Information Request
Off Site Fly Ash
GP Fort Bragg Sawmill

Georgia-Pacific Corporation
Fort Bragg, California

December 2006

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CERTIFIED–Return Receipt Requested

June 1, 1987

Steve Petrin
Director, Environmental Health and Safety
90 West Redwood Avenue
Fort Bragg, CA 95437

Dear Mr. Petrin:

Enclosed is Order No. 87-80, rescinding Cleanup and Abatement Order No. 86-43 for the Little Valley ash soil amendment site. I was pleased to see the efforts expended at the site have resulted in no further threat of discharge at the north site.

I was concerned to learn that the ash stockpiled in the area south of area "A" was not being incorporated Incorporation activities should commence at once on this stockpiled area. No further material should be stockpiled in this area.

I regret having to cancel our meeting of June 2, but I look forward to meeting with you and Rod Shippey on June 15, at 2 o'clock.

Sincerely,

Susan A. Warner
Associate Engineering Geologist

PS Form 3811, Feb. 1986 DOMESTIC RETURN RECEIPT

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Steve Petrin
Director, Environmental Health
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90 West Redwood Avenue
Fort Bragg, CA 95437

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P-503 342 410

Steve Petrin
Director, Environmental
Health and Safety
90 West Redwood Avenue
Fort Bragg, CA 95437

California Regional Water Quality Control Board
North Coast Region

ORDER NO. 87-80

RECISION OF CLEANUP AND ABATEMENT ORDER NO. 86-43

FOR

GEORGIA-PACIFIC CORPORATION
FORT BRAGG ASH SOIL AMENDMENT

Mendocino County

The California Regional Water Quality Control Board, North Coast Region, (hereinafter the Regional Board) finds that:

WHEREAS, Georgia-Pacific Corporation (hereinafter the discharger) was issued Cleanup and Abatement Order No. 86-43 on February 11, 1986, requiring that ash wastes be stabilized and remedial cleanup activities be undertaken.

WHEREAS, The Regional Board staff inspected the area on May 15, 1986, December 30, 1986, and on May 19, 1987, and determined that appropriate corrective actions had been taken, ash wastes were no longer discharging or threatening to discharge from the Little Valley site.

THEREFORE, IT IS HEREBY ORDERED that pursuant to Water Code Section 13304, Order No. 86-43 be rescinded.

Ordered by ORIGINAL SIGNED BY
Benjamin D. Kor
Executive Officer

June 1, 1987

ncasi technical bulletin

NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR AIR AND STREAM IMPROVEMENT, INC., 260 MADISON AVENUE, NEW YORK, N.Y. 10016

ASSESSMENT OF HUMAN HEALTH RISKS RELATED TO EXPOSURE TO DIOXIN FROM LAND APPLICATION OF WASTEWATER SLUDGE IN MAINE

TECHNICAL BULLETIN NO. 525

JUNE 1987

NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR AIR AND STREAM IMPROVEMENT, INC.
260 MADISON AVE. NEW YORK, N.Y. 10016 (212) 532-9000

Russell O. Blosser
Technical Director
(212) 532 9001

June 2, 1987

TECHNICAL BULLETIN NO. 525

ASSESSMENT OF HUMAN HEALTH RISKS RELATED TO EXPOSURE TO DIOXIN FROM LAND APPLICATION OF WASTEWATER SLUDGE IN MAINE

In late September 1985 it was announced in Maine that dioxin (2,3,7,8 TCDD) in low part per trillion levels had been found in some waste treatment sludges from the pulp and paper industry in Maine. This is in contrast to the findings on samples of sludges analyzed in 1983 by EPA as part of a joint study supported by the Paper Industry Information Office of Maine, the Maine Department of Environmental Protection (DEP) and the University of Maine. The analysis of three different samples then showed non-detectable levels at 85, 140 and 340 parts per trillion 2,3,7,8 TCDD.

As a result of the EPA findings of 1985, the Maine DEP held a series of public hearings in early 1986 to consider alternatives for managing the sludges used in land application in that state. Regulations which established the allowable level of dioxins in (a) sludges used in land application programs and (b) the soils to which they are applied were subsequently developed.

During the course of developing the land application regulations the Maine Paper Industry Information Office, Maine Wastewater Control Association and National Council for Air and Stream Improvement contracted with Envirologic Data Inc. to assess any potential risks to human health or impacts on the environment from land application of wastewater sludges. These assessments were presented orally at the hearings held by the Maine DEP.

The National Council then contracted with Envirologic Data to organize the oral presentations on human health risks into a comprehensive written report. This technical bulletin is the work product of that effort and incorporates additional new published literature and yet unpublished information collected since the time of the hearings.

The bulletin contents first deal briefly with human health risk assessment and hazard identification. The bulk of the bulletin is devoted to exposure assessment, risk assessment, and the conclusions. In presenting the exposure assessments the pathways for movement of dioxin from land application of sludge through both direct contact and the food chain are identified. The risk assessment then gives special attention to two population groups, (a) the Maine farmer and/or his family who may be subject to a different level of exposure in those situations where they depend solely on food, meat and milk derived from animals grazed on sludge amended fields and (b) the general population. The lowest acceptable levels for dioxin in sludges or soils to which these sludges were for Maine farmers who rely on milk and beef grown on sludge amended lands.

The authors caution that the risk assessment approach used is based on reasonably conservative parameters and over all the qualitative risk assessment estimates are conservative in light of the evidence to support TCDD's action as a cancer promoter, a subject covered in depth in NCASI Technical Bulletin No. 524. Finally, based on the results of this risk analysis the authors conclude that levels of TCDD even greater than those in Maine sludges may be of little concern to public health.

Your comments and questions on this technical bulletin are solicited and should be directed to me or Dr. Michael Sullivan, Toxicology Program Manager, at the address or telephone number above or to Mr. James J. McKeown at NCASI, Dept. Civil Engineering, Tufts University, Medford, MA 02155 (telephone 617-381-3254).

Yours very truly,

Russell O. Blosser

Russell O. Blosser
Technical Director

ROB:mh
Attach.

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ASSESSMENT OF HUMAN HEALTH RISKS RELATED TO EXPOSURE TO DIOXIN FROM LAND APPLICATION OF WASTEWATER SLUDGE IN MAINE

1.0 BACKGROUND AND INTRODUCTION

1.1 Background

The production of pulp and paper products utilizes several standard manufacturing processes in which water is used as a medium of transport, a cleaning agent, a solvent or mixer, and as an agent in the fiber-to-fiber bonding reaction during paper manufacture. Throughout these processes, wastewaters are generated, recycled, and eventually discharged to the mill's waste treatment plant.

The paper industry in Maine treats millions of gallons of waste process water per day. Primary wastewater treatment is basically a sedimentation process utilizing physical and chemical processes. The resultant product is called primary sludge.

Secondary treatment begins with the addition of nitrogen and phosphorus to the wastewater after much of the fiber and other solids have been removed in the primary clarification process (Watson and Hoitink, 1985). The added nitrogen and phosphorus support microorganisms that utilize the organic matter in sludge as a carbon source. This activity increases the microbial mass which is settled out and in some processes is then known as activated sludge. After dewatering, the material is called secondary sludge. Oftentimes, the primary and secondary sludges are combined and dewatered prior to disposal.

Land application of sludge as a low-cost fertilizer and soil conditioner has been a valuable, accepted practice for a number of years (EPA, 1984e). Sludge contains nutrients which are required for plant growth -- namely nitrogen, phosphorus, potassium, calcium, and minor trace elements. Sludge is high in organic matter which, when added to the soil, improves both its structure and water-holding capacity. In addition, the fibrous nature of a paper mill sludge retards runoff and erosion.

Trace chemical components in Maine paper mill sludges are well within the environmental and health levels established by the U.S. EPA for identifying nonhazardous wastes. The material contains no detected pathogens and is very low in concentrations of heavy metals. With the exception of copper, the metals found in paper mill sludges are present at concentrations lower than the concentrations of those metals in natural Maine soils (Resource Conservation Service, 1987, Personal Communication; NCASI, 1984).

In the State of Maine, the treatment of paper mill and municipally-derived wastewaters results in the production of over 1,000,000 cubic yards of sludge each year (Maine DEP, 1986a). Over 75 treatment plants dispose of their sludge through composting or land application for agricultural use. Without the approval to apply these materials on agricultural lands, Maine's major commercial landfills would be filled to capacity within one year, creating a serious landfill shortage and disposal problem (Maine DEP, 1986a).

Recently, low levels of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) were detected in Maine sludges, ranging from the limit of detection upwards to 51 parts per trillion (ppt) (Maine DEP, 1986b). Questions have been raised concerning the potential human health risks and environmental impacts of low levels of 2,3,7,8-TCDD in land-applied Maine sludges. This culminated in the Natural Resources Council of Maine and other citizens petitioning the Maine Board of Environmental Protection to establish a standard limiting or banning the land application of sludge containing dioxin.

Envirologic Data, Inc., a Portland, Maine based firm providing specialized counsel in human health and environmental risk assessment was contracted by the Maine Wastewater Control Association, the Maine Paper Industry Information Office, and the National Council of the Paper Industry for Air and Stream Improvement (NCASI), to assess any potential risks to human health or impacts on the environment from exposure to dioxin in land-applied wastewater sludges. The risk assessment results were presented orally at regulatory hearings before the Department of Environmental Protection (DEP) of the State of Maine in the Spring of 1986.

The National Council of the Paper Industry for Air and Stream Improvement, Inc., has subsequently contracted Envirologic Data to produce a comprehensive written report of the human health risk assessment presented before the Maine DEP. In the intervening time since the initial presentations, Envirologic Data has reviewed additional published literature as well as information available from unpublished sources. As a result of this review, Envirologic Data has refined its earlier analysis. The risk assessment presented in this document contains these refinements and is the current professional opinion of Envirologic Data, Inc. The present analysis differs somewhat from the 1986 testimony and supercedes previous risk estimates of Envirologic Data regarding land-applied wastewater sludge in Maine.

1.2 Introduction to Human Health Risk Assessment

Risk assessment is defined by the National Academy of Sciences as the characterization of the probability of potentially adverse health effects from human exposures to environmental hazards. Risk has two major components -- hazard and exposure. A very potent toxicant does not pose a health risk if there is no exposure. Similarly, exposure to a chemical with no toxicity does not pose a health risk. For 2,3,7,8-TCDD, the potential for carcinogenicity has been identified as the principal health concern. In this analysis, Envirologic Data has characterized the upper-bound incremental cancer risk, above the background risk, due to low-level exposure to dioxin in landspread wastewater sludges. This same analysis was used to develop "allowable" TCDD levels in soil and sludge.

When available data on humans are inadequate to predict carcinogenic response, animal data are used to extrapolate to low-level human exposure. This is the case with risk assessments of TCDD. Envirologic Data's approach to assessing the risks of low levels of TCDD in sludges is outlined below:

1. Review and evaluation of animal and human toxicity data through review of major secondary sources and evaluation of key primary sources.

2. Development of soil-loading models for predicting TCDD concentrations in the soil from repeated application of wastewater sludges.

3. Development of exposure scenarios and modeling of exposure parameters based on accepted agricultural practices, the experience of a technical advisory committee composed of agricultural experts and sludge utilization authorities, the scientific literature, and personal contacts with recognized authorities. Scenarios examined in the report include:

   - Maine consumer ingesting milk or beef from cattle grazed on sludge-amended pastures;
   - Maine farmer ingesting milk or beef from cattle grazed on sludge-amended pastures;
   - Maine farmer consuming milk or beef from cattle fed hay or silage corn grown on sludge-amended pastures;
   - Maine farmer consuming corn grown on sludge-amended fields;
   - Maine farmer inhaling dust or in dermal contact with soil from sludge-amended fields;
   - Maine child ingesting soil from sludge-amended fields; and
   - Maine child ingesting soil from lawn established with compost.

4. Analysis of dose-response data from TCDD carcinogenicity tests in laboratory animals leading to selection of appropriate cancer potency figure and virtually safe dose for analysis.

5. Integration of exposure and dose-reponse data and analyses to determine:

   - incremental cancer risks associated with each exposure scenario according to the soil-loading models in which sludge containing 50 ppt TCDD is applied annually until maximum loading on a given site is achieved; and

- "allowable" soil and sludge TCDD levels associated with each exposure scenario corresponding to levels of "acceptable" incremental cancer risk of 1×10^{-6} (one in one million) and 1×10^{-5} (one in one hundred thousand).

2.0 HAZARD IDENTIFICATION

This section contains a limited review of the extensive literature database regarding potential health hazards of 2,3,7,8-TCDD to animals and humans.

2.1 Animal Health Effects

The toxicity of TCDD has been extensively examined in a number of acute, subchronic, and chronic studies. TCDD is readily absorbed through the gastrointestinal (GI) tract with absorption fractions reported to range from 50 to 86% in feeding and gavage experiments depending on the vehicle matrix (Fries and Marrow, 1975; Rose et al., 1976; Piper et al., 1973; Olson et al., 1980a). Soil-borne TCDD typically is absorbed by the GI tract to a smaller extent. Bioavailability percentages reported in the literature have ranged from less than 1 to about 50% (Poiger and Schlatter, 1980; Lucier et al., 1986; Umbreit et al., 1986b; Bonaccorsi et al., 1984). The variation in oral bioavailability figures reported in the literature may be due to variations in the amount of soil and TCDD administered to the test animals, level of organic matter in the soil, length of soil-TCDD contact, presence of co-contaminants, and method for calculating bioavailability (Paustenbach et al., 1986; Poiger and Schlatter, 1980; Umbreit et al., 1986b; Lucier et al., 1986). TCDD is rapidly distributed to tissues with a high lipid content and typically is found localized in liver or adipose (fat) tissue, depending on the species (Gasiewicz et al., 1983). Excretion of TCDD is slow, with the elimination half-life in animals reported to range from about 10 days for the hamster (Olson et al., 1980a) to about 1 year for the monkey (McNulty et al., 1982).

The acute toxicity of TCDD exhibits more than a thousandfold range of response among different species. The acute LD_{50} in guinea pigs is reported to be 0.6 ug/kg body weight (b.w.) compared to a range of 1157 to 5051 ug/kg b.w. in the hamster (Kociba and Cabey, 1985). Symptoms of acute lethal poisoning include severe weight loss and thymic atrophy (Kociba and Schwetz, 1982) with death occurring up to 45 days after exposure (Olson et al., 1980b). Hepatic toxicity is a prominent component of TCDD toxicity in rats, mice, and rabbits (Kociba and Schwetz, 1982). TCDD may cause an acnegenic skin response in certain species (Kociba and Schwetz, 1982). TCDD has the potential to alter the immune response in animals (Dean and Kimbrough, 1986).

TCDD is a potent inducer of microsomal enzymes including aryl hydrocarbon hydroxylase (AHH), with considerable differences in response from species to species (Kociba and Schwetz, 1982; Kimbrough et al., 1984). Enzyme induction is a very sensitive, yet nonspecific, indicator of dioxin exposure. It is hypothesized that

TCDD's mechanism of toxic action may consist of TCDD combining with a receptor protein in the cell, which then enters the nucleus and initiates enzyme induction leading to toxicity (Poland et al., 1983; Kimbrough et al., 1984; Poland, 1986).

TCDD has induced teratogenic, fetotoxic, and other reproductive-related effects in mice, rats, and monkeys (Kimbrough et al., 1984). TCDD demonstrates a lack of mutagenic activity in the large majority of tests (Shu et al., 1987).

TCDD is carcinogenic in rats and mice and induces a number of different tumor types, although the liver is the primary target tissue (Kociba et al., 1978; NTP, 1982). TCDD has been shown to be a potent promoter of liver tumors in the rat (Pitot et al., 1980). TCDD also has been shown to be a tumor promoter in the skin of hairless mice (Poland et al., 1982). There is little evidence to suggest that it acts as an initiator (Pitot et al., 1980; Poland et al., 1982; Kimbrough et al., 1984; Poland, 1986). A more detailed discussion of this issue is presented in Section 4.3.

2.2 Human Health Effects

Although the health effects of TCDD in animals are well-documented, the human health effects of TCDD are less well defined. The data base on human exposure comes primarily from occupational exposures and industrial accidents at TCDD levels much greater than those typically encountered in the environment. Results of many of these studies are complicated by the difficulty and uncertainty in estimating exposures and by concomitant exposure to other chemicals.

The half-life of TCDD in humans is not known precisely, but Poiger and Schlatter (1985) have calculated a half-life of 4.95 years based on a human volunteer study which demonstrates almost complete absorption of TCDD from the gut. Jones et al. (1986) cite the data by Poiger and Schlatter (1985) as showing that the effective period of retention is much longer than one year.

Chloracne is the most consistent effect and "hallmark" of TCDD toxicity, and has been observed in cases of both acute and chronic exposure to high levels (Suskind, 1985; Kociba and Schwetz, 1982). Chloracne also can be caused by exposure to numerous other chlorinated aromatic hydrocarbons (Kimbrough et al., 1984), but 2,3,7,8-TCDD appears to be the most potent chloracnegen (Suskind, 1985). A number of health effects, including porphyria cutanea tarda (Bleiberg et al., 1964; Pazderova-Vejlupkova et al., 1981) hyperpigmentation (Bleiberg et al., 1964), hirsutism (Bleiberg et al., 1964), altered liver function (Pazderova-Vejlupkova et al., 1981), and neurological problems (Singer et al., 1982; Pazderova-Vejlupkova et al., 1981; Moses et al., 1984) have been attributed to TCDD based on case histories or clinical surveys. In most of these cases, exposure was to 2,4,5-T or chlorinated phenols contaminated with TCDD, thus making it difficult to determine which chemical or whether the chemicals together produced the specific effects (Young et al., 1983). Suskind (1985) points out that sufficient exposure to TCDD can induce chloracne, but that systemic effects such as peripheral neuritis and transient hepatic dysfunction have occurred only in association with and subsequent to chloracne.

A number of epidemiological studies have been conducted on persons exposed to TCDD from industrial accidents, occupational exposure, or herbicide spraying during the Vietnam War. Reviews of the epidemiologic database can be found in AMA (1984), EPA (1986), and NCASI (1987). Major findings of a few of the epidemiological studies that have been conducted are briefly summarized below.

Studies of Herbicide Users

- Case-control studies of workers in Sweden exposed to phenoxy herbicides or chlorophenols reported an increased incidence of soft-tissue sarcomas and malignant lymphomas (Hardell and Sandstrom, 1979; Eriksson et al., 1981, Hardell et al., 1981).
- Study of subcohorts of Swedish agricultural or forestry workers showed no significantly increased relative risk of soft tissue sarcoma when compared to Swedish men employed in other industries, even though the agricultural and forestry workers' exposure to phenoxy acids is assumed to be greater than that of other occupational groups (Wiklund and Holm, 1986).
- New Zealand case-control study of soft-tissue sarcoma reported to find no association with agricultural activities or herbicide exposure (Smith et al., 1982b, 1983, as cited in Blair, 1986).
- New Zealand interview study reported to find nonsignificant excess of non-Hodgkin's lymphoma in persons potentially exposed to phenoxyacetic acids and chlorophenols (Pearce et al., 1986, as cited in Blair, 1986).
- NCI case-control study of agricultural use of herbicides in Kansas reported to demonstrate association between use of phenoxyacetic acid herbicides, specifically 2,4-D, and non-Hodgkin's lymphoma. No association found with soft-tissue sarcoma or Hodgkin's disease. 2,4-D does not contain 2,3,7,8-TCDD, but may contain other less toxic congeners (Hoar et al., 1986).
- New Zealand birth defects study reported to show no suggestive evidence that 2,4,5-T adversely affected pregnancy outcomes (Smith et al., 1982a, as cited in AMA, 1984).

Studies of Vietnam Veterans

- New York State study reported to find no significant association between soft-tissue sarcoma and Vietnam service (Greenwald et al., 1984, as cited in AMA, 1984).
- Air Force Ranch Hand study reported to show no relationship between herbicide exposure and increased mortality or adverse health effects at this time (Wolfe et al., 1985).

- CDC study reported to provide strong evidence that Vietnam veterans are at no greater risk than others for siring babies with serious structural birth defects, when all types of birth defects are considered in the aggregate. (Erickson et al., 1984).
- Australian birth defects study reported to show no association between exposure and adverse pregnancy outcome and showed that risk of siring a malformed child was no higher for Vietnam or non-Vietnam veterans compared to other Australian males (Armstrong, 1983; Lipson, 1983; Minister of Veteran Affairs, 1983; as cited in AMA, 1984).

Studies of Workplace Exposures

- Study of workers exposed during accident involving 2,4,5-T manufacturing at Monsanto Chemical plant in Nitro, West Virginia, reported to show no increased risk for overall mortality, cardiovascular disease, hepatic disease, renal disease, central or peripheral nerve problems, reproductive problems, or birth defects among exposed and those who developed chloracne (Suskind, 1985).
- Dow Chemical study of a cohort of 2,192 chemical workers with potential occupational exposures to TCDD and/or other higher chlorinated dioxins reported to show no increased mortality or cancer mortality in exposed workers whose exposure resulted in chloracne when compared to U.S. white males (Cook et al., 1986; Bond et al., 1986).

The only consistently demonstrated long-term health effect related to TCDD exposure has been chloracne. The epidemiologic evidence relating exposure to substances contaminated with TCDD and cancer in humans has been termed contradictory (Blair, 1986). The cancer endpoints for which the strongest positive associations have been reported include soft-tissue sarcoma (Hardell and Sandstrom, 1979; Eriksson et al., 1981) and malignant lymphoma (Hardell et al., 1981). Other epidemiologic studies, however, have not confirmed the positive associations between phenoxy herbicide or chlorophenol exposure and soft-tissue sarcoma or malignant lymphoma shown in the Swedish case-control studies (Wiklund and Holm, 1986; Smith et al., 1982b, 1983, as cited in Blair, 1986; Pearce et al., 1986, as cited in Blair, 1986). It is not possible to conclude that herbicides or chlorophenols containing TCDD cause cancer in humans based on the results of the Swedish studies due to the lack of confirming evidence from other epidemiologic studies and the limitations associated with these studies.

Several studies have reported on background levels of 2,3,7,8-TCDD in the adipose tissue of individuals with no known exposure to TCDD (Graham et al., 1985; Patterson et al., 1986; Ryan et al., 1985a,b; Schecter et al., 1985; Nygren et al., 1986). These measurements suggest that exposure to 2,3,7,8-TCDD is widespread in the populations tested; however, the data are variable with some nondetectable levels. Mean background levels measured have been reported to range from about 3 to 10 ppt (Ryan et al., 1985a; Graham et al., 1985; Nygren et al., 1986; Patterson et al., 1986). Sielken

(1986a) found that evidence from North America suggests that 2,3,7,8-TCDD levels in human adipose tissue are log-normally distributed and are positively correlated with age. Sielken (1986a) also notes that among the observed U.S. background TCDD levels in adipose tissue, more than 10% were greater than 12 ppt.

TCDD levels in Vietnam veterans were reported to range from a few ppt to as high as 99 ppt in fat, with a mean of 8.3 ppt (Hobson et al., 1983, as cited in Young and Cockerham, 1985). TCDD levels measured in blood fat of Vietnam veterans exposed to Agent Orange were reported to average 48 ppt (New York Times, 1986). Samples of fat tissues from citizens of southern Vietnam believed to have been exposed to Agent Orange contained levels of TCDD ranging from 4 to 79 ppt, with a mean of 23 ppt (Schecter et al., 1986). The biological significance of dioxin levels measured in fat tissues in both unexposed and exposed individuals is not known at this time.

3.0 EXPOSURE ASSESSMENT

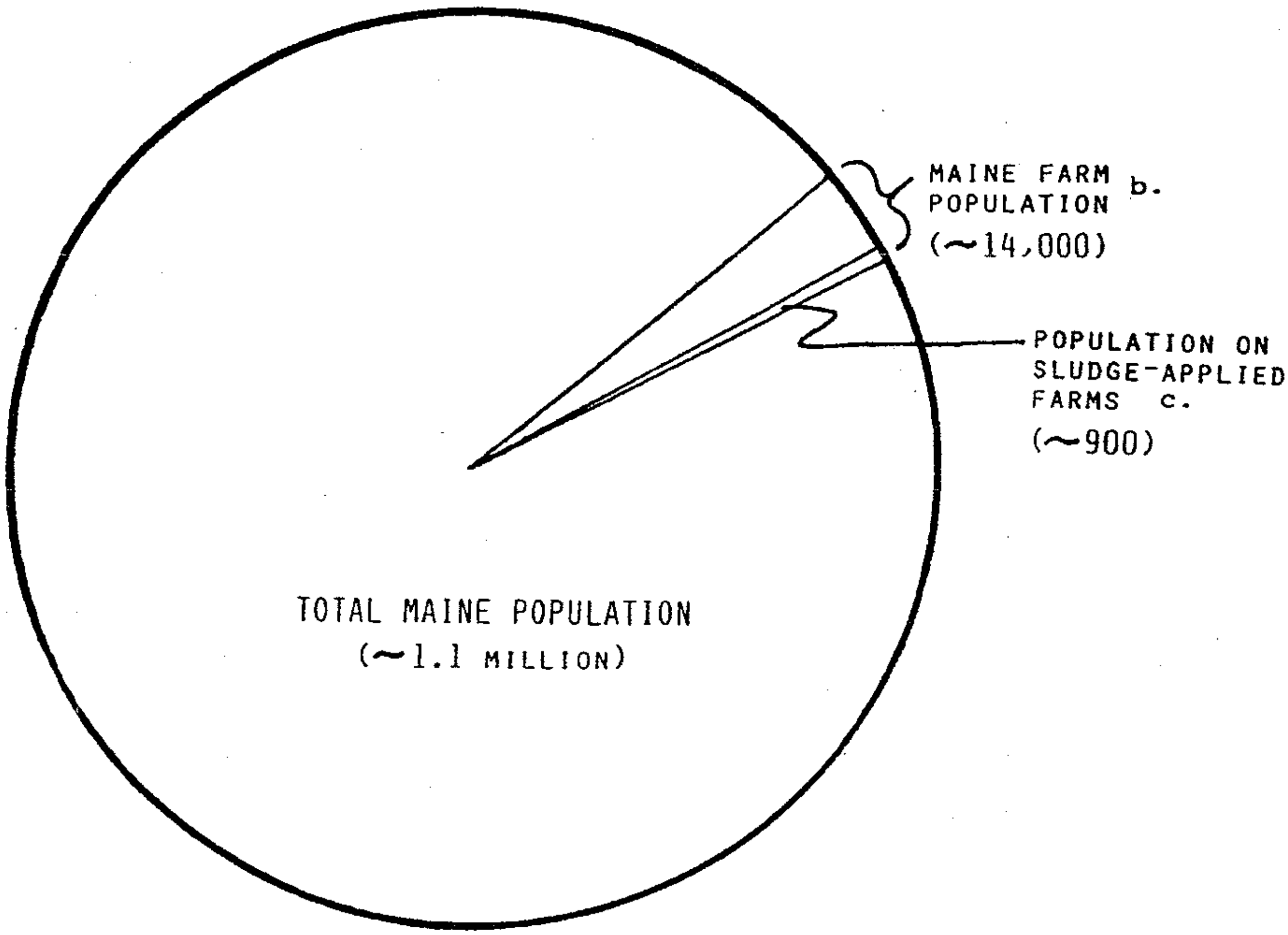
3.1 Identification of Potentially Exposed Populations and Routes of Exposure

In this section, populations potentially exposed to TCDD in landspread sludges are identified. Potential exposures may be categorized into three principal population groups: (1) the Maine farmer and family who use wastewater treatment plant sludges as soil amendments and fertilizers on pasture or crop lands, (2) the Maine consumer who ingests food produced on such farms, and (3) children in the general population who may potentially ingest soil from lawns established with compost generated from wastewater treatment plants.

As shown in Figure 3.1.A, the maximum population on farms using sludges is roughly estimated at about 900 people in 1986 (based on 265 sludge-spreading applications in Maine [Personal Communication, K. Townsend, Maine DEP] and an average number of persons per U.S. farm family of 3.3 in 1983 [U.S. Department of Commerce, 1984]). Not all wastewater treatment plant sludges in Maine have been shown to contain TCDD. Results of dioxin analyses in 1986 showed that 2 out of 6 pulp and paper mill sludges and 8 of 11 POTW sludges tested showed nondetectable levels of 2,3,7,8-TCDD (Maine DEP, 1986b). Therefore, the number of people actually residing on farms utilizing TCDD-containing sludge, and thus potentially exposed to TCDD, would likely be considerably less than the figure of 900. The total Maine farm population and total general population are shown in Figure 3.1.A for comparison.

Potential routes of exposure to TCDD in landspread sludges include ingestion, skin contact, and inhalation. Due to its lipophilic properties, TCDD may accumulate in milk and beef fat. This report examines exposure to Maine farmers who consume their own milk or beef from cattle grazed on sludge-amended pastures or fed silage hay or corn grown on sludge-amended fields. Potential exposure to Maine consumers is also examined. This scenario is based upon the possibility of farm sales of milk or beef, produced as described above, to commercial markets. One other food pathway

FIGURE 3.1.A. Maximum Estimated Population on Sludge-Applied Farms Compared to Maine Farm Population and Total Maine Population[a]



a. not drawn to scale

b. based on 1980 statistics

c. estimate based on approximate number of sludge-spreading farms in 1986 and average number of persons per farm family as of 1984 is examined, exposure to Maine farmers consuming their own produce that is grown on sludge-amended fields.

In addition to food exposure pathways, a farmer or his family may be exposed directly to TCDD in landspread sludges through skin contact, dust inhalation, or soil ingestion. For members of the general population using compost for lawn establishment, soil ingestion by children is identified as the route of primary concern. Potentially exposed populations and corresponding routes of exposure are summarized in Table 3.1.A.

3.2 Soil Loading Models for Estimating Concentrations of TCDD

Models were developed by Envirologic Data to predict soil concentrations of TCDD resulting from long-term land application of wastewater sludges. Computer-based models were constructed to allow for relatively easy manipulation of variables such as sludge application rate, application frequency, and TCDD content of sludge.

Two different methodologies exist for sludge application: topdressing and soil incorporation. In this analysis, sludge is considered to be topdressed on pastureland and hay fields and incorporated into corn fields. For the direct contact exposure scenarios (skin contact, dust inhalation, soil ingestion), sludge is assumed to be topdressed because it results in a worse-case analysis than soil incorporation. Key parameters in the topdressing and soil incorporation scenarios are described in Table 3.2.A. Annual application rates were based on typical sludge utilization rates in Maine. Relatively low concentrations of copper in sludge from a representative municipal treatment plant in Maine resulted in a lifetime permissible sludge loading of about 450 dry tons/acre, based on a copper limit of 500 kg/hectare (Maine DEP, 1985). This maximum permissible sludge loading limit of 450 dry tons/acre is used throughout this analysis. Based on this limit, for the topdressing methodology, sludge is applied at the rate of 10 dry tons/acre-year for 45 years. For soil incorporation, sludge is applied at 20 dry tons/acre-year for 22 years of application.

The model assumes that all TCDD applied remains within the top 1-inch layer of soil for years in which sludge is topdressed (with no incorporation), and that TCDD concentrations are uniform in that layer. For years in which soil incorporation occurs, all TCDD is assumed to remain within the top 6-inch layer of soil, and TCDD concentrations are assumed to be homogeneous in the 6-inch layer.

The model also calculates TCDD loss from soil using a half-life for TCDD of 10 years. The contribution of volatilization and microbial degradation to half-life remains somewhat unclear (Young, 1983). Young (1983) suggests that the half-life for TCDD in soil might be about 10 to 12 years, but Fries (1987) points out that it is probably shorter at the surface where losses by volatilization can occur. Envirologic Data selected a 10-year figure for this analysis.

Figure 3.2.A illustrates the TCDD soil loading models for both application methodologies at a hypothetical level of 50 ppt TCDD in the applied sludge. In the soil incorporation model, the soil TCDD concentration increases in a stepwise function until the cumulative loading limit is met, then decreases at a rate determined by the half-life. In the topdressing model, the soil TCDD concentration in the top inch increases until the sixth year of application, at which time the top 6 inches of soil are turned over and mixed as part of conventional agricultural practice, thus causing a dilution effect. With each 6-year cycle, the TCDD concentration at the base of the spikes gradually increases until the cumulative sludge loading limit is reached. As with soil incorporation, the TCDD concentration then decreases at a rate determined by half-life. Table 3.2.B presents the 70-year and 5-year average soil concentrations estimated by the soil loading models for sludge containing 50 ppt TCDD. These figures are used to calculate 70-year lifetime exposures and associated potential cancer risks from landspread sludges containing 50 ppt TCDD. The soil loading models are used in reverse fashion to determine the levels of TCDD in sludge that correspond to the allowable soil TCDD levels determined in the risk assessment.

One exposure scenario does not rely upon either the topdressing or soil incorporation TCDD loading model. In this situation, a lawn is established through the use of a one-time application of compost containing sludge as a primary constituent. The compost is then mixed with soil or sand. The relationship between the initial sludge TCDD level and the 5-year average soil TCDD level is determined by the percent of sludge in compost, percent compost in soil, and TCDD half-life. The 5-year average soil TCDD concentration from lawn application using sludge containing 50 ppt TCDD is shown in Table 3.2.B.

3.3 Exposure Models

In this section, models are developed for each exposure scenario in order to estimate worst-case TCDD exposures. Exposure and toxicological parameters are outlined for each scenario, and key points to the exposure assessment are discussed in detail. The text is supplemented by summary tables which immediately follow the text in which they are first mentioned.

Certain parameters, such as body weight or lifetime, are common to more than one scenario. Body weights used for adults are 70 kg (154 lb) and for children aged 2 to 6 are 17 kg (37 lb) (ICRP, 1975; EPA, 1984). With the exception of soil ingestion by children aged 2 to 6, all exposures are estimated to occur for a full lifetime of 70 years. This assumption is extremely protective, as it is highly unlikely that one person would be born, grow up, live, and work for 70 years on a farm using landspread sludges containing TCDD. Envirologic Data has used this approach to ensure that exposures estimated in this report encompass all conceivable possibilities. The effect of this and other conservative assumptions on the final analysis are discussed in Section 4.5. Exposure scenarios are described in the following sections.

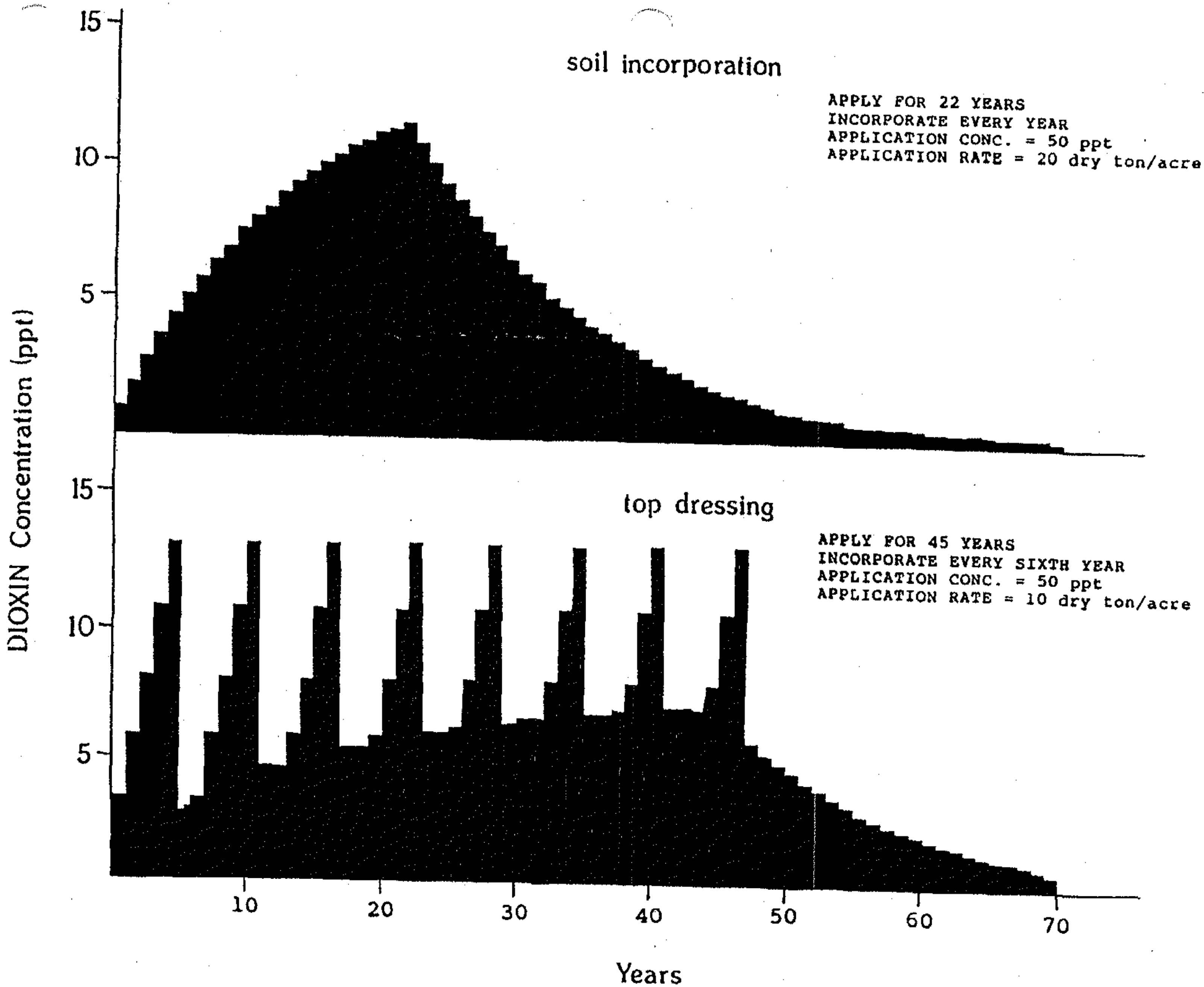


Figure 3.2.A. Soil TCDD Loading Models

Table 3.1.A. Potentially Exposed Populations and Corresponding Routes of Exposure

Maine Population	Exposure Route	Exposure Scenario
Farmer	Ingestion	Milk from cows grazed on sludge-amended pastures
Consumer	Ingestion	Milk from cows grazed on sludge-amended pastures
Farmer	Ingestion	Milk from cows fed hay grown on sludge-amended fields
Farmer	Ingestion	Milk from cows fed silage corn grown on sludge-amended fields
Farmer	Ingestion	Beef from cattle grazed on sludge-amended pastures
Consumer	Ingestion	Beef from cattle grazed on sludge-amended pastures
Farmer	Ingestion	Beef from cattle fed hay grown on sludge-amended fields
Farmer	Ingestion	Beef from cattle fed silage corn grown on sludge-amended fields
Farmer	Ingestion	Corn grown on sludge-amended fields
Farmer	Skin Contact	Soil in sludge-amended fields
Farmer	Dust Inhalation	Dust generated from resuspension of soil in sludge-amended fields
Child Residing On Farm	Ingestion	Ingestion of soil from sludge-amended fields
Child	Ingestion	Ingestion of soil from lawn established with compost

Table 3.2.A. Key Parameters for Sludge Application Methodologies

Parameter	Topdressing	Soil Incorporation
Application Rate/ Duration	10 tons/acre-year for 45 years	20 tons/acre-year for 22 years
Plowing Frequency	Once every 6 years	Once every year
Depth of Plow Zone	6 inches	6 inches
Uniform TCDD Concentration	Top 1 inch of soil	Top 6 inches of soil
TCDD Concentration Relevant to Exposures	70-year avg. for all exposure scenarios except 5-year avg. for soil ingestion	For all exposure scenarios except 70-year avg.

Table 3.2.B. Soil TCDD Concentrations Resulting From Long-Term Application of Sludges Containing 50 ppt TCDD, Averaged Over Exposure Period

	TCDD Level in Soil (ppt)		
	Topdressing	Soil Incorporation	Lawn Application[a]
70-year avg.	6.5	4.6	
5-year avg.[b]	8.2	--	8.8

a Single sludge application as part of compost.
b Represents average of first five years.

3.3.1 Milk Consumption by Maine Farmer -- Cows Grazed on Sludge-Amended Pastures

An individual residing on a dairy farm and consuming milk from cows that have been grazed on sludge-amended pastures may potentially be exposed to TCDD in milk. TCDD is known to concentrate in fat tissues, including milk fat. Exposure and toxicological parameters for this scenario are detailed in Table 3.3.1.A.

Based on data from Jensen and Hummel (1982), steady-state milk fat concentrations of TCDD are estimated to be about 4 times that of concentrations in feed. Dairy cows that are grazed ingest a certain amount of soil. Based upon data on New Zealand dairy cattle, soil intake during warm-weather months is estimated to constitute about 3% of total dry matter intake (Healy, 1968). Since supplemental feeding in Maine is expected to account for about 50% of total dry matter intake, soil consumption may be proportionately reduced, resulting in a soil intake factor of about 1.5% of total dry matter intake. The two factors described above can be combined to estimate a bioconcentration factor from soil to milk fat of 0.06; that is, 1 ppt of TCDD in soil would be expected to result in about 0.06 ppt TCDD in milk fat.

Fries (1987) points out that lactating dairy cows are rarely pastured and supplemental feeding is almost always employed. While grazing of dairy cattle is not typical practice in Maine, dairy cows that are grazed might be pastured for a maximum of up to about 2 or 3 months per year. At the beginning of the summer grazing period, the TCDD level in milk fat is assumed to be essentially zero. Several weeks of exposure are necessary before a steady-state TCDD level will be approached. Fries (1982) noted that the milk-fat concentrations of similar compounds, PCBs, approached steady state in about 3 weeks. When grazing on sludge-amended pastures ceases at the end of the 3-month period, the milk-fat TCDD level will decrease at a rate corresponding to the elimination half-life of TCDD, reported to be about 41 days by Jensen and Hummel (1982). In the following 9 months with no additional TCDD exposure, the milk-fat TCDD level is expected to decrease to less than 1% of the steady-state level reached during the grazing period, based on calculations using the 41-day half-life figure.

The farmer is assumed to consume milk for 365 days/year for 70 years. A milk consumption factor of 25% is applied to the farmer's consumption. That is, 25% of all milk consumed in a year is assumed to derive from cows grazing on sludge-amended fields where sludge contains TCDD. Essentially, applicaton of this factor relates to the milk consumed by the farmer during the 3-month grazing period. The actual duration of a farmer's exposure might be somewhat longer than the 3 months, if cows are actually grazed for a full 3 months, due to lingering milk-fat TCDD levels following cessation of grazing. However 3 months is used as an approximation assuming about 2 months of exposure at steady-state TCDD levels and the equivalent of 1 month steady-state exposure composed of lower TCDD levels achieved pre-steady-state and post-exposure.

Table 3.3.1.A. Milk Consumption by Maine Farmer, Cows Grazed on Sludge-Amended Pastures -- Exposure (Through Soil Ingestion by Grazed Cows) and Toxicological Parameters*

Parameter	Value	Explanation/Reference
Bioconcentration Factor From Feed to Milk Fat	4	Based on Jensen and Hummel (1982) data on TCDD levels in milk of cows fed TCDD in commercial feed. Data indicate an average BCF of about 0.145 from feed to whole milk for cows fed TCDD for about 2 to 3 weeks at levels of 15 to 500 ppt. Assuming an average fat content of whole milk of 3.7% (Maine Dept. of Agriculture, 1984) and that all TCDD in milk concentrates in milk fat, BCF from feed to milk fat is calculated to be about 4.
Soil Intake Factor	1.5%	Soil intake of grazed dairy cows expected to be about 1.5% of total dry matter intake based primarily on New Zealand study of soil ingestion by dairy cows (Healy, 1968) described below. During months of November through April (warm-weather months in New Zealand), soil ingestion for cows from six farms averaged about 0.4 kg/day (0.9 lb/day). Total dry matter intake estimated at about 12 kg/day (27 lb/day) over year. Thus soil intake was about 3% of total dry matter intake. Cows in this study received no supplemental feed and were grazed entire year. In Maine, supplemental feeding is expected to account for about 50% of dry matter intake during the grazing period. Therefore, soil intake projected to be only about 1.5% of total dry matter intake for Maine dairy cows grazed in summer months.
Bioconcentration Factor From Soil to Milk Fat	0.06	Product of bioconcentration factor from feed to milk fat and soil intake factor.

Table 3.3.1.A. Continued

Parameter	Value	Explanation/Reference
Milk Fat Consuption Rate	11 g/day (0.024 lb/day)	Based upon 305 g/day milk consumed (about 1.3 cups/day) (U.S. avg. per capita consumption in 1981 [Maine Dept. of Agric., 1984]) and 3.7% fat (percentage of fat in all milk produced in Maine in 1983 [Maine Dept. of Agric., 1984]).
Bioavailability, Human Consumption of Milk	100%	100% used because laboratory studies upon which TCDD cancer potencies are based were feeding and gavage studies (Kociba et al., 1978; NTP, 1982). Since human exposure route is feeding, no adjustment is made for calculation of carcinogenic risk.
Exposure Duration	365 days/yr, 70 yr	Farmer assumed to consume milk everyday for a lifetime
Milk Consumption Factor	25%	25% of all milk consume in a year assumed to derive from cows grazing on sludge-amended fields where sludge contains TCDD. Essentially relates to 3-month summer grazing period.
Body Weight	70 kg (154 lb)	Weight for adult male (ICRP, 1975). Approximately 154 lb.

*Assume that all dioxin uptake is from soil ingestion; potential uptake from grasses on pasture or silage grown on sludge not considered in this analysis.

A worst-case situation would exist where cows are grazed only on TCDD-containing sludge-applied pasture and a farmer drinks milk from only these cows. For this analysis, a Maine farmer is estimated to drink 1.3 cups of milk per day (the U.S. per capita consumption in 1981) which contains 3.7% fat (the percentage of fat in all milk produced in Maine in 1983) (Maine Department of Agriculture, 1984). While an individual farmer might consume milk directly from cows grazed on sludge-amended pastures, some farmers might consume no raw milk, and purchase milk produced by cows grazed on non-sludge-amended lands.

The amount of TCDD that is available for absorption depends on the route of administration. In this case, a bioavailability of 100% is used because the laboratory studies upon which the TCDD cancer potencies are based were feeding and gavage studies (Kociba et al., 1978; NTP, 1982). Since the human exposure route is through feeding in this scenario, no adjustment is made for calculation of carcinogenic risk.

3.3.2 Milk Consumption by Maine Consumer -- Cows Grazed on Sludge-Amended Pastures

Maine consumers may potentially be exposed to very small amounts of TCDD in milk produced from cows grazed on sludge-amended pastures. However, this milk would constitute only an extremely small percentage of the total milk consumed in Maine. Envirologic Data estimates that, as a worst-case approach, approximately 1% of total milk consumed in Maine might contain TCDD due to grazing of cows on sludge-amended pasture. This figure is based on an estimate of the number of dairy cows that might be grazed on TCDD-containing sludge-amended pasture compared to the total number of dairy cows in Maine. Further explanation is presented in Table 3.3.2.A. Of the total milk sold during the year to commercial markets by farms where cows are grazed on dioxin-contaminated sludge-amended pastures, it is assumed that about 25% of the milk is contaminated by TCDD at the level predicted by the BCF. This figure essentially relates to milk produced during the grazing period of 3 months. All other parameters are identical to those modeled for the Maine farmer.

3.3.3 Milk Consumption by Maine Farmer -- Cows Fed Hay or Silage Corn Grown on Sludge-Amended Fields

An individual residing on a dairy farm and consuming milk from cows fed hay or silage corn raised on TCDD-containing sludge-amended fields may potentially be exposed to TCDD that has accumulated in the milk. Exposure and toxicological parameters for the two scenarios are identical and are described in Table 3.3.3.A. The only factor distinguishing the two scenarios involves the sludge incorporation method, topdressing for hay fields and soil incorporation for corn fields.

Small amounts of TCDD may be taken up from soil into plants and be bioconcentrated into milk fat of dairy cows fed these plants. The hay/silage corn uptake coefficient for TCDD from soil is

Table 3.3.2.A. **Milk Consumption by Maine Consumer, Cows Grazed on Sludge-Amended Pastures -- Exposure (Through Soil Ingestion by Grazed Cows) and Toxicological Parameters***

Parameter	Value	Explanation/Reference
Milk Consumption Proportionality Factor	1%	Factor to relate milk containing TCDD produced by cows grazing on sludge-applied pastures to total milk supply available to consumer. Approach used to develop factor as follows: approximately 265 sludge-spreading applications in Maine as of Spring, 1986. At most, assume about 50% or 132 might be dairy farmers. Assume that about 10% of these, or 13 farms, might actually utilize TCDD-containing sludge-applied pastureland for grazing their dairy cattle. At an average number of cows per farm of 45 (57,000 milk cows/1266 farms, total no. of milk cows relative to total no. of farms selling dairy products in 1982 [Maine Dept. of Agric., 1984]), a total of about 585 milk cows might potentially be grazed on pastures amended with sludge containing TCDD. This constitutes about 1% (585/57,000) of the total number of milk cows in the state. Therefore, ELD estimates that, at worst, about 1% of total milk consumed in Maine might contain TCDD due to grazing of cows on sludge-amended pastures.
Milk Marketing Factor	25%	Of milk sold to commercial markets by farms where cows are grazed on sludge-amended pastures, assume 25% of such milk was contaminated by TCDD at the level predicted by the BCF, that is, was obtained from cows during the grazing period.
Bioconcentration Factor From Soil to Milk Fat	0.06	Product of bioconcentration factor from feed to milk fat and soil intake factor, as described in Table 3.3.1.A.

Table 3.3.2.A. Continued

Parameter	Value	Explanation/Reference
Milk Fat Consumption Rate	11 g/day (0.024 lb/ day)	Same rationale as given in Table 3.3.1.A.
Bioavailability Human Consumption of Milk	100%	Same rationale as given in Table 3.3.1.A.
Exposure Duration	365 days/yr 70 yr	Rationale similar to that given in Table 3.3.1.A.
Body Weight	70 kg (154 lb)	Weight for adult male (ICRP, 1975).

*Assume that all dioxin uptake is from soil ingestion; potential uptake from grasses in pasture or silage grown or sludge-amended fields not considered in this analysis.

Table 3.3.3.A. **Milk Consumption by Maine Farmer, Cows Fed Hay or Silage Corn Grown on Sludge-Amended Fields -- Exposure (Through Hay or Silage Corn Ingested by Dairy Cows) and Toxicological Parameters***

Parameter	Value	Explanation/Reference
Bioconcentration Factor From Feed to Milk Fat	4	Based on TCDD feeding study of cows (Jensen and Hummel, 1982). Same rationale as given in Table 3.3.1.A.
Diet Composition Factor	25%	Based on percent contribution of hay or silage corn to total diet estimated to be 50% (with remainder from feed not contaminated with TCDD) and percent of total hay or silage corn grown on TCDD-containing sludge-amended fields estimated to be 50%. Product of two factors gives an overall factor of 25% as that part of feed grown on sludge-amended fields.
Hay/Silage Corn Uptake Coefficient for TCDD From Soil	0.1%	Figure of 0.1% selected to represent uptake of TCDD into the plant tissue relative to the soil TCDD level, based on data from several studies on mono-cotyledonous plants, described in text.
Milk Fat Consumption Rate	11 g/day (0.024 lb/day)	Same rationale as given in Table 3.3.1.A.
Bioavailability, Human Consumption of Milk	100%	Same rationale as given in Table 3.3.1.A.
Exposure Duration	365 days/yr, 70 yr	Based on all milk consumed from own farm, from cattle fed hay or silage corn every day, for 70 yr.
Body Weight	70 kg (154 lb)	Weight for adult male (ICRP, 1975).

*Assume dioxin uptake solely from cows ingesting hay or ingesting silage corn raised on sludge-amended fields.

estimated to be about 0.1%, representing the potential uptake of TCDD into plant tissue relative to the soil TCDD level. This uptake coefficient is based on data from several studies of monocotyledenous plants. Wipf et al. (1982) found a level of 8 ppt TCDD in corn sheaths compared to 10,000 ppt in soil, one year following the Seveso accident. Envirologic Data calculated a percent uptake of 0.08% based upon their data. The authors noted that TCDD in the corn sheaths may in fact have been due to contamination from local dust rather than true uptake. In a controlled study, Facchetti et al. (1985) found tissue levels in maize of 0.6 and 1.2 ppt at 75 days, corresponding to initial TCDD soil levels of 478 and 752 ppt, respectively. Soil consisted of Seveso-contaminated soil mixed with Seveso-noncontaminated soil. Envirologic Data calculated percent uptakes of 0.13 and 0.16% respectively, from these data. Fries (1987) points out that uptake and translocation of TCDD in plants used for animal feed is not a significant route for animal exposure. Studies of other halogenated hydrocarbons have generally shown that contamination of aerial parts of plants is principally from surface contamination due to dust or redeposition of volatilized material from the soil (Fries, 1987). Fries reports that work on PBBs shows that surface contamination from dust gathered during harvest of forage crops provides a negligible contribution to residues in harvested feed with concentrations in feed of less than 1% of that in soil.

At first inspection, a recent greenhouse study (Sacchi et al., 1986) seems to indicate that a larger plant uptake coefficient may be more appropriate than the figure of 0.1% employed in this analysis. Several shortcomings, however, are associated with the Sacchi et al. (1986) study (G.F. Fries; A.F. Yanders, 1986, Personal Communications). First, the authors fail to report uptake values for nontreated control plants (Fries, 1986). Sacchi et al. (1986) indicate that some cross contamination occurred when plants grown in soil containing 3,300 ppt TCDD were raised in close proximity to plants grown in uncontaminated soil. There is no indication in the description of the other experiments conducted by these authors whether the treatments consisting of relatively high soil TCDD concentrations were physically located away from the treatments of relatively low TCDD levels. Depending on how close the pots were to one another, there may have been cross-contamination, which would have exaggerated the uptake values for the plants grown in soils of low TCDD concentration (Fries, 1986).

Secondly, the authors (Sacchi et al., 1986) report that varying amounts of tritium-labeled TCDD were sprayed onto the soil. Presumably, an organic solvent was used since TCDD is only very slightly soluble in water. It is very likely that the solvent would not rapidly evaporate, particularly if it were mixed with peat and soil under the conditions of the study (Kimbrough, 1986). Trace levels of solvent that remain in the soil would make the TCDD much more bioavailable for plant uptake and translocation than under normal field conditions. This circumstance also provides a greater opportunity for evaporation and subsequent adherence to the aerial portion of the plants, thereby resulting in higher measured concentrations of TCDD in plant material.

It was observed that the TCDD measured in the aerial plant parts in the Sacchi et al. (1986) study did not increase in proportion with increasing soil concentrations of the contaminant. This is further evidence in favor of the volatilization theory, as stated by Facchetti et al. (1985), rather than true plant uptake and translocation as concluded by Sacchi et al. (1986). In exposure modeling and risk assessment, it is important to use data collected under conditions that are most comparable to actual field situations. This is particularly true with respect to estimating plant uptake coefficients, as there may be more volatilization and redeposition on plants in a confined atmosphere than in the field where there is greater air movement (G.F. Fries, 1986, Personal Communication).

It appears that Sacchi et al. (1986) were aware of the possibility of volatilization and redeposition of TCDD into plant tissue as a phenomenon that might confound their results. However, they discount this mechanism as being responsible for the increased levels of TCDD observed in the aerial portions of bean plants. Their opinion is based on data reported for one experimental trial in which plants were grown in hydroponic culture containing tritium-labeled TCDD. As mentioned earlier, TCDD is only very slightly soluble in water. Presumably the dioxin was dissolved in an organic solvent followed by the use of a solubilizing surfactant to disperse the hydrophobic substance in the water-based nutrient solution. Under these experimental conditions, the potential TCDD uptake and translocation by plants would be greatly increased over field conditions in which the dioxin is tightly bound to soils of high organic content.

Finally, results based on studies using tritium-labeled TCDD can be misleading because the tritium can be exchanged from one molecule to another (Fries, 1986; Yanders, 1986). The phenomenon of chemiluminescence may produce spurious counts; thus, measurements of radioactivity for detecting dioxin may be greatly inaccurate. According to Fries (1986), the authors offer no indication that they used procedures to minimize this potential problem. Without background values from nontreated control samples, it is impossible to determine if chemiluminescence occurred. If it did, the amount of TCDD taken up by the plant would be overestimated and the error would be reflected to the greatest extent in the samples of relatively low concentration.

The TCDD bioconcentration factor from feed to milk fat is estimated as 4 as described previously. Hay or silage corn are estimated to constitute only about 50% of total feed, and only 50% of the hay or corn is estimated to be grown on TCDD-containing sludge-amended fields. The product of these two factors gives an overall TCDD-contaminated diet composition factor of 25%.

The length of time that a farmer might consume milk from his own farm from cattle fed hay or silage corn every day is estimated at 365 days/year for 70 years -- a full lifetime of exposure. This assumption is extremely conservative, as it is highly unlikely that a farmer would feed cows hay or corn grown on fields which are amended with TCDD-containing sludge, and drink milk from these cows all for a full 70 years.

3.3.4 Beef Consumption by Maine Farmer -- Cattle Grazed on Sludge-Amended Pastures

A farmer consuming beef from cattle grazed on TCDD-containing sludge-amended fields may potentially be exposed to TCDD that has bioconcentrated in beef fat as a result of cattle ingesting soil through grazing. Details of the exposure and toxicological parameters are given in Table 3.3.4.A.

In Maine, beef production is not a major agricultural industry, accounting for approximately 10% of all cattle in the State (Maine Department of Agriculture, 1984). The scenario addressed in this report of cattle slaughtered for home consumption after having been pastured for three months would likely be applicable mainly to cull breeding or cull dairy cattle.

A bioconcentration factor for TCDD of 4 from feed to beef fat was found by Jensen et al. (1981) in cows fed 24 ppt of TCDD for 28 days. Soil intake is estimated to constitute only about 1.5% of total dry matter intake in Maine, as described previously in Section 3.3.1. A bioconcentration factor for TCDD from soil to beef fat of 0.06 is calculated as the product of the two factors described above.

Cattle are assumed to be grazed on sludge-amended fields for a maximum of up to 3 months per year. Beef-fat residues tend to reflect average dietary concentrations over long periods of intake (Fries, 1982). Whereas milk-fat residues of PCBs may approach steady-state in a matter of weeks, Fries (1982) noted that beef-fat concentrations of an organic pesticide, heptachlor, took 280 days (40 weeks) to reach steady-state. Assuming TCDD exhibits similar behavior, tissue residue of TCDD at the end of a 3-month grazing period may not have reached a steady-state level. At the end of the grazing period, exposure ceases and beef-fat levels will decrease at a rate corresponding to the elimination half-life of TCDD in beef-fat, calculated to be 115 days by Jensen et al. (1981). Nine months with no additional TCDD exposure would be expected to reduce the TCDD residue to less than 15% of the level reached at the end of the grazing period, based on calculations using the 115-day half-life figure. As mentioned above, the bioconcentration factor of 4 for TCDD in feed to beef-fat was found by Jensen et al. (1981) at the end of a 28-day exposure. Longer exposures were not used, therefore it is unknown how closely this factor will approximate steady-state conditions. For the purpose of this analysis, Envirologic Data assumes that the BCF of 4 reasonably approximates the tissue residue of TCDD near the end of the grazing period. While there is some chance that cattle may accumulate somewhat higher levels following several years of summer grazing, the relatively short period of grazing (3 months maximum) compared to non-grazing (9 months) in Maine means that residues will be substantially reduced during the non-grazing period, and significant accumulation from year to year is unlikely to be of concern.

Table 3.3.4.A. Beef Consumption by Maine Farmer, Cattle Grazed on Sludge-Amended Pasture -- Exposure (Through Soil Ingestion by Grazed Cattle) and Toxicological Parameters*

Parameter	Value	Explanation/Reference
Bioconcentration Factor From Feed to Beef Fat	4	Based on Jensen et al. (1981) data on TCDD levels in fat of cows fed TCDD in commercial feed. Data indicate an avg. BCF of about 4 from feed to beef fat for cows fed 24 ppt of TCDD for 28 days.
Soil Intake Factor	1.5%	Soil intake expected to be about 1.5% of total dry matter intake based on some rationale as given in Table 3.3.1.A.
Bioconcentration Factor From Soil to Beef Fat	0.06	Product of BCF from feed to beef fat and soil intake factor.
Beef Fat Consumption Rate	12.6 g/day (0.028 lb/ day)	Based upon 105 g/day (0.23 lb/day) beef consumed, 12 percent fat content (Kimbrough et al., 1984).
Bioavailability, Human Consumption of Beef	100%	Same rationale as given in Table 3.3.1.A.
Exposure Duration	365 days/yr	Farmer assumed to consume beef every day for lifetime.
Beef Consumption Factor	25%	25% of total beef consumed in a year assumed to derive from cattle slaughtered near end of 3-month grazing period on sludge-amended fields where sludge is contaminated with dioxin. Remainder from cattle not grazed on sludge-amended fields, grazed on sludge-amended fields where sludge contains no dioxin, or slaughtered at time with very low tissue TCDD residues.
Body Weight	70 kg (154 lb)	Weight for adult male (ICRP, 1975).

*Assume that all dioxin uptake is from soil ingestion; potential uptake from grasses on pasture or silage grown on sludge not considered in this analysis.

The beef fat consumption rate is estimated at 12.6 g/day (0.028 lb/day) based on eating a quarter-pound of beef per day containing about 12% fat (Kimbrough et al., 1984). An exposure period of 365 days/year for a full lifetime of 70 years is assumed for the farmer's consumption of beef. A beef consumption factor of 25% is applied to the farmer's consumption, that is, 25% of total beef consumed in a year is assumed to derive from cattle slaughtered near the end of a 3-month grazing period on sludge-amended fields where sludge is contaminated with dioxin. This is a conservative analysis in that the cattle are assumed to be slaughtered at a time in which their fat tissues would contain maximum levels of dioxin. If slaughtering occurred a number of months after grazing ceased, dioxin levels in the beef fat would be much reduced. The remaining 75% of beef consumed comes from cattle either not grazed on sludge-amended fields, or grazed on sludge-amended fields where sludge contains no dioxin.

It is clear that a particular farmer's actual exposure would depend on when the animal was slaughtered in relation to the grazing period and how much of the beef consumed derives from animals grazed on sludge-amended fields contaminated with TCDD.

3.3.5 <u>Beef Consumption by Maine Consumer -- Cattle Grazed on Sludge-Amended Pastures</u>

Maine consumers who buy beef from commercial markets that purchase cattle grazed on sludge-amended fields have the potential for exposure to TCDD, although at a much lower level than Maine farmers. Envirologic Data estimates that, at worst, about 1.7% of Maine-grown beef consumed in the state might derive from cattle grazed on sludge-amended pastures. This figure is based on an estimate of the number of beef cows that might be grazed on sludge-amended pasture compared to the total number of beef cows in the state. More detailed explanation is given in Table 3.3.5.A.

For this analysis, 25% of the total beef sold to commercial markets by farms where cattle are grazed on sludge-amended pastures is assumed to have been slaughtered near the end of the grazing period, and it is assumed that the sludge contains TCDD.

Very little of the beef consumed in Maine actually is Maine-grown, and of the Maine-grown beef it is estimated that only about half might be marketed commercially, mainly for hamburger. Envirologic Data estimates that about 2% of the total beef consumed in Maine actually is produced in Maine. Details are given in Table 3.3.5.A.

The product of the factors described above acts as a proportionality factor relating the farmer's potential exposure to the consumer's potential exposure. Bioavailability, exposure duration, and body weight are identical to the Maine farmer scenario.

Table 3.3.5.A. **Beef Consumption by Maine Consumer, Cattle Grazed on Sludge-Amended Pasture -- Exposure (Through Soil Ingestion by Grazed Cattle) and Toxicological Parameters***

Parameter	Value	Explanation/Reference
Maine-Grown Beef Consumption Proportionality Factor	1.7%	Factor to relate beef containing TCDD to total Maine beef supply. Approach used to develop factor as follows: 265 sludge-spreading applications in Maine as of Spring, 1986. Assume conservatively that about 50%, or 132 farms, have beef cows. Assume that about 25% of these or 33 farms, might actually utilize pastureland amended with sludge for grazing their beef cattle. At an average number of cows per farm of 7 (13,242 beef cows/1811 farms in 1982 [Maine Dept. of Agric., 1984]), a total of about 231 beef cows might be grazed on sludge-applied pastures. This constitutes about 1.7% (231/13,242) of the total number of beef cows in the state. Therefore, ELD conservatively estimates that about 1.7% of Maine-grown beef consumed in the state might derive from cattle grazed on sludge-amended pasture.
Beef Marketing Factor	25%	Of beef sold to commercial markets by farms where cattle are grazed on sludge-amended pastures, assume 25% of such beef was actually slaughtered near end of grazing period and where sludge contains TCDD.
Maine-grown vs. Total Beef Consumption Proportionality Factor	2%	Out of 100.2 million lb/yr beef consumed in Maine, 4.3 million lb/yr was raised in Maine (Maine Dept. of Agric., 1984). Assume about 50% of that figure represents commercial use for hamburger, remainder home slaughter and direct marketing to consumer. 0.5 x 4.3 million lb/yr = 2.15 million lb/yr. 2.15 million lb/yr/100.2 million lb/yr = 0.02.

Table 3.3.5.A. Continued

Parameter	Value	Explanation/Reference
		Assume that beef imported into Maine from cattle not grazed on TCDD-containing sludge-applied pasture.
Bioconcentration Factor From Soil to Beef Fat	0.06	Product of BCF from feed to beef fat and soil intake factor, as described in Table 3.3.4.A.
Beef Fat Consumption Rate	12.6 g/day (0.028 lb/day)	Same rationale as in Table 3.3.4.A.
Bioavailability, Human Consumption of Beef	100%	Same rationale as in Table 3.3.1.A.
Exposure Duration	365 days/yr 70 yr	Rationale similar to that given in Table 3.3.4.A.
Body Weight	70 kg (154 lb)	Weight for adult male (ICRP, 1975).

*Assume that all dioxin uptake is from soil ingestion by cattle; potential uptake from grasses on pasture or silage grown on sludge-amended fields not considered in this analysis.

3.3.6 Beef Consumption by Maine Farmer -- Cattle Fed Hay or Silage Corn Grown on Sludge-Amended Fields

TCDD bioconcentrated in beef fat of cattle fed hay or silage corn grown on sludge-amended fields may be available for uptake by Maine farmers consuming the beef. Exposure and toxicological parameters are presented in Table 3.3.6.A. As in the similar milk consumption scenarios, sludge is topdressed onto hay fields and is incorporated into the soil of corn fields.

The bioconcentration factor from feed to beef fat of 4 and the hay/silage corn TCDD uptake coefficient of 0.1% were described in previous sections. Hay or silage corn are estimated to constitute approximately 67% of the total feed, with the remainder from supplemental feed. All of the hay or silage corn fed to cattle is conservatively assumed to be grown on TCDD-containing sludge-amended fields; thus 67% of the total feed has the potential for contamination.

Exposure duration is assumed to be 365 days/year for 70 years; that is, a farmer would eat beef from cattle fed hay or silage corn every day for a full lifetime.

3.3.7 Corn Consumption by Maine Farmer

A farmer raising corn on sludge-amended fields may potentially be exposed to small amounts of TCDD taken up by the corn. Parameters upon which this scenario is based are listed in Table 3.3.7.A. Limited information is available regarding uptake of TCDD into corn kernels. Wipf et al. (1982) found no detectable traces of TCDD in corn kernels from corn raised on TCDD-contaminated Seveso soil one year following the explosion in Italy. From this study, Envirologic Data has calculated that uptake would equal at worst about 0.008%, based on the detection limit of 0.8 ppt TCDD in corn kernels relative to 10,000 ppt TCDD in soil.

All corn consumed for the entire year is conservatively assumed to be that raised on TCDD-containing sludge-amended soil. The corn consumption rate is estimated at 160 g/day (0.35 lb/day) for 78 days/year based on the following rationale. For the farmer who grows his own corn, it is assumed that he might consume 250 g/day (0.55 lb/day) fresh corn for 30 days during the summer and 100 g/day (0.22 lb/day) corn frozen from the garden, one day each week for the remainder of the year. These figures give a weighted average consumption rate of about 160 g/day (0.35 lb/day) for 78 days/year.

3.3.8 Skin Contact by Maine Farmer

In this scenario, exposure is modeled for a Maine farmer who experiences skin contact with soil to which TCDD-containing sludge has been applied. Because of the greater potential for skin contact with soil by children, this analysis includes as part of the farmer's overall exposure that exposure specifically attributable to the childhood years. (The farmer is assumed to have grown up on a farm

Table 3.3.6.A. **Beef Consumption by Maine Farmer, Cattle Fed Hay or Silage Corn Grown on Sludge-Amended Fields -- Exposure (Through Hay or Silage Corn Ingested by Beef Cattle) and Toxicological Parameters***

Parameter	Value	Explanation/Reference
Bioconcentration Factor From Feed to Beef Fat	4	TCDD levels in beef fat shown to be 4 times levels in diet (Jensen et al., 1981). See also Table 3.3.4.A.
Hay/Silage Corn Intake Factor	67%	Hay or silage corn estimated to constitute about 67% of total feed with supplemental feed comprising remainder of diet. 100% of hay conservatively estimated to be grown on sludge-applied fields. Product of two factors gives an intake factor of 67% as that part of total feed grown on sludge-amended fields.
Hay/Silage Corn Uptake Coefficient for TCDD From Soil	0.1%	Same rationale as given in Table 3.3.3.A.
Beef Fat Consumption Rate	12.6 g/day (0.028 lb/ day)	Same rationale as given in Table 3.3.4.A.
Bioavailability, Human Consumption of Beef	100%	Same rationale as given in Table 3.3.1.A.
Exposure Duration	365 days/yr, 70 yr	Based on all beef consumed from own farm, from cattle fed hay or silage corn every day, for 70 yr.
Body Weight	70 kg (154 lb)	Weight for adult male (ICRP, 1975).

*Assume dioxin uptake solely from cattle ingesting hay or ingesting silage corn raised on sludge-amended fields.

Table 3.3.7.A. Corn Consumption by Maine Farmer -- Exposure and Toxicological Parameters

Parameter	Value	Explanation/Reference
Corn Uptake Coefficient for TCDD from Soil	0.008%	According to Wipf et al. (1982), no detectable traces of TCDD were found in corn kernels from corn grown in contaminated zone one year following accident at Seveso, Italy. *Therefore uptake was*, at worst, equal to detection limit of 0.8 ppt in corn/10,000 ppt in soil or 0.008%.
Percent Corn Raised on Sludge-Amended Soil	100%	Worst-case analysis based on all corn for human consumption grown on sludge-amended soil.
Consumption Rate	160 g/day (0.35 lb/ day)	250 g/day (0.55 lb/day) fresh corn for 30 days in summer and 100 g/day (0.22 lb/day) frozen corn once per week for remainder of the year, (for 48 days). Weighted avg. gives 158 g/day; round to 160 g/day (0.35 lb/day).
Bioavailability	100%	Same rationale as given in Table 3.3.1.A.
Exposure Duration	78 day/yr, 70 years	Based upon eating corn every day for one month when fresh corn is available, and once per week for remainder of year. All corn consumed from own garden for full 70 years.
Body Weight	70 kg (154 lb)	Weight of adult male (ICRP, 1975).

where TCDD-containing sludge was utilized as a soil amendment.) Exposure and toxicological parameters are summarized in Table 3.3.8.A.

The amount of soil that will accumulate on skin depends on the exposed skin surface area, exposure duration, and soil contact rate. Soil contact rate in turn depends on a number of factors including soil type, soil moisture, daily activities, age, etc. A soil contact rate of 1 mg soil/cm^2 surface area per day is used in this analysis based on studies reported by EPA (1984a) of soil accumulation on children's hands. It is assumed that this figure also pertains to other exposed areas of the body and that it applies to adults as well as to children. Thus applied, this parameter is very conservative.

Exposed skin surface area for children 2 to 12 years old is assumed to include both hands, legs, and feet; for 13 to 70 year olds, exposed surface area is based on both hands and most of forearms exposed (adapted from Hawley, 1985). Exposed surface areas for all age groups are given in Table 3.3.8.B. The duration of exposure i.e. how many days and years an individual might contact soil on fields that have been amended with sludge, is estimated to be 20 days/year for 70 years. This figure is believed to be reasonable, based partially on the minimum required setback of 500 feet from farm dwellings to sludge-amended fields. This setback would tend to minimize the frequency with which a child might play and incur significant skin contact on such fields. Additionally, only a portion of the fields on a given farm are expected to be amended with sludge containing TCDD. The exposure duration of 20 days/year for significant skin contact with soil amended with sludge is believed to be a reasonable estimate for the adult farmer as well. Exposed surface area, exposure duration, and daily soil contact rate are used to develop an estimate of lifetime soil accumulation as shown in Table 3.3.8.B.

Only about 1% of the TCDD in soil is estimated to be absorbed through the skin, based on data by Poiger and Schlatter (1980). This estimate may considerably overstate the bioavailability because rodent skin often is more permeable than human skin, and bioavailability in the Poiger and Schlatter study appears to decrease with decreasing TCDD concentration (Paustenbach et al., 1986). Wester and Maibach (1985) showed that human skin is less permeable to a number of compounds than rat skin.

3.3.9 Dust Inhalation by Maine Farmer

A farmer may potentially be exposed to TCDD through inhalation of airborne dust resuspended from soil containing TCDD. This scenario models exposure for the farmer who spends his entire life on a farm on which TCDD-containing sludge is applied, thereby affording the potential for exposure for 70 years. Exposure to TCDD from landspread sludge is believed to occur principally through inhalation of dust particles. Due to dilution in the outdoor environment, exposure from inhaling contaminated soil is expected to be quite small. Exposure from volatilization of TCDD from the soil is

Table 3.3.8.A. Skin Contact by Maine Farmer -- Exposure and Toxicological Parameters

Parameter	Value	Explanation/Reference
Soil Contact Rate	1 mg/cm^2-day	Based on studies of soil accumulation on children's hands reported in EPA (1984).
Exposed Surface Area	See Table 3.3.8.B	For outdoor exposure, exposed surface area for 2 to 12 yr olds based on both hands, legs, and feet exposed. For 13 to 70 yr olds, based on both hands and most of forearms exposed (Adapted from Hawley, 1985).
Exposure Duration	20 day/yr, 70 yr	Individual is assumed to spend 20 days/year in TCDD-contaminated sludge-amended fields for 70 yr.
Bioavailability	1%	1% selected based on data from Poiger and Schlatter (1980): 0.05% of lowest dose tested of TCDD in soil paste applied dermally to rats reached liver. As dose increased, liver concentration increased to 2.2%. Based on this study, Kimbrough et al. (1984) also selected 1% for dermal absorption of TCDD.
Body Weight	70 kg (154 lb)	Weight for adult male (ICRP, 1975).

