	EC008	EC007		EC008	EC007	EC005	
	Date on	20-2-96 9:45	27-2-96 9:15	5-3-96 9:30	12-3-96 9:30	19-3-96 9:07	26-3-96 9:00	3-4-96 14:05	9-4-96 9:00	16-4-96 9:05	23-4-96 8:55	30-4-96 8:12	7-5-96 8:25	14-5-96 8:38
	Date off	27-2-96 9:00	5-3-96 9:00	12-3-96 9:00	19-3-96 8:45	26-3-96 8:50	2-4-96 9:00	9-4-96 8:55	16-4-96 9:00	23-4-96 8:50	30-4-96 8:03	7-5-96 8:18	14-5-96 8:20	21-5-96 8:22
	Counter on	5639.39	5806.72	5974.43	6142.03	6309.24	6476.93	6645.06	6782.73	6950.69	7118.43	7286.57	7454.69	
	Counter off	5806.72	5974.43	6142.03	6309.24	6476.93	6645.06	6782.73	6950.69	7118.43	7286.57	7454.69	7622.36	
	Mag. Press. on	40	39	40	24	42	38	10	33	31	38	40	38	
	Mag. Press. off	38	34	37	22	41	na	33	34	20	43	38	na	
	Meter (m3) on	4103.37	4553.61	5009.12	5536.13	5769.12	6233.18	6456.32	7096.03	7679.17	8239.03	9088.13	9736.04	
	Meter (m3) off	4553.61	5009.12	5536.13	5769.12	6233.18	6456.32	7096.03	7679.17	8239.03	9088.13	9736.04	10188.02	
	Counter Diff'n	167.33	167.71	167.6	167.21	167.69	168.13	137.67	167.96	167.74	168.14	168.12	167.67	
	Meter diff sample (m3)	**450.24**	**455.51**	**527.01**	**232.99**	**464.06**	**223.14**	**639.71**	**583.14**	**559.86**	**849.1**	**647.91**	**451.98**	
	Comments						Pump dead Apr-02						Pump dead May-14	Splg stopped
	Avg P (mm HG)	**1009.8**	**1019.7**	**1020.4**	**1025.2**	**1020.9**	**1011.8**	**1020.0**	**1013.8**	**1013.1**	**1022.8**	**1021.5**	**1020.4**	**no sampling**
	Avg T (C)	**3.7**	**3.5**	**8.1**	**9.1**	**7.1**	**7.0**	**13.0**	**11.2**	**10.4**	**9.2**	**9.1**	**10.9**	
	Avg T (K)	276.8	276.6	281.2	282.2	280.2	280.1	286.1	284.3	283.5	282.3	282.2	284.0	
	Corrected Volume	483.2	494.0	562.6	249.0	497.4	237.1	670.9	611.7	588.6	905.0	689.9	477.7	
	File:	**F7847**	**F8028**	**F8220**	**F8459**	**F8656**	**F8847**	**F8988**	**F9223**	**F9434**	**F9583**	**F9784**	**G1029**	
	File Status:	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**n/a**
	Start:	20-2-96	27-2-96	5-3-96	12-3-96	19-3-96	26-3-96	2-4-96	9-4-96	16-4-96	23-4-96	30-4-96	7-5-96	14-5-96
	Stop:	27-2-96	5-3-96	12-3-96	19-3-96	26-3-96	2-4-96	9-4-96	16-4-96	23-4-96	30-4-96	7-5-96	14-5-96	21-5-96
	Note:	extr w H+ Acetone	extr w H+ Acetone	DCM extr'n		DCM extr'n	DCM extr'n	DCM extr'n	DCM extr'n	DCM extr'n	DCM extr'n	DCM extr'n	DCM extr'n	DCM extr'n
	Concs (ng/m3)	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PU**	**Agassiz HV/PU**	**Agassiz HV/PU**	**Agassiz HV/PUF**	**Agassiz HV/PU**	**Agassiz HV/PUF**	**Agassiz HV/PUF**

								F	F	F		F		
Organochlorine Pesticides	Captan	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.290		
	cis-Chlordane (a)	<DL	<DL	<DL	<DL	<DL	<DL	0.104	0.098	<DL	0.066	0.203		
	trans-Chlordane (g)	<DL	<DL	<DL	<DL	<DL	<DL	0.104	<DL	<DL	0.055	0.232		
	Dacthal	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL		
	4,4'-DDE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL		
	Dicofol	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL		
	Dieldrin	0.310	<DL	<DL	<DL	<DL	<DL	1.163	1.553	1.274	0.530	1.087		
	Endosulfan I	<DL	<DL	<DL	<DL	<DL	<DL	0.104	0.114	0.119	0.099	0.290		
	Endosulfan II	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL		
	Heptachlor	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL		
	Heptachlor Epoxide	<DL	<DL	<DL	<DL	<DL	<DL	0.134	0.163	<DL	<DL	0.290		
	Hexachlorobenzene	<DL	0.202	0.889	0.803	0.603	<DL	0.298	0.327	0.170	0.221	0.145		
	Lindane (g-BHC)	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.490	0.340	<DL	<DL		
	cis-Nanochlor	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL		
	trans-Nanochlor	<DL	<DL	<DL	<DL	<DL	<DL	0.149	<DL	<DL	0.066	0.217		
	Oxychlordane	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.130		
Herbicides	2,4-Dichlorophenoxy Acetic acid	15.729	<DL		<DL	<DL	<DL	<DL	1.962	<DL	<DL	<DL		
	Dicamba	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL		
	Silvex (2,4,5-TP)	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL		
	Chlorpyrifos	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL		
	Diazinon	<DL	<DL	<DL	<DL	0.201	<DL	0.894	<DL	0.170	<DL	0.435		
Organo-phosphate Pesticides	Dichlorvos	1.035	7.085	1.067	4.819	1.206	1.265	0.745	0.981	4.757	1.326	2.899		
	Dimethoate	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.340	<DL	<DL		
	Fonofos	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL		
	Malathion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL		
	Parathion Methyl	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL		
	Turbufos													
Sterilants	Atrazine	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL		

Agassiz - Pesticides
HV PUF Data

	Head ID				EC004	EC003	EC008	EC004	EC002	EC003	EC007	EC008	EC009	EC002
	Date on	21-5-96 8:51	28-5-96 9:04	4-6-96 9:17	11-6-96 8:20	18-6-96 8:05	25-6-96 8:10	2-7-96 8:17	9-7-96 8:25	16-7-96 8:13	23-7-96 9:00	31-7-96 11:15	6-8-96 8:45	13-8-96 11:50
	Date off	28-5-96 8:24	4-6-96 8:26	11-6-96 8:28	18-6-96 7:57	25-6-96 8:03	2-7-96 8:08	9-7-96 8:15	16-7-96 8:08	23-7-96 8:45	30-7-96 0:00	6-8-96 8:30	13-8-96 11:40	20-8-96 8:00
	Counter on				7622.36	7789.91	7957.88	8125.62	8296.60	8461.38	8629.90	8799.87	8941.12	9112.08
	Counter off				7789.91	7957.88	8125.62	8296.60	8461.38	8629.90	8799.87	8941.12	9112.08	9276.28

