PAIGE E. TOLBERT. Retrospective Cohort Study of a Community Exposed to Herbicide: An Investigation of Perceived Acute Health Effects

Eighty-five subjects possibly exposed to herbicide following aerial spraying of Tordon 101 and Weedone 2,4-DP and 159 subjects from a referent, unexposed community were interviewed regarding exposure and health symptoms. The a priori hypotheses that exposure would be associated with reported worsening of respiratory symptoms and not with a dummy symptom were supported by the data. The relative risk for respiratory symptoms was thirteen. An exploratory analysis of responses regarding 32 symptoms indicated a significant association of exposure with eight symptoms: cough, difficulty breathing, sinus congestion, runny nose, swollen glands, wheezing, dizziness, and peeling skin. Adjustment for age, race, sex, smoking status, and educational attainment did not alter these findings. Those exposed subjects reporting a worsening, within a month, of any of the eight symptoms significantly associated with exposure, constituted the "reactor" group. Reactors so defined reported greater duration of exposure than the non-reacting exposed subjects. Reactors tended to be more educated and better acquainted with the identity of the sprayed material than the non-reactors. The extent of over-reporting bias was assessed using dummy symptoms. This study constitutes the first epidemiological investigation of acute effects of community exposure to these herbicide formulations and demonstrates the importance of this type of community surveillance.

Dedicated
to the memory of
Maude Bryant

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INTRODUCTION

As pesticides move from the laboratory to real use situations, it is important to monitor the health of exposed communities in order to detect unanticipated adverse effects. The present study is an attempt to document possible acute health effects arising from aerial application of Tordon 101 and Weedone 2,4-DP, herbicides found safe in laboratory tests.

In June of 1982, a licensed helicopter pilot, under contract to the Boise-Cascade Corporation, applied a mixture of broadleaf herbicides to a 450-acre timber tract adjacent to the rural hamlet of Gorgus in Chatham County, North Carolina. (Excerpt of contract attached, Appendix A.) Within a few days, several residents of Gorgus reported to state officials that they were experiencing health problems they considered to be reactions to the herbicide, including upper respiratory ailments and skin rash, and that plants in their gardens were showing signs of damage. In response to these reports, representatives of the North Carolina Department of Agriculture visited the area a week after the spraying and determined that herbicide damage to garden vegetables was indeed evident (Appendices B and C). Their investigation concluded that herbicide had volatilized after target contact due to hot and humid weather conditions that followed the spraying (Appendix C). A month later, samples of vegetables from Gorgus gardens were analyzed and herbicide contamination was not detected (Appendices D and E).

The herbicidal preparations in question are: 1) Dow

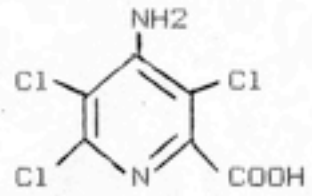
Chemical's Tordon 101, with active ingredients 4-amino-3,5,6-trichloropicolinic acid (picloram) and 2,4-dichlorophenoxyacetic acid (2,4-D), both in the triisopropanol amine salt form, and 2) Union Carbide's Weedone 2,4-DP, with active ingredient 2,4-dichlorophenoxypropionic acid (2,4-DP or "dichlorprop") as the butoxyethyl ester. (See Figure 1 for chemical structures and Appendices F and G for product labels.) These formulations are in widespread use as broadleaf herbicides in the maintenance of rights of way and in agriculture and forest management, for site preparation, conifer release, timber stand improvement, and weed control. Principal users include the U.S. Forest Service, state and local agencies, utilities, and forest products companies.

The three active ingredients, picloram, 2,4-D, and 2,4-DP, have similar modes of action. The chemicals are absorbed by plant roots and foliage, translocated throughout the plant, and accumulate at sites of active growth. They act as synthetic auxins, mimicking the activity of the plant growth hormone indoleacetic acid and thereby exerting effects on the metabolism of DNA, RNA, and protein. Plant death apparently results from uncontrolled proliferation of stem cells. Picloram is 10 to 500 times more toxic to most broadleaf species than the phenoxy herbicides, perhaps due to its resistance to degradation within plants (Witt & Baumgartner, 1979).

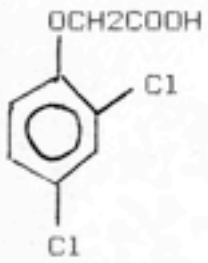
Environmental Fate -- Picloram

Picloram is considered a persistent herbicide, exerting continued herbicidal activity as long as five years after application (Burnside, 1971). Disappearance from the site of

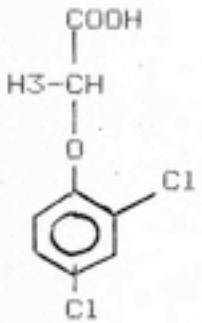
Figure 1: Chemical Structures of Picloram, 2,4-D, and 2,4-DP (Acid Forms)



4-Amino-3,5,6-Trichloropicolinic Acid (Picloram)



2,4-Dichorophenoxyacetic Acid (2,4-D)



2,4-Dichlorophenoxypropionic Acid (2,4-DP)

application occurs primarily by microbial degradation, photolysis, and leaching (NRCC, 1974; Merkle, 1967; Scifres, 1969). Chemical decomposition is negligible. Its persistence in soils is determined by conditions of temperature, moisture, organic content, acidity, and ultraviolet radiation (NRCC, 1974; Merkle, 1967; Scifres, 1967; Bovey, 1969; Byers, 1971). In the conditions of the southeastern U.S., picloram is moderately persistent with a half-life of several months (NRCC, 1974). Photo-degradation occurs on leaves and soil exposed to sunlight. Microbial degradation occurs predominantly in the first two feet of soil. An equilibrium between soil and vegetation is established within a few weeks of application (Getzendamer, et al., 1969). Within a month, levels of picloram on vegetation have been reported to decrease by 85 to 90 percent (Scifres, 1971; Hoffman, 1972). Because the amine salt is highly water soluble and sorption onto soil particles is low, leaching from the target site is common. Green and Goodin (1972) reported that at a site where picloram was aerially applied at a rate of two to four pounds per acre, runoff water collected two months after application contained over 5 ppm. At 22.5 months, the level in runoff water was 2 to 4 ppb. In a study of a Nebraska site that had received two pounds per acre, samples of water taken at depths of up to fifteen feet over a 38 month monitoring period contained levels of picloram ranging from undetectable to 400 ppb (Wicks & Fenster, 1973). The amine salt of picloram is of low volatility; potential for vaporization from the target site is considered minimal.

Environmental Fate -- 2,4-D

2,4-D is considered to be of low persistence. As in the case of picloram, its persistence in soils is strongly influenced by temperature, moisture, organic content, and acidity. The half-life of 2,4-D in soil varies from several days to two weeks; in the conditions of the southeastern U.S., its half-life would be expected to fall at the lower end of this range. On vegetables, its half-life has been reported to range from one to three weeks, depending on geographic location, climatic conditions, vegetation type and application technique. Oxygen, acidity, ultraviolet radiation, and temperature influence the half-life of 2,4-D in water; the half-life in water ranges from several days to several months. The amine salt form of 2,4-D is highly water soluble, and thus leaching from the sprayed site into surface and ground water occurs. The amine salt is considered to be of very low volatility, and therefore the potential for vaporization from the target site is believed to be minimal (U.S. Environmental Protection Agency, 1980; Weed Science Society, 1983).

Environmental Fate -- 2,4-DP

No studies of the environmental fate of the 2,4-DP butoxyethyl ester were located. Norris (1969) suggests that our knowlege of the behavior of 2,4-D provides a reasonable basis for prediction of the behavior of 2,4-DP, because of their chemical similarity. Kostowska and Sadowski (1975) reported that persistence of 2,4-DP was low and similar to that of 2,4-D. Since the butoxy ethyl ester (the form of 2,4-DP in Weedone 2,4-

DP) is less water soluble than the amine salts (the form of the active ingredients in Tordon 101), leaching into surface and ground water should be less extensive. On the other hand, although the 2,4-DP butoxethyl ester is not as volatile as other esters, it is more volatile than the salts and therefore has a greater potential to vaporize (Emerson, personal communication, 1986). The label for the Weedone 2,4-DP formulation (Appendix G) carries a precautionary statement: "Under very high temperatures vapors from this product may injure susceptible plants in the immediate vicinity."

Pharmacokinetics -- Picloram

Nolan (1984) studied the pharmacokinetics of picloram in male volunteers who were administered, at two week intervals, 0.5 or 5 mg/kg picloram orally or 2 mg/kg dermally. The ingested dose was rapidly absorbed across the gut wall, with a $t_{1/2}$ of 20 minutes. The half-life for elimination of the ingested dose was 0.5 hour, with over 90% recovered in 72 hours. Dermal absorption was slower, with a $t_{1/2}$ of 12 hours. Of the dermal dose, only 0.2% was absorbed. Because of its polar nature, picloram does not bioaccumulate in mammals. No metabolites of picloram have been reported in mammals. EPA does not consider the metabolism of picloram well understood and has required a metabolic study to support re-registration of picloram (Office of Pesticide Programs, EPA, 1985).

Pharmacokinetics -- 2,4-D

Chlorophenoxy compounds are absorbed across the gut wall,

lung, and skin (Morgan, 1982). Due to its polar character, 2,4-D does not bioaccumulate. In a study of human volunteers administered 5 mg/kg orally, the ingested dose was absorbed by a first order rate process, with a $t_{1/2}$ of 11.7 hours (Sauerhoff, et al., 1977). Almost all of the absorbed dose was excreted in the urine, with 82% excreted unchanged and 13% as a conjugate. Nash, et al., (1981) reported a half-life for elimination in agricultural workers exposed to 2,4-D of 35 to 48 hours.

Pharmacokinetics -- 2,4-DP

No studies of the absorption, metabolism, and elimination of the 2,4-DP butoxyethyl ester could be located. It has been assumed that, due to their chemical similarity, 2,4-DP and 2,4-D are handled similarly by the human body. (See, e.g., Libich, et al., 1984.) Data from agricultural workers exposed to 2,4-D amine salt and 2,4-DP (form unspecified) do indeed suggest similar patterns of absorption, metabolism (lack thereof), and elimination (Libich, et al., 1984.) Because the butoxyethyl ester is less polar, uptake through the lungs and skin should be higher than for the amine salts.

Acute Toxicity in Animals -- Picloram

Picloram is considered to be of low acute toxicity (Erickson, et al., 1970). The LD-50's for various animal models, ranging from 750 mg/kg to 8200 mg/kg, are shown in Table 1. For comparison, the LD-50 of aspirin is 1200 mg/kg and that of table salt is 3320 mg/kg (Weed Science Society, 1974). Some of the variability in values is due to the fact that different formulations were tested. Nonetheless, there is considerable

Table 1. Oral LD_{50}'s of Picloram in Various Animal Models

Animal	LD-50 (mg/kg)
Rats	2900 - 8200
Mice	1500 - 4000
Mallard	2000
Rabbit	2000
Guinea Pig	1900 - 3000
Sheep	1000
Cattle	750

Source: Lynn, 1965

inter-species variation, with higher order species having greater sensitivity than lower order species.

The physiological effect of acute dosing in rats was studied by Thompson et al. (1972). At autopsy, female rats fed 1000 mg/kg/day for up to ten days showed gastric mucosal hemorrhages, early pneumonia, congested and enlarged adrenals, and fatty enlarged liver. In a study of sheep fed acute oral doses of 720 mg/kg Tordon 22K (25% picloram salt), there were no signs of toxicity (Dow, 1983). When Tordon 101 was tested, however, at a level of 127 mg/kg picloram and 465 mg/kg 2,4-D, sheep became sick in three hours and died within three days. Symptoms included weakness, lack of coordination, abdominal pain and extensive hemorrhaging throughout the small intestine. A comparison of dosage levels in the two sheep studies suggests that either 2,4-D alone or synergism in the effects of 2,4-D and picloram was responsible for the observed toxicity in the latter study.

In a sub-chronic feeding study, rats were fed picloram at levels of 0, 15, 50, 150, 300, and 500 mg/kg/day for thirteen weeks (Dow, 1983). Body weight, food consumption, survival, enzyme levels, hematology, and urinalysis were comparable to controls. In rats fed more than 50 mg/kg/day, there was a dose dependent increase in relative liver weight and, in those fed more than 150 mg/kg/day, there was an increase in kidney weight. Histological examination of numerous tissue types revealed changes in the liver only in rats fed the three highest dose levels. A study of male rats fed a diet containing 0.1%

picloram (50-75 mg/kg/day) also noted liver and kidney effects (Suschetet & Causeret, 1973). In addition, an increase in relative testes weight was observed but this may have been a reflection of total weight reduction.

Dogs show signs of toxicity at low dose levels. Dogs are generally more sensitive to organic acid forms of herbicides than are rats, apes, or man due to a slower renal clearance of organic acids (Hook, et al., 1976). A six-month feeding study in which beagles were fed picloram in doses of 0, 7, 35, or 175 mg/kg/day found that those receiving the highest dose level experienced decreased body weight, decreased food consumption, decreased alanine transaminase, increased alkaline phosphatase, and increased liver weight (Jackson, 1966). Males receiving the intermediate dose level showed an increase in liver weight.

A 13-week feeding study of mice fed 0, 1000, 1400, or 2000 mg/kg/day found effects at all dose levels (Dow, 1983). Females receiving the highest dose showed significant weight reduction. Serum alkaline phosphatase levels were reduced in all groups. Liver weights were significantly increased in females at all dose levels; there also were dose-related morphological alterations in hepatocytes in females at all dose levels and in males receiving the two highest dosages. In another study of mice, 32-day treatments of up to 3000 mg/kg/day resulted in no observed effect in those receiving 1000 mg/kg/day or less, while those receiving 3000 mg/kg/day showed effects on the liver and gastric mucosa (Dow, 1983).

In several tests of dermal toxicity in the rabbit, no signs of systemic toxicity were noted. Dermal effects included slight

redness, swelling, and superficial necrosis (Lynn, 1965). Following application of undiluted picloram acid to the rabbit eye, there was slight to moderate conjunctival irritation and very slight and transient corneal response (Lynn, 1965).

Acute inhalation toxicity was low in the one species tested. Rats exposed to air saturated with either Tordon 22K or Tordon 101 for seven hours showed no toxic response when observed during the two weeks following exposure (Lynn, 1965).

EPA has determined that data on acute inhalation testing in the rat, acute oral testing in the rat, and acute dermal testing in the rabbit are inadequate and additional data must be submitted to support re-registration of picloram (Office of Pesticide Programs, 1985).

Acute Toxicity in Animals -- 2,4-D

Pure 2,4-D is considered to be of moderate acute toxicity (Erickson, et al., 1970). The LD-50 of 2,4-D in mammals ranges from 100-1000 mg/kg body weight (Hill & Carlisle, 1947). At dosage levels not causing immediate death, most species exhibit lack of coordination, stiffness in the extremities, lethargy and depression, stupor, and, finally, coma (Hill & Carlisle, 1947). In mice, myotonia and dilatation of the blood vessels of the lungs, liver, and kidneys have been observed (Bucher, 1946). In rats and guinea pigs, lethal doses of 2,4-D have caused congestion of the viscera and swelling of the proximal convoluted tubules of the kidney (Hill & Carlisle, 1947). Male rats receiving subcutaneous injections of 100 mg/kg experienced weight loss (Florsheim & Velcoff, 1962). Dogs become ataxic six hours

after a lethal dose and progress to spasm, accompanied by hepatic congestion and pneumonia (Drill & Hiratzka, 1953). In dogs, anorexia, weight loss, myotonia, and liver damage also occur. Acute doses of 2,4-D in sheep, cattle, and chickens result in hemorrhagic gastroenteritis and fatty degeneration of the liver, spleen, kidneys and heart (Bjorn & Northen, 1948; Palmer & Radeleff, 1964). Cows also exhibit rumen stasis and excess salivation (McLellan, 1964). Asthenia, dyspnea, paralysis, and intense reaction to light have been observed in sheep (Shavgulidze, et al., 1976). Subacute doses have been shown to cause increased mortality, growth retardation, liver and kidney enlargement, and anorexia in a variety of species (McLellan, 1964; Shavgulidze, et al, 1976). Dogs given 20 mg/kg of 2,4-D for periods ranging from 18 to 49 days exhibited a terminal fall in lymphocyte count (Drill & Hiratzka, 1953).

Acute Toxicity in Animals -- 2,4-DP

2,4-DP is of moderate acute toxicity in mammals. The acute oral LD-50 is 400 mg/kg in mice, 500-800 mg/kg in rats, and 600 mg/kg in guinea pigs. In rats fed 2,4-DP for 90 days, no effect was observed at 12.4 mg/kg/day and slight liver enlargement was noted at 50 mg/kg/day. In a chronic feeding study of rats, Kagan (1983) reported increased serum glucosephosphate aldolase, decreased adrenal ascorbic acid, increased weight coefficients for liver and adrenals, and extended estrual cycle phases.

The dermal LD-50 in mice and rats is 1400-1900 mg/kg (NIOSH, 1979; Kagan, et al., 1983). A 2.4% solution was not found to irritate the skin (NIOSH, 1979). A 1% solution was

non-irritating to the eye. (NIOSH, 1979)

Kagan (1983) reported the results of inhalation studies in the rat. The threshold for toxicity in acute tests was 500 mg/m^3, and 25 mg/m^3 in chronic tests. Rats inhaling 25-50 mg/m^3 showed increased levels of aminopyridine demethylase and aniline hydroxylase in the liver. At 100 mg/m^3, serum aspartate aminotransferase was stimulated and blood glucose 6-phosphate dehydrogenase was inhibited.