Table 3.3.8.B. Calculation of Outdoor Lifetime Soil Accumulation

Age	Exposed Surface Area (cm^2)	Surface Area Child: Adult[e]	Surface Area Child: 2 1/2 yr old	Exposure Duration[f] (days)	Daily Soil Contact Rate (g/cm^2)	Total Accumulated Soil[g] (g)
1	-	-	-	0	-	0
2, 3	2100[a]	0.33	1	40	0.001	84
4, 5	2520[b]	0.41	1.2	40	0.001	101
6, 7	2940[b]	0.47	1.4	40	0.001	118
8, 9	3150[b]	0.51	1.5	40	0.001	126
10	3360[b]	0.53	1.6	20	0.001	67
11	3780[b]	0.59	1.8	20	0.001	76
12	3990[b]	0.64	1.9	20	0.001	80
13, 14	1139[c]	0.67	-	40	0.001	46
15	1343[c]	0.79	-	20	0.001	27
16	1445[c]	0.85	-	20	0.001	29
17	1513[c]	0.89	-	20	0.001	30
18	1581[c]	0.93	-	20	0.001	32
19	1615[c]	0.95	-	20	0.001	32
20-70	1700[d]	1.00	-	1020	0.001	1734
					Total	2582

[a]Hawley, 1985: figure for both hands, legs, feet exposed for 2 1/2 yr old.

[b]Calculated using the 2100 cm^2 figure for 2 1/2 yr olds and multiplying by relative surface area of child to 2 1/2 yr old.

[c]Calculated using the 1700 cm^2 figure for adults and multiplying by surface area correction.

[d]Hawley 1985: figure for adults represents soiling of both hands, most of forearms.

[e]From EPA (1984).

[f]Assume 20 days per year exposure to soil outdoors.

[g]Product of: Exposed Surface Area x Exposure Duration x Soil Contact Rate.

believed to be a less significant route compared to resuspended dust and was not modeled in this analysis. Exposure and toxicological parameters are summarized in Table 3.3.9.A.

Specific data regarding outdoor resuspended dust concentrations generated by agricultural operations were unavailable. As a conservative approach, a figure of 150 ug/m^3 is used to estimate average ambient air particulate levels on those days in which an individual is involved with significant dust-generating activities on sludge-applied fields. This figure represents the maximum 24-hour total suspended particulate (TSP) concentration, not to be exceeded in the state of Maine, and is twice the National Ambient Air Quality Standard (NAAQS) of 75 ug/m^3. While TSP levels generated by farming activities may exceed this level for short periods, the figure of 150 ug/m^3 is believed to be a reasonably conservative average for the working day. As an additional conservative assumption, it is assumed that 100% of this TSP level is derived from the local soil. Thus, the TCDD level in the air TSP is considered equal to the TCDD level in the soil.

Not all of the TCDD in the particles inspired is absorbed by the body. It is assumed that 25% of inspired particles are exhaled, 25% are deposited in lower respiratory passages (of which half are retained and half eliminated from the lungs and swallowed), and 50% are deposited in upper respiratory passages and swallowed (EPA, 1984a; Paustenbach, 1986). Of those particles swallowed, about 20% might be absorbed in the gastrointestinal tract. (This figure is based on the bioavailability of TCDD absorbed onto soil particles discussed in Section 3.3.10.) An overall bioavailability factor of 25% for inhalation is calculated from the above data.

3.3.10 Soil Ingestion by Child Residing on Maine Farm

Children potentially may ingest small amounts of soil from agricultural fields amended with TCDD-containing sludge causing them to be exposed to TCDD. Exposure and toxicological parameters are described in Table 3.3.10.A. Children aged 2 to 6 are projected to consume soil outdoors at a rate of 100 mg/day for 20 days/year. While there is a degree of uncertainty concerning actual amounts of soil ingested by children, the figure of 100 mg/day appears to be a consensus estimate of much of the published literature (Paustenbach et al., 1986).

Binding of TCDD to sludge particles reduces the potential bioavailability of TCDD in the gastrointestinal tract compared to TCDD in a solvent or food medium. Envirologic Data uses an estimate of 20% bioavailability for TCDD on sludge particles. Experimental data regarding bioavailability of soil-borne TCDD is discussed below.

Poiger and Schlatter (1980) dosed rats by gavage with soil that had been in contact with TCDD for either 10 to 15 hours or 8 days (doses ranging from 12.7 to 22.9 ng TCDD) and determined the percent of administered dose remaining in the liver after 24 hours. For the 10 to 15-hour contact period, 24% of the administered dose was found

Table 3.3.9.A. Dust Inhalation by Maine Farmer -- Exposure and Toxicological Assumptions

Parameter	Value	Explanation/Reference
Total Suspended Particulate (TSP) in Outdoor Air	150 ug/m^3	Specific data regarding outdoor resuspended dust concentration generated by agricultural operations were not available. A figure of 150 ug/m^3 was selected as a conservative approach to estimating maximum average ambient particulate levels during the days an individual is involved with dust-generating farming activities on sludge-applied fields. This figure represents the maximum 24-hour particulate matter concentration not to be exceeded in Maine, and is twice the National Ambient Air Quality Standard of 75ug/m^3. While particulate levels generated by farming activities may exceed this level for short periods, it is believed to be a reasonable figure to use for the average of the 20-day exposure period.
TCDD Level in Air	Calculated from TSP air level and TCDD soil level	TCDD level in soil is conservatively assumed to be equal to TCDD level in air TSP. TCDD air level = TCDD soil level x TSP level in air (EPA, 1984).
Respiratory Rate	12 m^3/ 10-hr day	Based upon 20 l/min., light activity for 10 hours/day (ICRP, 1975).
Bioavailability	25%	Based on 100% particles inspired (very conservative because not all particles are inspired), 25% exhaled, 50% deposited in upper respiratory passages and swallowed (x 20% bioavailability of TCDD on soil), 25% deposited in lower respiratory passages (of which 12.5% is retained, 12.5% eliminated from lung and swallowed at 20%

Table 3.3.9.A. Continued

Parameter	Value	Explanation/Reference
Bioavailability (cont.)		bioavailability). Results in 25% bioavailability of inspired soil-borne TCDD particles (EPA, 1984).
Exposure Duration	10 hr/day, 20 days/yr, 70 yr	Represents period an individual might be exposed to dust-generating activities on TCDD-contaminated sludge-applied fields.
Body Weight	70 kg (154 lb)	Adult male (ICRP, 1975).

Table 3.3.10.A. Soil Ingestion by Child Residing on Maine Farm -- Exposure and Toxicological Parameters*

Parameter	Value	Explanation/Reference
Soil Ingestion Rate	100 mg/day	Outdoor estimate based on estimates from Lepow et al. (1974, 1975), Duggan and Williams (1977), Hawley (1985), van Wijnen et al. (1986), Clausing et al. (1986), Paustenbach et al. (1986) ranging from 50 to 250 mg dirt ingested per day. 100 mg/day of soil ingested was selected as reasonable estimate for child of 2-6 years.
Exposure Duration	20 days/yr, 5 yr	Child, aged 2 to 6, estimated to spend 20 days/yr playing on TCDD-contaminated sludge-amended farm fields.
Bioavailability	20%	Figure of 20% selected for bioavailability of TCDD bound to sludge or soil in the G.I. tract. Figure may depend on soil bolus size, TCDD level, soil type, presence of co-contaminants, time since TCDD application (Paustenbach et al., 1986).
Body Weight	17 kg (37 lb)	Avg. weight for 2 to 6 yr olds (EPA, 1984).

*Soil ingestion determined to be significant route for children aged 2 to 6. The exposure figure used to estimate incremental cancer risk is the daily avg. exposure over the 5-yr period, then averaged over a lifetime of 70 years.

in the liver. At an 8-hour contact period, 16% of the TCDD was found in the liver.

McConnell et al. (1984) measured liver concentrations in guinea pigs and rats and AHH induction in rats following ingestion of TCDD contaminated Missouri soil. A clear dose-response relationship was observed between dose and guinea pig liver levels. At the highest dose tested in rats (5.0 or 5.5 ug/kg TCDD) liver concentrations were twice as high in rats fed TCDD in corn oil (40.8 ppb) compared to rats given TCDD in contaminated soil (20.3 ppb) yet AHH induction was similar between the two groups. McConnell et al. concluded that absorption of TCDD in soil appears highly efficient in the guinea pig and rat but did not calculate a bioavailability percentage.

Lucier et al. (1986) republished the rat data of McConnell et al. (1984) and concluded that oral bioavailability of TCDD in soil was approximately 50%. This estimate is based on liver levels at the high dose, 5.0 or 5.5 ug/kg TCDD. Examination of the liver level data at the next lower dose, 1 or 1.1 ug/kg TCDD, indicates a 25% bioavailability based on liver levels of 7.6 ppb in rats fed TCDD in corn oil as compared to 1.8 ppb in rats fed TCDD in Missouri soil. These data suggest that bioavailability of soil-TCDD was dose-dependent in this study (Paustenbach et al., 1986).

Umbreit et al. (1986a) observed TCDD toxicity in guinea pigs and AHH induction in rats following oral doses of Times Beach soil and Newark manufacturing site soil. The results showed that both soils induced similar levels of AHH activity in rats (at total doses of 10 or 40 ug/kg), yet in guinea pigs (at 1 to 10 ug/kg) the Newark soil produced much lower toxicity than did the Missouri soil. The authors suggest that possible reasons for the differences in bioavailability between the two soils (as indicated by toxicity difference) may be related to different soil compositions and presence of aqueous versus waste oil components (Umbreit et al., 1986a).

In another study, Umbreit et al. (1986b) measured liver-TCDD concentrations in guinea pigs fed the same New Jersey manufacturing site soil and a New Jersey salvage yard soil at doses ranging from 0.32 to 12 ug/kg. Comparing the resulting liver levels to those in the positive controls (uncontaminated soil spiked with TCDD in acetone for 1 hour), Umbreit et al. calculated a bioavailability of less than 0.5% for the manufacturing site soil and 21.3% for the salvage yard soil.

Bonaccorsi et al. (1984) studied the bioavailability of TCDD-contaminated Seveso soil in rabbits. They compared liver concentrations after oral doses of Seveso soil or a comparable dose of TCDD in alcohol (doses ranged from 20 to 160 ng/day) and found the absorption of Seveso soil-borne TCDD to be 68% lower than that of solvent-borne TCDD at 80 ng/day. At the same dose, absorption of lab-contaminated soil was found to be 44% lower than that of solvent-borne TCDD. Differences in uptake of TCDD from lab contaminated soil relative to solvent appeared to be more evident at higher doses of TCDD.

Assuming the liver levels represent 70% of the body burden (Fries and Marrow, 1975), the EPA Exposure Assessment Group (1984a) used the 8-day data from Poiger and Schlatter to calculate a total GI tract absorption of 20 to 26%. Kimbrough et al. (1984) used a 30% bioavailability figure in the CDC risk assessment based on data from McConnell et al. (1984) and Poiger and Schlatter (1980). Lucier et al. (1986) attributed a 25 to 50% bioavailability to the McConnell et al. (1984) data, while Umbriet et al. (1986a,b) attributed an 85% bioavailability to the same McConnell et al. (1984) data. Umbreit et al. did not discuss how this figure was derived. Umbreit has since indicated that the figure is too high and is currently reanalyzing bioavailability calculations (Personal Communication, 1987).

Paustenbach et al. (1986) concluded that 30% bioavailability of TCDD in soil in the GI tract is likely to be an upper estimate and that 10% bioavailability may be a more reasonable estimate given the low concentrations of TCDD in the environment and the subsequent small daily oral dose anticipated for many contaminated sites.

The variation in oral bioavailability figures reported in the literature may be due to several factors. Investigators have examined bioavailability either using AHH induction for actual liver concentrations of TCDD. The amount of soil or TCDD administered to the test animals varies among studies. The organic content of the soils and the length of TCDD contact with soil has differed markedly from study to study. In addition, the presence of co-contaminants may affect bioavailability. A bioavailability figure of 20% for use in this analysis appears reasonable for TCDD in sludge given the high organic content, relatively small quantities of soil ingested, and low levels of TCDD in the sludge.

3.3.11 Soil Ingestion by Child From Yard -- Lawn Established with Compost

Wastewater treatment plant sludges may be used for compost that, among other uses, can be mixed with sand or soil for residential lawn establishment. This scenario models exposure to a child aged 2 to 6 who potentially may ingest soil from a lawn established with compost. Modeling assumptions are listed in Table 3.3.11.A. It is assumed that TCDD-contaminated sludge comprises 80% of compost and that one part of compost is mixed with three parts of soil or sand.

Soil ingestion rate and bioavailability figures are identical to those given in the previous section. Children are assumed to have the potential for soil ingestion for 5 days/week for 26 weeks/year (based on warm-weather months with days for inclement weather and trips away from home subtracted out). Exposure duration is greater for this scenario than for children ingesting soil from sludge-amended farm fields. This is due to the much greater potential for play in a yard immediately adjacent to the house compared to farm fields some distance from the residence.

Table 3.3.11.A. **Soil Ingestion by Child From Yard -- Lawn Established with Compost***

Parameter	Value	Explanation/Reference
% Sludge in Compost	80%	Sludge assumed to comprise 80% of compost, by weight.
% Compost in Soil	25%	1 part of compost mixed with 3 parts soil or sand.
Soil Ingestion Rate	100 mg/day	Same rationale as given in 3.3.10.A.
Bioavailability	20%	Same rationale as given in Table 3.3.10.A.
Exposure Duration	5 days/week, 26 weeks/yr, 5 years	Child, aged 2 to 6, estimated to spend 5 days/week, 26 weeks/year playing in yard.
Body Weight	17 kg (37 lb)	Avg. weight for 2 to 6 yr old, (EPA, 1984).

*Soil ingestion determined to be significant route for children aged 2 to 6. The exposure figure used to estimate incremental cancer risk is the daily avg. exposure over the 5-yr period, then averaged over a lifetime of 70 yrs.

3.4 Exposure Assessment

Exposures corresponding to a level of 50 ppt TCDD in sludge are calculated as lifetime average daily doses (LADDs), i.e. daily doses averaged over a full lifetime of 70 years. The LADD is computed as the product of TCDD soil concentration and a number of exposure-specific variables that relate the TCDD level in soil to the dose taken in by an individual. Derivation of average soil levels and exposure variables was discussed in the previous sections. The lifetime average daily doses corresponding to sludge containing 50 ppt TCDD are given in Table 3.4.A.

4.0 RISK ASSESSMENT

4.1 Dose-Response Assessment

Data from actual research on human health effects of TCDD are insufficient to allow for estimation of human risk from low-level exposures. Information on human health hazards at low exposure levels typically is limited. Therefore, information on the relationship between animal health effects and the doses required to elicit these effects is used to extrapolate to human exposure. This section discusses the use of animal cancer bioassay data on TCDD to extrapolate between dose and potential incidence of cancer in humans.

The EPA (1985), Centers for Disease Control (CDC) (Kimbrough et al., 1984), and the FDA (1983) have performed risk assessments of TCDD. The EPA and CDC employed the multistage model of carcinogenesis to extrapolate from high exposures of laboratory animals to low-level human exposures. The FDA employed a linear interpolation model. These models assume that no threshold for carcinogenesis exists, i.e. that any dose, no matter how small, will result in some level of risk. The basic purpose of these models is to estimate the maximum possible linear slope (the 95% upper confidence limit) of the dose-response curve in the low-dose range. This estimated slope constitutes the cancer potency, also termed q_1^* in the multistage model. The larger the value of the cancer potency, the greater the potential to induce cancer.

Potency estimates for TCDD have been based on studies of Sprague-Dawley rats fed TCDD in the diet at 0.001 to 0.1 ug/kg b.w.-day (Kociba et al., 1978), Osborne-Mendel rats administered 0.01 to 0.5 ug/kg b.w.-week and B6C3F1 mice administered 0.01 to 0.5 (male) or 0.04 to 2.0 ug/kg b.w.-week (female) TCDD by gavage (NTP, 1982). Animals administered TCDD exhibited increased incidence of a wide range of tumor types including those of the liver, subcutaneous tissue, tongue, nasal turbinate/hard palate, or lung, depending on the particular study.

Envirologic Data (ELD) reviewed and compared the agency approaches to TCDD risk assessment. The cancer potency figure used by the EPA, 1.56×10^5 (mg/kg b.w.-day)$^{-1}$, represents the geometric mean of two pathologists' (Dr. Kociba and Dr. Squire) reviews of the Kociba et al. (1978) data for female rats using pooled tumor types, and is the most conservative TCDD potency figure of

Table 3.4.A. **Lifetime Average Daily Doses (LADDs) Corresponding to Sludge Containing 50 ppt TCDD**

Exposure Scenario	LADD (mg/kg b.w.-day)
Milk Consumption	
Maine Farmer -- Cows Grazed	1.5×10^{-11}
Maine Consumer -- Cows Grazed	1.5×10^{-13}
Maine Farmer -- Cows Fed Hay	1.0×10^{-12}
Maine Farmer -- Cows Fed Silage Corn	7.2×10^{-13}
Beef Consumption	
Maine Farmer -- Cattle Grazed	1.7×10^{-11}
Maine Consumer -- Cattle Grazed	5.8×10^{-15}
Maine Farmer -- Cattle Fed Hay	3.1×10^{-12}
Maine Farmer -- Cattle Fed Silage Corn	2.2×10^{-12}
Corn Consumption	
Maine Farmer	1.8×10^{-13}
Skin Contact	
Maine Farmer	9.2×10^{-14}
Dust Inhalation	
Maine Farmer	2.3×10^{-15}
Soil Ingestion	
Maine Child Residing on Farm	3.8×10^{-14}
Maine Child -- Lawn Established with Compost	2.6×10^{-13}

those estimated by the three agencies. It is derived from data on the most sensitive combination of species, strain, and sex of laboratory animals tested. EPA (1985) also estimated cancer potencies based on the National Toxicology Program/National Cancer Institute studies but none were as conservative as that mentioned above. All potency figures calculated for TCDD by EPA (1985) are illustrated in bar chart form in Figure 4.1.A. The first two bars on the left represent the data used to develop the EPA potency estimate.

The CDC did not report actual potency figures in their analysis, rather they reported virtually safe doses (VSDs) for a range of sensitivities (i.e., from the most sensitive species/strain/sex/tumor type combination to the least sensitive species/strain/sex/tumor type combination) (Kimbrough et al., 1984). ELD calculated the range of cancer potencies corresponding to the VSDs reported to be 7.0×10^2 to 3.6×10^4 (mg/kg b.w.-day)$^{-1}$.

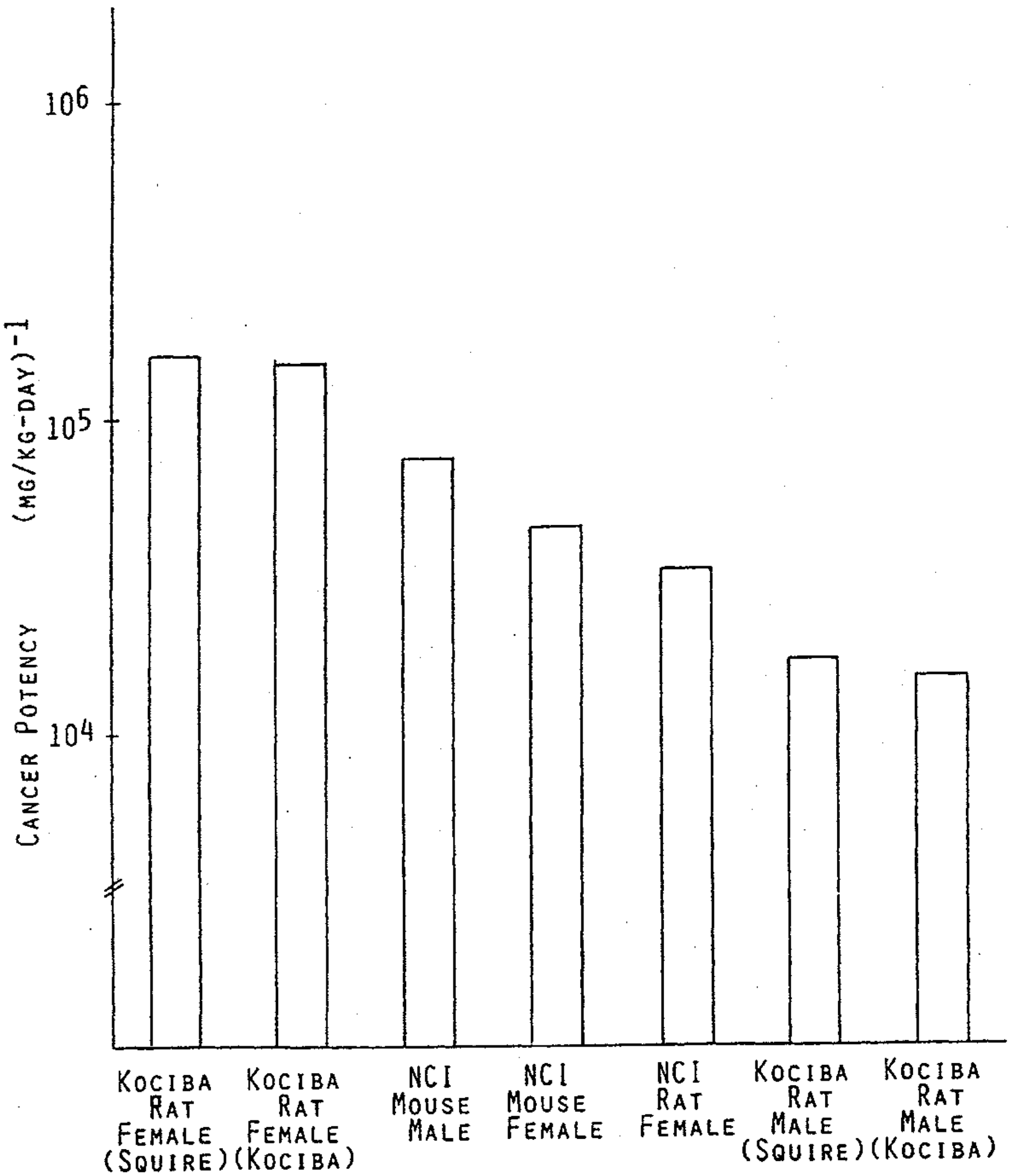
In addition to the full range of potency figures calculated from the CDC's VSD data, ELD also calculated the CDC cancer potency figure corresponding to the combination of the most sensitive tumor type in the least sensitive species, strain, and sex of laboratory animal tested. Specifically, this cancer potency figure was derived by examining the CDC data on virtually safe doses for each of the six subpopulations of laboratory animals tested, Sprague-Dawley female and male rats, Osborne-Mendel female and male rats, and B6C3F1 female and male mice. The lowest of the 95% lower confidence bounds for the VSD for each of the six subpopulations were compared (i.e., the most conservative VSD in each group, therefore the most sensitive tumor type). Of these, the highest VSD was associated with the B6C3F1 female mouse data for lymphoma and leukemia (making this species and sex the least sensitive). ELD calculated the cancer potency figure associated with this VSD from the CDC analysis, resulting in a potency of 1.8×10^3 (mg/kg b.w.-day)$^{-1}$.

The FDA used a cancer potency estimate of 1.75×10^4 (mg/kg b.w.-day)$^{-1}$ based on the Kociba rat data to support advisory levels for TCDD in Great Lakes fish: 50 ppt should not be consumed and 25 to 50 ppt should not be consumed more than twice a month (FDA, 1983; Scheuplein, 1983). Previous to this analysis, the FDA had used a no-observed-effect-level approach to support development of the advisory levels (Cordle, 1983).

A comparison of the cancer potency figures developed by the three agencies reveals considerable differences among the estimates. The EPA potency figure exceeds the most conservative CDC figure by a factor of 4 and exceeds the FDA figure by a factor of 9. These particular potency figures were all derived from the female rat data from the Kociba study. Discussion of some of the differences among the analyses follows.

The FDA used only the Kociba histopathological diagnosis; EPA used both the Kociba and Squire results in their analyses, while the more conservative of the CDC figures is based on the Squire results (EPA, 1984). EPA pooled tumor types, while CDC analyzed each tumor

FIGURE 4.1.A SUMMARY OF U.S. EPA CANCER POTENCY FIGURES PRESENTED IN 1985 HEALTH ASSESSMENT DOCUMENT



type separately with the liver tumor analysis for female rats comprising the most conservative analysis. Because almost all animals with tumors of any type also had liver tumors, this difference in approach between EPA and CDC has little impact on these agencies' most conservative potency and VSD determinations. While EPA and FDA used the administered dose in the model, CDC used the liver TCDD concentration for female rats with liver tumors. EPA adjusted for high early mortality in female rats while CDC and FDA did not make this adjustment. Whereas EPA extrapolated from rat to man using the assumption that dose per unit body surface area is an equivalent dose between species, CDC and FDA assumed dose per unit body weight (EPA, 1984).

The choice of animal-to-human extrapolation correction has a large effect on the value of the human cancer potency figure. For example, if the EPA had used the same methodology as the CDC and FDA, the EPA cancer potency figure of 1.56×10^5 (mg/kg b.w.-day)$^{-1}$ would have been reduced by a factor of 5.4 giving 2.9×10^4 (mg/kg b.w.-day)$^{-1}$, a figure similar to the more conservative CDC figure.

In place of any one agency approach, Envirologic Data has used the available data on TCDD cancer potency to develop its best estimate of a reasonably conservative figure for purpose of this risk assessment. For comparative purposes, cancer potency figures for TCDD used by the EPA, CDC, and FDA are shown in bar chart form in Figure 4.1.B. ELD has derived a cancer potency figure for TCDD by computing the geometric mean of the EPA figure, 1.56×10^5 (mg/kg b.w.-day)$^{-1}$, (labeled as (A) on Figure 4.1.B) and the figure derived from the CDC data, 1.8×10^3 (mg/kg b.w.-day)$^{-1}$, (labeled as (C) on Figure 4.1.B). The figure derived from the CDC corresponds to the potency figure mentioned earlier based on female mouse data for lymphoma and leukemia.

ELD's approach is summarized in Figure 4.1.C. The potency range used to derive ELD's estimate for cancer potency of 1.7×10^4 (mg/kg b.w.-day)$^{-1}$ (labeled (B) on Figure 4.1.B) represents a range from the most sensitive species, strain, sex of laboratory animal tested to the least sensitive species, strain, sex tested in terms of tumor development.

Cancer potency figures and corresponding VSDs for 2,3,7,8-TCDD are summarized in Table 4.1.A. Virtually safe doses are shown corresponding to levels of "acceptable" incremental cancer risk of 1×10^{-6} and 1×10^{-5}. Examination of this table shows that ELD estimates for VSDs at both risk levels fall within the broader range of agency estimates.

Envirologic Data believes that the cancer potency approach taken in this report retains a high degree of conservatism through use of the multistage model, yet also begins to take into account differential susceptibility to TCDD health effects between humans and the more sensitive laboratory animal species. Few data are available regarding differential susceptibility between species of laboratory animal and humans. However, studies by Kligman and Rowe indicate that humans are less sensitive to TCDD's chloracnegenic effects than

FIGURE 4.1.B CANCER POTENCY FIGURES FOR 2,3,7,8-TCDD

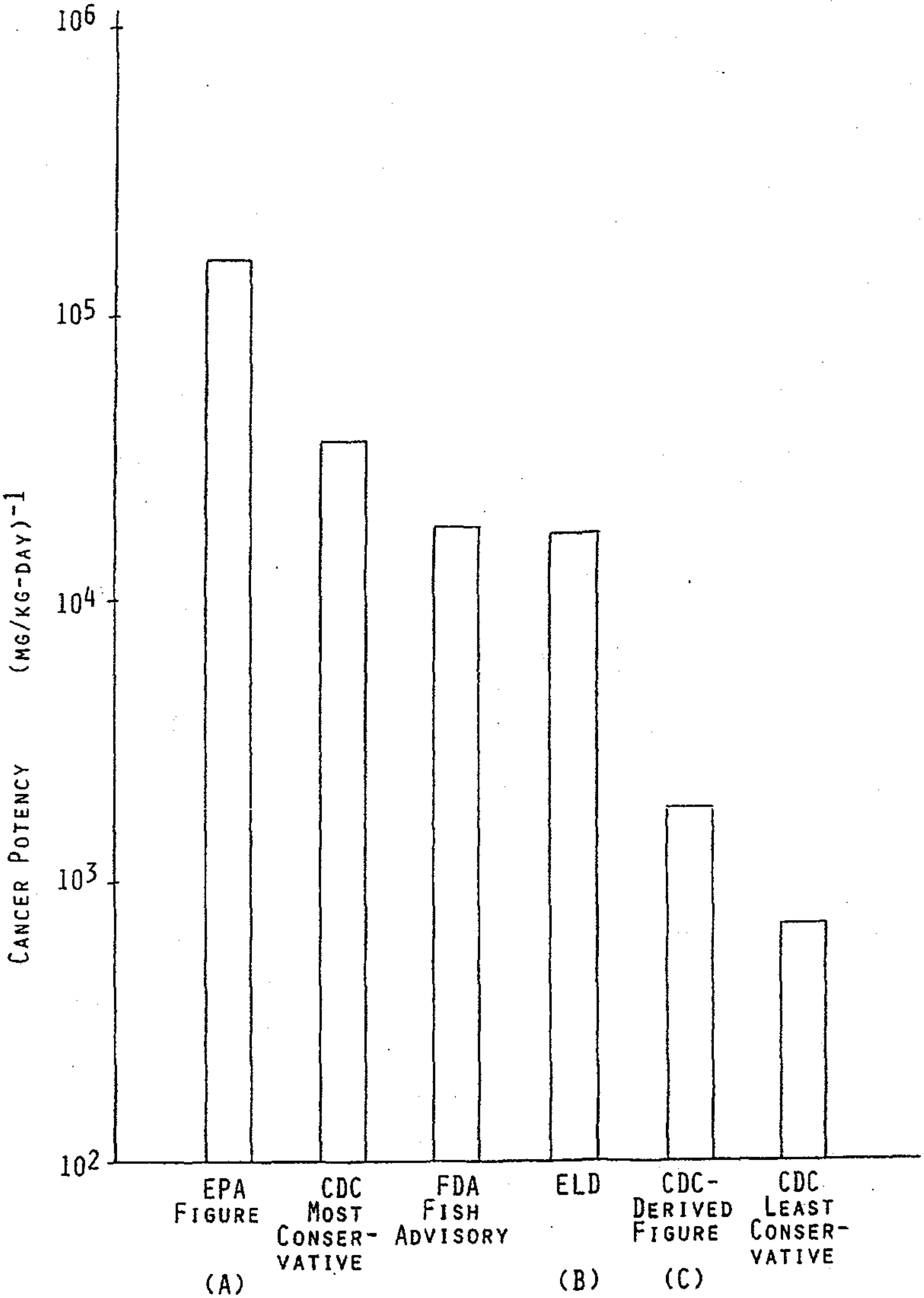


Figure 4.1.C. Approach to Selection of TCDD Cancer Potency

Cancer Potency A

- EPA-reported figure: 1.56×10^5 (mg/kg-day)$^{-1}$
- Combination of most sensitive species, strain and sex (Sprague-Dawley rat, female)
- Pooled tumor types (principally hepatocellular tumors)

Cancer Potency C

- Derived from CDC analysis (from VSD reported): 1.8×10^3 (mg/kg-day)$^{-1}$
- Combination of least sensitive species and sex (B6C3F1 mouse, female)
- Most sensitive tumor type (lymphoma/leukemia)

Cancer Potency B

- Geometric mean of A and C
- 1.7×10^4 (mg/kg-day)$^{-1}$

Table 4.1.A. Summary of Agency and ELD Cancer Potency Figures and Corresponding Virtually Safe Doses (VSDs) for 2,3,7,8-TCDD

	"Acceptable"* Incremental Cancer Risk	Cancer Potency (mg/kg b.w.-day)$^{-1}$	VSD (fg/kg b.w.-day)
EPA	1×10^{-6}	1.56×10^{5}	6.4
	1×10^{-5}	Same	64
CDC	1×10^{-6}	3.6×10^{4} to 7×10^{2}	28 to 1,400
	1×10^{-5}	Same	280 to 14,000
FDA	1×10^{-6}	1.75×10^{4}	57
	1×10^{-5}	Same	570
ELD	1×10^{-6}	1.7×10^{4}	60
	1×10^{-5}	Same	600

*All figures (cancer potencies or VSDs) calculated from agency data were rounded to two significant figures. For EPA and FDA, VSDs at acceptable cancer risks of 1×10^{-6} and 1×10^{-5} were calculated by ELD from cancer potencies used by the two agencies. For CDC, cancer potencies were calculated from VSDs. Equation for calculation: Acceptable Incremental Cancer Risk = VSD x Cancer Potency.

the rabbit ear (Rowe, 1980; Tschirley, 1986). Further evidence for possible reduced susceptibility in humans comes from epidemiologic data, discussed in Section 2.2. Although TCDD has clearly been shown to be an animal carcinogen, there is little epidemiologic evidence for TCDD-induced cancer in humans.

Further support for ELD's selection of a lower cancer potency than the EPA figure is found in Sielken's (1987b) reanalysis of TCDD's virtually safe dose. Sielken (1987b) shows that when the multistage model is fitted to the Kociba et al. (1978) data on rat liver tumors, trade-offs inherent in curve fitting may lead to questionable fits in the low-dose area. Fitted model tumor response rates, compared to observed response rates, are too large at the lowest nonzero experimental dose level and too small at the intermediate dose level. Sielken shows that the presense or absence of experimental data at the lowest experimental dose produces very little effect on the shape of the fitted models and makes only a very small change to the fitted model values for the VSD. Sielken demonstrates that the Kociba et al. data show a saturation-like phenomenon of the dose-response relationship at the highest dose level, and notes that it is impossible for the multistage model to portray both this phenomenon at the high doses and the observed nonlinearity at the lowest dose levels. In the fitting process, the lower dose behavior is essentially ignored while the relative flatness at higher doses is depicted. Sielken (1987b) excludes the highest dose level from the analysis and reevaluates the VSD (at a 1×10^{-6} risk level) for the probability of hepatocellular neoplastic nodule or carcinoma in a female rat to be 140 pg/kg b.w.-day (140,000 fg/kg b.w.-day) in the diet. Sielken's analysis clearly shows that results of mathematical modeling of the TCDD cancer bioassay data are very sensitive to modeling assumptions and that the agency analyses may considerably overestimate TCDD's cancer potency.

In addition to the factors mentioned above regarding the possibility of differential susceptibility to TCDD toxic effects and problems related to the mathematical modeling performed on the Kociba et al. (1978) data, evidence showing that TCDD may act as a cancer promoter rather than as an initiator suggests that the nonthreshold approach used by regulatory agencies in the U.S. likely overestimates potential carcinogenic risks. This argument is discussed further in Section 4.3.

4.2 Risk Estimation

Lifetime incremental cancer risks associated with the exposures presented in Section 3.4 are calculated as follows:

$$\text{Lifetime Incremental Cancer Risk} = \text{Cancer Potency} \times \text{LADD}$$

This equation is a valid approximation of extra risk at low doses (EPA, 1985). A cancer potency figure of 1.7×10^4 (mg/kg b.w.-day)$^{-1}$ was used in the risk calculations as described in the previous section. The results of the incremental risk calculations corresponding to a level of 50 ppt TCDD in the sludge are shown in

Table 4.2.A. Upper bounds of lifetime incremental cancer risks range from the highest risk of 3×10^{-7} for milk or beef consumption (Maine Farmer -- cows grazed) to the lowest risk of 4×10^{-11} for dust inhalation (Maine Farmer). The incremental cancer risks calculated are based on 70-year lifetime exposures for all scenarios except soil ingestion. Exposures of shorter duration would be associated with lower risks.

In addition to estimating risks at a level of 50 ppt TCDD in the sludge, Envirologic Data also performed a "reverse" calculation to estimate allowable soil and sludge TCDD levels at specified incremental cancer risk levels. Incremental cancer risk levels of 1×10^{-6} (one in one million) and 1×10^{-5} (one in one hundred thousand) were selected for the analysis. Allowable sludge levels were calculated from allowable soil levels using factors derived from the sludge loading models. Allowable TCDD levels in soil and sludge are presented in Table 4.2.B for the 1×10^{-6} and 1×10^{-5} incremental cancer risk levels.

For the direct grazing scenarios (milk and beef consumption by Maine farmers), allowable soil TCDD levels range from 22 to 250 ppt for both incremental cancer risk levels. Corresponding allowable sludge TCDD levels range from 170 to 2,000 ppt. Allowable soil TCDD levels for the consumer milk and beef scenarios show a range from 2,500 to 650,000 ppt, and corresponding sludge TCDD levels range from 20,000 to 5,100,000 ppt. For the nongrazing dairy and beef cattle scenarios, allowable TCDD levels in the soil range from 120 to 3,700 ppt corresponding to sludge TCDD levels of 950 to 41,000 ppt.

In the case of corn consumption, levels of 1,500 to 15,000 ppt in the soil are estimated corresponding to sludge TCDD levels of 16,000 to 160,000 ppt. For exposures through skin contact, dust inhalation, or soil ingestion, allowable soil TCDD levels range from 4,100 to 1,700,000 ppt with sludge levels of 32,000 to 13,000,000 ppt. Where compost is used in lawn application, allowable soil TCDD levels range from 2,000 to 20,000 ppt, corresponding to sludge TCDD levels of 11,000 to 110,000 ppt.

Incremental lifetime cancer risk levels of 1×10^{-5} and 1×10^{-6} were selected for use in this analysis because they bound the range generally considered acceptable by state and federal regulatory agencies. These risk levels represent the incremental or additional risk over and above the background lifetime cancer risk of about 25%. That is, an individual has a risk of 25% or 0.25 of getting cancer in his lifetime. An additional risk of 1×10^{-6} would increase the individual's total risk of getting cancer to 25.0001% or 0.250001. The selection of an appropriate risk level for a given analysis is a risk management decision. It is important for risk managers to not only understand the concept of "acceptable" risk but, in addition, to understand the uncertainties and conservatism inherent in the risk analysis. The latter points are discussed in Section 4.5.

Identification of the region of acceptable risk to the general population is made clearer by brief examination of EPA experience in

Table 4.2.A. Lifetime Incremental Cancer Risks Corresponding to Exposure to Sludge Containing 50 ppt TCDD

Exposure Scenario	Lifetime Incremental Cancer Risk
<u>Milk Consumption</u>	
Maine Farmer -- Cows Grazed	3×10^{-7}
Maine Consumer -- Cows Grazed	3×10^{-9}
Maine Farmer -- Cows Fed Hay	2×10^{-8}
Maine Farmer -- Cows Fed Silage Corn	1×10^{-8}
<u>Beef Consumption</u>	
Maine Farmer -- Cattle Grazed	3×10^{-7}
Maine Consumer -- Cattle Grazed	1×10^{-10}
Maine Farmer -- Cattle Fed Hay	5×10^{-8}
Maine Farmer -- Cattle Fed Silage Corn	4×10^{-8}
<u>Corn Consumption</u>	
Maine Farmer	3×10^{-9}
<u>Skin Contact</u>	
Maine Farmer	2×10^{-9}
<u>Dust Inhalation</u>	
Maine Farmer	4×10^{-11}
<u>Soil Ingestion</u>	
Maine Child Residing on Farm	6×10^{-10}
Maine Child -- Lawn Established with Compost	4×10^{-9}

Table 4.2.B. Allowable Average TCDD Levels in Soil and Sludge Corresponding to Lifetime Incremental Cancer Risks of 1×10^{-5} and 1×10^{-6}

	Allowable Average TCDD Levels (ppt)			
	1×10^{-5}		1×10^{-6}	
Exposure Scenario	Soil[a]	Sludge[b]	Soil[a]	Sludge[b]
Milk Consumption				
Maine Farmer -- Cows Grazed	250	2,000	25	200
Maine Consumer -- Cows Grazed	25,000	200,000	2,500	20,000
Maine Farmer -- Cows Fed Hay	3,700	29,000	370	2,900
Maine Farmer -- Cows Fed Silage Corn	3,700	41,000	370	4,100
Beef Consumption				
Maine Farmer -- Cows Grazed	220	1,700	22	170
Maine Consumer -- Cows Grazed	650,000	5,100,000	65,000	510,000
Maine Farmer -- Cows Fed Hay	1,200	9,500	120	950
Maine Farmer -- Cows Fed Silage Corn	1,200	13,000	120	1,300
Corn Consumption				
Maine Farmer	15,000	160,000	1,500	16,000
Skin Contact				
Maine Farmer	41,000	320,000	4,100	32,000

Table 4.2.B. Continued

Exposure Scenario	Allowable Average TCDD Levels (ppt)			
	1×10^{-5}		1×10^{-6}	
	Soil[a]	Sludge[b]	Soil[a]	Sludge[b]
Dust Inhalation				
Maine Farmer	1,700,000	13,000,000	170,000	1,300,000
Soil Ingestion				
Maine Child Residing on Farm	130,000	780,000	13,000	78,000
Maine Child -- Lawn Established with Compost	20,000	110,000	2,000	11,000

a. All soil TCDD levels represent 70-yr average except for soil ingestion which are 5-yr averages.

b. For exposure scenarios based on topdressing, sludge TCDD levels represent 45-yr averages. For scenarios based on soil incorporation, sludge TCDD levels represent 22-yr averages. For the compost scenario, sludge applied only once as an ingredient of compost.

assessing significance of risks and review of statistics on risks of commonplace activities. In proposed regulatory action on National Emissions Standards for Hazardous Air Pollutants (NESHAPs), EPA (1984) found maximum individual lifetime risks and total population risks from a number of benzene and radionuclide sources to be too low to properly be described as significant, and therefore withdrew the proposed regulations. For example, benzene emissions from maleic anhydride process vents were found to create maximum individual risks of 7.6 in 100,000 and an aggregate cancer incidence of 0.029 cancers per year (EPA, 1984c; Wrenn, 1986). Radionuclides from Department of Energy facilities would produce maximum individual risks, from lifetime exposure to a plant's most concentrated emissions, of 1 to 8 in 10,000 and an aggregate cancer incidence of 0.08 cancer per year (EPA, 1984d; Wrenn, 1986). Based on these data, Wrenn (1986) points out that account must be taken of the fact that average individual risk would be well below maximum risk. He notes that 1 in 100,000 appears to be a good rough indicator of the level that EPA has considered to be insignificant average risk, at least in situations such as the benzene and radionuclide sources described above, in which aggregate population risk is not greater than a fraction of a cancer per year.

The incremental risk level for the scenarios addressed in this report are estimated risks based on the modeling parameters described. These hypothetical risk levels are different from the real risks of everyday human activities that have been computed from actual statistics on death from different causes.

All activities involve some risk, whether it be voluntary such as the risk incurred by smoking cigarettes, or involuntary such as the risk from being struck by lightning. Risks of some selected activities are shown in Table 4.2.C. It is evident that annual risks from many activities greatly exceed the level of one in 100,000 or one in 1,000,000. Lifetime risks of death would be even greater. Yet, some of these risks are voluntarily incurred and not avoided.

Clearly, an insignificant lifetime risk range of one in 100,000 to one in 1,000,000 is well supported for exposures to the general population. This range appears to be suitable and also conservative when applied to the small number of persons in the State of Maine with potential exposure to TCDD from land application of sludge.

4.3 Application of the Multistage Model in Light of Evidence for a Promotion Mechanism

The risk estimates made with the multistage model are generally regarded as conservative in that they represent the upper limit for the risk; i.e. the true risk is not likely to be higher than the estimate, but it could be lower. In addition to the conservatism inherent in this model, there is evidence suggesting that the multistage model does not adequately address the mechanism by which TCDD induces carcinogenic effects.

Carcinogens may be roughly divided into two categories, initiators and promoters. An initiator, if not already

Table 4.2.C. *Comparison of Risks From Selected Activities on a Per Capita Basis*

Activity	Average Annual Per Capita Risk of Mortality
Smoking (cancer only)	1×10^{-3}
(all effects)	3×10^{-3}
Scuba Diving	4×10^{-4}
Motor Vehicle Accident	2×10^{-4}
Boating	5×10^{-5}
Hunting	3×10^{-5}
Swimming	3×10^{-5}
Lightning	5×10^{-7}

*From Crouch and Wilson (1982).

electrophilic, undergoes metabolic transformation to an electrophile and reacts covalently with DNA (Williams and Weisburger, 1986). Once a cell is initiated, it incorporates a critical amount of DNA damage into its replicating genome, which may be locked into the cell for as long as the cell line continues to reproduce. A promoter acts to increase the tumorigenic response to an initiator when applied after the carcinogen (Williams and Weisburger, 1986). Promoters require prolonged and repeated exposure or persistence in the body before tumor formation in animals, whereas for tumor initiators, short-term exposure may cause tumors (Shu et al., 1987). While tumor initiation is regarded as an irreversible event, tumor promotion may be reversible upon removal of the promoter, when the tumor has not progressed to an advanced state (Shu et al., 1987).

TCDD has been shown to be nonmutagenic based on the preponderance of data from bacterial mutagenesis tests and has been shown to bind to DNA at 3 to 4 orders of magnitude less than chemical initiators (Shu et al., 1987), indicating that it is not genotoxic, i.e. it does not interact directly with DNA. Pitot et al. (1980) and Poland et al. (1982) have demonstrated TCDD's tumor promoting activity. Many promoters, including TCDD, affect cellular growth and differentiation, and alter a number of cell membrane properties (Weinstein, 1984). Tumor promoters, in contrast to initiating and genotoxic carcinogens, may display a threshold in their dose response (Williams and Weisburger, 1986). If this is true for TCDD, the multistage model, which assumes a linear nonthreshold response, will overestimate the incremental cancer risk associated with TCDD exposure.

Authorities on TCDD risk assessment have raised the issue of the appropriateness of the use of the multistage model, given that TCDD acts as a promoter. In the CDC's risk assessment of TCDD in residential soil (Kimbrough et al., 1984), the authors note that the dose-response curve for promoters may not be linear, thus resulting in an overestimate of the risk. They also state, however, that a scientific data base that would allow the use of less conservative models did not exist.

In a recent paper, Shu et al. (1987) reexamines the scientific literature on bacteria and animals related to TCDD carcinogenesis. The authors show that the mechanism data on TCDD strongly support the thesis that tumor development is based on a promotional mechanism and not on initiation. Thus, they believe that risk estimates at low doses using currently formulated linear low-dose extrapolation models are not supported by the scientific evidence on initiation. The authors conclude that alternate means of evaluating TCDD risk should be investigated.

Kolbye (1983) notes that linear extrapolation may be appropriate for electrophilic, highly genotoxic compounds, but that it has little meaning for secondary carcinogens, including TCDD. As mentioned in Paustenbach et al. (1986), Weisburger and Williams (1981) have pointed out the importance of distinguishing between whether or not a substance acts through a genotoxic or non-genotoxic mechanism: "the action of epigenetic agents of the promoter class is highly dose-dependent and reversible, and thus, a distinctly different risk analysis is required to take account of their quantitatively lesser hazard."

Recent opinion of the Dioxin Update Committee (1986), convened by the EPA, is instructive concerning TCDD's mechanism of toxicity:

> "There is no evidence that TCDD or its metabolites alter the structure of DNA, but TCDD is carcinogenic in at least two rodent species. It acts as a potent promoting agent in at least two different tissues in two different species, but there is no evidence for initiation activity in any species."

Also pertinent is a statement from the Committee's conclusions regarding human health risk assessment:

> "Mechanistic models should be used for quantitative risk estimation for TCDD and related compounds. Such methods should consider epidemiological data, sex-species susceptibility, the promoting action of TCDD, and its pharmacokinetic properties in predicting risks for exposed populations."

Although valid arguments have been raised by a number of scientists concerning the appropriateness of modeling TCDD as a tumor initiator, Envirologic Data has chosen to use this conservative approach in the present risk assessment, while at the same time addressing concerns regarding relative susceptibilities of animal species to TCDD's toxic effects. An alternative threshold approach is discussed briefly in the following section.

4.4 Alternative Allowable Daily Intake Approaches

Based on the lack of evidence for the appropriateness of a nonthreshold model for TCDD, several agencies outside the U.S. have used the safety factor (threshold) approach and developed allowable daily intakes (ADIs) for TCDD. Shu et al. (1987) point out that risk assessments based on this approach more accurately reflect the scientific understanding of the mechanism of action of TCDD than those that assume an initiation mechanism. Allowable daily intakes are derived from no-observed-effect-levels (NOELs) with application of a safety (uncertainty) factor. The Ontario Ministry of the Environment (1985) calculated a maximum allowable daily intake for humans of 10 pg/kg b.w.-day based on a NOEL of 1 ng/kg b.w.-day (1000 pg/kg b.w.-day) and a safety factor of 100. The State Institute of National Health (SINH) in the Netherlands obtained a maximum ADI of 4 pg/kg b.w.-day based on a NOEL of 1 ng/kg b.w.-day and a safety factor of 250 (van der Heijden et al., 1982).

The EPA (1984b) while not using the ADI approach in their risk assessment, calculated an ADI at 1 pg/kg b.w.-day based on a NOEL of 1 ng/kg b.w.-day and a safety factor of 1,000. The FDA, prior to their linear model approach discussed earlier in the report (FDA, 1983), had originally used a safety factor approach to support advisory levels for TCDD in fish. FDA (1983) calculated a TCDD exposure level of 13 pg/kg b.w.-day from consuming fish containing

25 ppt TCDD at the 99th percentile of U.S. fish consumption. FDA noted that this exposure level was less than 1/70th of the animal NOEL of 1 ng/kg b.w.-day. This approach was used to support 25 ppt TCDD as a "safe" level in Great Lakes' fish.

Allowable daily intakes estimated for 2,3,7,8-TCDD generally range from 1 to 10 pg/kg b.w.-day. These figures, equal to 1,000 to 10,000 fg/kg b.w.-day, can be compared to the full range of virtually safe doses shown in Table 4.1.A of 6.4 to 14,000 fg/kg b.w.-day and to the ELD-derived VSDs of 60 to 600 fg/kg b.w.-day.

4.5 Factors Contributing to Uncertainties and Conservatism of Human Health Risk Assessment

Factors contributing to uncertainty and/or conservatism in the low-dose risk extrapolation of TCDD in sludge are briefly discussed in this section. First, the risk assessment process used in this analysis assumes that animal data on TCDD carcinogenicity can be used to adequately predict human response at much lower dose levels, on the order of 10,000,000 times less. This extrapolation, accomplished via a mathematical model introduces considerable uncertainty into the anlysis. At the same time, a high degree of conservatism is built into the model itself and the resulting upper-confidence-bound cancer potencies. Envirologic Data derived a TCDD cancer potency figure from data on the most sensitive tumor types in bioassays of several species and strains of laboratory animals. A conservative procedure for scaling from animal to human employed by EPA (1985) and problems with fit of the Kociba et al. (1978) female rat liver tumor data to the model due to apparent saturation at higher doses (Paustenbach et al., 1986) contribute additional conservatism to this analysis. The appropriateness of using the multistage model for TCDD risk estimation is called into question based on evidence for a cancer promotion mechanism, as described earlier. The use of the multistage model in this assessment to derive virtually safe doses may considerably overestimate the true risk.

Exposure estimation in this analysis depends upon a large number of individual factors as outlined elsewhere in the report. Limited data, in some cases, contributes to uncertainty of the factors used in the analysis. As one example, age-specific soil contact rate for exposed skin is not a fact, but is estimated from several studies of soil accumulation on children's hands. The final estimate will contain the uncertainty of the original data upon which it is based, as well as the uncertainty of the extrapolation from children to adults and from surface area of hands to other areas of the body. It is not possible at present to generate uncertainty estimates on each assumption in order to develop confidence bounds on exposure estimates. In order to address the problem of uncertainty in the exposure analysis, Envirologic Data selected conservative factors. Also, exposures are modeled for hypothetical individuals with lifetime exposure to TCDD in landspread sludge, a highly unlikely and again, conservative scenario.

The risk assessment results, both in terms of incremental lifetime cancer risks and allowable soil levels, contain a range of uncertainty. However, the overall process and factors used in this analysis contain a large degree of conservatism so as to ensure that the final results are sufficiently protective of public health.

A key issue in the interpretation of this risk assessment is an understanding of the conservative approach upon which it is based. When a number of worst-case assumptions are made, the combination of these conservative assumptions produces multiplicative conservatism which is unrealistic. As described throughout the document, ELD has approached exposure and risk estimation from a conservative approach which is consistent with realistic considerations. In spite of the attempt to inject a degree of reasonableness into the analysis, ELD believes that the results, whether expressed as incremental cancer risk or allowable soil level, still likely overestimate the risk by one to two orders of magnitude. For example, sensitivity analysis of two critical assumptions, virtually safe dose and exposure duration, demonstrates that if either factor overstates the most likely case by a factor of 10, the resulting predicted allowable soil level will be too conservative by a factor of 10. If both the VSD and exposure duration exceed the most likely case by a factor of 10, the resulting allowable soil level will be 100 times less than the most likely value. This scenario is not unlikely, given the extremely low probability of a Maine farmer being exposed to land-applied sludge containing TCDD for a full lifetime at the contact rates modeled by ELD, and the possibility that the low-dose extrapolation model overstates TCDD's true risk to humans.

Envirologic Data has elected to report exposure routes individually rather than to sum all routes of exposure to TCDD in this analysis. ELD believes that given the abundant conservatism in the exposure and risk estimation, summing all exposure routes would not accurately portray potential risks related to agricultural use of sludge in Maine. As an alternative to the present analysis, composite exposure scenarios could be developed, based on real-world, most likely scenarios of exposure.

5.0 CONCLUSIONS

Envirologic Data has examined potential exposure and corresponding risk to Maine farmers and consumers related to TCDD in landspread wastewater treatment plant sludges. At a hypothetical level of 50 ppt TCDD in sludge, upper-bound lifetime incremental cancer risks for all exposure scenarios examined are less than 1×10^{-6}.

Envirologic Data calculated allowable levels of TCDD in soil and sludge for each exposure scenario corresponding to acceptable risk levels of 1×10^{-5} and 1×10^{-6}. Levels of incremental lifetime cancer risk ranging from 1×10^{-5} to 1×10^{-6} generally are believed to be acceptable. The allowable soil levels should be considered as lower-bounds, i.e. in all likelihood, the "true" allowable soil level could be greater and still present an insignificant risk to public health.

For the Maine farmer, the lowest allowable soil and sludge levels determined by Envirologic Data correspond to milk and beef consumption from dairy and beef cattle grazed on sludge-amended pastures where exposure occurred through soil ingestion by cattle. Estimates range from 22 to 250 ppt for soil and 170 to 2,000 ppt for sludge for risk levels of 10^{-6} and 10^{-5}, respectively. For agricultural scenarios other than direct grazing, the lowest allowable levels for the Maine farmer scenarios correspond to milk and beef consumption from cattle fed hay or silage corn. Allowable TCDD levels range from 120 to 3,700 ppt in the soil and from 950 to 41,000 ppt in the sludge for risk levels of 1×10^{-6} and 1×10^{-5}, respectively.

Allowable average levels of TCDD in soil related to direct contact with TCDD-containing sludge through skin, inhalation, or soil ingestion may be 4,100 ppt or greater depending on the scenario examined and risk level. Corresponding sludge levels may be 32,000 ppt or greater. In the case of one-time lawn establishment with compost, allowable TCDD levels are estimated to be 2,000 ppt and greater with corresponding sludge TCDD level of 11,000 ppt and greater, depending on the risk level selected.

Upper-bound incremental cancer risks and lower-bound allowable soil levels estimated in this report are subject to uncertainties arising from the hazard, dose-response, exposure, and risk assessment sections of the analysis. The quantitative risk assessment approach used in this analysis constitutes a conservative approach to risk estimation, especially in light of evidence supporting TCDD's action as a cancer promoter. Envirologic Data selected reasonably conservative parameters throughout the analysis, and therefore, believes that while uncertainties exist, they exist principally on the side of over-conservatism. It is believed that the risk assessment results, expressed as incremental cancer risks or allowable soil levels, considerably overstate the most likely risk.

It is Envirologic Data's conclusion, based on the scenarios of exposure examined in this report, that 2,3,7,8-TCDD levels (ranging up to 51 ppt) reported for Maine wastewater treatment plant sludges would not present a significant risk to human health of Maine farmers and consumers. Based on the allowable TCDD levels determined for the individual exposure scenarios in this report, Envirologic Data concludes that levels of TCDD even greater than those detected in Maine sludges may be of little concern to public health.

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0367R

California Analytical Laboratory

Enseco Incorporated

REC'D JUN 0 8 1987

Enseco

June 3, 1987

Steven A. Petrin
Georgia-Pacific Corp.
90 West Redwood Ave.
Fort Bragg, CA 95437

Dear Mr. Petrin,

Enclosed is the confirmation of the 2,3,7,8, TCDF isomer you requested on June 1, 1987.

If you have any further questions please don't hesitate to call.

Sincerely,

Robert S. Mitzel

Robert S. Mitzel
GC/MS Lab Supervisor

RSM:mbw

2544 Industrial Boulevard
West Sacramento, California 95691
916/372-1393 Facsimile: 916/372-1059

Enseco

ENSECO-CAL LAB

POLYCHLORINATED DIOXIN/FURAN ANALYSIS REC'D JUN 08 1987

TICKET NO. 28882

CLIENT ID: Composite 20414, 20413, 20412

CAL ID: 28882C

Date Analyzed: 5/8/87
Wet Weight: 10.07g
Dry Weight: N/A
Percent Moisture: 0%

Column: DB-5

FURANS	AMOUNT FOUND (ng/g)	DETECTION LIMIT (ng/g)
tetra (total)	0.23	-
2378 DB-225 confirmation	0.015	-
penta	ND	0.032
hexa	ND	0.0096
hepta	ND	0.024
octa	ND	0.13
DIOXINS		
tetra (total)	ND	0.012
penta	ND	0.014
hexa	ND	0.025
hepta	ND	0.034
octa	ND	0.21

% Accuracy 37Cl-TCDD = 96%

% Recovery 13C-2378-TCDF = 54%
% Recovery 13C-2378-TCDD = 42%

ND = Not Detected

Calculations based on Dry Weight

PREPARED BY: DS

APPROVED BY: BSM DATE: 6/3/87

Ensco

2378-TCDF DATA REPORT
ENSECO - Cal Lab
2544 Industrial Blvd.
W. Sacramento, CA 95691

Lab: ENSECO - Cal Lab
Case No. 28882
Batch/Shipment No.

Report Date: 6/2/87
Column: DB-225

Cal Labs ID	Sample Number	C U	Aliquot Wet Wt. (grams)	PPB TCDF Meas	PPB TCDF Det. Lmt	Inst ID	Date	Time	304/ 306	316/ 318	304	306	316	318	Comments
28882MBRI	METHOD BLANK	Y	10.00	ND	0.0014	HR	06/02/87	18:43:00	-	0.69	-	-	1140000	1655000	
28882-1	ASH HOPPER	Y	10.07	0.015	-	HR	06/02/87	18:59:00	0.82	0.71	5535	6729	865800	1220000	

MB = Method Blank
P = Partial Scan/Confirmatory Analysis
NS = Native TCDF Spike
D = Duplicate/Fortified Field Blank
RI = Re-injection
CU = Clean Up
FB = Field Blank
ND = Not Detected
DL = Detection Limit
RX = Re-extraction
MPC = Maximum Possible Concentration

*Corrected for contribution by native TCDD; 0.9% of m/z 322 subtracted

Prepared by: DS

Approved by: BSM

Date: 6/3/87

FORM B-1

REC'D JUN 08 1987

Enseco

ENSECO - Cal Lab
Daily Calibration Summary

Native Conc ug/ml	ID	Injection Date	Injection Time	Standard ID	A304	A306	A316	A318	RF Native
0.020	HR	06/02/87	17:42:00	ST8706028	11420	13860	125500	190000	1.00

Average Native RRF = 1.00

REC'D JUN 08 1987

Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

WATER QUALITY
CONTROL BOARD
REGION I

JUN 15 '87

☐ BK ☐ DC
☐ CJ ☐ SW
☑ FR FR ☐
☐ RT ☐
☐ JH ☐
☐ DB ☐
☐ JG ☐ REPLY
☐ ☒ FILE GP SOIL AMEND Mendocino Co.

June 3, 1987

Ms. Susan Warner
Associate Engineering Geologist
Calif. Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95402

Dear Ms. Warner:

Thank you for your letter of June 1 with order No. 87-80, rescinding the C & A order at the Little Valley site. Stabilization and prevention of ash discharges at the site have been a major concern of ours and we are gratified that the Board has recognized our efforts by rescinding the order.

We had already addressed your concerns about the stockpile area prior to receipt of your letter. We have already begun incorporation of the stockpiled material and no new material has been stockpiled since the rains in late April.

Sincerely,

Steven A. Petrin

Steven Petrin
Director, Environmental
Health and Safety
California Wood Products

SP/jh

cc: D. Jacobszoon

STATE OF CALIFORNIA GEORGE DEUKMEJIAN, *Governor*

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—
NORTH COAST REGION
1440 GUERNEVILLE ROAD
SANTA ROSA, CA 95401
Phone: (707) 576-2220

June 1, 1987

NOTICE

RECISION OF

CLEANUP AND ABATEMENT ORDER NO. 87-80

FOR

GEORGIA-PACIFIC CORPORATION
FORT BRAGG ASH SOIL AMENDMENT

Mendocino County

Attached is a copy of an Order which rescinds Cleanup and Abatement Order No. 87-80.

Benjamin D. Kor
Executive Officer

Attachment

cc: SWRCB, Division of Water Quality, Attn: Archie Matthews
SWRCB, Office of the Chief Counsel, Attn: Bonnie Wolstoncroft
SWRCB, Division of Water Quality, Attn: Arnie Inouye
DFG, Yountville
DFG, Sacramento,
Mendocino County Health Department
DOHS, SEB, Santa Rosa
DWR, Central District, Sacramento, Attn: B.J. Archer
USDI, Fish and Wildlife Service, Sacramento
Dept. of Parks and Recreation, Sacramento, Attn: James M. Doyle
EPA, San Francisco, Mail Code W-3-2
All Board Members

Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

WATER QUALITY
CONTROL BOARD
REGION 1

JUN 11 '87

BK ___ RC ___
CJ ___ SW
FR ___
RT ___
JH ___
BB ___
JG ___ REPLY
FILE

June 8, 1987

Ms. Susan Warner
California Regional Water
Quality Control Board
1440 Guerneville Rd.
Santa Rosa, CA 95401

GP Ft Bragg Sawmill

Dear Ms. Warner:

Samples of powerhouse flyash have been collected and an analysis for dioxins and furans completed as you requested. As specified in the sampling plan, I took three samples over the period of April 2 to April 8, which were then composited into a single sample at California Analytical Laboratory for analysis.

As you can see from the enclosed lab sheets, this sample showed that no dioxins were present. The analysis for furans yielded a trace amount (0.23 ppb) of tetra-chlorinated dibenzofuran (TCDF). We have contacted the lab to initiate an isomer-specific analysis in order to determine which TCDSs were detected.

Please take the opportunity to evaluate these results and then contact me with any comments you may have on this matter.

Sincerely,

Steve Petrin

Steve Petrin
Director, Environmental
Health and Safety

SP/hm

cc: L. D. Ambrosini
J. Anderson/Atlanta
R. D. Benedetti
D. B. Whitman
D. G. Jacobszoon

Ensec

ENSECO-CAL LAB

POLYCHLORINATED DIOXIN/FURAN ANALYSIS

TICKET NO. 28882

WATER QUALITY
CONTROL BOARD
REGION I

JUN 12 '87

☑ BK ☐ CI ☐ FR ☐ RT ☐ JR ☐ BB ☐ JG ☐ ☐ REPLY ☐ ☐ ☐ ☐ ☐ ☐ FILE

CLIENT ID: METHOD BLANK

CAL ID: 28882MB

Date Analyzed: 5/8/87 ~~Column:~~ DB-5
Wet Weight: 10.09g
Dry Weight: N/A
Percent Moisture: N/A

FURANS	AMOUNT FOUND (ng/g)	DETECTION LIMIT (ng/g)
tetra (total)	ND	0.0018
penta	ND	0.014
hexa	ND	0.0050
hepta	ND	0.0073
octa	ND	0.025
DIOXINS		
tetra (total)	ND	0.0068
penta	ND	0.0067
hexa	ND	0.015
hepta	ND	0.018
octa	ND	0.053 *

% Accuracy 37Cl-TCDD = 97%

% Recovery 13C-2378-TCDF = 64%
% Recovery 13C-2378-TCDD = 66%

ND = Not Detected

* Chemical Interference

PREPARED BY: RDA

APPROVED BY: BSM

DATE: 5/13/87

WATER QUALITY CONTROL BOARD REGION I

Enseco

JUN 12 '87

ENSECO-CAL LAB

POLYCHLORINATED DIOXIN/FURAN ANALYSIS

TICKET NO. 28882

CLIENT ID: Composite 20414, 20413, 20412

CAL ID: 28882C

Date Analyzed: 5/8/87 Column: DB-5
Wet Weight: 10.07g
Dry Weight: N/A
Percent Moisture: 0%

FURANS	AMOUNT FOUND (ng/g)	DETECTION LIMIT (ng/g)
tetra (total)	0.23 ppb	-
penta	ND	0.032
hexa	ND	0.0096
hepta	ND	0.024
octa	ND	0.13
DIOXINS		
tetra (total)	ND	0.012
penta	ND	0.014
hexa	ND	0.025
hepta	ND	0.034
octa	ND	0.21

GP-Fort Bragg Sawmill Air Lumber Co.

% Accuracy 37Cl-TCDD = 96%

% Recovery 13C-2378-TCDF = 54%
% Recovery 13C-2378-TCDD = 42%

ND = Not Detected

Calculations based on Dry Weight

PREPARED BY: RDA

APPROVED BY: GSM DATE: 5/13/87

Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

CONTROL BOARD
REGION 1

JUN 1 8 '87

BK
SAW
FR

REPLY

June 16, 1987

CERTIFIED MAIL
Return Receipt Requested
P 236 628 666

Mr. Benjamin D. Kor
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95401

Dear Mr. Kor:

Enclosed is the May 1987 report for the Georgia-Pacific Soil Amending Project as per revised Monitoring and Reporting Program 86-3.

Sincerely,

Steven Petrin
Director, Environmental Health and Safety
California Wood Products

SP:sp

Encl.

MAY 1987 REPORT

GEORGIA-PACIFIC CORPORATION

FORT BRAGG SOIL AMENDMENT MONITORING AND REPORTING PROGRAM NO. 86-3

Monitoring

Volume of ash deposited by Week		Cubic Yards of Ash - deposited at the upper field of area A.
May	01 - 02	360
	03 - 09	920
	10 - 16	1020
	17 - 23	840
	24 - 30	840

Number of Treated Acres (Area A) 23.84 Acres
Number of Treated Acres (Area W) 5

Daily Precipitation Measurements		PPT (Inches)
May	1	0
	2	0
	3	0
	4	0
	5	0
	6	0
	7	0
	8	0
	9	0
	10	0
	11	0
	12	0
	13	0
	14	0
	15	0
	16	0
	17	0
	18	0
	19	0
	20	0
	21	0
	22	0
	23	0
	24	0
	25	0
	26	0
	27	0
	28	0
	29	0
	30	0.08
	31	0

No stormwater runoff monitoring was conducted due to minimal rainfall.

Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

Rec'd 6/18/87
1340
SOW

June 18 ,1987

Ms. Susan Warner
Associate Engineering Geologist
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95401

file

Dear Ms. Warner:

As indicated in my letter of June 8, a sample of powerhouse fly ash was analyzed for chlorinated dioxins and furans as per your request. Enclosed are the results of isomer-specific analysis. There was a trace amount of 2378-TCDF (15 ppt) detected.

Sincerely,

Steven A. Petrin

Steven Petrin
Director, Environmental
Health and Safety
California Wood Products

SP:sp

Encs.

cc: J. Anderson/Atlanta
D. Jacobszoon/Ft. Bragg
D. Whitman/Ft. Bragg

FCR:
These results mean that 15 ppt of the 2,3,7,8 isomer was present and 220 ppt of other tetrachlorodibenzofurans were present.

Enseco

ENSECO-CAL LAB

POLYCHLORINATED DIOXIN/FURAN ANALYSIS REC'D JUN 0 8 1987

TICKET NO. 28882

CLIENT ID: Composite 20414, 20413, 20412

CAL ID: 28882C

Date Analyzed: 5/8/87
Wet Weight: 10.07g
Dry Weight: N/A
Percent Moisture: 0%

Column: DB-5

FURANS	AMOUNT FOUND (ng/g)	DETECTION LIMIT (ng/g)
tetra (total)	0.23	-
2378 DB-225 confirmation	0.015	-
penta	ND	0.032
hexa	ND	0.0096
hepta	ND	0.024
octa	ND	0.13
DIOXINS		
tetra (total)	ND	0.012
penta	ND	0.014
hexa	ND	0.025
hepta	ND	0.034
octa	ND	0.21

% Accuracy 37Cl-TCDD = 96%

% Recovery 13C-2378-TCDF = 54%
% Recovery 13C-2378-TCDD = 42%

ND = Not Detected

Calculations based on Dry Weight

PREPARED BY: DS

APPROVED BY: BSM

DATE: 6/3/87

Enseco

2378-TCDF DATA REPORT
ENSECO - Cal Lab
2544 Industrial Blvd.
W. Sacramento, CA 95691

Lab: ENSECO - Cal Lab
Case No. 28882
Batch/Shipment No.

Report Date: 6/2/87
Column: DB-225

Cal Labs ID	Sample Number	CU	Aliquot Wet Wt. (grams)	PPB TCDF Meas	PPB TCDF Det. Lmt	Inst ID	Date	Time	304/306	316/318	304	306	316	318	Comments
28882MBRI	METHOD BLANK	Y	10.00	ND	0.0014	HR	06/02/87	18:43:00	-	0.69	-	-	1140000	1655000	
28882-1	ASH HOPPER	Y	10.07	0.015	-	HR	06/02/87	18:59:00	0.82	0.71	5535	6729	865800	1220000	

MB = Method Blank
P = Partial Scan/Confirmatory Analysis
NS = Native TCDF Spike
D = Duplicate/Fortified Field Blank
RI = Re-injection
CU = Clean Up

FB = Field Blank
ND = Not Detected
DL = Detection Limit
RX = Re-extraction
MPC = Maximum Possible Concentration

*Corrected for contribution by native TCDD; 0.9% of m/z 322 subtracted

Prepared by: DG

Approved by: BSM

Date: 6/3/87

FORM B-1

REC'D JUN 08 1987

Enseco

ENSECO - Cal Lab
Daily Calibration Summary

Native Conc ug/ml	ID	Injection Date	Injection Time	Standard ID	A304	A306	A316	A318	RF Native
0.020	HR	06/02/87	17:42:00	ST870602B	11420	13860	125500	190000	1.00

Average Native RRF = 1.00

REC'D JUN 08 1987

WATER QUALITY CONTROL BOARD REGION 1

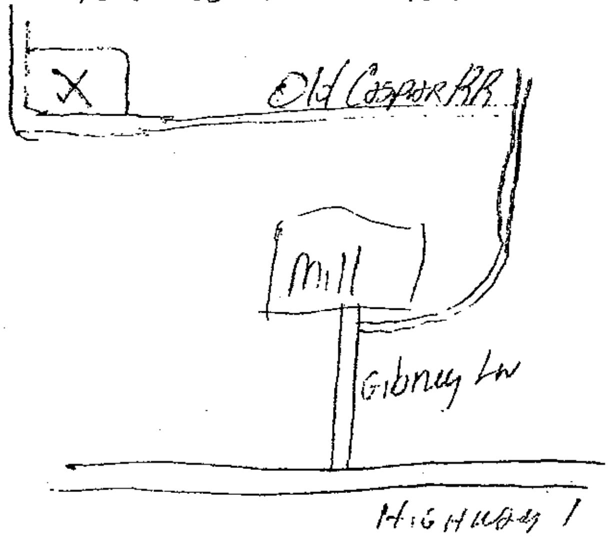
JUN 25 '87

BK RC CJ SAB FR PT JH BB JG REPLY FILE

Susan,

We are located on old Caspar RailRoad on the North East Corner of The Road about ½ mile from L.P. mill. We would like permission to haul power plant Ash into our yard to be mixed with our dirt, which will be used to grow a field.

We understand that the ash has to be wetted down and tilled in immediately.



Thank-you

Linda Sa[illegible]

33550 Gibney Ln

Ft Bragg, Ca

95437

STATE OF CALIFORNIA GEORGE DEUKMEJIAN, Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—
ORTH COAST REGION
1440 GUERNEVILLE ROAD
SANTA ROSA, CA 95401
Phone: (707) 576-2220

REC'D JUL 06 1987

July 2, 1987

Steve Petrin
Director, Environmental Health and Safety
Georgia-Pacific Corporation
~~90 West Redwood Avenue~~
Fort Bragg, CA 95437

Dear Mr. Petrin:

I reviewed the data submitted in response to our February 4 and March 23, 1987 letters requesting submittal of a technical report on analyses of the polychlorodibenzodioxins and polychlorodibenzofurans. The data show that 2,3,7,8-tetrachlorodibenzofuran and other tetrachlorodibenzofurans were present in the fly ash samples. Accordingly, these results will need to be confirmed with additional sampling and investigation. As I discussed in my meeting on June 18, 1987, with you, Jack Anderson, and Rod Shippey, no further soil amendment usage of the ash outside of the Little Valley site will be permitted until the dibenzofuran contaminant question is resolved.

A workplan describing additional tests, including a full description of sampling and analytical methodology and schedule for sampling and reporting, needs to be submitted to this office pursuant to Section 13267(b) of the Water Code by July 31, 1987. The workplan should include appropriate analysis of the ash and of the feedstock. At a minimum, the feedstock should be analyzed for chloride content and total organic halogens. Please call me if you have any questions in this matter.