	Mag. Press. on				21	34	32	31	30	31	36	30	35	31
	Mag. Press. off				28	29	30	30	23	30	??	39	29	29
	Meter (m3) on				188.13	696.01	1324.04	2035.62	2563.11	3144.03	3777.03	4412.07	5023.17	5676.1
	Meter (m3) off				696.01	1324.04	2035.62	2563.11	3144.03	3777.03	4412.07	5023.17	5676.10	6394.13
	Counter Diff'n				167.55	167.97	167.74	170.98	164.78	168.52	169.97	141.25	170.96	170.96
	Meter diff sample (m3)				**507.88**	**628.03**	**711.58**	**527.49**	**580.92**	**633**	**635.04**	**611.1**	**652.93**	**652.93**
	Comments	Splg stopped	Splg stopped	Splg stopped			spraying done near our sampling equipment				pump found dead on arrival			
	Avg P (mm HG)	**no sampling**	**no sampling**	**no sampling**	**1020.5**	**1016.0**	**1017.3**	**1017.9**	**1017.1**	**1020.6**	**1015.9**	**1016.0**	**1018.9**	**1019.7**
	Avg T (C)				**14.7**	**15.6**	**17.3**	**18.3**	**21.8**	**16.4**	**23.9**	**15.4**	**20.0**	**17.2**
	Avg T (K)				287.8	288.7	290.4	291.4	294.9	289.5	297.0	288.5	293.1	290.3
	Corrected Volume				529.8	650.2	733.3	542.0	589.4	656.5	639.0	633.1	667.7	674.7
	File:				**G2166**	**G2414**	**G2617**	**G2850r**	**G3095**	**G3320**	**G3576**	**G3783**	**G4044**	**G4300**
	File Status:	**n/a**	**n/a**	**n/a**	**final**	**Final**	**Final**	**Final**	**Final**	**Final**	**Final**	**Final**	**Final**	**Final**
	Start:	21-5-96	28-5-96	4-6-96	11-6-96	18-6-96	25-6-96	2-7-96	9-7-96	16-7-96	23-7-96	30-7-96	6-8-96	13-8-96
	Stop:	28-5-96	4-6-96	11-6-96	18-6-96	25-6-96	2-7-96	9-7-96	16-7-96	23-7-96	30-7-96	6-8-96	13-8-96	20-8-96
	Note:	DCM extr'n	DCM extr'n	DCM extr'n										
	Concs (ng/m3)	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Aggassiz HV/PUF**	**Aggassiz HV/PUF**	**Aggassiz HV/PUF**	**Aggassiz HV/PUF**	**Aggassiz HV/PUF**	**Aggassiz HV/PUF**	**Aggassiz HV/PUF**	**Aggassiz HV/PUF**	**Aggassiz HV/PUF**	**Agassiz HV/PUF**
Organochlorine Pesticides	**Captan**				4.153	1.230	<DL	2.029	4.242	1.676	1.095	1.422	1.198	1.038
	cis-Chlordane (a)				0.227	0.231	0.191	0.387	0.492	0.228	0.407	0.237	0.404	0.371
	trans-Chlordane (g)				0.264	0.261	0.205	0.424	0.730	0.274	0.438	0.253	0.494	0.385
	Dacthal				0.378	0.461	0.136	0.369	0.848	<DL	0.156	<DL	0.599	<DL
	4,4'-DDE				<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Dicofol				<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Dieldrin				1.680	1.615	1.132	2.657	2.070	1.996	2.285	1.738	2.157	1.793
	Endosulfan I				0.755	0.415	0.205	1.033	1.731	0.960	2.629	0.979	2.097	1.808
	Endosulfan II				0.170	0.123	<DL	0.221	0.271	0.183	0.548	0.269	0.509	0.415
	Heptachlor				<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.148
	Heptachlor Epoxide				0.283	0.446	0.218	0.627	0.662	0.259	0.516	0.269	0.389	0.371
	Hexachlorobenzene				0.378	0.308	1.091	0.553	0.509	0.914	1.095	<DL	0.300	0.445
	Lindane (g-BHC)				<DL	0.154	<DL	0.369	<DL	<DL	<DL	<DL	<DL	<DL
	cis-Nanochlor				<DL	<DL	<DL	0.184	<DL	<DL	<DL	<DL	<DL	<DL

	trans-Nanochlor				0.132	0.092	0.150	0.258	0.645	0.289	0.235	0.300		0.344	0.415
	Oxychlordane				0.189	<DL	0.123	0.387	0.763	0.183	0.344	0.174		0.315	0.267
Herbicides	**2,4-Dichlorophenoxy Acetic acid**				<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL		2.246	<DL
	Dicamba				<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL		<DL
	Silvex (2,4,5-TP)				<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL		1.947	<DL
Organo-phosphate Pesticides	**Chlorpyrifos**				0.566	0.461	<DL	0.922	0.170	0.457	0.313	1.264	<DL		0.741
	Diazinon				0.189	0.308	0.136	0.738	0.339	<DL	0.782	0.474	<DL		1.186
	Dichlorvos				5.852	0.923	<DL	0.738	10.689	4.265	5.790	3.001	<DL		<DL
	Dimethoate				<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL		<DL
	Fonofos				2.643	1.846	0.409	0.369	0.170	0.305	<DL	<DL	<DL		<DL
	Malathion				3.398	1.538	0.955	2.767	3.054	0.305	1.721	<DL	<DL		<DL
	Parathion Methyl				<DL	<DL	<DL	<DL	<DL	<DL	0.156	0.158	<DL		<DL
	Turbufos									0.305	0.469	0.316	<DL		0.741
Sterilants	**Atrazine**				5.663	14.458	<DL	4.243	5.260	1.676	1.878	<DL	<DL		<DL

Agassiz - Pesticides
HV PUF Data

	Head ID	EC008		EC001	EC003		EC009	EC003	EC006						
	Date on	20-8-96 8:08	27-8-96 8:10	3-9-96 8:10	10-9-96 8:05	17-9-96 0:00	24-9-96 8:30	1-10-96 9:45	8-10-96 8:25	15-10-96 8:55	22-10-96 8:50	29-10-96 8:48	5-11-96 16:00	13-11-96 9:45
	Date off	27-8-96 8:05	3-9-96 8:10	10-9-96 8:00	17-9-96 8:00	24-9-96 0:00	1-10-96 9:40	8-10-96 8:15	15-10-96 8:43	22-10-96 8:40	29-10-96 8:43	5-11-96 8:48	12-11-96 1:10	25-11-96 9:12
	Counter on	9276.28	9444.1	9612.12	9779.92	9832.04	9832.04	9998.98	10165.49	10333.83	10499.92	10667.81	na	10836.35
	Counter off	9444.1	9612.12	9779.92	9832.04	9832.04	9998.98	10165.49	10333.83	10499.92	10667.81	10836.35	na	11123.8
	Mag. Press. on	32	33	36	37	0	38	34	37	40	39	45	na	41
	Mag. Press. off	29	32	35	na	0	30	31	35	33	40	na	na	39
	Meter (m3) on	6394.13	6931.11	7582.12	8271.03	8428	8428	9071.02	9721	490.02	1195.03	1822.13	na	2517.02
	Meter (m3) off	6931.11	7582.12	8271.03	8428	8428	9071.02	9721	10490.02	1195.03	1822.13	2517.02	na	3822.12
	Counter Diff'n	167.82	168.02	167.8	52.12	0	166.94	166.51	168.34	166.09	167.89	168.54	na	287.45
	Meter diff sample (m3)	**536.98**	**651.01**	**688.91**	**156.97**	0	**643.02**	**649.98**	**769.02**	**705.01**	**627.1**	**694.89**	na	**1305.1**
	Comments				Pump dead	Pump dead	New pump					Pump dead	Pump dead	2 wk spl
	Avg P (mm HG)	**1016.8**	**1016.9**	**1016.2**	**1009.8**	**1022.0**	**1020.1**	**1019.2**	**1014.8**	**1017.3**	**1016.9**	**1021.8**	**1020.7**	**1014.5**
	Avg T (C)	**19.0**	**17.4**	**13.3**	**15.5**	**11.6**	**13.2**	**13.1**	**12.6**	**6.3**	**7.7**	**7.0**	**9.3**	**-6.7**
	Avg T (K)	292.1	290.5	286.4	288.6	284.7	286.3	286.2	285.7	279.4	280.8	280.1	282.4	266.4
	Corrected Volume	549.9	670.4	719.1	161.6	0.0	674.0	680.9	803.6	755.1	668.1	745.7	na	1462.1
	File:	**G4510**	**G4679**	**G4924**			**G5586**	**G5863**	**G6072**	**G6330**	**G6541**	**G6765**	**G6980**	**G7367**
	File Status:	**Final**	**Final**	**final**			**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**
	Start:	20-8-96	27-8-96	3-9-96	10-9-96	17-9-96	24-9-96	1-10-96	8-10-96	15-10-96	22-10-96	29-10-96	5-11-96	13-11-96
	Stop:	27-8-96	3-9-96	10-9-96	17-9-96	24-9-96	1-10-96	8-10-96	15-10-96	22-10-96	29-10-96	5-11-96	12-11-96	26-11-96
	Note:													
	Concs (ng/m3)	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**			**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**
Organochlorine Pesticides	**Captan**	0.727	0.746	0.278	<DL	<DL	0.148	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	cis-Chlordane	0.255	0.209	0.250	<DL	<DL	0.134	0.103	<DL	<DL	0.090	<DL	<DL	<DL

	(a) trans-Chlordane (g)	0.309	0.194	0.250	<DL	<DL	0.193	0.147	<DL	<DL	0.105	0.080	<DL	<DL
	Dacthal	0.182	<DL	0.139	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	4,4'-DDE	<DL	<DL	0.139	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Dicofol	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Dieldrin	1.709	1.298	0.987	<DL	<DL	0.727	0.602	<DL	0.278	0.434	0.443	<DL	0.103
	Endosulfan I	1.455	1.044	0.626	<DL	<DL	0.653	0.147	<DL	0.079	0.150	0.080	<DL	<DL
	Endosulfan II	0.309	0.209	0.111	<DL	<DL	0.134	<DL	<DL	<DL	0.075	<DL	<DL	<DL
	Heptachlor	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Heptachlor Epoxide	0.364	0.269	0.181	<DL	<DL	0.163	0.117	<DL	<DL	0.105	0.080	<DL	<DL
	Hexachlorobenzene	0.546	0.448	0.278	<DL	<DL	0.445	0.587	<DL	0.530	0.150	0.268	<DL	0.068
	Lindane (g-BHC)	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	cis-Nanochlor	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	trans-Nanochlor	0.200	0.164	0.209	<DL	<DL	0.148	0.147	<DL	<DL	0.120	<DL	<DL	<DL
	Oxychlordane	0.418	0.164	0.292	<DL	<DL	0.148	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Herbicides	**2,4-Dichlorophenoxy Acetic acid**	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Dicamba	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Silvex (2,4,5-TP)	2.182	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Organo-phosphate Pesticides	**Chlorpyrifos**	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Diazinon	<DL	<DL	<DL	<DL	<DL	0.445	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Dichlorvos	<DL	<DL	0.556	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.805	<DL	<DL
	Dimethoate	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Fonofos	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Malathion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Parathion Methyl	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Turbufos	0.727	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Sterilants	**Atrazine**	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL

Agassiz - Pesticides
HV PUF Data

	Head ID		SD-008												
	Date on	25-11-96 9:12	3-12-96 9:40	10-12-96 9:15	16-12-96 9:20	23-12-96 12:30	31-12-96 12:30	7-1-97 11:35	14-1-97 11:15	21-1-97 11:15	28-1-97 11:15	4-2-97 11:25	11-2-97 12:25	18-2-97 11:10	25-2-97 11:00
	Date off	3-12-96 9:25	10-12-96 9:15	16-12-96 9:15	23-12-96 12:30	31-12-96 12:25	7-1-97 11:15	14-1-97 11:10	21-1-97 11:10	28-1-97 11:15	4-2-97 11:20	11-2-97 12:25	18-2-97 12:25	25-2-97 10:50	4-3-97 10:45
	Counter on	11123.8	11315.98	11483.57	11627.55	11798.15	11990.11	12156.90	12324.39	12492.32	12660.18	12828.28	12997.15	13163.57	13331.27
	Counter off	11315.98	11483.57	11627.55	11798.15	11990.11	12156.90	12324.39	12492.32	12660.18	12828.28	12997.15	13163.57	13331.27	13498.93
	Mag. Press. on	44	42	41	31	39	44	32	44	45	45	50	49	28	40
	Mag. Press. off	30	39	41	42	38	40	34	40	45	46	44	na	35	39
	Meter (m3) on	3822.12	4673.15	5437	6097	6650	7265	7810	8511	9263	64	841	1657	1752	2488
	Meter (m3) off	4673.15	5437	6097	6650	7265	7810	8511	9263	10064	841	1657	1752	2488	3239
	Counter Diff'n	192.18	167.59	143.98	170.6	191.96	166.79	167.49	167.93	167.86	168.1	168.87	166.42	167.7	167.66
	Meter diff sample (m3)	**851.03**	**763.85**	**660**	**553**	**615**	**545**	**701**	**752**	**801**	**777**	**816**	**95**	**736**	**751**
	Comments				New motor installed			New motor installed					Motor dead on arrival		
	Avg P (mm HG)	**1018.0**	**1004.8**		**1018.8**	**1011.0**	**1013.1**	**1023.6**	**1017.2**	**1016.3**	**1021.1**	**1025.5**	**1018.8**	**1027.7**	
	Avg T (C)	**3.2**	**2.3**		**-0.6**	**-8.2**	**2.6**	**2.8**	**3.3**	**-1.7**	**4.2**	**3.8**	**5.8**	**6.1**	
	Avg T (K)	276.3	275.4		272.5	264.9	275.7	275.9	276.4	271.4	277.3	276.9	278.9	279.2	
	Corrected Volume	922.4	819.8		608.2	690.5	589.1	765.1	814.1	882.4	841.7	889.0	102.1	797.0	
	File:	**G7556**	**G7786**		**G8168**	**G8237**	**G8330**	**G8497**	**G8666**	**G8836**	**G9020**	**G9181**	**G9377**	**G9595**	
	File Status:	**final**	**final**		**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**	
	Start:	26-11-96	3-12-96	10-12-96	16-12-96	23-12-96	31-12-96	7-1-97	14-1-97	21-1-97	28-1-97	4-2-97	11-2-97	18-2-97	25-2-97
	Stop:	3-12-96	10-12-96		23-12-96	30-12-96	7-1-97	14-1-97	21-1-97	28-1-97	4-2-97	11-2-97	18-2-97	25-2-97	
	Note:			Calc Agassiz									possible switch w Abbotsford		
	Concs (ng/m3)	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Agassiz HV/PUF**	**Field Spike Calc. Spl-blk**
Organochlorine Pesticides	**Captan**	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	cis-Chlordane	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.063	

	(a) trans-Chlordane (g)	0.054	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Dacthal	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	4,4'-DDE	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Dicofol	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.337	<DL	<DL	
	Dieldrin	0.347	0.146		<DL	<DL	0.119	1.176	0.160	0.159	0.166	0.135	<DL	0.326	
	Endosulfan I	0.065	<DL		<DL	<DL	<DL	<DL	0.061	<DL	<DL	<DL	<DL	<DL	
	Endosulfan II	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Heptachlor	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Heptachlor Epoxide	0.141	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Hexachlorobenzene	0.217	0.366		0.329	<DL	0.339	0.915	0.246	0.227	0.238	0.337	1.959	0.251	
	Lindane (g-BHC)	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	cis-Nanochlor	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	trans-Nanochlor	0.054	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Oxychlordane	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
Herbicides	**2,4-Dichlorophenoxy Acetic acid**	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Dicamba	<DL	1.708		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Silvex (2,4,5-TP)	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
Organo-phosphate Pesticides	**Chlorpyrifos**	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Diazinon	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Dichlorvos	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Dimethoate	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Fonofos	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Malathion	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Parathion Methyl	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Turbufos	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
Sterilants	**Atrazine**	<DL	<DL		<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	

Appendix 2: Dry air concentrations at Abbotsford

Abbotsford Pesticides **HV PUF Data**

	Head ID		EC003	EC009	EC002	EC003	EC009	EC002	EC003	EC009
	Date on	7-2-96 9:25	15-2-96 11:10	20-2-96 11:20	27-2-96 11:35	5-3-96 11:30	12-3-96 11:15	19-3-96 10:50	26-3-96 11:30	3-4-96 12:10
	Date off	15-2-96 11:00	20-2-96 11:10	27-2-96 11:20	5-3-96 11:15	12-3-96 10:55	19-3-96 10:35	26-3-96 11:25	2-4-96 12:00	9-4-96 10:37
	Counter on	645.85	761.38	881.4	1049.39	1217.02	1384.48	1551.8	1720.37	1887.74
	Counter off	761.38	881.4	1049.38	1217.02	1384.48	1551.8	1720.37	1887.71	2029.17
	Mag. Press. on	62	66	65	69	67	60	60	63	47
	Mag. Press. off	na	62	64	66	62	56	61	na	57
	Meter (m3) on	8615.91	9063.65	10104.5	11482.61	12756.14	13909.12	14970.73	16078.72	16462.85
	Meter (m3) off	9063.65	10104.5	11482.6	12756.14	13909.12	14970.73	16078.72	16462.62	17187.03
	Counter Diff'n	115.53	120.02	167.98	167.63	167.46	167.32	168.57	167.34	141.43
	Meter diff sample (m^3)	447.74	1040.85	1378.1	1273.53	1152.98	1061.61	1107.99	383.9	724.18
	Comments	Motor died							Motor died	
	Avg P (mm HG)	1017.3	1008.9	1008.8	1017.6	1016	1024.6	1020	1010.7	1019.2
	Avg T (C)	6.26	9.29	3.11	2.86	7.86	8.03	6.28	6.57	12.6
	Avg T (K)	279.36	282.39	276.21	275.96	280.96	281.13	279.38	279.67	285.7
	Corrected Volume (m3)	479.6	1093.9	1480.7	1381.5	1226.5	1138.2	1190.0	408.1	760.0
	File:	**F7434**	**F7643**	**F7847**	**F8028**	**F8220**	**F8459**	**F8656**	**F8847**	**F8988**
	File Status:	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**
	Start:	7-2-96	15-2-96	20-2-96	27-2-96	5-3-96	12-3-96	19-3-96	26-3-96	2-4-96
	Stop:	15-2-96	20-2-96	27-2-96	5-3-96	12-3-96	19-3-96	26-3-96	2-4-96	9-4-96
	Concentrations (ng/m3)	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**
Organochlorine Pesticides	**Aldrin**	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Captan	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.263
	cis-Chlordane (a)	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL

	trans-Chlordane (g)	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Dacthal	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Dieldrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Endosulfan I	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL		0.132
	Endosulfan II	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Heptachlor	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Heptachlor Epoxide	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Hexachlorobenzene	<DL	<DL	<DL	0.072	<DL	0.088	0.084	<DL		0.132
	Lindane (g-BHC)	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	trans-Nanochlor	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Oxychlordane	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
Herbicides	**2,4-Dichlorophenoxy Acetic acid**	<DL	4.571	<DL	<DL	missing	<DL	<DL	<DL	<DL	
	Dinoseb	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Silvex (2,4,5-TP)	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
Organophosphate Pesticides	**Chlorpyrifos**	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Diazinon	<DL	<DL	<DL	0.072	0.652	5.711	4.034	<DL		3.947
	Dichlorvos	1.042	<DL	0.675	1.086	<DL	0.527	0.252	<DL		0.526
	Fonofos	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Malathion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Mevinphos	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Parathion Methyl	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
	Terbufos										
Sterilants	**Atrazine**	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	