Acute Toxicity in Humans -- Picloram

No studies of acute toxicity of picloram in humans were located. The EPA manual Recognition and Management of Pesticide Poisoning (Morgan, 1982) states that picloram is "irritating to the skin, eyes, and respiratory tract." From 1966 to 1980, the Health Effects Branch of the Office of Pesticide Programs at EPA maintained a Pesticide Incident Monitoring System (PIMS). A search of the PIMS files of unconfirmed reports of adverse effects on health or the environment yielded 48 incidents involving picloram (Health Effects Branch, 1980a). Of the incidents involving picloram alone (not in combination with other herbicides), seven entailed alleged health effects in humans involving nine persons. Four of the incidents were agriculture-related, two occurred at home, and one resulted from roadside exposure. One person was hospitalized and the remaining eight received medical attention. The symptoms reported were burning eyes and nose, swollen eyes and face, nausea, fever, headache, and body pain. Lawsuits have been filed throughout the U.S. alleging that exposure to Tordon (Dow's trademark for picloram

containing formulations) has caused a variety of ailments, including swollen joints, headaches, respiratory and eye problems, kidney damage, enlarged livers, and fatigue (Schneider, 1983; Nauss, 1982; Network News Inc., 1982).

Residents of a community in Alabama have expressed concern that picloram exposure led to the death of a seven-year-old boy (Sixty Minutes Transcript, 1983). The boy died from an apparent seizure that followed his eating an apple thought to have been contaminated with herbicide. Alabama's Pesticide Residue Laboratory found no detectable quantities of herbicide in tissue samples (Morgan, 1982; Santina, 1982). The pathologist who conducted an autopsy of the child reported that the only significant finding was edema of the brain, subcutaneous tissue, and the lung, and concluded that "within reasonable medical probability, this child succumbed to cardiac asystole and apnea due to epilepsy" (Santina, 1982).

Acute Toxicity of 2,4-D -- Human Studies

Under the Pesticide Incident Monitoring System (PIMS), EPA has received voluntary reports of 138 incidents involving human health effects allegedly associated with exposure to 2,4-D alone (Health Effects Branch, 1980b). Of these, one involved a fatality, 18 involved hospitalizations, and 92 were medical consultations. Unconfirmed symptoms included: burning sensation in the nose, mouth, throat, and chest (7 cases); difficulty breathing and unspecified respiratory problems (5 cases -- one with chest x-ray showing lung irritation); allergic nasopharyngitis (1), wheezing (1); worsening of existing

pulmonary restrictive and obstructive disease (1); nausea and vomitting (10); abdominal swelling (2); diarrhea (3); skin irritation (16); eye irritation (3); headache (4); fever (1); weakness (1); numbness, muscle tremors and spasms, and peripheral neuropathy (5); dizziness and light-headedness (13); loss of speech control (1); depression (1); drowsiness (1); and cerebral edema causing death (1).

Several investigations of deaths associated with 2,4-D exposure have been published. Following ingestion of an undetermined quantity of pure 2,4-D, an elderly man with senile dementia went into a coma, showing signs of myotonia. He died six days later, presumably as a direct result of atrial fibrillation induced by muscle irritability (Dudley & Thapar, 1972). Autopsy revealed widespread plaques of acute demyelination in all parts of the brain. In the suicide of a 23-year-old following ingestion of at least 80 mg/kg 2,4-D, all organs exhibited acute congestion (Nielsen, et al., 1965). Ganglion cells of the central nervous system showed severe degenerative changes.

Occupational exposure to 2,4-D has resulted in reported adverse health effects. Workers involved in the manufacture of 2,4-D reported anorexia and gastralgia, increased salivation, a sweet taste in the mouth, a drunken feeling, heaviness of the legs, hyperacusia, and somnolence (Assouly, 1951). Agricultural workers experienced the following symptoms following spraying of 2,4-D: vomiting, diarrhea, fever, muscular weakness, tachycardia and hyperthermia (Monarca & DiVito, 1961; Paggiaro, et al.,

1974; Todd, 1962). In the cases of two of these workers, there were neurological symptoms lasting up to two years, including loss of deep-tendon reflexes and paralysis of leg muscles. Another occupational cohort reportedly experienced fatigue, headache, loss of appetite, loss of sense of taste and smell, and pains in the area of the stomach and liver (Fetisor, 1966).

Examination of 292 workers exposed to 2,4-D ester and acid for up to ten years revealed that almost two thirds experienced excessive weakness, fatigue, headache or vertigo (Bashirov, 1965). One fifth had cardiovascular problems, particularly hypotension and bradycardia, and digestive disturbances including dyspeptic symptoms and gastritis. Liver dysfunction was found to be more severe with longer exposure. Another study noted increased blood cholesterol in workers involved in 2,4-D manufacture (Lukoshkira, et al., 1970). The investigators also reported decreased serum albumin levels, increased globulins, decreased blood sugar levels and altered glucose tolerance. No "meaningful" differences were found in the health profiles of 220 workers exposed to 2,4-D compared to 4600 unexposed men (Johnson, 1971).

In a clinical trial, six volunteers were given a single oral dose of 5 mg/kg of pure 2,4-D. No adverse effects were noted (Kohli, et al., 1974). Blood pressure, pulse rate, hemoglobin content and white cell counts were unchanged. No adverse effects were noted in a person who had ingested 8 mg/kg/day 2,4-D for three weeks (Mitchell, et al., 1946).

Acute Toxicity in Humans -- 2,4-DP

No published reports of acute toxicity in humans could be located. EPA's Pesticide Information Monitoring System has not been sorted by 2,4-DP and, thus, information on incidents involving this herbicide is not accessible (Boland, 1986). Libich (1984) has suggested that the toxicity of 2,4-DP in humans is likely to resemble that of 2,4-D.

Study Objective and Approach

Prompted by a few isolated reports of health effects among the residents of Gorgus after the spraying incident, the present study sought to obtain information on the experience of the entire community in a systematic manner, using a retrospective cohort design. In the absence of exposure measurements and medical records, interviews were conducted to evaluate exposure and health outcomes. Residents of Gorgus and visitors to the area at the time of the spraying were interviewed regarding their recollection of events at the time of and following the spraying. For comparison, residents of an unexposed referent community were interviewed regarding their health experience over the same time period to obtain an estimate of the baseline profile of symptoms (technically, the expected incidence of symptom onset or aggravation over the study period).

Information was sought on a large number of symptoms for thoroughness and assessment of over-reporting. Because of concern over the statistical aspects of multiple testing, one type of symptom was singled out to be tested for association with exposure first, and the rest were tested in an exploratory

analysis. Respiratory symptoms were of particular interest in light of the following facts:

1) Some of the initial complaints by Gorgus residents related to respiratory symptoms.

2) Some inhalatory exposure is known to have occurred because residents reported chemical odor in the air.

3) Animal data on the respiratory effects of these herbicides is scant and largely negative.

4) EPA's Pesticide Incident Monitoring System has received numerous reports alleging respiratory problems resulting from exposure to phenoxy compounds and picloram.

5) Pesticide poisoning manuals list phenoxy compounds and picloram as respiratory irritants.

6) No epidemiological studies of the respiratory effects of these herbicides have been published.

METHODS

Study Population

The community of Gorgus lies adjacent to the Boise Cascade timber tract. It is a predominantly black rural hamlet of less than 100 residents, most of whom are related by either blood or marriage to a couple who settled in the area in the 1840's. This quiet, somewhat isolated community occupies roughly 1000 acres, bounded on three sides by county roads 1954, 1955, and 1956, and on the fourth by the convergence of the Deep and Rocky Rivers. The mostly forested and rugged land is used to a limited extent to cultivate cash crops -- corn and tobacco -- and vegetables for home consumption, and for raising cows, goats and chickens. The economic status of the households ranges from low to middle income, and is reflected in the mixture of dilapidated and well-maintained homes. The black residents are a closely-knit group with a strong sense of community and a combination of traditional and progressive values. The dominant social structure is the community church. The elderly remain at home and are cared for; many of the young never leave, although high educational achievement is encouraged and a large proportion of the young attend college.

The community of Gum Springs, two miles from Gorgus, was selected to be the referent, unexposed group. Conversations with key community contacts and on-site observation indicated that the communities were demographically and socio-economically similar. The proximity of the communities ensured geographic control and

similar employment opportunities. It also simplified the task of coordinating interview schedules. A difference between the communities was an advantage from the design perspective: the boundaries of Gum Springs are less discreetly defined than in Gorgus, allowing recruitment of subjects on the periphery until the desired exposed:unexposed ratio (1:3) was achieved.

Data Collection

A questionnaire was developed to obtain information on demographic and socio-economic variables, occupational and medical history, health status and frequency of selected symptoms, exposure, and attitudes regarding pesticides and the incident. (The results of the attitude survey are not discussed in this report.) It was pilot-tested on three individuals from a similar neighborhood in the Rougemont area north of Durham and on one person (the key contact) from Gorgus. The questionnaire was modified following the pilot tests and the final version is attached (Appendix H).

Key contacts in Gorgus and Gum Springs were consulted for purposes of mapping and enumerating the households in each community. The phone number and location of each household and the name and approximate age of each household member were solicited. The key contacts agreed to announce and endorse this "environmental health study" at church and other social occasions and to encourage participation.

Five interviewers were hired and trained using role-playing techniques. Interviews were conducted over a two-week period in August 1983. For households with a telephone, subjects were

contacted by telephone and, if the subject consented, a convenient time was arranged for an interviewer to meet with him/her at home. Interviewers were randomly assigned. If the subject was under 12 years of age, a parent or guardian was interviewed, and a shortened form of the questionnaire was used, omitting the attitude survey and questions relating to occupation, education, marital status, and smoking habits. If the subject was between ages 12 and 18, the attitude survey was omitted. If the subject was ill, a care-giver was interviewed, and the attitude survey was omitted. Names and phone numbers of all visitors to Gorgus around the time of the spraying were solicited from Gorgus residents during the interview and, upon completion of the on-location interviews, a list of visitors was compiled. Over the next two months, attempts were made to contact by telephone all those visitors for whom permission to contact had been given by the Gorgus resident visited. An abridged version of the questionnaire was used in the telephone interviews: only information on age, race, sex, occupation, regularity of medical check-ups, perceived route of exposure, time spent in Gorgus, and the full symptoms profile was sought.

Keypunching of the coded data, editting, and verification were performed by personnel at the North Carolina Center for Health Statistics.

Analysis

First, the distributions of various demographic attributes in the exposed and unexposed groups were compared.

Next, the *a priori* hypotheses that:

1) a significantly larger proportion of the exposed group will report an aggravation of respiratory symptoms during the study period than in the unexposed group,

and, 2) the proportion of the exposed group reporting aggravation of a dummy symptom, fingernails breaking, will not be statistically significantly larger than in the unexposed group,

were tested. Crude analyses were performed using the logit risk ratio estimator, with precision-based confidence intervals (Kleinbaum, Kupper, & Morgenstern, 1982). Fisher's exact one-tailed test was used to assess significance of the crude risk ratios (Kendall & Stuart, 1979). The required level of significance was selected to be 0.025. Stratified analyses incorporating the control variables (age, sex, race, smoking status, and educational attainment) one at a time were performed to assess interaction and confounding. The TFREQ procedure, available in SAS, was used. This procedure produces a 2 X 2 E-D table for each level of the control variable and computes chi-square tests and measures of association within and across strata. The Breslow-Day test for homogeneity of the stratum-specific odds ratios was used to assess interaction (Breslow and Day, 1980). Where interaction was not considered to be significant, confounding was assessed by comparing the Mantel-Haenszel adjusted risk ratio to the crude risk ratio (Kleinbaum, Kupper, and Morgenstern, 1982). The Mantel-Haenszel estimator was selected due to the large number of zero cells in the stratified analyses. The Cochran-Mantel-Haenszel general association statistic was used to test significance of the adjusted relative risks (Cochran, 1954; Mantel & Haenszel, 1959; Mantel, 1963). Test-based confidence intervals were used for the

adjusted relative risk estimates, due to the abundance of zero cells in the stratified analyses (Kleinbaum, Kupper, and Morgenstern, 1982).

After the hypothesis-testing phase of analysis, an exploratory analysis was conducted. Association of worsening of each of the 32 symptoms with exposure status was investigated, using the TFREQ procedure, as above.

Those persons reporting a worsening of any of the symptoms significantly associated with exposure within a month of the incident were defined as "reactors". The reactors were characterized according to severity and persistence of symptoms, timing of onset, previous health status, and whether a doctor was consulted. Finally, reactors were compared with non-reactors in the exposed group with respect to a variety of characteristics including age, smoking, SES indices, location relative to the sprayed area, time spent at home after the spraying, and accuracy of recall.

RESULTS

Descriptive Statistics

Response rates for the different groups are shown in Table 2. Cooperation was exceptional; only one individual refused to cooperate, because of a general animosity toward the state government. As indicated in Table 2, most non-response was due to failure to find the subject at home. Useful data were obtained for 88% (52/59) of the residents of Gorgus. Telephone interviews were completed with 73% (33/45) of the visitors to Gorgus. In the reference community, a response rate of 99% (159/161) was achieved. Useful data were obtained for a total of 85 exposed persons (52 residents interviewed at home, 33 visitors interviewed by telephone), and 159 unexposed persons. The ratio of exposed to unexposed subjects interviewed at home (using the full questionnaire) was 1:3.1 and the ratio of exposed to unexposed subjects interviewed either by telephone or at home was 1:1.9.

Distributions of various demographic and socio-economic attributes in the exposed and unexposed populations are shown in Tables 3 through 11. The sex, race, and age distributions of the exposed and referent groups were similar. Sixty percent of the exposed subjects were female, while 58% of the unexposed were female (Table 3). Among the exposed, 88% were black, 11% white, and 1% Lumbee. Among the unexposed, 82% were black, 16% white, and 3% Lumbee (Table 3). The age structures of the two groups were remarkably similar. In each group, 22% were under age 12

Table 2. Distribution of Non-Respondents

Exposed Residents		
Too sick	1	
Inebriated	1	
Not home	1	
Did not recall incident	1	
Wrong questionaire used	3	
	7	(Non-Response Rate: 7/59 = 12%)
Exposed Visitors		
Permission to contact not provided	3	
No phone	5	
Not home	4	
	12	(Non-Response Rate: 12/45 = 27%)
Unexposed		
Refused	1	
Not home	1	
	2	(Non-Response Rate: 2/161 = 1%)

Table 3. Sex/Race Composition of Exposed and Unexposed Populations*

	Black		White		Lumbee		
	Women	Men	Women	Men	Women	Men	Total
Exposed	45(53)	30(35)	5(6)	4(5)	1(1)	0	85
Unexposed	75(47)	55(35)	15(9)	10(6)	3(2)	1(1)	159

* Parenthetical values are row percentages.

Table 4. Age Distribution of Exposed and Unexposed Populations*

	Age in Years								
	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70+	Total
Exposed	16(19)	11(13)	7(8)	13(15)	15(18)	6(7)	9(11)	8(10)	85
Unexposed	30(19)	23(14)	23(14)	18(11)	24(15)	11(7)	22(14)	8(5)	159

* Parenthetical values are row percentages.

Table 5. Educational Attainment of Subjects* Over Age 18 By Exposure Status**

	Years of Schooling		
	≤ 12	12	≥ 12
Exposed	16(50)	7(22)	9(28)
Unexposed	51(48)	37(35)	19(18)

*Residents only -- information not collected from visitors.
**Parenthetical values are row percentages.

Table 6. Employment Status of Subjects Over Age 18 by Exposure Status*

	Employed	In School	Homemaker	Unemployed/ Seeking Em.	Handicapped	Retired
Exposed	33(60)	2(4)	8(15)	0	2(4)	10(18)
Unexposed	66(60)	2(2)	7(6)	12(11)	1(1)	21(19)

* Parenthetical values are row percentages.

Table 7. Occupational Category of Employed Subjects Over Age 18 by Exposure Status*

	Blue Collar/ Low Skill	Blue Collar/ High Skill	White Collar/ Low Skill	White Collar/ High Skill
Exposed	10(30)	5(15)	6(18)	12(36)
Unexposed	36(57)	13(21)	9(14)	5(8)

* Parenthetical values are row percentages.

Table 8. Smoking Status of Subjects Over Age 12 by Reactor Status*

	Current Smoker	Ex-Smoker	Non-Smoker
Reactor	6(43)	3(21)	5(36)
Non-Reactor	10(20)	10(20)	31(61)

* Parenthetical values are row percentages.

Table 9. Cigarette Consumption of Current Smokers by Exposure Status*

	≤1/2 pack/day	1/2-2 pack/day	≥2 pack/day
Exposed	5(33)	10(67)	0
Unexposed	12(36)	21(64)	0

* Parenthetical values are row percentages.

Table 10. Pattern of Health Services Utilization by Exposure Status*

	Regular Check-Ups	No Regular Check-Ups
Exposed	62(75)	21(25)
Unexposed	114(75)	39(25)

* Parenthetical values are row percentages.

Table 11. Personal Use of Pesticides Among Subjects* Over Age 18 by Exposure Status**

	Personal Use	No Personal Use
Exposed	30(97)	1(3)
Unexposed	83(78)	23(22)

*Residents only -- information not collected from visitors.
**Parenthetical values are row percentages.

and therefore a parent was interviewed. Nine percent of each group was between the ages of 12 and 18 and thus were not administered the attitude survey. Twenty percent of the exposed and 19% of the unexposed were over 60 years of age. A more detailed breakdown of the age distribution is presented in Table 4.

The Gorgus population had somewhat more schooling than the reference group, had more white-collar and high-skill jobs, and less unemployment. Although about half of the adults in each community had not finished high school, 28% of the Gorgus adults had some schooling beyond high school, while only 18% of the reference adults had post-high school education (Table 5). The distribution of employment status was similar in the two groups, with 60% of those over 18 employed in each group (Table 6). The most marked difference between the groups with respect to employment status was in the percentage of homemakers and unemployed or seeking employment. In Gorgus, 15% were homemakers and no one reported being unemployed or in search of employment, whereas in Gum Springs 6% were homemakers and 11% were unemployed or seeking employment. Among the employed in each community, the type of job held varied markedly between the two groups (Table 7). Jobs were categorized roughly along two dimensions: white- vs. blue-collar and low- vs. high-skill level. Fifty-five per cent of employed Gorgus residents worked in white-collar types of jobs, whereas this was true of only 22% of the Gum Springs work force. And, whereas 52% of the Gorgus workers were employed in high-skill occupations, only 29% of the Gum Springs workers were

so employed.