Sincerely,

Susan A. Warner

Susan A. Warner
Associate Engineering Geologist

SAW:mkh

Cooperative Extension

UNIVERSITY OF CALIFORNIA MENDOCINO COUNTY

COUNTY AGRICULTURAL CENTER 707-463-4495
579 LOW GAP ROAD
UKIAH, CA 95482

July 6, 1987

Roderick A. Shippey

QUARTERLY NARRATIVE REPORT - Roderick A. Shippey
Livestock Advisor

FLY ASH IS FINALLY FREED

We have finished our first year at the Georgia Pacific Lumber Company's solid waste disposal site.

Cooperative Extension became involved with solid waste disposal when Georgia Pacific was embroiled in a dispute with California Water Quality Control Board because of the possible water pollution by the company's boiler ash disposal methods.

A test plot was laid out with three replications using six application rates of this ash. The plot was seeded with clovers and ryegrass. Weather data was kept. plot visits every two weeks made evaluation of a clearly responsive treatment an encouraging task. Stream quality was measured weekly to monitor the potential migration of fly ash into the water supply. None was found. The clovers and grasses responded to the six rates which were measured by clipping, drying and weighing.

Our application rates were:

Treatment:	Production:
Control	
0 tons/acre	10.32 T/A
48 " "	14.64 T/A
96 " "	19.02 T/A
192 " "	14.03 T/A
384 " "	28.03 T/A
768 " "	20.04 T/A

July 6, 1987

Mike Cleary
P.O. Box 14
Fort Bragg, CA 95437

Dear Mr. Cleary:

I am glad that the fly-ash/soil amendment application went well. I will inspect the site in August. We have requested additional laboratory analyses of the ash, and will need to obtain and evaluate this new data prior to approving additional ash use on farm lands.

Sincerely,

Susan A. Warner
Associate Engineering Geologist

SAW:mkh

July 8, 1987

Linda Sallinen
33550 Gibney Lane
Fort Bragg, CA 95437

Dear Ms. Sallinen:

I received your letter regarding use of the Georgia-Pacific fly ash on your property on the Old Casper Railroad. We are currently awaiting the results of further tests on the fly ash, and do not wish to authorize its use as a soil amendment until these results are received from Georgia-Pacific. I am also working with Rod Shippey of the Farm Advisors office in Ukiah to develop recommendations on application rates and seed mixtures for use as the ash as a soil amendment. Once these issues are resolved, then the ash may be used selectively as a soil amendment in the coastal areas. You should contact this office again in about six weeks if you still wish to obtain the ash for soil amendment use.

Sincerely,

Susan Warner
Associate Engineering Geologist

SAW:mkh

cc: Steve Petrin

Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

WATER QUALITY
CONTROL BOARD
REGION 1

JUL 16 '87

BK ___ RC ___
CJ ___ SW
FR FL
RT ___
JH ___
BB ___
JG ___ REPLY

July 15, 1987

CERTIFIED MAIL
Return Receipt Requested
P 236 628 664

Mr. Benjamin D. Kor
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Kor:

Enclosed is the June 1987 report for the Georgia-Pacific Soil Amending Project as per revised Monitoring and Reporting Program 86-3.

Sincerely,

Steven A. Petrin

Steven A. Petrin
Director, Environmental Health & Safety
California Wood Products

SP:sp

Encl.

JUNE 1987 REPORT

GEORGIA-PACIFIC CORPORATION

FORT BRAGG SOIL AMENDMENT MONITORING AND REPORTING PROGRAM NO. 86-3

Monitoring

Volume of ash deposited by Week		Cubic Yards of Ash - deposited in Area A.
June	01 - 06	780
	07 - 13	820
	14 - 20	900
	21 - 27	680
	28 - 30	240

Number of Treated Acres (Area A) 26.31 Acres

Number of Treated Acres (Area W) 5

Daily Precipitation Measurements		PPT (Inches)
June	1	0
	2	0
	3	0
	4	0
	5	0
	6	0
	7	0
	8	0
	9	0
	10	0
	11	0
	12	0
	13	0
	14	0
	15	0
	16	0
	17	0
	18	0
	19	0
	20	0
	21	0
	22	0
	23	0
	24	0
	25	0
	26	0
	27	0
	28	0
	29	0
	30	0
	31	0

No stormwater runoff monitoring was conducted due to lack of rainfall.

July 28, 1987

Dear Sue Warner,

I hope this letter finds you in good health and enjoying all the sunshine. (Santa Rosa temperatures melt me into a sodden ball of misery).

You are most welcome for the bouquet of flowers (sent several months ago). I am sure you deserved them.

This is Ellie Giovannoni from Fort Bragg, with a request for information. Did G.P. ever comply with your request to have its fly ash examined? (Actually, I guess it should more properly have been designated wood ash).

And, if so, what were the results?

After reading that the forests in Europe and Canada are dying, due to various kinds of pollution, I am all the more anxious as to what is happening in America. I understand that formaldehyde is being used to strengthen plywood because:

1. the wood is being harvested too early to be strong.
2. the trees seem to be less strong than they used to be.

I also understand that many people

consider the planetary situation so far out of control that fighting the problem is hopeless. There are other hopefuls who believe the opposite. I stand in neither camp. I will simply go on trying to help because that is my nature.

Please write back to me, Sue, even if H.P. has not complied with your request. I have come to know why such requests are ignored and are allowed to be ignored, though I cannot fathom the reasoning behind it. How can jobs and money be worth more than oxygen? There is a bumper sticker in Germany which reads something on the order of "My car will keep running long after your forests are destroyed." Those who carry such stickers are not the majority of Germans. Each. They (!!!) have slowed their cars down to keep pollution down. I mentioned the sticker to give you — if you did not know it — an example of one kind of mentality which is complicating the process of stopping a world-wide tragedy.

Sincerely yours,

Ellie Giovannoni
31251 Turner Rd.
Fort Bragg, Calif.
95431

Georgia-Pacific Corporation

90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

WATER QUALITY
CONTROL BOARD
REGION I

AUG 3 '87

July 30, 1987

CERTIFIED MAIL
Return Receipt Requested
P 236 628 660

Mr. Benjamin D. Kor
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Kor:

Enclosed is the 1986 Annual Report for the Georgia-Pacific Soil Amending Project as per revised Monitoring and Reporting Program 86-3.

Sincerely,

Steven A. Petrin, Director
Environmental Health and Safety
California Wood Products

SP:lv

Encl.

Storm-Water Monitoring

Stormwater monitoring for pH was conducted under original order 86-3 from February 1-11. Additional parameters for monitoring were added after February 11 under Revised order 86-3. Under the revised order, Georgia-Pacific personnel examined the Little Valley soil amending site on every day in which rainfall occurred and collected samples as required (results summarized below). No discharges of ash were observed to surface streams. Sampling occurred during the months of February, March, October and December.

Rainfall

Month	PPT (inches)
Feb	12.06
Mar	7.10
Apr	0.88
May	0.84
June	0
July	0
Aug	0
Sept	1.60
Oct	1.90
Nov	1.33
Dec	6.03

pH Measurements

Date	Location *								
	1	2	3	4	5	6	7	8	9
2-05-86	6.8	7.2	6.9	-	-	-	-	-	-
2-13-86	6.4	6.3	6.65	7.0	6.7	6.7	6.7	-	-
2-14-86	6.35	6.35	6.6	7.0	6.9	6.7	6.7	-	-
2-18-86	6.3	6.3	6.8	7.1	7.0	7.0	7.0	-	-
2-19-86	6.3	6.3	7.0	7.2	7.0	7.0	7.0	-	-
2-20-86	6.3	6.3	6.9	7.1	6.9	6.9	6.9	-	-
2-24-86	6.1	6.1	7.0	7.0	6.6	6.7	6.7	-	-
3-06-86	6.1	6.2	7.3	7.3	6.7	7.0	7.2	-	-
3-07-86	6.45	6.35	6.65	7.05	6.7	6.7	6.7	-	-
3-10-86	6.2	6.4	6.65	6.65	6.8	6.35	6.8	-	-
10-30-86	-	-	-	-	-	6.3	6.3	-	-
12-19-86	-	-	-	-	6.3	6.6	6.7	6.6	6.7
12-26-87	-	-	-	-	6.7	6.8	6.9	6.6	6.8
12-31-86	-	-	-	-	6.7	6.9	6.7	6.7	6.8

* See attached map provided by Board staff for locations of sampling points.

Suspended Solids (mg/l)

Date	Location 1	2	3	4	5	6	7	8	9
2-14-86	20.6	21.2	37.0	52.1	46.7	28.9	36.1	-	-
2-20-86	31.6	33.3	46.1	62.0	67.2	51.7	59.6	-	-
2-24-86	17.3	20.5	26.2	32.1	28.1	17.6	22.0	-	-
3-10-86	15.1	16.3	37.6	42.1	27.5	20.2	23.3	-	-
10-30-86	-	-	-	-	-	23	25	-	-
12-19-86	-	-	-	-	58	273	43	235	36
12-26-86	-	-	-	-	18	5	11	13	8
12-31-86	-	-	-	-	53	86	112	49	28

COD

Date	Location 1	2	3	4	5	6	7	8	9
3-07-86	30	43	39	50	41	51	37	-	-

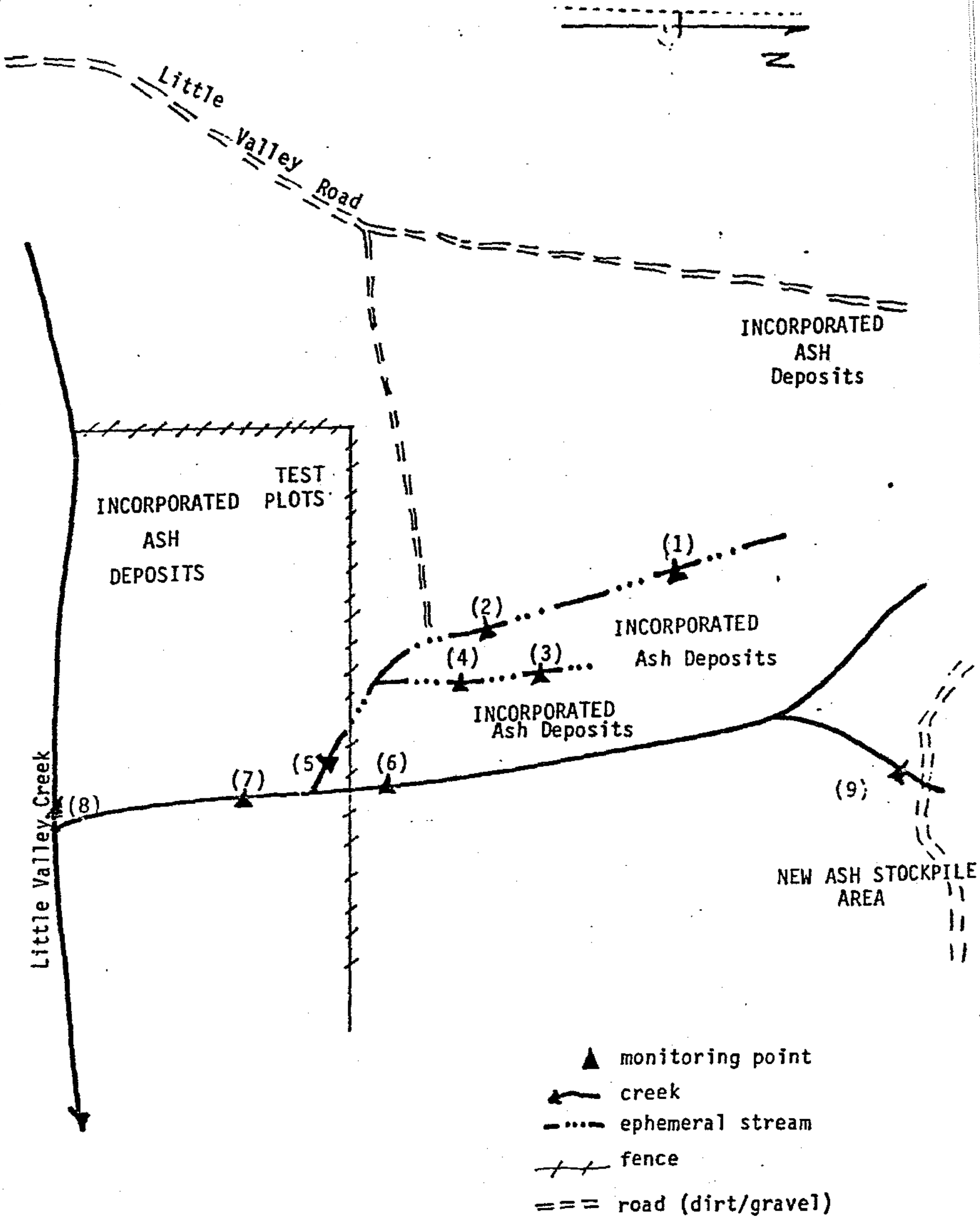
(insufficient discharge for sampling in November)

Ash Incorporation Activities

Ash incorporation activities were conducted during the months of May through November. Soil moisture conditions during the other months precluded incorporation activities, so ash was stockpiled in an approved area. Volume of ash delivered to the site and acreage amended are summarized below:

Month	Ash Delivered (cu. yd)	Total Amended Acreage
Feb	3060	4
Mar	4240	4
Apr	4420	4
May	3500	10
June	2520	20
July	2020	22
Aug	3060	23.5
Sept	3460	25.27
Oct	4040	27.47
Nov	3040	28.24
Dec	3080	28.24

NOTE: 5 acres in area W.



(map provided by Regional Board staff)

NOT TO SCALE

Soil and Yield Sampling

Soil Sampling and analysis were conducted during October. Results are summarized below:

	A-1		A-2		A-3	
	0-6"	6-12"	0-6"	6-12"	0-6"	6-12"
pH	7.3	6.3	6.5	5.4	7.7	6.6
CEC(meq/100g)	10.1	9.0	10.3	8.8	10.0	9.1
Nitrogen (ppm)	2416	2347	3106	2761	2347	2140
Phosphorous (ppm)	55	39	30	5	71	40
Calcium*	73.0	56.4	59.0	40.4	63.0	64.6
Hydrogen	0.0	10.5	7.5	28.5	0.0	6.0
Magnesium	10.7	14.4	18.8	23.6	15.5	15.2
Potassium	13.1	15.6	10.1	4.4	15.9	10.1
Sodium	3.2	3.1	4.6	3.1	5.6	3.6

* Last five elements given as percent base saturation

Analysis of the fly ash material is attached

Rod Shippey, U. C. Extension agent in Ukiah, ran test plots to study pasture yields at varying ash application rates. His data is summarized below.

L I T T L E   V A L L E Y   (cultivated)

Ash Application (tons/acre)	Biomass Yield (tons/acre)
0 (control)	3.44
48	4.88
96	6.40
192	4.77 (hit a bare spot)
384	9.42
768	3.47

A L L E N   S P R I N G S   (topical application)

Ash Application (tons/acre)	Biomass Yield (tons/acre)
0	1.39
4	1.88
8	2.24
16	2.42
32	2.17
64	2.11

Based upon number of bales and their weight, actual yield on incorporated areas was estimated to be 3.0-3.5 tons/acre. Visual inspection by personnel from U.C. Extension, the Regional Board, and Georgia-Pacific revealed excellent growth on both the treated test plots and the operating areas and U.C. Extension staff have been so far impressed with the results.

MA 0 1987

REPORT OF MISCELLANEOUS ANALYSIS

Fly ash

UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION LABORATORY

Lab number: D-86-M-898
County: MENDOCINO
Submitted by: SHIPPEY/MEYER/OSBORNE
Date sampled: 10/10/1986

No. of samples : 2

Date received : 10/13/1986
Date reported : 03/17/1987

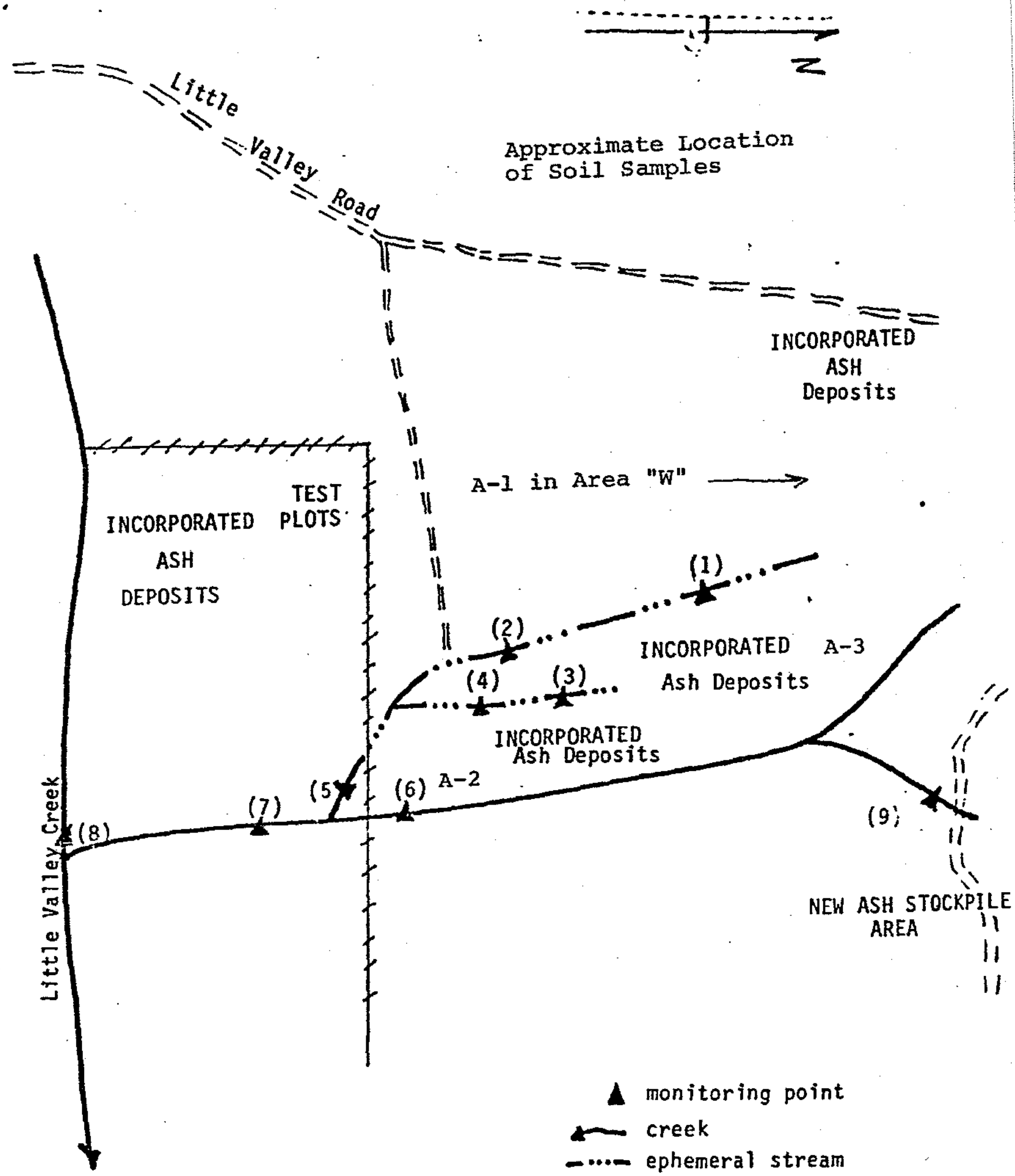
Identification: G P Fly Ash Trial

Crop: Sub Clover

Sample ##	Description	Ash	P	K	Na	Ca	Mg	Cl	Cu	Fe	Mn	Zn	S	N
	Annual Grassland Calc. on 100% Dry Basis	%	%	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm	%
1	Random Sample # 1	39.5	0.20	1.37	0.22	1.94	0.44	0.22	30	12	668	52	704	1.45
2	" " # 2	56.7	0.23	1.20	0.23	2.00	0.45	0.12	43	12	700	68	697	0.74

Checked and approved:

Cdl22487 D


N
Little Valley Road
Approximate Location
of Soil Samples
INCORPORATED
ASH
Deposits
A-1 in Area "W"
TEST
PLOTS
INCORPORATED
ASH
DEPOSITS
(1)
(2)
INCORPORATED A-3
Ash Deposits
(4)
(3)
INCORPORATED
Ash Deposits
(5)
(6)
A-2
(7)
(8)
(9)
Little Valley Creek
NEW ASH STOCKPILE
AREA
monitoring point
creek
ephemeral stream
fence
road (dirt/gravel)

NOT TO SCALE

Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

WATER QUALITY
CONTROL BOARD
REGION I

AUG 3 '87

July 31, 1987

CERTIFIED MAIL
Return Receipt Requested
P 236 628 671

Ms. Susan A. Warner
Assoc. Engineering Geologist
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Ms. Warner:

Enclosed is our proposed sampling and analysis plan for investigation of possible dibenzofuran contamination of wood waste fly ash. Past experience and discussion with other interested parties will allow us to conduct this sampling without the sampling problems encountered in our initial testing. There had been hopes that we could conclude the testing early in the Fall, but the time required for analysis (five weeks) has made this impossible.

I have discussed the issue of feedstock sampling with our Atlanta staff and Ray Whitmore of NCASI. We suspect that some chlorine would be found due to our proximity to the ocean,but Mr. Whitmore feels that there is insufficient evidence for any precursor compounds in wood wastes. The question arises as to what utility this analysis will serve, even if suspect elements are discovered, since the feedstock composition is largely beyond our control.

However, we are aware that you had requested such analysis. If you continue to consider this as an important aspect of the study, please contact me and we will discuss the issue further. If deemed necessary, we will promptly incorporate feedstock testing into our plans. It is our intention to fully cooperate with Board staff in this matter, we are merely questioning the need for feedstock analysis under the current conditions.

Please feel free to contact me on this matter with any further questions or comments. We hope to have final approval of our plans soon so that sampling and analysis of our fly ash may be quickly implemented and all questions of contamination resolved.

Sincerely,

Steven A. Petrin, Director
Environmental Health and Safety
California Wood Products

SP:lv Enc.

Wood Fly Ash Sampling and Analysis Plan
Georgia-Pacific Fort Bragg July 30, 1987

I. <u>INTRODUCTION:</u> This plan is designed to obtain an accurate analysis of the dibenzofuran content in wood fired boiler fly ash. The following procedures are proposed to gather a representative sample of fly ash, transport it to the analytical laboratory for accurate analysis while maintaining chain of custody documentation guaranteeing preservation of the sample.

II. <u>FLY ASH GENERATION</u>: Georgia-Pacific's Fort Bragg California Wood Production Plant Generates electricity and steam for process requirements by operating a boiler which utilizes wood chips and bark as a primary fuel. Incidental to the wood combustion, ash is formed and collected, utilizing high efficiency cyclonic air cleaners to reduce particulate emissions to the environment. This ash is commonly referred to as "fly ash".

III. <u>SAMPLING LOCATION</u>: The collected fly ash is stored in hoppers under the cyclones and periodically dropped through valves into trucks for transport off-site. Samples will be obtained at the hopper discharge valve outlet prior to entry into the truck beds. This will ensure an uncontaminated sample.

IV. <u>SAMPLING TECHNIQUE</u>: Specially cleaned widemouth glass jars with teflon lined caps will be provided by I-Chem Research or the contract laboratory. Sampling will consist of twelve discrete samples obtained over a two week period, with only a single sample obtained on any one day. Latex gloves will be worn by the sampler and discarded after each sample is obtained. All sampling implements will be cleaned with hexane prior to each sample. The separate sample jars will be shipped to the laboratory for blending to obtain three composite samples of four consecutive days each for analysis.

V. <u>SAMPLE PRESERVATION</u>: No unique or special preservation techniques are required. Samples will be stored in sealed containers to minimize sun light exposure and shipped to the analytical lab using overnight package delivery.

VI. <u>SAMPLE TRANSPORT</u>: Sample jars and the chain of custody documents will be placed in a sealed container for shipment to the contract laboratory. The container will either be hand carried to the contract laboratory by the sampler, or shipped via Federal Express overnite delivery under their "Constant Surveillance Service" (chain of custody).

VII. <u>CHAIN OF CUSTODY</u>: The sampler will complete the chain of custody sheet, including the Federal Express air bill number if applicable, and seal it inside the shipping container. The container access will be sealed with suitable tape and the container will be shipped or delivered to the contract laboratory. The laboratory technician receiving the Federal Express delivery will sign for the package and sign the chain of custody forms to complete the chain. The forms will be returned to the Fort Bragg facility and will be kept on file available for inspection.

VIII: <u>CONTRACT LABORATORY</u>: California Analytical Laboratories, Inc., Sacramento, California will perform the analysis. They have been chosen because of a demonstrated ability to determine dibenzofuran isomer content at extremely low concentration during work performed for USEPA and the National Council for Air and Stream Improvement (N.C.A.S.I.) and through participation in USEPA Quality Assurance Programs.

IX. <u>ANALYSIS PLANNED</u>: Sample preparation will be performed by California Analytical Labs using proprietary procedures. The quantitative analysis for tetra- through octa-chlorinated dibenzofurans will be performed using low resolution capillary gas chromotography/mass spectrometry (GC/MS). If tetra- through hepta- homologues are detected, further analysis using high resolution GC/MS will be performed to determine whether the 2,3,7,8 substituted isomers are present. The exact laboratory procedures including calibration, quality control, sample extraction and analytical methods are available from California Analytical Laboratories, Inc.

X. <u>SCHEDULE</u>:

Agency Approval of Plan	- Week 0	AUG 5
Sampling Equipment Shipping	- Week 2	19
Sample Collection & Shipping	- Week 4	SEP 3
Sample Preparation	- Week 5	10
Completion of Sample Analysis	- Week 9	OCT 8
Report Submittal	- Week 11	OCT 22

REGIONAL WATER QUALITY CONTROL BOARD
NORTH COAST REGION

Interoffice Communication

TO: (1) Frank Reichmuth FR DATE: July 9, 1987
(2) File: Georgia-Pacific, Fort Bragg

FROM: Susan Warner SW

RE: Summary of meeting with Georgia-Pacific, regarding the ash disposal problem

I met with Rod Shippey (Farm Advisor), Steve Petrin and Jack Anderson (Both of G-P) on June 18, 1987. We discussed the recent dibenzofuran report for the ash analyses, and I indicated that further work on G-P's part would be needed. I discussed analysis of both the ash and of the feedstock. If this issue can be resolved, then guidelines may be developed by the Farm Advisor's office on rate of ash application and seed mixes appropriate for use with the ash. Shippey's data indicated that low to medium applications of the ash greatly enhance appropriatly-seeded plant growth, but very high applications reduce growth.

I indicated that GP could expect a letter from us shortly requesting additional work to resolve the dibenzofuran question.

File: Ft Bragg/S.W.

Georgia-Pacific

intracompany memo

RECEIVED
AUG 01 1987
ENVIRONMENT

to	J.A. Anderson	location	Atlanta
from	S.A. Petrin	location	Fort Bragg
subject	Fly Ash Analysis	date	August 3, 1987

Jack:

The time involved to discuss our plans with local management made it impossible to get this to you during last week. We decided that another single composite sample would be basically repeating what we did previously, thus placing "all our eggs in one basket" again. After we had decided to composite several samples, I checked with Sue Warner and she confirmed that a single sample would have been considered inadequate.

I currently don't plan to make too much of a stink if she requests again that we include feedstock sampling, as we need to get this rolling in order to get done at a reasonable point in time. Let me know if you have any questions or comments.

Steve

S.P.

SP/sp

enc.

cc: D. Whitman/Ft. Bragg

GP 09-1

Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

WATER QUALITY
CONTROL BOARD
REGION 1

AUG 12 '87

BK ___ RC ___
CJ ___
FR FL SW
RT ___
JH ___
BR ___
JG ___ REPLY

August 11, 1987

CERTIFIED MAIL
Return Receipt Requested
P 317 147 336

Mr. Benjamin D. Kor
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Kor:

Enclosed is the July 1987 report for the Georgia-Pacific Soil Amending Project as per revised Monitoring and Reporting Program 86-3.

Sincerely,

Steven A. Petrin

Steven A. Petrin, Director
Environmental Health & Safety
California Wood Products

SP:sp

Encl.

JULY 1987 REPORT

GEORGIA-PACIFIC CORPORATION

FORT BRAGG SOIL AMENDMENT MONITORING AND REPORTING PROGRAM NO. 86-3

<u>Monitoring</u>

<u>Volume of ash deposited by week</u> - <u>Cubic Yards of Ash</u> - deposited in Area A.

July 01-04	440
05-11	920
12-18	740
19-25	780
26-31	560

Number of Treated Acres (Area A) 36.04 Acres
(includes 8 acres from winter stockpile)
Number of Treated Acres (Area W) 5 Acres

Daily Precipitation Measurements		PPT (Inches)
July	1	0
	2	0
	3	0
	4	0
	5	0
	6	0
	7	0
	8	0
	9	0
	10	0
	11	0
	12	0
	13	0
	14	0
	15	0
	16	0
	17	0
	18	0
	19	0
	20	0.08
	21	0.04
	22	0
	23	0
	24	0
	25	0
	26	0
	27	0
	28	0
	29	0
	30	0
	31	0

No Stormwater Runoff monitoring was conducted due to minimal precipitation.

STATE OF CALIFORNIA GEORGE DEUKMEJIAN, Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—
NORTH COAST REGION
1440 GUERNEVILLE ROAD
SANTA ROSA, CA 95401
Phone: (707) 576-2220

REC'D AUG 12 1987

August 11, 1987

Ms. Ellie Giovannoni
31251 Turner Road
Fort Bragg, CA 95431

Dear Ms. Giovannoni:

Thank you for your letter of July 28, 1987, regarding the Georgia-Pacific sawmill fly ash. You asked whether Georgia-Pacific complied with our request for additional analyses of the fly ash waste.

Georgia-Pacific submitted a plan for analysis of this waste on February 27, 1987. We requested revisions to the workplan on March 3, 1987, and Georgia-Pacific complied with our request on March 13, 1987. Georgia-Pacific commenced sampling in April, and reported on their results on June 8, 1987.

Georgia-Pacific reported that the laboratory (Enseco-Cal Lab in Sacramento) found no detectable polychlorodibenzo<u>dioxins</u>. However, the laboratory did report finding 0.23 ng/g (parts per billion) of the tetrachlorodibenzo<u>furans</u>, a somewhat similar group of chemicals, in one sample of composited ash. Further analysis on this same sample indicates that a small portion of the 0.23 ng/g detected was in the form of 2,3,7,8-tetrachlorodibenzofuran. These levels are very low, as you can see. In order to determine whether the detection of this small amount of the dibenzofuran compounds in one sample is typical for this mill, additional samples are being required. Accordingly, this agency requested that Georgia-Pacific submit a new sampling and analysis plan, and the company complied on July 31, 1987 (enclosed). I have approved this plan with minor modifications (also enclosed), and expect a final report from Georgia-Pacific by the end of October. I hope this answers your letter, and I will be glad to provide you additional information if you have further questions.

Sincerely,

ORIGINAL SIGNED BY

Susan A. Warner
Associate Engineering Geologist

Enclosures

cc Gerald Davis
Steven A. Petrin

STATE OF CALIFORNIA GEORGE DEUKMEJIAN, *Governor*

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—
NORTH COAST REGION

1440 GUERNEVILLE ROAD
SANTA ROSA, CA 95401
Phone: (707) 576-2220

August 11, 1987

REC'D AUG 1 2 1987

Mr. Steven A. Petrin
Director, Environmental Health and Safety
California Wood Products
Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, CA 95437

Dear Mr. Petrin:

I received your proposed sampling and analysis plan for the polychlorodibenzofurans, and have only a few comments. As we discussed on the telephone on August 5, 1987, samples of the feedstock for the monitoring period should be obtained and held until the dibenzofuran analytical results are available. If positive results are detected, then the feedstock should be analyzed for chloride and total organic halogens.

If you will be holding the first samples until the twelfth sample is taken, then the samples should be refrigerated, at a minimum.

The time schedule appears reasonable, and we will expect to see a report in this office no later than October 23, 1987. Please call me if you have any questions in this matter.

Sincerely,

Susan Warner FR

Susan A. Warner
Associate Engineering Geologist

cc Gerald Davis
Ellie Giovannoni

Per Michael Davis

F

Georgia-Pacific

intracompany memo

to	Distribution		
from	J. A. Anderson	location	Atlanta, GA
subject	Ft. Bragg - Dioxin/Furan Study	date	August 25, 1987

The attached information is the latest in the dioxin/furan study on the fly ash at Fort Bragg. The water quality agencies requested a second analysis after the first composite sample of fly ash was found to have undetectable levels of dioxin but very low levels of tetra furans.

For the second round, a sample of fly ash will be taken each day until 12 samples are available. The 12 samples will be sent to a laboratory for compositing into one sample. The analysis will be for furans only.

If the furans are present then a sample of wood fuel will be analyzed for chloride and total organic halogens. The value of the tests on the fuel are certainly questionable, but it was a point that we "traded".

Please note the second letter which is to Ellie Giovannoni, one of the two citizens that started the investigation.

J. A. A.

JAA/ms

Distribution

G. D. Dutton
P. Fetter
R. A. Horder
G. F. McCaig
D. L. Mobley
B. Zoffman

Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

WATER QUALITY
CONTROL BOARD
REGION I

SEP 11 '87

September 10, 1987

CERTIFIED MAIL
Return Receipt Requested
P 317 147 340

☐ BK ☐ RC
☐ CJ ☐ SW
☑ FR ☐
☐ RT ☐
☐ JH ☐
☐ BB ☐
☐ JG ☐ REPLY

Mr. Benjamin D. Kor
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Kor:

Enclosed is the August 1987 report for the Georgia-Pacific Soil Amending Project as per revised Monitoring and Reporting Program 86-3.

Sincerely,

Steven A. Petrin, Director
Environmental Health & Safety
California Wood Products

SP:lv

Encl.

AUGUST 1987 REPORT

GEORGIA-PACIFIC CORPORATION

FORT BRAGG SOIL AMENDMENT MONITORING AND REPORTING PROGRAM NO. 86-3

<u>Monitoring</u>

<u>Volume of ash deposited by week</u> - <u>Cubic Yards of Ash</u> - deposited in Area A.

August	01	80
	02-08	600
	09-15	660
	16-22	680
	23-29	660
	30-31	100

WATER QUALITY
CONTROL BOARD
REGION I

SEP 11 '87

Number of Treated Acres (Area A) 37.89 Acres

Number of Treated Acres (Area W) 5 Acres

☐ BK ☐ BC
☐ CI ☐
☐ FR ☐
☐ RT ☐
☐ JH ☐
☐ BB ☐
☐ JG ☐ REPLY

Daily Precipitation Measurements		PPT (Inches)
August	1	0
	2	0
	3	0
	4	0
	5	0
	6	0
	7	0
	8	0
	9	0
	10	0
	11	0
	12	0
	13	0
	14	0
	15	0
	16	0
	17	0
	18	0
	19	0
	20	0
	21	0
	22	0
	23	0
	24	0
	25	0
	26	0
	27	0
	28	0
	29	0
	30	0
	31	0

No Stormwater Runoff monitoring was conducted due to only trace amounts of precipitation.

F

September 10, 1987

Mr. Steven A. Petrin
Director, Environmental Health and Safety
California Wood Products
Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, CA 95437

Dear Mr. Petrin:

After inspecting the area of the proposed ash stockpiling area (to be followed by ash incorporation), I find the area is within the site covered by your existing waste discharge requirements. It is, however, near a stream tributary to Little Valley Creek. We discussed in the field steps which could be taken to stockpile ash in this area and not present a risk to water quality. Accordingly, please submit a brief plan outlining the drainage ditches, flagging, etc., which will be used to ensure the ash is not placed in an area which potentially could discharge to the tributary or other waters of the State. This information should be submitted prior to utilization of the area this winter.

In a related matter, please inform this office when seeding has occurred on the present soil incorporated areas. You may include this information with the self-monitoring report for the month following the seeding. Please call me if you have any questions in this matter.

Sincerely,

Susan A. Warner
Associate Engineering Geologist

Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

WATER QUALITY
CONTROL BOARD
REGION 1

SEP 15 '87

BK ___ RC ___
CJ ___ SW
FR SW
JH ___
BB ___
JG ___ REPLY

GP to send more info re how they will use this mat'l.
SW 9/28/87

September 11, 1987

Ms. Susan A. Warner
California Regional Water
Quality Control Board
1440 Guerneville Rd.
Santa Rosa, CA 95403

Dear Ms. Warner:

As per our earlier discussions, we have had our "Alum Pond" sediments analyzed for aluminum to determine their appropriateness as a soil amendment. These sediments are mainly composed of fine fly ash and should have similar properties to the material we are currently using as a soil amendment in Little Valley.

I collected three samples over a several month time period. These were collected from the bank of the pond using a long-handled polyethylene scoop and shipped to the lab in glass jars. No special handling was requested by the lab. Our results are as follows:

DATE	TTLC(ppm)*	TTLC(%)	STLC(ppm)
3/23/87	5,200	0.52	-----
5/18/87	36,000	3.60	1,170
8/13/87	14,110	1.41	759.6

*dry weight basis

We would like to incorporate this material with the other fly ash currently going to Little Valley. We dredge this pond once or twice a year, so the relative amount of sludge would be quite small.

We hope that there will be no problem with your approval of our plans. Please contact me if you have further questions.

Sincerely,

Steven A. Petrin

Steven A. Petrin, Director
Environmental Health & Safety
California Wood Products

SP/1v

Dear Sue, Sept. 14, 1987

Many thanks for your last letter; it helped to reassure me.

After due reflection, it occurred to me that I had, indeed, better stop sending you flowers. Drat!

I need to refresh your memory a tad as to what happened when the fly ash first started affecting people back in 1983–'84. Many townsfolk spoke of feeling tense and irritable. The situation has worsened. When I spoke to the mother of a policeman here in Fort Bragg, she told me that he said that if she knew of the violence occurring in Fort Bragg, it would "make her eyeballs bulge". He attributed it to the "new element in town", which I do not doubt is one causative factor. I believe the other to be chemical.

That same day, I spoke to a _very_ gentle woman whose symptoms almost parallel mine. She gets sick whenever her husband comes home from town and hugs her*. She gets sick when riding in his van. She gets sick when in Fort Bragg. And she is now "having to pretend to be nice", because she feels irritable all the time. If she hadn't been so nice to begin with, I doubt that she could have kept up the pretense as well as she does. She is reacting to the plywood her husband has stored upstairs, and the possibility exists that it is not just the formaldehyde

* due to the chemicals on his clothing, I believe.

in the plywood to
which she is reacting.
As you are undoubt-
edly aware, forests are
dying all over Europe
and Canada, due to
pollution. Herbicides
have ~~got~~ to be adding
to the problem; trees
treated with herbicides
are growing up cork-
screwed here in
America. Which means
one thing to me;
the trees themselves
must be contaminated,
and therefore the
wood products which
come from such trees.
Immune systems have
got to be breaking down
due to so much

exposure to toxins.

What a tragedy the Vietnam veterans' cancer rate is proving Agent Orange to be deadly. Is it possible that their suicide rate is also due, in part, to exposure to Agent Orange? Having your central nervous system messed with is no fun.

I don't expect a reply to this, Sue. Just wanted to pass along the information and the speculation.

Bless you!

Ellie Giovannoni
31251 Turner Rd.
Fort Bragg, Calif.
95437

P.S. I have now been diagnosed as diabetic. There is no history of diabetes in my family, which means I am a rare case. Most diabetics come from families in which there is a history of diabetes. Of course you will suspect what I think caused it.

Thank goodness I haven't got a sweet tooth!

And, am getting better on diet changes alone.

Ellie Giovannoni
31251 Tur[illegible]r Rd
Fort Bragg, Calif
95437

NORTH BAY, CA 949
PM
15 SEP
1987

Sue Warner
c/o California Water
Quality Control Board
North Coast Region
1440 Guerneville Rd.
Santa Rosa, Calif.
95401

Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

WATER QUALITY
CONTROL BOARD
REGION 1

SEP 29 '87

☐ BK ☐ RG
☐ CJ ☐ SW
☑ FR FR ☐
☐ RT ☐
☐ JH ☐
☐ BB ☐
☐ JG ☐ REPLY
☐ FILE

September 28, 1987

Ms. Susan A. Warner
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Ms. Warner:

As per our discussions of last week, I am providing additional information concerning our "Alum Pond" fly-ash sediments. In addition to the information earlier provided, we also had supernatant from the material analyzed. The results were as follows:

DATE	Al. Concentration
3/23/87	0.17 ppm
5/18/87	0.15 ppm
8/13/87	0.41 ppm

I have enclosed a copy of results from the last analysis so that you can get an idea of concentrations on a wet versus dry basis.

So that a large amount of this material is not placed in a concentrated mass at one location, we plan to dredge over a dispersed time period. We have not finalized these plans, but at a minimum, dredging will occur twice a year over a two to three week period. This would be a minimum dispersion time, as we may opt to dredge more frequently, or even on a schedule approaching continuous dredging. This will allow for a good mixture with our other fly-ash sources and thus keep aluminum at minimum levels in materials going to Little Valley.

If you have further questions in this matter, please call me at 964-5651.

Sincerely,

Steven A. Petrin

Steven Petrin, Director
Environmental Health & Safety
California Wood Products

SP:db

cc: R. Shippey/Ukiah
Encl.

REC'D SEP 2 1 1987

alpha
Alpha Analytical Laboratories Inc. •• 860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CLIENT Georgia Pacific
ADDRESS 90 West Redwood Avenue
Fort Bragg, CA 95437
ATTN: Steve Petrin

DATE COLLECTED 8-13-87
DATE IN LAB 8-13-87
COLLECTED BY S. Petrin
SAMPLE TYPE Sludge

LABORATORY NO.: 7-4340
CLIENT I.D. : Alum Pond Sludge

	as received	dry weight basis	
soluble aluminum (STLC)	519	760	mg/kg (ppm)
total aluminum (TTLC)	9,635	14,110	mg/kg (ppm)
aluminum in free liquid	0.41		mg/L (ppm)

Alpha
Analytical Laboratories, Inc.

Bruce L. [signature] 9-17-87
LABORATORY DIRECTOR DATE

REGIONAL WATER QUALITY CONTROL BOARD
NORTH COAST REGION

Interoffice Communication

TO: (1) Frank Reichmuth DATE: October 1, 1987
(2) FILE- Georgia-Pacific Ash Soil Amendment

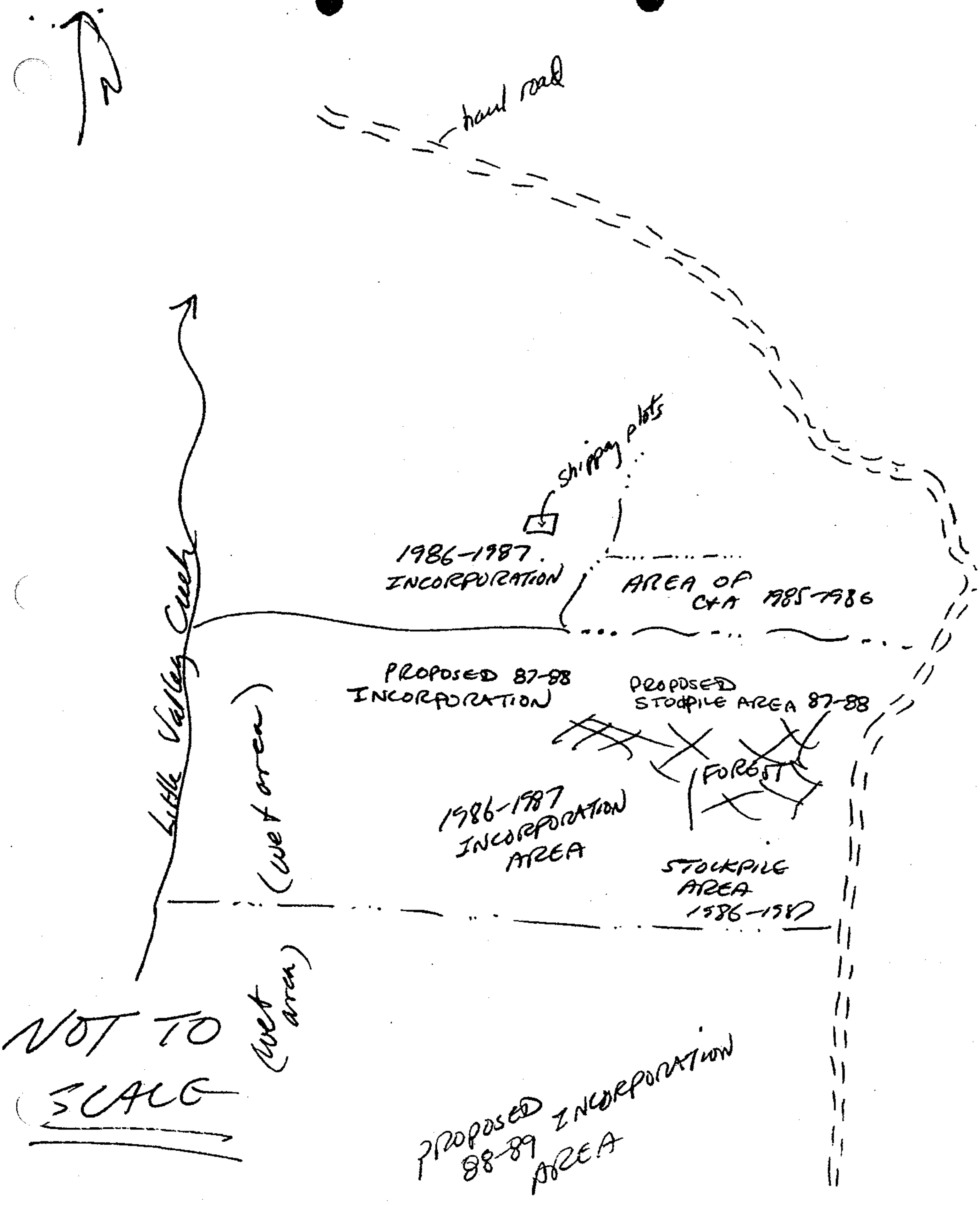
FROM: Susan Warner SAW

RE: Inspection of the proposed new ash amendment site.

I inspected the proposed new ash amendment site with Steven Petrin and Dave Larkin of Georgia-Pacific. The site is to the south of the temporary stockpile area of last winter, and is located within the current waste discharge requirements, with one minor exception. A small grove of very young redwood trees is outside of the mapped area, and Petrin discussed using this area as well during the winter of 1988-89. It is less than an acre in size, and adjacent to the mapped area which is proposed for use. They may not need to use the grove area. If so, I indicated that a new map showing the addition should be provided to this office in order for us to determine whether the change was substantive, requiring modified waste discharge requirements.

The area propose for use this winter is north of the 86-87 stockpile & cultivate area and south of the 85-86 C&A area. It is immediately across the creek from the principle 86-87 cultivation area and Rod Shippey's study area. The site is also immediately south of the tributary which is currently being monitored, and stream protection measures would be advisable. See attached sketch for the exact location.

I discussed stream protection measures for the area to be used during the winter of 1987-88 with Petrin and Larkin, including the need to flag setbacks from the creek, and construct small drainage ditches around the ash piles which carry surface runoff away from the piles, rather than through them. The ditches would be directed to a flat area where the runoff could spread out into the ripped and plowed pasture.



N
haul road
shipping plots
1986-1987.
INCORPORATION
AREA OF
C+A 1985-1986
Little Valley Creek
PROPOSED 87-88
INCORPORATION
PROPOSED
STOCKPILE AREA 87-88
FOREST
1986-1987
INCORPORATION
AREA
(wet area)
STOCKPILE
AREA
1986-1987
(wet area)
NOT TO
SCALE
PROPOSED INCORPORATION
88-89
AREA

STATE OF CALIFORNIA

FACILITIES INSPECTION REPORT

SWRCB 001 (NEW 6-87)

DLS

STATE WATER RESOURCES CONTROL BOARD

ADDITIONAL INFORMATION SHOULD BE ATTACHED TO ORIGINAL

1. WDS NUMBER (Must be 11 digits)	2. NAME OF AGENCY RESPONSIBLE FOR DISCHARGE
1B85032PRMEN	NCRWQCB
3. DATE INSPECTION COMPLETED (Year Mo Day)	4. NAME OF FACILITY
87 09 03	Georgia-Pacific Ash Soil Amendment

5. INSPECTION TYPE (Check One)

- A1 ☐ "A" type compliance—Comprehensive inspection in which samples are taken.
- B1 ☐ "B" type compliance—A routine nonsampling inspection.
- 02 ☐ Noncompliance follow-up—Inspection made to verify correction of a previously identified violation.
- 03 ☐ Enforcement follow-up—Inspection made to verify that conditions of an enforcement action are being met.
- 04 ☐ Complaint—Inspection made in response to a complaint.
- 05 ☒ Pre-requirement—Inspection made to gather information relative to preparing, modifying, or rescinding requirements.
- 06 ☐ Miscellaneous—Any inspection not mentioned above.

NPDES

6. INSPECTION BY	7. IS EPA INSPECTION REQUIRED?
☒ State ☐ State/EPA Joint	☐ Yes ☒ No
8. DID YOU TAKE A BIOASSAY SAMPLE?	**9. IF A BIOASSAY SAMPLE WAS TAKEN, WAS IT:**
☐ Yes ☒ No	☐ Static ☐ Flowthrough

10. INSPECTION COMMENTS SUMMARY-REQUIRED (100 Character Maximum)

NO REVISION TO WDRS REQUIRED AT THIS TIME.

11. WAS THERE A VIOLATION?

☐ Yes (Complete violation form.) ☒ No ■ Pending (e.g., lab results)

12. INSPECTOR'S INITIALS → SAW

ADDITIONAL COMMENTS

see pink memo

87 82495

WDS INSPECTION COVER SHEET

DATE: 25/27/87

TO: (Senior Engineer) FCR

Dennis Salisbury (for WDS computer input) DLS

File -GP, ash Fort Bragg Soil Amendment

FROM: (Inspector) SAW

WDS FACILITY ID NO.: 1B85Ø3ØRMEN

FACILITY NAME: Georgia-Pacific ash Soil Amendment

WAS THIS AN EPA INSPECTION? (Y/N): N (append form 3560-3 if Yes)

WAS A BIOASSAY SAMPLE TAKEN?: YES or NO

IF 'YES', WAS IT STATIC or FLOW-THROUGH (please circle one)

DATE OF INSPECTION: 5/19/87 TIME: 1500 INSPECTOR'S INITIALS: SAW

FACILITY EVALUATION: IN COMPLIANCE? yes
VIOLATION? (attach WDS violations input form)

SHORT INSPECTION COMMENT (check with your supervisor for a suitable format):

rescind CKA

TYPE OF INSPECTION:

1 - 'A' type compliance inspection
2 - 'B' type compliance inspection no flow
3 - Follow-up for non-compliance
4 - Follow-up for enforcement
5 - Complaint investigation
6 - Pre-requirement inspection
7 - Miscellaneous inspection

INSPECTING AGENCY: STATE FEDERAL (EPA) JOINT STATE/FEDERAL

SIGNATURE: S.A. Walker

Attach inspection narrative, sampling results, map of facility, lumbermill checklist, and/or underground tank evaluation as appropriate.

Revision Date: 02/03/87

Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

WATER QUALITY
CONTROL BOARD
REGION 1

OCT 13 '87

October 10, 1987

CERTIFIED MAIL
Return Receipt Requested
P 317 147 343

☐ BK ☐ RC
☐ CJ ☐ SW
☑ FR FC ☐
☐ RT ☐
☐ JH ☐
☐ BB ☐
☐ JG ☐ REPLY

Mr. Benjamin D. Kor
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Kor:

Enclosed is the September 1987 report for the Georgia-Pacific Soil Amending Project as per revised Monitoring and Reporting Program 86-3. For your information, seeding occurred at the site on the weekend of September 29, 1987.

Sincerely,

Steven A. Petrin

Steven A. Petrin, Director
Environmental Health & Safety
California Wood Products

SP:db

Encl.

SEPTEMBER 1987 REPORT

GEORGIA-PACIFIC CORPORATION

FORT BRAGG SOIL AMENDMENT MONITORING AND REPORTING PROGRAM NO. 86-3

Monitoring

Volume of ash deposited by week		Cubic Yards of Ash - deposited in Area A.
September	01-05	480
	06-12	620
	13-19	740
	20-26	780
	27-30	340

WATER QUALITY
CONTROL BOARD
REGION I

OCT 13 '87

☐ BK____ ☐ RG____
☐ CJ____ ☐ ____
☐ FR____ ☐ ____
☐ RT____ ☐ ____
☐ JH____ ☐ ____
☐ BB____ ☐ ____
☐ JG____ ☐ REPLY
☐ ALL STAFF ☐ FILE

Number of Treated Acres (Area A) 39.40 Acres

Number of Treated Acres (Area W) 5 Acres

Daily Precipitation Measurements		PPT (Inches)
September	1	0
	2	0
	3	0
	4	0
	5	0
	6	0
	7	0
	8	0
	9	0
	10	0
	11	0
	12	0
	13	0
	14	0
	15	0
	16	0
	17	0
	18	0
	19	0
	20	0
	21	0
	22	0
	23	0
	24	0
	25	0
	26	0
	27	0
	28	0
	29	0
	30	0

No Stormwater Runoff monitoring was conducted due to lack of precipitation.

California Analytical Laboratory

Enseco Incorporated

ATT. #5

REC'D OCT 19 1987

Enseco

October 13, 1987
Lab ID: 31397

Steven A. Petrin
Georgia-Pacific Corp.
90 West Redwood Ave
Fort Bragg, CA 95437

Dear Mr. Petrin:

Enclosed is the report for the twelve fly-ash samples for your G-P Boiler Ash Project, P.O. Number 15058 (MR-#01942) which were received at Enseco-Cal Lab on 16 September 1987.

The report consists of the following sections:

I Sample Description
II Analysis Request
III Quality Control Report
IV Analysis Results

No problems were encountered with the analysis of your samples.

If you have any questions, please feel free to call.

Sincerely,

Michael J. Mille

Michael J. Miille, Ph.D.
Vice President

dmc

2544 Industrial Boulevard
West Sacramento, California 95691
916/372-1393 Facsimile: 916/372-1059

Enseco

POLYCHLORINATED FURANS
ISOMER SPECIFIC ANALYSIS

Client Name: Georgia-Pacific Corp.
Client ID: 3A Composite
Lab ID: 31397-009C   Enseco ID: NA
Matrix: Soil   Sampled: 09-Sep-87   Received: 16-Sep-87
Authorized: 16-Sep-87   Prepared: 18-Sep-87   Analyzed: 28-Sep-87

Sample Amount: 10.18 g

Parameter	Result	Units	Detection Limit
Furans			
Tetra (total)	0.16	ng/g	-
(2378)	ND	ng/g	0.018
Penta (total)	ND	ng/g	0.054
(12378)	ND	ng/g	0.022
(23478)	ND	ng/g	0.024
Hexa (total)	ND	ng/g	0.018
(123478)	ND	ng/g	0.23
(123678)	ND	ng/g	0.11
(123789)	ND	ng/g	0.12
(234678)	ND	ng/g	0.11
Hepta (total)	ND	ng/g	0.077
(1234678)	ND	ng/g	0.077
(1234789)	ND	ng/g	0.077
Octa (total)	ND	ng/g	0.54

	% Accuracy	% Recovery
13C-2,3,7,8-TCDF	NA	60

ND=Not Detected
NA=Not Applicable

Reported by: DLB   Approved by: [signature]

The cover letter is an integral part of this report.
Version 070187

Enseco

POLYCHLORINATED FURANS
ISOMER SPECIFIC ANALYSIS

Client Name: Georgia-Pacific Corp.
Client ID: 2A Composite
Lab ID: 31397-005C   Enseco ID: NA
Matrix: Soil   Sampled: 02-Sep-87   Received: 16-Sep-87
Authorized: 16-Sep-87   Prepared: 18-Sep-87   Analyzed: 28-Sep-87

Sample Amount: 10.10 g

Parameter	Result	Units	Detection Limit
Furans			
Tetra (total)	0.19	ng/g	-
(2378)	ND	ng/g	0.022
Penta (total)	ND	ng/g	0.095
(12378)	ND	ng/g	0.062
(23478)	ND	ng/g	0.064
Hexa (total)	ND	ng/g	0.040
(123478)	ND	ng/g	0.40
(123678)	ND	ng/g	0.39
(123789)	ND	ng/g	0.50
(234678)	ND	ng/g	0.44
Hepta (total)	ND	ng/g	0.15
(1234678)	ND	ng/g	0.15
(1234789)	ND	ng/g	0.15
Octa (total)	ND	ng/g	0.083

	% Accuracy	% Recovery
13C-2,3,7,8-TCDF	NA	53

ND=Not Detected
NA=Not Applicable

Reported by: DLB   Approved by: MM

The cover letter is an integral part of this report.
Version 070187

Enseco

POLYCHLORINATED FURANS
ISOMER SPECIFIC ANALYSIS

Amended

Client Name: Georgia-Pacific Corp.
Client ID: 1A Composite
Lab ID: 31397-001C   Enseco ID: NA
Matrix: Soil   Sampled: 28-AUG-87   Received: 16-Sep-87
Authorized: 16-Sep-87   Prepared: 18-Sep-87   Analyzed: 28-Sep-87

Sample Amount: 10.25 g

Parameter	Result	Units	Detection Limit
Furans			
Tetra (total)	0.14	ng/g	-
(2378)	ND	ng/g	0.016
Penta (total)	ND	ng/g	0.040
(12378)	ND	ng/g	0.014
(23478)	ND	ng/g	0.013
Hexa (total)	ND	ng/g	0.010
(123478)	ND	ng/g	0.087
(123678)	ND	ng/g	0.085
(123789)	ND	ng/g	0.088
(234678)	ND	ng/g	0.078
Hepta (total)	ND	ng/g	0.021
(1234678)	ND	ng/g	0.021
(1234789)	ND	ng/g	0.021
Octa (total)	ND	ng/g	0.16

	% Accuracy	% Recovery
13C-2,3,7,8-TCDF	NA	63

ND=Not Detected
NA=Not Applicable

Reported by: DLB   Approved by: MAM

The cover letter is an integral part of this report.
Version 070187

Enseco

POLYCHLORINATED FURANS
ISOMER SPECIFIC ANALYSIS

Client Name: Georgia-Pacific Corp.
Client ID: Method Blank
Lab ID: 31397-MB   Enseco ID: NA
Matrix: Soil   Sampled: NA   Received: NA
Authorized: NA   Prepared: 18-Sep-87   Analyzed: 28-Sep-87

Sample Amount: 10.0 g

Parameter	Result	Units	Detection Limit
Furans			
Tetra (total)	ND	ng/g	0.0041
(2378)	ND	ng/g	0.0055
Penta (total)	ND	ng/g	0.023
(12378)	ND	ng/g	0.0068
(23478)	ND	ng/g	0.0084
Hexa (total)	ND	ng/g	0.0079
(123478)	ND	ng/g	0.040
(123678)	ND	ng/g	0.039
(123789)	ND	ng/g	0.041
(234678)	ND	ng/g	0.036
Hepta (total)	ND	ng/g	0.021
(1234678)	ND	ng/g	0.021
(1234789)	ND	ng/g	0.021
Octa (total)	ND	ng/g	0.033

	% Accuracy	% Recovery
13C-2,3,7,8-TCDF	NA	66

ND=Not Detected
NA=Not Applicable

Reported by: DLB   Approved by: *JOM*

The cover letter is an integral part of this report.
Version 070187

I Sample Description

Lab ID	Client ID	Matrix	Date Sampled	Containers
31397-001	1A	Fly-Ash	28-Aug-87	1-1QT. AB
-002	1B	Fly-Ash	29-Aug-87	1-1QT. AB
-003	1C	Fly-Ash	30-Aug-87	1-1QT. AB
-004	1D	Fly-Ash	1-Sep-87	1-1QT. AB
-005	2A	Fly-Ash	2-Sep-87	1-1QT. AB
-006	2B	Fly-Ash	3-Sep-87	1-1QT. AB
-007	2C	Fly-Ash	8-Sep-87	1-1QT. AB
-008	2D	Fly-Ash	8-Sep-87	1-1QT. AB
-009	3A	Fly-Ash	9-Sep-87	1-1QT. AB
-010	3B	Fly-Ash	10-Sep-87	1-1QT. AB
-011	3C	Fly-Ash	10-Sep-87	1-1QT. AB
-012	3D	Fly-Ash	11-Sep-87	1-1QT. AB

The samples were received under chain-of-custody.

II Analysis Request

The following analytical tests were requested.

Lab ID	Analysis Description
31397-1 thru 12	Cl_4-Cl_8 Furans

III Quality Control

A. Project Specific QC. No project specific QC (i.e., spikes and/or duplicates) was requested.

B. Method Blank Results. A method blank is a laboratory-generated sample which assesses the degree to which laboratory operations and procedures cause false-positive analytical results for your samples.

No target parameters were detected in the method blanks associated with your samples at the reporting limit levels noted on the data sheets in the Analytical Results section.

C. Laboratory Control Samples. An LCS is a well-characterized matrix (blank water, sand or celite) which is spiked with certain target parameters and analyzed at approximately 10% of the sample load in order to establish method-specific control limits. The LCS results associated with your samples follow:

Test: Dioxin Solid LCS
LCS ID: 31397-MBMS
Concentration Units: ng/g

	Concentration			Accuracy				Precision	
		Measured		% Recovery				RPD	
Parameter	Spike	LCS1	LCS2	LCS1	LCS2	Av.	Limits	LCS	Limit
2378-TCDD	10	1.3	--	129	--	--	NC	---	NC
12378-PECDD	10	0.98	--	98	--	--	NC	---	NC
123478-HXCDD	10	0.95	--	95	--	--	NC	---	NC
1234678-HPCDD	10	0.94	--	94	--	--	NC	---	NC
12345678-OCDD	50	6.9	--	137	--	--	NC	---	NC
2378-TCDF	10	1.2	--	119	--	--	NC	---	NC
12378-PECDF	10	0.73	--	73	--	--	NC	---	NC
123478-HXCDF	10	1.4	--	142	--	--	NC	---	NC
1234678-HPCDF	10	1.3	--	127	--	--	NC	---	NC
12345678-OCDF	50	4.8	--	96	--	--	NC	---	NC

NC = not calculated

Accuracy is measured by Percent Recovery as in:

$$\% \text{ recovery} = \frac{\text{(measured concentration)}}{\text{(actual concentration)}} \times 100$$

Precision is measured using duplicate tests by Relative Percent Difference (RPD) as in:

$$\text{RPD} = \frac{(\% \text{ recovery test 1} - \% \text{ recovery test 2})}{(\% \text{ recovery test 1} + \% \text{ recovery test 2})/2} \times 100$$

Control limits for accuracy (percent recovery) are based on the average, historical percent recovery +/-3 standard deviation units. Control limits for precision (relative percent difference) range from 0 (identical duplicate LCS results) to the average, historical relative percent difference + 3 standard deviation units. These control limits are updated on a quarterly basis.

IV Analysis Results

Test methods prefaced by "Enseco" indicate that minor modifications of published EPA Methods were made such as reporting limits or parameter lists. Reporting limits are adjusted to reflect dilution of the sample, when appropriate. Solid and waste samples are reported on an "as received" basis; i.e., no correction is made for moisture content. All data is "blank corrected" by subtracting the level of contamination, if any, found in the laboratory method blank from the analytical result before it is reported.

Results are on the attached data sheets.

Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

WATER QUALITY
CONTROL BOARD
REGION I

OCT 23 '87

BK RC
CJ SW
FR FR
RT
JH
BB
JG REPLY

October 22, 1987

CERTIFIED MAIL
Return Receipt Requested
P 317 147 346

Ms. Susan A. Warner
Associate Engineering Geologist
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Ms. Warner:

Additional samples of our powerhouse fly ash have been collected and analyzed for chlorinated furans as you requested. As per our approved sampling plan, we collected twelve discrete samples over the period from August 28 to September 11. These were then combined into three composite samples, of four discrete samples each, prior to analysis.

As you can see from the enclosed lab results, no 2,3,7,8 isomers were detected and only very trace amounts of the other tetra- isomers were found. We believe that this resolves the contamination question and demonstrates the non-hazardous nature of our fly ash.

If you should have further questions on this matter, please call me at 964-5651.

Sincerely,

Steven A. Petrin

Steven Petrin, Director
Environmental Health & Safety
California Wood Products

SP:db
Encs.

cc: L. Ambrosini/Fort Bragg
J. Anderson/Atlanta
D. Jacobszoon/Fort Bragg
R. Shoulders/Fort Bragg
D. Whitman/Fort Bragg

Enseco

POLYCHLORINATED FURANS
ISOMER SPECIFIC ANALYSIS

Amended

Client Name: Georgia-Pacific Corp.
Client ID: 1A Composite
Lab ID: 31397-001C   Enseco ID: NA
Matrix: Soil   Sampled: 28-AUG-87   Received: 16-Sep-87
Authorized: 16-Sep-87   Prepared: 18-Sep-87   Analyzed: 28-Sep-87

Sample Amount: 10.25 g

Parameter	Result	Units	Detection Limit
Furans			
Tetra (total)	0.14	ng/g	-
(2378)	ND	ng/g	0.016
Penta (total)	ND	ng/g	0.040
(12378)	ND	ng/g	0.014
(23478)	ND	ng/g	0.013
Hexa (total)	ND	ng/g	0.010
(123478)	ND	ng/g	0.087
(123678)	ND	ng/g	0.085
(123789)	ND	ng/g	0.088
(234678)	ND	ng/g	0.078
Hepta (total)	ND	ng/g	0.021
(1234678)	ND	ng/g	0.021
(1234789)	ND	ng/g	0.021
Octa (total)	ND	ng/g	0.16

	% Accuracy	% Recovery
13C-2,3,7,8-TCDF	NA	63

ND=Not Detected
NA=Not Applicable

Reported by: DLB   Approved by: MM

The cover letter is an integral part of this report.
Version 070187

Enseco

POLYCHLORINATED FURANS
ISOMER SPECIFIC ANALYSIS

Client Name: Georgia-Pacific Corp.
Client ID: 2A Composite
Lab ID: 31397-005C Enseco ID: NA
Matrix: Soil Sampled: 02-Sep-87 Received: 16-Sep-87
Authorized: 16-Sep-87 Prepared: 18-Sep-87 Analyzed: 28-Sep-87

Sample Amount: 10.10 g

Parameter	Result	Units	Detection Limit
Furans			
Tetra (total)	0.19	ng/g	-
(2378)	ND	ng/g	0.022
Penta (total)	ND	ng/g	0.095
(12378)	ND	ng/g	0.062
(23478)	ND	ng/g	0.064
Hexa (total)	ND	ng/g	0.040
(123478)	ND	ng/g	0.40
(123678)	ND	ng/g	0.39
(123789)	ND	ng/g	0.50
(234678)	ND	ng/g	0.44
Hepta (total)	ND	ng/g	0.15
(1234678)	ND	ng/g	0.15
(1234789)	ND	ng/g	0.15
Octa (total)	ND	ng/g	0.083

	% Accuracy	% Recovery
13C-2,3,7,8-TCDF	NA	53

ND=Not Detected
NA=Not Applicable

Reported by: DLB Approved by: [signature]

The cover letter is an integral part of this report.
Version 070187

Enseco

POLYCHLORINATED FURANS
ISOMER SPECIFIC ANALYSIS

Client Name: Georgia-Pacific Corp.
Client ID: 3A Composite
Lab ID: 31397-009C   Enseco ID: NA
Matrix: Soil   Sampled: 09-Sep-87   Received: 16-Sep-87
Authorized: 16-Sep-87   Prepared: 18-Sep-87   Analyzed: 28-Sep-87

Sample Amount: 10.18 g

Parameter	Result	Units	Detection Limit
Furans			
Tetra (total)	0.16	ng/g	-
(2378)	ND	ng/g	0.018
Penta (total)	ND	ng/g	0.054
(12378)	ND	ng/g	0.022
(23478)	ND	ng/g	0.024
Hexa (total)	ND	ng/g	0.018
(123478)	ND	ng/g	0.23
(123678)	ND	ng/g	0.11
(123789)	ND	ng/g	0.12
(234678)	ND	ng/g	0.11
Hepta (total)	ND	ng/g	0.077
(1234678)	ND	ng/g	0.077
(1234789)	ND	ng/g	0.077
Octa (total)	ND	ng/g	0.54

	% Accuracy	% Recovery
13C-2,3,7,8-TCDF	NA	60

ND=Not Detected
NA=Not Applicable

Reported by: DLB   Approved by: *[signature]*

The cover letter is an integral part of this report.
Version 070187

COOPERATIVE EXTENSION
UNIVERSITY OF CALIFORNIA

County of Mendocino
Co. Agricultural Center
Courthouse
Ukiah, CA 95482
707-463-4495

Date: ____________________

To: ____

____

☐ Per your request
☐ For your information
☐ Your files
☐ Your suggestions
☐ Your approval
☐ Your action

Message:

____

____

____

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____

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____

____

Rod Shippey

Roderick A. Shippey
Livestock Farm Advisor

WATER QUALITY
CONTROL BOARD
REGION 1

OCT 9 '87

☐ BK ☐ RC
☐ CI ☐ STAFF
☒ FR ☐
☐ RT ☐
☐ JH ☐
☐ BB ☐
☐ JG ☐ REPLY
☐ ☒ FILE GP-Ash

P
FLYASH, A WOOD WASTE AND ITS EFFECTS AS A FERTILIZER ON LEGUMES AND GRASSES, A FIRST YEAR REPORT.

R.A.Shippey, R.Meyer, Dow Jacobszoon
University of California Cooperative Extension
Georgia Pacific-Ft.Bragg Ca.

Fly ash from the Georgia Pacific Ft.Bragg saw mill is a waste product from the co-generation boilers where saw mill wastes are utilized as fuel.

Being black and very fine, fly ash stock piles would blow as the surfaces dried out. This caused problems with neighboring homeowners who filed complaints with the health department. California State ~~Department of~~ Water Quality Control Board became interested in fly ash as a possible stream and ground water contaminant and placed a Clean-Up and ~~Desist~~ Abatement order on Georgia Pacific Corporation to stop further disposal at their original site on a ranch north of Ft. Bragg California.

Georgia Pacific's boilers produce the electricity to run their Ft.Bragg mill and also sell surplus power to P.G.&E.

Sue O'Leary, Georgia Pacific's waste disposal manager worked with California Water Quality Control Board inspector, Sue Warner and set up a test area plan for the Georgia Pacific property, Little Valley, east of Ft.Bragg. Two test plots were initiated in Little Valley.

Sue O'Leary contacted the University of California Cooperative Extension office in Ukiah for help. UCCE soils specialist Roland Meyer from UCDavis and UC soils fertility researcher Milton Jones from the UC Hopland Field Station were brought in to review the proposed 400 acre Little Valley site. They met met and drew up an action plan to test different rates of fly ash soil treatments on pasture plants, subterranean clover, and two grasses-Palestine orchardgrass and perennial ryegrass..

Farm advisor Rod Shippey was the liason for University of California specialists, Mendocino County Health Department, California ~~Dept. of~~ Water Quality Control Board, and Georgia Pacific.

The GOALS OF THIS PROJECT WERE:
1. Recognize the problem.
2. Meet with the involved agencies to coordinate research plots.
3. Chemically analyze the fly ash for soil nutrient content.
4. Apply fly ash to the test plots in two ways:
   a) Plow down ash using a 5 gang 32" disk plow.
   b) Topically apply fly ash to existing clover-grass pastures.
5. Seed plow down plot with a clover-grass mixture.
6. Construct an electric deer fence around plowdown plot.
7. Observe plots during growing season.
8. Harvest plots and analize data for three years following plot

initiation.
9. Monitor plot soil pH and nutrient levels for three years .

1986-87

Three plots were established in 1986.

Georgia Pacific's Little Valley plots- pH 5.5
Soil Series: Shinglemill .
3.5 miles northeast of Ft. Bragg California. Township 18 North, Range 18 West, Northwest 1/4 of the Northwest 1/4 of section 23.
1. Plowdown plot-rates: 0-48-96-192-384-768 tons/acre.
2. Topical plot rates: 0-4-8-16-32-64 tons/acre.

Alan Spring's plot- pH 5.5
SOIL SERIES: Young Marine bench.
3/4 mile north of Van Damme State Park.Township 16 North, Range 18 West, the Southeast 1/4 of the Northwest 1/4 Section 6.
3. Topical plot rates: 0-4-8-16-32-64 tons/acre.

See appendix for soil and fly ash analyses data.

RESULTS: (TONS/ACRE)

PLOT	AMT FLY ASH/ACRE	CLOVER HAY PRODUCTION/ACRE
G.P.		
INCORP.	Check 0	3.44 t/a
"	48 t/a	4.88 t/a
"	96 t/a	6.40 t/a
"	192 t/a	4.77 t/a
"	384 t/a	9.42 t/a
"	768 t/a	3.47 t/a

G.P.
TOPICAL Cattle grazed the plot -no data 1986-87

PLOT		
ALAN SPRING		
INCORPORATION	Check 0	1.4 t/a
"	4 t/a	1.9 t/a
"	8 t/a	2.2 t/a
"	16 t/a	2.4 t/a
"	32 t/a	2.2 t/a
"	64 t/a	2.1 t/a

FLY ASH HANDLING SUGGESTIONS;

1. Wear goggles and respirator when handling fly ash.

2. Haul fly ash with a tarpaulin covering the load.

3. Wet the top of the load before covering with a tarpaulin.

4. Topical applications should be done on a 3"-4" stubble to stop blowing until the ash is stabilized by rain.

5. Fly ash over 32 tons per acre should be plowed down .

THIS PROJECT WAS MADE POSSIBLE THROUGH THE COOPERATION OF:

Dow Jacobszoon Sue O'Leary, Joaquin Ponts, Eino Freeman, Steve Petrin, David Larkin, Lee Rossavick, Dennis Osborn, Sue Warner.