Abbotsford Pesticides **HV PUF Data**

	Head ID	EC001	EC005	EC008	EC001	EC005				
	Date on	9-4-96	16-4-96	23-4-96	30-4-96	7-5-96	14-5-96	21-5-96	28-5-96	4-6-96
		10:47	11:15	10:45	10:40	10:10	10:10	10:10	10:10	10:10
	Date off	16-4-96	23-4-96	30-4-96	7-5-96	14-5-96	21-5-96	28-5-96	4-6-96	11-6-96
		11:10	10:40	10:35	10:04	10:10	10:10	10:10	10:10	10:10
	Counter on	2029.17	2197.64	2365.06	2533.88	2701.25				
	Counter off	2197.64	2365.06	2533.88	2701.25	2868.65				
	Mag. Press. on	58	59	62	65	66				

	Mag. Press. off	53	59	61	65	na				
	Meter (m3) on	17187.03	18013.03	19156.12	20108.04	20840.33				
	Meter (m3) off	18013.03	19156.12	20108.04	20840.33	20869.61				
	Counter Diff'n	168.47	167.42	168.82	167.37	167.4				
	Meter diff sample (m^3)	826	1143.09	951.92	732.29	29.28				
	Comments					Motor died	Sampling stopped	Sampling stopped	Sampling stopped	Sampling stopped
	Avg P (mm HG)	1013.1	1012.4	1022	1020.8	1019.6	m	m	m	m
	Avg T (C)	10.75	9.88	9.16	8.96	10.65	m	m	m	m
	Avg T (K)	283.85	282.98	282.26	282.06	283.75	m	m	m	m
	Corrected Volume (m3)	867.3	1203.0	1013.9	779.6	31.0	m	m	m	m
	File:	**F9223**	**F9434**	**F9583**	**F9784**					
	File Status:	**final**	**final**	**final**	**final**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
	Start:	9-4-96	16-4-96	23-4-96	30-4-96	7-5-96	14-5-96	21-5-96	28-5-96	4-6-96
	Stop:	16-4-96	23-4-96	30-4-96	7-5-96	14-5-96	21-5-96	28-5-96	4-6-96	11-6-96
	Concentrations (ng/m3)	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**
Organochlorine Pesticides	**Aldrin**	<DL	<DL	<DL	<DL					
	Captan	<DL	0.166	0.395	0.128					
	cis-Chlordane (a)	<DL	<DL	<DL	<DL					
	trans-Chlordane (g)	<DL	<DL	<DL	<DL					
	Dacthal	<DL	<DL	<DL	<DL					
	Dieldrin	<DL	<DL	<DL	<DL					
	Endosulfan I	<DL	0.050	<DL	0.128					
	Endosulfan II	<DL	<DL	<DL	<DL					
	Heptachlor	<DL	<DL	<DL	<DL					
	Heptachlor Epoxide	<DL	<DL	<DL	<DL					
	Hexachlorobenzene	0.115	0.083	<DL	<DL					
	Lindane (g-BHC)	0.346	0.166	<DL	<DL					
	trans-Nanochlor	<DL	<DL	<DL	<DL					
	Oxychlordane	<DL	<DL	<DL	<DL					

Herbicides	**2,4-Dichlorophenoxy Acetic acid**	1.614	<DL	<DL	<DL					
	Dinoseb	<DL	<DL	<DL	6.413					
	Silvex (2,4,5-TP)	<DL	<DL	<DL	<DL					
Organophosphate Pesticides	**Chlorpyrifos**	<DL	<DL	<DL	<DL					
	Diazinon	0.922	9.393	0.690	8.850					
	Dichlorvos	0.461	1.330	1.578	0.513					
	Fonofos	<DL	<DL	<DL	<DL					
	Malathion	<DL	<DL	<DL	<DL					
	Mevinphos	<DL	<DL	<DL	<DL					
	Parathion Methyl	<DL	<DL	<DL	<DL					
	Terbufos									
Sterilants	**Atrazine**	<DL	<DL	<DL	<DL					

Abbotsford Pesticides **HV PUF Data**

	Head ID	EC006	EC005						EC002	EC008
	Date on	11-6-96 10:15	18-6-96 10:00	25-6-96 10:04	3-7-96 8:00	9-7-96 10:30	16-7-96 10:00	23-7-96 11:30	30-7-96 8:15	6-8-96 10:20
	Date off	18-6-96 9:55	25-6-96 9:53	2-7-96 8:00	9-7-96 10:25	16-7-96 9:55	23-7-96 11:12	30-7-96 8:00	6-8-96 10:20	13-8-96 8:00
	Counter on	3541.23	3708.07	3875.95	4064.02	4210.64	4377.90	4547.07	4672.35	4842.29
	Counter off	3708.07	3875.95	4043.22	4210.64	4377.90	4547.07	4672.35	4842.29	5007.84
	Mag. Press. on	52	62	58	81	71	55	56	60	60
	Mag. Press. off	58	58	na	70	66	53	57	56	58
	Meter (m3) on	20869.61	21598.94	22352.32	22824.84	23720.61	24693.41	25533.1	26185.33	27166.78
	Meter (m3) off	21598.94	22352.32	22824.83	23720.61	24693.41	25533.1	26185.33	27166.78	28111.34
	Counter Diff'n	166.84	167.88	167.27	146.62	167.26	169.17	125.28	169.94	165.55
	Meter diff sample (m^3)	729.33	753.38	472.51	895.77	972.8	839.69	652.23	981.45	944.56
	Comments	spraying along fence		sample pump was dead						
	Avg P (mm HG)	1019.9	1015.5	1017.2	1017.5	1016.7	1019.9	1015.7	1015.9	1018.3
	Avg T (C)	13.41	14.55	16.5	16.95	20.35	15.68	22.72	15.95	19.77

	Avg T (K)	286.51	287.65	289.6	290.05	293.45	288.78	295.82	289.05	292.87
	Corrected Volume (m3)	763.7	782.4	488.2	924.4	991.5	872.4	658.8	1014.7	966.1
	File:	**G2166**	**G2414**	**G2617**	**G2850r**	**G3095**	**G3320**	**G3576**	**G3783**	**G4044**
	File Status:	**final**	**final**	**final**	**final**	**Final**	**final**	**final**	**final**	**Final**
	Start:	11-6-96	18-6-96	25-6-96	2-7-96	9-7-96	16-7-96	23-7-96	30-7-96	6-8-96
	Stop:	18-6-96	25-6-96	2-7-96	9-7-96	16-7-96	23-7-96	30-7-96	6-8-96	13-8-96
	Concentrations (ng/m3)	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**
Organochlorine Pesticides	**Aldrin**	<DL	<DL	0.246	<DL	<DL	<DL	<DL	<DL	<DL
	Captan	4.714	2.301	0.614	0.757	6.556	3.439	3.339	1.872	3.105
	cis-Chlordane (a)	<DL	<DL	0.123	<DL	<DL	<DL	<DL	<DL	<DL
	trans-Chlordane (g)	<DL	0.102	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Dacthal	<DL	<DL	1.024	<DL	0.202	<DL	<DL	<DL	0.207
	Dieldrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.072
	Endosulfan I	0.249	0.230	0.410	0.411	0.746	0.447	1.230	0.384	1.573
	Endosulfan II	<DL	0.077	<DL	0.076	0.202	0.080	0.379	0.138	<DL
	Heptachlor	<DL	<DL	1.024	<DL	<DL	<DL	<DL	<DL	<DL
	Heptachlor Epoxide	<DL	0.077	0.184	<DL	<DL	<DL	<DL	<DL	<DL
	Hexachlorobenzene	0.262	0.128	1.024	0.108	0.303	0.344	0.455	0.099	0.207
	Lindane (g-BHC)	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	trans-Nanochlor	<DL	0.077	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Oxychlordane	<DL	<DL	0.430	<DL	0.111	<DL	<DL	<DL	<DL
Herbicides	**2,4-Dichlorophenoxy Acetic acid**	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Dinoseb	<DL	<DL	<DL	<DL	3.127	<DL	<DL	<DL	<DL
	Silvex (2,4,5-TP)	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	1.242
Organophosphate Pesticides	**Chlorpyrifos**	<DL	<DL	<DL	<DL	0.303	0.917	1.518	0.197	0.311
	Diazinon	2.881	42.688	1.229	8.654	1.412	18.684	0.759	0.296	0.518
	Dichlorvos	1.833	1.406	<DL	0.433	6.556	0.917	3.491	0.985	0.311
	Fonofos	<DL	0.128	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Malathion	<DL	<DL	<DL	<DL	7.464	2.636	11.385	0.197	<DL
	Mevinphos	<DL	<DL	2.458	8.654	<DL	<DL	<DL	<DL	<DL

	Parathion Methyl	<DL	<DL	<DL	<DL	<DL	0.229	0.607	<DL	<DL
	Terbufos						3.783	0.759	<DL	0.828
Sterilants	**Atrazine**	<DL	<DL	<DL	<DL	2.622	<DL	<DL	<DL	<DL