Smoking habits of the exposed and referent groups were similar (Tables 8 and 9). Of the exposed subjects over 12 years of age, 29% were current smokers, 20% were ex-smokers, and 43% were non-smokers, while among the unexposed the respective percentages were 33%, 22%, and 42%. Among the current smokers, the number of packs smoked per day was also distributed similarly between the two groups. About a third of the smokers in both groups were light smokers (less than 1/2 pack per day), two thirds were moderate smokers (1/2 to 2 packs per day), and none smoked over two packs a day.

Hypotheses Tests

A significantly higher proportion of the exposed population reported a worsening of at least one respiratory symptom (cough, difficulty breathing, wheezing, sinus congestion, hay fever, asthma, runny nose, burning on breathing) over the study period than of the unexposed: 28 subjects (33%) from Gorgus, compared to 4 (3%) from Gum Springs (Table 12). The crude risk ratio was 13.1, with a p-value less than 0.001 and 95% confidence interval of (6, 28). The results of stratifying by age, sex, race, smoking status, and educational attainment are shown in Table 13. The Breslow- Day test for homogeneity was not significant for any of the control variables. In the absence of significant interaction, confounding was assessed. The Mantel-Haenszel risk ratios adjusted for the control variables age, sex, race, and smoking status were negligibly different from the crude risk ratio. Controlling for educational attainment resulted in a

Table 12. Association of Grouped Respiratory Symptoms with Exposure: Results of Crude Analysis

	Symptom Aggravated	Symptom Not Aggravated	Total
Exposed	28	57	85
Unexposed	4	155	159

Crude RR = 13.1
Precision-Based 95% Confidence Interval = (4.7, 36.1)
Fisher's Exact (One-Tailed) Test, P-Value < 0.001

Table 13. Association of Grouped Respiratory Symptoms with Exposure: Results of Stratified Analyses

Control Variable	Breslow-Day Test for Homogeneity (P-Value)	Mantel-Haenszel Adjusted Risk Ratio	C-M-H Test for General Association (P-Value)
Age (0-9/10-19/20-59/60+)	0.42	13.3	0.000
Sex (male/female)	0.87	13.1	0.000
Race (black/white/Lumbee)	0.73	13.4	0.000
Smoking Status (smoker/non-smoker)	0.71	13.5	0.000
Educational Attainment (<12 yrs/12 yrs/>12 yrs)	0.10	10.1	0.000

Crude RR = 13.1
Fisher's Exact Test (P-Value) = 0.000

modest change in the risk ratio from 13.1 to 10.1.

Worsening of the dummy symptom "breaking fingernails" was tested for association with exposure status (Table 14). The risk ratio was 3.1 with a p-value of 0.100 and 95% confidence interval of (0.8, 12.7).

Exploratory Analysis

The results of running the TFREQ procedure on each of the 32 symptoms are shown in Table 15. A consistently greater proportion of the exposed group reported worsening of symptoms than in the unexposed group, indicating a systematic bias that will be discussed in the "Discussion" section. For eight symptoms, the crude risk ratio for the exposure-worsened symptom relationship was associated with a p-value of less than 0.025. These symptoms, in order of the association's significance, were: cough (RR=12.2), difficulty breathing (RR=12.2), sinus congestion (RR=6.2), runny nose (RR=8.4), swollen glands (RR=11.2), skin peeling (RR=16.7), wheezing (RR=5.6), and dizziness (RR=5.6).

For the eight symptoms significantly associated with exposure, stratified analyses for each control variable were performed (Tables 16 through 23). The Breslow-Day test for homogeneity was not significant for any of the stratified analyses. In the absence of significant interaction, it became appropriate to compare the adjusted Mantel-Haenszel risk ratios to the crude risk ratio for each symptom. Adjustment for age, sex, race or smoking did not alter the finding of significant association of symptom with exposure, nor were the magnitudes of the risk ratios materially altered. Because adjustment for

Table 14. Association of "Breaking Fingernails" with Exposure: Results of Crude Analysis

	Symptom Aggravated	Symptom Not Aggravated	Total
Exposed	5	80	85
Unexposed	3	156	159

Crude RR = 3.1
Precision-Based 95% Confidence Interval = (0.8, 12.7)
Fisher's Exact (One-Tailed) Test, P-Value = 0.10

Table 15. Association of Each Symptom Queried with Exposure: Results of Crude Analyses

Symptom	Observed Among Exposed	RR	Precision-Based 95% CI	Fisher's Exact Test P-Value
Cough	13	12.2	(2.8, 52.6)	0.000
Difficulty breathing	13	12.2	(2.8, 52.6)	0.000
Sinus congestion	10	6.2	(1.8, 22.0)	0.002
Runny nose	9	8.4	(1.9, 38.1)	0.002
Swollen glands	6	11.2	(1.4, 91.7)	0.008
Skin peeling	4	16.7	(0.9, 307.3)	0.014
Wheezing	6	5.6	(1.2, 27.2)	0.023
Dizziness	6	5.6	(1.2, 27.2)	0.023
Blurred vision	9	2.8	(1.0, 7.6)	0.036
Nausea	7	3.3	(1.0, 10.9)	0.045
Hay fever	4	7.5	(0.8, 65.9)	0.051
Constipation	4	7.5	(0.8, 65.9)	0.051
Vomitting	5	4.7	(0.9, 23.6)	0.052
Skin rash	9	2.4	(0.9, 6.2)	0.059
Burning eyes	8	2.5	(0.9, 7.0)	0.068
Upset stomach	7	2.6	(0.9, 8.0)	0.077

Table 15. Association of Each Symptom Queried with Exposure: Results of Crude Analysis (Continued)

Symptom	Observed Among Exposed	RR	95% CI	P-Value
Fatigue	9	2.1	(0.8, 5.2)	0.089
Breaking fingernails	5	3.1	(0.8, 12.7)	0.100
Headaches	10	1.9	(0.8, 4.3)	0.109
Chest pain	4	3.7	(0.7, 20.0)	0.113
Asthma	2	9.3	(0.4, 191.6)	0.120
Hair loss	3	5.6	(0.6, 53.1)	0.123
Swollen eyes	6	2.2	(0.7, 7.1)	0.141
Lack of appetite	5	2.3	(0.6, 8.5)	0.165
Blood in urine	3	2.8	(0.5, 16.5)	0.231
Bleeding gums	2	3.7	(0.3, 40.7)	0.279
Burning on breathing	2	5.6	(0.2, 135.5)	0.348
Easy bruising	1	5.6	(0.2, 135.5)	0.348
Fainting	1	5.6	(0.2, 135.5)	0.348
Burning on urination	1	5.6	(0.2, 135.5)	0.348
Aching joints	1	0.8	(0.3, 2.4)	0.494
Seizures	0	--	--	--

Table 16. Association of "Cough" with Exposure: Results of Stratified Analyses

Control Variable	Breslow-Day Test for Homogeneity (P-Value)	Mantel-Haenszel Adjusted Risk Ratio	C-M-H Test for General Association (P-Value)
Age (0-9/10-19/20-59/60+)	0.32	12.6	0.000
Sex (male/female)	0.97	12.2	0.000
Race (black/white/Lumbee)	0.75	13.6	0.000
Smoking Status (smoker/non-smoker)	0.30	9.0	0.000
Educational Attainment (<12 yrs/12 yrs/>12 yrs)	0.36	11.3	0.000

Crude RR = 12.2
Fisher's Exact Test (P-Value) = 0.000

Table 17. Association of "Difficulty Breathing" with Exposure: Results of Stratified Analyses

Control Variable	Breslow-Day Test for Homogeneity (P-Value)	Mantel-Haenszel Adjusted Risk Ratio	C-M-H Test for General Association (P-Value)
Age (0-9/10-19/20-59/60+)	0.47	12.0	0.000
Sex (male/female)	0.17	12.5	0.000
Race (black/white/Lumbee)	0.75	13.6	0.000
Smoking Status (smoker/non-smoker)	0.94	10.5	0.000
Educational Attainment (<12 yrs/12 yrs/>12 yrs)	0.23	8.15	0.002

Crude RR = 12.2
Fisher's Exact Test (P-Value) = 0.000

Table 18. Association of "Sinus Congestion" with Exposure: Results of Stratified Analyses

Control Variable	Breslow-Day Test for Homogeneity (P-Value)	Mantel-Haenszel Adjusted Risk Ratio	C-M-H Test for General Association (P-Value)
Age (0-9/10-19/20-59/60+)	0.49	6.2	0.001
Sex (male/female)	0.12	6.3	0.001
Race (black/white/Lumbee)	0.11	6.4	0.001
Smoking Status (smoker/non-smoker)	0.35	6.3	0.001
Educational Attainment (<12 yrs/12 yrs/>12 yrs)	0.03	4.4	0.030

Crude RR = 6.2
Fisher's Exact Test (P-Value) = 0.002

Table 19. Association of "Runny Nose" with Exposure: Results of Stratified Analyses

Control Variable	Breslow-Day Test for Homogeneity (P-Value)	Mantel-Haenszel Adjusted Risk Ratio	C-M-H Test for General Association (P-Value)
Age (0-9/10-19/20-59/60+)	0.74	8.3	0.001
Sex (male/female)	0.67	8.4	0.001
Race (black/white/Lumbee)	0.06	9.1	0.001
Smoking Status (smoker/non-smoker)	0.34	14.1	0.001
Educational Attainment (<12 yrs/12 yrs/>12 yrs)	0.39	5.9	0.012

Crude RR = 8.4
Fisher's Exact Test (P-Value) = 0.002

Table 20. Association of "Swollen Glands" with Exposure: Results of Stratified Analyses

Control Variable	Breslow-Day Test for Homogeneity (P-Value)	Mantel-Haenszel Adjusted Risk Ratio	C-M-H Test for General Association (P-Value)
Age (0-9/10-19/20-59/60+)	0.81	10.7	0.004
Sex (male/female)	0.22	11.5	0.004
Race (black/white/Lumbee)	1.0	10.4	0.006
Smoking Status (smoker/non-smoker)	0.45	11.2	0.003
Educational Attainment (<12 yrs/12 yrs/>12 yrs)	0.63	11.1	0.007

Crude RR = 11.2
Fisher's Exact Test (P-Value) = 0.008

Table 21. Association of "Peeling Skin" with Exposure: Results of Stratified Analyses

Control Variable	Breslow-Day Test for Homogeneity (P-Value)	Mantel-Haenszel Adjusted Risk Ratio	C-M-H Test for General Association (P-Value)
Age (0-9/10-19/20-59/60+)	0.35	8.4	0.006
Sex (male/female)	0.35	8.8	0.005
Race (black/white/Lumbee)	0	15.0	0.008
Smoking Status (smoker/non-smoker)	0.37	8.2	0.010
Educational Attainment (<12 yrs/12 yrs/>12 yrs)	0.41	7.0	0.027

Crude RR = 16.7
Fisher's Exact Test (P-Value) = 0.014

Table 22. Association of "Wheezing" with Exposure: Results of Stratified Analyses

Control Variable	Breslow-Day Test for Homogeneity (P-Value)	Mantel-Haenszel Adjusted Risk Ratio	C-M-H Test for General Association (P-Value)
Age (0-9/10-19/20-59/60+)	0.20	5.5	0.017
Sex (male/female)	0.37	5.8	0.014
Race (black/white/Lumbee)	0.11	6.0	0.017
Smoking Status (smoker/non-smoker)	0.69	5.3	0.022
Educational Attainment (<12 yrs/12 yrs/>12 yrs)	0.50	5.6	0.025

Crude RR = 5.6
Fisher's Exact Test (P-Value) = 0.023

Table 23. Association of "Dizziness" with Exposure: Results of Stratified Analyses

Control Variable	Breslow-Day Test for Homogeneity (P-Value)	Mantel-Haenszel Adjusted Risk Ratio	C-M-H Test for General Association (P-Value)
Age (0-9/10-19/20-59/60+)	0.14	5.5	0.015
Sex (male/female)	0.69	5.6	0.016
Race (black/white/Lumbee)	0.23	5.5	0.013
Smoking Status (smoker/non-smoker)	0.29	5.6	0.014
Educational Attainment (<12 yrs/12 yrs/>12 yrs)	0.24	5.2	0.057

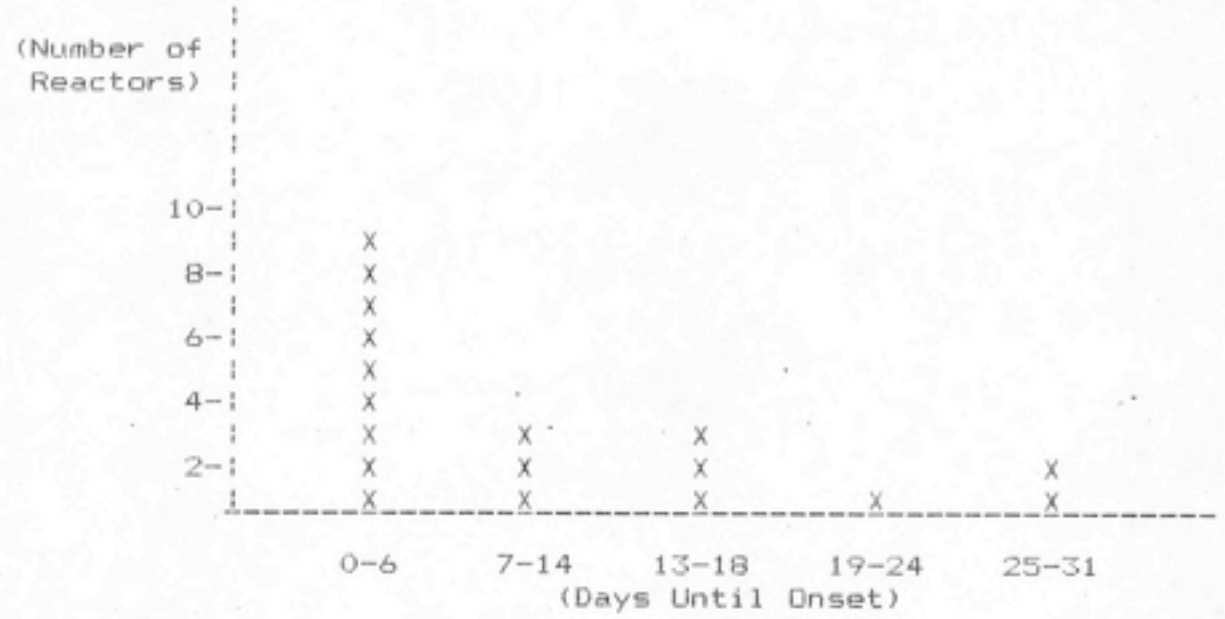
Crude RR = 5.6
Fisher's Exact Test (P-Value) = 0.023

educational attainment required dropping those under 18 years of age, the power in the analyses stratifying by education was reduced and in a few cases (sinus congestion, skin peeling, and dizziness), the p-value for the Mantel-Haenszel risk ratio was no longer less than 0.025 (the a priori required level of significance), although it remained less than 0.05 and the magnitude of the adjusted risk ratio remained similar to that of the crude risk ratio.

Characterization of "Reactors"

The "reactor" group was defined as those exposed subjects who reported a worsening, within one month following the spraying, of any of the symptoms significantly associated with exposure. Eighteen persons fell into this category. For thirteen of the reactors, the symptoms were reportedly new rather than a worsening of an existing condition. The distribution of time of onset of worsened symptoms was skewed toward the time of the spraying (Figure 2) Eight of the reactors reported that the onset of their worsened condition occurred within three days of the spraying, 12 reported the onset to have occurred within a week, and 14 within two weeks. Four reactors reported that their symptoms following exposure were "severe" (e.g., "incapacitating"), eight reported "moderate" severity (e.g., "interfered with usual activities") and six reported "mild" severity (e.g., "mildly irritating"). Eleven reactors reported that their worsened condition persisted one week or less, while three reported persistence of over one month. Eight consulted a doctor about their symptoms. In one case, the doctor considered

Figure 2. Timing of Onset of Reactor Symptoms



the symptoms to be related to the exposure, and in another, the doctor said the condition was "possibly" related.

The distribution of age, race and sex in the reactors and non-reactors was similar (Tables 24 through 26). The proportion of current smokers among the reactors was over twice that among the non-reactors, while cigarette consumption of current smokers was similar in reactors and non-reactors (Tables 27 and 28). According to both the education and occupation variables, the reactors tended to be of a higher socioeconomic status (Tables 29 and 30).

In response to the question, "Can you recall a time when you were exposed to a pesticide at home within the last two years, other than times when you applied a pesticide yourself or hired an exterminator?", a greater proportion of the reactors than of the non-reactors recalled the spraying incident without prompting (Table 31). Accuracy of recall of the date of the spraying was similar between the reactors and non-reactors, but familiarity with the identity of the sprayed material was more prevalent among the reactors (Tables 32 and 33).

The distribution of hours spent in Gorgus (Table 34) indicates that, compared to the non-reactors, the reactors reported being in Gorgus for a greater part of the day during the spraying, the first day after the spraying, on average over the first week after the spraying, and on average over the first month after the spraying. Certain questions regarding exposure were asked only of Gorgus residents (i.e., not visitors) over age 18, so numbers are small (Tables 35 through 40). All twelve of the adult resident reactors responded affirmatively to the

Table 24. Sex Distribution by Reactor Status*

	Male	Female
Reactor	9(50)	9(50)
Non-Reactor	25(37)	42(63)

* Parenthetical values are row percentages.