October 23, 1987

Steve Petrin
Director, Environmental Health
and Safety
California Wood Products
Georgia-Pacific Corporation
90 W. Redwood Avenue
Fort Bragg, CA 95437

Dear Mr. Petrin:

I have reviewed your request to mix the ash dredgings from the alum pond in with the routine ash treatments at Little Valley. Your scheduling of dredging should not occur when ash materials would be stockpiled, allowing for the dredged aluminum-rich material to be isolated and not well mixed with the other ash soil amendment material. Otherwise, the proposal to use the ash from the alum ponds along with the other ash at Georgia-Pacific for a soil amendment in accordance with your Little Valley Waste Discharge Requirements appears appropriate.

The levels of mobile aluminum should not exceed 10 mg/1 in the supernatant (and your submitted data indicates that the levels are generally two orders of magnitude less than 10 ppm). You may wish to discuss with your farm advisor potential cropping affects from phytotoxicity of aluminum in highly acid soils. Your monthly monitoring should report when alum pond ash was included in the routine ash treatments. Your self-monitoring should also include soil analyses (for your annual report) indicating representative pre-treatment and post-treatment levels of aluminum. This additional monitoring may be reduced subsequently if the first year's data indicates insignificant differences. In addition, stockpiling and amending activities should ensure that no leachate occurs which may carry levels of aluminum which could affect beneficial uses of ground or surface waters.

Sincerely,

Susan A. Warner
Associate Engineering Geologist

Enclosure

ATT. # 7

TOXICOLOGICAL PROFILE REPORT
FOR
2,3,7,8-TCDD

Date Published — November 1987

Prepared by:

Michael W. Neal and Dipak K. Basu
Center for Chemical Hazard Assessment
Syracuse Research Corporation
Syracuse, NY 13210

Contract No. 68-03-3228
Task 53

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6. ENVIRONMENTAL FATE

6.1 OVERVIEW

The important sources of 2,3,7,8-TCDD in the environment are production and use of certain herbicides and chlorophenols, incineration of municipal and industrial wastes, and improper disposal of chemical wastes produced during the manufacture of 2,4,5-trichlorophenol, 2,4,5-T, and related herbicides, hexachlorophene, and chlorinated benzenes. The fate of 2,3,7,8-TCDD in the environment is not clearly understood. It appears that particulate-bound 2,3,7,8-TCDD in the air may undergo photolysis and may be removed by wet and dry deposition. The half-life of atmospheric 2,3,7,8-TCDD is such that 2,3,7,8-TCDD can be transported long distances in the air. The ultimate sink of airborne 2,3,7,8-TCDD is sediments of surface waters. The two processes that are likely to remove 2,3,7,8-TCDD from water and soils are vaporization and photolysis. The estimated half-life of 2,3,7,8-TCDD in surface water is >1 year, and the ultimate sink of aquatic 2,3,7,8-TCDD is sediments. The bioconcentration factor of 2,3,7,8-TCDD in the fathead minnow (*Pimephales promelas*) is 7900 to 9300. 2,3,7,8-TCDD is immobile in most soils, but horizontal movement of soil-bound 2,3,7,8-TCDD may occur in runoff water during flooding. As observed in Seveso, Italy, minimal vertical movement may occur in soils containing low organic matter. The estimated half-life of 2,3,7,8-TCDD is 1 to 3 years on soil surfaces and 10 to 12 years in the interior of soils. Although not accumulated, the level of 2,3,7,8-TCDD absorbed in parts of plants underground is of the same order of magnitude as in soil, but the aerial parts of plants contain 50% lower concentrations.

6.2 *RELEASES TO THE ENVIRONMENT*

Although the following paragraphs discuss the sources of 2,3,7,8-TCDD in the environment, the sources responsible for its background levels are not clear.

6.2.1 Production and Use of Certain Herbicides and Chlorophenols

The phenoxy herbicide 2,4,5-T produced prior to 1960 contained up to 100 μg/g 2,3,7,8-TCDD. The level of 2,3,7,8-TCDD in commercial 2,4,5-T has been reduced in recent years to <0.1 μg/g, and most commercial 2,4,5-T available today may contain <0.02 μg/g 2,3,7,8-TCDD. Agent Orange, a 1:1 mixture of butyl esters of 2,4,5-T and 2,4-D produced before 1970, contained 0.02 to 54 μg/g 2,3,7,8-TCDD. Hexachlorophene, a germicide manufactured from trichlorophenol, contains 0.2 to 0.5 ng/g 2,3,7,8-TCDD. 2,4,6-Trichloro-, 2,3,4,6-tetrachloro-, and pentachlorophenol were found to contain <0.1 μg/g other tetra isomers but no 2,3,7,8-TCDD. 2,3,7,8-TCDD was detected at a concentration <1 ng/g (2,3,7,8-TCDD detection limit of 0.03 ng/g) in all samples of sodium pentachlorophenate, 2,3,4,5-tetrachlorophenol, and hexachlorophene. 2,4,5-Trichlorophenol, on the other hand, contained up to 6.2 μg/g 2,3,7,8-TCDD. Similarly, diphenyl ether herbicides were found to contain other tetrachloro isomers but no 2,3,7,8-TCDD (EPA 1985b, HSDB 1987, Rappe 1984, Hagenmaier 1986, Weeren and Asshauer 1985). From the analysis of sediments of a western Lake Ontario site, Czuczwa and Hites (1986) concluded that the likely source of tetrachlorodibenzo-p-dioxins was a pentachlorophenol production facility. The analytical method used, however, could not distinguish 2,3,7,8-TCDD from other tetra isomers.

6.2.2 Photochemical Reactions

The photochemical reaction of phenoxy herbicides has been found to produce polychlorinated dibenzo-p-dioxins through photodechlorination and subsequent condensation reactions; however, this process does not produce 2,3,7,8-TCDD (Rappe 1984). Lower substituted dibenzo-p-dioxins are also formed during photodechlorination of higher chlorine-substituted dibenzo-p-dioxins. Trace amounts of 2,3,7,8-TCDD were observed from the photodechlorination of both 1,2,3,6,7,8-hexa- and 1,2,3,7,8,9-hexachlorodibenzo-p-dioxin (Buser 1979).

6.2.3 Thermal Reactions

Small amounts of 2,3,7,8-TCDD have been detected in the flue gases from municipal incinerators. From the experimentally determined concentrations in flue gases of five municipal incinerators, the maximum average concentration of 2,3,7,8-TCDD in ambient air at ground level was estimated as 38 fg/g. Incineration of industrial wastes containing 2,4,5-T salts and esters, polychlorinated benzenes, and chlorophenoxy ethers also produced 2,3,7,8-TCDD (Rappe 1984, Barnes 1983). Upon analysis of sediments from Saginaw Bay, Saginaw River, and the Great Lakes, Czuczwa and Hites (1984, 1986) concluded that the source of tetrachlorodibenzo-p-dioxins was incineration, although the analytical method used was unable to separate 2,3,7,8-TCDD from other tetra isomers. Combustion of coal did not produce 2,3,7,8-TCDD at a detection limit of 1.2 ng/kg (HSDB 1987), but burning of woods did produce 0.65 μg/kg 2,3,7,8-TCDD (EPA 1985b). Exhausts from automobiles powered with leaded gasoline were reported to contain <0.05 to 0.3 ng 2,3,7,8-TCDD/24.8 km, but no 2,3,7,8-TCDD was detected in exhausts of automobiles powered with unleaded gasoline (Marklund et al. 1987). Accidental fires involving capacitors or transformers containing chlorobenzene will also release 2,3,7,8-TCDD to the environment. An example of such a contamination is the State Office Building in Binghamton, New York.

6.2.4 Improper Disposal of Chlorinated Chemical Wastes

Improper disposal of certain chemical wastes produced during the manufacture of 2,4,5-trichlorophenol, 2,4,5-T, and related herbicides, hexachlorophene, chlorinated benzenes, etc., may be a source of 2,3,7,8-TCDD in the environment. Examples of such improper disposal leading to the contamination of the environment are the Love Canal, Niagara Falls, New York, sites where 2,3,7,8-TCDD up to a level of 672 μg/kg was detected. Similarly, several sites in the state of Missouri were contaminated with up to 1750 μg/kg 2,3,7,8-TCDD (Tiernan et al.

1985).

6.3 ENVIRONMENTAL FATE

The fate of 2,3,7,8-TCDD in air, water, and soil is not understood with certainty. Although some experimental efforts have been directed in recent years to elucidate its fate in different media, a substantial data gap exists in this area. In air, 2,3,7,8-TCDD is likely to be present predominantly in the gas phase. The two important processes that may remove 2,3,7,8-TCDD from the atmosphere are photochemical degradation and wet deposition. Even an estimate of the atmospheric half-life of 2,3,7,8-TCDD is not available. On the basis of photochemical experiments with 2,3,7,8-TCDD coated on silica gel, the half-life of atmospheric particulate 2,3,7,8-TCDD may be a few days. The half-life of atmospheric gas-phase 2,3,7,8-TCDD may be higher than particulate 2,3,7,8-TCDD. The lifetime of atmospheric 2,3,7,8-TCDD is such that it can be transported long distances in the air. The ultimate environmental sink of airborne particulate 2,3,7,8-TCDD is likely to be sediments of surface waters (Eitzer and Hites 1986, Czuczwa and Hites 1986, Choudhry and Hutzinger 1982).

The biodegradation of 2,3,7,8-TCDD in water is probably slow. The two processes that may be important for the removal of 2,3,7,8-TCDD are volatility and photodegradation. Although the photolysis of 2,3,7,8-TCDD in hydrogen-donating solvents is a fast process, a suspension of 2,3,7,8-TCDD in distilled water showed no appreciable photodegradation. In natural waters, the presence of small amounts of hydrogen-donating substrate or the presence of photosensitizers may account for its observed photodegradation; however, the photochemical degradability of 2,3,7,8-TCDD in water, as provided by model ecosystem studies (Tsushimoto et al. 1982, Matsumura et al. 1983), has not provided definite evidence through mass balance that the observed loss of 2,3,7,8-TCDD attributed to photolysis was not due to its sorption on sediment and biota. The photodegradation is usually a dechlorination process leading to the formation of tri- and dichlorinated dibenzo-p-dioxins. In sediment-containing lake water, the estimated half-life of 2,3,7,8-TCDD is >1.5 years. In lake water alone, the estimated half-life is >1 year. The ultimate sink of aquatic 2,3,7,8-TCDD is the sediment. Recent flow-through experiments with fathead minnows (*Pimephales promelas*) have shown that the bioconcentration factor for 2,3,7,8-TCDD in this species is 7900 to 9300 on a wet weight basis (EPA 1985b, Adams et al. 1986).

2,3,7,8-TCDD is expected to be immobile in most soils by irrigation and rainfalls. A downward movement of 10 cm in 12 years was observed with soil from Eglin Air Force Base. Although 2,3,7,8-TCDD usually does not leach through soil, leaching is possible in rare instances from soils of very low organic carbon content as a result of 2,3,7,8-TCDD solvation with organic solvent or biotic mixing by earthworms or other soil invertebrates. A white rot fungus (*Phanerochaete chrysosporium*) has been shown to degrade 2,3,7,8-TCDD. This biodegradation does not occur significantly in natural soils, probably because of the lack of this or other degrading microorganisms. Both volatilization and photoreaction may remove some 2,3,7,8-TCDD from soil surfaces. The photoreaction on soil surfaces can be greatly enhanced by the presence of hydrogen-donating substrates (e.g., olive oil or arachis oil) in soil. The photoreaction will be insignificant beyond the surface soil layers. The estimated half-life of 2,3,7,8-TCDD on soil surfaces is 1 to 3 years, but the half-life in the interior of soil may be 10 to 12 years (EPA 1985b, Freeman and Schroy 1986, Bumpus et al. 1985, HSDB 1987).

2,3,7,8-TCDD present on leaves of plants as a result of spraying herbicides will photolyze with a half-life of a few hours. The chemical is absorbed by higher plants and is probably translocated, but it is not accumulated. The absorption by underground parts may be at the same level as soil, but the aerial part contains ~50% lower concentrations (Choudhry and Hutzinger 1982, Sacchi et al. 1986).

State of California

Memorandum

To : James Baetge, Chief
Division of Water Quality
State Water Resources Control Board

Date : November 2, 1987

Craig Johnson
Assistant Executive Officer

From : California Regional Water Quality Control Board
North Coast Region – 1440 Guerneville Road
Santa Rosa, California 95401

Subject: Subchapter 15 Classification of Fly Ash

This Regional Board reviewed the waste characteristics of fly ash generated at a wood-fueled power plant operated by Georgia-Pacific Corporation in Fort Bragg, and determined that the waste was suitable for use as a soil amendment under waste discharge requirements pursuant to Subchapter 15 Section 2510(f). This determination was based on a finding that the ash was non-hazardous and decomposable, and would not threaten water quality if used as a soil amendment pursuant to best management practices. Subsequent to our determination, new information on the waste characteristics of the ash became available. This new information includes laboratory results on the polychlorodibenzofuran and polychlorodibenzodioxin content of the fly ash. No dioxins were found, but some tetrachlorodibenzofuran was detected in samples of the ash. The levels of tetrachlorodibenzofuran present in the ash are low, and range from 0.14 – 0.19 ng/g (parts per billion).

It may no longer be appropriate for the ash to be used as a soil amendment, and the ash may need to be considered a designated waste pursuant to Subchapter 15. We would appreciate any technical support you may be able to provide on this matter, particularly an assessment of the levels found in the ash and the potential risk to water quality posed by these levels. Please contact Susan Warner of my staff if you require further information. We look forward to hearing from you on this matter.

SAW:mkh

Attachments

cc: Steve Petrin
Jerry Davis
Ellie Giovannoni

NOV 06 1987

November 2, 1987

David J. Leu, Chief
Alternative Technology and Policy
Development Section
Toxic Substances Control Division
Department of Health Services
1219 K Street
Sacramento, CA 95814

Dear Dr. Leu:

Some time ago we contacted you regarding the waste classification of fly ash generated at a wood-burning power plant operated by Georgia-Pacific Corporation in Fort Bragg. At that time, the fly ash was suspected of being contaminated with octachlorodibenzodioxin (OCDD). You reported to us in the attached letter that the OCDD isomer was thought to be noncarcinogenic and less toxic by far than the 2,3,7,8-TCDD isomer, and that the designation of the fly ash as non-hazardous waste was still appropriate. Subsequently, this Board requested Georgia-Pacific sample the ash for polychlorinated dibenzodioxins and dibenzofurans. The results of these analyses are attached. You will note that no dioxins were detected, but that tetrachlorodibenzofurans were found. These materials were found at very low levels, and the Regional Board does not believe that the results warrant reclassification of the ash as a hazardous waste. However, we are informing you of these results in the event that your agency may wish to review the data and reconsider the waste classification.

The waste is currently classified as a non-hazardous decomposable waste under Section 2510(f) of Subchapter 15 of Title 23 of the California Administrative Code. However, these recent results may require the Regional Board to reconsider the applicability of this waste as decomposable and suitable for use as a soil amendment. We are currently reviewing this new information to determine whether the waste is a designated waste, a non-hazardous solid waste, or an inert waste pursuant to Subchapter 15, and will be coordinating our decision in this matter with the State Water Resources Control Board.

Sincerely,

Susan A. Warner
Associate Engineering Geologist

cc: Steve Petrin
Jerry Davis
Ellie Giovannoni

Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

WATER QUALITY
CONTROL BOARD
REGION 1

NOV 16 '87

BK ___ RC ___
CI ___ 1 KAD
2 FR ___ SW
RT ___
JH ___
BB ___
JG ___ REPLY

November 4, 1987

CERTIFIED MAIL
Return Receipt Requested
P 317 147 349

86003

Mr. Benjamin D. Kor
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Kor:

Enclosed is the October 1987 report for the Georgia-Pacific Soil Amending Project as per revised Monitoring and Reporting Program 86-3. Also enclosed is a sketch map of our winter storage area as requested by Ms. Warner. A small amount of ash has been deposited there.

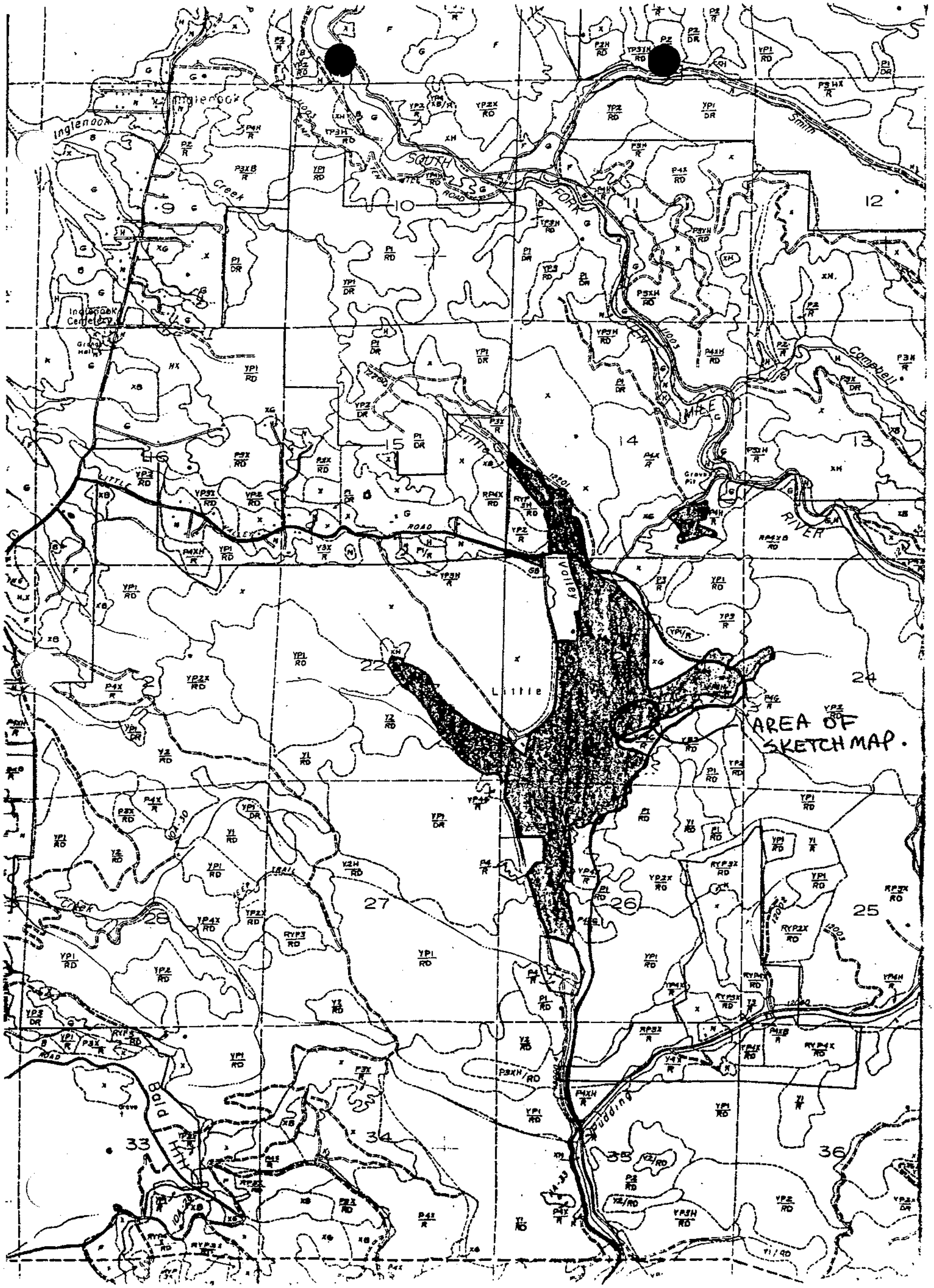
Sincerely,

Steven A. Petrin

Steven A. Petrin, Director
Environmental Health & Safety
California Wood Products

SAP:db

Encl.



AREA OF SKETCH MAP.
Inglenook
Inglenook Cemetery
SOUTH FORK
TEN MILE
Inglenook Creek
Smith
Campbell
RIVER
Little Valley
LITTLE VALLEY ROAD
Bald Hill
Pudding
9
10
11
12
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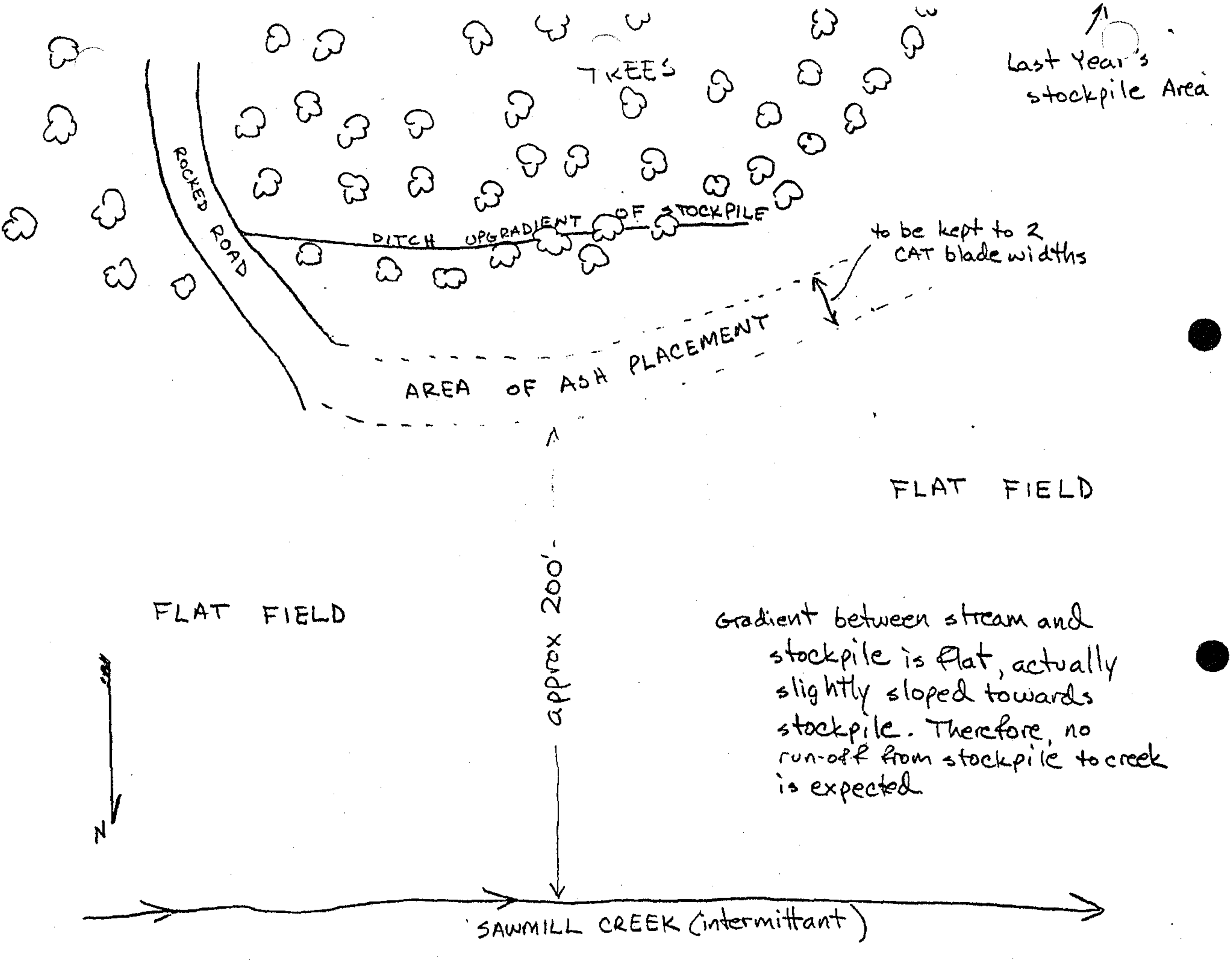

Last Year's stockpile Area
TREES
ROCKED ROAD
DITCH UPGRADIENT OF STOCKPILE
to be kept to 2 CAT blade widths
AREA OF ASH PLACEMENT
FLAT FIELD
FLAT FIELD
approx 200'
Gradient between stream and stockpile is flat, actually slightly sloped towards stockpile. Therefore, no run-off from stockpile to creek is expected
N
SAWMILL CREEK (intermittant)

OCTOBER 1987 REPORT

GEORGIA-PACIFIC CORPORATION

FORT BRAGG SOIL AMENDMENT MONITORING AND REPORTING PROGRAM NO. 86-3

Monitoring

Volume of ash deposited by week		Cubic Yards of Ash - deposited in Area A and stockpile.
October	01-03	400
	04-10	880
	11-17	580
	18-24	580
	25-31	760

Number of Treated Acres (Area A) 40.70 Acres

Number of Treated Acres (Area W) 5 Acres

WATER QUALITY
CONTROL BOARD
REGION 1

NOV 16 '87

☐ BK. ____ ☐ BC ____
☐ CI ____ ☐ ____
☐ FR ____ ☐ ____
☐ RT ____ ☐ ____
☐ JR ____ ☐ ____
☐ RB ____ ☐ ____
☐ JG ____ ☐ REPLY

Daily Precipitation Measurements		PPT (Inches)
October	1	0
	2	0
	3	0
	4	0
	5	0
	6	0
	7	0
	8	0
	9	0
	10	0
	11	0
	12	0
	13	0
	14	0
	15	0
	16	0
	17	0
	18	0
	19	0
	20	0
	21	0
	22	0.24
	23	0
	24	0
	25	0
	26	0
	27	0.48
	28	0.02
	29	0
	30	0
	31	0.17

No Stormwater Runoff monitoring was conducted due to minimal precipitation.

UNIVERSITY OF NEVADA-RENO

Department of Biochemistry
University of Nevada-Reno
Reno, Nevada 89557-0014
(702) 784-6031

Nov. 10, 1987

Dr. Cate Jenkins
MD-WH562B
Office of Solid Waste Emergency Response
U.S. Environmental Protection Agency
401 M. St. S.W.
Washington D.C. 20460

Dear Cate,

Richard Zepp informed me of the Greenpeace memorandum regarding our presentation at the Dioxin '87 meetings in Las Vegas. I'm enclosing the slides of that presentation, an abstract, and also a reprint of the dioxin chemistry article that came out of the ACS symposium. I am in the process of writing up the OCDD to TCDD work for the Chemosphere symposium publicaton and will send you a prepublication copy when it is completed.

Sincerely,

Glenn C. Miller,
Associate Professor

PLS RETURN TO MKN.

Photolysis of Octachlorodibenzo-p-dioxin on Soils: Production of 2,3,7,8-TCDD

Glenn C. Miller and Vincent R. Hebert
Department of Biochemistry
University of Nevada, Reno, Nevada 89557

Michael J. Mille and Robert Mitzel
Enseco-Cal Lab
2533 Industrial Blvd.
Sacramento, California 95691

Richard G. Zepp
Environmental Research Laboratory
U.S. Environmental Protection Agency
Athens, Georgia 30615

Octachlorodibenzo-p-dioxin (OCDD) is a contaminant of the widely used wood preservative pentachlorophenol (PCP). PCP and OCDD contamination of soils have occurred in many areas where PCP has been used, particularly at lumber mill sites. In solution, OCDD absorbs sunlight and undergoes photolysis to lower chlorinated products. Conflicting results have been published on whether this dechlorination occurs predominantly at the 2,3,7,8 or on the 1,4,6,9 positions. Dechlorination occurring predominantly at the 1,4,6,9 positions will result in formation of the highly toxic tetra-, penta- and hexa-chlorinated dibenzo-p-dioxins.

This research was designed to determine the degree to which the toxic 2,3,7,8-chlorinated congeners were formed on irradiation of OCDD on soils in relation to the total amount of the various tetra-, penta and hexa-chlorinated congeners produced.

Laboratory irradiations were performed on two sandy loam soils fortified at 10ppm OCDD. The first was a northeastern Montana soil (2.2% organic matter) and the second was a Riverside, California soil (0.49% organic matter). Each soil was evenly spread in petri dishes at 0.25mm thickness and irradiated under a light bank constructed of 16 Westinghouse FS40 sunlamps. These lamps were arranged to provide an even light field while maintaining constant temperature at 30 C. Treatment and dark controls were exposed for 0, 5, 10, and 20 day intervals. Samples were extracted with 20% methanol in hexane. The extracted PCDD isomers were quantitated by high resolution gas chromatography low resolution mass spectroscopy using a 60m DB-5 fused silica capillary column. Qualitative and quantitative confirmation of the tetra- through hexa-chlorinated isomers was obtained by separation on a 60m x 0.25mm fused silica SP-2331 column with mass spectrometric quantitation.

In all of the experiments, 30-40% loss of OCDD was apparent after five days of irradiation. No significant additional loss was observed at the 10 or 20 day exposures, which suggest that the remaining OCDD was protected from photolysis. This also indicates that volatilization was minimal from the 0.25 mm deep soils. The concentrations of the lower chlorinated congeners, however, increased slightly from 5 to 20 days exposure. On day 20 the concentrations of OCDD and the lower chlorinated products are presented below for the Montana soil. These are average of four samples. The results for the Riverside soil are similar. Also present are the results of irradiation of a 26,000 ng/ml ppb solution of OCDD under the same lamp bank for a four hour period.

	Montana soil 20-day exposure (average of 4 samples) (ng/gm)	Toluene solution 4 hour irradiation (ng/ml)
tetra (total)	1.48	ND
2,3,7,8	0.76	ND
penta (total)	19.4	9.3
1,2,3,7,8	5.0	ND
hexa (total)	71.3	18.1
2,3,7,8 substi.	18.5	ND
hepta (total)	261	7560
1,2,3,4,6,7,8	111	163
octa	6975	14400

These results support two general observations. First, photolysis is slow on the soils, and dechlorination at the 1,4,6,9 positions is preferred over that at the 2,3,7,8 positions. This is particularly evident for the tetra- and pentachlorinated congeners. Approximately half of the total amount of tetra isomers is 2,3,7,8-TCDD. This is a substantial enhancement, since 22 separate TCDD isomers exist. Of the heptachlorinated isomers, no enhanced concentration of the 2,3,7,8 chlorinated isomers was observed. Second, the photochemistry on soils was observed to be significantly different than in solution. Very little of the 2,3,7,8-chlorinated congeners was evident, and even for the heptachlorinated congener, less than 3% was substituted at the 2,3,7,8 positions.

Slides from

"Photolysis of Octachlorodibenzo-p-dioxin on Soils: Production of 2,3,7,8-TCDD"

Glenn C. Miller and Vincent R. Hebert
Department of Biochemistry
University of Nevada, Reno, NV

Michael J. Miille and Robert Mitzel
Enseco-Cal Lab
2533 Industrial Blvd.
Sacremento, CA

Richard G. Zepp
Environmental Research Laboratory
U.S. Environmental Protection Agency
Athens, GA

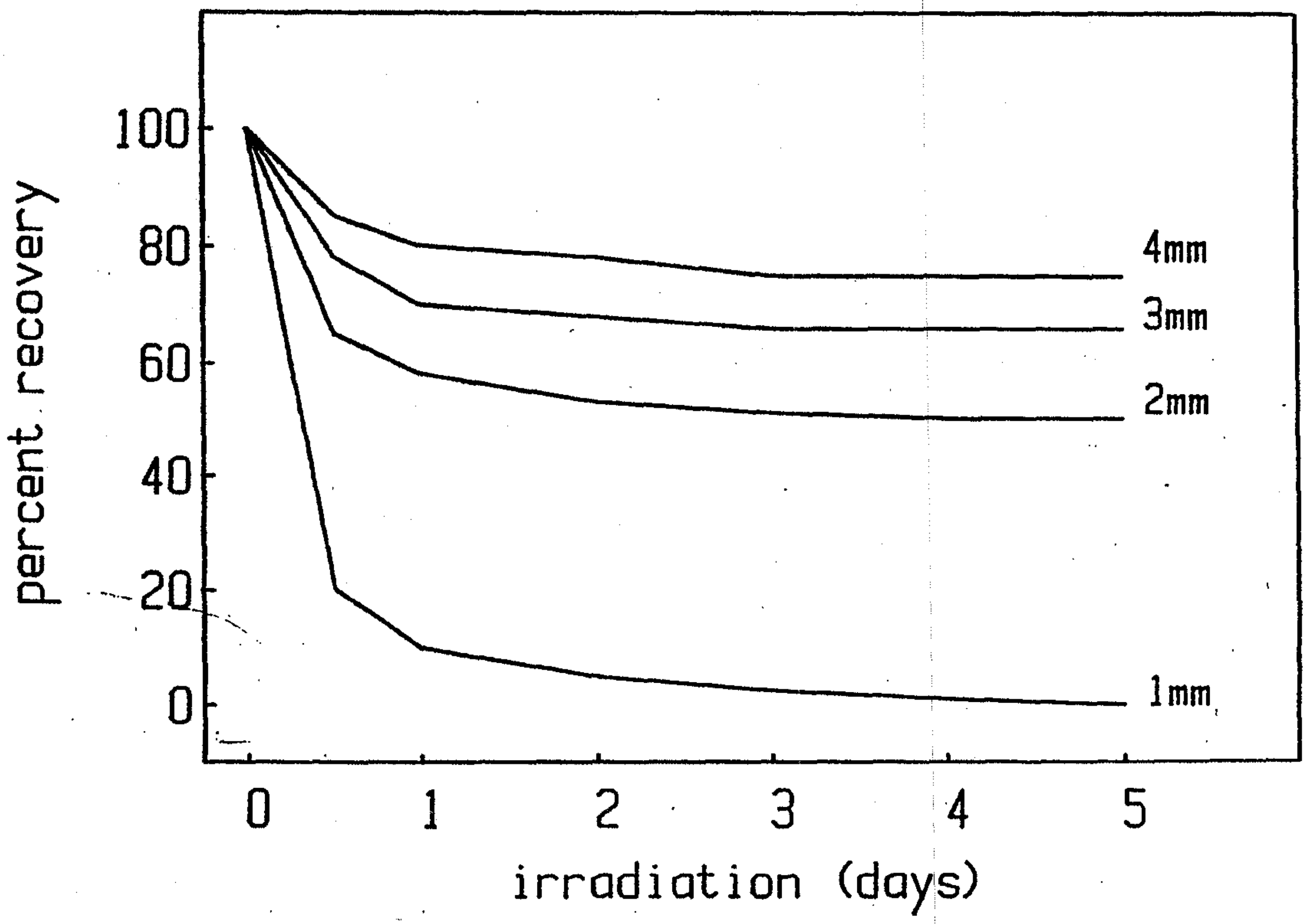
Presented at Dioxin '87 Conference in Las Vegas, NV
October 1987

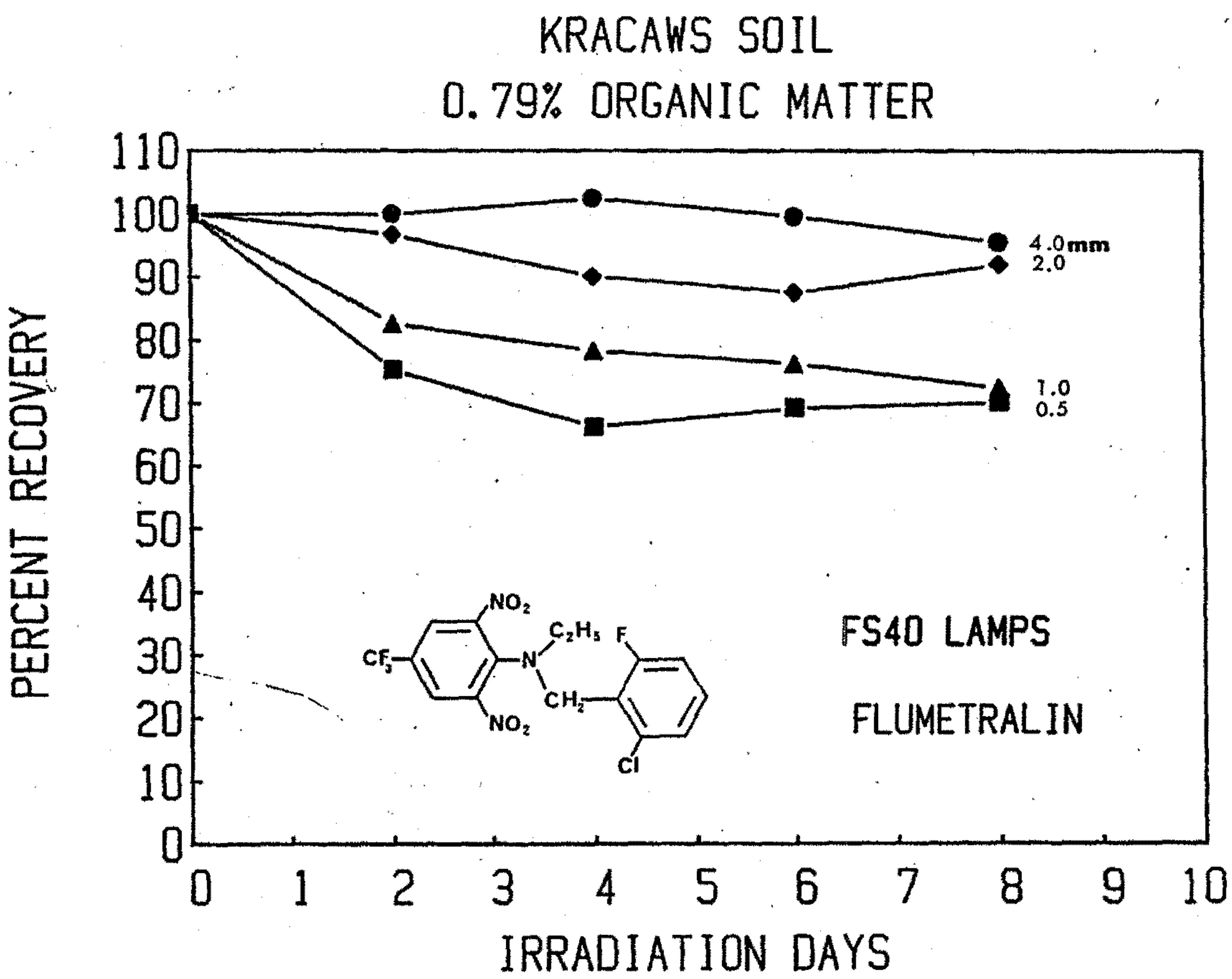
Considerations of Photolysis on Soil Surfaces

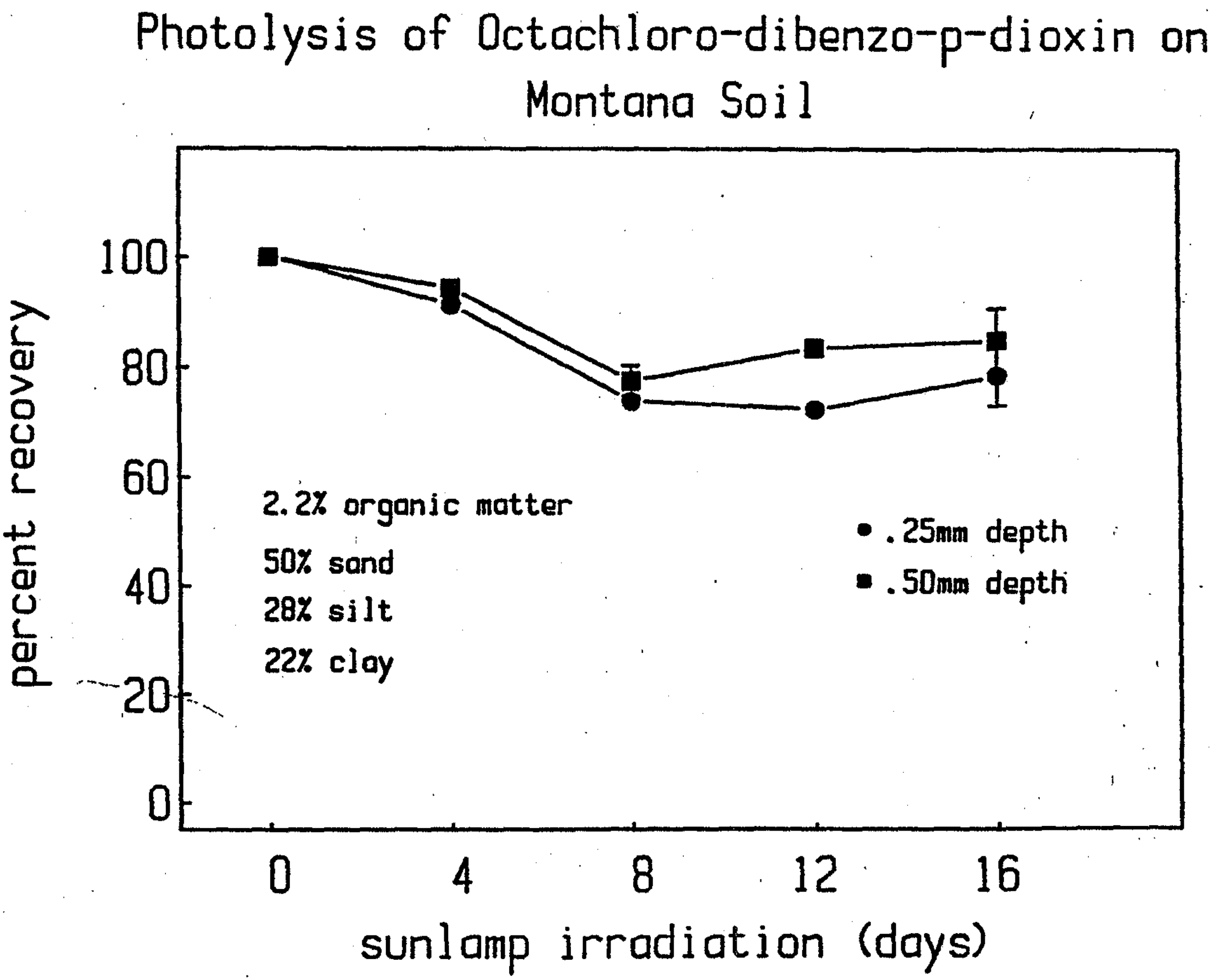
- soils are a complicated, non-homgeneous matrix
- first order rates are not observed
- surface heating can exceed 50 C
- transport to the exposed surface may control photolysis rates
- direct and indirect processes may be involved

IDEAL PHOTODEGRADATION RATES WHEN PHOTOLYSIS

DEPTH = 1 mm

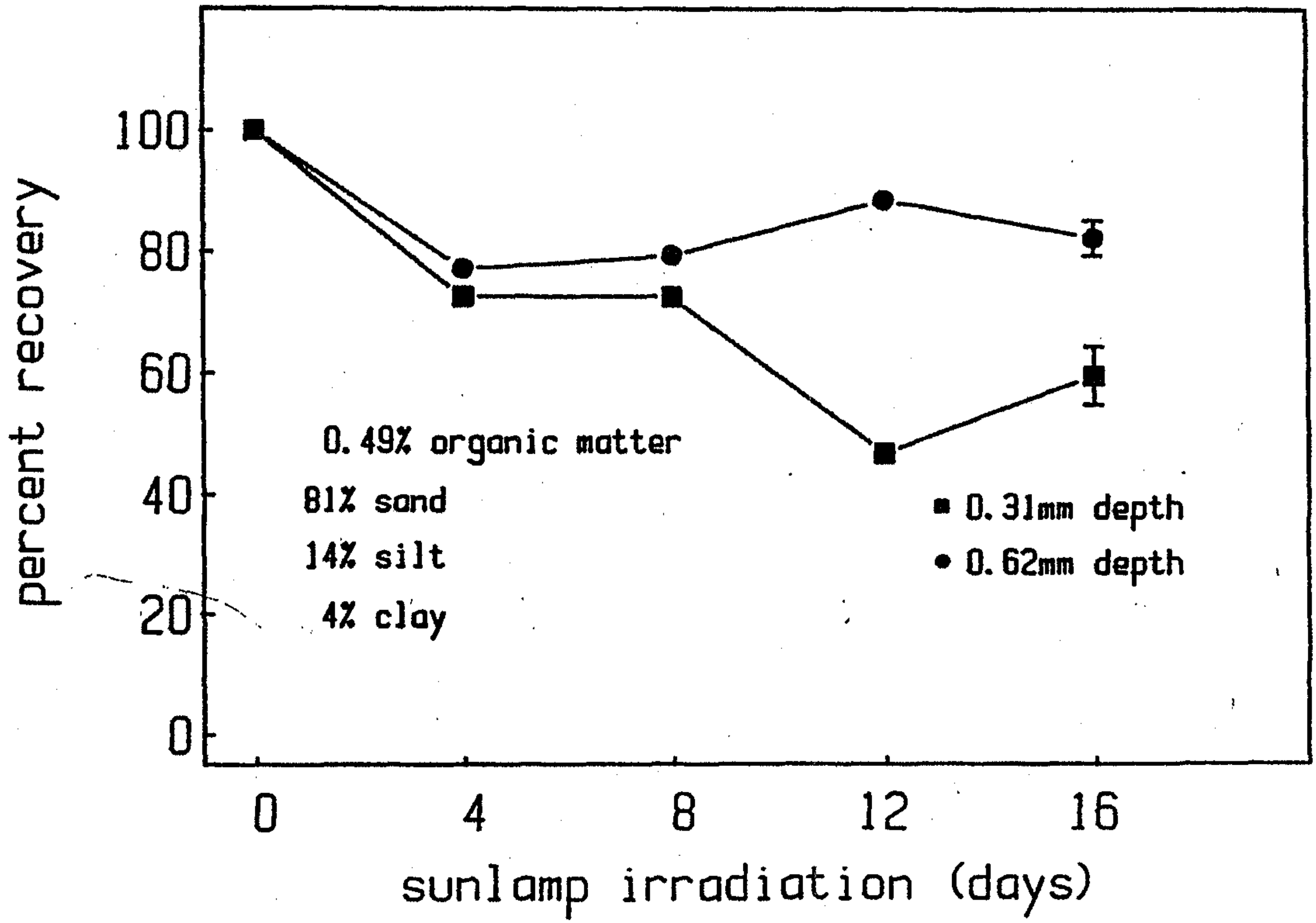


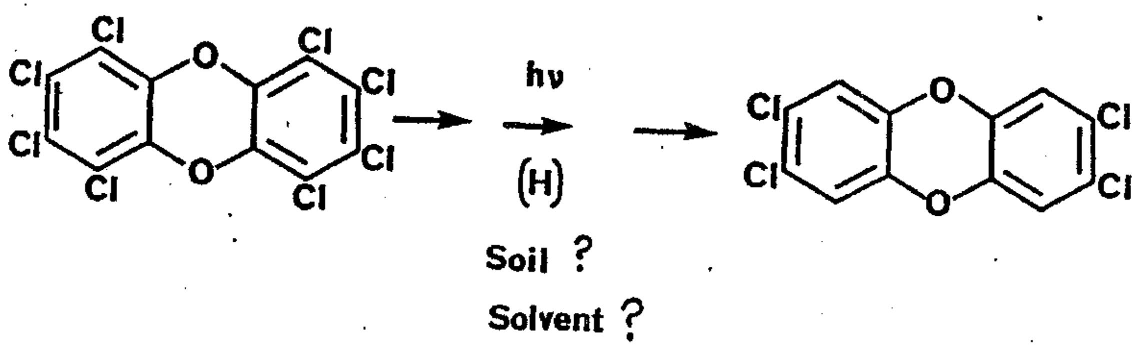

KRACAWS SOIL
0.79% ORGANIC MATTER
PERCENT RECOVERY
110
100
90
80
70
60
50
40
30
20
10
0
0
1
2
3
4
5
6
7
8
9
10
IRRADIATION DAYS
4.0mm
2.0
1.0
0.5
NO2
CF3
N
C2H5
F
CH2
NO2
Cl
FS40 LAMPS
FLUMETRALIN



Photolysis of Octachloro-dibenzo-p-dioxin on
Montana Soil
100
80
60
40
20
0
percent recovery
2.2% organic matter
50% sand
28% silt
22% clay
● .25mm depth
■ .50mm depth
0
4
8
12
16
sunlamp irradiation (days)

Photolysis of Octachlorodibenzo-p-dioxin on Tajunga Soil





Cl
O
hν
(H)
Soil ?
Solvent ?

PHOTODECHLORINATION OF OCTACHLORODIBENZO-p-DIOXIN ON MONTANA SOIL UNDER FS40 LAMPS

	Days of Exposure						
Dioxin	0	5		10		20*	
octa	10500 ng/gm	6550 ng/gm		7250 ng/gm		6940 ng/gm	
hepta total	34	190		220		253	
(1234678)	14	81		97		109	
hexa total	(<0.12)	33		45		75	
(123478)		2.2		4.3		6.1	
(123678)		2.7	8.3	3.8	13	6.1	19
(123789)		3.4		5.0		7.0	
penta total	(<0.13)	4.3		10.1		19	
(12378)		1.5		2.1		5.2	
tetra total	(<0.087)	0.55		0.64		1.5	
(2378)		(<0.34)		0.39		0.86	

*average of duplicate samples

PHOTODECHLORINATION OF OCTACHLORODIBENZO-p-DIOXIN ON MONTANA SOIL UNDER FS40 LAMPS WITH 0.1% ETHYL OLEATE

Days of Exposure

Dioxin	0*	5	10	20*
octa	9845ng/gm	6800 ng/gm	4750 ng/gm	7000 ng/gm
hepta total	36	214	193	269
(1234678)	15	90	86	115
hexa total	(<0.12)	36	52	67
(123478)		3.0	5.4	6.7
(123678)		2.6 9.1	5.4 15	5.5 19
(123789)		3.5	3.7	6.7
penta total	(<0.13)	7.0	11	19
(12378)		2.1	2.0	4.9
tetra total	(<0.087)	0.57	(<0.35)	1.5
(2378)		0.34		0.66

* average of duplicate samples

PHOTODECHLORINATION OF OCTACHLORODIBENZO-p-DIOXIN ON TAHUNGA SOIL UNDER FS40 LAMPS

	Days of Exposure			
Dioxin	0	5	10	20*
octa	9580 ng/gm	5510 ng/gm	5750 ng/gm	5570 ng/gm
hepta total	36	293	304	318
(1234678)	14	132	140	146
hexa total	(<0.24)	58	67	75
(123678+123478)		11 18	13 21	15.2 24
(123789)		7.1	7.9	8.7
penta total	(<0.32)	14.8	12.0	15.6
(12378)		4.4	3.4	4.6
tetra total	(<0.042)	1.5	1.5	2.0
(2378)		0.94	1.1	1.2

*average of duplicate samples

PHOTODECHLORINATION OF OCTACHLORODIBENZO-p-DIOXIN ON TAJUNGA SOIL
CONTAINING 0.1% ETHYL OLEATE UNDER FS40 LAMPS

Days of Exposure

Dioxin	0	5	10	20*
octa	9365 ng/gm	6260 ng/gm	6920 ng/gm	6080 ng/gm
hepta total	42	305	233	340
(1234678)	17	96	102	116
hexa total	(<0.27)	50	49	53
(123478)		2.7	3.5	3.9
(123678)		2.2 > 8.7	3.7 > 11	3.6 > 12
(123789)		3.8	3.7	4.8
penta total	(<0.43)	6.6	7.7	7.9
(12378)		0.88	2.4	1.9
tetra total	(<0.050)	0.60	0.70	0.63
(2378)		0.25	0.39	0.41

*average of duplicate samples

PHOTODECHLORINATION OF OCTACHLORODIBENZO-p-DIOXIN
IN ISOOCTANE UNDER FS40 LAMPS

	Hours of Exposure		
Dioxin	0	4	12
octa	25900 ng/mL	14400 ng/mL	3500 ng/mL
hepta total	30	7560	6360
(1234678)	8.3	163	110
hexa total	(<0.47)	18	2130
(123678)			1.6
penta total	(<0.28)	9.3	24
tetra total	(<0.11)	(<1.9)	(<3.4)

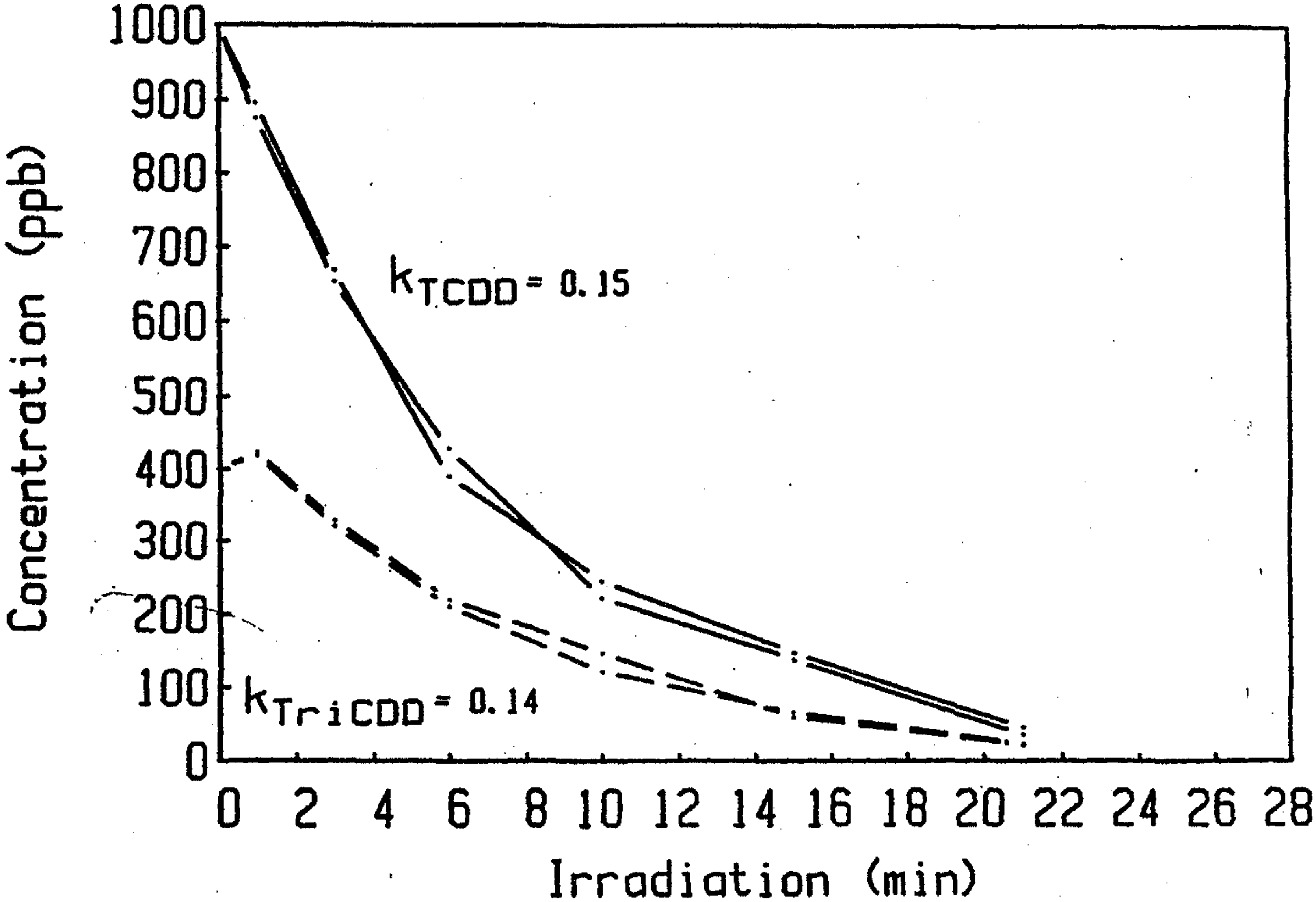
$$A \xrightarrow{h\nu} B \longrightarrow \text{other products}$$

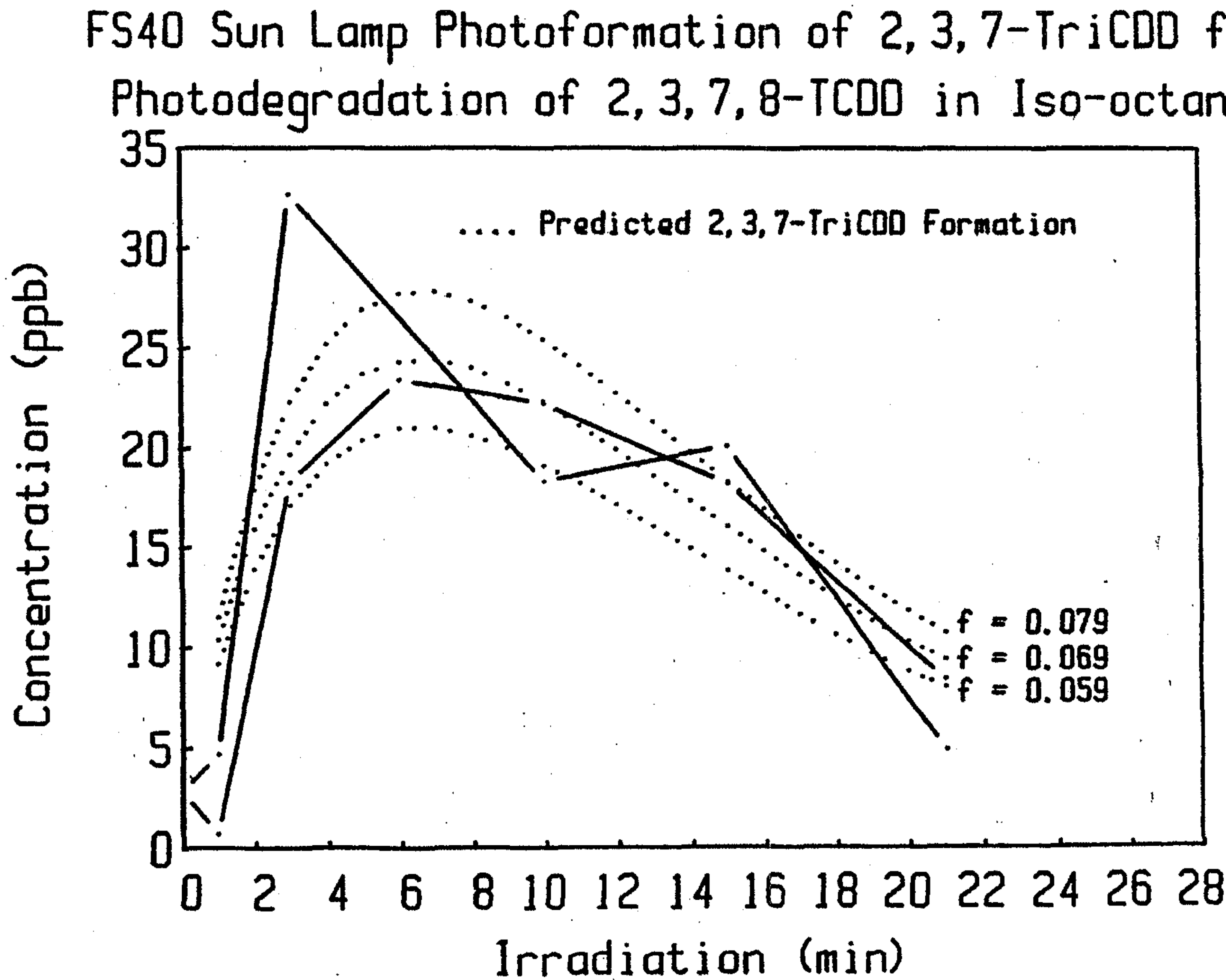
The fraction of A that is converted to B is :

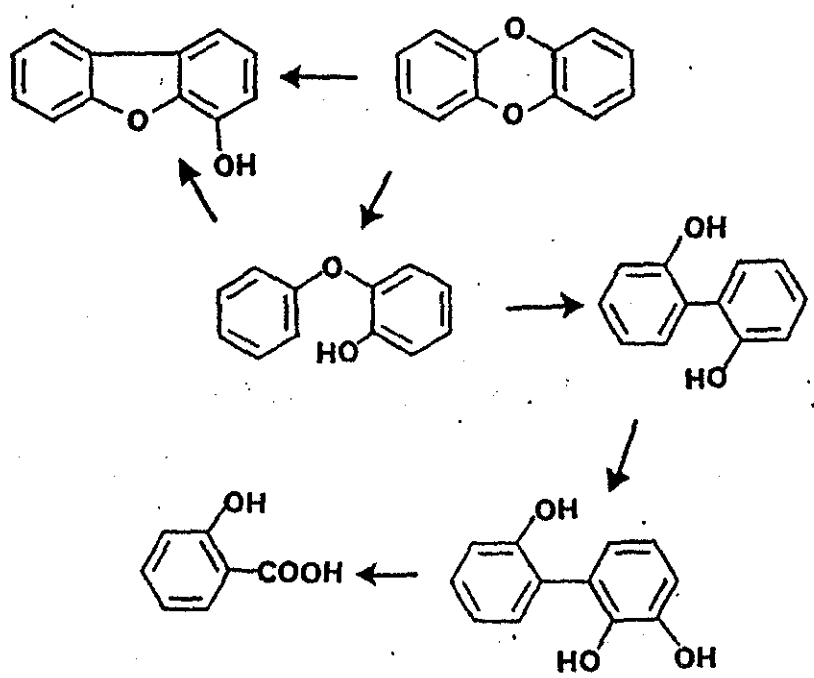
$$f = \frac{k_A\ [A]}{k_B\ [B]}$$

when k_A and k_B are first order rate constants for loss of A and B, and [A] and [B] are concentrations when [B] is maximized

FS40 Sun Lamp Photodegradation of 2,3,7,8-TCDD and 2,3,7-TriCDD in Iso-octane




FS40 Sun Lamp Photoformation of 2,3,7-TriCDD from
Photodegradation of 2,3,7,8-TCDD in Iso-octane
.... Predicted 2,3,7-TriCDD Formation
f = 0.079
f = 0.069
f = 0.059
Concentration (ppb)
Irradiation (min)
0
5
10
15
20
25
30
35
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28



PHOTODEGRADATION PATHWAYS OF DIBENZO-P-DIOXIN
USING 254 NM RADIATION

MASSE' AND PELLETIER
(CHEMOSPHERE 16:7-17, 1987)

CONCLUSIONS

- the mean photolysis depth of OCDD in soils is 0.1-0.3 mm
- on soils, photoreduction of OCDD to 2,3,7,8-TCDD is observed, and 2,3,7,8-TCDD is a major tetrachlorinated isomer observed
- in solution, photoreduction of OCDD to 2,3,7,8-TCDD is not observed
- in solution, photodechlorination of 2,3,7,8-TCDD accounts for approximately 6% of the overall photolysis

ATTACHMENT 1

California Regional Water Quality Control Board
North Coast Region

ORDER NO. 86-3
ID NO. 1B85030RMEN

WASTE DISCHARGE REQUIREMENTS

For

GEORGIA-PACIFIC CORPORATION
FORT BRAGG SOIL AMENDMENT

Mendocino County

The California Regional Water Quality Control Board, North Coast Region (hereinafter Board) finds that:

1. Georgia-Pacific Corporation (hereinafter discharger) submitted a Report of Waste Discharge dated December 19, 1985.

2. The Report of Waste Discharge describes use of woodwaste ash, a nonhazardous decomposable waste, as a soil amendment using applicable Best Management Practices pursuant to Section 2511(f) of Title 23, Chapter 3, Subchapter 15 of the California Administrative Code. The woodwaste is generated by the power plant operated at the Georgia-Pacific sawmill. The soil amendment site is located in Little Valley within Sections 14, 22, 23, 24, and 26 of T19N, R17W, MDB&M on 330 acres of pasture land along Little Valley Creek. There will be occasional stockpiling of ash during inclement weather on an additional eight acre parcel in Section 14, T19N, R17W MDB&M adjacent to the South Fork of Ten Mile Creek. Drainage controls and management practices for incorporating the ash into the soil are designed to prevent a discharge of ash to surface streams.

3. Soils in the area of the soil amendment application are preliminarily classified as Shinglemill and Gibney, with 20 percent inclusions. Soil analyses have been conducted at the site on cation exchange capacity, base saturation, pH and other nutrient analyses.

4. The Board adopted the North Coastal Basin Water Quality Control Plan on March 20, 1975. The basin plan contains a prohibition against new waste discharges to all coastal streams and natural drainageways that flow directly to the ocean.

5. The beneficial uses of Little Valley Creek, Pudding Creek, and Ten Mile Creek include:

    a. municipal and domestic water supply
    b. agricultural water supply
    c. potential industrial service water supply
    d. potential industrial process water supply
    e. groundwater recharge

f. water contact recreation
g. non-contact water recreation
h. warm freshwater habitat
i. cold freshwater habitat
j. wildlife habitat
k. fish migration
l. fish spawning

6. The County of Mendocino has zoned this area as timber production and does not require a permit for a use of the land consistent with this zoning. The Board has determined that compliance with this Order will mitigate any potential adverse water quality impact.

7. The Board has notified the discharger and interested agencies and persons of its intent to prescribe waste discharge requirements for the proposed discharge and has provided them with an opportunity for a public meeting and an opportunity to submit their written views and recommendations.

8. The Board, in a public meeting, heard and considered all comments pertaining to the discharge.

THEREFORE, IT IS HEREBY ORDERED, that in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder, the discharger shall comply with the following:

A. PROHIBITIONS:

1. There shall be no discharge of ash to surface streams at any time.

B. SPECIFICATIONS:

1. There shall be no runoff of ash to land which is not controlled by the discharger.

2. The soil amendment usage of ash shall not cause a pollution or nuisance as defined in Section 13050 of the California Water Code.

3. No ash materials shall be deposited outside of the soil amendment areas shown on Attachment "A".

4. The soil amendment area shall be protected from any washout or erosion of ash or covering materials and from inundation which could occur as a result of floods having a predicted frequency of once in 100 years.

5. Annually, prior to the anticipated rainfall period, a cover crop shall be established in the soil amendment area to prevent erosion of the site.

6. During the rainy season, only the active area of ash placement shall be left exposed to rainfall. The active area shall not be excessively large for incorporation operations and vegetation establishment.

C. PROVISIONS:

1. The discharger shall maintain a copy of this Order so as to be available at all times to site operating personnel.

2. The discharger shall comply with the Contingency Planning and Notification Requirements Order No. 74-151 and the Monitoring and Reporting Program No. 86-3 and the General Provisions for Monitoring and Reporting, and any modifications to these documents as specified by the Executive Officer. Such documents are attached to this Order and incorporated herein. Monitoring and Reporting Program No. 86-3 shall be reviewed by staff at least annually and modified if appropriate, to ensure compliance with Section 13267(b) of the State Water Code.

3. In the event of any change in control or ownership of land used for soil amendment purposes presently owned or controlled by the discharger, the discharger shall notify the succeeding owner or operator of the existence of this Order by letter, a copy of which shall be forwarded to this Board.

4. The discharger shall submit to the Board by January 31 of each year an annual summary report presenting data from the previous year on total amount of ash applied, number of acres receiving ash, pertinent soil and ash analyses, and estimated pasture land yield.

5. The discharger shall file with the Board a Report of Waste Discharge at least 120 days before making any material change or proposed change in the character, location or volume of the soil amendment use of ash waste.

6. After notice and opportunity for a meeting, this Order may be terminated or modified for cause, including, but not limited to:

   a. violation of any term or condition contained in this Order;
   b. obtaining this Order by misrepresentation, or failure to disclose fully all relevant facts;
   c. a change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

7. The requirements prescribed herein do not authorize the commission of any act causing injury to the property of another, nor protect the discharger from his liabilities under Federal, State, or local laws, nor guarantee the discharger a capacity right in the receiving waters.

8. The discharger shall permit the Regional Board:

   a. entry upon premises in which the ash waste is stored or used in which any required records are kept;
   b. access to copy any records required to be kept under terms and conditions of this Order;
   c. inspection of monitoring equipment or records; and
   d. sampling of any discharge.

9. In the event the discharger is unable to comply with any of the conditions of this Order due to:

   a. breakdown of soil amendment application equipment;
   b. accidents caused by human error or negligence; or
   c. other causes such as acts of nature;

   the discharger shall notify the Executive Officer by telephone as soon as he or his agents have knowledge of the incident and confirm this notification in writing within two weeks of the telephone notification. The written notification shall include pertinent information explaining reasons for the noncompliance and shall indicate what steps were taken to correct the problem and the dates thereof, and what steps are being taken to prevent the problem from recurring.

10. This Order expires on January 30, 1990, and the discharger must file a Report of Waste Discharge in accordance with Title 23, California Administrative Code, not later than October 30, 1989.

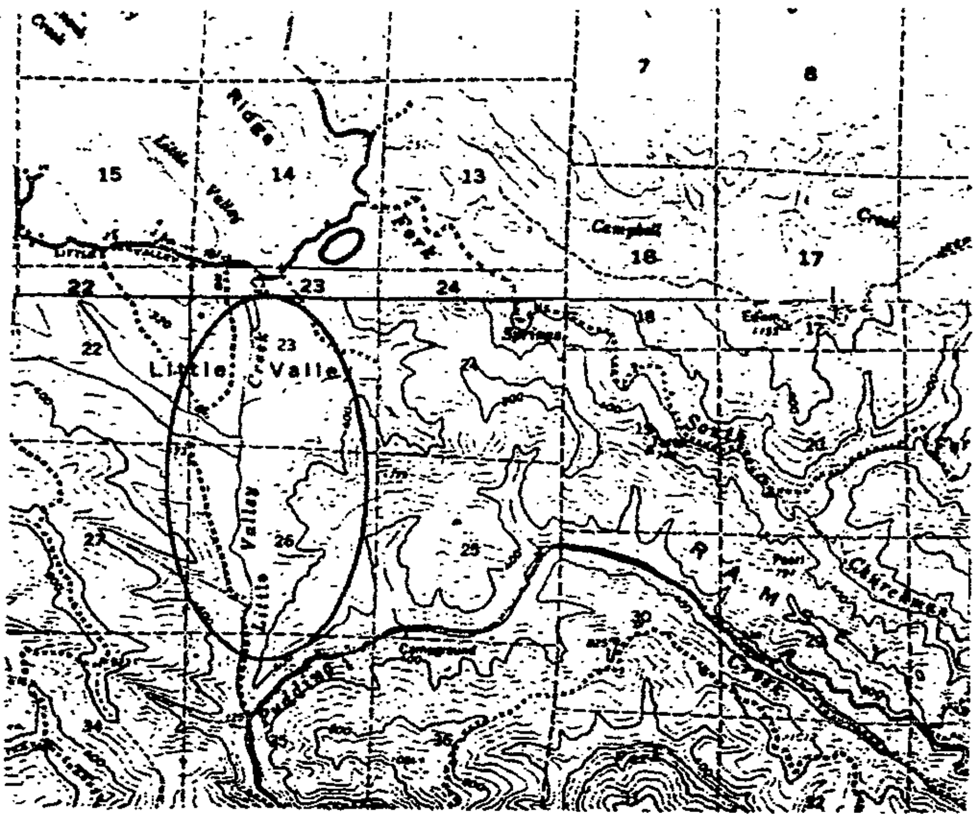
<u>Certification</u>

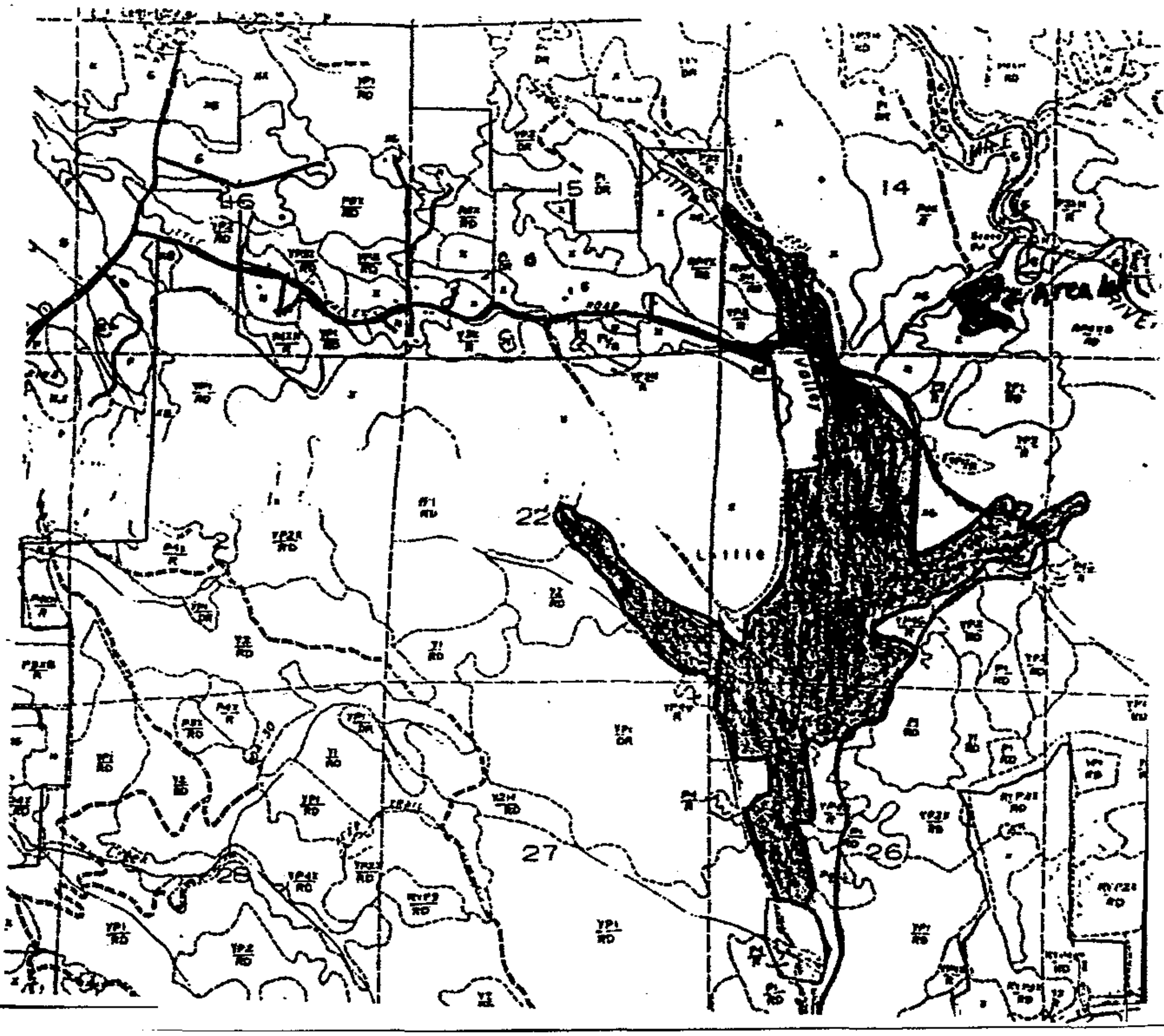
I, Benjamin D. Kor, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, North Coast Region, on January 30, 1986.