Abbotsford Pesticides **HV PUF Data**

	Head ID	EC007		EC009	EC009			EC001	EC005	
	Date on	13-8-96 8:15	21-8-96 11:35	27-8-96 10:05	6-9-96 14:35	10-9-96 11:25	17-9-96 9:55	24-9-96 10:00	1-10-96 11:00	8-10-96 10:20
	Date off	20-8-96 0:00	27-8-96 9:40	3-9-96 8:00	10-9-96 10:40	17-9-96 9:55	24-9-96 10:00	1-10-96 10:50	8-10-96 9:45	15-10-96 10:25
	Counter on	5007.84	5202.09	5344.17	5513.38	5606.49	5772.97	5940.22	6108.86	6274.98
	Counter off	5176.97	5344.17	5511.89	5606.49	5772.97	5940.22	6108.86	6274.98	6443
	Mag. Press. on	64	58	60	73	62	na	58	68	70
	Mag. Press. off	na	59	na	66	58	55	58	63	na
	Meter (m3) on	28111.34	28468.12	29249.32	29297.22	30278.22	31855.24	33407.18	34614.42	35747.41
	Meter (m3) off	28468.12	29249.32	29297.22	30278.22	31855.24	33407.18	34614.42	35747.41	36507.22
	Counter Diff'n	169.13	142.08	167.72	93.11	166.48	167.25	168.64	166.12	168.02
	Meter diff	356.78	781.2	47.9	981	1577.02	1551.94	1207.24	1132.99	759.81
	sample (m^3)									
	Comments	pump found dead on arrival		pump found dead on arrival						pump found dead on arrival
	Avg P (mm HG)	1019.1	1016	1016.1	1015.2	1009	1021.3	1019.6	1018.3	1014.1
	Avg T (C)	17.43	19.9	17.79	14.6	15.11	11.28	12.66	13.41	13.17
	Avg T (K)	290.53	293	290.89	287.7	288.21	284.38	285.76	286.51	286.27
	Corrected Volume (m3)	368.2	796.9	49.2	1018.3	1624.2	1639.6	1267.2	1184.6	791.8
	File:	**G4300**	**G4510**	**G4679**	**G4924**	**G5137**	**G5338**	**G5586**	**G5863**	**G6072**
	File Status:	**Final**	**Final**	**Final**	**final**	**final**	**final**	**final**	**final**	**final**
	Start:	13-8-96	20-8-96	27-8-96	3-9-96	10-9-96	17-9-96	24-9-96	1-10-96	8-10-96
	Stop:	20-8-96	27-8-96	3-9-96	10-9-96	17-9-96	24-9-96	1-10-96	8-10-96	15-10-96
	Concentrations (ng/m3)	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**
Organochlorine	**Aldrin**	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL

Pesticides										
	Captan	2.716	2.635	4.063	0.196	0.431	0.183	0.158	<DL	0.253
	cis-Chlordane (a)	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.253	<DL
	trans-Chlordane (g)	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Dacthal	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Dieldrin	<DL	<DL	<DL	0.049	<DL	<DL	0.063	<DL	<DL
	Endosulfan I	2.309	1.468	1.828	0.442	0.228	0.213	0.229	0.101	<DL
	Endosulfan II	0.652	0.389	<DL	0.069	0.043	<DL	0.063	<DL	<DL
	Heptachlor	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Heptachlor Epoxide	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Hexachlorobenzene	0.272	0.125	<DL	0.098	<DL	0.122	0.079	0.253	<DL
	Lindane (g-BHC)	<DL	<DL	<DL	<DL	0.185	<DL	<DL	<DL	<DL
	trans-Nanochlor	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Oxychlordane	0.190	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Herbicides	**2,4-Dichlorophenoxy Acetic acid**	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Dinoseb	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Silvex (2,4,5-TP)	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Organophosphate Pesticides	**Chlorpyrifos**	<DL	0.753	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Diazinon	1.086	0.502	<DL	0.295	<DL	<DL	<DL	0.253	0.253
	Dichlorvos	2.173	1.380	<DL	0.491	0.308	<DL	0.552	1.182	0.631
	Fonofos	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Malathion	<DL	0.251	<DL	0.196	<DL	<DL	<DL	<DL	<DL
	Mevinphos	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Parathion Methyl	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Terbufos	<DL	0.627	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Sterilants	**Atrazine**	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL

Abbotsford Pesticides **HV PUF Data**

	Head ID									
	Date on	18-10-96 12:20	22-10-96 10:40	29-10-96 9:55	1-11-96 14:00	5-11-96 11:25	13-11-96 10:55	25-11-96 13:10	5-12-96 8:45	10-12-96 11:30
	Date off	22-10-96	29-10-96	1-11-96	5-11-96	12-11-96	25-11-96	3-12-96	10-12-96	16-12-96

		9:55	9:55	14:00	9:55	10:40	12:20	8:45	11:25	11:15
	Counter on	6443	6536.66		6537.09	6538.15	6538.15	6827.09	7017.39	7139.85
	Counter off	6536.66			6538.15	6538.15	6827.09	7017.39	7139.85	7283.58
	Mag. Press. on	71			56	64	62	69	60	66
	Mag. Press. off	64			na	na	60	na	66	74
	Meter (m3) on	36507.22			36405.7	36897.44	37576.64	41131.52	42720.6	43427.3
	Meter (m3) off	36408.01			36897.44	37576.6	41131.52	42720.6	43427.3	44230.5
	Counter Diff'n	0	0		1.06	0	288.94	190.3	122.46	143.73
	Meter diff	0	0		491.74	679.16	3554.88	1589.08	706.7	803.2
	sample (m^3)									
	Comments	do not analyze	dry gas meter dead	dry gas meter dead	dry gas meter dead	pump found dead on arrival		pump found dead on arrival	New motor Lost 2 d spl	
	Avg P (mm HG)	1016.3	1015.1	1022.8	1019	1019.9	1012.8	1017	1003.7	1019.4
	Avg T (C)	6.38	7.66	6.74	6.49	9.31	-0.97	3.94	3.56	3.57
	Avg T (K)	279.48	280.76	279.84	279.59	282.41	272.13	277.04	276.66	276.67
	Corrected Volume (m3)	0.0	0.0	0.0	527.2	721.5	3892.1	1716.1	754.2	870.6
	File:	**G6330**	**G6541**		**G6765**	**G6980**	**G7367**	**G7558**	**G7786**	**G7954**
	File Status:				**final**		**final**	**final**	**final**	**final**
	Start:	15-10-96	22-10-96	29-10-96	1-11-96	5-11-96	12-11-96	26-11-96	3-12-96	10-12-96
	Stop:	22-10-96	29-10-96	1-11-96	5-11-96	12-11-96	26-11-96	3-12-96	10-12-96	16-12-96
	Concentrations (ng/m3)	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**		**Abbotsford HV/PUF**		**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**
Organochlorine Pesticides	**Aldrin**				<DL		<DL	<DL	<DL	<DL
	Captan				<DL		<DL	<DL	<DL	<DL
	cis-Chlordane (a)				<DL		<DL	<DL	<DL	<DL
	trans-Chlordane (g)				<DL		<DL	<DL	<DL	<DL
	Dacthal				<DL		<DL	<DL	<DL	<DL
	Dieldrin				<DL		<DL	<DL	<DL	<DL
	Endosulfan I				0.209		<DL	<DL	<DL	<DL
	Endosulfan II				<DL		<DL	<DL	<DL	<DL
	Heptachlor				<DL		<DL	<DL	<DL	<DL
	Heptachlor Epoxide				<DL		<DL	<DL	<DL	<DL
	Hexachlorobenzene				<DL		<DL	0.058	<DL	<DL

	Lindane (g-BHC)				<DL		<DL	<DL	<DL	<DL
	trans-Nanochlor				<DL		<DL	<DL	<DL	<DL
	Oxychlordane				<DL		<DL	<DL	<DL	<DL
Herbicides	**2,4-Dichlorophenoxy Acetic acid**				<DL		0.719	<DL	<DL	<DL
	Dinoseb				<DL		<DL	<DL	<DL	<DL
	Silvex (2,4,5-TP)				<DL		<DL	<DL	<DL	<DL
Organophospha te Pesticides	**Chlorpyrifos**				<DL		<DL	<DL	<DL	<DL
	Diazinon				<DL		<DL	<DL	<DL	<DL
	Dichlorvos				1.138		<DL	0.233	<DL	<DL
	Fonofos				<DL		<DL	<DL	<DL	<DL
	Malathion				<DL		<DL	<DL	<DL	<DL
	Mevinphos				<DL		<DL	<DL	<DL	<DL
	Parathion Methyl				<DL		<DL	<DL	<DL	<DL
	Terbufos				<DL		<DL	<DL	<DL	<DL
Sterilants	**Atrazine**				<DL		<DL	<DL	<DL	<DL