Table 25. Race Distribution by Reactor Status*

	Black	White	Lumbee
Reactor	15(83)	3(17)	0
Non-Reactor	60(90)	6(9)	1(1)

* Parenthetical values are row percentages.

Table 26. Age Distribution of Gorgus Residents by Reactor Status*

	Age (years)				
	0-12	13-18	19-60	61+	Total
Reactor	3(17)	3(17)	7(39)	5(28)	18
Non-Reactor	16(24)	5(7)	34(51)	12(18)	67

* Parenthetical values are row percentages.

Table 27. Smoking Status of Subjects Over Age 12 by Reactor Status*

	Current Smoker	Ex-Smoker	Non-Smoker
Reactor	6(43)	3(21)	5(36)
Non-Reactor	10(20)	10(20)	31(61)

* Parenthetical values are row percentages.

Table 28. Cigarette Consumption of Current Smokers by Reactor Status*

	< 1/2 pack/day	1/2 - 2 packs/day	> 2 packs/day
Reactor	2(33)	4(67)	0
Non-Reactor	3(33)	6(67)	0

* Parenthetical values are row percentages.

Table 29. Educational Attainment of Gorgus Subjects* Over Age 18 by Reactor Status**

	Years of Schooling		
	< 12	12	> 12
Reactor	4(44)	0	5(56)
Non-Reactor	14(56)	7(28)	4(16)

*Residents only -- information not collected from visitors.
**Parenthetical values are row percentages.

Table 30. Occupational Category of Employed Gorgus Subjects by Reactor Status*

	Blue Collar/ Low Skill	Blue Collar/ High Skill	White Collar/ Low Skill	White Collar/ High Skill
Reactor	0	1(14)	1(14)	5(71)
Non-Reactor	10(38)	4(15)	5(19)	7(27)

* Parenthetical values are row percentages.

Table 31. Spontaneous Recall of Spraying Incident of Gorgus Subjects* Over Age 18 by Reactor Status**

	Recalled Spontaneously	Did Not Recall Spontaneously
Reactor	9(90)	1(10)
Non-Reactor	14(61)	9(39)

*Residents only -- information not collected from visitors.
**Parenthetical values are row percentages.

Table 32. Accuracy of Recall of Date of Spraying, Gorgus Subjects Over Age 18, by Reactor Status*,**

	Recalled Precisely	Recalled Approximately	Recalled Incorrectly or Did Not Know
Reactor	8(73)	1(9)	2(18)
Non-Reactor	15(65)	3(13)	5(22)

*Residents only -- information not collected from visitors.
**Parenthetical values are row percentages.

Table 33. Knowledge of Identity of Sprayed Material, Gorgus Subjects* Over Age 18, by Reactor Status**

	Knew Precise Identity	Knew Approximate Identity	Did Not Know Identity
Reactor	6(60)	2(20)	2(20)
Non-Reactor	3(13)	4(18)	16(70)

*Residents only -- information not collected from visitors.
**Parenthetical values are row percentages.

Table 34. Time Spent in Gorgus by Reactor Status*

	Time Spent in Gorgus (hours/day)			
	0	1-7	8-15	16-24
During Spraying				
Reactor	2(13)	1(7)	2(13)	10(67)
Non-Reactor	16(40)	5(12)	5(12)	14(35)
First Day After Spraying				
Reactor	2(13)	0	1(7)	12(80)
Non-Reactor	14(30)	3(7)	10(22)	19(41)
First Week After Spraying				
Reactor	0	1(7)	2(14)	11(79)
Non-Reactor	2(4)	4(9)	12(27)	27(60)
First Month After Spraying				
Reactor	1(7)	0	1(7)	12(86)
Non-Reactor	9(24)	3(8)	7(18)	19(50)

* Parenthetical values are row percentages.

Table 35. "Do you think you were exposed?", Gorgus Subjects* Over Age 18, by Reactor Status**

	Yes	No	Do Not Know
Reactor	12(100)	0	0
Non-Reactor	13(57)	7(30)	3(13)

*Residents only -- information not collected from visitors.
**Parenthetical values are row percentages.

Table 36. Presence in Spray Path, Gorgus Subjects* Over Age 18, by Reactor Status**

	In Spray Path	Not In Spray Path
Reactor	2(17)	10(83)
Non-Reactor	0	22(100)

*
Residents only -- information not collected from visitors.
**Parenthetical values are row percentages.

Table 37. Presence at Time of Spraying, Gorgus Subjects* Over Age 18, by Reactor Status**

	At Home During Spraying	Not At Home During Spraying
Reactor	12(100)	0
Non-Reactor	21(91)	2(9)

*Residents only -- information not collected from visitors.
**Parenthetical values are row percentages.

Table 38. Odor Detected After Spraying, Gorgus Subjects* Over Age 18, by Reactor Status**

	Odor Detected	Odor Not Detected
Reactor	11(92)	1(8)
Non-Reactor	18(78)	5(22)

*Residents only -- information not collected from visitors.
**Parenthetical values are row percentages.

Table 39. Chemical Felt on Skin, Gorgus Subjects* Over Age 18, by Reactor Status**

	Felt Chemical	Did Not Feel Chemical
Reactor	3(25)	9(75)
Non-Reactor	2(9)	20(91)

*Residents only -- information not collected from visitors.
**Parenthetical values are row percentages.

Table 40. Chemical Tasted, Gorgus Subjects* Over Age 18, by Reactor Status**

	Tasted Chemical	Did Not Taste Chemical
Reactor	3(25)	9(75)
Non-Reactor	2(9)	20(91)

*Residents only -- information not collected from visitors.
**Parenthetical values are row percentages.

question, "Do you think you were exposed?" (Table 35). Two of the reactors in this group reported that they were in the direct path of the spray while none of the non-reactors were (Table 36). Eleven of twelve and 13 of 23 of the reactors and non-reactors, respectively, reported noting an odor in Gorgus after the spraying (Table 38).

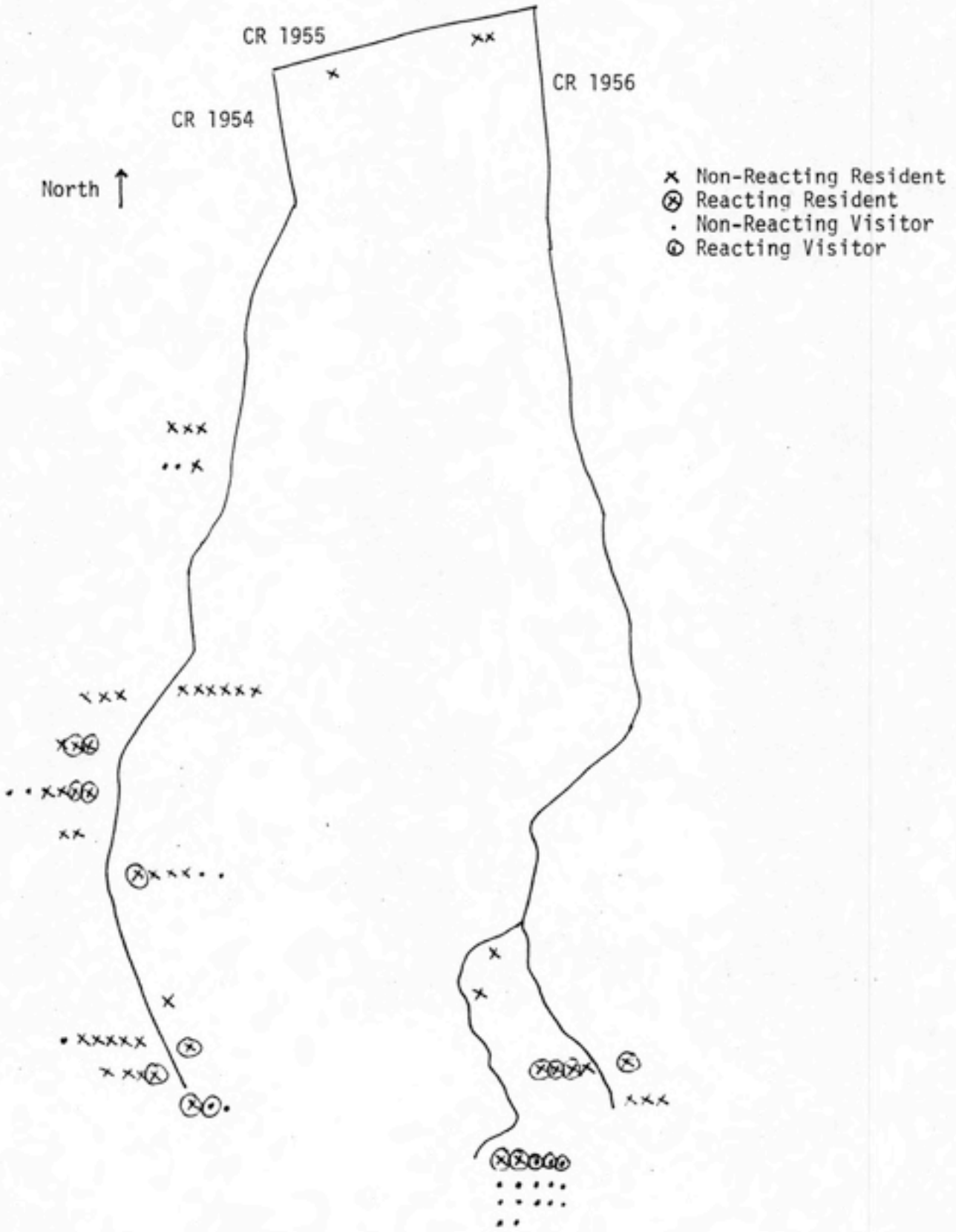
A map depicting where each Gorgus resident resided and where each Gorgus visitor visited, distinguishing between reactors and non-reactors, is attached (Figure 3 and Table 41). There is no apparent clustering of the reactors; they seem to be randomly distributed between East and West Gorgus.

Table 41. Geographical Distribution of Gorgus Subjects by Reactor Status*

	West Gorgus Resident	East Gorgus Resident	North Gorgus Resident	West Gorgus Visitor	East Gorgus Visitor
Reactor	8(44)	6(33)	0	1(6)	3(17)
Non-Reactor	25(37)	8(12)	5(7)	9(13)	20(30)

* Parenthetical values are row percentages.

Figure 3. Geographic Distribution of Reactors and Non-Reactors



DISCUSSION AND CONCLUSIONS

The data support the two a priori hypotheses. Reported aggravation of respiratory symptoms was found to be significantly associated with exposure, while reported aggravation of a pre-selected dummy symptom was not. The relative risk for respiratory symptoms was high -- a thirteen-fold increased risk in the exposed relative to the unexposed -- and the association was highly significant.

Because testing of the a priori hypotheses involved only two tests, confidence in the statistical findings of this phase of the analysis is relatively high. The second phase, the exploratory analysis, involved multiple tests, heightening the concern that an association could have been found to be significant that was in fact due to chance. This caveat noted, the exploratory analysis suggests a significant association of exposure with reported worsening of eight symptoms: cough, difficulty breathing, sinus congestion, runny nose, swollen glands, wheezing, dizziness, and peeling skin.

Stratification by each of the five control variables did not alter the findings in either phase of the analysis. The distributions of four of the control variables -- age, sex, race, and smoking status -- were very similar between the exposed and unexposed populations. Thus, these variables could not operate as confounders in this dataset. Stratification was still necessary, however, to assess effect modification and to increase

precision of the relative risk estimate (Kleinbaum, Kupper, & Morgenstern, 1982). Stratification by the fifth control variable, educational attainment, was largely ineffectual; only those over age 18 could be included in this analysis and, thus, power was greatly reduced. None of the control variables was found to be a significant effect modifier.

Although the definition of "reactors" was somewhat arbitrary, the group did differ from the non-reactors in certain notable ways. The reactors as a whole reported being in Gorgus for more hours per day at the time of the spraying and during the first month following the incident. The reacting adults were on the whole more educated, and they sought or retained more accurate information regarding the identity of the sprayed material. That these individuals were better educated and had a higher level of awareness of events in their community may have led them to expect effects either at the time of the spraying or when reminded in the interview (i.e., a "self-fulfilling prophecy"). On the other hand, they may simply have been more observant.

The findings must be interpreted within the limitations of the study. The study was limited from the outset by severe design constraints, one of which was the lack of objective exposure measurements at the time of the incident. Unfortunately, the first environmental measurement was taken a month after the spraying, at which time concentrations of the herbicides in the gardens of Gorgus residents were undetectable. Exposure of the residents is inferred from the fact that they reported a chemical

odor at home as well as damage to their gardens. Exposure to the carrier agents in the herbicide formulation may have occurred, but the identity of these agents is confidential under Section 10(d)(1)(C) of the Federal Insecticide, Fungicide, and Rodenticide Act. Of the active ingredients, 2,4-DP is most likely to have volatilized, because it was in the ester form, while picloram and 2,4-D may have leached from the sprayed site due to the water solubility of the amine salts. Exposure to any of the components of the sprayed material may have occurred by drift or contact with sprayed brush. The study is therefore limited by uncertainty regarding the extent, type, and routes of exposure.

The second major constraint was the lack of health data. In the absence of any medical work-ups of the residents at the time of the spraying, the study had to rely on subjective data using personal interviews conducted a year afterwards. This introduced concerns regarding precision and validity of the data.

In order to stimulate recall, and thus increase precision, it was necessary to provide a reference point for the Gorgus subjects to use in reporting health symptoms. The decision to use the incident itself as a reference point was later supported by the fact that 31% of the Gorgus subjects could not recall the approximate date of the incident. Thus, had subjects been asked to recall their health status before and after June 22 of the previous summer without mentioning the incident, the level of recall would clearly have been unacceptable. By mentioning the incident, thereby suggesting the purpose of our "environmental health study," a bias was introduced. Conscious over-reporting

of symptoms might be expected to occur among those harboring animosity toward the sprayers. Unconscious over-reporting would be likely to occur among most Gorgus subjects due to the power of suggestion. To reduce both types of over-reporting, the interviewers explained to the Gorgus subjects, prior to seeking information on health, that many of the symptoms to be queried were not thought to be related to pesticide exposure. Despite this measure, a systematic over-reporting bias remained. The symptoms fingernail breaking, bleeding gums, and blood in urine are highly unlikely to result from the exposure, yet their risk ratios were each about three. In interpreting the other risk ratios, a correction factor of roughly three might therefore be appropriate. Even after applying such a correction factor, the relative risks for the eight symptoms singled out in the analysis remain substantial.

It must be emphasized that this is a study of perceived health effects, and, as such, it cannot discriminate between physiological and psychological factors mediating response. Nonetheless, it is of interest that despite the study limitations the symptoms which emerged from the analysis significantly associated with exposure are all symptoms which have been previously associated with phenoxy herbicides and picloram in reports to EPA under the Pesticide Incident Monitoring System. Furthermore, the fact that reactors reported longer exposure periods than the non-reacting exposed subects suggests a dose-related effect. This is the first epidemiological study of the acute effects of community exposure to these herbicides and

indicates the importance of continued monitoring of exposed communities.

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APPENDIX A

Excerpt of Contract, Boise-Cascade Corporation
and Cane Air Incorporated

Boise Cascade Corporation

FOREST TYPE MAP

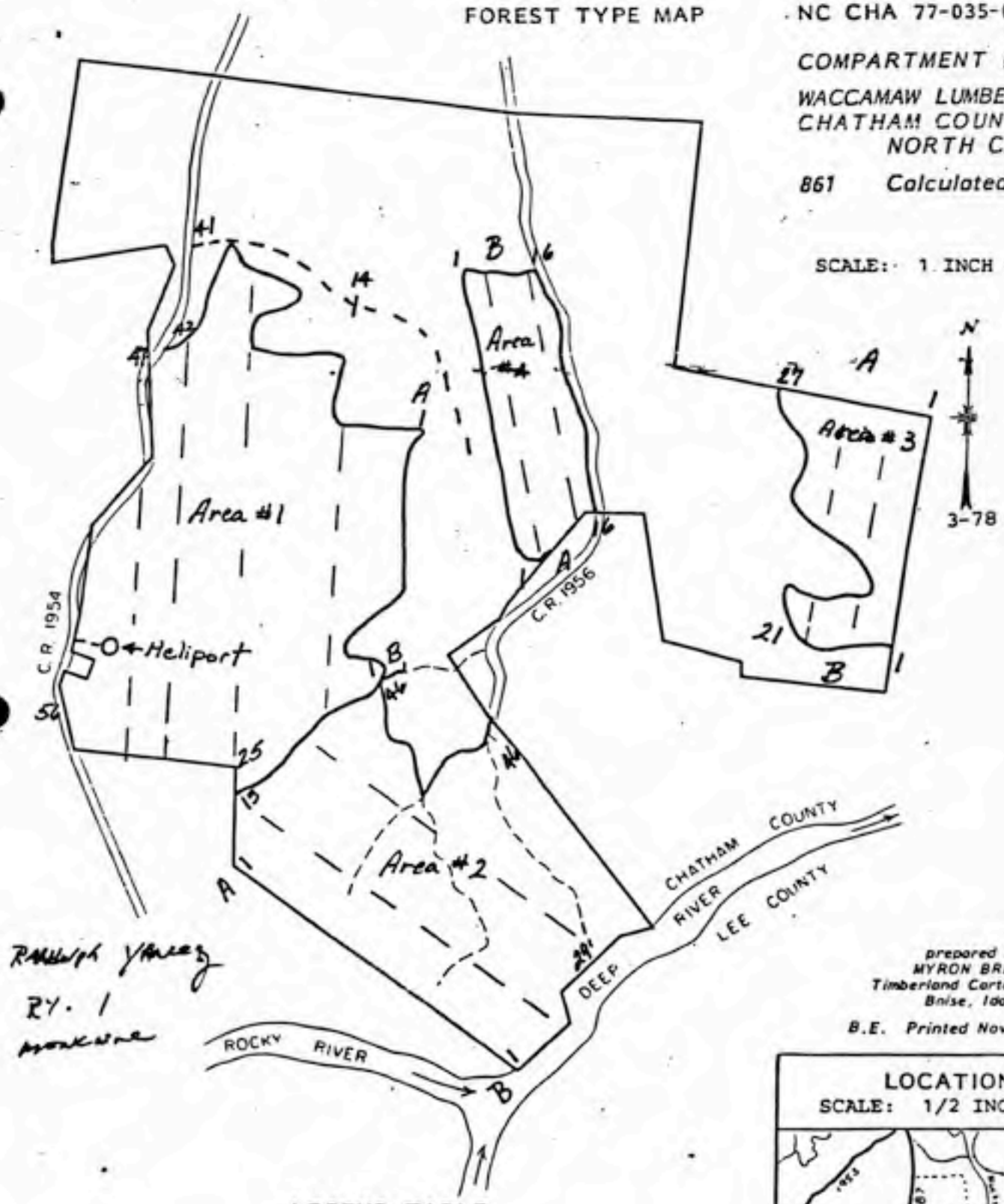
NC CHA 77-035-000

COMPARTMENT # FEE 307-

WACCAMAW LUMBER CO. TR.
CHATHAM COUNTY
NORTH CAROLINA

861 Calculated Acres

SCALE: 1 INCH = 1,320 FT



prepared by
MYRON BREDY
Timberland Cartographics
Boise, Idaho

B.E. Printed November 1981

LOCATION MAP
SCALE: 1/2 INCH = 1 MILE

LEGEND TABLE

Area 1	Application A	211 Acres
Area 2	Application BA	148 acres
Area 3	Application A	45 Acres
Area 4	Application B	46 Acres
Total		450 Acres

EXHIBIT B

AERIAL APPLICATIONS

Applications will be made by Contractor as specified in this Contract and more particularly described below:

1. Application A

Chemical	Amount/Acre	Acres
Tordon 101 mixture	2 gallons	404
Weedone 2,4,DP	1 gallon	
Water	12 gallons	
TOTAL	15 gallons	

2. Application B

Chemical	Amount/Acre	Acres
Roundup	3/4 gallon	46
Water	9¼ gallon	
TOTAL	10 gallons	

The above applications will be made by Contractor on the Waccamaw Tract, FEE-307A & B, as shown on Exhibit A. The above acreages are approximate. Actual acres sprayed will be determined as specified in Paragraph 4, "Payment," of this Contract.