ORIGINAL SIGNED BY

Benjamin D. Kor
Executive Officer

ATTACHMENT "A"





California Regional Water Quality Control Board
North Coast Region

MONITORING AND REPORTING PROGRAM NO. 86-3

FOR

GEORGIA-PACIFIC CORPORATION
FORT BRAGG SOIL AMENDMENT

Mendocino County

Monitoring

The discharger shall record the approximate volume of ash deposited at the site each month, the approximate number of treated acres, and the approximate tons of ash stockpiled in area "W".

Stormwater Runoff Monitoring

Grab samples shall be taken periodically when streams are flowing from the points shown on the attached map. Samples shall be analyzed as follows:

Constituent	Units	Frequency
pH	pH units	weekly
COD	mg/l	November, January, March

Weekly rainfall totals shall also be recorded and reported.

Soils receiving ash shall be analyzed every October for CEC, percent base saturation, and pH at a depth of 0-1" and 11-12". An annual report shall be prepared each January 1 summarizing the water and soil analyses, amount of ash applied, the approximate number of acres receiving ash, and evidence of increased pasture land yield.

Reporting

Monitoring reports shall be submitted monthly to the Board by the fifteenth of the month. Copies of signed laboratory sheets shall be submitted with any monthly summary report.

Ordered by ORIGINAL SIGNED BY
Benjamin D. Kor
Executive Officer

January 30, 1986

STATE OF CALIFORNIA—HEALTH AND WELF. AGENCY

GEORGE DEUKMEJIAN, Govern

DEPARTMENT OF HEALTH SERVICES

714/744 P STREET
SACRAMENTO, CA 95814
(916) 324-1826

ATTACHMENT 2

APR 2 1 1983

Mr. Carl Johnson
Albert's Best
P.O. Box 1103
Fort Bragg, CA 95437

Dear Mr. Johnson:

This is in response to your letter of December 6, 1982 and the subsequent February 18, 1983 laboratory report provided by Georgia-Pacific Corporation.

You request, based upon the information provided, that the ash to be produced by the burning of wood by-products at the Georgia-Pacific Fort Bragg Mill be classified as nonhazardous waste. We have reviewed your request and the information provided by Georgia-Pacific and its conformance to the provisions outlined in our policy letter of November 2, 1982 for obtaining a nonhazardous classification for biomass ash.

Based on the information provided, we feel your project has met the criteria as outlined. Pursuant to the provisions of Title 22, Section 66305(b) of the California Administrative Code, the fly ash, bottom ash and flue gas emission control residue generated by the burning of wood by-products at the Georgia-Pacific Fort Bragg Mill is hereby classified as nonhazardous.

This classification is contingent upon the facility providing adequate operating measures to prevent hazardous wastes from entering the combustion process. We will request that the State Solid Waste Management Board include such a provision in the facility permit issued pursuant to Government Code Section 66796.30 et seq.

Please be aware that while this classification exempts the waste ash from the hazardous waste regulations of the Department, the requirements of the Regional Water Quality Control Board and other agencies must be complied with.

Sincerely,

ORIGINAL SIGNED BY
R[illegible] P. WILCOXON

Richard P. Wilcoxon
Acting Deputy Director
Toxic Substances Control Division

cc: See attached list.

State of California

ATTACHMENT 3

Memorandum

To : Craig Johnson
Assistant Executive Officer
North Coast Regional Board

Date : JAN 26 1988

Harold

Harold J. Singer, Chief
Land Disposal Branch
Division of Water Quality

From : **STATE WATER RESOURCES CONTROL BOARD**

Subject: **CLASSIFICATION OF FLY ASH FROM GEORGIA PACIFIC CORPORATION, FORT BRAGG, CALIFORNIA**

Your memorandum of November 2, 1987 concerning disposal of fly ash generated by the Georgia-Pacific Corporation power plant at Fort Bragg requested assistance in assessing the concentrations of tetrachlorodibenzofuran (TCDF) recently reported in the fly ash and the potential risk to water quality posed by this substance. Your memorandum was referred to Dr. Frank Palmer of the Investigations Branch and to Bud Eagle, Program Manager for Subchapter 15. I have attached Dr. Palmer's comments which indicate that the highest exposure and risks from TCDF may be related to bioaccumulation and food chain exposure and that TCDFs would be considered nondegradable when compared to typical organic material. This information raises a question as to whether the fly ash represents a threat to water quality and, consequently, whether it should be classified as nonhazardous.

Subsection 2511(f) of Subchapter 15 provides that if certain conditions are satisfied, decomposable nonhazardous waste may be used as a soil amendment. However, it now appears that if this fly ash is added to soil it could result in toxic conditions in plants and animals as the result of bioaccumulation. Our opinion is that this waste does not meet the "decomposable" criterion required for an exemption under Subsection 2511(f) considering that TCDF is essentially a nondecomposable and possibly toxic constituent of the waste which may concentrate in the soil when decomposable constituents of the fly ash infiltrate into lower layers.

If you or your staff have questions or wish to discuss this matter further, please contact Bud Eagle at ATSS 492-0205.

Attachment

Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

WATER QUALITY
CONTROL BOARD
REGION I

NOV 19 '87

CJ
FR FR
RT
JH
BB
JG
REPLY

November 18, 1987

Ms. Susan Warner
California Regional Water
Quality Control Board
1140 Guerneville Road
Santa Rosa, CA 95403

Dear Ms. Warner:

Just a note of clarification on the Little Valley stockpile area map. There is no formal drainage ditch between the stockpile and the stream, but this entire area has been ripped, effectively ditching the area several times over. You may remember the broken character of the ground when we reviewed the area.

Also, we had some difficulties with Anatec's handling of our Truck Wash Pond account (notably that they were very late). I anticipate submitting results to you by the end of this week.

Sincerely,

Steven Petrin, Director
Environmental Health & Safety
California Wood Products

SP:db

cc: D. Jacobszoon

UNIVERSITY OF NEVADA-RENO

Department of Biochemistry
University of Nevada-Reno
Reno, Nevada 89557-0014
(702) 784-6031

Nov. 10, 1987

Dr. Cate Jenkins
MD-WH562B
Office of Solid Waste Emergency Response
U.S. Environmental Protection Agency
401 M. St. S.W.
Washington D.C. 20460

Dear Cate,

Richard Zepp informed me of the Greenpeace memorandum regarding our presentation at the Dioxin '87 meetings in Las Vegas. I'm enclosing the slides of that presentation, an abstract, and also a reprint of the dioxin chemistry article that came out of the ACS symposium. I am in the process of writing up the OCDD to TCDD work for the Chemosphere symposium publicaton and will send you a prepublication copy when it is completed.

Sincerely,

Glenn C. Miller,
Associate Professor

PLS RETURN TO MKN.

Photolysis of Octachlorodibenzo-p-dioxin on Soils: Production of 2,3,7,8-TCDD

Glenn C. Miller and Vincent R. Hebert
Department of Biochemistry
University of Nevada, Reno, Nevada 89557

Michael J. Miille and Robert Mitzel
Enseco-Cal Lab
2533 Industrial Blvd.
Sacramento, California 95691

Richard G. Zepp
Environmental Research Laboratory
U.S. Environmental Protection Agency
Athens, Georgia 30615

Octachlorodibenzo-p-dioxin (OCDD) is a contaminant of the widely used wood preservative pentachlorophenol (PCP). PCP and OCDD contamination of soils have occurred in many areas where PCP has been used, particularly at lumber mill sites. In solution, OCDD absorbs sunlight and undergoes photolysis to lower chlorinated products. Conflicting results have been published on whether this dechlorination occurs predominantly at the 2,3,7,8 or on the 1,4,6,9 positions. Dechlorination occurring predominantly at the 1,4,6,9 positions will result in formation of the highly toxic tetra-, penta- and hexa-chlorinated dibenzo-p-dioxins.

This research was designed to determine the degree to which the toxic 2,3,7,8-chlorinated congeners were formed on irradiation of OCDD on soils in relation to the total amount of the various tetra-, penta and hexa-chlorinated congeners produced.

Laboratory irradiations were performed on two sandy loam soils fortified at 10ppm OCDD. The first was a northeastern Montana soil (2.2% organic matter) and the second was a Riverside, California soil (0.49% organic matter). Each soil was evenly spread in petri dishes at 0.25mm thickness and irradiated under a light bank constructed of 16 Westinghouse FS40 sunlamps. These lamps were arranged to provide an even light field while maintaining constant temperature at 30 C. Treatment and dark controls were exposed for 0, 5, 10, and 20 day intervals. Samples were extracted with 20% methanol in hexane. The extracted PCDD isomers were quantitated by high resolution gas chromatography low resolution mass spectroscopy using a 60m DB-5 fused silica capillary column. Qualitative and quantitative confirmation of the tetra- through hexa-chlorinated isomers was obtained by separation on a 60m x 0.25mm fused silica SP-2331 column with mass spectrometric quantitation.

In all of the experiments, 30-40% loss of OCDD was apparent after five days of irradiation. No significant additional loss was observed at the 10 or 20 day exposures, which suggest that the remaining OCDD was protected from photolysis. This also indicates that volatilization was minimal from the 0.25 mm deep soils. The concentrations of the lower chlorinated congeners, however, increased slightly from 5 to 20 days exposure. On day 20 the concentrations of OCDD and the lower chlorinated products are presented below for the Montana soil. These are average of four samples. The results for the Riverside soil are similar. Also present are the results of irradiation of a 26,000 ng/ml ppb solution of OCDD under the same lamp bank for a four hour period.

	Montana soil 20-day exposure (average of 4 samples) (ng/gm)	Toluene solution 4 hour irradiation (ng/ml)
tetra (total)	1.48	ND
2,3,7,8	0.76	ND
penta (total)	19.4	9.3
1,2,3,7,8	5.0	ND
hexa (total)	71.3	18.1
2,3,7,8 substi.	18.5	ND
hepta (total)	261	7560
1,2,3,4,6,7,8	111	163
octa	6975	14400

These results support two general observations. First, photolysis is slow on the soils, and dechlorination at the 1,4,6,9 positions is preferred over that at the 2,3,7,8 positions. This is particularly evident for the tetra- and penta-chlorinated congeners. Approximately half of the total amount of tetra isomers is 2,3,7,8-TCDD. This is a substantial enhancement, since 22 separate TCDD isomers exist. Of the heptachlorinated isomers, no enhanced concentration of the 2,3,7,8 chlorinated isomers was observed. Second, the photochemistry on soils was observed to be significantly different than in solution. Very little of the 2,3,7,8-chlorinated congeners was evident, and even for the heptachlorinated congener, less than 3% was substituted at the 2,3,7,8 positions.

Slides from

"Photolysis of Octachlorodibenzo-p-dioxin on Soils: Production of 2,3,7,8-TCDD"

Glenn C. Miller and Vincent R. Hebert
Department of Biochemistry
University of Nevada, Reno, NV

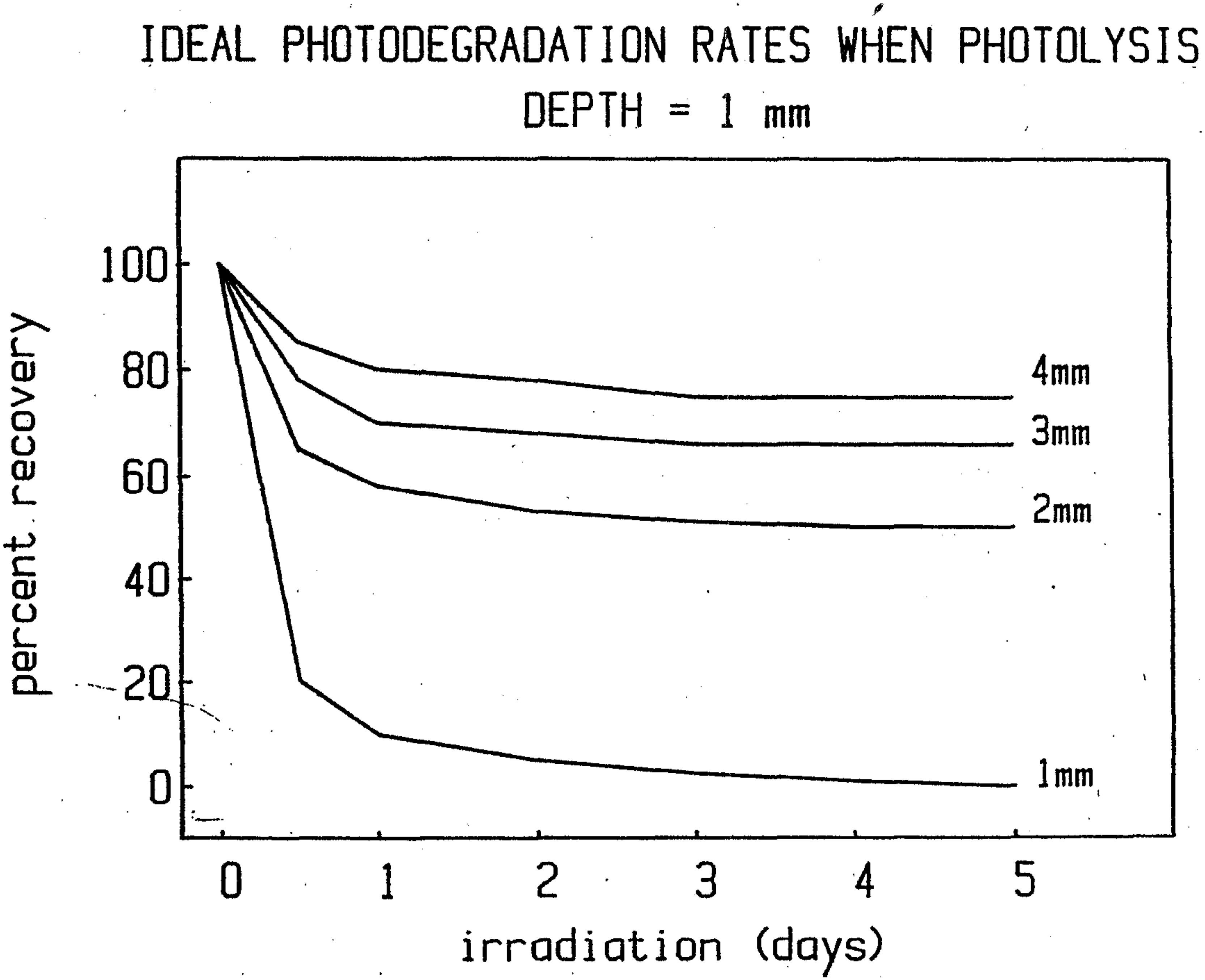
Michael J. Miille and Robert Mitzel
Enseco-Cal Lab
2533 Industrial Blvd.
Sacremento, CA

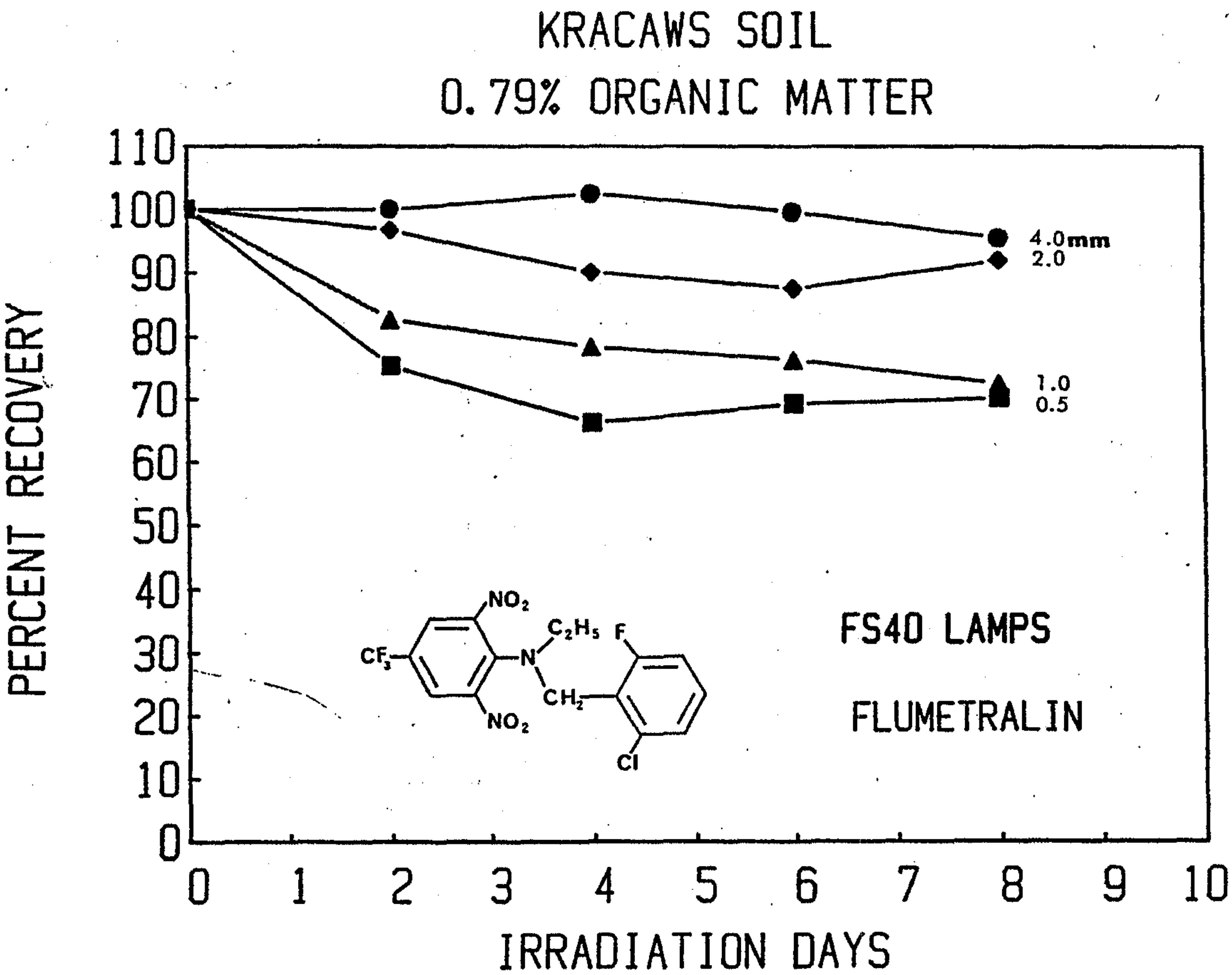
Richard G. Zepp
Environmental Research Laboratory
U.S. Environmental Protection Agency
Athens, GA

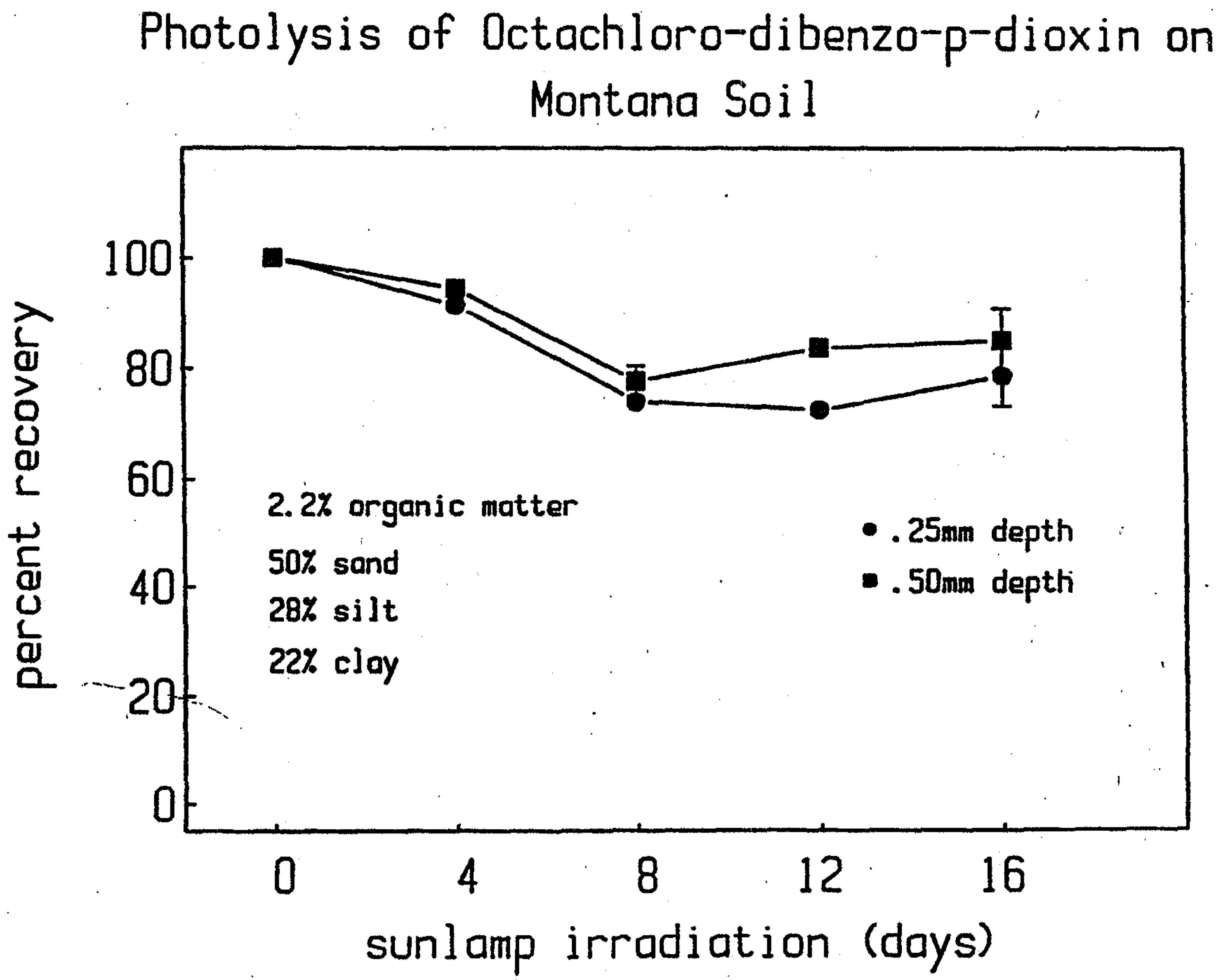
Presented at Dioxin '87 Conference in Las Vegas, NV
October 1987

Considerations of Photolysis on Soil Surfaces

- soils are a complicated, non-homgeneous matrix
- first order rates are not observed
- surface heating can exceed 50 C
- transport to the exposed surface may control photolysis rates
- direct and indirect processes may be involved

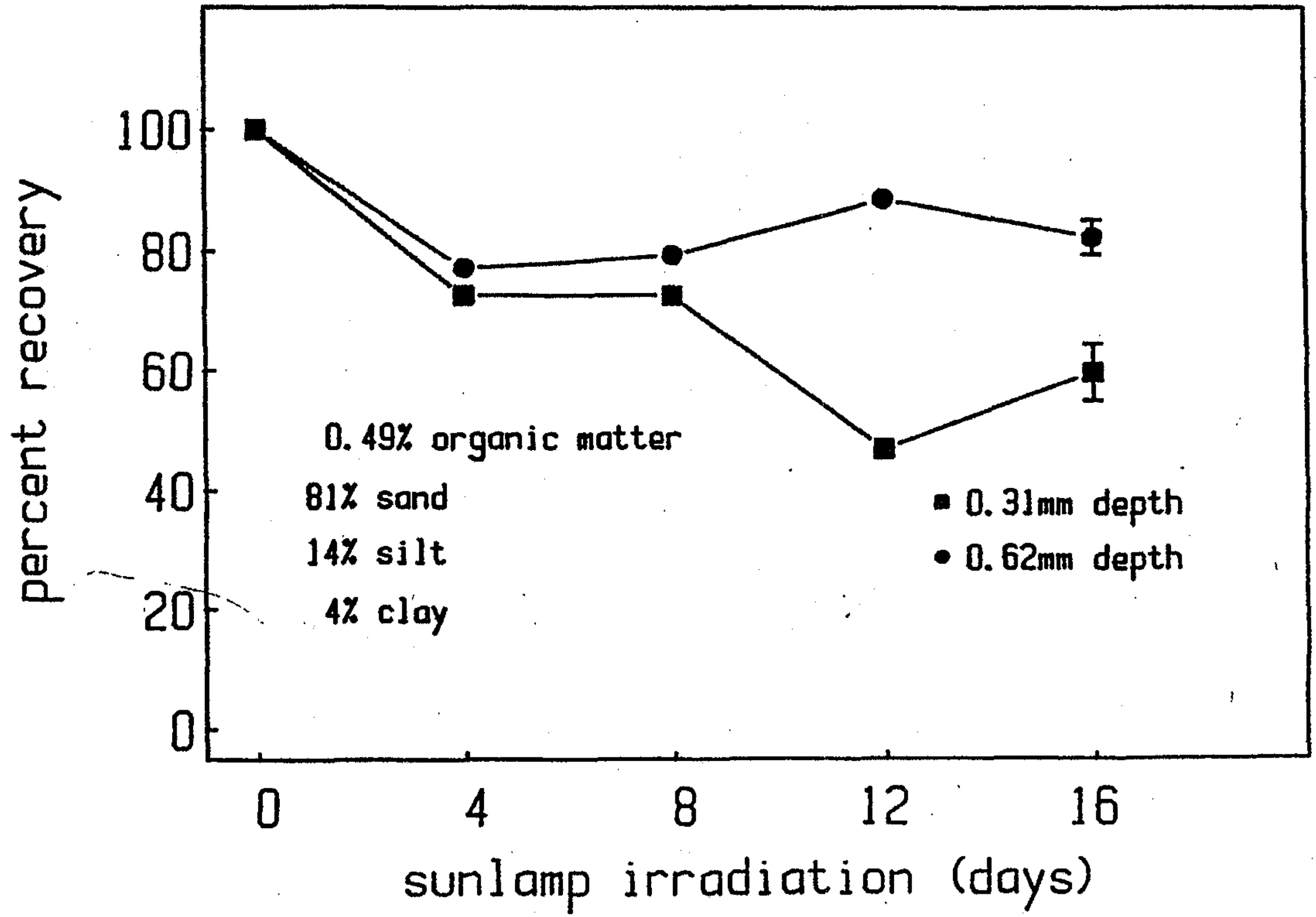

IDEAL PHOTODEGRADATION RATES WHEN PHOTOLYSIS
DEPTH = 1 mm
percent recovery
100
80
60
40
20
0
0
1
2
3
4
5
irradiation (days)
4mm
3mm
2mm
1mm

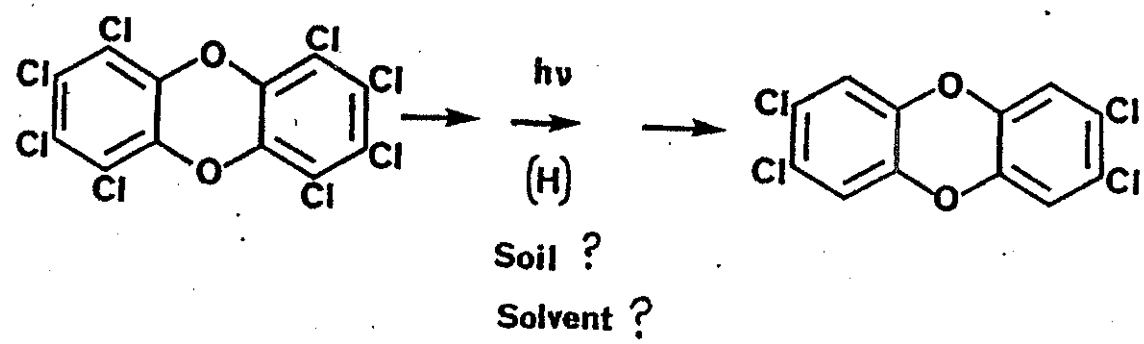

KRACAWS SOIL
0.79% ORGANIC MATTER
PERCENT RECOVERY
110
100
90
80
70
60
50
40
30
20
10
0
0
1
2
3
4
5
6
7
8
9
10
IRRADIATION DAYS
4.0mm
2.0
1.0
0.5
NO_2
C_2H_5
F
CF_3
N
CH_2
NO_2
Cl
FS40 LAMPS
FLUMETRALIN



Photolysis of Octachloro-dibenzo-p-dioxin on
Montana Soil
percent recovery
100
80
60
40
20
0
0
4
8
12
16
sunlamp irradiation (days)
2.2% organic matter
50% sand
28% silt
22% clay
.25mm depth
.50mm depth

Photolysis of Octachlorodibenzo-p-dioxin on Tajunga Soil




hν
(H)
Soil ?
Solvent ?

PHOTODECHLORINATION OF OCTACHLORODIBENZO-p-DIOXIN ON MONTANA SOIL UNDER FS40 LAMPS

	Days of Exposure			
Dioxin	0	5	10	20*
octa	10500 ng/gm	6550 ng/gm	7250 ng/gm	6940 ng/gm
hepta total	34	190	220	253
(1234678)	14	81	97	109
hexa total	(<0.12)	33	45	75
(123478)		2.2	4.3	6.1
(123678)		2.7 > 8.3	3.8 > 13	6.1 > 19
(123789)		3.4	5.0	7.0
penta total	(<0.13)	4.3	10.1	19
(12378)		1.5	2.1	5.2
tetra total	(<0.087)	0.55	0.64	1.5
(2378)		(<0.34)	0.39	0.86

*average of duplicate samples

PHOTODECHLORINATION OF OCTACHLORODIBENZO-p-DIOXIN ON MONTANA SOIL UNDER FS40 LAMPS WITH 0.1% ETHYL OLEATE

Days of Exposure

Dioxin	0*	5	10	20*
octa	9845ng/gm	6800 ng/gm	4750 ng/gm	7000 ng/gm
hepta total	36	214	193	269
(1234678)	15	90	86	115
hexa total	(<0.12)	36	52	67
(123478)		3.0	5.4	6.7
(123678)		2.6 > 9.1	5.4 > 15	5.5 > 19
(123789)		3.5	3.7	6.7
penta total	(<0.13)	7.0	11	19
(12378)		2.1	2.0	4.9
tetra total	(<0.087)	0.57	(<0.35)	1.5
(2378)		0.34		0.66

* average of duplicate samples

PHOTODECHLORINATION OF OCTACHLORODIBENZO-p-DIOXIN ON TAHUNGA SOIL UNDER FS40 LAMPS

	Days of Exposure			
Dioxin	0	5	10	20*
octa	9580 ng/gm	5510 ng/gm	5750 ng/gm	5570 ng/gm
hepta total	36	293	304	318
(1234678)	14	132	140	146
hexa total	(<0.24)	58	67	75
(123678+123478)		11 — 18	13 — 21	15.2 — 24
(123789)		7.1	7.9	8.7
penta total	(<0.32)	14.8	12.0	15.6
(12378)		4.4	3.4	4.6
tetra total	(<0.042)	1.5	1.5	2.0
(2378)		0.94	1.1	1.2

*average of duplicate samples

PHOTODECHLORINATION OF OCTACHLORODIBENZO-p-DIOXIN ON TAJUNGA SOIL CONTAINING 0.1% ETHYL OLEATE UNDER FS40 LAMPS

Days of Exposure

Dioxin	0	5	10	20*
octa	9365 ng/gm	6260 ng/gm	6920 ng/gm	6080 ng/gm
hepta total	42	305	233	340
(1234678)	17	96	102	116
hexa total	(<0.27)	50	49	53
(123478)		2.7	3.5	3.9
(123678)		2.2 8.7	3.7 11	3.6 12
(123789)		3.8	3.7	4.8
penta total	(<0.43)	6.6	7.7	7.9
(12378)		0.88	2.4	1.9
tetra total	(<0.050)	0.60	0.70	0.63
(2378)		0.25	0.39	0.41

*average of duplicate samples

PHOTODECHLORINATION OF OCTACHLORODIBENZO-p-DIOXIN
IN ISOOCTANE UNDER FS40 LAMPS

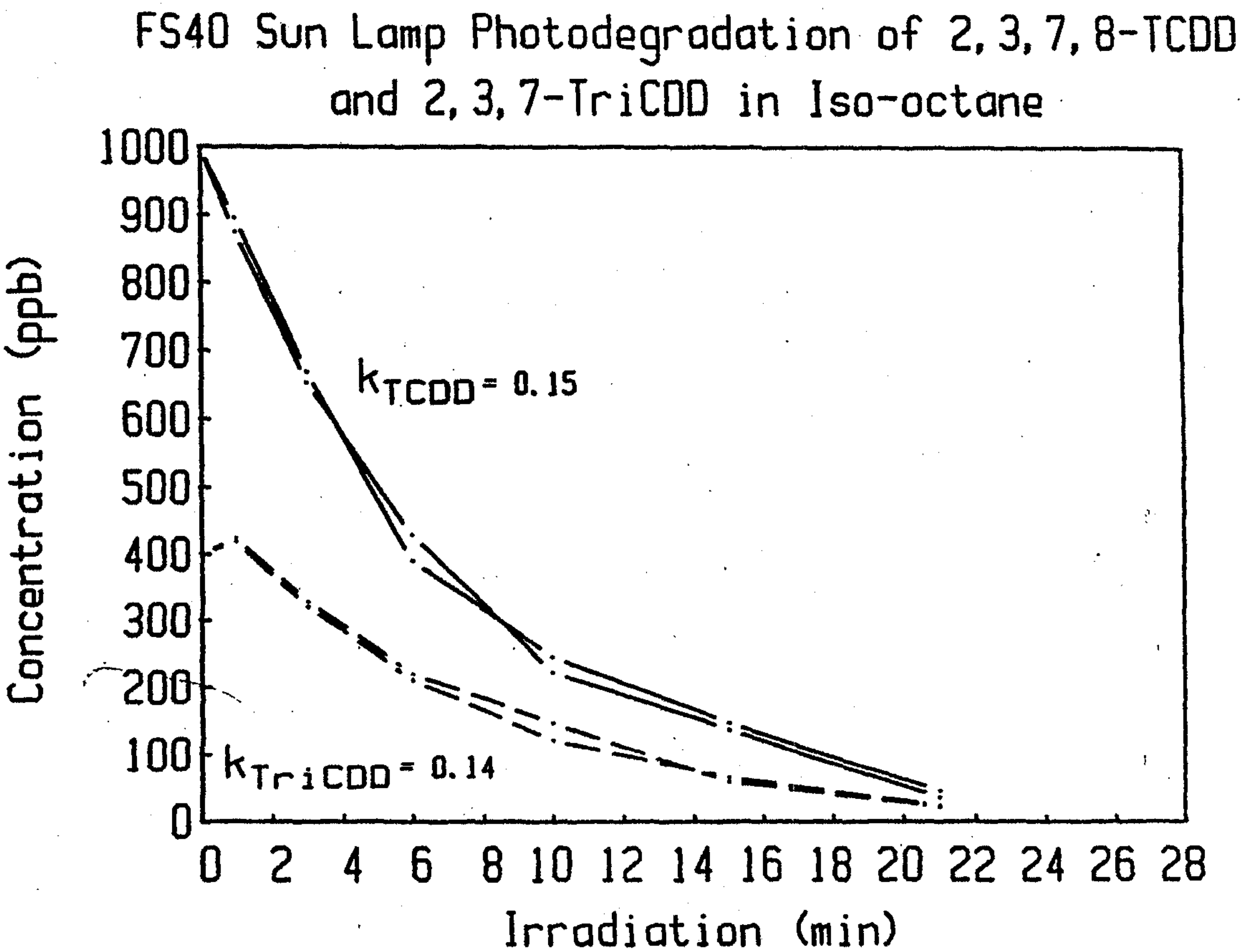
	Hours of Exposure		
Dioxin	0	4	12
octa	25900 ng/mL	14400 ng/mL	3500 ng/mL
hepta total	30	7560	6360
(1234678)	8.3	163	110
hexa total	(<0.47)	18	2130
(123678)			1.6
penta total	(<0.28)	9.3	24
tetra total	(<0.11)	(<1.9)	(<3.4)

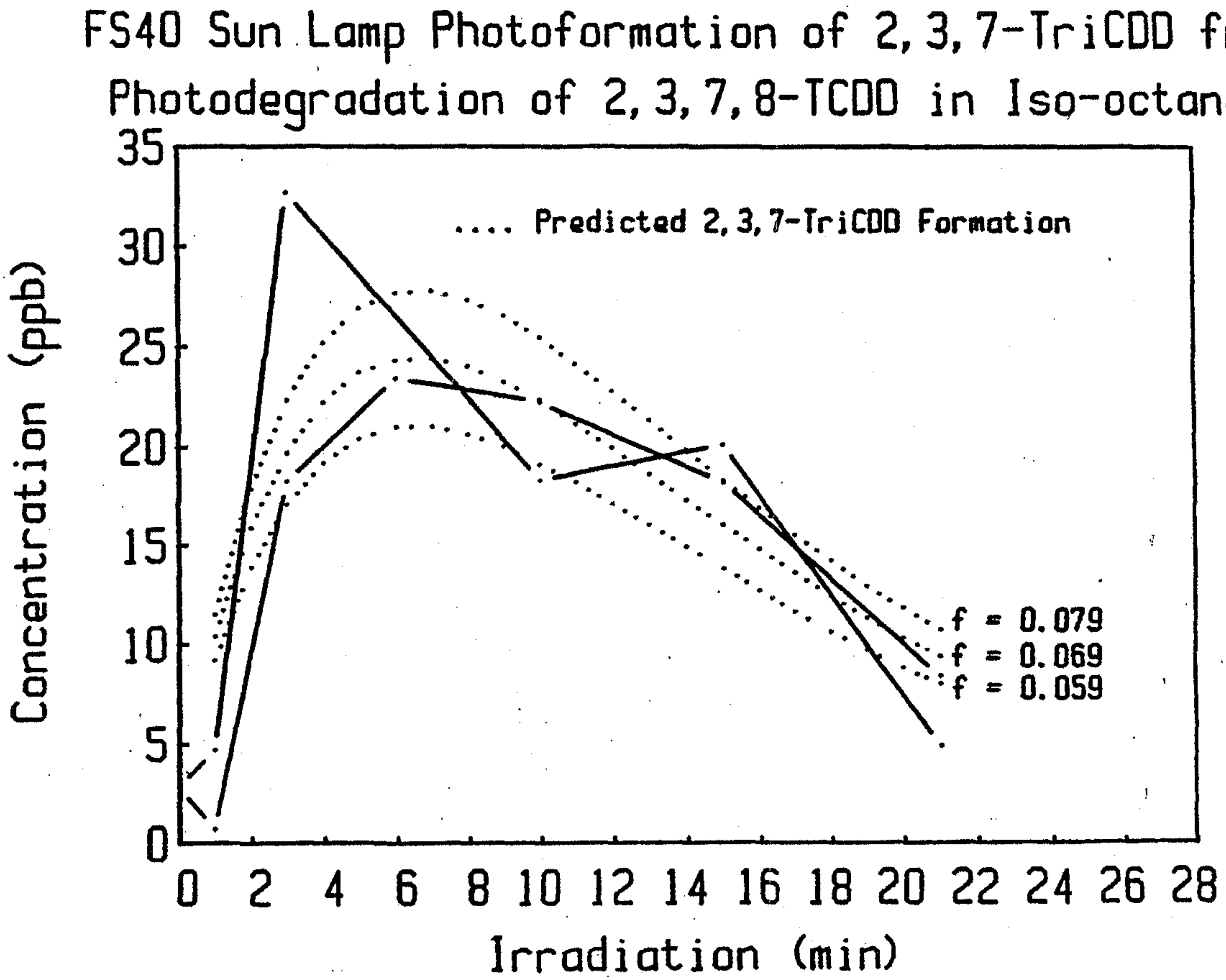
$$A \xrightarrow{h\nu} B \longrightarrow \text{other products}$$

The fraction of A that is converted to B is :

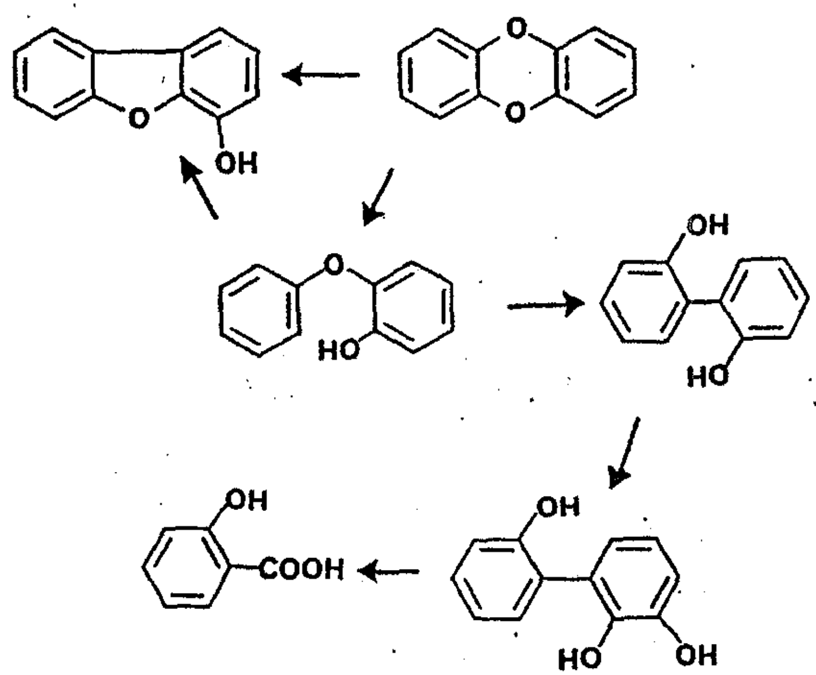
$$f = \frac{k_A\ [A]}{k_B\ [B]}$$

when k_A and k_B are first order rate constants for loss of A and B, and
[A] and [B] are concentrations when [B] is maximized


FS40 Sun Lamp Photodegradation of 2,3,7,8-TCDD
and 2,3,7-TriCDD in Iso-octane
Concentration (ppb)
1000
900
800
700
600
500
400
300
200
100
0
k_{TCDD} = 0.15
k_{TriCDD} = 0.14
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
Irradiation (min)



FS40 Sun Lamp Photoformation of 2,3,7-TriCDD from
Photodegradation of 2,3,7,8-TCDD in Iso-octane
.... Predicted 2,3,7-TriCDD Formation
f = 0.079
f = 0.069
f = 0.059
Concentration (ppb)
Irradiation (min)
0
5
10
15
20
25
30
35
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28



PHOTODEGRADATION PATHWAYS OF DIBENZO-P-DIOXIN
USING 254 NM RADIATION

MASSE' AND PELLETIER
(CHEMOSPHERE 16:7-17, 1987)

CONCLUSIONS

- the mean photolysis depth of OCDD in soils is 0.1-0.3 mm
- on soils, photoreduction of OCDD to 2,3,7,8-TCDD is observed, and 2,3,7,8-TCDD is a major tetrachlorinated isomer observed
- in solution, photoreduction of OCDD to 2,3,7,8-TCDD is not observed
- in solution, photodechlorination of 2,3,7,8-TCDD accounts for approximately 6% of the overall photolysis

ATTACHMENT 1

California Regional Water Quality Control Board
North Coast Region

ORDER NO. 86-3
ID NO. 1B85030RMEN

WASTE DISCHARGE REQUIREMENTS

For

GEORGIA-PACIFIC CORPORATION
FORT BRAGG SOIL AMENDMENT

Mendocino County

The California Regional Water Quality Control Board, North Coast Region (hereinafter Board) finds that:

1. Georgia-Pacific Corporation (hereinafter discharger) submitted a Report of Waste Discharge dated December 19, 1985.

2. The Report of Waste Discharge describes use of woodwaste ash, a nonhazardous decomposable waste, as a soil amendment using applicable Best Management Practices pursuant to Section 2511(f) of Title 23, Chapter 3, Subchapter 15 of the California Administrative Code. The woodwaste is generated by the power plant operated at the Georgia-Pacific sawmill. The soil amendment site is located in Little Valley within Sections 14, 22, 23, 24, and 26 of T19N, R17W, MDB&M on 330 acres of pasture land along Little Valley Creek. There will be occasional stockpiling of ash during inclement weather on an additional eight acre parcel in Section 14, T19N, R17W MDB&M adjacent to the South Fork of Ten Mile Creek. Drainage controls and management practices for incorporating the ash into the soil are designed to prevent a discharge of ash to surface streams.

3. Soils in the area of the soil amendment application are preliminarily classified as Shinglemill and Gibney, with 20 percent inclusions. Soil analyses have been conducted at the site on cation exchange capacity, base saturation, pH and other nutrient analyses.

4. The Board adopted the North Coastal Basin Water Quality Control Plan on March 20, 1975. The basin plan contains a prohibition against new waste discharges to all coastal streams and natural drainageways that flow directly to the ocean.

5. The beneficial uses of Little Valley Creek, Pudding Creek, and Ten Mile Creek include:

   a. municipal and domestic water supply
   b. agricultural water supply
   c. potential industrial service water supply
   d. potential industrial process water supply
   e. groundwater recharge

f. water contact recreation
g. non-contact water recreation
h. warm freshwater habitat
i. cold freshwater habitat
j. wildlife habitat
k. fish migration
l. fish spawning

6. The County of Mendocino has zoned this area as timber production and does not require a permit for a use of the land consistent with this zoning. The Board has determined that compliance with this Order will mitigate any potential adverse water quality impact.

7. The Board has notified the discharger and interested agencies and persons of its intent to prescribe waste discharge requirements for the proposed discharge and has provided them with an opportunity for a public meeting and an opportunity to submit their written views and recommendations.

8. The Board, in a public meeting, heard and considered all comments pertaining to the discharge.

THEREFORE, IT IS HEREBY ORDERED, that in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder, the discharger shall comply with the following:

A. PROHIBITIONS:

1. There shall be no discharge of ash to surface streams at any time.

B. SPECIFICATIONS:

1. There shall be no runoff of ash to land which is not controlled by the discharger.

2. The soil amendment usage of ash shall not cause a pollution or nuisance as defined in Section 13050 of the California Water Code.

3. No ash materials shall be deposited outside of the soil amendment areas shown on Attachment "A".

4. The soil amendment area shall be protected from any washout or erosion of ash or covering materials and from inundation which could occur as a result of floods having a predicted frequency of once in 100 years.

5. Annually, prior to the anticipated rainfall period, a cover crop shall be established in the soil amendment area to prevent erosion of the site.

6. During the rainy season, only the active area of ash placement shall be left exposed to rainfall. The active area shall not be excessively large for incorporation operations and vegetation establishment.

C. PROVISIONS:

1. The discharger shall maintain a copy of this Order so as to be available at all times to site operating personnel.

2. The discharger shall comply with the Contingency Planning and Notification Requirements Order No. 74-151 and the Monitoring and Reporting Program No. 86-3 and the General Provisions for Monitoring and Reporting, and any modifications to these documents as specified by the Executive Officer. Such documents are attached to this Order and incorporated herein. Monitoring and Reporting Program No. 86-3 shall be reviewed by staff at least annually and modified if appropriate, to ensure compliance with Section 13267(b) of the State Water Code.

3. In the event of any change in control or ownership of land used for soil amendment purposes presently owned or controlled by the discharger, the discharger shall notify the succeeding owner or operator of the existence of this Order by letter, a copy of which shall be forwarded to this Board.

4. The discharger shall submit to the Board by January 31 of each year an annual summary report presenting data from the previous year on total amount of ash applied, number of acres receiving ash, pertinent soil and ash analyses, and estimated pasture land yield.

5. The discharger shall file with the Board a Report of Waste Discharge at least 120 days before making any material change or proposed change in the character, location or volume of the soil amendment use of ash waste.

6. After notice and opportunity for a meeting, this Order may be terminated or modified for cause, including, but not limited to:

   a. violation of any term or condition contained in this Order;
   b. obtaining this Order by misrepresentation, or failure to disclose fully all relevant facts;
   c. a change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

7. The requirements prescribed herein do not authorize the commission of any act causing injury to the property of another, nor protect the discharger from his liabilities under Federal, State, or local laws, nor guarantee the discharger a capacity right in the receiving waters.

8. The discharger shall permit the Regional Board:

   a. entry upon premises in which the ash waste is stored or used in which any required records are kept;
   b. access to copy any records required to be kept under terms and conditions of this Order;
   c. inspection of monitoring equipment or records; and
   d. sampling of any discharge.

9. In the event the discharger is unable to comply with any of the conditions of this Order due to:

   a. breakdown of soil amendment application equipment;
   b. accidents caused by human error or negligence; or
   c. other causes such as acts of nature;

   the discharger shall notify the Executive Officer by telephone as soon as he or his agents have knowledge of the incident and confirm this notification in writing within two weeks of the telephone notification. The written notification shall include pertinent information explaining reasons for the noncompliance and shall indicate what steps were taken to correct the problem and the dates thereof, and what steps are being taken to prevent the problem from recurring.

10. This Order expires on January 30, 1990, and the discharger must file a Report of Waste Discharge in accordance with Title 23, California Administrative Code, not later than October 30, 1989.

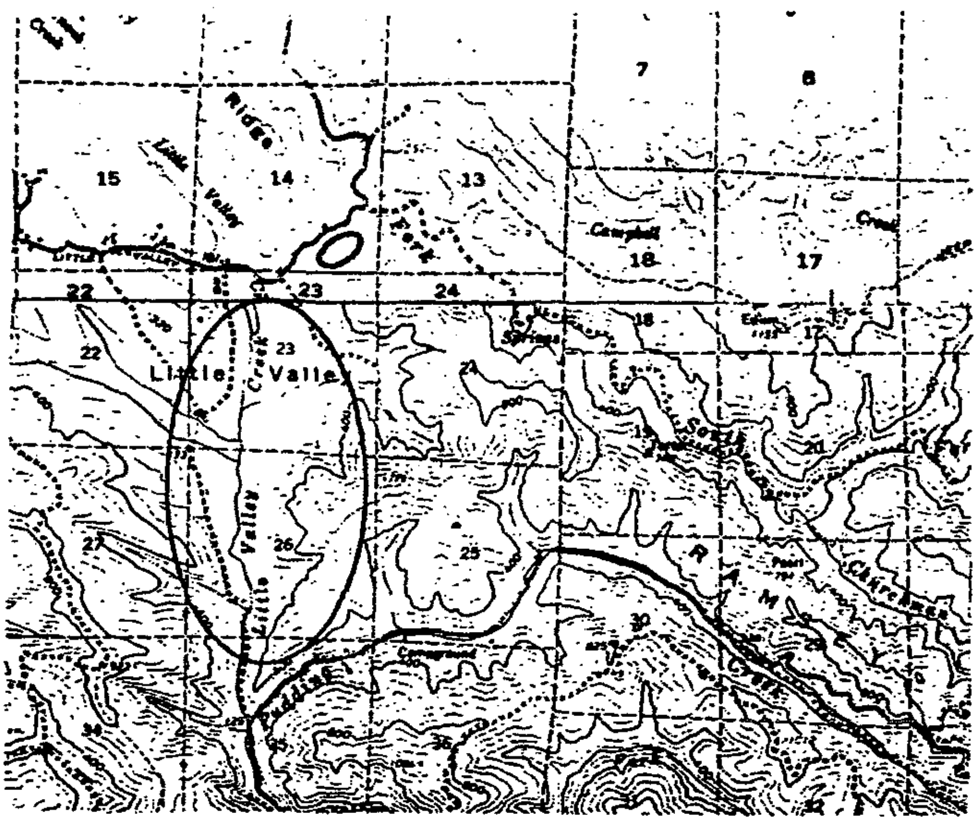
<u>Certification</u>

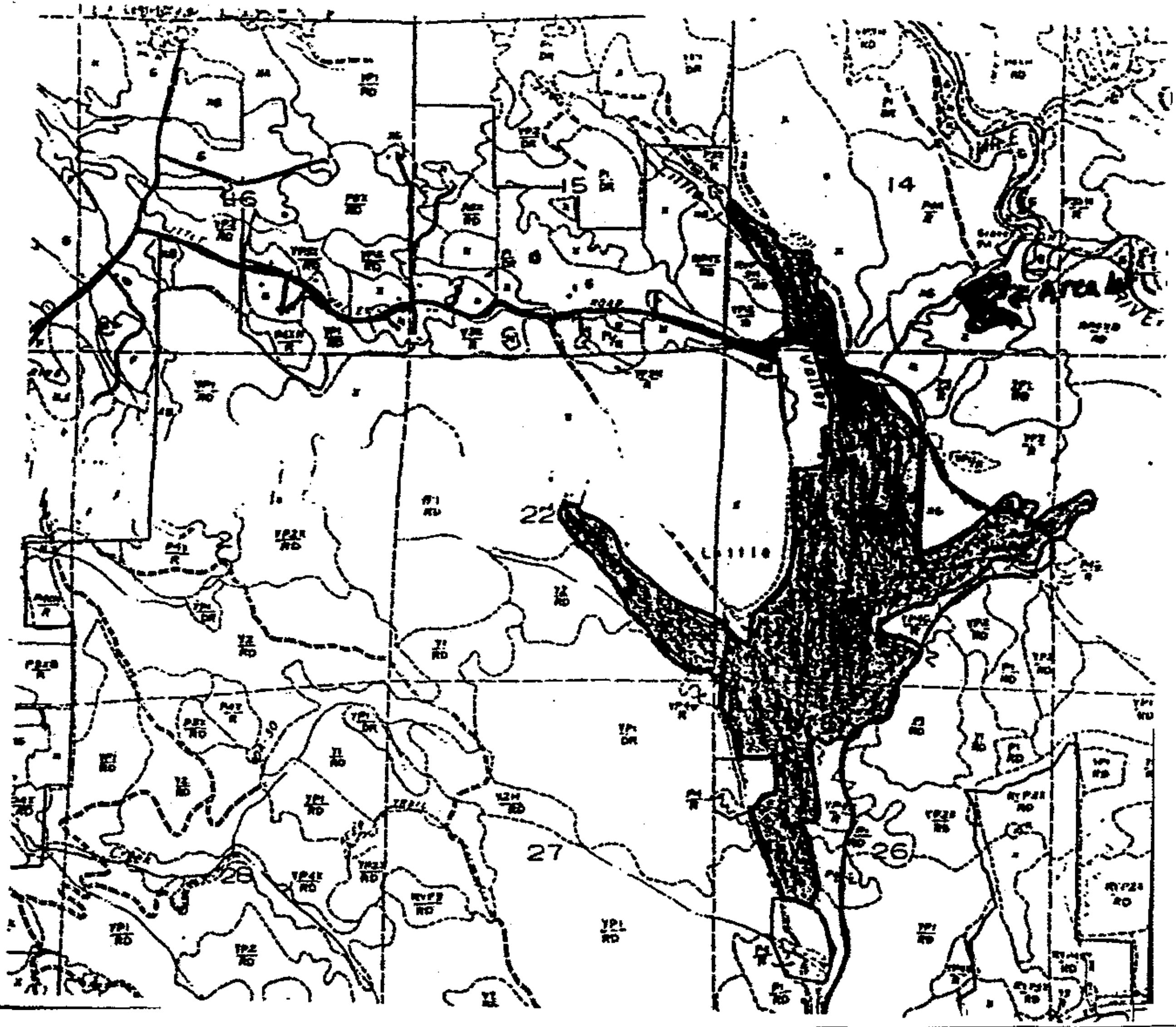
I, Benjamin D. Kor, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, North Coast Region, on January 30, 1986.

ORIGINAL SIGNED BY

Benjamin D. Kor
Executive Officer

ATTACHMENT "A"





California Regional Water Quality Control Board
North Coast Region

MONITORING AND REPORTING PROGRAM NO. 86-3

FOR

GEORGIA-PACIFIC CORPORATION
FORT BRAGG SOIL AMENDMENT

Mendocino County

Monitoring

The discharger shall record the approximate volume of ash deposited at the site each month, the approximate number of treated acres, and the approximate tons of ash stockpiled in area "W".

Stormwater Runoff Monitoring

Grab samples shall be taken periodically when streams are flowing from the points shown on the attached map. Samples shall be analyzed as follows:

Constituent	Units	Frequency
pH	pH units	weekly
COD	mg/l	November, January, March

Weekly rainfall totals shall also be recorded and reported.

Soils receiving ash shall be analyzed every October for CEC, percent base saturation, and pH at a depth of 0-1" and 11-12". An annual report shall be prepared each January 1 summarizing the water and soil analyses, amount of ash applied, the approximate number of acres receiving ash, and evidence of increased pasture land yield.

Reporting

Monitoring reports shall be submitted monthly to the Board by the fifteenth of the month. Copies of signed laboratory sheets shall be submitted with any monthly summary report.

Ordered by ORIGINAL SIGNED BY
Benjamin D. Kor
Executive Officer

January 30, 1986

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ATT # 6

DRILL, FRIESS, HAYS, LOOMIS & SHAFFER, INC.
CONSULTANTS IN TOXICOLOGY

Chicago Office
1620 Meadow Lane
Glenview, Il. 60025
(312) 724-5468

1901 N. Fort Myer Drive
Suite 704
Arlington, Virginia 22209
Phone (703) 527-6450

Seattle Office
2707 E. Becker Rd.
Clinton, Wa. 98236
(206) 321-5175

MEMORANDUM

November 22, 1987

To: C. T. "Kip" Howlett, Esq.
Director, Government Affairs
Georgia-Pacific Corporation
International Square
1875 Eye Street, N.W.
Washington, D.C. 20006

From: S. L. Friess S. L. Friess

Subject: Fort Bragg, CA fly ash problem

1. I have now had occasion to review analytical results, EPA documents, memoranda and California documents relative to the Fort Bragg problem. From the recent analytical results, it is clear that the fly ash contains trace levels (ng/g of ash) of polychlorinated dibenzofurans (PCDFs).

2. It is my opinion that EPA is proceeding on a very reasonable course in treating potential health hazards from PCDFs in the environment by translating the hazards into "2378-TCDD equivalence" through the use of structure-specific toxicity equivalence factors (TEFs). As the Table 1 entries from the EPA document indicate, the EPA congener-specific TEF values are in the range 0 - 0.1 for those compounds in the tetra-, penta-, hexa-, hepta- and octa-PCDF series which possess the minimum core structure of four chlorine atoms at the 2, 3, 7 and 8 positions on the rings. Lacking a complete filling of these positions, the TEF values drop sharply in value. The TEF values are based on biological test data, and relate the toxicity of the core-structure PCDF congeners to the toxicity of 2378-TCDD (dioxin) taken as unity.

3. The California TEF values for the core-structure PCDFs seem to be way out of line with the biological data and with the TEF guidelines set up by other agencies, countries, etc. California seems to want to consider all core-structure PCDFs as being equal in potency (unity) to that of the reference toxin 2378-TCDD. This just isn't so. Perhaps the best reason for using the U.S. EPA values for TEFs is that they may be the best compromise among all the cited values and the biology underlying potency at this time.

4. In applying the EPA values of TEFs to the fly ash PCDF problem, it is important to note that in the four sets of analyses carried out by Enseco, all values for core-structure content in the various classes of PCDFs (tetra-, penta-, etc.) are listed as ND for non-detected, along

with the limits of detectibility (DL). For analysis purposes, therefore, I have averaged the DL values for each structure class across all four analysis sheets, and assigned the average analytical figure of 0.5 DL to an ND notation for each class. This is rather general practice, and preferable to the assignment of either zero content or a full DL content to an ND notation.

5. From the 0.5 DL values, transformed into 2378-TCDD toxicity equivalency via the EPA-TEF values for each class of core structures, I have added up the total 2378-TCDD equivalency per gram of the fly ash analyzed. The total amounts to 0.0071 ng of 2378-TCDD equivalency per gram of ash. This can also be expressed as 7.1 ppt of 2378-TCDD equivalency.

6. I consider this degree of contamination of the ash to be insignificant with respect to potential health hazards from delivery to a waste site. The equivalency content is more than two orders of magnitude lower than the generally accepted U.S. clean-up level for dioxin in soils, down to 1 ppb. Even if full DL values rather than 0.5 DL values had been assigned to ND notations, in my analysis, the equivalency level for PCDFs (core structure) in the fly ash would still be two orders of magnitude lower than "how clean is clean?" for dioxin remediation in soils.

7. It would be a good idea to check criteria for acceptable levels of dioxin (or dioxin equivalency) in national and state standards/guidelines for waste delivered to various categories of waste management sites, for comparison with the 7.1 ppt value for fly ash.

State of California

Memorandum

To : Bud Eagle, Senior Engineering Geologist
Hydrogeology Section
Division of Water Quality

Date : DEC - 1 1987

Frank Palmer

Frank Palmer
Investigations Branch
Division of Water Quality

From : STATE WATER RESOURCES CONTROL BOARD

Subject: NORTH COAST REGIONAL WATER QUALITY CONTROL BOARD (RWQCB) REQUEST FOR CLARIFICATION ON SUBCHAPTER 15 CLASSIFICATION OF FLY ASH (DWQ CONTROL NO. 229)

You asked me to comment on Craig Johnson's memorandum to James Baetge of November 2, 1987, concerning characteristics of fly ash formed by a Georgia-Pacific Corporation power plant located at Fort Bragg. The fly ash was deemed suitable for use as a soil amendment based on its characteristics as non-hazardous and decomposable. Subsequent chemical analyses have detected low levels of tetrachlorodibenzofurans (TCDFs) present in the fly ash. The Regional Board indicated it was particularly interested in technical information related to concentrations of TCDF detected in the fly ash and potential risk to water quality from these levels. It seems to me that there are two issues here: (1) are the concentrations of TCDFs that were detected hazardous and (2) are the TCDFs decomposable (not environmentally persistent)?

My opinion is that, at the concentrations detected (0.14 to 0.19 ppb) in the fly ash, the non-2,3,7,8-chlorinated TCDFs probably are non-hazardous if they are not incorporated into food chains. It is generally accepted that the most toxic chlorinated dibenzodioxins (CDDs) and dibenzofurans (CDFs) are those chlorinated at the 2,3,7, and 8 molecular positions. Those with other chlorination patterns, i.e., non-2,3,7,8-chlorinated, are believed to be at least one or two orders of magnitude less toxic than their 2,3,7,8-chlorinated isomers. Although there are no criteria or standards for non-2,3,7,8-tetrachlorodibenzofurans the U.S. EPA (Bellin and Baines, 1987) has developed an interim approach for assessing toxicity of various CDDs and CDFs by expressing their predicted toxicity relative to the most toxic and most studied CDD, 2,3,7,8-tetrachlorodibenzo-p-dioxin or TCDD. TCDD is given a toxic equivalency factor (TEF) of 1.0. This relative toxicity can then be multiplied by the detected concentration of CDD/CDF compounds and compared to known advisory or action levels for TCDD. For example, the TEF for non-2,3,7,8-chlorinated TCDFs would be estimated as follows:

a. TEF for 2,3,7,8-TCDF is equal to 0.1-2,3,7,8-TCDD;

b. TEF for non-2,3,7,8-TCDF is 0.01 to 0.1 that of 2,3,7,8-TCDF;

c. TEF for non-2,3,7,8-TCDF = 0.1 (0.01 to 0.1) 2,3,7,8-TCDD;

d. Or 0.001 to 0.01

e. When the TCDF TEF is multiplied by the concentration of TCDF detected in fly ash (0.19 ppb), the predicted toxic equivalence will be 0.0002 ppb to 0.002 ppb, or 0.2 to 2.0 parts per trillion.

A comparison of the relative TEF for the TCDFs detected in fly ash can then be made with existing advisory levels:

- The Centers for Disease Control established a site-specific TCDD clean-up level of 1 ppb for Times Beach, Missouri. The high TEF value derived from the fly ash analysis is 1/500 of this clean-up level.

- The U.S. Food and Drug Administration (FDA) has set an action level of 25 ppt (.025 ppb) for TCDD in fish consumed for food. Similarly the States of New York and Michigan have set action levels in fish of 10 ppt. The high TEF for TCDFs detected in the fly ash is 2/25 of the FDA action level for fish consumption. Theoretically, if the TCDF levels in fly ash were found in fish tissue, the FDA level would allow consumption based on a TEF approach.

However, it should be noted that the TEF approach does not account for food chain accumulation. If, for example, a cover crop is grown on the soil and the land is used for pasture, then consideration should be made for accumulation of TCDFs in foraging livestock. A preliminary draft, circulated by EPA for technical review purposes only in June 1987, examined a number of exposure scenarios and concluded that the highest exposures and consequent risks from TCDD would be associated with food chain related exposure such as plants, beef, fish and dairy products. Under these conditions, it is possible that disposal of fly ash containing CDDs and CDFs could pose a much higher risk than that estimated by the Centers for Disease Control when the 1 ppb site specific concentration was suggested as a clean-up level.

Compared to typical organic material such as municipal refuse, I would consider the TCDFs non-degradable. These compounds are resistant to breakdown and are persistent in the environment. While little is known about the physical and chemical characteristics of the TCDFs, they can be compared to the TCDDs. The water solubilities of 1,3,6,8-TCDD and 2,3,7,8-TCDD are 0.4 ppb and 0.2 ppb (SWRCB, 1987) respectively, indicating that these compounds will be resistent to degradation in the environment. These compounds will tend to adsorb strongly to organic matter in soil and particulate matter in aqueous systems. They will also bioaccumulate in aquatic systems; the highest reported bioaccumulation factor for 2,3,7,8-TCDD is 9,000 in both rainbow trout and mosquito larva (SWRCB, 1987).

Finally, I noted in the background documents, included with the RWQCB 1 memo requesting technical assistance, a February 9, 1987 communication from Dr. David Leu of the Department of Health Services related to octachlorodibenzodioxin (OCDD) contamination in fly ash. The communication correctly summarized current scientific opinion that OCDD is relatively non-toxic. However, you should be aware that recent research (Miller et al., 1987) presented at the Dioxin 87 meetings in Las Vegas, Nevada in October 1987 shows that OCDD in the upper 0.1 mm to 0.3 mm of soil is converted to 2,3,7,8-chlorinated CDDs, including 2,3,7,8-TCDD. I am attaching a summary of that research which concludes: "on soils, photoreduction of OCDD to 2,3,7,8-TCDD is observed, and 2,3,7,8-TCDD is a major tetrachlorinated isomer observed..." Although the research summary is for work done with ultraviolet radiation, subsequent research using natural sunlight has resulted in similar findings (G. Miller, personal communication, November 1987). Because of the potential for photoformation of more toxic CDDs and CDFs from less toxic, more highly chlorinated CDDs and CDFs, I would be very cautious about using fly ash containing CDDs and CDFs as a soil amendment. It appears that this is an area of active research which promises interpretable results in the near future.

References:

Bellin J. and D. Barnes. March 1987. Interim Procedures for Estimated Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and -Dibenzofurans (CDDs and CDFs). U.S. EPA/625/3-87/012, Risk Assessment Forum, U.S. EPA, Washington, DC.

Miller, G. et al. 1987. Photolysis of octachlorodibenzo-p-dioxin on soils: Production of 2,3,7,8-TCDD. Presented at Dioxin '87 Conference in Las Vegass, Nevada. October 1987.

SWRCB. 1987. Chlorinated Dibenzo-p-dioxin and Dibenzofuran Contamination from the Use of Chlorophenol Wood Preservatives in California. Draft Report. October 1987.

Attachment

cc: G.W. Bowes
D.B. Cohen

DEC 7 - 1987

COOPERATIVE EXTENSION
UNIVERSITY OF CALIFORNIA

RIVERSIDE, CALIFORNIA 92521
714- 787- 5994

December 3, 1987

Rod Shippey
Livestock Farm Advisor
Cooperative Extension
Agricultural Center/Courthouse
579 Low Gap Road
Ukiah, California 95482

Dear Rod,

Thank you for sending me copies of letters from the North Coast Water Quality Control Board describing the findings of low levels of tetrachlorinated dibenzofurans (TCDF's) from fly ash that you are using for field trials. I have reviewed literature concerning TCDF's in the environment and offer the following assessment:

1. The levels of TCDF found (0.14-0.19 parts per billion) are very low and could simply constitute normal environmental levels. TCDF's are known to be present in polychlorinated biphenyls (PCB's), and PCB contamination has been shown to be ubiquitous in the world. It has also been shown that TCDF's are produced naturally through combustion processes. Levels of TCDF's from fly ash, interestingly, have been reported to be much higher (20.8 to 9028 ppb) than those reported by the WQCB.

2. Although widespread environmental TCDF contamination may be evident, the potential for TCDF to pose a threat to water quality is extremely low. Studies have shown that the related dioxin contaminant TCDD binds tightly to soil (equilibrium concentrations of TCDD in a soil/water medium have been reported to be about one million parts TCDD in the soil to one part TCDD in the water) and thus would not be expected to enter the water in appreciable amounts. It is assumed, due to the chemical similarity of TCDF to TCDD, that TCDF would similarly strongly bind to soil.

I am sending copies of articles describing environmental contamination by TCDF's and the environmental fate of TCDD. If you desire further assistance in this matter, please don't hesitate to call me at (714) 787-5994. Good luck.

Sincerely,

Carl

Carl K. Winter, Ph.D.
Extension Toxicologist

Enclosures

cc B. Willoughby

Cooperative Extension

UNIVERSITY OF CALIFORNIA MENDOCINO COUNTY

COUNTY AGRICULTURAL CENTER
579 LOW GAP ROAD
UKIAH, CA 95482

707-463-4495

December 4, 1987

QUARTERLY NARRATIVE REPORT: Rod Shippey
Livestock Advisor

Roderick Shippey

IT'S GREAT TO BE AN AUTHORITY ON SOMETHING - EVEN IF IT IS EFFLUENT!

Oh well, why not! The experiences I've had at the Lakeport Northwest sprinkler field have paid off. An engineering firm in Santa Rosa called to explore installing another system at Lower Lake. Our work with the Lakeport unit has been extremely valuable in seeing how NOT TO SET UP AN EFFLUENT DISPOSAL SYSTEM.

I called on our CE irrigation specialist, Blaine Hanson, to meet with the engineers and we were away. Soil types to be used, amounts of water to be applied, the rate of application, seeding recommendations, grazing of pastures, fencing materials (in general), the nuts and bolts of irrigating a pasture to dispose of waste water from a sewage disposal plant.

SOLID WASTE - NUMBER TWO

I began our second set of flyash as a soil amendment test plot this fall. Georgia Pacific and Masonite Corporation both have co-generation plants at their mills. Their steam plants produce power for the plant operation but they also generate flyash which must be disposed of at the city dump. Our Fort Bragg flyash solid waste disposal tests are so encouraging that we began another series of tests in Potter Valley on that valley's very shallow, low producing soils.

Potter Valley also has an elk problem which prompted a cooperative test fence with California Department of Fish and Game around the plot. Elk grazed my earilier plots at the site. The results are in the making now. Fall rains started the clovers in the area with the treated plots showing an early response to this wood fired boiler waste.

The test application rates are:

4 tons/acre
8 tons/acre
16 tons/acre
Control
Three replications

Georgia-Pacific Corporation 90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

WATER QUALITY
CONTROL BOARD
REGION I

DEC 16 '87

BK ___ RC ___
CJ ___ KAD
FR ___ MAH
RT ___
JH ___
BB ___
JG ___ REPLY

December 15, 1987

CERTIFIED MAIL
Return Receipt Requested
P 317 147 348

Mr. Benjamin D. Kor
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

86003

Dear Mr. Kor:

Enclosed is the November 1987 report for the Georgia-Pacific Soil Amending Project as per revised Monitoring and Reporting Program 86-3. Incorporation activities were discontinued after November 17; all subsequent ash has gone to the winter stockpile.

Sincerely,

Steven A. Petrin, Director
Environmental Health & Safety
California Wood Products

SP:db

Encl.

NOVEMBER 1987 REPORT

GEORGIA-PACIFIC CORPORATION

FORT BRAGG SOIL AMENDMENT MONITORING AND REPORTING PROGRAM NO. 86-3

Monitoring

Volume of ash deposited by week - Cubic Yards of Ash - deposited in Area A and stockpile.

November	01-07	680
	08-14	720
	15-21	700
	22-28	540
	29-30	80

Number of Treated Acres (Area A) 41.44 Acres

Number of Treated Acres (Area W) 5 Acres

Daily Precipitation Measurements		PPT (Inches)
November	1	0
	2	0
	3	0
	4	0
	5	0
	6	0
	7	0
	8	0.50
	9	0
	10	0
	11	0
	12	1.04
	13	0.06
	14	0
	15	0
	16	0.94
	17	0
	18	0
	19	1.68
	20	0.75
	21	0
	22	0.24
	23	0
	24	0
	25	0
	26	0
	27	0.13
	28	0
	29	1.19
	30	0.93

WATER QUALITY CONTROL BOARD REGION I

DEC 16 '87

☐ BK ☐ RL
☐ CJ ☐
☐ FR ☐
☐ RT ☐
☐ JH ☐
☐ BB ☐
☐ JG ☐ REPLY

Stormwater Runoff monitoring has commenced as of December.

Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

WATER QUALITY
CONTROL BOARD
REGION 1

JAN 25 '88

BK___ SC___
SJ___ ID KOD
FR ___
RT___ MN MN
JH___
BB___
JG___ REPLY
ALL STAFF FILE

80003

January 21, 1988

CERTIFIED MAIL
Return Receipt Requested
P 140 647 495

Mr. Benjamin D. Kor
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Kor:

Enclosed is the December 1987 report for the Georgia-Pacifc Soil Amending Project as per revised Monitoring and Reporting Program 86-3. As per my earlier telephone message, this report has been delayed by a few days by my recent illness.

Sincerely,

Steven Petrin, Director
Environmental Health & Safety
California Wood Products

enc.

DECEMBER 1987 REPORT

GEORGIA-PACIFIC CORPORATION

FORT BRAGG SOIL AMENDMENT MONITORING AND REPORTING PROGRAM NO. 86-3

Monitoring

Volume of ash deposited by Week		Cubic Yards of Ash - deposited at the winter storage area.
December	01 - 05	440
	06 - 12	740
	13 - 19	480
	20 - 26	320
	27 - 31	180

Number of Treated Acres (Area A) 41.44 Acres
Number of Treated Acres (Area W) 5

Daily Precipitation Measurements		PPT (Inches)
March	1	1.98
	2	0.45
	3	2.52
	4	0.34
	5	1.72
	6	0.34
	7	1.05
	8	0.81
	9	1.84
	10	0
	11	0
	12	0
	13	0
	14	0
	15	0.01
	16	0
	17	0
	18	0
	19	0
	20	0.52
	21	0.19
	22	0
	23	0
	24	0
	25	0
	26	0
	27	0.73
	28	0.57
	29	0.06
	30	0.24
	31	0

Due to wet ground conditions, no ash was incorporated during December. All loads of ash were placed in the winter storage area as approved by Sue Warner. Total volume to the winter storage area was 2,160 cubic yards during the month December.