Abbotsford Pesticides **HV PUF Data**

	Head ID									
	Date on	16-12-96 11:15	23-12-96 9:45	31-12-96 10:30	7-1-97 9:20	14-1-97 8:55	21-1-97 9:15	28-1-97 9:05	4-2-97 8:45	11-2-97 10:20
	Date off	23-12-96 9:30	31-12-96 9:30	7-1-97 9:15	14-1-97 8:55	21-1-97 9:15	28-1-97 9:00	4-2-97 8:45	11-2-97 9:00	18-2-97 8:45
	Counter on	7283.58	7449.62	7641.06	7807.84	7975.4	8142.33	8310.03	8477.75	8646.19
	Counter off	7449.62	7641.06	7807.84	7975.4	8142.33	8310.03	8477.75	8646.19	8812.98
	Mag. Press. on	63	70	52	63	60	60	61	60	66
	Mag. Press. off	65	na	68	60	58	61	60	na	69
	Meter (m3) on	44230.5	45158.6	45500.3	46893.2	48030.9	49157.8	50252.7	51249.7	52136.6
	Meter (m3) off	45158.6	45500.3	46893.2	48030.9	49157.8	50252.7	51249.7	52136.6	53463.7
	Counter Diff'n	166.04	191.44	166.78	167.56	166.93	167.7	167.72	168.44	166.79
	Meter diff	928.1	341.7	1392.9	1137.7	1126.9	1094.9	997	886.9	1327.1
	sample (m^3)									
	Comments		pump found dead on arrival	Motor replaced					Motor dead	New motor
	Avg P (mm HG)	1017	1009.2	1012	1023.3	1016	1014.7	1020.1	1025.2	1018.3

	Avg T (C)	-0.94	-8.06	4.59	2.68	3.32	-1.18	5	2.36	6.73
	Avg T (K)	272.16	265.04	277.69	275.78	276.42	271.92	278.1	275.46	279.83
	Corrected Volume (m3)	1020.2	382.8	1493.3	1241.9	1218.5	1201.9	1075.8	971.0	1420.7
	File:	**G8168**	**G8237**	**G8330**	**G8497**	**G8666**	**G8836**	**G9020**	**G9181**	**G9377**
	File Status:	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**
	Start:	16-12-96	23-12-96	31-12-96	7-1-97	14-1-97	21-1-97	28-1-97	4-2-97	11-2-97
	Stop:	23-12-96	30-12-96	7-1-97	14-1-97	21-1-97	28-1-97	4-2-97	11-2-97	18-2-97
	Concentrations (ng/m3)	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**
Organochlorine Pesticides	**Aldrin**	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Captan	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	cis-Chlordane (a)	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	trans-Chlordane (g)	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Dacthal	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Dieldrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Endosulfan I	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Endosulfan II	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.035
	Heptachlor	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Heptachlor Epoxide	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Hexachlorobenzene	0.098	<DL	<DL	0.322	0.082	<DL	0.093	0.103	<DL
	Lindane (g-BHC)	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	trans-Nanochlor	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Oxychlordane	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Herbicides	**2,4-Dichlorophenoxy Acetic acid**	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Dinoseb	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Silvex (2,4,5-TP)	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Organophosphate Pesticides	**Chlorpyrifos**	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Diazinon	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Dichlorvos	<DL	<DL	0.938	1.047	<DL	<DL	<DL	<DL	<DL
	Fonofos	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Malathion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL

	Mevinphos	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Parathion Methyl	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
	Terbufos	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Sterilants	**Atrazine**	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL

Abbotsford Pesticides **HV PUF Data**

	Head ID		
	Date on	18-2-97 8:45	25-2-97 8:55
	Date off	25-2-97 8:55	4-3-97 8:45
	Counter on	8812.98	8981.05
	Counter off	8981.05	9148.9
	Mag. Press. on	69	62
	Mag. Press. off	60	61
	Meter (m3) on	53463.7	54761.4
	Meter (m3) off	54761.4	55970.1
	Counter Diff'n	168.07	167.85
	Meter diff	1297.7	1208.7
	sample (m^3)		
	Comments		
	Avg P (mm HG)	1027.9	1011.8
	Avg T (C)	5.59	4.64
	Avg T (K)	278.69	277.74
	Corrected Volume (m3)	1408.0	1295.3
	File:	**G9595**	**G9754**
	File Status:	**final**	**final**
	Start:	18-2-97	25-2-97
	Stop:	25-2-97	4-3-97
	Concentrations (ng/m3)	**Abbotsford HV/PUF**	**Abbotsford HV/PUF**
Organochlorine Pesticides	**Aldrin**	<DL	<DL
	Captan	<DL	<DL
	cis-Chlordane	<DL	<DL
	(a)		

	trans-Chlordane (g)	<DL	<DL
	Dacthal	<DL	<DL
	Dieldrin	<DL	<DL
	Endosulfan I	<DL	<DL
	Endosulfan II	<DL	<DL
	Heptachlor	<DL	<DL
	Heptachlor Epoxide	<DL	<DL
	Hexachlorobenzene	0.142	0.154
	Lindane (g-BHC)	<DL	0.154
	trans-Nanochlor	<DL	<DL
	Oxychlordane	<DL	<DL
Herbicides	**2,4-Dichlorophenoxy Acetic acid**	<DL	<DL
	Dinoseb	<DL	<DL
	Silvex (2,4,5-TP)	<DL	<DL
Organophosphate Pesticides	**Chlorpyrifos**	<DL	<DL
	Diazinon	0.355	2.470
	Dichlorvos	<DL	<DL
	Fonofos	<DL	<DL
	Malathion	<DL	<DL
	Mevinphos	<DL	<DL
	Parathion Methyl	<DL	<DL
	Terbufos	<DL	0.232
Sterilants	**Atrazine**	<DL	<DL

Appendix 3: Rainfall Concentrations at Agassiz

Agassiz Pesticides-Rain

Rainfall (area= 0.212 m2)

Date on	17-1-90 12:00	6-2-96 14:10	13-2-96 9:00	20-2-96 9:25	27-2-96 9:30	5-3-96 9:15	12-3-96 9:50
Date off	6-2-96 12:20	13-2-96 8:50	20-2-96 9:20	27-2-96 9:25	5-3-96 9:10	12-3-96 9:40	19-3-96 9:20
mm RG	17.2	64.4	34.4	15.4	10.6	26.8	16.4
Comments	Wind knocked						

	over sampler						
Vol (L)=	3.6464	13.6528	7.2928	3.2648	2.2472	5.6816	3.4768
File:	**F7323**	**F7434**	**F7643**	**F7847**	**F8028**	**F8220**	**F8459**
File Status:	**final**	**final**	**final**	**final**	**final**	**final**	**final**
Start:	17-1-96	6-2-96	13-2-96	20-2-96	27-2-96	5-3-96	12-3-96
Stop:	6-2-96	13-2-96	20-2-96	27-2-96	5-3-96	12-3-96	19-3-96
Days Sampled	**20**	**7**	**7**	**7**	**7**	**7**	**7**
Note:			extr w H+ Acetone	extr w H+ Acetone	extr w H+ Acetone	DCM extr'n	DCM extr'n
Concentrations (ug/L)	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**
Comment							
a-BHC	0.038	<DL	<DL	<DL	<DL	<DL	<DL
Captan	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Dieldrin	0.052	<DL	<DL	<DL	<DL	<DL	<DL
2,4-Dichlorophenoxy Acetic acid	<DL	<DL	0.878	<DL	<DL	missing	<DL
Diazinon	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Dichlorvos	<DL	<DL	<DL	<DL	0.089	<DL	<DL
Malathion	<DL	<DL	<DL	<DL	<DL	<DL	<DL

Date on	19-3-96 9:25	26-3-96 9:20	2-4-96 9:30	9-4-96 9:15	16-4-96 9:15	23-4-96 9:05	30-4-96 8:45
Date off	26-3-96 9:15	2-4-96 9:30	9-4-96 9:10	16-4-96 9:10	23-4-96 9:00	30-4-96 8:15	7-5-96 8:42
mm RG	9.0	40.0	22.6	26.0	49.4	40.8	20.6
Comments		moisture sensor broken					
Vol (L)=	1.908	8.48	4.7912	5.512	10.4728	8.6496	4.3672
File:	**F8656**	**F8847**	**F8988**	**F9223**	**F9434**	**F9583**	**F9784**
File Status:	**final**	**final**	**final**	**final**	**final**	**final**	**final**
Start:	19-3-96	26-3-96	2-4-96	9-4-96	16-4-96	23-4-96	30-4-96

Stop:	26-3-96	2-4-96	9-4-96	16-4-96	23-4-96	30-4-96	7-5-96
Days Sampled	**7**	**7**	**7**	**7**	**7**	**7**	**7**
Note:	DCM extr'n	DCM extr'n	DCM extr'n	DCM extr'n	DCM extr'n	DCM extr'n	DCM extr'n
Concentrations (ug/L)	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz**	**Agassiz Rain**
Comment							
a-BHC	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Captan	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Dieldrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL
2,4-Dichlorophenoxy Acetic acid	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Diazinon	<DL	<DL	<DL	<DL	<DL	<DL	0.046
Dichlorvos	<DL	<DL	<DL	<DL	0.029	<DL	<DL
Malathion	<DL	<DL	<DL	<DL	<DL	<DL	<DL