APPENDIX B

Incident Investigation Report
N.C. Department of Agriculture
July 26, 1982

INCIDENT INVESTIGATION REPORT

FOR RALEIGH OFFICE USE ONLY

Investigative No. IR 82-58

Date of Origin June 30, 1982

Initial Source _____

Method of Contact _____

File Name Yancey / Lee / Johnson, Thomas L

Completion Date Oct. 6, 1982

1. Inspector(s) John E. Hunter III, Melvin C. Nunn
2. Date July 26, 1982
3. Complainant: Thomas L. Johnson
   Street or Rt. & Box: PO Box 126
   City: Pittsboro ZIP Code: 27312
   Telephone: Home _____ Business 542-4641
4. Initial Source of Information: John L. Smith
5. Brief Description of Incident: Aerial application of herbicides near dwellings and gardens.
6. Date of Incident: End of June, 1982
7. Location of Incident: Chatham county along secondary roads 1954, 1955 & 1956
8. Number of Samples: 7
9. Inspector Sample No(s). MN-281 → MN-287
10. Description of Materials (Other than Samples) submitted with this report: Diagram, slides
11. Other Individuals Involved: (Explain Involvement Below under No. 14)
    Randolph Yancey, Route 1, Moncure, N.C. 27559 (542-2736)
    John W. Lee, Route1 Box 148, Moncure, N.C. 27559 (673-9411)
    Charles A. Sibley, Boise Cascade Corp., PO Box 16, West End, N. 27376
    Bob Van Tilburg, Environ. Mgt. NR&CD, 733-2314
12. Person(s) who have requested final report:
    Randolph Yancey
    John W. Lee
    Charles A. Sibley
13. ✓ Attach Sample Transcripts.
14. ✓ Attach Detailed Report of Investigation.

John W E Hunter III
Pest Control Inspector or Specialist

1982

YANCEY/LEE INVESTIGATION:

On July 26, 1982, Melvin C. Nunn and John E. Hunter, III, visited the gardens of Mr. Randolph Yancey and John W. Lee with Mr. Thomas L. Johnson, District Health Department Director, P. O. Box 126, Pittsboro, N. C. 27312 (542-4641). Melvin and John reviewed the treatment area of the Boise Cascade Corporation by traveling CR 1954, 1955 and 1956 with Mr. Johnson.

At Mr. Yancey's garden Melvin Nunn and John Hunter obtained a tomato and a squash sample. Mr. Yancey has not continued to work his garden since the initial complaint therefore the weeds have outgrown the garden plants except for the squash. Mr. Johnson pointed out some damage on the weeds and other plants. A survey of the area revealed that a buffer path had been made around three sides of the Yancey property and no major damage was observed at this time to the various trees within this area while most of the vegetation in the treated area was dead or dying to the point of being brown in color.

An interview was conducted with Mr. Yancey's 12 year old son who witnessed the spraying. He stated that a burgandy and white helicopter made 2-3 passes over the area. At the time of the spraying, the young man was standing between the house and the well. He said the helicopter did not go directly over the house or him but he pointed up and eastward and said it went over the smoke house. The smoke house is approximately 22 feet east of the well. This indication could place the helicopter over the garden or over the spray area. He stated that he was wearing a short sleeved shirt and long jeans. He stated that he wasn't wearing a hat. He said some white-like drops fell on him like rain and he noticed an odor. He said he did not experience any sickness.

A visit with Mr. Lee to his garden off CR 1956 revealed no major visible damage but a genuine concern about whether he should eat the produce from his garden. Mr. Lee's garden was in good shape and it was evident that he had worked it. Samples were obtained of corn, tomatoes, peas, okra and cabbage. Mr. Lee stated that there were a few spots on his corn (Silver Queen). He stated that the wind was from the West during the three or four days the spraying occurred. He said that the scent was real bad on Sunday during the spraying and that it was bad after a rain.

The Boise Cascade property line comes almost to the edge of his garden but a buffer zone was left without treatment.

YANCEY/LEE INVESTIGATION

On Friday, August 6, 1982, John E. Hunter, III and Melvin C. Nunn surveyed the Boise Cascade Treatment area in Chatham County, made photographs and slides and discussed the labels and aerial regulations with residents of the area at the home of Wilbur Bryant at the request of Margaret Pollard. Copies of the labels of Tordon 101 Mixture, EPA Reg. No. 464-306 and Weedone 2,4-DP, EPA Reg. No. 264-231 and copies of the N. C. Pesticide Law of 1971 and aerial regulations were discussed and left for the citizens for review.

John Hunter offered the assistance of the NCDA, Pesticide Section, in routing questions submitted by the group to the proper agency for review and response. Ms. Pollard said that they would develop a list of questions and submit them.

The following laboratory results were discussed with Mrs. Yancey and Mr. Lee:

No measurable amounts of picloram were found in any of the samples.

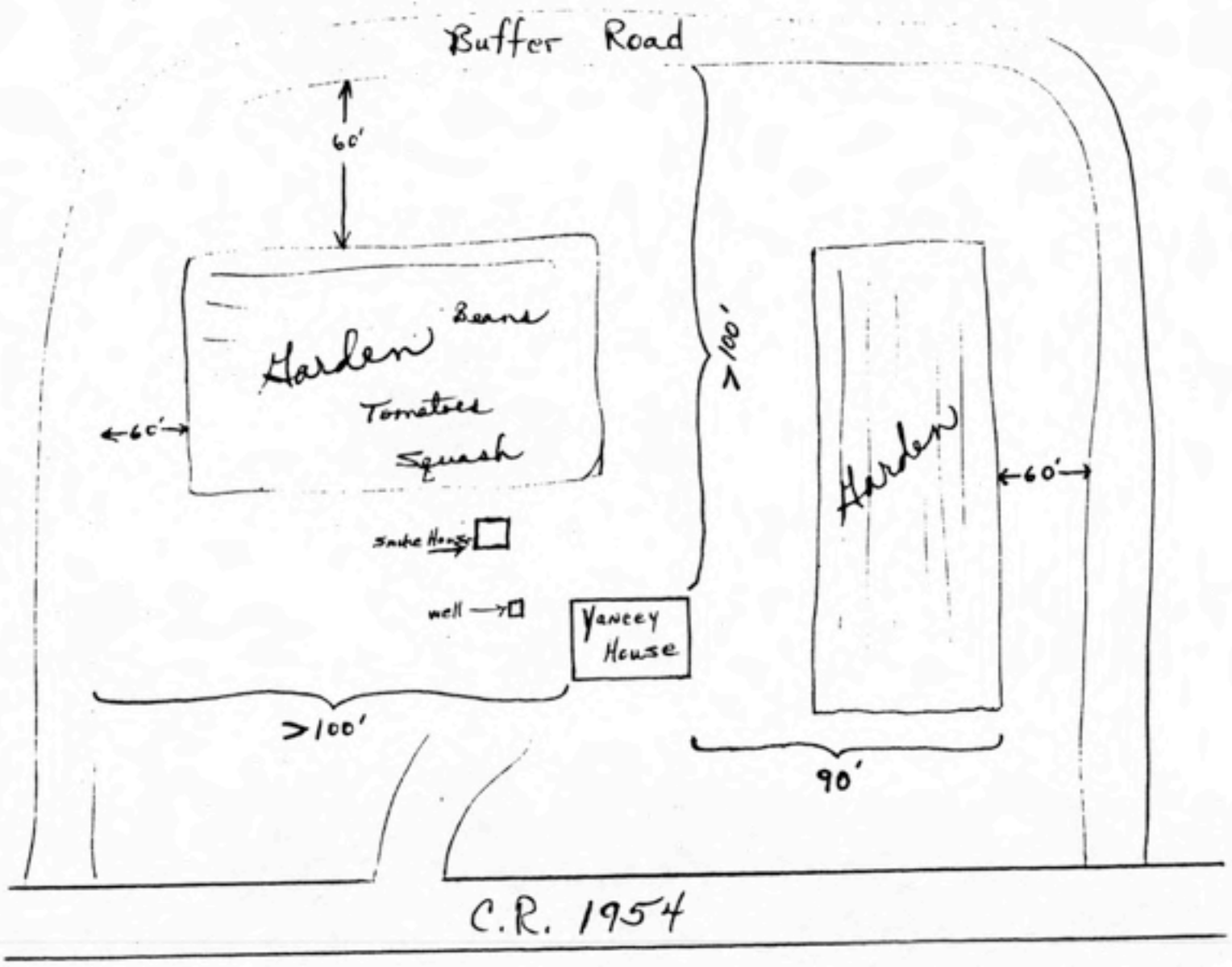
No measurable amounts of 2,4-D were found in:

Yancey's Squash
Lee's Tomatoes
Lee's Okra
Lee's Peas
Lee's Cabbage

Samples of Yancey's tomatoes and vines and Lee's corn are still being analyzed.

On August 9, 1982, John Hunter talked with R. W. (Bob) Tilburg, Environmental Management, NR&CD (733-2314) about the citizen discussion.

On August 10, 1982, John Hunter called Mr. Charles Sibley and asked permission to obtain a sample of Weedone 2,4-DP so that the laboratory could use it for comparison in their evaluation of the garden samples. Mr. Sibley said that a sample could be obtained.


Buffer Road
60'
Garden
Beans
Tomatoes
Squash
60'
>100'
Smoke House
well
Yancey House
>100'
Garden
60'
90'
C.R. 1954

IR82-58

APPENDIX C

Letter
E. Umstead to R. Yancey
July 9, 1982

JAMES A. GRAHAM
COMMISSIONER
WILLIAM G. PARHAM, JR.
DEPUTY COMMISSIONER

State of North Carolina
Department of Agriculture
Raleigh
27611

FOOD AND DRUG PROTECTION
DIVISION
L. F. BLANTON
DIRECTOR
R. L. GORDON
DEPUTY DIRECTOR

July 9, 1982

Mr. Randolph Yancey
Route 1
Moncure, North Carolina 27559

Dear Mr. Yancey:

On June 30, 1982, I was notified of possible herbicide damage to your garden as a result of aerial spraying contracted by Boise Cascade Corporation. An inspection of your garden did indicate herbicide injury. According to Charles Sibley, District Forester for Boise Cascade, Cane Air Incorporated. Post Office Box 5, Belle Rose, Louisiana, aerially applied Tordon 101, EPA Reg. No. 464-306 and Weedone, EPA Reg. No. 264-231 to adjacent land.

It is my opinion that the damage to your garden was caused by vaporization of the Weedone product after it was applied. After reviewing the labels of the two products and talking to Mr. Sibley, it is not apparent that a violation of the North Carolina Pesticide Law of 1971 occurred. However, this does not prevent you from seeking civil action to recover your losses, if an amicable agreement cannot be reached between the parties involved.

By copy of this letter, I am informing Cane Air of damage to your garden. If you have any further questions concerning this matter, please do not hesitate to contact this office.

Sincerely,

Erick G. Umstead
Pesticide Specialist II

EGU/csd

PESTICIDE SECTION
P.O. Box 27647 Raleigh, North Carolina 919-733-3556

cc: Verlie R. Thornton, Contractor
Cane Air Incorporated
Post Office Box 5
Belle Rose, Louisiana 70341

Charles A. Sibley
Southern Pines District
Post Office Box 16
West End, North Carolina 27376

Tom Johnson
District Health
Post Office Box 126
Pittsboro, North Carolina 27312

APPENDIX D

Letter
E. Umstead to R. Yancey
October 6, 1982

JAMES A. GRAHAM
COMMISSIONER
WILLIAM G. PARHAM, JR
DEPUTY COMMISSIONER

State of North Carolina
Department of Agriculture
Raleigh
27611

FOOD AND DRUG PROTECTION
DIVISION
L F BLANTON
DIRECTOR
R L GORDON
DEPUTY DIRECTOR

October 6, 1982

Mr. Randolph Yancey
Route 1
Moncure, N. C. 27559

Re: 1R82-58

Dear Mr. Yancey:

On June 30, 1982 we were notified of possible herbicide damage to your garden. An inspection of your garden by Erick G. Umstead and subsequent review of the labels for Tordon 101 Mixture and Weedone 2,4-DP revealed the possibility that the damage was caused by the vaporization of 2,4-DP after it was applied.

On July 26, 1982 we obtained samples of tomato vines, tomatoes and squash from your garden for analysis. These samples were analyzed for Tordon 101 Mixture (picloram and 2,4-D) and 2,4-DP. Measurable amounts of these pesticides were not detected through analysis of these samples.

Our initial investigation revealed damage to your garden through possible vaporization of Weedone 2,4-DP. Our analyses of the samples neither confirm nor refute this opinion as the cause of the damage.

If you have any questions regarding these results or need additional information about the sample analyses, please contact this office.

Sincerely,

John E. Hunter III

John E. Hunter III
Assistant Pesticide Administrator

JEH:ljj

cc: Mr. Thomas L. Johnson
Mr. Melvin C. Nunn, Pesticide Inspector

PESTICIDE SECTION
P.O. Box 27647 Raleigh, North Carolina 919-733-3556

APPENDIX E

Results of Lab Analysis
N.C. Department of Agriculture
October 22, 1982

NORTH CAROLINA DEPARTMENT OF AGRICULTURE

FOOD AND DRUG PROTECTION DIVISION

PESTICIDE SECTION
P. O. BOX 27647
RALEIGH, N. C. 27611
(919) 733-3556

JAMES A. GRAHAM
COMMISSIONER OF AGRICULTURE

DATE: October 22, 1982 - Randolph Yancey

LAB. NO: IR82-58A

OFFICIAL SAMPLE: Tomato Fruit and Vines

EPA NO:

BATCH NO:

INSPECTOR: Melvin C. Nunn

DATE SAMPLED: July 26, 1982

MFR. OR DISTRIBUTOR:

RETAIL DEALER:

RESULTS OF ANALYSIS:

	Guaranteed %	Found %
	Detectable Quantity	
Tomatoes		
picloram	1 ppb	none detected
2,4-D	1 ppb	none detected
2,4-DP, Butoxy ethyl ester	3 ppb	none detected
Tomato Vines		
picloram	1 ppb	none detected
2,4-D	1 ppb	none detected
2,4-DP, Butoxy ethyl ester	25 ppb	none detected

CONCLUSIONS:

John L. Smith
PESTICIDE ADMINISTRATOR

NORTH CAROLINA DEPARTMENT OF AGRICULTURE

FOOD AND DRUG PROTECTION DIVISION

PESTICIDE SECTION
P. O. BOX 27647
RALEIGH, N. C. 27611
(919) 733-3556

JAMES A. GRAHAM
COMMISSIONER OF AGRICULTURE

DATE: October 22, 1982 - - Randolph Yancey

LAB. NO: IR82-588

OFFICIAL SAMPLE: Squash

EPA NO:

BATCH NO:

INSPECTOR: Melvin C. Nunn

DATE SAMPLED: July 26, 1982

MFR. OR DISTRIBUTOR:

RETAIL DEALER:

RESULTS OF ANALYSIS:

	Guaranteed %	Detectable Quantity	Found %
Squash			
picloram		1 ppb	none detected
2,4-D		1 ppb	none detected
2,4-DP, Butoxy ethyl ester		3 ppb	none detected

CONCLUSIONS:

John L. Smith
PESTICIDE ADMINISTRATOR

NORTH CAROLINA DEPARTMENT OF AGRICULTURE

FOOD AND DRUG PROTECTION DIVISION

PESTICIDE SECTION
P. O. BOX 27647
RALEIGH, N. C. 27611
(919) 733-3556

JAMES A. GRAHAM
COMMISSIONER OF AGRICULTURE

DATE: October 22, 1982 John W. Lee

LAB. NO: IR82-58C

OFFICIAL SAMPLE: Tomato Fruit

EPA NO:

BATCH NO:

INSPECTOR: Melvin C. Nunn

DATE SAMPLED: July 26, 1982

MFR. OR DISTRIBUTOR:

RETAIL DEALER:

RESULTS OF ANALYSIS:

	Guaranteed %	Found %
	Detectable Quantity	
Tomatoes		
picloram	1 ppb	none detected
2,4-D	1 ppb	none detected
2,4-DP, Butoxy ethyl ester	3 ppb	none detected

CONCLUSIONS:

John L. Smith
PESTICIDE ADMINISTRATOR

NORTH CAROLINA DEPARTMENT OF AGRICULTURE

FOOD AND DRUG PROTECTION DIVISION

PESTICIDE SECTION
P. O. BOX 27647
RALEIGH, N. C. 27611
(919) 733-3556

JAMES A. GRAHAM
COMMISSIONER OF AGRICULTURE

DATE: October 22, 1982 - John W. Lee

LAB. NO: IR82-58D

OFFICIAL SAMPLE: Okra

EPA NO:

BATCH NO:

INSPECTOR: Melvin C. Nunn

DATE SAMPLED: July 26, 1982

MFR. OR DISTRIBUTOR:

RETAIL DEALER:

RESULTS OF ANALYSIS:

	Guaranteed %	Found %
Okra		
picloram	Detectable Quantity 1 ppb	none detected
2,4-D	1 ppb	none detected
2,4-DP, Butoxy ethyl ester	3 ppb	none detected

CONCLUSIONS:

John L. Smith
PESTICIDE ADMINISTRATOR

NORTH CAROLINA DEPARTMENT OF AGRICULTURE

FOOD AND DRUG PROTECTION DIVISION

PESTICIDE SECTION
P. O. BOX 27647
RALEIGH, N. C. 27611
(919) 733-3556

JAMES A. GRAHAM
COMMISSIONER OF AGRICULTURE

DATE: October 22, 1982 - John W. Lee

LAB. NO: IR82-58E

OFFICIAL SAMPLE: Corn kernels

EPA NO:

BATCH NO:

INSPECTOR: Melvin C. Nunn

DATE SAMPLED: July 26, 1982

MFR. OR DISTRIBUTOR:

RETAIL DEALER:

RESULTS OF ANALYSIS:

	Guaranteed %	Found %
	Detectable Quantity	
Corn kernels		
picloram	1 ppb	none detected
2,4-D	1 ppb	none detected
2,4-DP, Butoxy ethyl ester	3 ppb	none detected

CONCLUSIONS:

John L. Smith
PESTICIDE ADMINISTRATOR

NORTH CAROLINA DEPARTMENT OF AGRICULTURE

FOOD AND DRUG PROTECTION DIVISION

PESTICIDE SECTION
P. O. BOX 27647
RALEIGH, N. C. 27611
(919) 733-3556

JAMES A. GRAHAM
COMMISSIONER OF AGRICULTURE

DATE: October 22, 1982 - John W. Lee

LAB. NO: IR82-58F

OFFICIAL SAMPLE: Green peas

EPA NO:

BATCH NO:

INSPECTOR: Melvin C. Nunn

DATE SAMPLED: July 26, 1982

MFR. OR DISTRIBUTOR:

RETAIL DEALER:

RESULTS OF ANALYSIS:

	Guaranteed %	Found %
	Detectable Quantity	
Green peas		
picloram	1 ppb	none detected
2,4-D	1 ppb	none detected
2,4-DP, Butoxy ethyl ester	3 ppb	none detected

CONCLUSIONS:

John L. Smith
PESTICIDE ADMINISTRATOR

NORTH CAROLINA DEPARTMENT OF AGRICULTURE

FOOD AND DRUG PROTECTION DIVISION

PESTICIDE SECTION
P. O. BOX 27647
RALEIGH, N. C. 27611
(919) 733-3556

JAMES A. GRAHAM
COMMISSIONER OF AGRICULTURE

DATE: October 22, 1982 - John W. Lee

LAB. NO: IR82-58G

OFFICIAL SAMPLE: Cabbage

EPA NO:

BATCH NO:

INSPECTOR: Melvin C. Nunn

DATE SAMPLED: July 26, 1982

MFR. OR DISTRIBUTOR:

RETAIL DEALER:

RESULTS OF ANALYSIS:

	Guaranteed %	Found %
Cabbage	Detectable Quantity	
picloram	1 ppb	none detected
2,4-D	1 ppb	none detected
2,4-DP, Butoxy ethyl ester	100 ppb	none detected

CONCLUSIONS:

John L. Smith
PESTICIDE ADMINISTRATOR

APPENDIX F

Tordon 101 Label

Revised 1984
Rev 5-10-84

RESTRICTED USE PESTICIDE
For retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification

SPECIMEN LABEL
REDUCED TO 80%

Tordon* 101 Mixture

Weed and Brush Killer

Active Ingredients
Picloram (4 amino 3 5 6 trichloropicolinic acid), as the trisopropanol amine salt 10.2%
2 4 Dichlorophenoxyacetic Acid as the trisopropanol amine salt 39.8%
Inert Ingredients 50.2%
ACID EQUIVALENTS
Picloram (4 amino 3 5 6 trichloropicolinic acid) 3.7%, 0.54 lb gal
2 4 Dichlorophenoxyacetic acid 21.2%, 2 lb gal
E P A Registration No 464 306 E P A Est 464 MI-

KEEP OUT OF REACH OF CHILDREN

CAUTION

AVISO: PRECAUCION AL USARIO
Si usted no lee ingles no use este producto hasta que la etiqueta le haya sido explicada ampliamente

PRECAUTIONARY STATEMENTS
Hazards to Humans and Domestic Animals
HARMFUL IF SWALLOWED • CAUSES EYE INJURY • MAY CAUSE SKIN IRRITATION
Avoid Contact with Eyes, Skin and Clothing • Wash Well After Handling or Use • Keep Container Closed • When handling concentrate wear suitable eye protection • Remove contaminated clothing and wash before reuse

STATEMENT OF PRACTICAL TREATMENT If in eyes, flush with plenty of water. Get medical attention. If on skin, wash with plenty of soap and water, get medical attention if irritation persists. If swallowed, induce vomiting immediately by giving two glasses of water and sticking finger down throat. Call a physician. Do not induce vomiting or give anything by mouth to an unconscious person

Physical or Chemical Hazards
COMBUSTIBLE Do Not Use or Store Near Heat or Open Flame. Do Not Cut or Weld Container

Environmental Hazards
Do not apply directly to any body of water. Use with care when applying on areas adjacent to any body of water. Do not contaminate water by cleaning of equipment or disposal of wastes. Do not allow run off or spray to contaminate irrigation ditches or water used for irrigation or domestic purposes. Do not make application when circumstances favor movement from treatment site.

In case of an emergency endangering life or property involving this product, call collect 517-636-4400

AGRICULTURAL CHEMICAL
Do Not Ship or Store with Food, Feeds, Drugs or Clothing

18.93 L/5 gal

86-1160 PRINTED IN U.S.A. IN MARCH, 1984.
REPLACES SPECIMEN LABEL 86-1160 PRINTED IN FEBRUARY, 1984.
DISCARD PREVIOUS SPECIMEN LABELS.
REVISIONS INCLUDE: WITHIN GENERAL INFORMATION SECTION TO ADD "FOREST PLANTING SITES: AND WITHIN ENVIRONMENTAL HAZARDS SECTION TO ADD A SENTENCE USE WITH CARE WHEN APPLYING ...; AND TO INCLUDE A PARAGRAPH [illegible]

51 2610

:IMEN LABEL
(BACK)
REDUCED TO 80%

GENERAL INFORMATION

TORDON 101 Mixture weed and brush killer is recommended for control of unwanted annual and perennial broadleaved weeds and woody plants and vines on forest planting sites and non-crop areas including industrial manufacturing and storage sites, rights-of-way such as electrical power lines, communication lines, pipelines, rights-of-ways and railroads.

Among the annual and perennial broadleaved weeds controlled by TORDON 101 Mixture are:

Bindweed, Field	**Goldenrod**	**Rush Skeleton-Weed**
Bouncingbet	**Horsenettle**	**Smartweed**
Carrot, Wild	**Knapweed**	**Spurge, Leafy**
Chicory	**Milkweed**	**Starthistle, yellow**
Clover	**Plantain**	**Thistles**
Dandelion	**Prickly Lettuce**	**Toadflax**
Dock	**Ragweed**	**Vetch**
Fleabane	**Ragwort, Tansy**	

Among the woody plants and vines controlled by TORDON 101 Mixture are:

Ailanthus	**Fir, Balsam**	**Persimmon**
Alder	**Gorse**	**Pine**
Aspen	**Gum**	**Poison Oak**
Birch	**Hemlock**	**Sassafras**
Blackberry	**Hickory**	**Sourwood**
Bracken Fern	**Honeysuckle**	**Spruce**
Buttonbush	**Kudzu**	**Sumac**
Cherry	**Locust**	**Tulip Poplar**
Douglas Fir	**Maple**	**Wild Rose**
Elm	**Oak**	**Willow**

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Use TORDON 101 Mixture weed and brush killer at rates of 1/2 to 3 gallons per acre to control broadleaved weeds and at rates of 1 to 4 gallons per acre to control woody plants and vines. TORDON* 101 Mixture may be tank mixed with GARLON* 4, GARLON 3A Herbicides, or 4 lb/gal 2,4-D low volatile esters to control mixed woody plant and vine species. When tank mixing, observe all precautions, directions, and limitations on both products labeling. In all cases use the amounts specified in enough water to give thorough and uniform coverage of the plants to be controlled. **Note:** TORDON 101 Mixture does not mix readily with oil.

OBSERVE ALL USE PRECAUTIONS LISTED ON THIS LABEL

HIGH VOLUME LEAF-STEM TREATMENT: Use TORDON 101 Mixture at the rate of 1 gallon in water to make 100 gallons of spray to control broadleaved weeds, vines and other woody plants. To control a wider range of plant species, mix 1/4 to 1/2 gallon of TORDON 101 Mixture with 1/4 to 1/2 gallon of GARLON 3A, GARLON 4 or 4 lb/gal 2,4-D low-volatile ester and dilute to make 100 gallons of spray. Apply after the foliage is well developed and in a manner to give thorough spray coverage. For woody plants, up to 5 to 8 feet tall, use a drenching spray and wet all leaves, stems, and root collars. For hard-to-kill species such as ash and oak spray. Avoid as minute amounts of spray drift, to contact desirable broadleaf plants, and do not soak the soil over roots of such plants.

LOW VOLUME BROADCAST GROUND OR AERIAL FOLIAGE TREATMENT: For these uses the required amount of TORDON 101 Mixture should be applied in a total spray volume of 5 to 50 gallons per acre, depending upon the plant species, height and density of growth. The preferred volume range is 15 to 30 gallons per acre.

Broadleaved Annual and Perennial Weed and Woody Vine Control: Use TORDON 101 Mixture weed and brush killer at rates of 2 quarts to 3 gallons per acre in 15 to 50 gallons of a water spray mixture. Apply to problem weeds and vines any time after growth begins in the spring and late in summer or fall. For seasonal control of vigorously growing stands of field bindweed, Canada thistle or mixtures of these with susceptible annual weeds such as ragweed, dandelion, plantain, clovers and dock use 2 to 3 quarts of TORDON 101 Mixture per acre in 15 to 50 gallons of water spray. In arid areas and for control of more resistant perennial weeds use 1 to 3 gallons of TORDON 101 Mixture per acre in 15 to 50 gallons of spray. Use 1 to 1.5 gallons per acre to control species such as Canada thistle, field bindweed and milkweed. The higher rates should be used under drought stress conditions and for the more resistant species such as bouncingbet, leafy spurge, toadflax and woody vines. The spectrum of activity can be improved by tank mixing 1/2 to 1 gallon of TORDON 101 Mixture with 1/3 to 1 gallon of GARLON 3A or 1 to 3 quarts of GARLON 4 per acre.

Woody Plant Control: Use TORDON 101 Mixture at the rate of 1 to 4 gallons per acre in 15 to 50 gallons of a water spray mixture. For **susceptible seedling stages** of species such as aspen, cherry and sumac use 1 to 1.5 gallons of TORDON 101 Mixture per acre in 15 to 50 gallons of a water spray mixture. For more mature and/or less susceptible species such as Poison oak, blackberries, Douglas fir, willow, buttonbush, black locust, sassafras, sumac, tulip poplar and cherry use 2 to 2.5 gallons of TORDON 101 Mixture per acre in 15 to 50 gallons of a water spray mixture.

For more resistant brush such as maple, elm, sourwood, blackgum, cedar and oak where growing on heavy clay soils or on rocky terrain use 3 to 4 gallons of TORDON 101 Mixture weed and brush killer per acre in 15 to 50 gallons of a water spray mixture. Use the higher rate and volume where the foliage of more difficult to kill brush is covered with dense vine growth. To improve the spectrum of species controlled, 1 to 2 gallons of TORDON 101 Mixture per acre can be tank mixed with 1/2 to 2 gallons per acre of GARLON 3A, GARLON 4 or 4 lb/gal 2,4-D low-volatile ester. **Note:** For best results under conditions of drought stress use the higher rates recommended. Even these rates under such conditions may not be as effective as the lower rates under good growing conditions.

CUT SURFACE TREATMENTS: In forest and other non-crop areas to kill unwanted trees of hardwood species such as elm, maple, oak and conifers such as pine apply TORDON 101 Mixture, either undiluted or diluted in a 1 to 1 ratio with water, as directed below.

With Tree Injector Method: Application should be made by injecting 1/2 milliliter of undiluted TORDON 101 Mixture or 1 milliliter of the diluted solution through the bark at intervals of 3 inches between edges of the injector wound. The injections should completely surround the tree at any convenient height.

With Frill or Girdle Method: Make a single girdle through the bark completely around the tree at a convenient height. Wet the cut surface with the diluted solution.

Stump Treatment: Spray or paint to wet the cut surfaces of freshly cut stumps or stubs with TORDON 101 Mixture undiluted or diluted 1:1 in water. All of the cambium area next to the bark is the most vital area to wet.

The above methods may be used successfully at any season except during periods of heavy sap flow of certain species such as maples or during drought periods. Untreated trees within a few feet of the treated trees or stumps may be injured or killed.

USE PRECAUTIONS

Use this product only as specified on this label. Observe any special use and application restrictions and limitations, including method of application and permissible areas of use as promulgated by state authorities.

Do Not Contaminate Water Intended for Irrigation or Domestic Purposes. To avoid injury to crops or other desirable plants, do not treat or allow spray drift or run-off to fall onto innerbanks or bottoms of irrigation ditches, either dry or containing water, or other channels that carry water that may be used for irrigation or domestic purposes. Do not contaminate nontarget land areas or cropland.

Do not Apply or Otherwise Permit TORDON 101 Mixture or Sprays Containing TORDON 101 Mixture to Contact Crops or Other Desirable Broadleaf Plants including but not limited to alfalfa, beans, cotton, grapes, melons, peas, potatoes, safflower, soybeans, sugar beets, sunflower, tobacco, tomatoes, and other vegetable crops, flowers, fruit plants, ornamentals or shade trees.

Avoid Injurious Spray Drift: Applications should be made only when there is little or no hazard from spray drift. Very small quantities of spray which may not be visible, may seriously injure susceptible plants. Do not spray when wind is blowing toward susceptible crops or ornamental plants near enough to be injured. It is suggested that a continuous smoke column at or near the spray site or a smoke generator on the spray equipment be used to detect air movement, lapse conditions, or temperature inversions (stable air). If the smoke layers or indicates a potential of hazardous spray drift, do not spray.

Aerial Application: For aerial application on rights-of-way or other areas near susceptible crops, use NALCO-TROL* drift control additive as recommended by the manufacturer or apply through the MICROFOIL** boom or equivalent drift control system. Thickened sprays prepared by using high viscosity invert systems or other drift reducing systems may be utilized if they are made as drift-free as are mixtures containing NALCO-TROL or applications made with the MICROFOIL boom. If a spray thickening agent is used, follow all use recommendations and precautions on the product label. Do not use a thickening agent with the MICROFOIL boom, or other systems that cannot accommodate thick sprays.

With aircraft, drift can be lessened by applying a coarse spray, by using no more than 30 pounds spray pressure at the nozzles, by using straight stream nozzles directed straight back, by using a spray boom no longer than 3/4 the rotor or wing length, by spraying only when wind velocities are low, or by using approved drift control system.

*Trademark of NALCO Chemical Company

**Trademark of Union Carbide Agricultural Chemical Division

Ground Equipment: To aid in reducing spray drift, TORDON 101 Mixture should be used in thickened (high viscosity) spray mixtures using NALCO-TROL drift control additive or equivalent as directed by the manufacturer. With ground equipment, spray drift can be reduced by keeping the spray boom as low as possible, by applying 20 gallons or more of spray per acre, by using no more than 30 pounds spraying pressure with large droplet producing nozzle tips, and by spraying when wind velocity is low. Do not apply with hollow cone-type insecticide or other nozzles that produce a fine droplet spray.

High Volume Leaf-Stem Treatment: To minimize spray drift, do not use pressure exceeding 50 psi at the spray nozzle and keep sprays no higher than brush tops. NALCO-TROL thickening agent or equivalent may be used to reduce spray drift.

Conifer planting intervals vary. Pines planted sooner than six months after treatment with TORDON 101 may be injured in the south or west of the Cascade Mountains. Other conifers, west of the Cascade Mountains, may be injured if planted sooner than 8 to 9 months after treatment. For all conifers, the waiting period between treatment and planting should be 11 to 12 months in the area between the Cascade and Rocky Mountains and 8 to 9 months in the Lake States and the Northeastern U.S.