Stormwater Runoff Monitoring

Suspended sediment samples were analyzed by Alpha Analytical Labs in Ukiah. The pH samples were tested by G/P personnel (Steve Petrin).

LITTLE VALLEY pHs

Date	pt:	5	6	7	8	9
12/01		6.2	6.4	6.5	6.4	6.4
12/02		6.9	6.9	7.0	6.5	6.9
12/04		7.3	6.9	7.0	6.7	7.0
12/08		7.1	7.1	7.1	6.9	7.2
12/10		7.2	7.0	7.0	6.9	6.9

SUSPENDED SOLIDS mg/l

Date	pt:	5	6	7	8	9
12/01		26	14	19	34	35
12/10		5	5	5	7	3

COD

12/01		28	28	37	37	37

REC'D DEC 2 6 1987

Alpha Analytical Laboratories Inc. • 860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CLIENT Georgia Pacific
ADDRESS 90 West Redwood Avenue
Fort Bragg, CA 95437
ATTN: Steve Petrin

DATE COLLECTED 12-~~9~~ 0-87
DATE IN LAB 12-16-87
COLLECTED BY Petrin
SAMPLE TYPE Water

LABORATORY NO.:	7-6845	7-6846	
CLIENT I.D. :	L.V. # 8	L.V. # 9	
NFR	7	3	mg/L (ppm)

Alpha
Analytical Laboratories, Inc.

LABORATORY DIRECTOR 12-22-87
DATE

REC'D DEC 2 6 1987

Alpha

Alpha Analytical Laboratories Inc. • 860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CLIENT Georgia Pacific
ADDRESS 90 West Redwood Avenue
Fort Bragg, CA 95437
ATTN: Steve Petrin

DATE COLLECTED 12-~~9~~10-87
DATE IN LAB 12-16-87
COLLECTED BY S. Petrin
SAMPLE TYPE Water

LABORATORY NO.:	7-6842	7-6843	7-6844	
CLIENT I.D. :	L.V. # 5	L.V. # 6	L.V. # 7	
NFR	5	5	5	mg/L (ppm)

Alpha
Analytical Laboratories, Inc.

Bruce L. Gore 12-22-87
LABORATORY DIRECTOR DATE

REC'D DEC 1 1 1987

Alpha Analytical Laboratories Inc. • 860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CLIENT	Georgia Pacific	DATE COLLECTED	12-1-87
ADDRESS	90 West Redwood Avenue	DATE IN LAB	12-3-87
	Fort Bragg, CA 95437	COLLECTED BY	S. Petrin
	ATTN: Steve Petrin	SAMPLE TYPE	Water

LABORATORY NO.:	7-6494	7-6495	7-6496	
CLIENT I.D. :	L.V. # 5	L.V. # 6	L.V. # 7	
COD	28	28	37	mg/L (ppm)
NFR	26	14	19	mg/L (ppm)
pH	6.2	6.4	6.5	

Alpha
Analytical Laboratories, Inc.

[signature] 12-9-87
LABORATORY DIRECTOR DATE

State of California

Memorandum

To : Craig Johnson
Assistant Executive Officer
North Coast Regional Board

Date : JAN 2 0 1988

WATER QUALITY CONTROL BOARD REGION 1

JAN 29 '88

Harold

Harold J. Singer, Chief
Land Disposal Branch
Division of Water Quality

From : STATE WATER RESOURCES CONTROL BOARD

Subject: **CLASSIFICATION OF FLY ASH FROM GEORGIA PACIFIC CORPORATION, FORT BRAGG, CALIFORNIA**

Your memorandum of November 2, 1987 concerning disposal of fly ash generated by the Georgia-Pacific Corporation power plant at Fort Bragg requested assistance in assessing the concentrations of tetrachlorodibenzofuran (TCDF) recently reported in the fly ash and the potential risk to water quality posed by this substance. Your memorandum was referred to Dr. Frank Palmer of the Investigations Branch and to Bud Eagle, Program Manager for Subchapter 15. I have attached Dr. Palmer's comments which indicate that the highest exposure and risks from TCDF may be related to bioaccumulation and food chain exposure and that TCDFs would be considered nondegradable when compared to typical organic material. This information raises a question as to whether the fly ash represents a threat to water quality and, consequently, whether it should be classified as nonhazardous.

Subsection 2511(f) of Subchapter 15 provides that if certain conditions are satisfied, decomposable nonhazardous waste may be used as a soil amendment. However, it now appears that if this fly ash is added to soil it could result in toxic conditions in plants and animals as the result of bioaccumulation. Our opinion is that this waste does not meet the "decomposable" criterion required for an exemption under Subsection 2511(f) considering that TCDF is essentially a nondecomposable and possibly toxic constituent of the waste which may concentrate in the soil when decomposable constituents of the fly ash infiltrate into lower layers.

If you or your staff have questions or wish to discuss this matter further, please contact Bud Eagle at ATSS 492-0205.

Attachment

FILE GEORGIA-PACIFIC
FT. BRAGG ASH

Georgia-Pacific Corporation

90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

86003

January 31, 1988

CERTIFIED MAIL
Return Receipt Requested
P-504 613 693

Mr. Benjamin D. Kor:
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Kor:

Enclosed is the 1987 annual report for the Georgia-Pacific Soil Amending Project as per Monitoring and Reporting Program 86-3.

Sincerely,

Steven Petrin, Director
Environmental Health & Safety
California Wood Products

enc.

1987 Annual Report - Georgia Pacific Soil Amending Project

Storm-Water Monitoring

Under revised order 86-3, Georgia-Pacific personnel examined the Little Valley soil amending site on every day in which rainfall occurred and collected samples as required (results summarized below). No discharges of ash were observed to surface streams. Sampling occurred during the months of January, February, March and December.

Rainfall

Month	PPT (inches)
Jan	7.37
Feb	5.28
Mar	7.74
Apr	1.01
May	0.08
June	0
July	0.12
Aug	0
Sept	0
Oct	0.91
Nov	7.22
Dec	13.37

pH Measurements

Date	Location *				
	5	6	7	8	9
01-01-87	6.6	6.5	6.6	6.6	6.5
01-03-87	7.0	6.9	7.0	6.6	6.8
01-24-87	6.8	6.7	6.7	6.5	6.5
01-28-87	7.0	7.1	7.1	6.9	7.1
02-02-87	7.5	7.0	6.9	6.6	6.8
02-13-87	6.7	6.7	6.8	6.8	6.8
02-14-87	6.5	6.7	6.7	6.6	6.7
03-05-87	6.8	6.9	6.7	7.1	7.0
03-12-87	6.5	6.6	6.7	6.5	6.6
03-21-87	7.4	7.1	7.1	6.8	6.7
03-22-87	6.7	6.8	6.7	6.9	6.7
12-01-87	6.2	6.4	6.5	6.4	6.4
12-02-87	6.9	6.9	7.0	6.5	6.9
12-04-87	7.3	6.9	7.0	6.7	7.0
12-08-87	7.1	7.1	7.1	6.9	7.2
12-10-87	7.2	7.0	7.0	6.9	6.9

* See attached map provided by Board staff for locations of sampling points.

Suspended Solids (mg/l)

Date	Location 5	6	7	8	9
01-24-87	17	7	12	27	7
01-28-87	6	18	27	7	2
02-02-87	8	8	N/A	6	7
02-13-87	12	14	28	13	19
03-05-87	1	22	26	19	20
03-12-87	10	6	7	19	11
03-21-87	8	2	4	11	2
12-01-87	26	14	19	34	35
12-10-87	5	5	5	7	3

COD

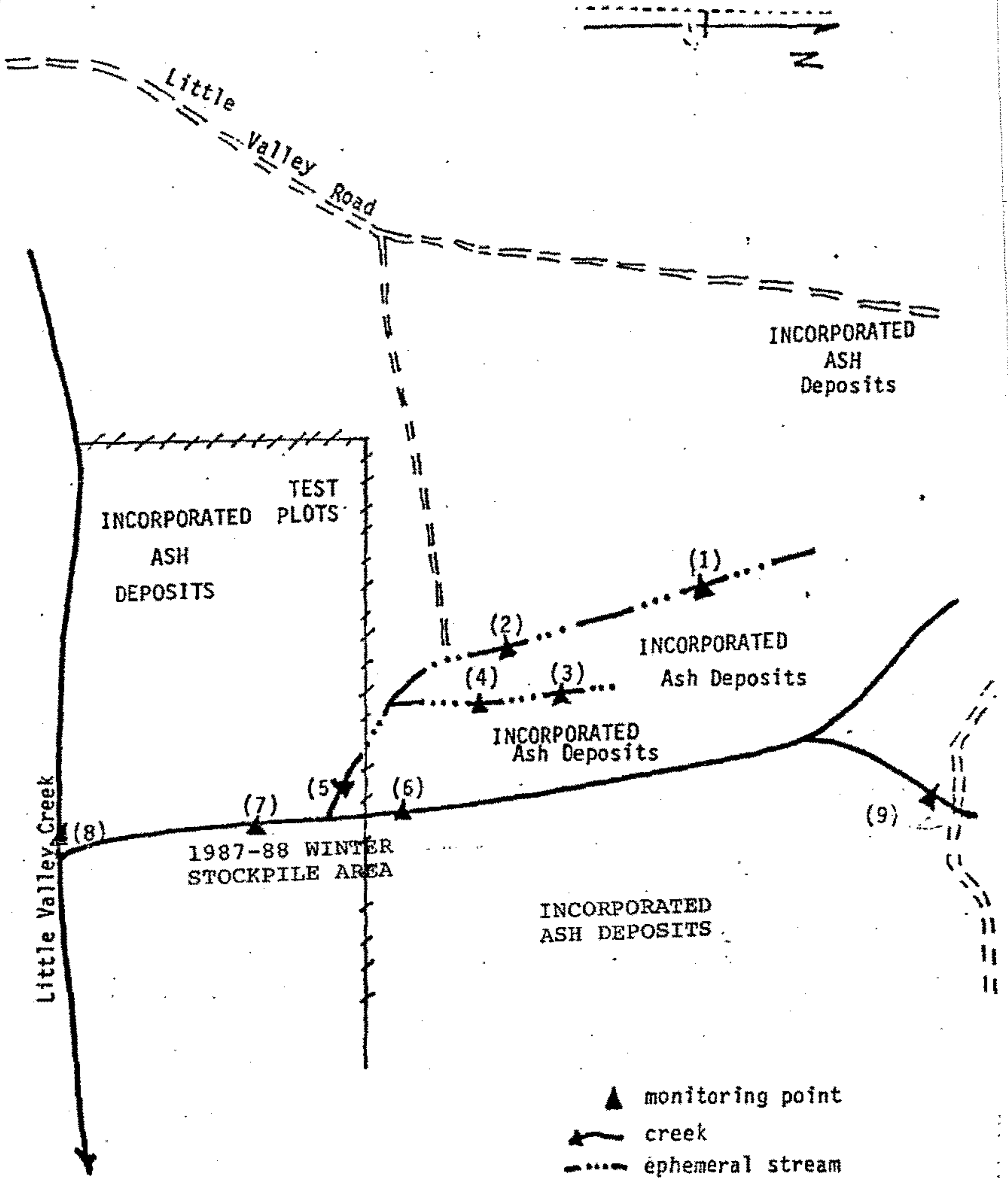
Date	Location 5	6	7	8	9
01-24-87	26	19	22	49	33
03-12-87	14	<1	<1	19	11
12-01-87	28	28	37	37	37

Ash Incorporation Activities

Ash incorporation activities were conducted during the months of April through November. Soil moisture conditions during the other months precluded incorporation activities, so ash was stockpiled in an approved area. Volume of ash delivered to the site and acreage amended are summarized below:

Month	Ash Delivered (cu. yd)	Total Amended Acreage
Jan	3480	28.24
Feb	3480	28.24
Mar	3680	28.24
Apr	3740	28.32
May	3980	28.84
June	3420	31.31
July	3440	41.04
Aug	2780	42.89
Sept	2960	44.40
Oct	3200	45.70
Nov	2720	46.44
Dec	2160	46.44

NOTE: 5 acres in area W.



(map provided by Regional Board staff)

NOT TO SCALE

A L L E N   S P R I N G S   (topical application)

Ash Application (tons/acre)	Biomass Yield (tons/acre)
0	1.39
4	1.88
8	2.24
16	2.42
32	2.17
64	2.11

Based upon number of bales and their weight, actual yield on incorporated areas was estimated to be 3.0-3.5 tons/acre. Exact measurements were not done, but will be conducted in 1988. Visual inspection by personnel from U.C. Extension, the Regional Board, and Georgia-Pacific revealed excellent growth on both the treated test plots and the operating areas and U.C. Extension staff have so far been impressed with the results.

ing several hours, and the solution appeared perfectly homogeneous at all times. The spectra showed a continuous red shift of the onset of absorption with time. Presumably 1 decomposed and formed monomeric GaAs, which was solvated by the donor THF. In a subsequent association, these monomers aggregated to GaAs clusters of increasing size. Brus has calculated the size dependence of the energy of the lowest excited state for clusters of various semiconductors, including GaAs (*12*). According to these calculations (for an absorption onset of about 600 nm for the rightmost curve in Fig. 2), the average particle size in the solution at that time was estimated as 60 Å.

As our understanding of the chemistry of mixed-metal main-group organometallics develops, chemists will be able to design a new generation of precursors for III-V semiconductors. In addition, the study of these molecules is already revealing an intriguing diversity of reaction pathways and has provided an opportunity to investigate the physical properties of small clusters of these solids.

REFERENCES AND NOTES

1. A. M. Glass, *Science* 235, [illegible]003 (1987); V. Narayanamurti, *ibid.*, p. 1023.
2. G. B. Stringfellow, *Rep. Prog. Phys.* 45, 469 (1982); M. R. Leys, *Chemtronics* 2, 155 (1987).
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18 April 1988; accepted 2 June 1988

3

Congenital Poisoning by Polychlorinated Biphenyls and Their Contaminants in Taiwan

WALTER J. ROGAN, BETH C. GLADEN, KUN-LONG HUNG, SHIN-LAN KOONG, LING-YU SHIH, JAMES S. TAYLOR, YING-CHIN WU, DOROTHY YANG, N. BETH RAGAN, CHEN-CHIN HSU

In 1979, a mass poisoning occurred in Taiwan from cooking oil contaminated by thermally degraded polychlorinated biphenyls. Because these chemicals persist in human tissue, children born to female patients after the outbreak were exposed in utero. In 1985, 117 children born to affected women and 108 unexposed controls were examined and evaluated. The exposed children were shorter and lighter than controls; they had abnormalities of gingiva, skin, nails, teeth, and lungs more frequently than did controls. The exposed children showed delay of developmental milestones, deficits on formal developmental testing, and abnormalities on behavioral assessment. These findings are most consistent with a generalized disorder of ectodermal tissue. This syndrome is one of very few documented to result from transplacental exposure to pollutant chemicals.

COOKING OIL CONTAMINATED BY polychlorinated biphenyls (PCBs) and dibenzofurans led to an outbreak of illness (called *yucheng* or "oil disease") in Taiwan. The illness consisted of chloracne, hyperpigmentation, and meibomian gland dilatation among other findings (*1*, *2*). The epidemic was noted in May 1979, and the oil was removed from the market in October; cases were identified retrospectively from as far back as December 1978. There is a registry of about 2000 persons who were exposed to the oil. A similar outbreak ("*yusho*") had occurred in Japan in 1968.

Because these chemicals persist in human tissue [similar dioxins have half-lives in humans of about 7 years (*3*)], offspring of female patients continue to be born affected, even though maternal exposure has ceased. By 1983, 8 of 39 hyperpigmented children born to exposed mothers had died (*1*). In April 1985 we performed a field survey of all living children who were known to have been in utero during or after the period of oil contamination. These children would have had transplacental exposure and possibly exposure through breast milk, but would not themselves have consumed the contaminated oil.

Seventy-four women in the health department's registry had living children born between June 1978 and March 1985. Use of these dates should identify any child with transplacental exposure, since the latent period during which oil was consumed but mothers were asymptomatic was about 6 months. Chinese-speaking nurses interviewed the mothers in their homes and scheduled the examinations. The women reported 159 pregnancies in this time; 3 were ongoing, 5 miscarried, 8 were aborted, 6 were stillborn, and 5 born live later died, leaving 132 living children. We obtained usable information on 128. One more child died between interview and examination. Twenty-nine families had 1 eligible child, 34 had 2, 9 had 3, and 2 had 4. Controls came from 96 families who lived in the same neighborhoods. These 96 mothers reported 205 pregnancies in this period; 3 were ongoing, 8 miscarried, 4 were aborted, and 190 produced live births; we obtained data on 115. The exposed children averaged 32 months old, range from 1 to 82 months; the controls averaged 31 months, range 3 to 98

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months. The families lived near each other and knew of each other's medical difficulties, and some mothers still had obvious chloracne, so that it was not possible to use a blind study design.

Exposed mothers reported lower birth weight (mean ± SE: 2749 g ± 46 g, $n = 128$; 3228 g ± 40 g, $n = 115$), hyperpigmentation, conjunctivitis, nail changes, and natal teeth in the children at birth (Table 1). The largest difference in the medical histories was the higher rate of bronchitis in the exposed children. There was consistent reported developmental delay in the exposed children; of the 33 milestones that we asked about, the exposed children were behind in 32 (the no-effect value would be 16.5).

The physical examinations were carried out during 11 days in April 1985 at four local clinics; 117 exposed children and 108 control children attended. There were neurologic, dysmorphologic, dermatologic, dental, and general examinations. The exposed children were smaller than controls, averaging 93% [95% confidence interval (CI), 90–96] of control weight and 97% (95% CI, 96–99) of control height, adjusted for age and sex. The gum hypertrophy or swelling noted by the mothers at birth was still apparent on examination (Table 2). Neither acne nor conjunctival cysts were much more common in the exposed, but the differences in hyperpigmentation and nail deformities and pigmentation are large. Most of the pulmonary auscultation abnormalities were consistent with bronchitis, and this diagnosis was made clinically in several of the children. The marked differences in eyebrow flare, hypertelorism and clinodactyly were not expected. There were no abnormal reflexes or any localizing findings in the neurologic exam; however, the exposed children were delayed compared to controls in the age at which they performed tasks such as saying phrases and sentences, turning pages, carrying out requests, pointing to body parts, holding pencils, imitating drawn circles, or catching a ball. The neurologists had an overall clinical impression of developmental or psychomotor delay in 12 (10%) of the exposed compared with 3 (3%) of the control children, and of a speech problem in 8 (7%) versus 3 (3%).

We did age-appropriate testing of cognitive development and behavioral assessment in the home after the survey, using new controls matched for neighborhood, sex, age, sib order, and family socioeconomic status. Except for verbal IQ on the Wechsler Intelligence Scale for Children (WISC), the exposed children always scored lower than the controls on the three developmental and cognitive tests (Table 3). On the Rutter scales, the exposed children showed higher (that is, worse) scores on all three scales. There are no Taiwanese norms for the Rutter scales; both exposed and control children scored higher than would be expected based on the norms developed by Rutter *et al.* (*4*).

Thermally degraded PCBs were identifed as human teratogens in the Japanese epidemic in 1968. Children born to *yusho* mothers had low birth weight, hyperpigmentation of gums and nails, conjunctivitis, dysplastic nails, wide fontanels, metastatic scalp calcification, diffuse dark skin pigmentation, and natal teeth; 2 in 13 were stillborn (*5*). Four of these children were reported as normal at ages 8 to 19 months (*6, 7*), but Harada (*8*) reported that the 13 children he examined up to 7 years after the exposure were apathetic and dull with IQs in the 70s.

In Taiwan, Wong and Hwang (*9*) noted skin desquamation, deformed, pigmented nails, hypersecretion of the meibomian glands, hyperpigmentation of the nose, and acne in six offspring of *yucheng* mothers. Four of these children weighed 2500 g or less at birth. Lan *et al.* (*10*) added another case with diffuse skin hyperpigmentation and low birth weight who died at 22 months. Law *et al.* (*11*) reported twins seen at 3 months of age for respiratory distress and pneumonia. They weighed 1800 and 2820 g at birth, and had wide fontanels, hyperpigmentation, and persistent conjunctival swelling.

The effects in the children we saw are most apparent in nails, hair, teeth, gums,

Table 1. Physical signs present at birth and selected medical history items as reported by mothers. Frequencies are those reporting "yes" over those reporting "yes" or "no." "Don't know" and missing values are not included.

Physical sign	Exposed	Control
At birth		
White eye discharge	32/108	5/113
Eyelid swelling	25/106	0/111
Teeth present	11/127	0/113
Irritated or swollen gums	11/ 99	0/114
Hyperpigmentation	54/127	2/114
Deformed or small nails	30/122	1/113
Acne	16/125	0/114
Subsequent history		
Bronchitis or pneumonia in first 6 months	30/124	5/115
Bronchitis bad enough for 2 days in bed	21/126	3/111
Seizure with fever	15/127	5/115
Seizure without fever	1/127	1/113
Chipped or broken teeth	38/107	25/106
Hair loss	14/115	2/105
Acne scars	11/115	0/106
Loss of muscle strength	5/ 89	0/ 85
Joint pain	5/ 91	0/ 84
Generalized itching	32/115	12/102
Skin abscesses or boils	26/116	11/103
Warts	8/114	1/106

Table 2. Selected findings on physical examination. Ratios represent number recorded positive over number examined.

Physical sign	Exposed	Control
Gum hypertrophy	7/116	0/107
Tooth chipping	11/101	0/100
Intraoral hyperpigmentation	43/116	33/107
Caries	68/101	54/100
Acne or acne scars	20/117	10/106
Hyperpigmentation		
Perineal-genital	50/117	29/106
Head or face	13/117	4/106
Pigmented or deformed nails		
Fingers	19/117	1/106
Toes	74/117	22/106
Conjunctivitis or cysts	12/117	9/106
Lymphadenopathy	28/117	11/106
Eyebrow flare	25/117	4/106
Lungs not clear to auscultation	19/116	6/106
Hirsutism	18/117	5/106
Hypertelorism	24/117	10/106
Clinodactyly	47/117	25/106

Table 3. Results of formal developmental testing and behavioral assessment. Entries are mean ± *SE*; number in parentheses are sample sizes. The Bayley Scales of Infant Development were used until 30 months. The Stanford-Binet yields an intelligence quotient (IQ) and was used from 30 to 72 months. The Wechsler Intelligence Scales for Children (WISC) were used after 72 months. On the Rutter scale higher scores represent more behavior disorders.

Test	Exposed	Control
Bayley		
Mental scale	100 ± 2.5 (45)	106 ± 2.4 (45)
Motor scale	101 ± 2.7 (45)	108 ± 2.1 (45)
Stanford-Binet (IQ)	85 ± 2.7 (52)	89 ± 2.7 (52)
WISC		
Verbal IQ	82 ± 3.1 (21)	82 ± 2.3 (21)
Performance IQ	90 ± 2.7 (21)	97 ± 2.9 (21)
Full IQ	84 ± 2.9 (21)	88 ± 2.4 (21)
Rutter		
Health problems	2.64 ± 0.21 (118)	1.43 ± 0.15 (120)
Habits	1.50 ± 0.13 (117)	0.98 ± 0.11 (120)
Behavior	11.08 ± 0.45 (117)	9.24 ± 0.41 (119)

skin hyperpigmentation, and growth and development, and are thus generally consistent with an acquired (neuro)ectodermal dysplasia. The acne present at birth and persistent in some children is a specific effect of the class of polycyclic, polyhalogenated hydrocarbons, but may also be a part of the apparent effects on ectodermal structures. The increased frequency of bronchitis may be due to a specific pulmonary lesion, which has been seen in adults (*12*) and children (*11*) exposed to this class of agents, or due to a more generalized immune disorder (*13*, *14*). The developmental effects are consistent with those seen in rhesus monkeys exposed transplacentally (*15*), and the behavioral problems may be secondary to the developmental delay or a form of direct toxicity (*16*).

These children have been exposed only by transplacental passage of the chemicals or by breast milk exposure. It is impossible to separate cleanly effects that persist because of structural changes during the fetal period from those that persist because of continued internal exposure. Transplacental passage of the chemicals has been documented in autopsy studies (*10*), and it is reasonable to suspect that the chemicals will persist in the children. There were metabolic changes in the placentae of some of these children (*17*) and a few have mild hepatic porphyria (*18*).

The kinds of toxicities seen are consistent with PCBs, but the exposures are relatively low. The children of workers exposed to PCBs uncontaminated by polychlorinated dibenzofurans (PCDFs) do not show nearly so much toxicity, but the mothers achieve blood PCB levels that are comparable to those seen in the outbreaks (*19*). The most likely reason is the presence of the very toxic PCDFs (*2*) in the cooking oil. Qualitatively, the PCBs and PCDFs are similar in toxicity, but the PCDFs are active at much lower doses. The oil in Taiwan had about 100 ppm PCBs, and about 0.1 ppm PCDFs (*20*). Although there has not been a human exposure to PCDFs in the absence of PCBs, it is reasonable to assume that much of the toxicity seen in both outbreaks is due at least in part to PCDF contamination.

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9 February 1988; accepted 24 May 1988

Molecular Cloning of Odorant-Binding Protein: Member of a Ligand Carrier Family

JONATHAN PEVSNER, RANDALL R. REED, PAUL G. FEINSTEIN, SOLOMON H. SNYDER*

Odorant-binding protein (OBP) is found in nasal epithelium, and it selectively binds odorants. Three complementary DNAs encoding rat odorant-binding protein have now been cloned and sequenced. One clone contains an open reading frame predicted to encode an 18,091-dalton protein. RNA blot analysis confirms the localization of OBP messenger RNA in the nasal epithelium. This OBP has 33 percent amino acid identity to α_2-microglobulin, a secreted plasma protein. Other members of an α_2-microglobulin superfamily bind and transport hydrophobic ligands. Thus, OBP probably binds and carries odorants within the nasal epithelium to putative olfactory receptors.

Animals can detect subnanomolar concentrations of odorants in ambient air despite a thousandfold lesser sensitivity of olfactory receptors to direct stimulation by odorants (*1*) and the requirement that the highly lipophilic odorants traverse a hydrophilic mucus to reach the receptors. A specific odorant-binding protein (OBP) may satisfy both these requirements (*2*, *3*). A globular protein with a subunit molecular size of 20 kD, OBP is found in nasal glands and secreted into the nasal mucus where it has been detected by the binding of radiolabeled odorants. The OBP binds a variety of odorants including 2-isobutyl-3-methoxypyrazine, 3,7-dimethyloctan-1-ol, methyl dihydrojasmonate, and amyl acetate (*4*). A pyrazine-binding protein, purified from bovine nasal epithelium (*3*), shares many physical properties with bovine OBP. We have sequenced 15 amino-terminal amino acids of bovine OBP. These match the partial sequence of the pyrazine-binding protein (*5*), confirming that the two proteins are the same. We now describe the cloning and sequence analysis of three cDNAs for the mRNA encoding rat OBP. We also show that OBP is part of a family of small homologous proteins, most of which appear to serve as carriers for small lipophilic molecules.

We utilized the binding of the odorants 2-isobutyl-3-[^{3}H]methoxypyrazine and 3,7-dimethyl-[^{3}H]octan-1-ol as an assay to purify rat OBP to homogeneity by DEAE-cellulose chromatography and reversed-phase high-performance liquid chromatography (HPLC) (*2*, *4*). In reversed-phase HPLC only a single discrete peak of protein is apparent, and SDS–polyacrylamide gel electrophoresis reveals a single band of 20 kD (*2*, *4*). Direct amino-terminal amino acid sequencing of the HPLC purified protein yields the sequence H_2N-Ala-His-His-Glu-Asn-Leu-Asp-Ile-Ser-Pro-Ser-Glu-Val-Asn-Gly-Asp. On the basis of the frequency of codon utilization (*6*), we constructed a mixed oligonucleotide probe (21-mer) containing 32 distinct sequences. We screened a rat olfactory cDNA library in λgt 10 (*7*) with the oligonucleotide and isolated 16 independent clones. Positive phages were subcloned into the plasmid vector Bluescript

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STATE OF CALIFORNIA GEORGE DEUKMEJIAN, *Governor*

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—NORTH COAST REGION

1440 GUERNEVILLE ROAD
SANTA ROSA, CA 95403
Phone: (707) 576-2220

February 19, 1988

Mr. Steven Petrin, Director
Environmental Health and Safety
California Wood Products
Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, CA 95437

Dear Mr. Petrin:

On November 2, 1987, we requested a technical opinion from the State Water Resources Board as to whether the use as a soil amendment of fly ash generated by the Georgia-Pacific power plant was appropriate under Subchapter 15 regulations. In their opinion, based on the presence of low levels of tetrachlorobenzofuran, and the bioaccumulative and nondegradable properties of the compound, the waste could pose a threat to water quality and cannot be considered to be decomposable. Therefore, it does not meet the criterion for exemption under Subsection 2511(f), and the ash can no longer be disposed of by incorporation into soil. I have enclosed the pertinent documents for your consideration.

Due to this finding, the Regional Board intends to rescind Waste Discharge Requirements Order No. 86-3, and Georgia-Pacific will be required to devise an alternative disposal method. Tentatively, the recision will go before the Board at the meeting on April 28, 1988, in the Santa Rosa/Rohnert Park area. You should immediately cease incorporation of ash into soils as provided by Order No. 86-3. An alternative long-term disposal plan will need to be approved by the Board, although an interim plan may be acceptable. Because the Department of Health Services has determined the waste to be nonhazardous, it could be disposed of in a Class III landfill.

Please call if you have any questions.

Sincerely,

Mark Neely
Associate Engineering
Geologist

MN:jm

Enclosure

Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, California 95437
Telephone (707) 964-5651

March 21, 1988

CERTIFIED MAIL
Return Receipt Requested
P-504 613 689

Mr. Benjamin D. Kor
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

86003

Dear Mr. Kor:

Enclosed is the February 1988 report for the Georgia-Pacific Soil Amending Project as per Monitoring and Reporting Program 86-3.

Sincerely,

Steven Petrin db

Steven Petrin, Director
Environmental Health & Safety
California Wood Products

SP:db

Encl.

WATER QUALITY
CONTROL BOARD
REGION I

MAR 22 '88

☐ BK ___ ☐ BB ___
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☐ RC ___ ☐ REPLY
☐ ALL STAFF ☒ FILE G-P Ft. Bragg Soil Amendment

FEBRUARY 1988 REPORT

GEORGIA-PACIFIC CORPORATION

FORT BRAGG SOIL AMENDMENT MONITORING AND REPORTING PROGRAM NO. 86-3

Monitoring

Volume of ash deposited by Week — Cubic Yards of Ash - deposited at the winter storage area.

February	01 - 06	240
	07 - 13	360
	14 - 20	400
	21 - 27	320
	28 - 29	60

Number of Treated Acres (Area A)	41.44 Acres
Number of Treated Acres (Area W)	5

Daily Precipitation Measurements

Only trace amounts of rainfall occurred during the month of February.

Due to wet ground conditions, no ash was incorporated during January. All loads of ash were placed in the winter storage area as approved by Sue Warner. Total volume to the winter storage area was 1,380 cubic yards during the month of January.

Stormwater Runoff Monitoring

No monitoring was conducted due to minimal rainfall.

JANUARY 1988 REPORT

GEORGIA-PACIFIC CORPORATION

FORT BRAGG SOIL AMENDMENT MONITORING AND REPORTING PROGRAM NO. 86-3

Monitoring

Volume of ash deposited by Week - Cubic Yards of Ash - deposited at the winter storage area.

January	01 - 02	0
	03 - 09	560
	10 - 16	560
	17 - 23	380
	24 - 30	320
	31	20

Number of Treated Acres (Area A) 41.44 Acres
Number of Treated Acres (Area W) 5

Daily Precipitation Measurements		PPT (Inches)
January	1	0.04
	2	0.83
	3	0.77
	4	0
	5	0
	6	0
	7	0.27
	8	0.80
	9	0.46
	10	0.96
	11	0.06
	12	0.03
	13	0.18
	14	1.77
	15	0.52
	16	0.25
	17	0.03
	18	0
	19	0
	20	0
	21	0
	22	0
	23	0
	24	0
	25	0
	26	0
	27	0
	28	0
	29	0
	30	0
	31	0

2 KAD

March 1988 Report

Georgia-Pacific Corporation

Fort Bragg Soil Amendment Monitoring and Reporting Program 86-3.

Monitoring

Volume of Ash Deposited by Week		=	Cubic Yards of Ash Deposited.
Week of,	01-05		240 $Yd.^3$
	06-12		320
	13-19		520
	20-26		520
	27-31		220
Number of Treated Acres in Area "A"			41.4
Number of Treated Acres in Area "W"			5

Precipitation Measurements

Minimal precipitation occurred during the month of March.

All loads of ash were deposited in the winter-storage area, as approved by Sue Warner. Total volume placed in the winter-storage area was 1,820 cubic yards for the month of March.

Stormwater Runoff Monitoring

No monitoring was done due to minimal rainfall, and lack of water in the ephemeral draws.

Signed,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

April 1988 Report

Georgia-Pacific Corporation

Fort Bragg Soil Amendment Montioring and Reporting Program 86-3

Monitoring

Volume of Ash Deposited by Week	=	Cubic Yards of Ash Deposited.
Week of, 01 - 02		140 Yd^3.
03 - 09		340
10 - 16		340
17 - 23		340
24 - 30		240

Number of Treated Acres (Area A)	41.4 Acres
Number of Treated Acres (Area W)	5

Precipitation Measurements

Minimal rainfall occurred during the month of April.

All loads of ash were deposited in the winter-storage area, approved by Sue Warner. Total volume to the winter storage area was 1,400 cubic yards for the month of April.

Stormwater Runoff Monitoring

No monitoring was conducted due to minimal rainfall, and lack of water in the ephemeral draws.

Signed,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

<u>May 1988 Report</u>

Georgia-Pacific Corporation

Fort Bragg Soil Amendment Monitoring and Reporting Program 86-3

Monitoring

Volume of Ash Deposited by Week		=	Cubic Yards of Ash Deposited	(Deposited) (Areas A & W.)
Week of;	01 - 07		320 Yds^3	
	08 - 14		360	
	15 - 21		440	
	22 - 28		500	
	29 - 31		80	
			Total = 1,700 Yds^3	

Number of treated Acres - Area A = 41.4

Number of Treated Acres - Area W = 5

Precipitation Measurements

Minimal rainfall occurred during the month of May; Saturday May 7=.43",Friday May 13=.17" and Wednesday May 18=.62 inches.

Stormwater Runoff Monitoring

No monitoring was possible due to minimal rainfall, and lack of water in the ephemeral draws.

Ash Depositions

1,700 Yards of ash (Approx.) were deposited to the winter area.

0 Yards of ash were amended, into Area A. (See above)

Kent C. Mayer
Kent C. Mayer
Environmental Engineer

F

STATE OF CALIFORNIA — GEORGE DEUKMEJIAN, *Governor*

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—
NORTH COAST REGION
1440 GUERNEVILLE ROAD
SANTA ROSA, CA 95403
Phone: (707) 576-2220

April 4, 1988

NOTICE

PROPOSED RECISION OF WASTE DISCHARGE REQUIREMENTS

FOR

GEORGIA-PACIFIC CORPORATION
FORT BRAGG ASH SOIL AMENDMENT

Mendocino County

Comments or recommendations you may have concerning the proposed Order should be submitted in writing to the Regional Board by April 15, 1988. Comments received after this date cannot be given full consideration.

Benjamin D. Kor
Executive Officer

Attachment

cc: SWRCB, Division of Water Quality, Attn: Archie Matthews
SWRCB, Office of the Chief Counsel, Attn: Bonnie Wolstoncroft
DFG, Sacramento
DFG, Yountville
Mendocino County Health Department, Attn: Gerald F. Davis
DOHS, SEB, Santa Rosa, Attn: B. David Clark
DWR, Central District, Sacramento, Attn: James M. Doyle
Mendocino County Planning Department, Ukiah, Attn: Ray Hall

Mark Neely

California Regional Water Quality Control Board
North Coast Region

ORDER NO. 88-56

PRELIMINARY

RECISION OF WASTE DISCHARGE REQUIREMENTS

FOR

GEORGIA-PACIFIC CORPORATION
FORT BRAGG ASH SOIL AMENDMENT

Mendocino County

The California Regional Water Quality Control Board, North Coast Region (hereinafter the Regional Board), finds that:

1. Georgia-Pacific Corporation (hereinafter the discharger) was issued Waste Discharge Requirements Order No. 86-3 on January 30, 1986, for the use of fly ash from their powerplant boiler as a soil amendment.

2. Under Subchapter 15 of the Water Code, nonhazardous decomposable waste can be used as a soil amendment pursuant to applicable best management practices, provided that the Regional Board may issue waste discharge requirements.

3. Laboratory analysis of the ash revealed low levels (0.16 - 0.23 parts per billion) of tetrachlorodibenzofurans (TCDF), a toxic substance. Staff of the State Water Resources Control Board determined that, due to the bioaccumulative and nondegradable properties of TCDF, the ash "does not meet the decomposable criterion required for an exemption" from the provisions of Subchapter 15.

THEREFORE, IT IS HEREBY ORDERED that pursuant to Water Code Division 7, Order No. 86-3 be rescinded.

Certification

I, Benjamin D. Kor, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, North Coast Region, on April 28, 1988

Benjamin D. Kor
Executive Officer

88-00830-CM

STATE OF CALIFORNIA
HAZARDOUS SUBSTANCE SPILL REPORT

DTG 1525 17 Mar 88
COUNTY Mendocino

N... ED OES CHP - Ukiah - Brooks PHONE 707 463-4719

REPORTED BY ______ PHONE ______

SUBSTANCE 50/50 formaldehide QTY 20#

SPILL SITE: P/L __ SHP __ RD __ O/F __ REF __ R/R __ S/S __ IND PLT __ DTG OCC FND 1241

LOCATION N/B North State St by Chevron Station Ukiah

WHAT HAPPENED Truck tank leaking... Truck was weighed to determine the loss.

CONTAINMENT/CLEANUP/WATER INVOLVED no waterways
RESP Georgia Pacific - Byron Yelzerton
707-462-9281

LCL AGEN..S ON SCENE/NTFD: FD __ SO __ PD __ CO DOH/HW __ CO OES ... NRC ______

RECD BY Carolyn

NOTIF	NAME TIME				
DFG		FED R/R		CC CO OES	
RWQCB		CHP	On Scene	FRESNO CO	
EPA	Cindy 1548	CALTRANS		HUMBOLDT CO	
SFM P L		F & A		LA CO F/C	
DOG		CDF		SBDO CO	
USCG		DPR		SF F/D	
LANDS		USFWS		SOLANO CO	
DOH/ST		E B PARKS		VENTURA CO	
DOH/CO		UC S BARB		FEMA 9	

CERTIFIED-Return Receipt Requested

April 4, 1988

Mr. Don Whitman
Georgia-Pacific Corporation
90 West Redwood Avenue
Fort Bragg, CA 95437

Dear Mr. Whitman:

Enclosed is a copy of a tentative Order to rescind the Waste Discharge Requirements, Order No. 86-3, adopted by the California Regional Water Quality Control Board, North Coast Region, for Georgia-Pacific Corporation on January 30, 1986.

The Regional Board will consider adoption of the tentative Order at the April 28, 1988, meeting in Rohnert Park. If you have any questions, please call.

Sincerely,

Mark Neely
Associate Engineering Geologist

MKN:mkh

Enclosure

cc: Dow Jacobszoon
Gerald W. Tice
Pete Fetter

SENDER: Complete items 1 and 2 when additional services are *desired*, and complete items 3 and 4.
Put your address in the "RETURN TO" Space on the reverse side. Failure to do this will prevent this card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for additional service(s) requested.

1. ☐ Show to whom delivered, date, and addressee's address. †*(Extra charge)*†
2. ☐ Restricted Delivery †*(Extra charge)*†

3. Article Addressed to:
Mr. Don Whitman
Georgia-Pacific Corporation
90 W St Redwood Avenue
Fort Bragg, CA 95437

4. Article Number
702 781

Type of Service:
☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail

Always obtain signature of addressee or agent and DATE DELIVERED.

5. Signature — Addressee
X

6. Signature — Agent
X Tam Harrison

7. Date of Delivery
APR 5 1988

8. Addressee's Address *(ONLY if requested and fee paid)*

PS Form **3811**, Mar. 1987 ★ U.S.G.P.O. 1987-178-268 **DOMESTIC RETURN RECEIPT**

P 167 702 781

RECEIPT FOR CERTIFIED MAIL

NO INSURANCE COVERAGE PROVIDED
NOT FOR INTERNATIONAL MAIL

(See Reverse)

Sent to
Mr. Don Whitman
Street and No.
Georgia-Pacific Corporation
90 West Redwood Avenue
P.O., State and ZIP Code
Fort Bragg, CA 95437

*U.S.G.P.O. 1984-446-014

4/5/88

TO: Mark Neely, File

From: Frank Reichmuth

Subject: G.P. Ash Disposal.

I spoke to Kip Howlett of G.P in Washington, D.C. regarding their rebuttal of the findings of Dioxin and Furans in the G.P. Ash. He told me hat is sending information today which indicates the TCDF, and TCDD are not a problem in soil amendment. He told him the item could be continued to the next agenda in May if the information needs some study. After we review the information we will schedule a meeting with G.P.

Georgia-Pacific Corporation
International Square
1875 Eye Street N.W.
Washington, D.C. 20006
Telephone (202) 659-3600

WATER QUALITY
CONTROL BOARD
REGION I

APR 7 '88

☐ BK ☐ BG
☐ GI ☐ JG
☐ FR ☐ KD
☐ RT ☐ M
☐ JH ☐
☐ SW ☐
☐ RC ☐ REPLY

G-P F.B.
SOIL AMEND.

April 5, 1988

Mr. Frank Reichmuth
California Regional Water
Quality Control Board
North Coast Region
1440 Gueneville Road
Santa Rosa, CA 95403

Re: Soil Amendment of Fly Ash - Order No. 86-3

Dear Mr. Reichmuth:

Following up on our telephone conversation last week, Georgia-Pacific has serious concerns with the validity of the Regional Board's determination that fly ash from our Fort Bragg operation is not suitable for soil amendment purposes.

Accordingly, we respectfully request that the rescission of Waste Discharge Requirements Order Number 86-3 be removed from the Board's April 28 meeting agenda. We are attaching a draft response to both you and the State Water Resources Control Board which addresses our technical concerns with one of the state reports.

We would appreciate the opportunity for this information to be fully considered prior to the issuance of a formal ruling and request a meeting with you and your staff at your earliest convenience. I have also talked with Frank Palmer and will have reviewed this draft letter with him prior to a meeting with all of us in Santa Rosa.

Please call me to arrange the particulars.

Sincerely,

C. T. Howlett, Jr.
Vice President,
Government Affairs

CTH/cka
cc: F. McCaig
S. Friess
G. Tice

April 8, 1988

Mr. C.T. Howlett, Jr.
Vice President, Governmental Affairs
Georgia-Pacific Corporation
1875 Eye Street N.W.
Washington, D.C. 20006

Dear Mr. Howlett:

We have received your letter dated April 5, 1988, in which you request the recision of Waste Discharge Requirements Order No. 86-3 be removed from the Regional Board's April 28, 1988 agenda. We will honor your request and confirm the item will not be considered at the April 28 meeting. Unfortunately, we did not receive your request in time to remove the item from our agenda prior to mailing. However, rest assured the item will not be considered during the April 28 meeting.

We will be reviewing the information submitted with Frank Palmer and Bud Eagle of our State Board and will contact you to arrange a meeting in early May.

Sincerely,

Frank C. Reichmuth
Senior Water Resource
Control Engineer

FCR:mkh

cc: Lowell D. Ambrosini

STATE OF CALIFORNIA

GEORGE DEUKMEJIAN, *Governor*

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD— NORTH COAST REGION

1440 GUERNEVILLE ROAD
SANTA ROSA, CA 95403
Phone: (707) 576-2220

May 23, 1988

Mr. Kent Mayer
Georgia-Pacific Corporation
P.O. Box 1618
Eugene, OR 97440

Dear Mr. Mayer:

This letter is in response to your request for changes in the Monitoring and Reporting Programs for both the Fort Bragg Sawmill and the Little Valley soil amendment.

Presently, your revised Monitoring and Reporting Program No. 86-3 for the Ft. Bragg Ash Soil Amendment requires pH to be measured daily during rain events. In response to your request, we agree to lessen the frequency to measuring pH once per week while there is flow. Enclosed is the Revised Program No. 86-3.

As for the Fort Bragg sawmill, any major modification to an NPDES permit (which includes any lessening of monitoring requirements) requires public notice followed by a comment period. Proposed new state regulations on ocean discharge will require bioassays for industrial facilities, as they are already required on sewage treatment plants and other ocean dischargers. In light of these facts, we propose that the bioassay frequency be lessened to quarterly, subject to public notice and review. We are in the process of sending notice to EPA, and built-in deadlines will rule out final Board action until perhaps August.

Feel free to call if you have any questions.

Sincerely,

SENDER: Complete items 1 and 2 when additional services are desired, and complete items 3 and 4.
Put your address in the "RETURN TO" Space on the reverse side. Failure to do this will prevent this card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for additional service(s) requested.
1. ☐ Show to whom delivered, date, and addressee's address. †(*Extra charge*)†
2. ☐ Restricted Delivery †(*Extra charge*)†

3. Article Addressed to:
Mr. Kent Mayer
Georgia-Pacific Corporation
P.O. Box 1618
Eugene, OR 97440

4. Article Number
395 353

Type of Service:
☐ Registered ☐ Insured
XX Certified ☐ COD
☐ Express Mail

Always obtain signature of addressee or agent and DATE DELIVERED.

5. Signature — Addressee
X

6. Signature — Agent
X 5-27-88

7. Date of Delivery
MAY 27 1988

8. Addressee's Address (*ONLY if requested and fee paid*)

PS Form **3811**, Mar. 1987 ★ U.S.G.P.O. 1987-178-268 **DOMESTIC RETURN RECEIPT**

P 754 395 353
RECEIPT FOR CERTIFIED MAIL
NO INSURANCE COVERAGE PROVIDED
NOT FOR INTERNATIONAL MAIL
(*See Reverse*)

Sent to
Mr. Kent Mayer
Georgia-Pacific Corporation
P.O. Box 1618
State and ZIP Code
Eugene, OR 97440

California Regional Water Quality Control Board
North Coast Region

REVISED MONITORING AND REPORTING PROGRAM NO. 86-3
(Revised May 23, 1988)

FOR

GEORGIA-PACIFIC CORPORATION
FORT BRAGG SOIL AMENDMENT

Mendocino County

Monitoring

The discharger shall record the approximate volume of ash deposited at the site each week, the approximate number of treated acres, and the location and approximate tons of any ash stockpiled.

The discharger shall submit records of daily rainfall measurements, dates of ash incorporation, and explanations of periods of no incorporation activities.

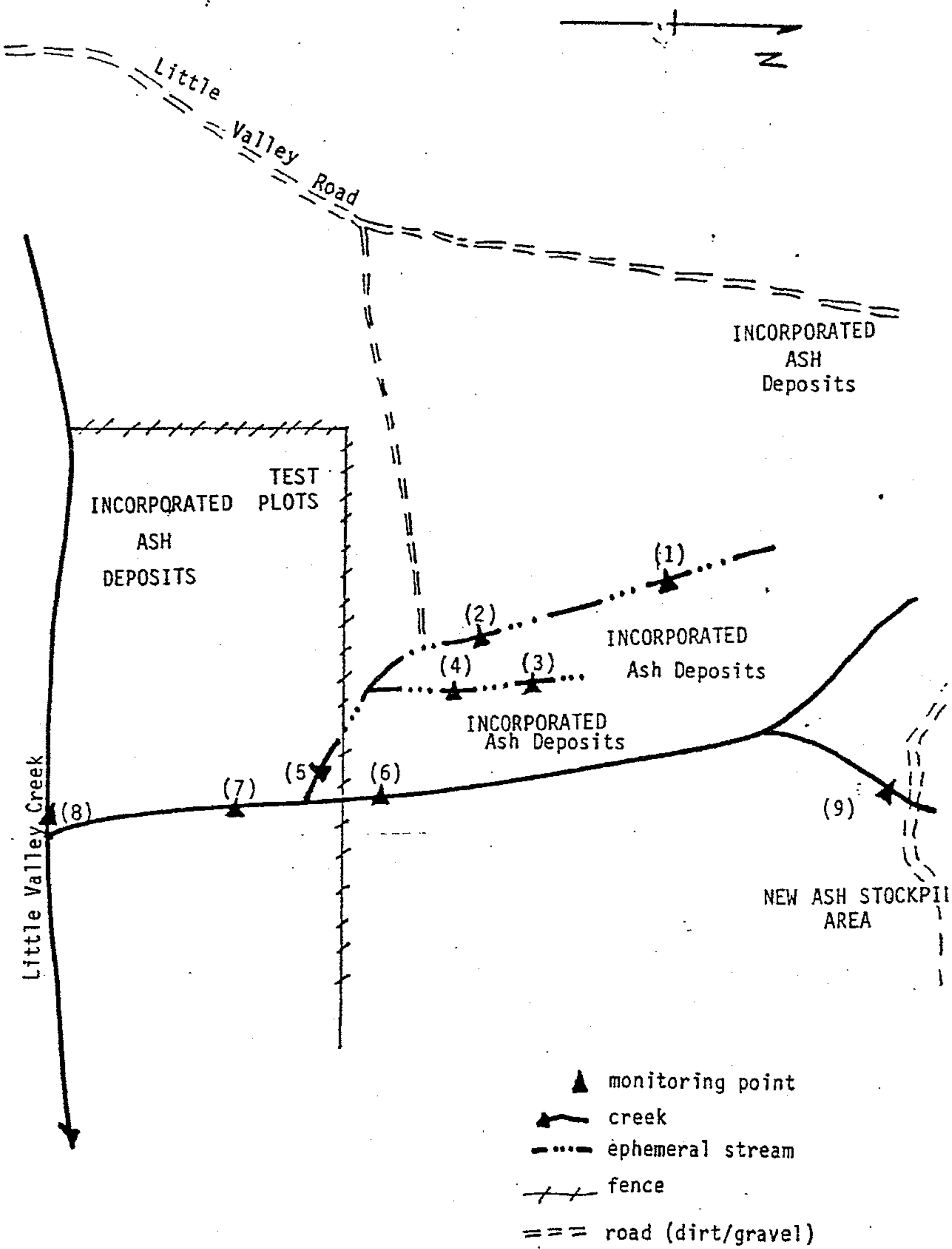
Soils receiving ash shall be analyzed every October for CEC, percent base saturation, and pH at a depth of 0-1" and 11-12". An annual report shall be prepared each July summarizing the water and soil analyses, amount of ash applied, the approximate number of acres receiving ash, and the evidence of increased pasture land yield.

Stormwater Runoff Monitoring

The discharger shall inspect the areas of ash placement daily during rain events, and record and report any instances of ash discharge to surface streams, and measures taken to correct the discharge.

Grab samples shall be taken from five points (shown as points 5,6,7,8 and 9 on the attached map) at least once per week during rain events, from two points on each of the ephemeral streams, at their confluence,and above and below the point of confluence of the ephemeral streams with the intermittent stream tributary to Little Valley Creek. Additional monitoring points shall be added as ash placement areas increase to ensure that drainage from all areas of ash placement are monitored. Samples shall be analyzed as follows:

Constituent	Units	Frequency
pH	pH units	Weekly
Suspended Solids	mg/l	Weekly
COD	mg/l	November, January, March



N
Little Valley Road
INCORPORATED ASH Deposits
TEST PLOTS
INCORPORATED ASH DEPOSITS
(1)
(2)
(3)
(4)
INCORPORATED Ash Deposits
INCORPORATED Ash Deposits
(5)
(6)
(7)
(8)
(9)
Little Valley Creek
NEW ASH STOCKPI
AREA
monitoring point
creek
ephemeral stream
fence
road (dirt/gravel)

NOT TO SCALE

FILE
G-P FT BRAGG SOIL AMENDMENT

MEETING OF 5-12-88
REGARDING G-P ASH DISPOSAL

NAME	REPRESENTING
BEN KOR, EXEC. OFFICER	NORTH COAST REG. BD.
MARK NEELY	" " " "
KIP HOWLETT	Georgia - Pacific
Gerald Tice	" "
Kent Mayer	" "
Don Whitman	" "
DOUG DUTTON	" " - ATLANTA
SEYMOUR FRIESS	" " (consultant)
FRANK REICHMUTH	WCRWQCB
FRANK PALMER	SWRCB

STATE OF CALIFORNIA ATTACHMENT 5 GEORGE DEUKMEJIAN, Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—
NORTH COAST REGION
1440 GUERNEVILLE ROAD
SANTA ROSA, CA 95403
Phone: (707) 576-2220

May 27, 1988

Mr. Don Whitman
Mill Manager
Georgia Pacific Corporation
90 Redwood Avenue
Fort Bragg, CA 95437

Dear Mr. Whitman:

This letter will serve to verify the agreements we reached during the meeting in our office on May 12, 1988, regarding the possible recision of the Waste Discharge Requirements for the Little Valley soil amendment site. The soil amendment of ash is exempt from some Subchapter 15 regulations based on the ash being both decomposable and nonhazardous. We have concluded that the ash is decomposable, although the low levels of furans contained in it may linger for a period of a few years. These furans pose no immediate threat to groundwater due to their characteristic of binding strongly to soil and low water solubility. As for surface water, so long as erosion and transport of soil and ash is prevented through best management practices, the possibility of a threat to water quality is minimal.

The tetrachlorodibenzofuran (TCDF) content of the ash is considered to be nonhazardous. However, there remains the questions of the bioaccumulative character of TCDF which may concentrate in plant, animal or aquatic life to levels which are hazardous. Based on these facts, we have agreed that Georgia Pacific can continue use of the boiler fly ash as a soil amendment, with the understanding that a proposal for a sampling and analysis program will be forthcoming from Georgia Pacific. This program will investigate the possibility of bioaccumulation of hazardous levels of TCDF found in the ash. The three possible mechanisms of bioaccumulation area: respiration of ash and/or soil through wind transport off-site; exposure of both aquatic and terrestrial animals to furans in soil and nearby streams; and grazing of cover crop by ruminants.

Therefore, pursuant to Section 13267(b) of the Porter Cologne Water Quality Control Act, we request Georgia Pacific submit a sampling and analysis proposal by August 1, 1988, with an interim report due by July 1, 1988. Please feel free to call if you have any questions.

Sincerely,

Benjamin D. Kor
Executive Officer

cc: Frank Palmer, SWRCB
Kip Howlett
Gerald W. Tice
Kent Mayer
G. Doug Dutton

STATE OF CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

FACILITIES INSPECTION REPORT

SWRCB 001 (NEW 6-87)

ADDITIONAL INFORMATION SHOULD BE ATTACHED TO ORIGINAL

1. WDS NUMBER (Must be 11 digits)	2. NAME OF AGENCY RESPONSIBLE FOR DISCHARGE
1B850307RMEN	GEORGIA - PACIFIC CORP.
3. DATE INSPECTION COMPLETED Year Mo. Day	**4. NAME OF FACILITY**
88 06 10	FT. BRAGG ASH SOIL AMENDMENT

5. INSPECTION TYPE (Check One)

- A1 [ ] "A" type compliance—Comprehensive inspection in which samples are taken.
- B1 [X] "B" type compliance—A routine nonsampling inspection.
- 02 [ ] Noncompliance follow-up—Inspection made to verify correction of a previously identified violation.
- 03 [ ] Enforcement follow-up—Inspection made to verify that conditions of an enforcement action are being met.
- 04 [ ] Complaint—Inspection made in response to a complaint.
- 05 [ ] Pre-requirement—Inspection made to gather information relative to preparing, modifying, or rescinding requirements.
- 06 [ ] Miscellaneous—Any inspection not mentioned above.

NPDES

6. INSPECTION BY	7. IS EPA INSPECTION REQUIRED?
[X] State [ ] State/EPA Joint	[ ] Yes [X] No
8. DID YOU TAKE A BIOASSAY SAMPLE?	**9. IF A BIOASSAY SAMPLE WAS TAKEN, WAS IT:**
[ ] Yes [X] No	[ ] Static [ ] Flowthrough

10. INSPECTION COMMENTS SUMMARY–REQUIRED (100 Character Maximum)

IN COMPLIANCE. APPROVED AMENDMENT SITES FOR 87-88 STOCKPILE, AND 88-89 STOCKPILE AND AMENDMENT

11. WAS THERE A VIOLATION?

[ ] Yes (Complete violation form.) [X] No [ ] Pending (e.g., lab results)

12. INSPECTOR'S INITIALS ⟶ MKN

ADDITIONAL COMMENTS

G-P WILL SUBMIT LONG-RANGE AMENDMENT PLANS FOR THREE-YEAR PERIOD.

Georgia-Pacific Corporation
P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

Mark Neely
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

8003

Dear Mr. Neely,

June 10, 1988

Enclosed is the May 1988 report for the Georgia-Pacific Soil Amending Project as per revised Monitoring and Reporting Program 86-3. A small amount of amending was started during this month.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

Encl.

May 1988 Report

Georgia-Pacific Corporation

Fort Bragg Soil Amendment Monitoring and Reporting Program 86-3

Monitoring

Volume of Ash Deposited by Week		=	Cubic Yards of Ash Deposited	(Deposited) (Areas A & W.)
Week of;	01 - 07		320 Yds^3	
	08 - 14		360	
	15 - 21		440	
	22 - 28		500	
	29 - 31		80	
			Total = 1,700 Yds^3	

Number of treated Acres - Area A = 41.4

Number of Treated Acres - Area W = 5

Precipitation Measurements

Minimal rainfall occurred during the month of May; Saturday May 7=.43",Friday May 13=.17" and Wednesday May 18=.62 inches.

Stormwater Runoff Monitoring

No monitoring was possible due to minimal rainfall, and lack of water in the ephemeral draws.

Ash Depositions

1,700 Yards of ash (Approx.) were deposited to the winter area.

0 Yards of ash were amended, into Area A. (See above)

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
NORTH COAST REGION

Interoffice Communication

TO: 1)Frank Reichmuth DATE: 14 June 1988
2)File:Georgia-Pacific Ash soil Amendment

FROM: Mark Neely

SUBJECT: Compliance inspection of G-P Ash Little Valley Soil Amendment Site

On 10 June 1988 I completed a level B compliance inspection of the subject site. I was accompanied by Kent Mayer, G-P's environmental director, and Dave Larkin, construction engineer. We inspected the storage area and the planned amendment areas for the 87-88 winter stockpile, and the planned storage and amendment areas for the 88-89 stockpile and the ash produced by the mill boiler for summer 1988. We also toured the area with an eye for areas to use in the future.

My impression of the Little Valley area is that it is a good area to utilize for soil amending. The valley floor is poorly dissected, so there are few drainage features (see sketch map). Between the amending and storage areas and the Creek there is a large flat area that will catch any ash that may erode off of the stockpiles.

The best management practices for amending the ash entail a 40-foot setback from all drainage ways, whether ephemeral, intermittent, or perennial. The actual setback appears to be more on the order of 50 or 60 feet. The ground surface is ripped prior to stockpiling or amending,as the soil has very poor drainage and disking is difficult without ripping. There is an obvious increase in fertility where the ash has been amended, as the grass is thicker and higher (they use a Caltrans seed mix which includes perennial and annual ryegrass and clover). However, where vehicle tracks have disrupted the ground cover, the surface is prone to rilling. Drainage ditches are excavated around each stockpile to divert runoff.

Larkin told me that the ash production has dropped off, so that not enough ash is delivered to amend a large enough area to allow a tractor and disk to operate daily. I recommended that they disk as soon as it is feasible, not less than weekly.

After inspection and discussion, we came to the following agreements:

1) The existing stockpile from this past winter can be amended at the agreed-upon site. It is a ridgetop location with plenty of room.

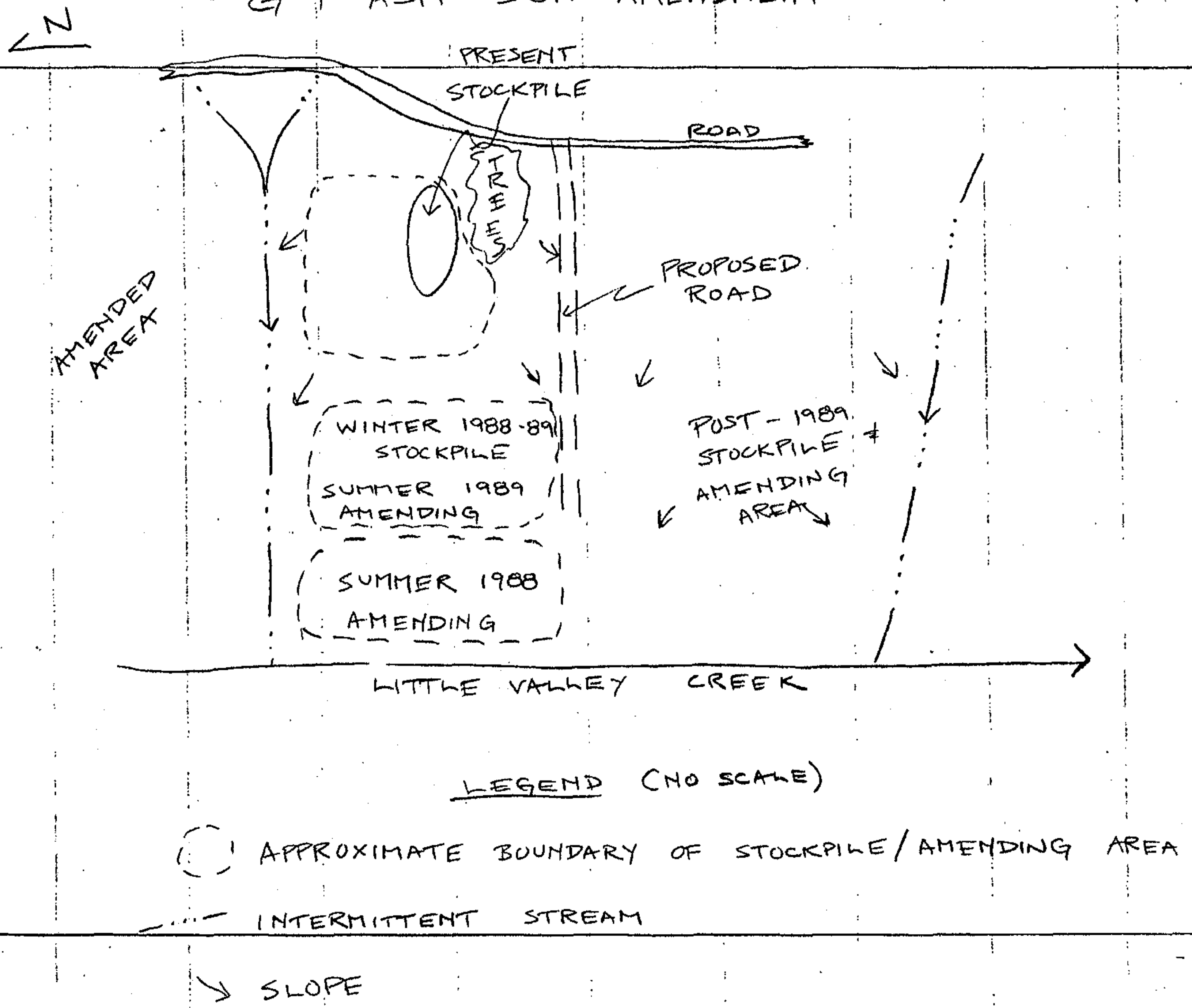
2) Due to the potential of rilling on disrupted surfaces, the ash produced through this summer should be amended beginning down by Little Valley Creek, working back away from the Creek so that each amended area can remain undisturbed following disking. There appears to be enough room to amend the ash produced for the next three years, at a minimum.

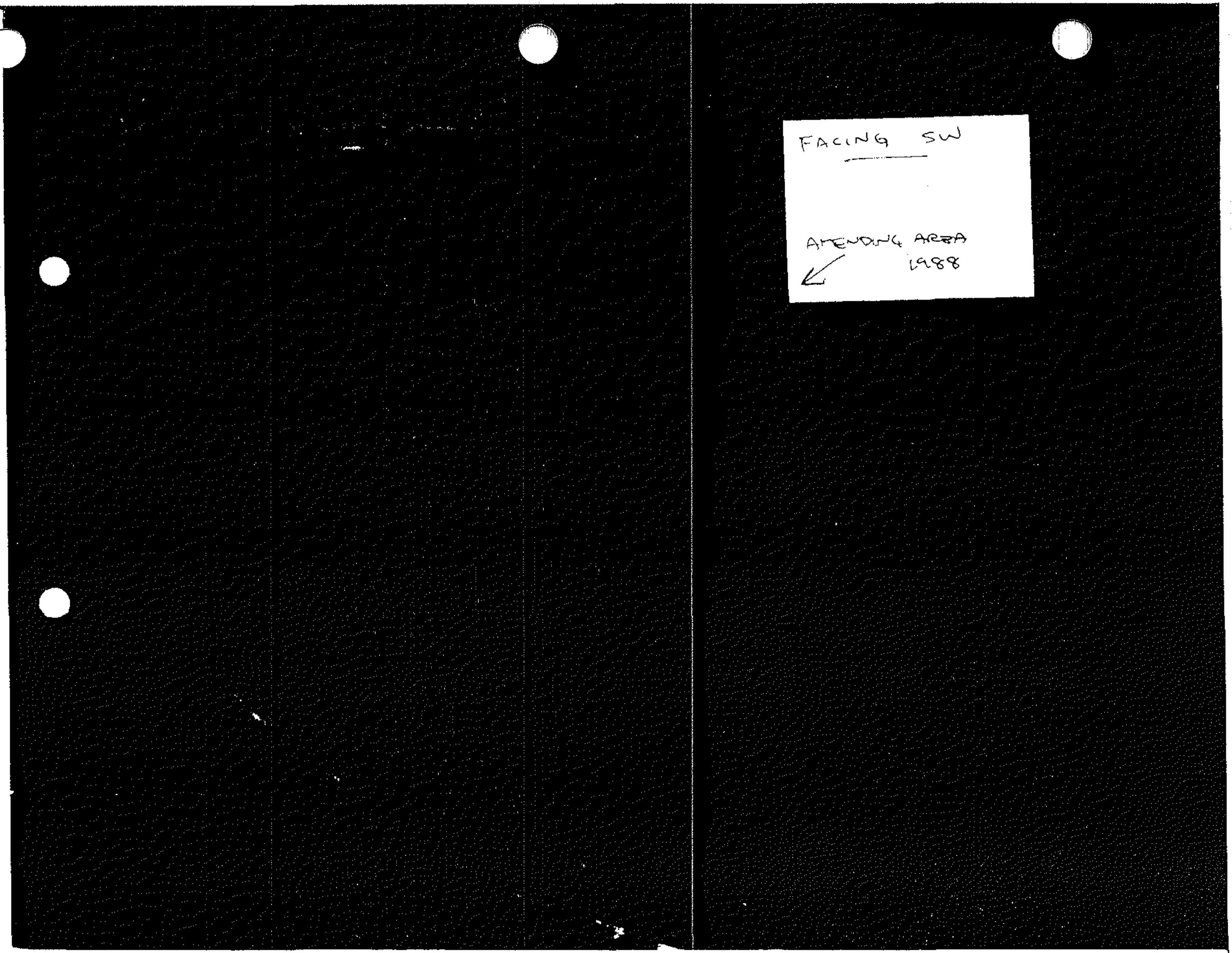
3) G-P will build a rocked road to access the new amending areas. this will prevent further disruption of any amended areas.

4) G-P will submit a long-range amending plan, rather than come back each year with a new proposal. This is dependant on the results of the on-going toxicology study, and on my observations during future inspections.

G-P appeared to be in compliance with their Waste Discharge Requirements.

G-P ASH SOIL AMENDMENT





FACING SW

ATTENDING AREA
1988

Georgia-Pacific Corporation

P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

WATER QUALITY
CONTROL BOARD
REGION I

JUL 15 '88

☐ BK ☐ BB
☐ CJ ☐ JG
☑ FR FR ☑ KD
☐ RT ☑ M NEELY
☐ JH ☐
☐ SW ☐
☐ RC ☐ REPLY

Mark Neely
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

80003

Dear Mr. Neely,

July 12, 1988

Enclosed is the June, 1988, report for the Soil Amending Project for Georgia-Pacific, as per Monitoring and Reporting Order No. 86-3.

No amending was done last month, as previously reported, because the site-operator decided to wait for the site inspection which was performed in June, by Mark Neely of the Regional Water Board.

Soil amending was scheduled to begin July 1, 1988, for the summer season.

Again, minimal rainfall was reported for the month of June. Details of precipitation are included in the Monitoring Report.

If you have any questions, please call me anytime.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

Encl.

July 1988 Report

Georgia-Pacific Corporation

Fort Bragg Soil Amending Project- Monitoring and Reporting- #86-3.

Monitoring

Volume of Ash Deposited, by Week			Cubic Yards Ash Deposited (Areas A & W)
Week of,	01-03	=	260 Yds^3
	04-10		480
	11-17		500
	18-24		420
	25-31		560
		=	2,220 Total Yds^3 Deposited

Area A - Number of Acres Treated = 49.2

Area W - Number of Acrea Treated = 5.

Precipitation

Minimal (insifnificant) rainfall fell during the month.

Stormwater Monitoring

No monitroing was possible because of lack of rainfall.

Ash Deposited

All the ash at the site, both from the winter stockpile and from the mill production of this summer, has been amended. Total amount of ash amended was 7.25 acres, (see cover page), into Area W.

Kent C Mayer

Kent Mayer
Environmental Engineer

WATER QUALITY CONTROL BOARD REGION 1

JUL 15 '88

☐ BK ~~86-3~~ ☐ BB
☐ CJ ☐ JG
☐ FR ☐ KD
☐ RT ☐
☐ JH ☐
☐ SW ☐
☐ RC ☐ REPLY

June 1988 Report

Georgia-Pacific Corporation

Fort Bragg Soil Amending Project - Monitoring and Reporting

Monitoring

Volume of Ash Deposited, by Week	=	Cubic Yards of Ash Deposited (Into Areas A & W).
Week of; 01-04		360 Yds^3
05-11		360
12-18		320
19-25		400
26-30		320

1,740 Total Cubic Yards Deposited

Area A - Number of Acres Treated = 41.4

Area W - Number of Acres Treated = 5

Precipitation Measurements

For the month of June, there was .83 inches of rain during the week of June 2, and .10 inches in the week of June 16. A total of .93 inches of rainfall was recorded for the month.

Stormwater Runoff Monitoring

No monitoring was possible because of minimal rainfall.

Ash Depositions

1,740 $Yards^3$ of ash (Approx.) deposited to the Winter Area.

0 Yards of ash were amended into Area A.

Kurt C. Moyer

JANUARY 1988 REPORT

Due to wet ground conditions, no ash was incorporated during January. All loads of ash were placed in the winter storage area as approved by Sue Warner. Total volume to the winter storage area was 1,840 cubic yards during the month of January.

Stormwater Runoff Monitoring

The pH samples were tested by G/P personnel (Steve Petrin). Ms. Warner has informed me that we need not strictly follow revised monitoring order 86-3 now that the C & A has been lifted, as long as the ash is checked daily. I have continued to sample pH until further guidance arrives.

LITTLE VALLEY pHs

Date	pt:	5	6	7	8	9
01/03		6.4	6.4	6.5	6.5	6.5
01/09		6.8	6.9	6.9	6.8	6.9
01/14		6.8	6.9	7.0	7.1	7.0

April 1988 Report

Georgia-Pacific Corporation

Fort Bragg Soil Amendment Montioring and Reporting Program 86-3

Monitoring

Volume of Ash Deposited by Week	=	Cubic Yards of Ash Deposited.
Week of, 01 - 02		140 $Yd.^3$
03 - 09		340
10 - 16		340
17 - 23		340
24 - 30		240

Number of Treated Acres (Area A)	41.4 Acres
Number of Treated Acres (Area W)	5

Precipitation Measurements

Minimal rainfall occurred during the month of April.

All loads of ash were deposited in the winter-storage area, approved by Sue Warner. Total volume to the winter storage area was 1,400 cubic yards for the month of April.

Stormwater Runoff Monitoring

No monitoring was conducted due to minimal rainfall, and lack of water in the ephemeral draws.

Signed,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

WATER QUALITY
CONTROL BOARD
REGION I

MAY 12 '88

☐ RK ____ ☐ BB ____
☐ GJ ____ ☐ JG ____
☐ FR ____ ☐ KD ____
☐ RT ____ ☐ ____
☐ JR ____ ☐ ____
☐ SW ____ ☐ ____
☐ RC ____ ☐ REPLY

March 1988 Report

Georgia-Pacific Corporation

Fort Bragg Soil Amendment Monitoring and Reporting Program 86-3.

Monitoring

Volume of Ash Deposited by Week		=	Cubic Yards of Ash Deposited.
Week of,	01-05		240 Yd^3.
	06-12		320
	13-19		520
	20-26		520
	27-31		220
Number of Treated Acres in Area "A"			41.4
Number of Treated Acres in Area "W"			5

Precipitation Measurements

Minimal precipitation occurred during the month of March.

All loads of ash were deposited in the winter-storage area, as approved by Sue Warner. Total volume placed in the winter-storage area was 1,820 cubic yards for the month of March.

Stormwater Runoff Monitoring

No monitoring was done due to minimal rainfall, and lack of water in the ephemeral draws.

Signed,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

JANUARY 1988 REPORT

GEORGIA-PACIFIC CORPORATION

FORT BRAGG SOIL AMENDMENT MONITORING AND REPORTING PROGRAM NO. 86-3

Monitoring

<u>Volume of ash deposited by Week</u> – <u>Cubic Yards of Ash</u> – deposited at the winter storage area.