Date on	7-5-96 8:45	14-5-96 0:00	21-5-96 0:00	28-5-96 0:00	4-6-96 0:00	11-6-96 8:35	18-6-96 8:12
Date off	14-5-96 8:15	21-5-96 0:00	28-5-96 0:00	4-6-96 0:00	11-6-96 0:00	18-6-96 8:10	25-6-96 8:15
mm RG	48.4					3.6	3.8
Comments			Sampling stopped				
Vol (L)=	10.2608					0.7632	0.8056
File:	**G1029**					**G2166**	**G2414**
File Status:	**final**					**final**	**final**
Start:	7-5-96	14-5-96	21-5-96	28-5-96	4-6-96	11-6-96	18-6-96
Stop:	14-5-96	21-5-96	28-5-96	4-6-96	11-6-96	18-6-96	25-6-96
Days Sampled	**7**	**7**	**7**			**7**	**7**
Note:	DCM extr'n					DCM extr'n	DCM extr'n
Concentrations (ug/L)	**Agassiz Rain**					**Agassiz Rain**	**Agassiz Rain**

Comment							
a-BHC	<DL					<DL	<DL
Captan	<DL					<DL	<DL
Dieldrin	0.055					<DL	<DL
2,4-Dichlorophenoxy Acetic acid	<DL					<DL	<DL
Diazinon	<DL					<DL	<DL
Dichlorvos	0.019					<DL	<DL
Malathion	<DL					<DL	<DL

Date on	25-6-96 8:17	2-7-96 9:00	9-7-96 8:50	16-7-96 8:00	23-7-96 8:30	30-7-96 11:00	6-8-96 8:30
Date off	2-7-96 8:48	9-7-96 8:07	16-7-96 7:57	23-7-96 8:00	30-7-96 11:00	6-8-96 8:30	13-8-96 11:40
mm RG	9.1	12.4	<0.2	29.8	<0.2	58.4	<0.2
Comments		sample loss; tube not draining	Trace rain				
Vol (L)=	1.9292	2.6288	NA	6.3176	NA	12.3808	NA
File:	**G2617**	**G2850r**	**G3095**	**G3320**	**G3576**	**G3783**	**N/A**
File Status:	**final**	**final**	**final**	**final**	**final**	**final**	
Start:	25-6-96	2-7-96	9-7-96	16-7-96	23-7-96	30-7-96	6-8-96
Stop:	2-7-96	9-7-96	16-7-96	23-7-96	30-7-96	6-8-96	13-8-96
Days Sampled	**7**	**7**	**7**	**7**	**7**	**7**	**7**
Note:	DCM extr'n	DCM extr'n	DCM extr'n	DCM extr'n	DCM extr'n	DCM extr'n	
Concentrations (ug/L)	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**
Comment							
a-BHC	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Captan	<DL	0.114	<DL	0.032	<DL	0.040	<DL
Dieldrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL
2,4-Dichlorophenoxy Acetic acid	<DL	<DL	<DL	<DL	<DL	<DL	<DL

Diazinon	<DL	0.076	<DL	<DL	<DL	0.008	<DL
Dichlorvos	<DL	<DL	<DL	0.063	<DL	0.040	<DL
Malathion	<DL	<DL	<DL	0.016	<DL	<DL	<DL

Date on	13-8-96 11:40	20-8-96 8:23	27-8-96 8:20	3-9-96 8:15	10-9-96 8:25	17-9-96 8:25	24-9-96 8:30
Date off	20-8-96 7:47	27-8-96 7:55	3-9-96 8:15	10-9-96 7:50	17-9-96 7:50	24-9-96 8:30	1-10-96 8:15
mm RG	2.0	1.0	28.2	50.0	50.4	26.6	0.2
Comments							
Vol (L)=	0.424	0.212	5.9784	10.6	10.6848	5.6392	0.0424
File:	**G4300**	**G4510**	**G4679**	**G4924**	**G5137**	**G5338**	**G5586**
File Status:	**final**	**final**	**final**	**final**	**final**	**final**	
Start:	13-8-96	20-8-96	27-8-96	3-9-96	10-9-96	17-9-96	24-9-96
Stop:	20-8-96	27-8-96	3-9-96	10-9-96	17-9-96	24-9-96	1-10-96
Days Sampled	**7**	**7**	**7**	**7**	**7**	**7**	**7**
Note:							
Concentrations (ug/L)	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**
Comment							
a-BHC	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Captan	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Dieldrin	<DL	<DL	<DL	<DL	<DL	<DL	<DL
2,4-Dichlorophenoxy Acetic acid	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Diazinon	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Dichlorvos	<DL	<DL	<DL	<DL	0.009	<DL	<DL
Malathion	<DL	<DL	<DL	<DL	<DL	<DL	<DL

Date on	1-10-96 8:15	8-10-96 8:35	15-10-96 9:10	22-10-96 8:40	29-10-96 8:30	5-11-96 9:30	12-11-96 9:10
Date off	8-10-96 7:55	15-10-96 8:00	22-10-96 7:40	29-10-96 8:30	5-11-96 8:50	12-11-96 8:50	18-11-96 9:05

mm RG	42.6	54.6	78.4	80.0	17.8	53.2	na
Comments							
Vol (L)=	9.0312	11.5752	16.6208	16.96	3.7736	11.2784	NA
File:	**G5863**	**G6072**	**G6330**	**G6541**	**G6765**	**G6980**	**G7367**
File Status:	**final**	**final**	**final**	**final**	**final**	**final**	**final**
Start:	1-10-96	8-10-96	15-10-96	22-10-96	29-10-96	5-11-96	12-11-96
Stop:	8-10-96	15-10-96	22-10-96	29-10-96	5-11-96	12-11-96	26-11-96
Days Sampled	**7**	**7**	**7**	**7**	**7**	**7**	**14**
Note:							
Concentrations (ug/L)	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**
Comment							
a-BHC	<DL	<DL	<DL	<DL	<DL	<DL	
Captan	<DL	<DL	<DL	<DL	<DL	<DL	
Dieldrin	<DL	<DL	<DL	<DL	<DL	<DL	
2,4-Dichlorophenoxy Acetic acid	<DL	<DL	<DL	<DL	<DL	<DL	
Diazinon	<DL	<DL	<DL	<DL	<DL	<DL	
Dichlorvos	<DL	<DL	<DL	<DL	<DL	<DL	
Malathion	<DL	<DL	<DL	<DL	<DL	<DL	

Date on	25-11-96 9:30	3-12-96 10:00	10-12-96 9:15	16-12-96 9:20	23-12-96 12:30	31-12-96 12:30	7-1-97 8:45
Date off	3-12-96 9:15	10-12-96 9:15	16-12-96 9:20	23-12-96 12:30	31-12-96 12:30	7-1-97 8:45	14-1-97 11:15
mm RG	138.0	82.0	34.0	na	na	na	162.0
Comments							
Vol (L)=	29.256	17.384	7.208	NA	NA	NA	34.344
File:	**G7558**	**G7786**	**G7954**	**G8168**	**G8330**		**G8497**
File Status:	**final**	**final**	**final**	**final**			**final**

Start:	26-11-96	3-12-96	10-12-96	17-12-96	24-12-96	31-12-96	7-1-97
Stop:	3-12-96	10-12-96	17-12-96	24-12-96	31-12-96	7-1-97	14-1-97
Days Sampled	**7**	**7**	**7**	**7**	**7**	**7**	**7**
Note:			**Calculated**	Spl frozen ?	Spl frozen ?	Spl frozen ?	*4 week spl ??*
Concentrations (ug/L)	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**				**Agassiz Rain**
Comment							
a-BHC	<DL	<DL	<DL				<DL
Captan	<DL	<DL	<DL				<DL
Dieldrin	<DL	<DL	<DL				<DL
2,4-Dichlorophenoxy Acetic acid	<DL	<DL	<DL				<DL
Diazinon	<DL	<DL	<DL				<DL
Dichlorvos	0.003	<DL	<DL				<DL
Malathion	<DL	<DL	0.014				<DL