Do not move treated soil to other areas. Do not use it to grow plants unless adequate sensitive bioassay or chemical tests show that no detectable picloram is present in the soil.

STORAGE AND DISPOSAL

Prohibitions: Do not contaminate water, food or feed by storage or disposal. Open dumping is prohibited.

Pesticide Disposal: Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Rinse application equipment after use at least three times with water and dispose of rinse water in a non-cropland area away from water supplies.

Container Disposal: Do not re-use containers for TORDON 101 Mixture for any purpose. Puncture and dispose of in a sanitary landfill or by other approved state and local procedures.

General: Consult federal, state or local disposal authorities for approved alternative procedures.

Be sure that use of this product conforms to all applicable regulations.

NOTICE: Seller warrants that the product conforms to its chemical description and is reasonably fit for the purposes stated on the label when used in accordance with directions under normal conditions of use, but neither this warranty nor any other warranty of MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, express or implied, extends to the use of this product contrary to label instructions, or under abnormal conditions, or under conditions not reasonably foreseeable to seller, and buyer assumes the risk of any such use.

U.S. Patent No. 3,285,925

10680-010 I

8120-4384

DOW

THE DOW CHEMICAL COMPANY
Midland, Michigan 48640 U.S.A.

* Trademark of THE DOW CHEMICAL COMPANY

APPENDIX G

Weedone 2,4-DP Label

WEEDONE® 2,4-DP
WOODY PLANT HERBICIDE

Controls mixed brush on Highways, Railroads and Utility Rights-of-way. Also controls solid stands of post, blackjack, sand shinnery oak, and sandsage.

1981 Revised BB 3-11-81

CAUTION: KEEP OUT OF REACH OF CHILDREN.
See side panel for additional precautionary statements.

ACTIVE INGREDIENT:	
2,4-Dichlorophenoxypropionic acid, butoxyethyl ester*	59.1%
INERT INGREDIENTS	40.9%

*2-4-Dichlorophenoxypropionic acid equivalent—3.7 lb./gal. or 41.5%/wt.

Same Label 1982 1/14/82 Kg

UNION CARBIDE AGRICULTURAL PRODUCTS COMPANY, INC.
AMBLER, PA. 19002
CLINTON, IA ■ ST. JOSEPH, MO ■ FREMONT, CA

EPA REG. No. 264-231 EPA Est. 264-PA-1, 264-MO-1, 264-CA-1

DIRECTIONS

WEEDONE 2,4-DP Woody Plant Herbicide will control mixed brush along utility rights-of-way, highways, railroads, drainage ditchbanks and firebreaks; including post oak, blackjack oak, white oak, sand shinnery oak, red oak, pine, fir, spruce, blackcherry, alder, willow, sandsage, elm, and similar species, as well as solid stands of post oak, blackjack oak, sand shinnery oak and sandsage.

FOLIAGE STEM METHOD

This is the standard method for high volume sprays along fencerows, highways and utility rights-of-way. Use it as a "first spray" on thick brush composed of mixed species. Apply spray to both foliage and stems of all plants from the time foliage is fully developed until plants begin to go dormant. For effective control, all leaves, stems and suckers must be thoroughly wet to ground line. Some regrowth may be expected on resistant species, such as ash, maple, oak and persimmon.

To control mixed brush, add 1 gallon of WEEDONE 2,4-DP Woody Plant Herbicide to 99 gallons of water. Mix thoroughly before spraying. Apply 100 to 300 gallons of spray mixture per acre.

Up to 5 gallons of oil per 100 gallons may be added to these spray mixtures.

RAILROAD ON-TRACK APPLICATION

For use with the DIRECTA-SPRA® spray applicator mounted on Hi-Rail equipment, use 3 gallons WEEDONE® 2,4-DP Woody Plant Herbicide in 25-50 gallons of water per acre. For added drift control add 2-2.5 oz. Lo-Drift™ spray additive in each 25-50 gallons of water. If higher total spray volumes are needed, do not apply more than 3 gallons WEEDONE® 2,4-DP Woody Plant Herbicide per acre.

AERIAL APPLICATION—UTILITY RIGHTS-OF-WAY

For aerial application to mixed brush along utility rights-of-way, apply 2-3 gallons of WEEDONE® 2,4-DP Woody Plant Herbicide in 12 to 30 gallons of water per acre. One gallon of fuel oil may be added.

Apply the spray only through equipment designed to provide effective drift control. A helicopter mounted MICROFOIL® applicator or other equipment that provides equivalent drift control is recommended.

SOLID STANDS OF OAK OR SANDSAGE

Apply chemicals with fixed wing or helicopter aircraft using 5 gallons of spray mixture per acre. Spray when plants have just developed full sized leaves, when soil moisture is sufficient for good growing conditions, when relative humidity is high, and wind velocities are less than 5 miles per hour. Spray season normally runs from early May to mid-June in Texas, California and New Mexico and from mid-May to early July in Oklahoma and northward.

AMOUNTS PER ACRE

Types of Brush	WEEDONE 2,4-DP Qts.	Oil Gallons	Water Gallons	Remarks
Post & Blackjack Oak	2	1/2	4	Re-treat the 2nd year with 1 qt. per acre
Sand Shinnery Oak	1/2	1/2	4 3/8	Re-treat the 2nd year with ½ qt. per acre
Sandsage	1/2	1/2	4 3/8	

Aerial spraying is a specialized job. Secure qualified technical guidance for each job and employ a competent reliable applicator. Become familiar with state laws governing the application of herbicides. Do not use aerial sprays in areas where possible spray drift may injure valuable crops or plants.

TO PREPARE A SPRAY: Add this product to the proper amount of oil, if any, and mix thoroughly. Then pour this mixture into the required amount of water while agitating continuously. This material forms an emulsion in water—not a solution. Provide agitation to prevent separation and insure a uniform spray mixture.

AERIAL OR GROUND APPLICATION TO CONTROL MIXED BRUSH INCLUDING CONIFERS AND ROOT SUCKERING SPECIES ON UTILITY, RAILROAD AND HIGHWAY RIGHTS-OF-WAY AND FENCEROWS:

Where red maple, conifers and root-suckering species such as sassafras, sumac, black locust or persimmon are the major problem, use 1 to 2½ gallons WEEDONE 2,4-DP Woody Plant Herbicide in combination with 1 to 2½ gallons AMIDON 101 or Tordon* 101 herbicide mixture or in combination with 3 to 6 pints AMIDON K or Tordon* K herbicide. Dilute with water and apply in a total spray volume of 15 to 50 gallons per acre. Use lower rates to control brush on sandy soils or coarse soils with susceptible species such as seedling aspen, cherry, willow and sumac. Use higher rates to control brush on clay soils or fine soils or rocky terrain with more resistant species such as maple, oak, pine and redcedar. When making the spray mixture, add WEEDONE 2,4-DP to the required amount of water while agitating the mixture in the spray tank. Then add the AMIDON 101 of AMIDON K while continuing agitation. (Do not mix concentrates of WEEDONE 2,4-DP with concentrates of AMIDON 101 or AMIDON K.) Aerial applications of the tank mixture should be made only with a helicopter mounted MICROFOIL® applicator or an equipment system providing equivalent drift control. Ground applications to control brush on railroad or utility rights-of-way should be made only with the DIRECTA-SPRA® spray applicator or an equipment system providing equivalent drift control. Do not use these tank mixtures on drainage ditchbanks or firebreaks. Observe all restrictions, precautions and limitations on the labeling of each product used in tank mixtures.

*Trademark of the Dow Chemical Company

CAUTION

Harmful if swallowed. Avoid contact with eyes, skin and clothing.

ENVIRONMENTAL HAZARD

This product is toxic to fish. Rinse spray equipment and containers and dispose of liquid wastes in a pit in non-crop lands locate away from water supplies and desirable vegetation. Keep out of any body of water.

Do not apply when runoff is likely to occur.

DIRECTIONS FOR USE

Do not apply WEEDONE 2,4-DP Woody Plant Herbicide near, directly to, or permit spray mist to drift onto cotton, okra, grapes, tomatoes, fruit trees, vegetables, flowers or other desirable crop or ornamental plants which are susceptible to 2,4-DP herbicide. Very small quantities of WEEDONE 2,4-DP Woody Plant Herbicide will cause severe injury during the growing or dormant periods. Crops contacted by WEEDONE 2,4-DP Woody Plant Herbicide sprays or spray drift may be killed or suffer significant stand loss with extensive quality and yield reduction. Do not apply when weather conditions favor drift from target area.

Do not use the same spray equipment for other purposes unless thoroughly cleaned. Do not contaminate irrigation ditches or water used for domestic or irrigation purposes especially in areas where grapes, cotton, tomatoes or other susceptible plants are grown. Do not use in a greenhouse.

Do not graze dairy animals on treated areas within 6 weeks after application. Do not graze meat animals on treated areas within two weeks of slaughter.

Do not apply when a temperature air inversion exists. Such a condition is characterized by little or no air movement and an increase in air temperature with an increase in height. In humid regions a fog or mist may form. An inversion may be detected by producing a smoke column and checking for a layering effect. If questions exist pertaining to the existence of an inversion consult with local weather services before making an application.

Use coarse sprays to minimize drift. Do not apply with hollow cone-type insecticide or other nozzles that produce fine spray droplets. Do not apply when any wind is blowing toward susceptible crops or valuable plants. Drift from aerial applications may be reduced by: (1) applying as near to the target as possible in order to obtain coverage; (2) by using 20 pounds pressure or less at the nozzle tips; (3) by using nozzles which produce a coarse spray pattern; (4) by spraying only when the wind velocity is less than 5 miles per hour; (5) by applying sprays at low pressure and high volume, (6) by applying 5 or more gallons of spray per acre.

Drift from ground applications may be reduced by: (1) keeping the spray as near to the target as possible in order to obtain complete coverage, (2) by applying 25 gallons or more of spray per acre; (3) by using no more than 20 pounds of pressure at the nozzle tips; (4) by using nozzles which produce a coarse spray pattern; and (5) by applying sprays at low pressure and high volume.

Under very high temperatures vapors from this product may injure susceptible plants in the immediate vicinity.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage, disposal or cleaning of equipment. Do not store near other pesticides, seeds, fertilizers, food or feedstuffs. Open dumping is prohibited. Do not reuse container. Do not burn.

Pesticide, spray mixture or rinsate that cannot be used or chemically reprocessed should be disposed of in a landfill approved for pesticides or buried in a safe place away from water supplies.

Triple rinse container (or equivalent) and offer for recyling, reconditioning, or disposal in approved landfill or bury in a safe place.

Consult federal, state or local disposal authorities for approved alternative procedures.

Local conditions may affect the use of herbicides. Consult your State Agriculture Experiment Station, Farm Advisors, or Extension Weed Specialists for advice in selecting treatment from this label to best fit local conditions.

Be sure that use of this product conforms to all applicable laws, rules and regulations. Certain states have restrictions pertaining to application distances from susceptible crops. The applicator should become familiar with these laws, rules or regulations and follow them exactly. Apply this product only as specified on this label.

LIMITED WARRANTY AND DISCLAIMER

The manufacturer warrants (a) that this product conforms to the chemical description on the label; (b) that this product is reasonably fit for the purposes set forth in the directions for use when it is used in accordance with such directions; and (c) that the directions, warnings and other statements on this label are based upon responsible experts' evaluation of reasonable tests of effectiveness, phytotoxicity to laboratory animals and to plants, and of residues on food crops, and upon reports of field experience. Tests have not been made on all varieties or in all states or under all conditions. THE MANUFACTURER NEITHER MAKES NOR INTENDS, NOR DOES IT AUTHORIZE ANY AGENT OR REPRESENTATIVE TO MAKE, ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, AND IT EXPRESSLY EXCLUDES AND DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

This warranty does not extend to, and the Buyer shall be solely responsible for, any and all loss or damage which results from the use of this product in any manner which is inconsistent with the label directions, warnings or cautions.

BUYER'S EXCLUSIVE REMEDY AND MANUFACTURER'S OR SELLER'S EXCLUSIVE LIABILITY FOR ANY AND ALL CLAIMS, LOSSES, DAMAGES, OR INJURIES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, WHETHER OR NOT BASED ON CONTRACT, NEGLIGENCE, STRICT LIABILITY IN TORT OR OTHERWISE, SHALL BE LIMITED, AT THE MANUFACTURER'S OPTION, TO REPLACEMENT OF OR THE REPAYMENT OF THE PURCHASE PRICE FOR THE QUANTITY OF PRODUCT WITH RESPECT TO WHICH DAMAGES ARE CLAIMED. IN NO EVENT SHALL MANUFACTURER OR SELLER BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT.

FORM NO. 2818-F 2-80 C.P.C.

APPENDIX H

Questionnaire

Environmental Health Study
Consent for Participation

Researchers at the UNC School of Public Health and the North Carolina Division of Health Services are doing an environmental health study. The study is being done to examine the relationship of certain environmental factors to health conditions.

I agree to be in the study and to be interviewed. I understand that:

1) The questionnaire asks about my health, environment, and certain biographical information.

2) All responses will be held confidential. My name will never be linked to my answers.

3) I am free to drop out of the study at any time; I can refuse to answer any questions.

If I have any questions about the study, I may call Paige Tolbert, N. C. Division of Health Services, at (919) 733-3410.

Date_____

Participant's Name_____

Participant's Signature_____

Field Interviewer's Signature_____

DHS 3174 7/83
Env. Epi. Branch

QUESTIONNAIRE

Date _____

Study Subject Name _____
(first) (middle) (last)

Respondent Name (if different from study subject)

_____
(first) (middle) (last)

If answering for someone else, what is his/her relation to you?

son	____	01	niece	____	05
daughter	____	02	nephew	____	06
grandson	____	03	other	____	
granddaughter	____	04	DK	____	08
			R	____	09

Study Subject Age (years) _____ Year of Birth _____

DK	____	08	DK	____	08
R	____	09	R	____	09

Sex M _____ F _____
01 02

Race	White	____	01
	Black	____	02
	Native American	____	03
	Other _____ specify		
	DK	____	08
	R	____	09

I. Residence History

1. Current Address: _____

   _____

   _____

2. Current Telephone Number: (home) _____

   (work) _____

3. How long have you lived at this address? (years) _____

Interviewer: Ask Question 4 if subject has lived at current address less than two years.

4. For the last two years, list other towns or counties where you have lived, beginning with the most recent:

   1) _____

   2) _____

   3) _____

II. Employment

1. Are you currently:

employed/ self-employed	____	01	looking for work	____	07
in school	____	02	unemployed	____	08
in school/employed	____	03			
pre-school	____	04	a homemaker	____	09
retired	____	05	other	____	
handicapped	____	06	DK	____	98
			R	____	99

2. If employed, what is your present occupation? _____

   _____

3. Describe the kinds of work you do at this job: _____

   _____

   _____

   _____

4. Employment address: _____

_____

_____

5. How long have you worked there? (years) _____

6. Do you like your job? yes ___01 DK ___ 08
no ___02 R ___ 09 ____

Interviewer: If subject worked at current job less than ten years or is not currently employed ask Question 7.

7. What other jobs have you held for at least a year over the last 10 years? (List the most recent first and work backward):

	Years (dates)	Position	Description	Name of Company (if applicable)
1)	_____	_____	_____	_____
	Did you like this job? Yes ___ 01 No ___ 02 DK ___ 08 R ___ 09			
2)	_____	_____	_____	_____
3)	_____	_____	_____	_____
4)	_____	_____	_____	_____
5)	_____	_____	_____	_____
6)	_____	_____	_____	_____
7)	_____	_____	_____	_____

8. Have you ever been exposed at work to anything that was poisonous or made you sick? (For example, asbestos, solvents, cotton dust, pesticides.)

yes ____ 01 DK ____ 08

no ____ 02 R ____ 09

If yes:

	Type of Substance (be as precise as possible)	Approx. Dates (years) From:	To:
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____

9. Do you have any hobbies?

yes ___ 01

no ___ 02

DK ___ 08

R ___ 09

If yes, what are they? _____

_____

Are chemicals, paints, lacquers, glues, or solvents used?

yes ____ 01

no _____ 02

DK _____ 08

R ____ 09

Is so, which ones? _____

_____

_____

III. Education and Marital Status

1. Have you been to school? Yes ___01 No ___02 DK ___08 R ____09

If yes,

2. how many years of schooling have you completed?
(Circle last year completed)

none.	0	01
elementary	1 2 3 4 5 6 7 8	02
high school.	9 10 11 12	03
technical school . . .	1 2	
college.	1 2 3 4 5 +	04
DK ____		08
R ____		09

3. Have you had any vocational, professional or graduate training?

yes ____	01
no ____	02
DK ____	08
R ____	09

If so, what type? _____

4. What is your marital status?

married ____	01	separated ____	04
widowed ____	02	never married ____	05
divorced____	03	DK ____	08
		R ____	09

IV. Medical History and Health Habits

1. When you or someone in your family gets sick, is there a doctor or clinic you ordinarily go to?

yes ____	01
no ____	02
DK ____	08
R ____	09

2. Do you have checkups regularly? (**at least** once every 2 years)

yes ____	01
no ____	02
DK ____	08
R ____	09

3. About how often do you seek medical attention (including check-ups)?

once a month ____
once every 2 months ____
2 times a year ____
once a year ____
once every few years ____
rarely ____
never ____
DK____
R ____

4. Are you on any medications?

yes ____	01
no ____	02
DK ____	08
R ____	09

If yes, which medications? _____ ____

_____

5. Do you now or have you ever smoked tobacco?

yes ____	01
no ____	02
DK ____	08
R ____	09

Interviewer: If subject is a smoker, ask questions 5 (a) through (f).

a) When did you start? age ____

DK ____ 98

R ____ 99

b) Have you now stopped? yes ____ 01

no ____ 02

DK ____ 08

R ____ 09

If yes, when did you quit? Age ____

DK ____ 98

R ____ 99

c) What type of tobacco do (did) you smoke?