January	01 – 02	0
	03 – 09	560
	10 – 16	560
	17 – 23	380
	24 – 30	320
	31	20

Number of Treated Acres (Area A) 41.44 Acres
Number of Treated Acres (Area W) 5

Daily Precipitation Measurements		PPT (Inches)
January	1	0.04
	2	0.83
	3	0.77
	4	0
	5	0
	6	0
	7	0.27
	8	0.80
	9	0.46
	10	0.96
	11	0.06
	12	0.03
	13	0.18
	14	1.77
	15	0.52
	16	0.25
	17	0.03
	18	0
	19	0
	20	0
	21	0
	22	0
	23	0
	24	0
	25	0
	26	0
	27	0
	28	0
	29	0
	30	0
	31	0

1 KAD
2

JANUARY 1988 REPORT

Due to wet ground conditions, no ash was incorporated during January. All loads of ash were placed in the winter storage area as approved by Sue Warner. Total volume to the winter storage area was 1,840 cubic yards during the month of January.

Stormwater Runoff Monitoring

The pH samples were tested by G/P personnel (Steve Petrin). Ms. Warner has informed me that we need not strictly follow revised monitoring order 86-3 now that the C & A has been lifted, as long as the ash is checked daily. I have continued to sample pH until further guidance arrives.

LITTLE VALLEY pHs

Date	pt:	5	6	7	8	9
01/03		6.4	6.4	6.5	6.5	6.5
01/09		6.8	6.9	6.9	6.8	6.9
01/14		6.8	6.9	7.0	7.1	7.0

ATTACHMENT 6

Georgia-Pacific Corporation
International Square
1875 Eye Street, N.W.
Washington, DC 20006
Telephone (202) 659-3600

WATER QUALITY CONTROL BOARD

JUL 21 '88

☐ BK ☐ BB
☐ CJ ☐ JG
☐ FR ☐ KD

July 15, 1988

Mr. Benjamin D. Kor
Executive Officer
California Regional Water Quality
Control Board
North Coast Region
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Kor,

In your letter of May 27, 1988, you requested a proposal for a sampling and analysis program for tetrachlorodibenzo-furans (TCDFs) in the fly ash from Ft. Bragg wood products manufacturing facility.

It is our understanding that because none of the fly ash analyses to date have shown any 2,3,7,8 TCDFs (core), we agreed at our May meeting that the analysis of samples in these studies would be for non-2,3,7,8 TCDFs (non-core). These analyses would be for the summation of non-core congeners. You will observe that in the cover crop study plan there is a confirming analyses for the assumption of the absence of the core TCDF congener.

We appreciate your willingness to extend the submission of the interim report to July 15 and believe the attached protocols are specific enough to be considered as the sampling and analysis proposal due on August 1, 1988.

The sampling and analysis proposal addresses the three areas of interest identified in your letter. These areas include wind transport off-site, animal exposure to amended soil, and the cover crop potentially available for grazing.

Due to the extremely low concentration for which we will be analyzing, sample volumes may have to be relatively substantial. For example, to determine low parts per trillion concentration in particulate, air samples may have to collect dust for extended periods of time. For this reason, these projects may begin concurrently but extend over different periods of time.

Mr. Benjamin Kor
July 15, 1988
Page two

While we plan to use California Analytical Laboratories in Sacramento for the analytical work, consultants have not been identified for the other activities in these projects until your review and comments of these proposals have been made.

We appreciate your assistance in this matter and look forward to your comments.

Sincerely,

C.T. Howlett, Jr.

C. T. Howlett, Jr.
Vice President,
Government Affairs

Encl.
CTH/cka

Georgia-Pacific Corporation
International Square
1875 Eye Street, NW
Washington, DC
Telephone (202) 659-3600

WATER QUALITY CONTROL BOARD REGION I

JUL 21 '88

BK, BB, CJ, JG, FR, KD, RT, send copy to Frank Elmer DONE, JH, SW, RC, REPLY

this takes 2 months

July 15, 1988

Mr. Benjamin D. Kor
Executive Officer
California Regional Water Quality
Control Board
North Coast Region
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Kor,

In your letter of May 27, 1988, you requested a proposal for a sampling and analysis program for tetrachlorodibenzo-furans (TCDFs) in the fly ash from Ft. Bragg wood products manufacturing facility.

It is our understanding that because none of the fly ash analyses to date have shown any 2,3,7,8 TCDFs (core), we agreed at our May meeting that the analysis of samples in these studies would be for non-2,3,7,8 TCDFs (non-core). These analyses would be for the summation of non-core congeners. You will observe that in the cover crop study plan there is a confirming analyses for the assumption of the absence of the core TCDF congener.

We appreciate your willingness to extend the submission of the interim report to July 15 and believe the attached protocols are specific enough to be considered as the sampling and analysis proposal due on August 1, 1988.

The sampling and analysis proposal addresses the three areas of interest identified in your letter. These areas include wind transport off-site, animal exposure to amended soil, and the cover crop potentially available for grazing.

Due to the extremely low concentration for which we will be analyzing, sample volumes may have to be relatively substantial. For example, to determine low parts per trillion concentration in particulate, air samples may have to collect dust for extended periods of time. For this reason, these projects may begin concurrently but extend over different periods of time.

While we plan to use California Analytical Laboratories in Sacramento for the analytical work, consultants have not been identified for the other activities in these projects until your review and comments of these proposals have been made.

We appreciate your assistance in this matter and look forward to your comments.

Sincerely,

C.T. Howlett Jr.

C. T. Howlett, Jr.
Vice President,
Government Affairs

Encl.
CTH/cka

PROPOSAL FOR
RESEARCH PLAN TO DETERMINE
NON-2,3,7,8 TCDFs IN FLY ASH AMENDED SOIL
AND RELATED ENVIRONMENTAL VECTORS

I. Cover Crop Study Plan
II. Dust Sampling Plan
III. Terrestrial Animal Exposure Plan

JULY 15, 1988

COVER CROP STUDY PLAN

Objective: To determine levels of non-2,3,7,8 TCDFs in cover crops grown on soil amended with fly ash from Ft. Bragg wood products facility.

Purpose: To determine whether non-2,3,7,8 TCDFs are taken up and perhaps accumulated in flora and therefore become available to animals grazing on soil amended with fly ash.

Study Design: From the sample site used in the terrestrial animal study plan on which fly ash was amended within the last 12 months, a pair of soil samples will be taken to a depth of 30 inches and analyzed for non-2,3,7,8 TCDFs. Similar soil samples from the "control" site will also be taken and analyzed.

Simultaneous with the acquisition of the paired soil samples from the two sites, paired samples of ground cover (grass and clover) from the two sites will be harvested and analyzed for non-2,3,7,8 TCDFs. Assuming these initial samples of soil and forage are taken in the fall of 1988, in the spring of 1989, paired samples of ground cover from the same areas previously sampled will be taken. These crop samples will be analyzed for non-2,3,7,8 TCDFs. If two consecutive samples have reported values of non-detectability, this study will be completed. If the values reported are above the limit of detection, then the study will continue until two consecutive values of non-detectability are obtained. All samples taken will be split with one set for analysis and the other set archived under QA/QC criteria for good laboratory practices.

The analysis for TCDFs in the first set of soil samples will be for core (2,3,7,8) and a summation of non-core (non-2,3,7,8) TCDFs. If these results are consistent with all previous analyses of the fly ash from this facility, that is only non-core has been detectable, and all values for 2,3,7,8 TCDF have been non-detectable, all subsequent analyses of samples taken in this or the other studies will be for total TCDFs but shall be reported as non-2,3,7,8 TCDF. This procedure will facilitate the analytical phase of these studies and achieve a cost savings.

Reports: An analytical report of the initial soil and crop samples will be prepared. Subsequent progress reports of each additional crop sampling phase will be prepared.

Timing: This study will take at least six months and may extend for a year or more.

DUST SAMPLING PLAN

Objective: Determine concentrations of non-2,3,7,8 TCDF in airborne dust from sites amended with fly ash from the Ft. Bragg wood products manufacturing facility

Purpose: To provide a basis for determining if wind borne particulate provides a means of transport off-site for non-2,3,7,8 TCDFs that may be present in the soil.

Study Design: An upwind and downwind airborne dust samples will be taken at two locations in the same valley. One location will have had fly ash amended in the soil within the last six months and the other site will not have amended soil and serve as a control. The upwind/downwind samples will be placed in parallel configuration and at equal distances from each other at the respective sites.

Wind direction, its periodicity, and velocity will be obtained from the Weather Service, the air field, and other appropriate sources. This information will be used to determine the proper location for placement of the samplers. In addition, using currently available particulate dispersion models from the scientific literature, particle distribution from the ash amended site will be calculated with particular attention paid to the dispersion potential and pattern within the valley.

Standard cascade impactions will be used for sampling in order to provide particle size distribution for use in the dispersion modeling and the percentage of dust in the respirable size range (0.2-10 microns)

The four dust samples will be analyzed for non-2,3,7,8 TCDFs and will be weighed within specified sized distributions (eg. respirable particulate) and total weights and samples will be split so that one part can be analyzed and a full archived sample can be retained under specified QA/QC criteria for good laboratory practices (GLP).

Reports: There will be two reports on this project. One will be an Analytical report from the laboratory. The other report will be prepared by the industrial hygiene or environmental monitoring consultant. This report will contain the particle size distribution data and the results of the dispersion modeling.

Timing: The completion of this project is largely dependent on the sample collection phase to obtain enough material for both the analytical and archive samples for the limit of detection that is of interest.

TERRESTRIAL/AQUATIC ANIMAL EXPOSURE STUDY PLAN

Objective: To measure the levels of non-2,3,7,8 TCDFs in terrestrial animals in contact with soil amended with fly ash from the Ft. Bragg wood products manufacturing facility.

Purpose: To determine whether bioaccumulation of non-2,3,7,8 TCDF occurs in animals from contact with amended soil. Sampling of aquatic species will not be undertaken until the dust distribution study is completed and or determinations can be made whether a stream that supports aquatic life is in contact with amended soil.

Study Design: Four sites will be selected for this study. One site without amended soil will be used as a control. These sites where soil amendment has occurred within the last six months, from 6-18 months, and two years will be selected.

Earthworms will be used as the test species because their migratory pattern maximizes the likelihood of contact with only the amended soil, while foraging mammals with a wider range of habitat would make correlation of observed concentration with potential exposure virtually impossible to make.

Earthworms will be taken at a depth of about 12 inches (± 6" either way) from two locations at each site. The four sets of paired samples will be weighed, dyed, and split. One-half of each paired set will be analyzed for non-2,3,7,8 TCDFs and the other half retained under QA/QC criteria of good laboratory practices.

Reports: An analytic report and description of the study's methodology and procedure will be prepared.

Timing: Less than one year.

STATE OF CALIFORNIA
GEORGE DEUKMEJIAN, *Governor*

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—
NORTH COAST REGION**

1440 GUERNEVILLE ROAD
SANTA ROSA, CA 95403
Phone: (707) 576-2220

July 27, 1988

Mr. Kent Mayer
Georgia-Pacific Corporation
P.O. Box 1618
Eugene, OR 93340

Dear Mr. Mayer:

During my inspection of the Little Valley ash amending site on June 12, 1988, I agreed to Georgia-Pacific's proposed amendment site for the 1987-88 winter period stockpile. This amending will take place just to the north of the stockpile. This letter will serve as official confirmation of that assent. I have provided a sketch map from my inspection.

Please call if you have any questions.

Sincerely,

Mark Neely
Associate Engineering Geologist

cc: Dave Larkin

ATTACHMENT 2

State of California

Memorandum

WATER QUALITY
CONTROL BOARD
REGION I

To : Frank Reichmuth
North Coast Regional Water
Quality Control Board
1440 Guerneville Rd.
Santa Rosa, CA 95403

Date : AUG - 5 1988

FEB 16 '90

☐ BK ___ ☐ RK ___
☐ CJ ___ ☐ LR ___
☐ FR ___ ☐ BB ___
☐ RT ___ ☐ KD ___
☐ JH ___ ☐ JS ___
☐ SW ___ ☐ ___
☐ ___ ☐ REPLY
☐ ALL STAFF ☐ FILE

Frank Palmer
Water Quality Criteria
Division of Water Quality

From : STATE WATER RESOURCES CONTROL BOARD

Subject: REVIEW OF PROPOSAL SUBMITTED BY GEORGIA PACIFIC CORPORATION

This is in response to your request for review of the subject proposal, relating to possible bioaccumulation of tetrachlorodibenzofuran (TCDF) present in fly ash that is used as a soil amendment. Overall, I think the three part study plan should provide sufficient information for determining if TCDF is bioaccumulating. I have one suggested addition to the Terrestial/Aquatic Animal Exposure Study Plan: include 2,3,7,8-TCDF as well as the proposed non-2,3,7,8-TCDF in the earthworm analyses. I am suggesting specific analysis for 2,3,7,8-TCDF because of the possibility that bioaccumulation of this TCDF isomer may be sufficiently great to reveal its presence even though the fly ash analyses indicated that that TCDF present were non-2,3,7,8 isomers. As I have mentioned before, a recent study showed bioconcentration of 2,3,7,8-TCDF by rainbow trout to exceed a factor of 6,000.

I also wish to repeat that, based on the Japanese and Taiwanese human exposures, there is reason to believe that non-2,3,7,8-TCDFs can accumulate in humans and are potentially toxic. The enclosed article by Rappe et al. (1983) indicates that both 2,3,6,8- and 2,3,7,8-TCDF were retained by people exposed to these contaminants. Masuda et al. (1983) found 0.4 ppb 2,3,6,8-TCDF present in the liver of a Yusho patient who died in 1975, seven years after exposure. Note that the concentration of 2,3,7,8-TCDF was below detection. These data are suggestive that the 2,3,6,8-TCDF isomer may have as long or longer half-life in humans as the 2,3,7,8-TCDF isomer.

Masuda et al. (1983) also report that 2,3,6,8-TCDF causes enzyme induction analogous to that of 2,3,7,8-TCDF in rat liver and lung. Masuda et al. (1983) note in their discussion that <u>three or four</u> chlorine atoms in the lateral (2,3,7,8) positions enhance enzyme activity. At least two of the non-2,3,7,8-TCDFs (2,3,6,7-TCDF and 2,3,6,8-TCDF) may have toxicological consequences.

name	Palmer 8/5/88		

Finally, I am attaching a recent article that appeared in Science (July 15, 1988), which reports congenital poisoning to offspring of women exposed in a 1979 Taiwanese incident to PCBs contaminated with PCDFs. This incident was remarkably similar to the Japanese event that occurred 11 years earlier.

Attachments

bcc: Dave Cohen
Gerry Bowes

FPALMER:KPennino
8/4/88/2-8400
Filename: rechmuth.fhp
Disk: Palmer #4

Georgia-Pacific Corporation
P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

Mark Neely
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Neely,

August 8, 1988

Enclosed is the report for the Soil Amending project for July, 1988, as per Monitoring and Reporting Order 86-3.

Amending at the site was started this month. During the month of July, all of the stockpile from the winter of '87-88 was amended into 6.5 acres. Another 1-¼ acres were amended with this summers' production, as per Order 86-3.

There was no rainfall at the Little Valley site for the month of July, 1988.

If you have any questions, please feel free to call me.

Sincerely,

Kent C Mayer

Kent C. Mayer
Environmental Engineer

August 1988 Report

Georgia-Pacific Corporation

Soil Amending Project - Monitoring and Reporting Order 86-3.

Monitoring

Volume of Ash Deposited, by Week			Cubic Yards Ash Deposited (Area A, South)
Week of,	01-06	=	480 Yds^3
	07-13		500
	14-20		360
	21-27		380
	28-31		200
		=	1,920 Yds^3 Total Deposited

Area A (South portion) - Number of Acres Treated = 50.8

Area W is constant at 5.0 acres.

Precipitation

No measureable rainfall.

Stormwater Monitoring

See above.

Ash Deposited

All ash generated from the mill from the month of August, 1988, was ammended into the soil. The area covered is south of the treated area A and continues south, covering approximately 1.6 acres.

Kent C. Mayer
Environmental Engineer

STATE OF CALIFORNIA GEORGE DEUKMEJIAN, *Governor*

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—
NORTH COAST REGION
1440 GUERNEVILLE ROAD
SANTA ROSA, CA 95403
Phone: (707) 576-2220

August 15, 1988

Mr. Dave Larkin
Georgia-Pacific Corporation
90 Redwood Avenue
Fort Bragg, CA 95437

Dear Mr. Larkin:

In my letter to you dated July 29, I neglected to state that I had agreed to your request to begin incorporation of the ongoing ash production from the mill, as well as the stockpile from last winter. You are free to do so in the area agreed upon (see attached sketch map). I would like to take this opportunity to reaffirm some of the best management practices that we have also agreed upon.

1. Retain a minimum 50 foot buffer between incorporation activities and any watercourse, whether perennial, intermittent, or ephemeral. Wider buffers are certainly allowable and probably preferable.

2. The ash should not be allowed to accumulate for longer than a week during the summer period. It should be incorporated as soon as there is enough ash to feasibly incorporate with heavy equipment. This office should be notified if a need arises to store the ash for longer periods.

3. Once the ash has been incorporated in an area and planted with grass seed, there shall be no passage of vehicles or equipment over the amended area. This will prevent disruption of the ground cover that leads to surface erosion.

A stated in our phone conversation on August 8, I will be arranging an inspection of the Little Valley site during the week of September 19-23 in order to evaluate the planting situation and the planned stockpile site for next winter. Feel free call if you have any questions.

Sincerely,

Mark Neely
Associate Engineering Geologist

MKN:mkk

STATE OF CALIFORNIA GEORGE DEUKMEJIAN, *Governor*

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—
NORTH COAST REGION

1440 GUERNEVILLE ROAD
SANTA ROSA, CA 95403
Phone: (707) 576-2220

August 25, 1988

Mr. C.T. Howlett, Jr.
Georgia-Pacific Corporation
International Square
1875 Eye Street N.W.
Washington, D.C. 20006

Dear Mr. Howlett:

We have received your "Proposal for Research Plan to Determine non-2,3,7,8 TCDFs in Fly Ash Amended Soil and Related Environmental Vectors", dated July, 15, 1988. We believe that the three part study plan should provide sufficient information for determining if TCDF is bioaccumulating. One addition we would like to suggest would be to include 2,3,7,8-TCDF as well as the proposed non-2,3,7,8-TCDF in the earthworm analyses. The reason for this is because of the possibility that bioaccumulation of this TCDF isomer may be sufficiently great to reveal its presence even though the fly ash analyses indicated that the TCDF present were non-2,3,7,8-TCDF isomers.

Also, we would like to formalize the dates of submission of the progress reports in order to keep the study moving in a timely fashion and allow us to anticipate when we can expect specific goals to be met. Please provide us with such a schedule by September, 1988.

With the inclusion of the additional analysis for the earthworm study, we concur with your study proposal and agree that you may begin as soon as feasible. Please call if you have any questions.

Sincerely,

Benjamin D. Kor
Executive Officer

BDK:mkk

cc: Kent Mayer

Georgia-Pacific Corporation

P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

WATER QUALITY
CONTROL BOARD
REGION 1

SEP 12 '88

Mark Neely
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Neely,

September 9, 1988

Enclosed is the report for the Soil Amending project as per Monitoring and Reporting Order 86-3, for August, 1988, for the Georgia-Pacific mill at Fort Bragg, California.

There was no measureable rainfall at the site for the month of August. Approximately 1.6 acres was amended, from the production for the month.

If you have any questions, please call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

Encl.

September 1988 Report

Georgia-Pacific Corporation

Soil Amending Project- Monitoring and Reporting- Order 86-3.

Monitoring

Volume of Ash Deposited, by Week			Cubic Yards Ash Deposited= Area A, South- (newly approved)
Week of,	01-04	=	160 Yds^3
	05-11		480
	12-18		460
	19-25		80
	26-30		60
		=	1,240 Yds^3 Deposited

Area A-(South) - Number of Treated Acres is 52.4

Precipitation

4/100" of drizzle, for the month of September.

Stormwater Monitoring

N/A

Ash Deposited

All the ash generated from the boilers was deposited and amended for the month of September in an area of approximately 1.6 acres. It should be noted that the mills were down for 4½ (workweek) days this month.

STATE OF CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

FACILITIES INSPECTION REPORT

SWRCB 001 (NEW 6-87)

ADDITIONAL INFORMATION SHOULD BE ATTACHED TO ORIGINAL

1. WDS NUMBER (Must be 11 digits) 1B85Ø3ØRMEN	2. NAME OF AGENCY RESPONSIBLE FOR DISCHARGE GEORGIA-PACIFIC
3. DATE INSPECTION COMPLETED Year Mo. Day 88 09 20	4. NAME OF FACILITY FT. BRAGG ASH SOIL AMENDMENT

5. INSPECTION TYPE (Check One)

A1 [ ] "A" type compliance—Comprehensive inspection in which samples are taken.

B1 [X] "B" type compliance—A routine nonsampling inspection.

02 [ ] Noncompliance follow-up—Inspection made to verify correction of a previously identified violation.

03 [ ] Enforcement follow-up—Inspection made to verify that conditions of an enforcement action are being met.

04 [ ] Complaint—Inspection made in response to a complaint.

05 [ ] Pre-requirement—Inspection made to gather information relative to preparing, modifying, or rescinding requirements.

06 [ ] Miscellaneous—Any inspection not mentioned above.

NPDES

6. INSPECTION BY [X] State [ ] State/EPA Joint

7. IS EPA INSPECTION REQUIRED? [ ] Yes [X] No

8. DID YOU TAKE A BIOASSAY SAMPLE? [ ] Yes [X] No

9. IF A BIOASSAY SAMPLE WAS TAKEN, WAS IT: [ ] Static [ ] Flowthrough

10. INSPECTION COMMENTS SUMMARY—REQUIRED (100 Character Maximum)

AMENDING IN PROCESS. SOME WIND DISPERSION OF ASH, BUT NO IMPACT ON WATER APPARENT

11. WAS THERE A VIOLATION? [ ] Yes (Complete violation form.) [X] No [ ] Pending (e.g., lab results)

12. INSPECTOR'S INITIALS → MKN

ADDITIONAL COMMENTS

SEE ATTACHED MEMO.

87 82495

Chemosphere, Vol.17, No.7, pp 1369-1379, 1988
Printed in Great Britain

0045-6535/88 $3.00 + .00
Pergamon Press plc

PCDD/F-CONCENTRATIONS IN CHIMNEY SOOT FROM HOUSE HEATING SYSTEMS

H. Thoma, University of Bayreuth, Chair of Ecological Chemistry and Geochemistry, P.O.Box 10 12 51, 8580 Bayreuth, FRG

SUMMARY

50 different chimney soot samples from house heating in the area of Bayreuth, Germany, were analyzed for PCDD/F. The furnaces operated with wood, coal, wood/coal or oil. PCDD/F were detected in all samples and their isomer patterns were similar to those from municipal waste incinerators. Expressed as toxicity equivalents (Federal health office FRG) the following average concentrations were detected: oil (central heating) 147 ppt, oil (oven) 907 ppt, wood/coal (oven) 909 ppt, wood (central heating) 14896 ppt, wood (oven) 7489 ppt and coal (oven) 5120 ppt.

INTRODUCTION

Little is known about the formation of PCDD/F from burning of fossil fuels[1-3]. Clement et al. [4] detected PCDD/F in chimney ash from wood burning furnaces in concentrations which were significantly lower than the concentrations in fly ash from municipal waste incinerators. In an earlier investigation [5] we detected PCDD/F in concentrations which were almost as high as those in fly ash from municipal waste incinerators in one chimney soot from an oil burner and one from a wood/coal burner. To get more information about the contribution of PCDD/F load from house heating 50 chimney soots from different firing were analyzed for PCDD/F.

EXPERIMENTAL

Sample description: 50 chimney soot samples of house heating were collected from the area of Bayreuth, Germany.
The following samples were analyzed representing different heating systems:

fuel	system	samples
oil	central heating	21
oil	oven	7
coal	oven	7
wood/coal	oven	2
wood	central heating	4
wood	oven	9

Extraction and clean up: 50 g chimney soot was treated 2 h with 10% HCl and then dried at 70°C overnight. After addition of the ^{13}C-labelled internal standards (tetra to octa, one isomer for each chlorination grade) the sample was soxhlet-extracted for 48 h with toluene. The clean up was made by the method previously reported by Dow Chemical [6].

GC/MS-conditions: The analysis of the cleaned-up samples were performed using a high resolution mass spectrometer Finnigan MAT 8230 in the SIM mode (resolution 3000).
GC conditions were: initial temperature, 100°C; held for one minute (0.7 min. splitless); initial program rate, 20°C/min to 180°C; second program rate, 5°C/min to 320°C, final temperature held for 10 min. A 25 m x 0.2 mm fused silica SE 54 column was used.
The isomer specific analysis was carried out using a 60 m fused silica SP 2331 column. GC conditions: initial temperature, 100°C; held for one minute (0.7 min. splitless); initial program rate, 20°C/min to 180°C; second program rate, 5°C/min to 250°C, final temperature held for 80 min.
The quantification was carried out with the ^{13}C-labelled internal standards.

RESULTS

a) Analysis of chimney soot from oil burning
Table 1 and 2 show the data of the analysis of chimney oil burning. All samples had detectable levels of PCDD/F. The concentrations of PCDD/F from oil central heating were, on the average, 10 times less than in the samples of oil ovens, though the range between the minimum and maximum PCDD/F-concentrations were about 10 to 100 in both plants. In comparison to fly ash from municipal waste incinerators the concentrations in chimney soot were 10 to 100 times less.

b) Analysis of chimney soot from coal burning
Table 3 shows the data of the analysis of chimney coal burning. In these high levels of PCDD/F were detected. The concentrations were in the range

of municipal waste incinerators and thus 10 to 100 times higher than the concentrations of oil burning.

c) Analysis of chimney soot from wood burning
Table 4 and 5 show the data of the analysis of chimney wood oven and wood central heating. As shown in table 4 and 5 also high amounts of PCDD/F were detected which were similar to the PCDD/F concentrations of coal firing. A difference between oven and central heating was not detected contrary to oil fuelled systems.

d) Analysis of chimney soot from wood/coal burning
Table 6 shows the data of the analysis of chimney wood/coal firing. The PCDD/F concentrations were about 5 times less than those of wood and coal burning, but definite conclusions cannot be drawn since only two samples were available.

DISCUSSION

Contrary to earlier studies high concentrations of PCDD/F were detected in analyzed chimney soots. The lowest PCDD/F concentrations were formed in oil central heating.
Furthermore, the data indicate that home heating is probably a major source of PCDD/F emission. Diffuse sources such as home heating could be a major source of PCDD/F background levels in so-called clean area regions [7].
The PCDD/F concentrations were only 5 to 10 times lower in such areas than around municipal waste incinerators.

Table 1: PCDD/F-concentrations of chimney soot from oil central heating (ppt)

Compound	1	2	3	4	5	6	7	8	9
TCDD	1950.0	14.7	1640.0	133.9	6.4	48.9	260.3	20.1	120.5
PCDD	460.0	80.0	3600.0	193.5	7.4	18.0	178.1	10.3	89.8
H_6CDD	340.0	95.6	2400.0	94.2	18.7	33.8	237.1	19.6	309.8
H_7CDD	560.0	115.2	1100.0	141.7	23.4	85.7	382.4	32.6	318.3
OCDD	370.0	245.3	564.2	169.1	33.8	177.1	498.3	49.2	403.8
TCDF	3510.0	2290.0	24500.0	871.9	176.7	268.8	2800.0	104.4	3800.0
PCDF	2260.0	1930.0	16900.0	505.9	73.1	177.3	1700.0	67.4	2000.0
H_6CDF	630.0	474.0	8100.0	203.7	28.4	75.7	346.8	44.5	407.4
H_7CDF	150.0	86.7	3800.0	64.3	10.4	28.0	65.3	17.8	74.4
OCDF	44.0	36.2	1500.0	31.7	7.4	17.2	19.1	10.3	22.4
2378-TCDD	10.8	2.4	68.5	5.8	$<$1.0	1.0	13.1	2.5	14.2
12378-PCDD	18.7	4.2	150.6	9.0	$<$1.0	3.6	20.4	1.8	7.6
123478-H_6CDD	8.7	2.5	82.6	4.2	$<$1.0	1.5	10.1	1.0	12.6
123678-H_6CDD	16.8	5.3	267.1	8.4	1.5	3.0	20.6	2.2	24.0
123789-H_6CDD	13.0	3.6	164.6	6.3	1.0	1.8	18.1	1.8	21.5
1234678-H_7CDD	323.4	62.3	612.4	80.7	11.5	48.9	216.3	16.8	191.2
2378-TCDF	385.5	406.8	1500.0	34.9	15.8	17.6	357.9	7.4	463.7
12378-PCDF	228.4	192.1	1300.0	40.1	6.7	21.6	143.3	5.3	200.6
23478-PCDF	327.3	371.8	1600.0	40.0	7.5	14.2	189.2	6.7	246.6
123478-H_6CDF	97.9	73.3	1100.0	25.4	3.5	8.5	54.1	4.3	72.1
123678-H_6CDF	74.2	51.4	728.8	29.3	3.7	10.8	37.7	4.9	63.5
123789-H_6CDF	5.3	4.2	57.6	4.2	$<$1.0	1.5	4.6	1.0	6.2
234678-H_6CDF	41.4	20.9	438.9	16.0	2.4	4.7	21.3	2.7	26.1
1234678-H_7CDF	99.6	54.6	2600.0	37.3	6.9	15.1	40.0	10.2	47.5
1234789-H_7CDF	11.3	6.8	204.6	4.2	$<$1.0	1.8	4.9	1.2	5.9

Table 1: PCDD/F-concentrations of chimney soot from oil central heating (ppt)

Compound	10	11	12	13	14	15	16	17	18
TCDD	31.0	164.2	29.8	177.0	98.4	312.0	28.1	536.2	13.0
PCDD	5.0	153.8	12.7	30.8	77.4	89.1	25.6	184.6	31.7
H_6CDD	11.0	225.9	45.9	15.2	23.7	101.4	10.4	169.9	22.5
H_7CDD	19.0	274.8	95.3	31.8	48.3	199.0	29.1	274.5	52.4
OCDD	40.0	305.9	116.1	58.3	51.8	298.4	58.9	314.3	73.1
TCDF	93.0	1227.6	159.0	146.8	84.7	754.4	84.6	549.3	68.0
PCDF	66.0	990.9	132.9	318.7	93.7	478.8	65.6	366.4	69.6
H_6CDF	28.0	399.8	67.9	150.6	57.1	177.6	28.0	166.8	42.6
H_7CDF	13.0	105.2	47.7	32.9	35.0	75.4	14.0	53.3	20.7
OCDF	11.0	43.3	32.8	13.2	20.1	41.1	10.1	21.7	10.8
2378-TCDD	1.3	7.2	3.1	25.7	11.1	12.5	<1.0	28.3	1.2
12378-PCDD	<1.0	17.1	3.0	4.1	3.4	13.3	7.6	10.7	2.0
123478-H_6CDD	4.0	9.7	1.6	1.9	1.5	4.2	<1.0	9.7	1.6
123678-H_6CDD	<1.0	20.4	5.7	1.5	1.8	7.2	1.8	12.7	3.2
123789-H_6CDD	<1.0	15.1	4.0	1.0	1.3	6.5	1.4	14.6	2.4
1234678-H_7CDD	15.4	151.9	52.3	16.1	24.1	101.6	15.2	135.4	26.0
2378-TCDF	14.3	80.8	25.5	36.9	15.6	171.4	12.3	25.8	5.5
12378-PCDF	6.1	75.6	12.1	25.7	9.1	51.3	6.1	25.4	5.1
23478-PCDF	6.3	90.8	14.9	73.6	14.2	73.2	9.9	24.5	6.2
123478-H_6CDF	3.8	51.5	8.6	30.4	4.8	23.1	3.3	17.6	5.2
123678-H_6CDF	2.8	51.9	8.5	16.9	9.7	22.7	3.9	25.0	6.3
123789-H_6CDF	<1.0	7.0	2.5	2.3	1.5	3.7	1.4	3.4	1.1
234678-H_6CDF	1.5	26.1	5.4	13.0	4.4	10.2	1.9	9.9	3.6
1234678-H_7CDF	7.3	63.5	30.2	21.0	21.2	44.4	7.6	29.8	13.3
1234789-H_7CDF	1.2	7.5	3.2	2.3	2.4	4.1	1.0	3.0	1.2

Table 1: PCDD/F-concentrations of chimney soot from oil central heating (ppt)

Compound	19	20	21
TCDD	27.8	15.5	170.1
PCDD	106.4	78.8	323.6
H_6CDD	152.8	17.8	279.3
H_7CDD	193.5	48.6	403.0
OCDD	286.7	73.8	413.7
TCDF	254.2	31.7	1083.0
PCDF	143.4	40.3	917.4
H_6CDF	60.1	32.6	563.9
H_7CDF	23.7	18.1	373.8
OCDF	13.2	10.6	158.3
2378-TCDD	2.7	1.8	3.2
12378-PCDD	8.7	2.9	14.5
123478-H_6CDD	5.4	1.0	14.4
123678-H_6CDD	7.7	2.5	21.2
123789-H_6CDD	5.7	1.5	16.1
1234678-H_7CDD	98.1	24.6	202.3
2378-TCDF	16.1	3.9	86.8
12378-PCDF	12.9	3.7	71.5
23478-PCDF	12.7	5.8	101.5
123478-H_6CDF	7.8	3.8	68.4
123678-H_6CDF	12.9	5.5	64.7
123789-H_6CDF	1.3	<1.0	22.7
234678-H_6CDF	4.1	5.8	59.7
1234678-H_7CDF	12.2	11.3	238.0
1234789-H_7CDF	1.8	1.1	23.8

Table 2: PCDD/F-concentrations of chimney soot from oil oven (ppt)

Compound	1	2	3	4	5	6	7
TCDD	2770.0	1580.0	2780.0	219.5	263.5	3390.0	433.8
PCDD	2530.0	2220.0	2680.0	490.3	287.8	2940.0	619.2
H_6CDD	1950.0	1910.0	10720.0	320.1	293.8	2100.0	859.9
H_7CDD	1000.0	2010.0	13490.0	489.4	188.4	926.6	886.2
OCDD	1010.0	2080.0	21540.0	454.2	76.8	200.3	913.8
TCDF	26580.0	11820.0	30910.0	3080.0	2700.0	10720.0	3912.7
PCDF	17890.0	10640.0	24050.0	3160.0	2910.0	12900.0	4929.0
H_6CDF	6490.0	11400.0	8850.0	2050.0	1290.0	5750.0	4504.6
H_7CDF	2600.0	5770.0	2360.0	1550.0	371.5	1520.0	2939.0
OCDF	590.0	1310.0	495.0	502.3	60.5	177.8	1052.0
2378-TCDD	121.5	60.6	79.6	5.1	9.7	93.2	11.7
12378-PCDD	252.7	243.9	439.4	20.9	27.1	208.2	50.4
123478-H_6CDD	116.0	224.8	179.7	23.5	14.2	96.9	53.5
123678-H_6CDD	150.1	196.4	484.5	29.0	27.0	128.3	65.3
123789-H_6CDD	140.4	535.6	539.6	26.8	20.9	110.4	44.0
1234678-H_7CDD	544.8	1119.7	7810.4	294.1	102.5	455.5	460.0
2378-TCDF	1466.0	821.9	1449.7	367.0	225.0	897.1	193.3
12378-PCDF	1308.1	848.9	1590.9	236.2	248.4	1200.0	387.5
23478-PCDF	1059.5	639.5	2649.8	375.6	300.1	1290.0	487.3
123478-H_6CDF	859.3	1290.3	1275.4	263.5	179.8	706.1	554.1
123678-H_6CDF	753.7	1280.7	1051.2	221.7	135.0	625.4	519.2
123789-H_6CDF	59.9	109.9	53.8	35.3	16.5	42.0	163.7
234678-H_6CDF	400.8	802.5	421.9	212.9	104.9	509.4	427.5
1234678-H_7CDF	1777.8	3668.8	1487.2	1100.0	253.0	1100.0	2184.0
1234789-H_7CDF	173.1	193.6	180.4	67.3	22.0	66.2	157.2

Table 3: PCDD/F-concentrations of chimney soot from coal oven (ppt)

Compound	1	2	3	4	5	6	7
TCDD	15010.0	7770.0	6870.0	3190.0	3360.0	44986.0	2460.0
PCDD	7330.0	6090.0	17370.0	4620.0	2760.0	16722.0	840.0
H_6CDD	12120.0	4260.0	10060.0	3350.0	19240.0	33093.0	1550.0
H_7CDD	4910.0	1200.0	3350.0	3650.0	25750.0	39242.0	2030.0
OCDD	3410.0	950.0	3000.0	3780.0	38920.0	56355.0	1500.0
TCDF	73080.0	43890.0	256070.0	40550.0	8540.0	83083.0	8040.0
PCDF	82030.0	46740.0	102200.0	29240.0	10980.0	196963.0	6510.0
H_6CDF	68030.0	18490.0	28810.0	8060.0	2990.0	49787.0	2290.0
H_7CDF	17760.0	6460.0	6090.0	1700.0	1650.0	9952.0	692.1
OCDF	1800.0	900.0	560.0	210.0	720.0	1531.0	155.5
2378-TCDD	459.1	136.6	291.3	331.6	118.2	749.7	150.5
12378-PCDD	1221.7	575.8	1097.5	464.4	411.1	1979.0	122.0
123478-H_6CDD	768.2	265.8	683.5	254.1	817.9	190.8	61.3
123678-H_6CDD	711.7	346.4	848.7	400.8	1511.4	344.9	107.7
123789-H_6CDD	684.8	357.1	1015.7	369.4	1340.6	260.4	96.9
1234678-H_7CDD	2519.2	672.8	1643.7	1843.5	15430.6	22832.0	1084.0
2378-TCDF	25142.0	2283.0	8863.9	7909.5	1692.4	12365.0	597.9
12378-PCDF	10471.0	3127.0	5632.5	1739.3	835.5	15025.0	501.8
23478-PCDF	12368.2	2018.0	22756.6	5937.1	1138.9	19097.0	527.4
123478-H_6CDF	6867.7	2943.8	3958.5	1092.0	538.6	7361.0	286.9
123678-H_6CDF	6586.1	1956.8	3854.6	935.5	370.2	8239.0	294.6
123789-H_6CDF	377.5	165.1	250.0	84.6	35.2	531.5	38.0
234678-H_6CDF	3242.6	739.2	904.0	347.9	233.2	3759.0	146.8
1234678-H_7CDF	12650.9	4194.2	3807.6	1196.9	688.3	6010.0	450.6
1234789-H_7CDF	778.6	567.5	377.4	79.5	185.1	729.8	35.8

Table 4: PCDD/F-concentrations of c. imney soot from wood central heating (ppt)

Compound	1	2	3	4
TCDD	50530.0	23120.0	48827.0	2640.0
PCDD	38430.0	3650.0	30629.0	11960.0
H_6CDD	15740.0	7880.0	43037.0	26400.0
H_7CDD	4830.0	19690.0	62466.0	71770.0
OCDD	2020.0	5720.0	87453.0	110730.0
TCDF	90460.0	205410.0	162116.0	192800.0
PCDF	409460.0	227280.0	183000.0	221860.0
H_6CDF	86060.0	65740.0	61862.0	94420.0
H_7CDF	20340.0	10870.0	10152.0	14030.0
OCDF	4380.0	2010.0	2069.0	2870.0
2378-TCDD	350.7	170.9	476.0	242.9
12378-PCDD	1699.1	668.1	1809.0	1540.0
123478-H_6CDD	399.9	1377.1	933.8	836.7
123678-H_6CDD	414.3	1956.6	1693.0	1597.0
123789-H_6CDD	562.7	1681.2	1451.0	1355.0
1234678-H_7CDD	3313.5	11283.3	34112.0	39551.0
2378-TCDF	7144.3	6182.9	18084.0	13766.0
12378-PCDF	11988.8	24185.3	19268.0	23193.0
23478-PCDF	6992.0	68684.6	30026.0	33573.0
123478-H_6CDF	7702.3	9134.2	8304.0	12549.0
123678-H_6CDF	7494.1	7865.3	8635.0	10697.0
123789-H_6CDF	538.1	523.8	579.4	714.1
234678-H_6CDF	3432.4	4320.1	4694.0	6214.0
1234678-H_7CDF	12372.9	5956.5	5561.0	8112.0
1234789-H_7CDF	1742.5	851.1	643.6	795.9

Table 5: PCDD/F-concentrations of chimney soot from wood oven (ppt)

Compound	1	2	3	4	5	6	7	8	9
TCDD	950.0	10800.0	11400.0	10420.0	6410.0	27.5	17300.0	9699.0	25706.0
PCDD	1640.0	6720.0	6140.0	5030.0	2730.0	119.1	8500.0	11649.0	191287.0
H_6CDD	2600.0	8780.0	8510.0	8440.0	10640.0	129.3	8200.0	11810.0	105672.0
H_7CDD	1200.0	16590.0	12120.0	8470.0	7810.0	209.8	1900.0	14945.0	59470.0
OCDD	640.0	23650.0	4390.0	6730.0	7570.0	110.7	967.3	11483.0	40212.0
TCDF	7740.0	91170.0	50930.0	53410.0	46830.0	543.7	66700.0	47552.0	321642.0
PCDF	4290.0	85570.0	40710.0	40540.0	26180.0	327.9	70700.0	51823.0	499291.0
H_6CDF	1690.0	34430.0	10680.0	12930.0	7400.0	108.1	21100.0	25030.0	398605.0
H_7CDF	1020.0	7360.0	2620.0	3350.0	2320.0	23.7	4800.0	6471.0	91569.0
OCDF	210.0	980.0	700.0	650.0	640.0	15.6	593.6	1066.0	60559.0
2378-TCDD	29.2	273.7	320.2	208.3	144.5	2.5	311.1	233.5	2263.0
12378-PCDD	97.9	900.4	657.5	649.2	434.4	4.2	713.1	885.2	3406.0
123478-H_6CDD	67.5	653.0	454.5	528.4	418.4	2.5	218.9	496.2	5870.0
123678-H_6CDD	127.5	848.8	938.3	820.2	786.4	7.7	382.7	822.6	7862.0
123789-H_6CDD	110.1	758.6	1312.8	1451.0	798.6	4.6	293.2	828.9	5287.0
1234678-H_7CDD	670.0	9470.6	7174.1	4981.6	5137.7	159.6	919.7	8302.0	30751.0
2378-TCDF	244.9	3520.9	9567.8	4511.1	23025.3	36.8	5944.0	3994.0	33523.0
12378-PCDF	346.4	5413.0	4254.0	3482.4	4632.0	27.3	5318.0	4794.0	69648.0
23478-PCDF	160.8	8099.0	4699.7	1534.5	7257.7	66.4	6335.0	3539.0	63609.0
123478-H_6CDF	316.0	4267.5	1462.5	1509.2	971.0	9.9	2711.0	2912.0	24078.0
123678-H_6CDF	247.0	3217.0	1096.5	1233.7	994.5	9.0	2404.0	3478.0	16685.0
123789-H_6CDF	20.7	167.3	60.7	64.0	124.3	<1.0	277.6	276.3	2539.0
234678-H_6CDF	150.9	1765.6	510.4	663.9	340.7	7.9	1605.0	1427.0	13335.0
1234678-H_7CDF	633.5	4814.2	1446.2	2047.5	1181.1	13.2	3417.0	3994.0	65531.0
1234789-H_7CDF	47.2	551.5	253.2	226.2	187.2	1.5	242.6	418.0	6255.0

Table 6: PCDD/F-concentrations of chimney soot from wood/coal oven (ppt)

Compound	1	2	Compound	1	2
TCDD	2000.0	2820.0	123478-H_6CDD	26.2	17.3
PCDD	1130.0	1520.0	123678-H_6CDD	98.5	28.6
H_6CDD	1100.0	118.2	123789-H_6CDD	93.3	13.6
H_7CDD	516.2	414.7	1234678-H_7CDD	302.0	204.6
OCDD	426.8	197.8	2378-TCDF	2100.0	1700.0
TCDF	20700.0	21200.0	12378.PCDF	462.4	830.7
PCDF	5970.0	10160.0	23478-PCDF	1600.0	975.6
H_6CDF	2320.0	2350.0	123478-H_6CDF	278.1	268.1
H_7CDF	545.0	656.2	123678-H_6CDF	266.7	236.7
OCDF	91.6	200.6	123789-H_6CDF	15.5	21.0
2378-TCDD	40.7	201.7	234678-H_6CDF	106.2	95.0
12378-PCDD	103.5	111.1	1234678-H_7CDF	355.2	400.6
-			1234789-H_7CDF	36.0	60.1

REFERENCES

1) The Trace Chemistry of Fire - A Source of and Routes for the Entry of Chlorinated Dioxins into the Environment, The Chlorinated Dioxin Task Force, The Michigan Division, Dow Chemical, USA, 1978
2) Bumb, R.R., Crummett, W.B., Cutie, S.S., Gledhill, J.R., Hummel, R.H., Kagel, R.O., Lamparski, L.L., Lourna, E.V., Miller, D.L., Nestrik, T.J., Shadoff, L.A., Stehl, R.H., Woods, J.S., Science 210, 385 (1980)
3) Crummett, W.B., Townsend, D.T., Chemosphere 13, 777 (1984)
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(Received in UK 20 May 1988)

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
NORTH COAST REGION

Interoffice Communication

TO: 1) Frank Reichmuth
2) File

DATE: 4 October 1988

FROM: Mark Neely MKN

SUBJECT: Compliance inspection of Georgia-Pacific Soil Amendment site, Little Valley, Mendocino County

On 20 September I undertook a routine level B compliance inspection of the subject site. I was accompanied by Dave Larkin, the G-P logging supervisor. The timing of the inspection was set up so that I could observe the amending process, which takes place before the last week in September, the time period specified by the U.C. Extension in Davis.

While I was there the tractor operator has just finished his final discing of one patch, and mad his first inital pass across the adjoining patch. The first discing penetrates the soil to a depth of perhaps two feet. Additional passes are made until the soil is well broken up; then, a smaller disc is used to mix the ash and soil thoroughly. Many passes with the smaller disc are necessary to result in complete mixing. Following this, the soil is smoothed out by dragging a large log across the surface. This is necessary because the rancher complains about any uneven surfaces.

A couple of troubling things: 1) the wind which always blows up the valley really blew the ash off the field as the tractor and disc passed over it, and 2) Mr. Larkin said that the rancher often grazes the stubble following harvest of the grass. The wind problem is inherent in this kind of agricultural practice, and definitely needs to be an important part of the on-going study by G-P. Grazing of the stubble should not pose a big problem, but overgrazing can lead to the destruction of the grass, and erosion of the soil and ash. Given the slope of the land, the chance of deposition into a watercourse is unlikely. I have told Mr. Larkin that the overgrazing should be avoided, although it is largely out of his hands.

We agreed upon the location of the stockpiling and amending area for the coming season, and they will be rocking the access spur road immediately. I will inspect the area again following a few rainstorms to observe any erosional effects.

Georgia-Pacific Corporation
P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

CONTROL BOARD

OCT 17 '88

☐ BK ☐ BN
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☐ SW ☐
☐ RC ☐ REPLY

Mark Neely
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Neely,

October 13, 1988

This is the September, 1988, Soil Amending ~~project~~ report, as per Monitoring and Reporting Order 86-3, for Georgia-Pacific at Fort Bragg, California.

There was no significant rainfall for the month. Approximately 1.6 acres was amended, again this month. The enclosed report will summarize the operations.

If you have any questions, please feel free to call.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

Encl.

October 1988 Report

Georgia-Pacific Corporation

Soil Amending Project, Montiroing and Reporting Program Number 86-3.

Monitoring

Volume of Ash by Week,

Week of;	Cubic Yards Deposited (Area A-South = Winter 1989 Storage)
01	40
02-08-	420
09-16	480
17-23	400
24-30	400
31	120
	Total = 1,860 Yds^3

Total number of treated acres to date is 52.4 acres.

No precipitation for the month. (No effect)

No stormwater monitoring, due to lack of runoff.

All ash deposition was placed into the newly-approved winter storage area for 1988-1989. This is in a location about 300 yards south of the 1988 amending area, as per inspection report by Mr. Mark Neely dated July 27, 1988.

Approximately 1,860 cubic yards of ash were deposited at Little Valley for the month of October, 1988.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

Georgia-Pacific Corporation

P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

CONTROL BOARD

NOV 14 '88

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☐ SW ☐
☐ RC ☐ REPLY

What is status of Dioxin monitor

6003

Mark Neely
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Neely,

November 10, 1988

G-P FT. BRAGG ASH SOIL AMEND.

Here is the October, 1988, Monitoring and Reporting report for the soil amending project, as per Order No. 86-3, for Georgia-Pacific at Fort Bragg, California.

A total of .21 inches of rain fell during the month, so there was no significant rainfall. The attached report summarizes the month.

Notes: 1) There was no amending during the month, as seeding was done during the last week in September.

2) Also during the month of September, there were thirteen (13) more loads of ash taken to the site, than previously reported, making the total 1,500 Yds^3, for the month of September, 1988.

If you have any questions, please feel free to call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

Encl.

October 1988 Report

Georgia-Pacific Corporation

Soil Amending Project, Montiroing and Reporting Program Number 86-3.

Monitoring

Volume of Ash by Week,

Week of;	Cubic Yards Deposited (Area A-South = Winter 1989 Storage)
01	40
02-08-	420
09-16	480
17-23	400
24-30	400
31	120
Total =	1,860 Yds^3

Total number of treated acres to date is 52.4 acres.

No precipitation for the month. (No effect)

ɔ stormwater monitoring, due to lack of runoff.

All ash deposition was placed into the newly-approved winter storage area for 1988-1989. This is in a location about 300 yards south of the 1988 amending area, as per inspection report by Mr. Mark Neely dated July 27, 1988.

Approximately 1,860 cubic yards of ash were deposited at Little Valley for the month of October, 1988.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

Georgia-Pacific Corporation
P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

NOV 1 '88

☐ BK ☐ FB
☐ CI ☐ JG
☐ FR FR ☐ KG K
☐ RY ☐ MN
☐ JH ☐
☐ SW ☐
☐ RC ☐ REPLY

G-P FT BRAGG
ASH SOIL AMEND.

S4089
86-003

Mark Neely
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Neely,

November 11, 1988

This is an amendment to the October, 1988, Monitoring and Reporting Program Number 86-3.

One, point two (1.2) acres were amended and seeded during the month of October, 1988. This brings the total number of treated acres to 53.6.

I apologize for any convenience this may have caused you. If you have any questions about this, please call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

Georgia-Pacific = November 1988 Report

Soil Amending Project- Monitoring and Reporting Order No. 86-3.

Volume of Ash Deposited		Cubic Yards Area A-South	Rainfall Measurements
Week of, 1-5	=	640 Yds^3	2.0 inches
6-12	=	620	1.2
13-19	=	520	2.9
20-26	=	640	5.1
27-30	=	360	0.2
TOTALS	=	2,780 Yds^3	11.3 Inches Rain

Total number of treated acres to date = 53.6 at Little Valley

Precipitation

A total of 11.3 inches for the month, (detail above).

Stromwater Monitoring

These pH levels were recorded on November 28, 1988;

Point #5 = 6.6
6 = 7.1
7 = 7.1
8 = 6.8
9 = 7.0

Deposition

All woodwaste ash generated and hauled to Little Valley was stockpiled, and stockpiled in the winter area for 1988-89, as per your letter of July 27, 1988.

The soil analysis taken in the month of November is at the laboratory and will be reported later.

STATE OF CALIFORNIA

GEORGE DEUKMEJIAN, *Governor*

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—
NORTH COAST REGION
1440 GUERNEVILLE ROAD
SANTA ROSA, CA 95403
Phone: (707) 576-2220

November 23, 1988

Mr. C. T. Howlett, Jr.
Georgia-Pacific Corporation
International Square
1875 Eye Street N.W.
Washington, D.C. 20006

Dear Mr. Howlett:

In our last letter to you, dated August 25, 1988, we requested a time schedule for the submission of progress reports for your research plan to study non-2,3,7,8 TCDF's in fly ash amended soil in Ft. Bragg, California. This time schedule, due in September 1988, is meant to allow us to track the progress of the study and allow us to anticipate when we can expect specific goals to be met. We also should have received notification of what consultants you have retained for the various activities, as promised in your letter of July 15, 1988. Please submit the timeline, as well as a progress report for the study, by December 5, 1988.

Feel free to call if you have any questions.

Sincerely,

Mark K. Neely
Associate Engineering Geologist

MKN:mkk

Georgia-Pacific Corporation *Eastern Wood Products*
Manufacturing Division
P.O. Box 105603
Atlanta, Georgia 30348
Telephone (404) 521-4000
Teletype (810) 751-1000

WATER QUALITY
CONTROL BOARD
DEC 5 '88
☑ FR ER
☐ MKW/MKM
☐ REPLY
G-P FT. BRAGG
SOIL AMENDMENT

November 29, 1988

Mr. Benjamin D. Kor
Executive Officer
California Regional Water
Quality Control Board
North Coast Region
1440 Guerneville Road
Santa Rosa, CA 95403

Re: Fly Ash Amended Soil Study

Dear Mr. Kor,

As requested, we are submitting a schedule of how we plan to proceed with the fly ash research plan that was submitted to you by our Mr. C. T. Howlett, Jr. in July, 1988. As you know, this study is to be conducted at Georgia-Pacific's Little Valley fly ash soil amending site near Ft. Bragg, CA.

We have divided the study into two phases, which will encompass the sampling outlined in the July, 1988 plan and the additional analysis requested in your letter of August 25, 1988. The plan calls for the selection of four (4) sites to be used as the study plots. As outlined in the plan, one site will serve as a control site where no fly ash has been amended, one site will have fly ash amended within the last six months, one site will have fly ash amended within the last 6 - 18 months and one site will have been amended approximately three years ago.

PHASE 1

This phase will entail the actual selection of the study plots which includes a review of available wind data in order to properly locate the control site in relation to the amended sites. Also, sampling protocol will be established, an outside consultant will be selected to obtain the samples, and arrangements will be made with the lab to conduct the analysis. Phase 1 sampling will involve sampling for cover crops, soils (subsurface soils beneath amended areas), and earthworms.

PHASE 2

This phase will repeat the cover crop and soil sampling conducted in Phase 1 and will also address the airborne dust issue.

The schedule for this project is as follows:

*Complete Phase 1 - November, 1988

*Submit Phase 1 Progress Report - January, 1989

*Complete Phase 2
-Cover Crop and Soil Sampling - March, 1989
-Dust Sampling - April, 1989

*Submit Draft and Final Report - May, 1989

I am pleased to report that the sampling outlined in Phase 1 was completed during the week of November 14, 1988. The consulting firm of Selvage, Heber, Nelson and Associates in Eureka, CA was selected to obtain the samples. California Analytical Laboratories in Sacramento, CA will be doing the analytical work.

Please let me know if there are any questions.

Sincerely,

Gerald W. Tice

GERALD W. TICE
CHIEF ENVIRONMENTAL ENGINEER
WOOD PRODUCTS MANUFACTURING DIVISION

GWT/rc

cc: Messrs. A. T. Johnson
Kent Mayer
D. B. Whitman
C. T. Howlett, Jr.
G. D. Dutton
G. F. McCaig

Georgia-Pacific Corporation P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

CONTROL BOARD

DEC 15 '88

☐ BK ☐ BB
☐ CJ ☐ JG
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☐ SW ☐
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86003

Mark Neely
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Neely,

December 12, 1988

Attached is the November, 1988, report for the Soil Amending project, for Georgia-Pacific at Little Valley, as per Monitoring and Reporting Order 86-3.

This is the first month with any significant rainfall, which is documented along with the deposition rate, in the report. No amending was performed- Amending has stopped for the year, as of November, 1988.

If there are any questions, please call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

Encl.

Georgia-Pacific = November 1988 Report

Soil Amending Project- Monitoring and Reporting Order No. 86-3.

Volume of Ash Deposited		Cubic Yards Area A-South	Rainfall Measurements
Week of, 1-5	=	640 Yds^3	2.0 inches
6-12	=	620	1.2
13-19	=	520	2.9
20-26	=	640	5.1
27-30	=	360	0.2
TOTALS	=	2,780 Yds^3	11.3 Inches Rain

Total number of treated acres to date = 53.6 at Little Valley

Precipitation

A total of 11.3 inches for the month, (detail above).

Stromwater
Monitoring

These pH levels were recorded on November 28, 1988;

Point #5 = 6.6
6 = 7.1
7 = 7.1
8 = 6.8
9 = 7.0

Deposition

All woodwaste ash generated and hauled to Little Valley was stockpiled, and stockpiled in the winter area for 1988-89, as per your letter of July 27, 1988.

The soil analysis taken in the month of November is at the laboratory and will be reported later.

STATE OF CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

FACILITIES INSPECTION REPORT

SWRCB 001 (NEW 6-87)

ADDITIONAL INFORMATION SHOULD BE ATTACHED TO ORIGINAL

1. WDS NUMBER (Must be 11 digits): 1 B 8 S Ø 3 Ø R M E N	2. NAME OF AGENCY RESPONSIBLE FOR DISCHARGE: G. [illegible] - PACIFIC
3. DATE INSPECTION COMPLETED: Year 88, Mo. 12, Day 16	4. NAME OF FACILITY: FT BRAGG ASH SOIL AMENDMENT

5. INSPECTION TYPE (Check One)

A1 ☐ "A" type compliance—*Comprehensive inspection in which samples are taken.*

B1 ☒ "B" type compliance—A routine nonsampling inspection.

02 ☐ Noncompliance follow-up—Inspection made to verify correction of a previously identified violation.

03 ☐ Enforcement follow-up—Inspection made to verify that conditions of an enforcement action are being met.

04 ☐ Complaint—Inspection made in response to a complaint.

05 ☐ Pre-requirement—Inspection made to gather information relative to preparing, modifying, or rescinding requirements.

06 ☐ *Miscellaneous—Any inspection not mentioned above.*

NPDES

6. INSPECTION BY: ☒ State ☐ State/EPA Joint	7. IS EPA INSPECTION REQUIRED? ☐ Yes ☒ No
8. DID YOU TAKE A BIOASSAY SAMPLE? ☐ Yes ☒ No	9. IF A BIOASSAY SAMPLE WAS TAKEN, WAS IT: ☐ Static ☐ Flowthrough

10. INSPECTION COMMENTS SUMMARY–REQUIRED (100 Character Maximum)

NO APPARENT VIOLATION. NO DISCHARGE OCCURRING

11. WAS THERE A VIOLATION?

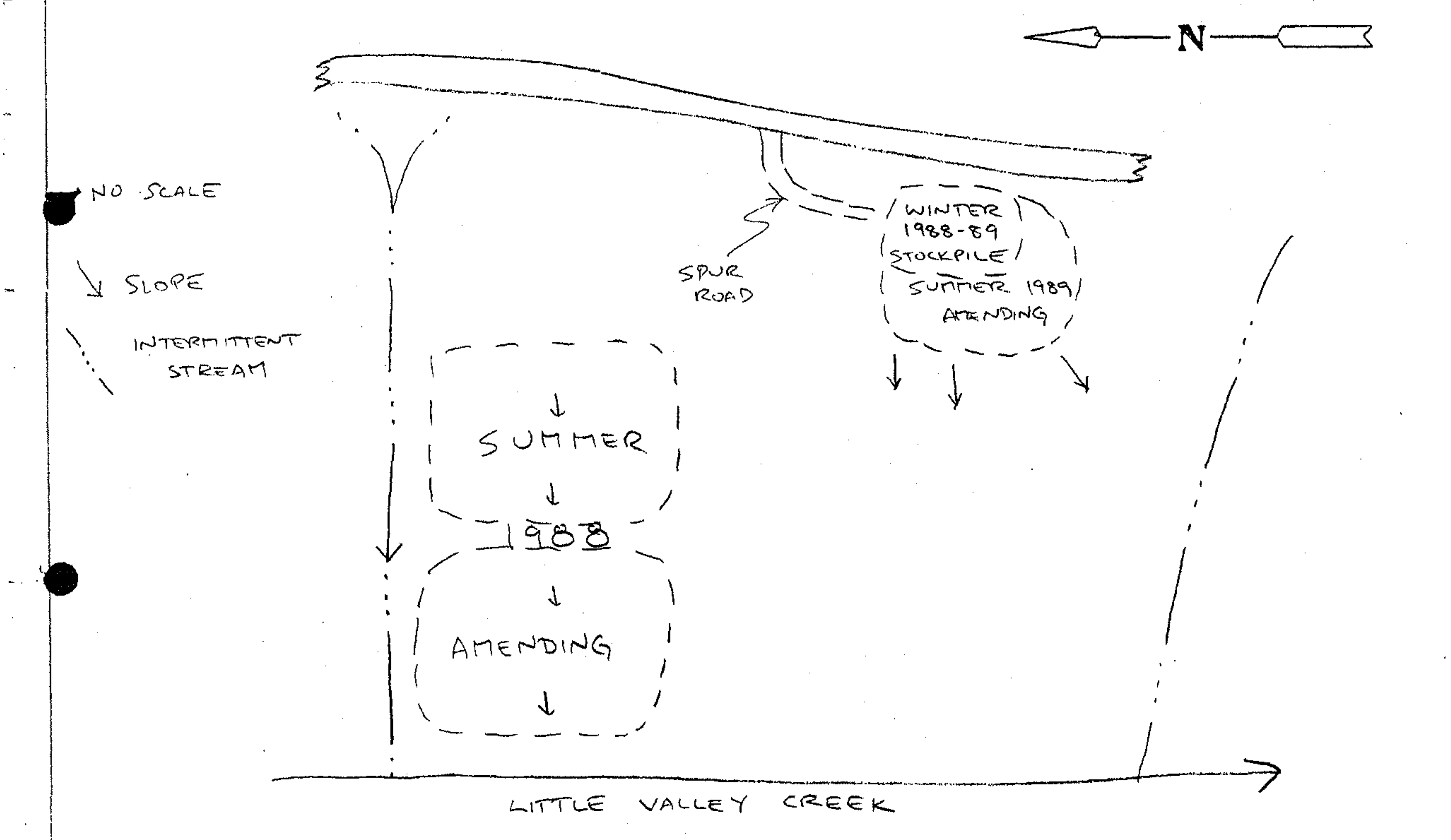
☐ Yes *(Complete violation form.)* ☒ No ☐ Pending *(e.g., lab results)*

12. INSPECTOR'S INITIALS ⟶ MKN

ADDITIONAL COMMENTS

SEE ATTACHED MEMO.

GEORGIA-PACIFIC FT. BRAGG SOIL AMENDMENT



STATE OF CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

FACILITIES INSPECTION REPORT

SWRCB 001 (NEW 6-87)

ADDITIONAL INFORMATION SHOULD BE ATTACHED TO ORIGINAL

1. WDS NUMBER (Must be 11 digits): 1B85Ø3ØRMEN	2. NAME OF AGENCY RESPONSIBLE FOR DISCHARGE: GEORGIA-PACIFIC
3. DATE INSPECTION COMPLETED (Year Mo. Day): 88 12 16	4. NAME OF FACILITY: FT. BRAGG ASH SOIL AMENDMENT

5. INSPECTION TYPE (Check One)

- A1 ☐ "A" type compliance—Comprehensive inspection in which samples are taken.
- B1 ☒ "B" type compliance—A routine nonsampling inspection.
- 02 ☐ Noncompliance follow-up—Inspection made to verify correction of a previously identified violation.
- 03 ☐ Enforcement follow-up—Inspection made to verify that conditions of an enforcement action are being met.
- 04 ☐ Complaint—Inspection made in response to a complaint.
- 05 ☐ *Pre-requirement—Inspection made to gather information relative to preparing, modifying, or rescinding requirements.*
- 06 ☐ Miscellaneous—Any inspection not mentioned above.

NPDES

6. INSPECTION BY: ☒ State ☐ State/EPA Joint	7. IS EPA INSPECTION REQUIRED? ☐ Yes ☒ No
8. DID YOU TAKE A BIOASSAY SAMPLE? ☐ Yes ☒ No	9. IF A BIOASSAY SAMPLE WAS TAKEN, WAS IT: ☐ Static ☐ Flowthrough

10. INSPECTION COMMENTS SUMMARY-REQUIRED (100 Character Maximum)

NO APPARENT VIOLATION. NO DISCHARGE OCCURRING.

11. WAS THERE A VIOLATION?

☐ Yes (Complete violation form.) ☒ No ☐ Pending (e.g., lab results)

12. INSPECTOR'S INITIALS → MKN

ADDITIONAL COMMENTS

SEE ATTACHED MEMO.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
NORTH COAST REGION

Interoffice Communication

TO: 1) Frank Reichmuth DATE: 30 December 1988
2) File: G-P Ash Soil Amendment

FROM: Mark Neely

SUBJECT: Compliance inspection of Georgia-Pacific Ft. Bragg Ash Soil Amendment, Little Valley

On 16 December 1988 I completed a level 'B' inspection of the subject site. I was accompanied by Mr. Kent Mayer of G-P's Eugene office. The areas amended this fall have grown a good cover of grass, and there was no evidence of any transport by surface flow. The stockpile is located where we agreed upon last September, and again there was no evidence of transport to waters of the State. This was despite approximately 11.5" of rain in November. Mr. Mayer had been out a few weeks previous, collecting samples for the bioaccumulation study. This inspection was done following the mill inspection earlier that morning.

California Regional Water Quality Control Board
North Coast Region

REVISED MONITORING AND REPORTING PROGRAM NO. 86-3
(Revised May 23, 1988)

FOR

GEORGIA-PACIFIC CORPORATION
FORT BRAGG SOIL AMENDMENT

Mendocino County

Monitoring

The discharger shall record the approximate volume of ash deposited at the site each week, the approximate number of treated acres, and the location and approximate tons of any ash stockpiled.

The discharger shall submit records of daily rainfall measurements, dates of ash incorporation, and explanations of periods of no incorporation activities.

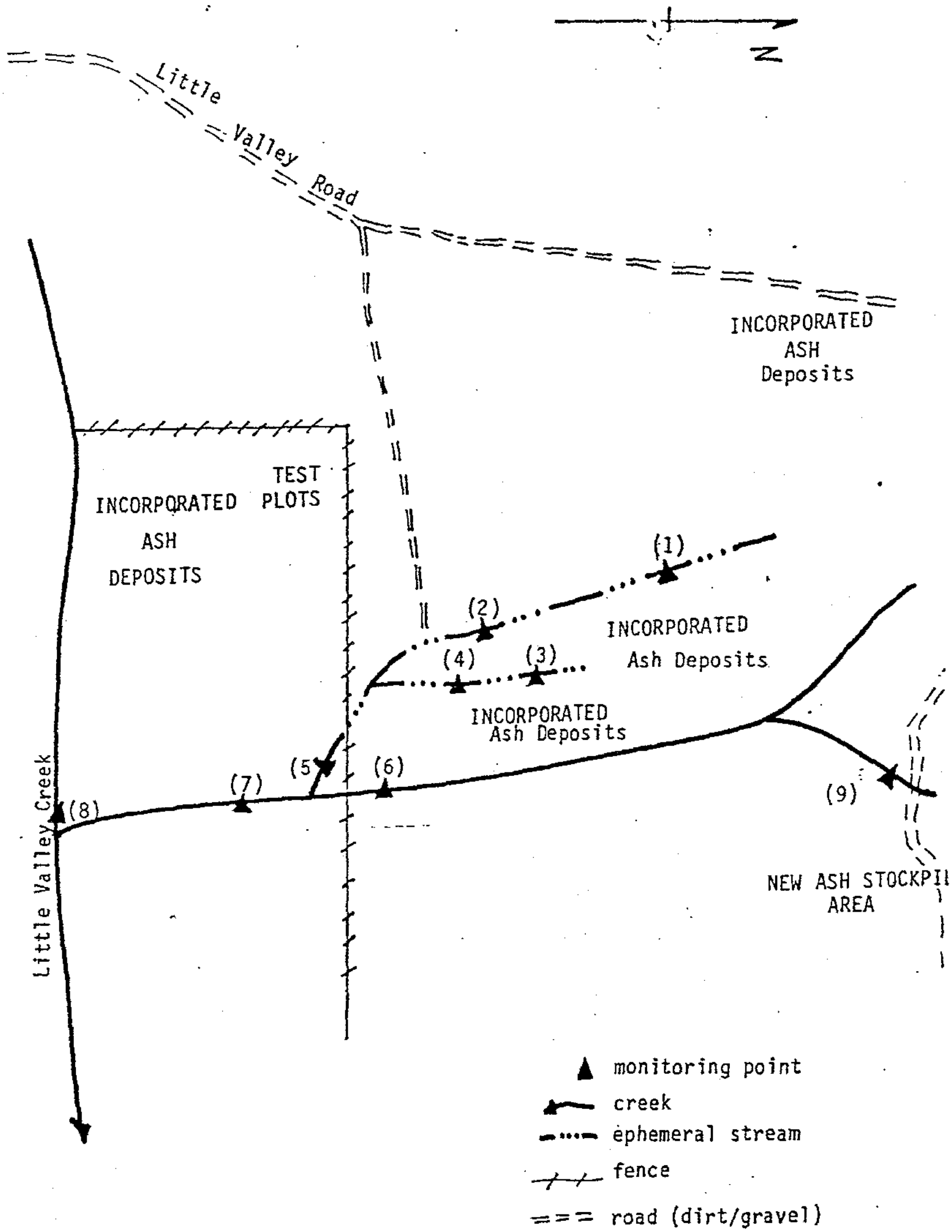
Soils receiving ash shall be analyzed every October for CEC, percent base saturation, and pH at a depth of 0-1" and 11-12". An annual report shall be prepared each July summarizing the water and soil analyses, amount of ash applied, the approximate number of acres receiving ash, and the evidence of increased pasture land yield.

Stormwater Runoff Monitoring

The discharger shall inspect the areas of ash placement daily during rain events, and record and report any instances of ash discharge to surface streams, and measures taken to correct the discharge.

Grab samples shall be taken from five points (shown as points 5,6,7,8 and 9 on the attached map) at least once per week during rain events, from two points on each of the ephemeral streams, at their confluence,and above and below the point of confluence of the ephemeral streams with the intermittent stream tributary to Little Valley Creek. Additional monitoring points shall be added as ash placement areas increase to ensure that drainage from all areas of ash placement are monitored. Samples shall be analyzed as follows:

Constituent	Units	Frequency
pH	pH units	Weekly
Suspended Solids	mg/l	Weekly
COD	mg/l	November, January, March



N
Little Valley Road
INCORPORATED ASH Deposits
TEST PLOTS
INCORPORATED ASH DEPOSITS
(1)
(2)
(3)
(4)
INCORPORATED Ash Deposits
INCORPORATED Ash Deposits
(5)
(6)
(7)
(8)
(9)
Little Valley Creek
NEW ASH STOCKPI
AREA
monitoring point
creek
ephemeral stream
fence
road (dirt/gravel)

NOT TO SCALE

FILE
G-P FT BRAGG SOIL AMENDMENT

MEETING OF 5-12-88
REGARDING G-P ASH DISPOSAL

NAME	REPRESENTING
Ben Kor, Exec. Officer	North Coast Reg. Bd.
MARK NEELY	" " " "
KIP HOWLETT	Georgia - Pacific
Gerald Tice	" "
Kent Mayer	" "
Don Whitman	" "
DOUG DUTTON	" " - ATLANTA
SEYMOUR FRIESS	" " (consultant)
FRANK REICHMUTH	NCRWQCB
FRANK PALMER	SWRCB

ATTACHMENT 1

California Regional Water Quality Control Board
North Coast Region

ORDER NO. 86-3
ID NO. 1B85030RMEN

WASTE DISCHARGE REQUIREMENTS

For

GEORGIA-PACIFIC CORPORATION
FORT BRAGG SOIL AMENDMENT

Mendocino County

The California Regional Water Quality Control Board, North Coast Region (hereinafter Board) finds that:

1. Georgia-Pacific Corporation (hereinafter discharger) submitted a Report of Waste Discharge dated December 19, 1985.

2. The Report of Waste Discharge describes use of woodwaste ash, a nonhazardous decomposable waste, as a soil amendment using applicable Best Management Practices pursuant to Section 2511(f) of Title 23, Chapter 3, Subchapter 15 of the California Administrative Code. The woodwaste is generated by the power plant operated at the Georgia-Pacific sawmill. The soil amendment site is located in Little Valley within Sections 14, 22, 23, 24, and 26 of T19N, R17W, MDB&M on 330 acres of pasture land along Little Valley Creek. There will be occasional stockpiling of ash during inclement weather on an additional eight acre parcel in Section 14, T19N, R17W MDB&M adjacent to the South Fork of Ten Mile Creek. Drainage controls and management practices for incorporating the ash into the soil are designed to prevent a discharge of ash to surface streams.

3. Soils in the area of the soil amendment application are preliminarily classified as Shinglemill and Gibney, with 20 percent inclusions. Soil analyses have been conducted at the site on cation exchange capacity, base saturation, pH and other nutrient analyses.

4. The Board adopted the North Coastal Basin Water Quality Control Plan on March 20, 1975. The basin plan contains a prohibition against new waste discharges to all coastal streams and natural drainageways that flow directly to the ocean.

5. The beneficial uses of Little Valley Creek, Pudding Creek, and Ten Mile Creek include:

   a. municipal and domestic water supply
   b. agricultural water supply
   c. potential industrial service water supply
   d. potential industrial process water supply
   e. groundwater recharge

California Regional Water Quality Control Board
North Coast Region

MONITORING AND REPORTING PROGRAM NO. 86-3

FOR

GEORGIA-PACIFIC CORPORATION
FORT BRAGG SOIL AMENDMENT

Mendocino County

Monitoring

The discharger shall record the approximate volume of ash deposited at the site each month, the approximate number of treated acres, and the approximate tons of ash stockpiled in area "W".

Stormwater Runoff Monitoring

Grab samples shall be taken periodically when streams are flowing from the points shown on the attached map. Samples shall be analyzed as follows:

Constituent	Units	Frequency
pH	pH units	weekly
COD	mg/l	November, January, March

Weekly rainfall totals shall also be recorded and reported.

Soils receiving ash shall be analyzed every October for CEC, percent base saturation, and pH at a depth of 0-1" and 11-12". An annual report shall be prepared each January 1 summarizing the water and soil analyses, amount of ash applied, the approximate number of acres receiving ash, and evidence of increased pasture land yield.