Date on	14-1-97 11:15	21-1-97 11:00	28-1-97 11:15	4-2-97 11:15	11-2-97 12:30	18-2-97 10:45	25-2-97 10:45
Date off	21-1-97 11:00	28-1-97 11:15	4-2-97 11:15	11-2-97 12:30	18-2-97 10:45	25-2-97 10:45	4-3-97 10:45
mm RG	104.0	na	96.0	1.6	70.4	44.0	45.2
Comments							
Vol (L)=	22.048	NA	20.352	0.3392	14.9248	9.328	9.5824
File:	**G8666**	**G9020**		**G9181**	**G9377**	**G9595**	**G9754**
File Status:	**final**	**final**		**final**	**final**	**final**	**final**
Start:	14-1-97	21-1-97	28-1-97	4-2-97	11-2-97	18-2-97	25-2-97
Stop:	21-1-97	28-1-97	4-2-97	11-2-97	18-2-97	25-2-97	4-3-97
Days Sampled	**7**	**7**	**7**	**7**	**7**	**7**	**7**
Note:							
Concentrations (ug/L)	**Agassiz Rain**	**Agassiz Rain**		**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**	**Agassiz Rain**
Comment							**- spike**

a-BHC	<DL	<DL		<DL	<DL	<DL	<DL
Captan	<DL	<DL		<DL	<DL	<DL	<DL
Dieldrin	<DL	<DL		<DL	<DL	<DL	<DL
2,4-Dichlorophenoxy Acetic acid	<DL	<DL		<DL	<DL	<DL	<DL
Diazinon	<DL	<DL		<DL	<DL	<DL	0.038
Dichlorvos	<DL	<DL		<DL	<DL	<DL	0.002
Malathion	<DL	<DL		<DL	<DL	<DL	0.041

Agassiz Pesticides-Rain

Concentrations (ug/L)	Maximum	Minimum	Average
a-BHC	0.038	0.038	0.038
Captan	0.114	0.032	0.062
Dieldrin	0.055	0.052	0.053
2,4-Dichlorophenoxy Acetic acid	0.878	0.878	0.878
Diazinon	0.076	0.008	0.042
Dichlorvos	0.089	0.002	0.032
Malathion	0.041	0.014	0.023

Appendix 4: Rainfall Concentrations at Abbotsford

Abbotsford
Rain Pesticides

Rainfall (mm)	29.6	>49.5	10	5.8	27	10.2	20.8	28.4	26.6	32.4	77.8	34
Volume (L)	6.2752	10.494	2.12	1.2296	5.724	2.1624	4.4096	6.0208	5.6392	6.8688	16.4936	7.208
File:	**F7434**	**F7643**	**F7847**	**F8028**	**F8220**	**F8459**	**F8656**	**F8847**	**F8988**	**F9223**	**F9434**	**F9583**
File Status:	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**
Start:	6-2-96	13-2-96	20-2-96	27-2-96	5-3-96	12-3-96	19-3-96	26-3-96	2-4-96	9-4-96	16-4-96	23-4-96
Stop:	13-2-96	20-2-96	27-2-96	5-3-96	12-3-96	19-3-96	26-3-96	2-4-96	9-4-96	16-4-96	23-4-96	30-4-96
Days Sampled	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**
Conc (ug/l)		extr w H+ Acetone	extr w H+ Acetone	extr w H+ Acetone	DCM extr'n	DCM extr'n	DCM extr'n	DCM extr'n	DCM extr'n	DCM extr'n	DCM extr'n	DCM extr'n
Captan	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.006	<DL
cis-Chlordane (a)	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.042
2,4-D	<DL	1.029	0.528	<DL	missing	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Diazinon	<DL	<DL	0.189	<DL	0.017	0.092	0.136	<DL	0.053	0.044	0.042	0.014
Dichlorvos	<DL	0.048	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.024	<DL
Malathion	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL

Rainfall (mm)	24.8	59					1	4.4	7.9	5.8	0	22.8
Volume (L)	5.2576	12.508					0.212	0.9328	1.6748	1.2296	0	4.8336
File:	**F9434**	**G1029**					**G2166**	**G2414**	**G2617**	**G2850r**	**G3095**	**G3320**
File Status:	**final**	**final**					**final**	**final**	**final**	**final**	**final**	**final**
Start:	30-4-96	7-5-96	14-5-96	21-5-96	28-5-96	4-6-96	11-6-96	18-6-96	25-6-96	2-7-96	9-7-96	16-7-96
Stop:	7-5-96	14-5-96	21-5-96	28-5-96	4-6-96	11-6-96	18-6-96	25-6-96	2-7-96	9-7-96	16-7-96	23-7-96
Days Sampled	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**
Conc (ug/l)	DCM extr'n	DCM extr'n					?				No rain	
Captan	0.019	0.625					1.415	1.072	0.358	0.895	no rain	0.352
cis-Chlordane (a)	<DL	<DL					<DL	<DL	<DL	<DL	no rain	<DL
2,4-D	<DL	<DL					<DL	<DL	<DL	<DL	no rain	<DL
Diazinon	0.019	0.088					<DL	<DL	<DL	<DL	no rain	<DL

Dichlorvos	0.057	0.040					<DL	0.107	<DL	<DL	no rain	0.062
Malathion	<DL	<DL					<DL	<DL	<DL	<DL	no rain	0.021

Rainfall (mm)	0	22.1	0	0.6	0	19.4	21.6	60.4	11.2	0	21.6	33
Volume (L)	0	4.6852	0	0.1272	0	4.1128	4.5792	12.8048	2.3744	0	4.5792	6.996
File:	**G3576**	**G3783**	**N/A**	**G4300**	**G4510**	**G4679**	**G4924**	**G5137**	**G5338**	**G5586**	**G5863**	**G6072**
File Status:	**final**	**final**		**final**	**final**	**final**	**final**	**final**	**final**		**final**	**final**
Start:	23-7-96	30-7-96	6-8-96	13-8-96	20-8-96	27-8-96	3-9-96	10-9-96	17-9-96	24-9-96	1-10-96	8-10-96
Stop:	30-7-96	6-8-96	13-8-96	20-8-96	27-8-96	3-9-96	10-9-96	17-9-96	24-9-96	1-10-96	8-10-96	15-10-96
Days Sampled	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**
Conc (ug/l)												
Captan	no rain	0.427	no rain	<DL	no rain	1.337	0.066	0.055	0.084	no rain	0.087	0.029
cis-Chlordane (a)	no rain	<DL	no rain	<DL	no rain	<DL	<DL	<DL	<DL	no rain	<DL	<DL
2,4-D	no rain	<DL	no rain	<DL	no rain	<DL	<DL	<DL	<DL	no rain	<DL	<DL
Diazinon	no rain	<DL	no rain	<DL	no rain	<DL	<DL	<DL	<DL	no rain	<DL	<DL
Dichlorvos	no rain	<DL	no rain	<DL	no rain	<DL	<DL	<DL	<DL	no rain	<DL	<DL
Malathion	no rain	<DL	no rain	<DL	no rain	<DL	<DL	<DL	<DL	no rain	<DL	<DL

Rainfall (mm)	50	104	23.2	25.8	na	73	79	35.2	na	na	113	na
Volume (L)	10.6	22.048	4.9184	5.4696	na	15.476	16.748	7.4624	na	na	23.956	na
File:	**G6330**	**G6541**	**G6765**	**G6980**	**G7367**	**G7558**	**G7786**	**G7954**	**G8330**	**G8497**	**G8666**	**G9020**
File Status:	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**	**final**
Start:	15-10-96	22-10-96	29-10-96	5-11-96	12-11-96	26-11-96	3-12-96	10-12-96	16-12-96	7-1-97	14-1-97	21-1-97
Stop:	22-10-96	29-10-96	5-11-96	12-11-96	26-11-96	3-12-96	10-12-96	17-12-96	7-1-97	14-1-97	21-1-97	28-1-97
Days Sampled	**7**	**7**	**7**	**7**	**14**	**7**	**7**	**7**	**22**	**7**	**7**	**7**
Conc (ug/l)												
Captan	<DL	<DL	<DL	<DL		<DL	<DL	<DL			<DL	
cis-Chlordane (a)	<DL	<DL	<DL	<DL		<DL	<DL	<DL			<DL	
2,4-D	<DL	<DL	<DL	<DL		<DL	<DL	<DL			<DL	
Diazinon	<DL	<DL	<DL	<DL		<DL	<DL	<DL			<DL	
Dichlorvos	<DL	<DL	0.020	<DL		0.032	<DL	<DL			<DL	
Malathion	<DL	<DL	<DL	<DL		<DL	<DL	<DL			<DL	

Rainfall (mm)	3.2	63	33	36.6
Volume (L)	0.6784	13.356	6.996	7.7592
File:	**G9181**	**G9377**	**G9595**	**G9754**
File Status:	**final**	**final**	**final**	**final**
Start:	4-2-97	11-2-97	18-2-97	25-2-97
Stop:	11-2-97	18-2-97	25-2-97	4-3-97
Days Sampled	**7**	**7**	**7**	**7**
Conc (ug/l)				
Captan	<DL	<DL	<DL	<DL
cis-Chlordane (a)	<DL	<DL	<DL	<DL
2,4-D	<DL	<DL	<DL	<DL
Diazinon	<DL	<DL	<DL	0.026
Dichlorvos	<DL	<DL	<DL	<DL
Malathion	<DL	<DL	<DL	<DL

Conc (ug/l)	**Max.**	**Min.**	**Average**
Captan	1.415	0.006	0.455
cis-Chlordane (a)	0.042	0.042	0.042
2,4-D	1.029	0.528	0.779
Diazinon	0.189	0.014	0.066
Dichlorvos	0.107	0.020	0.049
Malathion	0.021	0.021	0.021