Cigarettes? yes ____ 01

no ____ 02

DK ____ 08

R ____ 09

If yes, what brand(s)? _____

filtered? __

non-filtered? __

Cigars? yes __ 01

no __ 02

DK __ 08

R __ 09

Pipe? yes __ 01

no __ 02

DK __ 08

R __ 09

d) If you smoke(d) cigarettes, how many packs/day do (did) you usually smoke?

occasional, less than ½ pack/day	____	01
½ pack - 1 pack/day	____	02
1½-2 packs/day	____	03
more than 2 packs/day	____	04
DK	____	08
R	____	09

e) If you smoke(d) cigars, how many do (did) you usually smoke each day? (cigars/day) _____

DK	_____	08
R	_____	09

f) If you smoke (d) a pipe, estimate the usual number of pipe refills per day: (refills/day) _____

DK	_____	08
R	_____	09

Interviewer:	If study subject is a woman ask questions in Part V. Reproductive History. Remind respondents that they can refuse to answer any questions.

V. Reproductive History

1. How many children have you had? _____

2. How many pregnancies have you had? _____

For each please state the outcome of the pregnancy:

	Year	Premature 01	Term 02	Miscarriage 03	Therapeutic Abortion 04	Now Living yes 05	Now Living no 06
Pregnancy # 1							
Pregnancy # 2							
Pregnancy # 3							
Pregnancy # 4							
Pregnancy # 5							
Pregnancy # 6							
Pregnancy # 7							
Pregnancy # 8							
Pregnancy # 9							
Pregnancy # 10							

3. Have you ever taken or do you take birth control pills?

yes ____	01
no ____	02
DK ____	08
R ____	09

If yes, for how long? (years) _____

DK _____	98
R _____	99

VI. Pesticide Exposure

Now I'm going to ask you some questions about your experience with pesticides. By pesticide, I mean a liquid, powder, pellet or spray used to kill bugs, weeds, rodents, or other pests.

1. Have you ever hired an exterminator? (e.g., for roaches, termites, mice, ants.)

yes ____

no ____

DK ____

R ____

If yes, what was the pest, do you remember the name of the pesticide used and when?

	Pest	Pesticide	Date(s) (years)	How often?
1)	_____	_____	_____	_____
2)	_____	_____	_____	_____
3)	_____	_____	_____	_____
4)	_____	_____	_____	_____

2. Do you personally use any pesticides in your home or on your land? (for example, roach killer, Raid, Sevin, Round-up)

yes ____ 01

no ____ 02

DK ____ 08

R ____ 09

If yes, what pesticide (be as precise as possible, include brand name), what do you use it for, and how often:

Name	Use	How often?

Interviewer: In Question 3 ask subjects who recall more than one pesticide incident to refer to the most significant one in responding to the following questions. If the subject is a Gorgus resident, and does not spontaneously recall the herbicide spraying by Boise-Cascade last summer, jog their memory and note that this had to be done. Subjects who recall a pesticide incident (including those whose memory had to be jogged) are hereafter referred to as the "exposed"; those who do not, the "unexposed".

3. Can you recall a time when you were exposed to a pesticide at home within the last two years, other than times when you applied a pesticide yourself or hired an exterminator?

yes ____ 01

no ____ 02

DK ____ 08

R ____ 09

If a Gorgus resident, recalled Boise-Cascade spraying spontaneously?

yes ____ 01

no ____ 02

Interviewer comments: _____

_____

_____

_____

Interviewer: Ask Questions 3 through 8 if subject is "exposed".

(a) When was the incident? (date: mo/yr) _____

DK ____ 98

R ____ 99

(b) Which pesticide? _____

DK ____ 08

R ____ 09

(c) Where was it used? _____

DK ____ 08

R ____ 09

(d) Who used it? _____

DK ____ 08

R ____ 09

(e) How was the pesticide applied? (for example, ground application or aerial spraying?)

ground application ____ 01

aerial spraying ____ 02

other _____ (specify)

DK ____ 08

R ____ 09

(f) How far is your home from where the pesticide was used?

_____(feet)

_____DK 08

_____R 09

(g) How did you learn about it? (Check any that apply; you can check more than one.)

_____user told me

_____neighbor told me

_____I heard about it on TV or read about it in the newspaper

_____I saw it.

If so, what did it look like? _____

_____

_____I smelled it.

If so, what did it smell like?_____

_____

_____I felt it.

If so, what did it feel like? (oily, watery?)_____

_____

_____I tasted it.

If so, what did it taste like?_____

_____

(h) If the pesticide was sprayed, were you in the path of the actual spraying (directly sprayed, not in house)?

yes ____ 01

no ____ 02

DK ____ 08

R ____ 09

(i) Do you think you were exposed? yes ___ 01 DK ___ 08
no ___ 02 R ___ 09

If so and if you were not in the spray path or the pesticide was applied by means other than spraying, by what route do you think you were exposed? (check any that apply)

air (breathed it) ____

water (drank contaminated water) ____

food (ate contaminated food) ____

skin contact (walked through brush) ____

other ____

DK ____

R ____

(j) Were you present (nearby) while the pesticide was being used?

yes ____ 01

no ____ 02

DK ____ 08

R ____ 09

(k) How much time did you spend in your neighborhood

on the day the pesticide was used? (hours) _____

on the day after? (hours) _____

on average, over the first week afterwards (excluding weekend)? (hrs/day) _____

on average, over the first month afterwards? (hrs/day) _____

on average, during the second month? (hrs/day) _____

DK ____ 08

R ____ 09

4. Did you have a vegetable garden?

yes ____ 01

no ____ 02

DK ____ 08

R ____ 09

(a) If yes, did you notice any changes in your garden after the pesticide was used? (for example, sudden browning or withering)

yes ____ 01

no ____ 02

DK ____ 08

R ____ 09

If so, what changes?

browning ____ 01

wilting ____ 02

other _____ 03
(specify)

DK ____ 08

R ____ 09

(b) Did you eat the vegetables you grew in your garden?

yes ____ 01

no ____ 02

DK ____ 08

R ____ 09

If yes, did you eat any vegetables immediately (within a week) after the spraying?

yes ____ 01
no ____ 02
DK ____ 08
R ____ 09

5. What kind of water do you use?

shallow ground water (above bedrock)	____	01
deep ground water	____	02
spring water	____	03
municipal water	____	04
other	_____ (specify)	
DK	____	08
R	____	09

(a) If groundwater, did you drink it after the pesticide was used?

yes	____	01
no	____	02
DK	____	08
R	____	09

If yes, did it taste different?

yes	____	01
no	____	02
DK	____	08
R	____	09

If yes, how? _____

_____

(b) If groundwater, do you drink it now?

never	____	01
yes, but less than I used to	____	02
yes, as much as I used to	____	03
DK	____	08
R	____	09

6. Did you eat any fish from ponds or creeks by your home during the summer after the pesticide was used?

yes ____	01
no ____	02
DK ____	08
R ____	09

If yes, did it taste different than usual?

yes ____	01
no ____	02
DK ____	08
R ____	09

7. Did you eat any game from around your home after the pesticide was used?

yes ____	01
no ____	02
DK ____	08
R ____	09

If yes, did it taste different?

yes ____	01
no ____	02
DK ____	08
R ____	09

Interviewer: one person in household should answer Questions 8(a) through (c)

8. (a) Now I want you to think back on any pets or farm animals you owned a year ago. Did you have any?

yes ____	01
no ____	02
DK ____	08
R ____	09

If yes, please list what kind, age, sex, and how long you (have) owned each one:

	Kind of Animal	Age	Sex	How long have you had (or did you have) this animal? (years)	If you no longer have this animal: Date changed hands	or Date died
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						

(b) Have you eaten any milk products, eggs, or meat from any of these animals since the incident?

yes ____	01	DK ____	08
no ____	02	R ____	09

(c) I would like to ask you some questions about the health of each of your animals? (See following chart and table.)

Household No. _____
Animal No. _____
from Question 8(a)

Use Sign Code

	Sign ____	Sign ____	Sign ____	Sign ____	Sign____	Sign____	Sign ____
Pre-Exposure							
How often? Use Frequency Code							
For how long?							
Vet consulted?							
What did he/she say?							
Post-Exposure							
After the pesticide was used, was condition worse(1), better (2), or no change (3)?							
How often did condition occur? Use Frequency Code							
If worse: How long after exposure did onset of worsened condition occur? (days)							
How long did it persist? (days)							
Vet consulted?							
What did he/she say?							
Did your animal die?							
If not, is animal better now? [no (1), mostly (2), completely (3)]							
Did you consume any of this animal's products?							

Interviewer: In Question 9, fill in the following table for all subjects. In the first part of the table, ask "unexposed" regarding symptoms last summer and "exposed" regarding symptoms before the pesticide incident. For the second part of the table, ask the "unexposed" regarding their current symptoms and the "exposed" regarding symptoms following exposure. Inform the "exposed" that many of the health effects listed are not thought to be related to pesticide exposure; they are simply included for the sake of thoroughness. Ask them to be accurate and to refrain from exaggeration.

9. The following questions seek information about your health. (see following table and code sheet)

Frequency Code

A All the time
B 5 x / day
C 1 x / day
D 2 x / week
E 1 x / week
F 1 x / month
G 1 x / season
H 1 x / year
I 1 x every few years
J 1 x
K Never

Sign Code (Animals)

A unsteady gait/walks funny
B vomiting
C wheezing
D skin or hair problems
E miscarriages
F diarrhea
G hyperactivity
H sluggishness
I itching
J change in appetite
K change in milk production
L change in any food products from this animal
M other

Severity Code

1 Slight (e.g., mildly irritating)
2 Moderate (e.g., interferes with usual activities)
3 Severe (e.g., incapacitating)

Symptom Code (People)

1 Headaches
2 Dizziness
3 Fainting
4 Blurred vision
5 Seizures
6 Ringing ears
7 Swollen/puffy eyes
8 Nausea
9 Vomiting
10 Vomiting blood
11 Upset stomach
12 Lack of appetite
13 Fatigue/lack of energy
14 Constipation ("bound up")
15 Bleeding/painful gums
16 Easy bruising
17 Easy cracking of fingernails
18 Burning on breathing
19 Coughing
20 Wheezing
21 Asthma
22 Hay Fever
23 Sinus congestion
24 Runny nose
25 Difficulty breathing
26 Swollen glands
27 Skin rash
28 Skin peeling
29 Hair loss
30 Burning eyes/redness
31 Bloody or dark urine
32 Burning on urination ("passing water"
33 Aching joints

conditions

34 Arthritis
35 Emphysema
36 High blood pressure ("high blood")
37 Anemia ("low blood")
38 Chest pain/angina
39 Diabetes
40 Liver disease
41 Jaundice (yellowing of eyes)
42 Cancer (state type under diagnosis)

If a woman:

43 Irregular menstruation
44 Miscarriages

45 Other

Use Symptom Code

Pre-Exposure ("exposed" any time last summer ("unexposed")	Symptom	Symptom	Symptom	Symptom	Symptom	Symptom
How often? Use Frequency Code						
How bad? Use Severity Code						
For how long?						
Did you go to a doctor/clinic?						
If yes, what were you told?						
Were you given any medications?						
If yes, what were they?						
Did you take any other medications?						
If so, which ones?						
If "unexposed", had you ever had this before?						
Did this get worse (1), better (2), or no change (3)?						
Frequency Use Frequency Code						
How bad?						
If worse: Doctor/clinic consulted?						
What were you told?						
Were you given any medications?						
If so, which ones?						
Did you take any other medications?						
If so, which ones?						
Post-Exposure ("exposed") or Now ("unexposed") — If "exposed": How long after exposure did onset of worsened condition occur? (days)						
How long did it persist? (days)						
Did your doctor relate it to the pesticide?						
Are you better now? [no (1), mostly (2), completely (3)]						

Interviewer: Ask Question 10 if subject is a Corgus resident. Ask "unexposed" Corgus residents re: guests last July.

10. Did you have any family or friends from outside the neighborhood visiting during the time the pesticide was used or within a month afterwards? (any visit within a week, any visit for more than a day the rest of the month) yes ___ no ___ DK ___ R ___

	Name	Visited during time pesticide was being applied?	If not, visited how long afterwards? (days)	Stayed for how long after the pesticide was used? (days)	Any signs of health changes?	If so, describe changes.	May we contact him/her?	Address
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								

VII. Attitude Survey

1. Do you live in the country for any of the following reasons ? (check any that apply)

grew up here _____

family _____

job/like to farm _____

environment _____

health _____

don't like the city _____

cost of living or housing is less _____

other _____ (Specify)

DK _____

R _____

2. Do you like living here because you:

feel closer to nature _____

like fresh air _____

don't like pollution _____

other _____ (Specify)

DK _____

R _____

Interviewer: If subject does not use pesticides (see Part VI, Q 1 & 2) ask Question 3, with following statement as lead-in. If subject does use pesticides, go straight to Question 4, still using following statement as lead-in.

Earlier you said you (did/did not) use pesticides around your home.

3. Do you not use pesticides because:

no pest problem____

am concerned about possible health effects____

too expensive____

don't care about pests____

other _____
(specify)

DK____

R____

4. If a pesticide is used according to instructions on the label, do you think that:

all government approved pesticides are safe for humans ____	01
some approved pesticides are safe for humans and some are not ____	02
no approved pesticide is safe for humans ____	03
DK ____	08
R ____	09

5. Do you think people should be able to do whatever they want to on their own property regardless of how it affects their neighbors?

yes ____	01
no ____	02
DK ____	08
R ____	09

6. Do you think people should have a say over what chemicals they are exposed to at home or on their property?

yes ____	01
no ____	02
DK ____	08
R ____	09

Interviewer: If subject is an "exposed" Gorgus resident, ask Questions 7 through 15.

7. After the pesticide was sprayed: (check any that apply.)

I was not concerned _____

I was worried _____

I complained to the user _____

I complained to my public officials _____

I found out what I could about the pesticide _____

I closed my doors & windows and stayed inside _____

I got a neighborhood meeting together _____

I left home for a few days because of the spraying_____

I left home for a few weeks _____

I considered moving _____

8. Do you think the pesticide had a bad effect on your health?

yes ____

no ____

DK ____

R ____

9. Have you been worried that the pesticide may cause a bad effect on your health sometime in the future?

yes ____

no ____

DK ____

R ____

10. Were you satisfied with the response of public officials immediately after the pesticide incident?

yes ____

no ____

Dk ____

R ____

11. How do you feel toward the person or company responsible for the incident? (check any that apply.)

No feelings _____

Everyone has to make a living _____

Angry _____

Worried that they will spray again _____

Other _____
(specify)

DK____

R ____

12. Do you think that there is still some chemical on your land?

yes ____	01
no ____	02
DK ____	08
R ____	09

13. Do you think that there is still some chemical in your water?

yes ____	01
no ____	02
DK ____	08
R ____	09

14. If the pesticide is applied the same way again: (check any that apply.)

I wouldn't be at all concerned _____

I would be concerned _____

I would wait to see if anything else happens before doing anything _____

(cont'd)

I would complain to the user _____

I would complain to my public officials ____

I would find out what I could about the pesticide _____

I would close my doors and windows and stay inside _____

I would get a neighborhood meeting together to discuss the issue _____

I would leave home for a few days _____

I would leave home for a few weeks if I could afford to ____

I would consider moving if I could afford to _____

15. Did you plant a garden this year?

yes ____ 01

no ____ 02

DK ____ 08

R ____ 09

If no, was the pesticide incident:

the only reason ____ 01

one of several reasons ____ 02

not a reason ____ 03

DK ____ 08

R ____ 09

Interviewer: Ask Question 16 through 18 if subject "unexposed" or does not live in Gorgus.

16. Suppose the following sequence of events happened to you. The owner of the land next to your home hires someone to spray his tract with a pesticide. Immediately after the spraying and for several days afterward, you and your neighbors can smell the pesticide in your homes. You hear that some of your neighbors got skin rashes and coughs. A few days later, you notice that some of the vegetables in your garden are turning brown, and some of your farm animals do not seem well.

What would you do? (Check any that apply.)

I wouldn't be at all concerned _____

I would be concerned _____

I would wait to see if anything else happens before doing anything _____

I would complain to the user _____

I would complain to my public officials _____

I would find out what I could about the pesticide _____

I would close my doors & windows and stay inside _____

I would get a neighborhood meeting together to discuss the issue _____

I would leave home for a few days _____

I would leave home for a few weeks if I could afford it _____

I would consider moving if I could afford it _____

Other _____
(Specify)

17. How would you feel toward the person or company responsible for the spraying if you knew that the spraying didn't break any laws? (Check any that apply.)

No feelings _____

Everybody has to make a living _____

Angry _____

Worried that they would spray again _____

Other _____
(specify)

18. Would you worry that being exposed to a pesticide (as in this story) would cause bad health effects a year or more later?

yes ____ 01

no ____ 02

DK ____ 08

R ____ 09

Interviewer: Ask Questions 19 through 22 of all subjects.

19. In a case like this, do you feel that exposing nearby residents to a pesticide is unavoidable from time to time?

yes ____ 01

no ____ 02

DK ____ 08

R ____ 09

20. Do you think it is just too bad for the nearby residents or do you think they should be compensated (paid for damages)?

too bad for residents ____ 01

should be compensated ____ 02

other _____ (specify)

DK ____ 08

R ____ 09

21. Do you think aerial spraying is safe for people living nearby?

yes ____ 01

sometimes ____

no ____ 02

DK ____ 08

R ____ 09

22. Do you think stricter new laws should be passed to keep accidents like these from happening?

yes	____	01
no	____	02
DK	____	08
R	____	09

Interviewer: Ask Question 23 if subject is not a Gorgus resident.

23. Have you heard or read about the spraying last summer of an herbicide on the Boise-Cascade tract next to Gorgus?

yes	____	01
no	____	02
DK	____	08
R	____	09