Reporting

Monitoring reports shall be submitted monthly to the Board by the fifteenth of the month. Copies of signed laboratory sheets shall be submitted with any monthly summary report.

Ordered by ORIGINAL SIGNED BY
Benjamin D. Kor
Executive Officer

January 30, 1986

NET
NATIONAL ENVIRONMENTAL TESTING, INC.

NET Pacific, Inc.
435 Tesconi Circle
Santa Rosa, CA 95401
Tel: (707) 526-7200
Fax: (707) 526-9623

Formerly: ANATEC Labs, Inc.

Mark Neely
Calif. Reg. Water Quality
Control Board- NCR
1440 Guerneville Rd
Santa Rosa, CA 95403

01-05-89
NET Pacific Log No: 5069 (-1)
Series No: 12.19
Client Ref: Contract# 8-052-110-0

Subject: Analytical Results for One Water Sample Received 12-16-88.

Dear Mr. Neely:

Analysis of the sample referenced above has been completed. This report is written in confirmation of results telefaxed on January 5, 1989. Results are presented following this page.

Please feel welcome to contact us should you have questions regarding procedures or results.

Submitted by:

Sue J. Long
Project Chemist

Approved by:

Jules Skamarack
Project Manager

/sm

WATER QUALITY
CONTROL BOARD

JAN 9 '89

☐ BK ____ ☐ BB ____
☐ CJ ____ ☐ JG ____
☑ FR EX ☐ KD ____
☐ RT ____ ☐ MFN
☐ JH ____ ☐ ____
☐ SW ____ ☐ ____
☐ RC ____ ☐ REPLY

X

G-P FT. BRAGG
~~SAMOA~~ SAWMILL

KEY TO ABBREVIATIONS

mg/Kg (ppm)	:	Concentration in units of milligrams of analyte per kilogram of sample, wet-weight basis (parts per million).
mg/L	:	Concentration in units of milligrams of analyte per liter of sample, unless noted otherwise.
mL/L/hr	:	Milliliters per liter per hour.
MPN/100 mL	:	Most probable number of bacteria per one hundred milliliters of sample.
NA	:	Not analyzed; see cover letter for details.
ND	:	Not detected; the analyte concentration is less than the listed reporting limit.
NR	:	Not requested.
NTU	:	Nephelometric turbidity units.
RL	:	Reporting limit.
RPD	:	Relative percent deviation.
SNA	:	Standard not available.
ug/Kg (ppb)	:	Concentration in units of micrograms of analyte per kilogram of sample, wet-weight basis (parts per billion).
ug/L	:	Concentration in units of micrograms of analyte per liter of sample.
ug/filter	:	Concentration in units of micrograms of analyte per filter.
umhos/cm	:	Micromhos per centimeter.
*	:	See cover letter for details.

SAMPLE DESCRIPTION: GPFB
LAB NO.: (-20059)

Parameter	Reporting Limit	Results	Units
Nonfilterable residue	1	29	mg/L
Settleable matter	0.1	ND	mg/L
Turbidity	0.05	29	NTU
Phenols (colorimetric)	0.05	ND	mg/L
Cyanide	0.02	0.03	mg/L
Arsenic	0.005	0.008	mg/L
Cadmium	0.01	0.02	mg/L
Chromium, total	0.02	0.05	mg/L
Copper	0.02	ND	mg/L
Lead	0.002	0.002	mg/L
Mercury	0.0005	ND	mg/L
Nickel	0.02	0.05	mg/L
Zinc	0.02	0.07	mg/L

12/16/88 COMPLIANCE INSPECTION

NET

SAMPLE DESCRIPTION: GPFB
LAB NO.: (-20059)

FILE: G-P FT. BRAGG

Parameter	Reporting Limit	Results	Units
Nonfilterable residue	1	29	mg/L
Settleable matter	0.1	ND	mg/L
Turbidity	0.05	29	NTU
Phenols (colorimetric)	0.05	ND	mg/L
Cyanide	0.02	0.03	mg/L
Arsenic	0.005	0.008	mg/L
Cadmium	0.01	0.02	mg/L
Chromium, total	0.02	0.05	mg/L
Copper	0.02	ND	mg/L
Lead	0.002	0.002	mg/L
Mercury	0.0005	ND	mg/L
Nickel	0.02	0.05	mg/L
Zinc	0.02	0.07	mg/L

Georgia-Pacific Corporation

P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

WATER QUALITY
CONTROL BOARD
REGION 1

JAN 11 '89

☐ BK ___ ☐ BB ___
☐ CJ ___ ☐ JG ___
☐ FR ___ ☐ KD ___
☐ RT ___ ☐ MKN
☐ JH ___ ☐ ___
☐ SW ___ ☐ ___
☐ RC ___ ☐ REPLY

Mark Neely
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

GEORGIA-PACIFIC
FT. BRAGG SOIL
AMENDMENT

Dear Mr. Neely,

January 9, 1989

Enclosed are the lab analysis for the CEC, percent base saturation and pH for our receiving soils, at Little Valley, as per Monitoring and Reporting Program No. 86-3.

These samples were taken in November, 1988, and were taken at a depth of about 1" and about 12", as per program.

If you have any questions, please call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

Encl.

Alpha Analytical Laboratories Inc. • 860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CLIENT Georgia Pacific
ADDRESS P.O. Box 1618
Eugene, OR 97440
ATTN: Kent Mayer

DATE COLLECTED 11-28-88
DATE IN LAB 12-12-88
COLLECTED BY Larkin
SAMPLE TYPE Soil

LABORATORY NO.: 88-1212-1-1
CLIENT I.D. : L.V. Area # 1
0" - 12"

	ppm	meq/100g	% of CEC	Ideal %
Calcium	820		80.1	60 - 70
Magnesium	49		8.0	15
Sodium	42		3.6	3 - 5
Potassium	166		8.3	3 - 5
Exchangeable Acidity		0		0 - 5
Cation Exchange Capacity(CEC)		5.1		
Nitrogen, total kjeldahl	1,950			
Phosphorus, weak bray	54			
Aluminum, total	15,700			
pH		7.7		

Alpha
Analytical Laboratories, Inc.

12-31-88
LABORATORY DIRECTOR DATE

Alpha
Alpha Analytical Laboratories Inc. • 860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CLIENT Georgia Pacific
ADDRESS P.O. Box 1618
Eugene, OR 97440
ATTN: Kent Mayer

DATE COLLECTED 11-28-88
DATE IN LAB 12-12-88
COLLECTED BY Larkin
SAMPLE TYPE Soil

LABORATORY NO.: 88-1212-1-2
CLIENT I.D. : L.V. Are # 1
12"+

	ppm	meq/100g	% of CEC	Ideal %
Calcium	880		52.5	60 - 70
Magnesium	212		21.1	15
Sodium	48		2.5	3 - 5
Potassium	780		23.9	3 - 5
Exchangeable Acidity		0		0 - 5
Cation Exchange Capacity(CEC)		8.4		
Nitrogen, total kjeldahl	1,640			
Phosphorus, weak bray	30			
Aluminum, total	19,800			
pH		6.7		

Alpha
Analytical Laboratories, Inc.

Bruce L. [signature] 12-31-88
LABORATORY DIRECTOR DATE

alpha
Alpha Analytical Laboratories Inc. • 860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CLIENT Georgia Pacific
ADDRESS P.O. Box 1618
Eugene, OR 97440
ATTN: Kent Mayer

DATE COLLECTED 11-28-88
DATE IN LAB 12-12-88
COLLECTED BY Larkin
SAMPLE TYPE Soil

LABORATORY NO.: 88-1212-1-3
CLIENT I.D. : L.V. Area # 2
0" - 12"

	ppm	meq/100g	% of CEC	Ideal %
Calcium	1,230		68.6	60 - 70
Magnesium	174		16.2	15
Sodium	48		2.3	3 - 5
Potassium	450		12.9	3 - 5
Exchangeable Acidity		0		0 - 5
Cation Exchange Capacity(CEC)		9.0		
Nitrogen, total kjeldahl	1,720			
Phosphorus, weak bray	43			
Aluminum, total	24,400			
pH		7.3		

Alpha
Analytical Laboratories, Inc.

Bruce L. [signature] 12-31-88
LABORATORY DIRECTOR DATE

alpha
Alpha Analytical Laboratories Inc. • 860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CLIENT Georgia Pacific
ADDRESS P.O. Box 1618
Eugene, OR 97440
ATTN: Kent Mayer

DATE COLLECTED 11-28-88
DATE IN LAB 12-12-88
COLLECTED BY Larkin
SAMPLE TYPE Soil

LABORATORY NO.: 88-1212-1-4
CLIENT I.D. : L.V. Area # 2
12"+

	ppm	meq/100g	% of CEC	Ideal %
Calcium	1,320		79.3	60 - 70
Magnesium	101		10.1	15
Sodium	49		2.6	3 - 5
Potassium	260		8.0	3 - 5
Exchangeable Acidity		0		0 - 5
Cation Exchange Capacity(CEC)		8.3		
Nitrogen, total kjeldahl	2,730			
Phosphorus, weak bray	47			
Aluminum, total	25,600			
pH		7.3		

Alpha
Analytical Laboratories, Inc.

Bruce L. Hope 12-31-88
LABORATORY DIRECTOR DATE

alpha
Alpha Analytical Laboratories Inc. • 860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CLIENT Georgia Pacific
ADDRESS P.O. Box 1618
Eugene, OR 97440
ATTN: Kent Mayer

DATE COLLECTED 11-28-88
DATE IN LAB 12-12-88
COLLECTED BY Larkin
SAMPLE TYPE Soil

LABORATORY NO.: 88-1212-1-5
CLIENT I.D. : L.V. Area # 3
0" - 12"

	ppm	meq/100g	% of CEC	Ideal %
Calcium	790		71.9	60 - 70
Magnesium	86		13.0	15
Sodium	37		2.9	3 - 5
Potassium	260		12.1	3 - 5
Exchangeable Acidity		0		0 - 5
Cation Exchange Capacity(CEC)		5.5		
Nitrogen, total kjeldahl	2,420			
Phosphorus, weak bray	72			
Aluminum, total	15,100			
pH		7.6		

Alpha
Analytical Laboratories, Inc.

Bruce L Gay 12-31-88
LABORATORY DIRECTOR DATE

alpha
Alpha Analytical Laboratories Inc. •• 860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CLIENT	Georgia Pacific	DATE COLLECTED	11-28-88
ADDRESS	P.O. Box 1618	DATE IN LAB	12-12-88
	Eugene, OR 97440	COLLECTED BY	Larkin
	ATTN: Kent Mayer	SAMPLE TYPE	Soil

LABORATORY NO.: 88-1212-1-6
CLIENT I.D. : L.V. Area # 3
12"+

	ppm	meq/100g	% of CEC	Ideal %
Calcium	900		77.1	60 - 70
Magnesium	82		11.7	15
Sodium	39		2.9	3 - 5
Potassium	189		8.3	3 - 5
Exchangeable Acidity		0		0 - 5
Cation Exchange Capacity(CEC)		5.8		
Nitorgen, total kjeldahl	1,400			
Phosphorus, weak bray	93			
Aluminum, total	9,300			
pH		7.8		

Alpha
Analytical Laboratories, Inc.

12-31-88
LABORATORY DIRECTOR DATE

Georgia-Pacific Corporation P.O. Box 1618
Eugene, Oregan 97440
(503) 689-1221

WATER QUALITY CONTROL BOARD
JAN 1 7 '89

BK BB
CJ JG
FR KO
RT MENDMOA
JH
SW
RC REPLY

Mark Neely
California Regional Water
  Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Neely,

January 11, 1989

Enclosed is the Monitoring and Reporting Program report, as per Order No. 86-3, for Georgia-Pacific and its' Little Valley soil amending project, for the month of December, 1988.

Also included in this report are the amounts of rainfall and the pH measurements from the various ephemeral draws (when available). Two of the pH measurements taken on 12-21 show high pH's at points #6 & 8. I do not know what the reason for this was, but subsequent measurements taken show the pH's to be 7.7 & 7.1, respectively.

If you have any questions or comments, please feel free to call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

Encl.

Georgia-Pacific Little Valley Report for January, 1989

Monitoring and Reporting Order No. 86-3, Soil Amending Project.

Volume of Ash Deposited (@ site)		Cubic Yards Area A-South	Rainfall Totals
Week of,	1-7	380 Yds^3	1.55 inches
	8-14	380	1.70
	15-21	460	0.0
	22-28	320	.80
	29-31	100	.40
	Total	= 1,640 Yds^3	4.55 inches

The Total number of treated acres to date = 53.6 acres.

Precipitation

4.55 inches of rain fell during the month, (see detail above). Some of the ephemeral draws were dry during the month.

Water Monitoring and Testing

Here are the pH, suspended solids and COD levels:

	1-10-89	1-23-89		S. Soilds	COD
pH @5=	7.8	7.7	pt. 5 =	23	N/D
6=	7.7	7.1	6 =	11	N/D
7=	7.4	7.4	7 =	11	N/D
8=	7.1	7.2	8 =	11	N/D
9=	7.2	7.3	9 =	5	N/D

The ephemeral draws were dry in the 1st and 4th weeks of the month.

Deposition

All deposites of woodwaste ash were placed in the Winter stockpile area for 1988-89.

Georgia-Pacific Corporation Eastern Wood Products
Manufacturing Division
P.O. Box 105603
Atlanta, [illegible]
Telephone [illegible]
Teletype (810) [illegible]

WATER QUALITY CONTROL BOARD REGION 1
FEB 5 '89

February 1, 1989

Mr. Benjamin D. Kor
Executive Officer
California Regional Water
Quality Control Board
North Coast Region
1440 Guerneville Road
Santa Rosa, CA 95403

RE: Progress Report - Fly Ash Amended Soil Study
Georgia-Pacific Corporation
Fort Bragg, CA

Dear Mr. Kor:

As indicated in my letter to you dated November 29, 1988, the sampling outlined in Phase 1 of fly ash amended soil study was completed during the week of November 14, 1988. These samples were sent to California Analytical Labs for analysis. The lab tells us that all the analytical work has been completed and that they are in the process of preparing the written report.

Our plans are to proceed with the Phase 2 sampling as outlined in my November letter. Please let me know if there are any questions. You can reach me at 404/521-5084.

Very truly yours,

Gerald W. Tice

GERALD W. TICE
CHIEF ENVIRONMENTAL ENGINEER
WOOD PRODUCTS MANUFACTURING DIVISION

GWT/pcw

cc: Messrs. A. T. Johnson
P. Fetter
K. Mayer
D. B. Whitman
C. T. Howlett, Jr.
G. D. Dutton
G. F. McCaig

Georgia-Pacific Corporation P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

WATER QUALITY CONTROL BOARD REGION 1

FEB 17 '89

☐ BK ☐ BB
☐ CJ ☐ JG
☐ FR ☐ KD
☐ RT ☐ MKW
☐ JH ☐
☐ SW ☐
☐ RC ☐ REPLY

G-P FT BRAGG SOIL AMENDMENT

Mark Neely
California Regional Water
Quality Control Board
1440 Geurneville Road
Sanata Rosa, CA 95403

February 14, 1989

Dear Mr. Neely,

Here is the January, 1989, Monitoring and Reporting Program report, as per Order No. 86-3, for Georgia-Pacific at Fort Bragg, (Little Valley).

Periodic testing required by the permit is included, as well as the normal pH measurements.

If you have any questions, please call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

Encl.

GEORGIA-PACIFIC LITTLE VALLEY REPORT

Month of February, 1989

Monitoring and Reporting Order No. 86-3, Soil Amending Project

Volume of Ash Deposited (@ Site)		Cubic Yards Area A-South		Rainfall Totals
Week of	1-4	240	Yds^3	.50 inches
	5-11	420		
	12-18	460		
	19-25	300		
	26-28	160		.65
TOTAL	=	1,640 yds^3		1.15 Inches

The total number of treated acres to date = 53.6 acres

Precipitation

Minimal (See Above)

Water Monitoring and Testing

Here are the pH levels:

The ephemeral draws were dry all month.

Deposition

All ash was placed in the 1988-1989 Winter stockpile area.

ATE OF CALIFORNIA GEORGE DEUKMEJIAN, Governor

ALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—
NORTH COAST REGION
1440 Guerneville Road
Santa Rosa, CA 95403
Phone: (707) 576-2220

February 16, 1989

Mr. Gerald W. Tice
Chief Environmental Engineer
Wood Products Manufacturing Division
Georgia-Pacific Corporation
P.O. Box 105603
Atlanta, GA 30348

Dear Mr. Tice:

We received your progress report on the Fly Ash Amended Soil Study at the Little Valley site, dated February 1, 1989. It appears that the schedule you propose is acceptable, and we look forward to receiving the draft report by May 1, 1989. It is unclear how the draft report and the final report can be submitted in the same month. It will take some time for us to review and comment on the draft, and for those comments to be addressed by you in the final report. Therefore, the final report will probably not be submitted until a month or two later than proposed.

Please call if you have any questions.

Sincerely,

Mark K. Neely
Associate Engineering Geologist

MKN:pcg

Georgia-Pacific Corporation
P.O. Box 1618
Eugene, Oregon 97440
(503) 689-

WATER QUALITY
CONTROL BOARD

MAR 15 '89

☐ BK ☐ BB
☐ CJ ☐ JG
☐ FR ☐ KB K
☐ RT ☐ ~~MKN~~ MM
☐ JH ☐
☐ SW ☐
☐ RC ☐ REPLY

March 13, 1989

Mark Neely
California Regional Water
 Quality Control Board
1440 Geurneville Road
Santa Rosa, CA 95403

Dear Mr. Neely:

Here is the February, 1989, Monitoring and Reporting Program report, as per Order No. 86-3, for Georgia-Pacific Corporation at Fort Bragg (Little Valley).

If you have any questions, please call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

KCM:jap

Enclosure

GEORGIA-PACIFIC LITTLE VALLEY REPORT

Month of March, 1989

Monitoring and Reporting order No. 86-3, Soil Amending Project

Volume of Ash Deposited (@ Site)	Cubic Yards Area A-South	Rainfall Totals
Week of 1 - 4	260 Yds^3	1.51 inches
5 - 11	420	4.65
12 18	300	3.13
19 - 25	380	3.0
26 - 31	340	1.12
	Total = 1,700 Yds^3	13.41 inches

The total number of treated acres to date = 53.6 acres

Precipitation

13.41 inches of rain fell during the month, (see detail above). Some of the ephemeral draws were dry during the month.

Water Monitoring and Testing

Here are the pH measurements from the ephemeral draws:

	3-06-89	3-21-89
pH @ 5 =	7.9	7.8
@ 6 =	7.8	7.8
@ 7 =	7.8	7.8
@ 8 =	7.4	7.3
@ 9 =	7.3	7.2

The ephemeral draws were dry in the 1st and 4th weeks of the month.

Deposition

All deposits of woodwaste ash were placed in the Winter stockpile area for 1988-89.

STATE OF CALIFORNIA

STATE WATER RESOURCES CONTROL BOAR

FACILITIES INSPECTION REPORT

SWRCB 001 (NEW 6-87)

ADDITIONAL INFORMATION SHOULD BE ATTACHED TO ORIGIN

1. WDS NUMBER (Must be 11 digits): 1B85Ø3ØRMEN
2. NAME OF AGENCY RESPONSIBLE FOR DISCHARGE: GEORGIA PACIFIC CORP.
3. DATE INSPECTION COMPLETED (Year Mo. Day): 890321
4. NAME OF FACILITY: ASH SOIL AMENDMENT

5. INSPECTION TYPE (Check One)

- A1 ☐ "A" type compliance—Comprehensive inspection in which samples are taken.
- B1 ☒ "B" type compliance—A routine nonsampling inspection.
- 02 ☐ Noncompliance follow-up—Inspection made to verify correction of a previously identified violation.
- 03 ☐ Enforcement follow-up—Inspection made to verify that conditions of an enforcement action are being met.
- 04 ☐ Complaint—Inspection made in response to a complaint.
- 05 ☐ Pre-requirement—Inspection made to gather information relative to preparing, modifying, or rescinding requirements.
- 06 ☐ Miscellaneous—Any inspection not mentioned above.

NPDES

6. INSPECTION BY: ☒ State ☐ State/EPA Joint
7. IS EPA INSPECTION REQUIRED? ☐ Yes ☒ No
8. DID YOU TAKE A BIOASSAY SAMPLE? ☐ Yes ☒ No
9. IF A BIOASSAY SAMPLE WAS TAKEN, WAS IT: ☐ Static ☐ Flowthrough

10. INSPECTION COMMENTS SUMMARY–REQUIRED (100 Character Maximum)

STOCKPILE SHOWS NO SIGN OF SURFACE TRANSPORT OF ASH. NO AMENDING SINCE LAST INSPECTION.

11. WAS THERE A VIOLATION? ☐ Yes (Complete violation form.) ☒ No ☐ Pending (e.g., lab results)

12. INSPECTOR'S INITIALS ——→ MKN

ADDITIONAL COMMENTS

SEE ATTACHED MEMO

Georgia-Pacific Corporation

P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

WATER QUALITY
CONTROL BOARD
REGION I

APR 13 '89

BK ___ SC ___
CJ ___ K 4-13-89
FR ___
RT ___
JW ___
BB ___
JG ___ REPLY

April 11, 1989

8603

Mark Neely
California Regional Water
Quality Control Board
1440 Geurneville Road
Santa Rosa, CA 95403

Dear Mr. Neely:

Enclosed is the March, 1989 Monitoring and Reporting Program report, as per Order No. 86-3, for Georgia-Pacific Corporation at Fort Bragg (Little Valley).

Ash deposition is detailed in the enclosed report. Rainfall and pH measurements are also given.

If you have any questions, please call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer
Western Area
Wood Products Manufacturing

KCM:jap

Enclosures

GEORGIA-PACIFIC LITTLE VALLEY REPORT

Month of APRIL, 1989

Monitoring and Reporting order No. 86-3, Soil Amending Project

Volume of Ash Deposited (@ Site)		Cubic Yards Area A-South		Rainfall Totals
Week of 1 - 8		400	Yds^3	inches
9 - 15		320		
16 - 22		220		
23 - 30		200		
TOTAL	=	1,140	Yds^3	-0- Inches

The total number of treated acres to date = 53.6 acres

Precipitation

Minimal (See Above)

Water Monitoring and Testing

Here are the pH levels:

The ephemeral draws were dry all month.

Deposition

All ash was placed in the 1988-1989 Winter stockpile area.

5/4/89

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
NORTH COAST REGION

Interoffice Communication

TO: 1) Frank Reichmuth 14 April 1989
2) File: G-P Soil Amendment

FROM: Mark Neely

SUBJECT: Compliance inspection of Georgia-Pacific Ft. Bragg Ash Soil Amendment

On 21 March I completed a level B inspection of the subject site. I was accompanied by Kent Mayer, evironmental supervisor, G-P Eugene.

Kent showed me the location of the soil, vegetation, and earthworm samples. The experimental plots were taken from the most recently amended area, and from a one year old plot. The control site was located north of the amendment area, out of the downwind area of the amendment site. Kent reiterated the problem G-P has with colecting sufficient sample for the airborne component of the study, as I had discussed with Gerald Tice of the G-P Atlanta office. Kent unofficially told me that all samples had been negative, so they were prepared to request that the airborne component of the study be dropped. We can review this, along with Frank Palmer, when the draft report come in.

The stockpile area looked secure, with no evidence of surface transport by runoff. They have not amended any ash since my last inspection.

Georgia-Pacific Corporation
P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

WATER QUALITY
CONTROL BOARD
REGION I

MAY 8 '89

☐ BK ☐ BB
☐ CJ ☐ JG
☐ FR ☐ KD ✓ 5-9-89
☐ RT ☐ WCU
☐ JH ☐
☐ SW ☐
☐ RC ☐ REPLY
☐ ALL STAFF ☐ FILE

May 4, 1989

Mark Neely
California Regional Water
Quality Control Board
1440 Geurneville Road
Santa Rosa, CA 95403

~~880889~~
86003

Dear Mr. Neely:

Here is the April, 1989, Monitoring and Reporting Program report, as per order No. 86-3, for Georgia-Pacific Corporation at Fort Bragg (Little Valley).

If you have any questions, please call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

KCM:jap

Enclosure

Georgia-Pacific Corporation
P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

WATER QUALITY
CONTROL BOARD
REGION I

MAY 8 '89

☐ BK ☐ BB
☐ CJ ☐ JG
☐ FR ☐ KD
☐ RT ☐ NCN
☐ JH ☐
☐ SW ☐
☐ RC ☐ REPLY
☐ ALL STAFF ☐ FILE

May 5, 1989

Mark Neely
California Regional Water
Quality Control Board
1440 Geurneville Road
Santa Rosa, CA 95403

Dear Mr. Neely:

As an amendment to the April, 1989 Monitoring and Reporting Program report dated 5/4/89, there was 2.56 inches of precipitation for the month.

If you have any questions, please call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

KCM:jap

Enclosure

GEORGIA-PACIFIC LITTLE VALLEY REPORT

MONTH OF MAY, 1989

Monitoring and Reporting Order NO. 86-3, Soil Amending Project

Volume of Ash Deposited (@ Site)		Cubic Yards Area A-South	Rainfall Totals
Week of	1 - 6	160 Yds^3	inches
	7 - 13	180	
	14 - 20	260	
	21 - 27	320	.46
	28 - 31	180	
TOTAL	=	900 Yds^3	.46 inches

The total number of treated acres to date = 53.6 acres

Precipitation

.46 inches of rain fell for the month - Minimal (See above)

Water Monitoring and Testing

Here are the pH levels:

The ephemeral draws were dry all month.

Depositition

All ash was placed in the 1988-1989 winter stockpile area.

6/14/89

Georgia-Pacific Corporation *Eastern Wood Products*
Manufacturing Division
P.O. Box 105605
Atlanta, Georgia 30348
Telephone (404) 521-4000
Teletype (810) 7

JUN 12 '89

June 6, 1989

Mr. Mark K. Neely
Associate Engineering Geologist
California Regional Water Quality Control Board
1440 Greenesville Road
Santa Rosa, CA 95403

MN

G-P FT. BRAGG SOIL AMENDED

Dear Mr. Neely:

Concerning our conversation on Friday June 2, 1989, I advised you we had encountered a delay in completing the Fly Ash Amended Soil Study at the Little Valley site near our Fort Bragg, CA. mill.

There are two reasons for this delay. First, a question has come up concerning the laboratory detection limits for 2, 3, 7, 8 TCDF and total TCDF in the grass samples obtained from the site. We are seeking clarification from the lab (Enseco) on what they consider the actual detection limit for these samples. Also we are going ahead with the analysis on the split grass sample in questions, which had been achieved.

Secondly, we have found it necessary to obtain additional soil samples from the amended sites to confirm the results of the single composited soil sample that was taken. Unfortunately, the consultant we have employed to obtain these samples will not be able to take the samples until mid July, 1989 because of previous commitments. Once the samples are obtained and sent to the lab it will probably take an additional 30 days to get the sample results. This means our report cannot be completed until about September 1, 1989. We really do not want to submit this report until we feel we have an accurate indication of actual conditions at the site.

We thank you for your cooperation in this matter. If you desire, I will be happy to provide you with continued progress reports until this project is complete.

Very truly yours,

Gerald W. Tice

GERALD W. TICE
CHIEF ENVIRONMENTAL ENGINEER
WOOD PRODUCTS MANUFACTURING DIVISION

GWT/pcw

cc: Messrs. C. T. Howlett, Jr.
A. T. Johnson
L. P. E. Otwell
P. M. Fetter
K. C. Mayer
L. D. Ambrosini
D. B. Whitman
G. F. McCaig
T. N. Treichelt

Georgia-Pacific Corporation
P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

CONTROL BOARD

JUN 16 '89

☐ CJ ☐ JG
☐ FR ☐ KD R-6-19-89
☐ RT ☐
☐ JH ☐ MN
☐ SW ☐
☐ RC ☐ REPLY
☐ ALL STAFF ☑ FILE G-P Ft. Bragg
Soil Amendment

June 14, 1989

Mark Neely
California Regional Water
Quality Control Board
1440 Geurneville Road
Santa Rosa, CA 95403

Dear Mr. Neely:

Here is the May, 1989 Monitoring and Reporting Program report, as per order No. 86-3, for Georgia-Pacific Corporation at Fort Bragg, California (Little Valley).

If you have any questions, please call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

KCM:jap

Enclosure

GEORGIA-PACIFIC LITTLE VALLEY REPORT

MONTH OF JUNE, 1989

Monitoring and Reporting Order No. 86-3, Soil Amending Project

Volume of Ash Deposited (@ Site)		Cubic Yards Area A-South	Rainfall Totals
Week of	1 - 3	180 Yds^3	inches
	4 - 10	300	
	11 - 17	380	
	18 - 24	340	
	25 - 30	320	.07
TOTAL		1,520 Yds^3	.07 inches

The total number of treated acres to date = 60.5 acres

Precipitation

.07 inches of rain fell for the month = Minimal (See above).

Water Monitoring

The ephemeral draws were dry.

Deposition

All ash in the 1988-1989 winter stockpile area was amended in June, into an area of about 5.9 acres.

All ash generated during the month was amended into 1 acre.

Georgia-Pacific Corporation
P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

JUL 19 '89

July 14, 1989

7-21-89

WOW

AW AL

Mark Neely
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

~~84089~~ 86003

REPLY

G-P F.E ASH
SOIL AMENDMENT

Dear Mr. Neely:

Here is the June, 1989 Monitoring and Reporting Program report, as per Order No. 86-3 for Georgia-Pacific Corporation at Fort Bragg, California (Little Valley).

If you have any questions, please call me.

Sincerely,

Kent C. Mayer
Environmental Engineer

KCM:jap

Enclosure

GEORGIA-PACIFIC LITTLE VALLEY REPORT

MONTH OF JULY, 1989

Monitoring and Reporting Order No. 86-3, Soil Amending Project.

Volume of Ash Deposited (@ Site		Cubic Yards Area A-South		Rainfall Totals	
Week of	1 - 2	20	Yds^3	-0-	inches
	3 - 9	300			
	10 - 16	300			
	17 - 23	320			
	24 - 31	200			
	TOTAL =	1,180	Yds^3		

The total number of treated acres to date = 62 acres

Precipitation

None

Water Monitoring and Testing

Here are the pH levels: NA

Deposition

All ash produced during the month of July was amended into 1.45 acres in the summer, 1989 amending area.

Georgia-Pacific Corporation
P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

JUL 26 '89

☐ DR ____
☐ CJ ____ ☐ JG ____
☐ FR ____ ☐ KD ____ 7-27-89
☐ RT ____ ☐ ____
☐ SW ____ ☐ ____
☐ RC ____ ☐ REPLY
☐ ALL STAFF ☒ FILE G-P FT. BRAGG SOIL AMENDMENT

86003

July 18, 1989

Mark Neely
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, Ca 95403

Dear Mr. Neely:

Enclosed is the 1988 Annual Report for the Georgia-Pacific Soil Amending Project as per Monitoring and Reporting Program No. 86-3.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer
Western Area
Wood Products Division

KCM:jap

Enclosures

1988 WATER ANALYSIS

TEST	JANUARY	FEB - OCT	NOVEMBER	DECEMBER
		MONTH		
pH*		N/A		6.6
	2 @ 6.4		6.6	2 @ 7.0
	3 @ 6.5		6.8	4 @ 7.1
	3 @ 6.8		7.0	2 @ 7.2
	4 @ 6.9		7.1	3 @ 7.3
	2 @ 7.0		7.1	7.4
	7.1			7.6
	15 = 6.8 Ave.	TOTALS	5 = 6.9 Ave.	14 = 7.2 Ave.
NFR				2 @ 1 ppM
				2 @ 2
				2 @ 3
				5
				6
				7
				10
COD				ND
				13
				24
				30
				39

*See attached map for sampling locations.

1988 SOIL ANALYSIS

TEST	AREA					
	AREA NO. 1		AREA NO. 2		AREA NO. 3	
	@ 1"	@ 12"	@ 1"	@ 12"	@ 1"	@ 12"
CEC	5.1	8.4	9.0	8.3	5.5	5.8
CALCIUM (ppM)	820	880	1,230	1,320	790	900
% CEC	80	52.5	68.6	79.3	72	77
MAGNESIUM	49	212	174	101	86	82
% CEC	8	21	16.2	10	13	11.7
SODIUM	42	48	48	49	37	39
% CEC	3.6	2.5	2.3	2.6	3	3
POTASSIUM	166	780	450	260	260	189
% CEC	8.3	24	13	8	12	8.3
NIGROGEN (ppM)	1,950	1,640	1,720	2,730	2,420	1,400
PHOSPHOURUS	54	30	43	47	72	93
ALUMINUM	15,700	19,800	24,400	25,600	15,100	9,300
pH	7.7	6.7	7.3	7.3		7.8

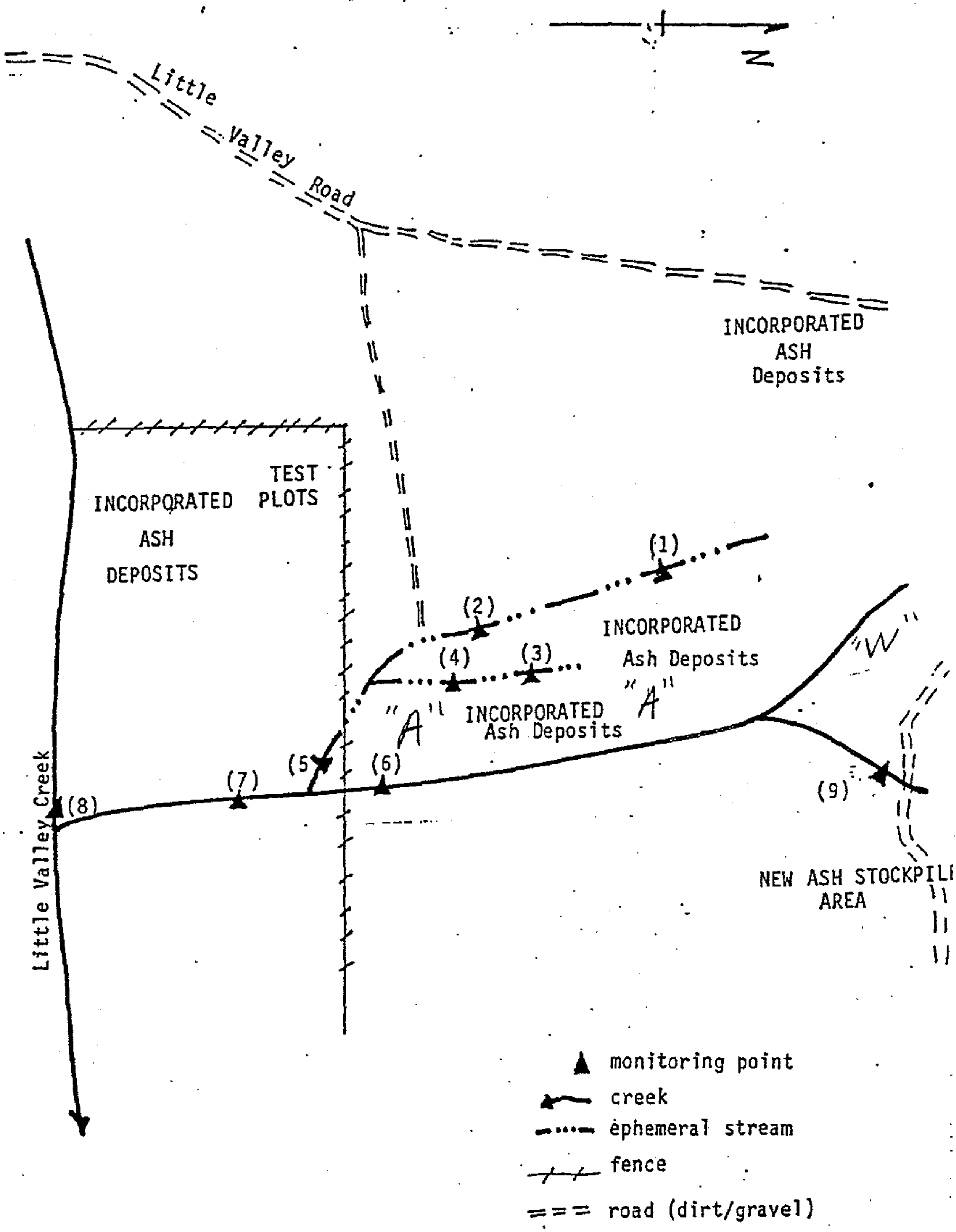
AMOUNT OF ASH APPLIED - 1988

MONTH	CUBIC YARDS (Yds^3)
January	1,840
February	1,380
March	1,820
April	1,400
May	1,700
June	1,740
July	2,220
August	1,920
September	1,500
October	1,860
November	2,780
December	1,760
TOTAL =	21,920 Yds^3 of ash deposited.
AVERAGE =	1,825 Yds^3/Month

SUMMARY: Number of acres receiving ash = 12.2 acres amended in 1988.

Pasture yield rates are estimated to be about 3.5 tons per acre, based on an ash application rate of 1,167 tons per acre.* Visual observations by Georgia-Pacific, the Regional Water Board and the V. of C. Extension Agency indicated increased growth and color on the acres treated.

* The ash is received wet, but amended dry - if the ash is at 50% moisture content, then the application rate is closer to 584 tons per acre.



N
Little Valley Road
INCORPORATED ASH Deposits
TEST PLOTS
INCORPORATED ASH DEPOSITS
(1)
(2)
INCORPORATED Ash Deposits
(4)
(3)
"W"
"A"
INCORPORATED Ash Deposits
"A"
(5)
(6)
(7)
(8)
(9)
Little Valley Creek
NEW ASH STOCKPILE AREA
monitoring point
creek
ephemeral stream
fence
road (dirt/gravel)

NOT TO SCALE

Georgia-Pacific Corporation

P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

WATER QUALITY
CONTROL BOARD
REGION I

AUG 1 1989

August 10, 1989

☐ KK ____ ☐ SS ____
☐ CI ____ ☐ JG ____
☐ FR ____ ☐ XD ✓ 9/11/89
☐ RT ____ ☐ ____ 9/19/89
☐ JH ____ ☐ ____
☐ SW ____ ☐ ____
☐ RC ____ ☐ REPLY
☐ ALL STAFF ☐ FILE

Mark Neely
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Neely:

Here is the July, 1989 Monitoring and Reporting Program report, as per Order No. 86-3 for Georgia-Paific Corporation at Fort Bragg, California (Little Valley).

If you have any questions, please call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

KCM:jap

Enclosure

GEORGIA-PACIFIC LITTLE VALLEY REPORT

MONTH OF AUGUST, 1989

Monitoring and Reporting Order No. 86-3, Soil Amending Project.

Volume of Ash Deposited (@ Site	Cubic Yards Area A-South		Rainfall Totals
			inches
Week of 1 - 6	180	Yds^3	
7 - 13	280		
14 - 20	320		
21 - 27	360		
28 - 31	320		
TOTAL =	1,460	Yds^3	-0- inches

The total number of treated acres to date = 62.0 acres

Precipitation

No measureable rainfall

Water Monitoring and Testing

Here are the pH levels:

N/A

Deposition

All ash was stockpiled and amended into an area of approximately 1.5 acres.

STATE OF CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

FACILITIES INSPECTION REPORT

SWRCB 001 (NEW 6-87)

ADDITIONAL INFORMATION SHOULD BE ATTACHED TO ORIGINAL

1. WDS NUMBER (Must be 11 digits)	2. NAME OF AGENCY RESPONSIBLE FOR DISCHARGE
1B85Ø3ØRMEN	GEORGIA - PACIFIC CORP
3. DATE INSPECTION COMPLETED (Year / Mo. / Day)	4. NAME OF FACILITY
89 / 08 / 17	FT. BRAGG SOIL AMENDMENT

5. INSPECTION TYPE (Check One)

- A1 ☐ "A" type compliance—Comprehensive inspection in which samples are taken.
- B1 ☒ "B" type compliance—A routine nonsampling inspection.
- 02 ☐ Noncompliance follow-up—Inspection made to verify correction of a previously identified violation.
- 03 ☐ Enforcement follow-up—Inspection made to verify that conditions of an enforcement action are being met.
- 04 ☐ Complaint—Inspection made in response to a complaint.
- 05 ☐ Pre-requirement—Inspection made to gather information relative to preparing, modifying, or rescinding requirements.
- 06 ☐ Miscellaneous—Any inspection not mentioned above.

NPDES

6. INSPECTION BY: ☒ State ☐ State/EPA Joint

7. IS EPA INSPECTION REQUIRED? ☐ Yes ☒ No

8. DID YOU TAKE A BIOASSAY SAMPLE? ☐ Yes ☒ No

9. IF A BIOASSAY SAMPLE WAS TAKEN, WAS IT: ☐ Static ☐ Flowthrough

10. INSPECTION COMMENTS SUMMARY-REQUIRED (100 Character Maximum)

NEW STORAGE/AMENDMENT AREA APPROVED

11. WAS THERE A VIOLATION? ☐ Yes (Complete violation form.) ☒ No ☐ Pending (e.g., lab results)

12. INSPECTOR'S INITIALS → MKN

ADDITIONAL COMMENTS

SEE ATTACHED MEMO.

Georgia-Pacific Corporation

P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

September 11, 1989

Mark Neely
California Regional Water
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Neely:

Here is the August, 1989 Monitoring and Reporting Program report, as per Order No. 86-3 for Georgia-Pacific Corporation at Fort Bragg, California (Little Valley).

If you have any questions, please call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

KCM:jap

Enclosure

GEORGIA-PACIFIC LITTLE VALLEY REPORT

MONTH OF SEPTEMBER, 1989

Monitoring and Reporting Order No. 86-3, Soil Amending Project.

Volume of Ash Deposited (@ Site			Cubic Yards Area A-South	Rainfall Totals
Week of 1	-	3	120 Yds^3	-0- inches
4	-	10	380	-0-
11	-	17	220	.04
18	-	23	320	.81
24	-	30	360	.70
	TOTAL =		1,400 yds^3	

The total number of treated acres to date = 63 acres

Precipitation

There was a total of 1.55 inches for the month.

Water Monitoring and Testing

Here are the pH levels: N/A

The ephemeral draws were dry.

Deposition

All ash generated in September has been amended and the area seeded.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
NORTH COAST REGION

Interoffice Communication

TO: 1) Frank Reichmuth
2) File:G-P Ft. Bragg Soil Amendment, Mendo. Co.

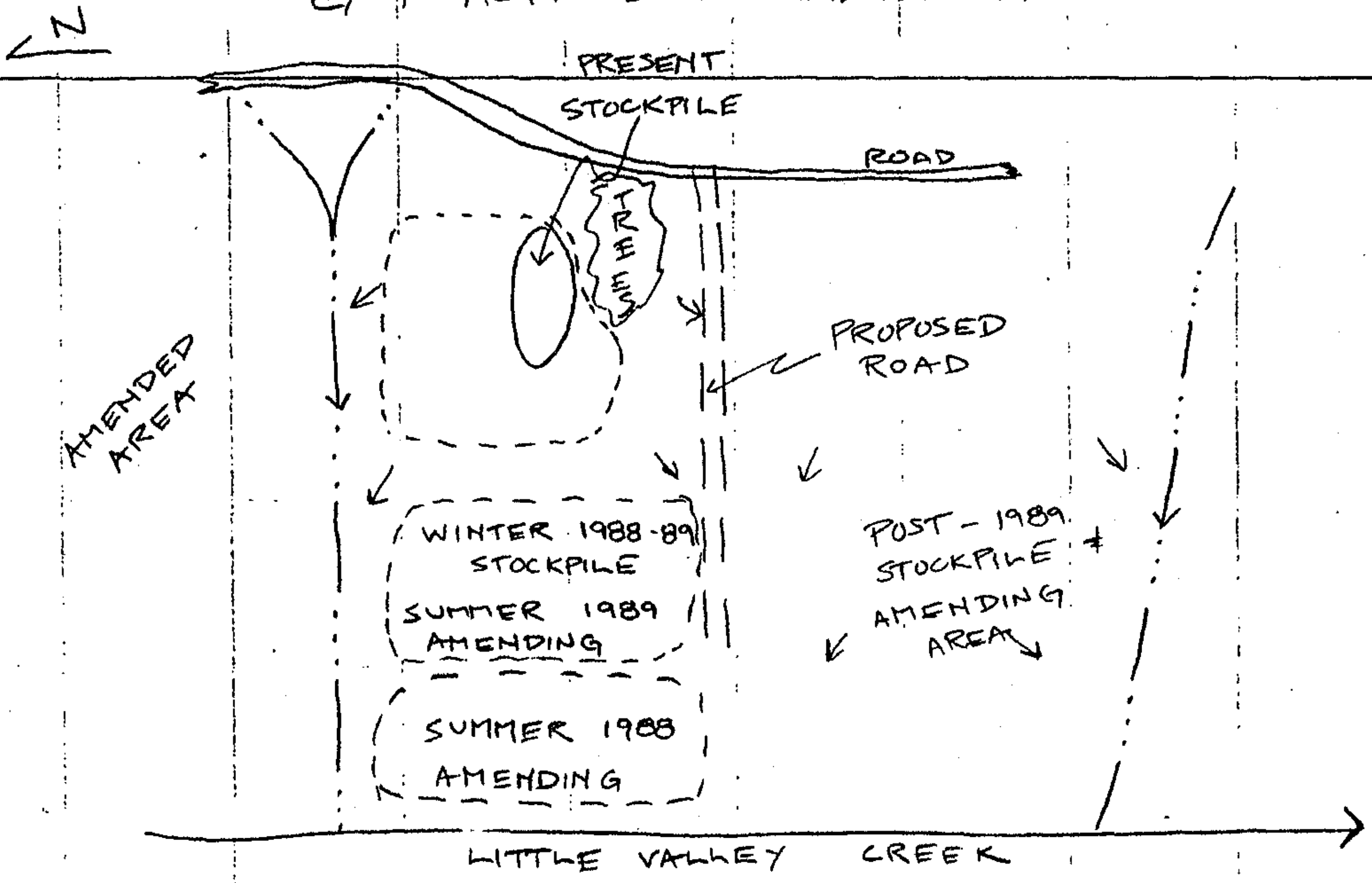
12 September 1989

FROM: Mark Neely MN

SUBJECT: Compliance inspection of Georgia-Pacific Fort Bragg Ash Soil Amendment

On 17 August 1989 I completed a short inspection of the subject site. I was accompanied by Kent Mayer, G-P Environmental Engineer. Mr. Mayer wanted to get approval for a new stockpile and amendment site for the upcoming year. It is located to the south of the present area (see attached map). This is the same area conceptually agreed to last year. The only potential problem is a very subtle swale that runs through the site. However, it does not appear to be capable of transporting ash or causing significant erosion. In any case, the swale settles out onto a flat and never makes it to Little Valley Creek. I gave verbal appproval of the site, and will formalize it by a letter. The present stockpile area seemed to be working out, although a few wisps of ash were kicked up by a breeze. I will inspect it again following seeding this fall.

G-P ASH SOIL AMENDMENT



LEGEND (NO SCALE)

APPROXIMATE BOUNDARY OF STOCKPILE/AMENDING AREA

INTERMITTENT STREAM

SLOPE

ATTACHMENT 7

F

STATE OF CALIFORNIA

GEORGE DEUKMEJIAN, Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—
NORTH COAST REGION

1440 GUERNEVILLE ROAD
SANTA ROSA, CA 95403
(707) 576-2220

September 19, 1989

Mr. Kent Mayer
Georgia-Pacific Corporation
P. O. Box 1618
Eugene, OR 97440

Dear Mr. Mayer:

On August 17, 1989, I visited the Little Valley soil amendment site with you in order to approve the new ash storage and amending area for the upcoming season. The new area, located south of the present amending area, appears to be a satisfactory location. The wet area that crosses the new amending area does not appear capable of generating overland flow and eroding the ash, and therefore should not pose a threat of ash transport. Please remember that the areas amended this year need to be finished and seeded by October 1. Also, you must ensure that once an area has been amended and seeded, it should not be disturbed again throughout the coming winter.

On the same subject, the Waste Discharge Requirements for the site expire on January 30, 1990. In order to ensure that the permit is renewed in time, a Report Of Waste Discharge (ROWD) form and the filing fee will need to be submitted to this office. The timing requirements for the permit process call for 120 days for review and issuance, so the ROWD should be submitted to us by October 2, 1989. Enclosed you will find a copy of the application forms and a filing fee for calculating the fee amount.

Of course, renewal of the permit is dependent on the results of your ongoing study of the bioaccumulation potential of the low levels of furans in the ash. The report is due this month, and any further delay in submitting the report could lead to a delay in reissuing the permit.

Should you have any questions about any of the items contained in this letter, please give me a call.

Sincerely,

Mark K. Neely
Associate Engineering Geologist

MKN:ba/gpashltr

Enclosures

cc: Gerald Tice
Dave Larkin

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

WATER QUALITY CONTROL BOARD
REGION I

FEB 23 '90

RECEIVED 9/21/89

OFFICE OF RESEARCH AND DEVELOPMENT

☐BK ☐RK
☐CJ ☐CT
☐FR ☐BB
☐RT ☐KD
☐JH ☐JS
☐ ☐REPLY
☐ALL STAFF ☐FILE

September 21, 1989

SUBJECT: OHEA Critique to Champion Corporation's Alternative Risk Assessment for TCDD: Discharge Permit for the Canton (North Carolina) Mill.

FROM: Steven Bayard, Ph.D
Human Health Assessment Group (RD-689)
Office of Research and Development

Steven Bayard

TO: John Marlar
Water Management Division
Region IV

THRU: Charles Ris
Deputy Director
Human Health Assessment Group (RD-689)

Before addressing the risk assessment issues raised by the Champion International Corporation, it is important to realize the scope of the health issues associated with 2,3,7,8-TCDD. 2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) is the most potent animal carcinogen ever tested. It causes cancer in all three species (rat, hamster and mouse) in which it has been tested and at multiple sites in the rat (liver, lung, hard palate and nasal turbinates). In a relative context it is 50 times more potent than aflatoxin B1 on a per mole basis and 50 million times more potent than vinyl chloride. In addition to its carcinogenic potency, 2,3,7,8-TCDD is also the most potent animal teratogen known and causes other reproductive, neurobehavioral and immune system effects at extremely low doses as well.

Only one other polychlorinated dibenzo dioxin (PCDD) compound, a 50-50 mixture of 1,2,3,6,7,8 and 1,2,3,7,8,9 hexachlorodibenzo-dioxin (HxCDD) has been tested for carcinogenicity in animals (rats and mice) and this has also been shown to be carcinogenic (liver cancers) in both species. Upper-limit estimates of the carcinogenic potency of HxCDD place it at about one-twenty fifth that of 2,3,7,8-TCDD, but still in the top five most potent animal carcinogens ever tested.

In humans, the effects of 2,3,7,8-TCDD and other PCDDs are they argue that 1) the EPA methodology (use of the linearized multistage model (LMS) for risk extrapolation) should not be used and 2) "that the effluent limitation for dioxin proposed in the permit be deleted until adequate reliable scientific evidence supports the need to limit the amount of dioxin in the discharge" (letter to Suzanne Durham, April 27, 1989, pg. 14).

Addressing (2) first, Champion argues that because dioxin has not been shown to be carcinogenic in humans, that "until scientific evidence more strongly supports an increased risk of such adverse health effects any regulatory action which is based upon an assumed adverse human health effect is premature." (ibid pg. 14)

The EPA strongly rejects this argument in general (that effects must be seen in humans before regulatory action is justifiable) and especially for 2,3,7,8-TCDD. The wide range of severe effects in animals tested at extremely low doses of 2,3,7,8-TCDD, and the lack of suitable human studies for confirmation or refutation, compel the Agency to rely on results of animal testing. This position is not unique to EPA and has long been a hallmark in public health programs worldwide.

Argument (1) requires a more lengthy discussion. Champion suggests that if argument (1) is not accepted, then as an "alternative that the limit suggested by Dr. Anderson be imposed." Dr. Anderson's analysis is presented in a document prepared for Champion dated April, 1989, document number 1360-010-000. Dr. Anderson presents his own dioxin effluent limit recommendation of 88,266 parts per quadrillion (ppqd), roughly <u>one million times</u> (10^6) <u>higher</u> than the 0.1 ppqd effluent limit proposed by EPA. Over one-half of the difference (1.6×10^3) is based on Dr. Anderson's assumption of TCDD carcinogenicity in animals as having a threshold response and thus adaptable to an ADI with safety factor criteria formulation methodology. This is in contrast with EPA's assumption of a nonthreshold response and use of the LMS model for low dose criteria formulation. Dr. Anderson uses the same ADI approach that has been adopted for 2,3,7,8-TCDD by Health and Welfare Canada and, in fact, Dr. Anderson's results are identical to theirs.

Dr. Anderson's arguments for an ADI with safety factor approach for 2,3,7,8-TCDD are based on a sequential logic of certain observations and assumptions, which focus on hypothesizing about mechanisms of action which then lead to choices in the procedure for dose-response analysis:

a. 2,3,7,8-TCDD is a potent promoter of liver cancer, but is not known to be an initiator of liver cancer.

b. The action of (some) tumor promoters is reversible in that when the promotor is removed from the one is even less certain that it acts like other promoters.

(4) Besides causing liver tumors in the rat, 2,3,7,8-TCDD also causes tumors of the tongue, lung, hard palate and nasal turbinates. The lung tumors are of a rare type (keratinizing squamous cell) as are those of the tongue, hard palate and nasal turbinates. Because these are all rare tumors, 2,3,7,8-TCDD must be both initiating and promoting the cells and, therefore, must be a complete carcinogen in some target organs.

(5) A recent study by Rao et al. (1988), showed the carcinogenicity of 2,3,7,8-TCDD in the Syrian golden hamster exposed either by the subcutaneous or intraperitoneal route. The animals developed squamous cell carcinomas of the skin of the facial region, "in which spontaneous benign or malignant tumors are unknown." Furthermore, the authors had never encountered any skin tumors before in over ten years "in the many hundreds of hamsters used in various carcinogenesis experiments." This strongly suggests that 2,3,7,8-TCDD is a complete carcinogen, at least for some sites.

(6) The proximate location of these tumors in the hamster and the rat reasons for accumulation of 2,3,7,8-TCDD at these sites. The identification of specific receptors in the olfactory epithelium of the rat capable of high affinity binding of 2,3,7,8-TCDD, argue for a direct (originating in target cells) rather than an indirect mechanism of action (an indirect mechanism is more likely to show a threshold).

(7) The hamster is the most resistant mammalian species thus far identified to the toxicity of 2,3,7,8-TCDD. (LD_{50} > 3000 ug/kg b.w.). Thus, any claim of 2,3,7,8-TCDD promotion effects due to cell toxicity and subsequent replication is dismissed in this case.

Based on the above arguments, OHEA rejects Dr. Anderson's and Champion's (and those of CanTox Inc., April 10, 1989) recommendation that an ADI methodology is adequate to characterize the potential carcinogenic impact on humans from exposure to 2,3,7,8-TCDD. While many of their arguments have merit, and in fact these arguments are used in like form by other Agencies in their criteria setting for PCDDs, OHEA believes that the evidence for the liver promoting effects of 2,3,7,8-TCDD does not justify use of an ADI with safety factor in view of the evidence supporting its action as a complete carcinogen. Furthermore, OHEA is also concerned about the other potential conclude that a threshold exists. Without a more scientific basis for such a radical departure from EPA's traditional approach to the risk assessment for carcinogens, the Workgroup is unwilling to adopt a threshold approach for 2,3,7,8-TCDD.

- The innovative approaches of Sielken and Moolgavkar, Venson, and Knudson are interesting, but untested. Therefore, the Workgroup concludes that it would be imprudent to use them at this time for 2,3,7,8-TCDD.

- The available evidence suggests that reliance on the LMS model, as traditionally used by EPA, may be less appropriate for 2,3,7,8-TCDD than for many other chemicals, and that the Agency's 1985 assessment based on the LMS model may overestimate the upper bound on the risk by some unknown amount. However, a rationale for a possible linear behavior at low doses has been developed in this report, and the LMS model provides a useful and familiar context which is widely used in the Federal government when discussing risk estimates. Therefore, the Workgroup discusses its recommendation using the LMS model as a construct, that is, the plausible upper-bound estimate of risk and the risk-specific dose."

Finally, the draft 1988 EPA assessment proposed that the 1985 EPA low dose risk characterization for 2,3,7,8-TCDD be relaxed by a factor of sixteen, from a Risk Specific Dose (RsD) associated with an upper limit 10^{-6} incremental lifetime risk of 0.006 pg/kg-day to 0.1 pg/kg-day. The reasoning was (pg. 51):

"the scientific data indicate that the Agency's current upper bound for 2,3,7,8-TCDD may be an overestimate;

the scientific data do not permit an estimate of the extent of the overestimate;

all of the UCL LMS RsD estimates generated by the Federal agencies are arguably of equal scientific merit at this time;

for strictly policy purposes, there is great benefit in Federal agencies adopting consistent positions in the absence of compelling scientific information; and an order of magnitude estimate of the RsD (potency), as opposed to some more precise estimate of the risk-specific dose, helps to convey the notion that the numerical expression is only a rough estimate (the

REFERENCES

Agency for Toxic Substances and Disease Registry. (1989) Toxicological Profile for 2,3,7,8-TCDD. ATSDR/TP-88/23

Bayard S., (1988). Quantitative Implications of the Use of Different Extrapolation Procedures for Low-Dose Cancer Risk Estimates from Exposure to 2,3,7,8-TCDD. In U.S. EPA 1988. EPA/600/6-88/007A6.

Gillner M., Brittebo E.B., Brondt I., Soderkvist P., Appelgren L., and Gustafsson J., (1987). Uptake and Specific Binding of 2,3,7,8-TCDD in the Olfactory Mucose of Mice and Rats. Cancer Research 47, 4150-4159, August 1, 1987.

Rao M.S., Subbaro V., Prasad J.D., and Scarpellin D.G. (1988). Carcinogenicity of 2,3,7,8-TCDD in the Syrian Golden hamster. Carcinogenesis Vol. 9, No. 9, pp. 1677-1679, 1988.

U.S. Environmental Protection Agency. (1985) Health Assessment Document for Polychlorinated Dibenzo-p-Dioxins. Office of Health and Environmental Assessment, Washington, DC. EPA/600/8-84/014F. NTIS PB86-122546/AS.

U.S. Environmental Protection Agency. (1986) Guidelines for Carcinogen Risk Assessment. Federal Register 51 (185) 33992-34003.

U.S. Environmental Protection Agency. (1988) A Cancer Risk-Specific Dose Estimate for 2,3,7,8-TCDD. Review Draft. Office of Health and Environmental Assessment, Washington, D.C. EPA/600/6-88/007A and Ab.

ROUTING AND TRANSMITTAL SLIP

Date 11/17/89

TO: (Name, office symbol, room number, building, Agency/Post)	Initials	Date
1. Dioxin Strategy Team		
2.		
3.		
4.		
5.		

	Action		File		Note and Return
	Approval		For Clearance		Per Conversation
	As Requested		For Correction		Prepare Reply
	Circulate	✓	For Your Information		See Me
	Comment		Investigate		Signature
	Coordination		Justify		

REMARKS

Draft 2,3,7,8-TCDD tracking report
from CSD, ~ 11/13/1989
being revised to add certain
add'l elements

Questions or comments, if any, to
Bob April

DO NOT use this form as a RECORD of approvals, concurrences, disposals, clearances, and similar actions

FROM: (Name, org. symbol, Agency/Post)	Room No.—Bldg. WH-553
[signature]	Phone No. 382-7[illegible]

5041-102

OPTIONAL FORM 41 (Rev. 7-76)
Prescribed by GSA
FPMR (41 CFR) 101-11.206

GPO : 1987 0 - 196-409

WATER QUALITY CONTROL BOARD
REGION I

FEB 23 '90

☐ BK ____ ☐ RK ____
☐ CJ ____ ☐ LR ____
☐ FR ____ ☐ GB ____
☐ RT ____ ☐ KD ____
☐ JH ____ ☐ JS ____
☐ SW ____ ☐ ____
☐ ____ ☐ REPLY
☐ ALL STAFF ☐ FILE

Attachment 1

DIOXIN (2,3,7,8 TCDD) TRACKING REPORT 1
STATE DIOXIN CRITERIA OVERVIEW

STATE	REGION	SUMMARY STATUS
CT	01	NUMERIC CRITERIA EXPECTED
ME	01	NUMERIC CRITERIA ADOPTED
MA	01	NUMERIC CRITERIA EXPECTED
NH	01	NUMERIC CRITERIA EXPECTED
RI	01	
VT	01	
NJ	02	
NY	02	NUMERIC CRITERIA ADOPTED
PR	02	
VI	02	
DE	03	NUMERIC CRITERIA EXPECTED
DC	03	
MD	03	NUMERIC CRITERIA PROPOSED
PA	03	NUMERIC CRITERIA AND TRANSLATOR ADOPTED
VA	03	NUMERIC CRITERIA EXPECTED
WV	03	
AL	04	NUMERIC CRITERIA EXPECTED
FL	04	NUMERIC CRITERIA EXPECTED
GA	04	NUMERIC CRITERIA ADOPTED
KY	04	NUMERIC CRITERIA PROPOSED
MS	04	TRANSLATOR PROPOSED
NC	04	NUMERIC CRITERIA ADOPTED
SC	04	
TN	04	NUMERIC CRITERIA EXPECTED
IL	05	TRANSLATOR PROPOSED
IN	05	NUMERIC CRITERIA PROPOSED
MI	05	TRANSLATOR ADOPTED
MN	05	NUMERIC CRITERIA EXPECTED
OH	05	NUMERIC CRITERIA PROPOSED
WI	05	NUMERIC CRITERIA ADOPTED
AR	06	
LA	06	
NM	06	
OK	06	
TX	06	
IA	07	
KS	07	
MO	07	NUMERIC CRITERIA ADOPTED
NE	07	NUMERIC CRITERIA ADOPTED
CO	08	NUMERIC CRITERIA ADOPTED
MT	08	NUMERIC CRITERIA ADOPTED
ND	08	
SD	08	NUMERIC CRITERIA ADOPTED
UT	08	
WY	08	NUMERIC CRITERIA PROPOSED
AZ	09	NUMERIC CRITERIA EXPECTED
AS	09	NUMERIC CRITERIA EXPECTED
CA	09	NUMERIC CRITERIA PROPOSED
		NUMERIC CRITERIA EXPECTED

Draft

STATE	REGION	SUMMARY STATUS
GU	09	NUMERIC CRITERIA ADOPTED
HI	09	NUMERIC CRITERIA PROPOSED
NV	09	NUMERIC CRITERIA PROPOSED
CM	09	NUMERIC CRITERIA EXPECTED
TT	09	NUMERIC CRITERIA EXPECTED
AK	10	NUMERIC CRITERIA ADOPTED
		NUMERIC CRITERIA EXPECTED
ID	10	NUMERIC CRITERIA EXPECTED
OR	10	NUMERIC CRITERIA ADOPTED
WA	10	

	ADOPTED	ADOPTED/ PROPOSED	ADOPTED/ PROPOSED/ EXPECTED
# STATES WITH CRITERIA:	14	22	36
# STATES WITH TRANSLATOR:	2	4	4
# STATES WITH CRITERIA OR TRANSLATOR:	15	25	39

Attachment 2

DIOXIN TRACKING REPORT
STATE DIOXIN CRITERIA FACT SHEET

STATE: CT
EPA REGION: 01

STATUS SUMMARY: NUMERIC CRITERIA EXPECTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			0.000013 ng/l
HUMAN HEALTH (Fish Only):			0.000014 ng/l
HUMAN HEALTH (Water Only):			
RISK LEVEL			10-6
FISH CONSUMPTION RATE			6.5 g/day
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	09/30/90

COMMENT
Connecticut is expected to adopt EPA human health criteria based on water and fish consumption.

STATE: ME
EPA REGION: 01

STATUS SUMMARY: NUMERIC CRITERIA ADOPTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):	0.000013 ng/l		
HUMAN HEALTH (Fish Only):	0.000014 ng/l		
HUMAN HEALTH (Water Only):			
RISK LEVEL	10-6		
FISH CONSUMPTION RATE	6.5 g/day		
ACTUAL/PLANNED ADOPTION DATE	02/01/89	/ /	/ /

COMMENT
Maine adopted EPA human health criteria based on water and fish consumption.

Draft

STATE: MA
EPA REGION: 01

STATUS SUMMARY: NUMERIC CRITERIA EXPECTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT
Massachusetts is expected to adopt....

STATE: NH
EPA REGION: 01

STATUS SUMMARY: NUMERIC CRITERIA EXPECTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT
New Hampshire is expected to adopt...

STATE: RI
EPA REGION: 01

STATUS SUMMARY: NEITHER NUMERIC CRITERIA NOR A TRANSLATOR PROCEDURE ARE ADOPTED/PROPOSED/EXPECTED AT PRESENT

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT

STATE: VT
EPA REGION: 01

STATUS SUMMARY: NEITHER NUMERIC CRITERIA NOR A TRANSLATOR PROCEDURE ARE ADOPTED/PROPOSED/EXPECTED AT PRESENT

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT

STATE: NJ
EPA REGION: 02

STATUS SUMMARY: NEITHER NUMERIC CRITERIA NOR A TRANSLATOR PROCEDURE ARE ADOPTED/PROPOSED/EXPECTED AT PRESENT

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT

STATE: NY
EPA REGION: 02

STATUS SUMMARY: NUMERIC CRITERIA ADOPTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):	0.001 ng/l		
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	09/01/85	/ /	/ /

COMMENT
New York has adopted a human health criterion based on a 1981 New York State Department of Health (NYSDOH) recommended maximum level of 10 ppt TCDD in fish flesh, and a BCF of 10,000. This maximum level was based on analytical detectability. Information on other exposure assumptions are not available at this time.

STATE: PR
EPA REGION: 02

STATUS SUMMARY: NEITHER NUMERIC CRITERIA NOR A TRANSLATOR PROCEDURE ARE ADOPTED/PROPOSED/EXPECTED AT PRESENT

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT

STATE: VI
EPA REGION: 02

STATUS SUMMARY: NEITHER NUMERIC CRITERIA NOR A TRANSLATOR PROCEDURE ARE ADOPTED/PROPOSED/EXPECTED AT PRESENT

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT

STATE: DE
EPA REGION: 03

STATUS SUMMARY: NUMERIC CRITERIA EXPECTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):		0.0004 ng/l	
HUMAN HEALTH (Fish Only):		0.00043 ng/l	
HUMAN HEALTH (Water Only):			
RISK LEVEL		10-6	
FISH CONSUMPTION RATE		5.2 g/day	
ACTUAL/PLANNED ADOPTION DATE	/ /	11/01/89	/ /

COMMENT
The criteria listed above are for fresh waters. The State has also proposed a human health criterion for marine/estuarine waters of 0.000061 ng/l based on consumption of fish and shellfish. The assumed fish consumption rate for marine waters is 37 g/day.

STATE: DC
EPA REGION: 03

STATUS SUMMARY: NEITHER NUMERIC CRITERIA NOR A TRANSLATOR PROCEDURE ARE ADOPTED/PROPOSED/EXPECTED AT PRESENT

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT

STATE: MD
EPA REGION: 03

STATUS SUMMARY: NUMERIC CRITERIA PROPOSED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):		0.0012 ng/l	
HUMAN HEALTH (Water Only):			
RISK LEVEL		10-5	
FISH CONSUMPTION RATE		6.5 g/day	
ACTUAL/PLANNED ADOPTION DATE	/ /	12/01/89	/ /

COMMENT
Maryland is proposing to use the FDA cancer potency factor, therefore the criterion equates to an EPA risk level of 10-4.

STATE: PA
EPA REGION: 03

STATUS SUMMARY: NUMERIC CRITERIA AND TRANSLATOR ADOPTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):	0.00001 ng/l		
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL	10-6		
FISH CONSUMPTION RATE	6.5 g/day		
ACTUAL/PLANNED ADOPTION DATE	03/25/89	/ /	/ /

COMMENT
Human health criterion assuming water and fish consumption applies statewide. Pennsylvania used EPA 304(a) methods and fish consumption rates.

STATE: VA
EPA REGION: 03

STATUS SUMMARY: NUMERIC CRITERIA EXPECTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	03/01/90

COMMENT
Virginia is expected to adopt dioxin criteria in March of 1990, but at present no details are available.

STATE: WV
EPA REGION: 03

STATUS SUMMARY: NEITHER NUMERIC CRITERIA NOR A TRANSLATOR PROCEDURE ARE ADOPTED/PROPOSED/EXPECTED AT PRESENT

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT

STATE: AL
EPA REGION: 04

STATUS SUMMARY: NUMERIC CRITERIA EXPECTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):		0.00013 ng/l	
HUMAN HEALTH (Fish Only):		0.00014 ng/l	
HUMAN HEALTH (Water Only):			
RISK LEVEL		10-5	
FISH CONSUMPTION RATE		6.5 g/day	
ACTUAL/PLANNED ADOPTION DATE	/ /	09/30/90	/ /

COMMENT
The proposed criteria will apply to waters classified for public water supply (water and fish) and all other surface waters (fish only).

STATE: FL
EPA REGION: 04

STATUS SUMMARY: NUMERIC CRITERIA EXPECTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	09/30/90

COMMENT
Florida is expected to adopt a human health criterion for dioxin during FY 1990 but at present no details regarding the assumptions to be used are available.

STATE: GA
EPA REGION: 04

STATUS SUMMARY: NUMERIC CRITERIA ADOPTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):	0.000014 ng/l		
HUMAN HEALTH (Water Only):			
RISK LEVEL	10-6		
FISH CONSUMPTION RATE	6.5 g/day		
ACTUAL/PLANNED ADOPTION DATE	06/30/89	/ /	/ /

COMMENT
Georgia adopted a human health criterion based on fish consumption and EPA Section 304(a) methods by emergency rulemaking. The criterion applies to all State waters. The State has committed to adopt this criterion permanently during the first quarter of FY 1990.

STATE: KY
EPA REGION: 04

STATUS SUMMARY: NUMERIC CRITERIA PROPOSED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):		0.000013 ng/l	
HUMAN HEALTH (Fish Only):		0.000014 ng/l	
HUMAN HEALTH (Water Only):			
RISK LEVEL		10-6	
FISH CONSUMPTION RATE		6.5 g/day	
ACTUAL/PLANNED ADOPTION DATE	/ /	09/30/90	/ /

COMMENT
Kentucky has proposed to adopt human health criteria based on water and fish consumption and EPA Section 304(a) methods. The criteria would be applicable to all State waters.

STATE: MS
EPA REGION: 04

STATUS SUMMARY: TRANSLATOR PROPOSED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	09/30/90

COMMENT
To date, Mississippi has not formally proposed numeric criteria for dioxin; the State has proposed to adopt a translator procedure which would be used where no human health criteria are adopted. However, EPA expects that the State will formally propose numeric dioxin criteria very soon, perhaps within the next month. The assumptions are risk level are unknown.

STATE: NC
EPA REGION: 04

STATUS SUMMARY: NUMERIC CRITERIA ADOPTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):	0.000013 ng/l		
HUMAN HEALTH (Fish Only):	0.000014 ng/l		
HUMAN HEALTH (Water Only):			
RISK LEVEL	10-6		
FISH CONSUMPTION RATE	6.5 g/day		
ACTUAL/PLANNED ADOPTION DATE	07/13/89	/ /	/ /

COMMENT
North Carolina has adopted two human health criteria: a "fish only " criterion applicable to all State waters, and a "water and fish criterion applicable to water supply reaches only. The State used EPA Section 304(a) methods and consumption rate assumptions.

STATE: SC
EPA REGION: 04

STATUS SUMMARY: NEITHER NUMERIC CRITERIA NOR A TRANSLATOR PROCEDURE ARE ADOPTED/PROPOSED/EXPECTED AT PRESENT

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT
South Carolina has not proposed numeric dioxin criteria. Future plans are unknown.

STATE: TN
EPA REGION: 04

STATUS SUMMARY: NUMERIC CRITERIA EXPECTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	09/30/90

COMMENT
Tennessee is expected to adopt a numeric criterion for dioxin. Assumptions and risk levels are unknown.

STATE: IL
EPA REGION: 05

STATUS SUMMARY: TRANSLATOR PROPOSED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL		10-5	
FISH CONSUMPTION RATE		20 g/day	
ACTUAL/PLANNED ADOPTION DATE	/ /	02/04/90	/ /

COMMENT
Illinois did not include a dioxin criterion in the WQS proposal, but did include a translator procedure for derivation of criteria on an as-needed basis. Risk level up to 10-4 for multiple contaminants.

STATE: IN
EPA REGION: 05

STATUS SUMMARY: NUMERIC CRITERIA PROPOSED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):		0.0001 ng/l	
HUMAN HEALTH (Fish Only):		0.0001 ng/l	
HUMAN HEALTH (Water Only):			
RISK LEVEL		10-5	
FISH CONSUMPTION RATE		6.5 g/day	
ACTUAL/PLANNED ADOPTION DATE	/ /	02/04/90	/ /

COMMENT
Indiana has proposed human health criteria based on water and fish consumption using EPA methods and a risk level of 10-5.

STATE: MI
EPA REGION: 05

STATUS SUMMARY: TRANSLATOR ADOPTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL	10-5		
FISH CONSUMPTION RATE	6.5 g/day		
ACTUAL/PLANNED ADOPTION DATE	01/18/85	/ /	/ /

COMMENT
Michigan adopted a translator procedure for derivation of dioxin criteria on an as-needed basis.

STATE: MN
EPA REGION: 05

STATUS SUMMARY: NUMERIC CRITERIA EXPECTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			0.00013 ng/l
HUMAN HEALTH (Fish Only):			0.00014 ng/l
HUMAN HEALTH (Water Only):			
RISK LEVEL			10-5
FISH CONSUMPTION RATE			30 g/day
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	02/04/90

COMMENT
Minnesota is expected to adopt specific numeric criteria for dioxin consistent with USEPA criteria. Procedures for deriving those criteria have been proposed, but the actual values have not been calculated.

STATE: OH
EPA REGION: 05

STATUS SUMMARY: NUMERIC CRITERIA PROPOSED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):		0.00013 ng/l	
HUMAN HEALTH (Fish Only):		0.00014 ng/l	
HUMAN HEALTH (Water Only):			
RISK LEVEL		10-5	
FISH CONSUMPTION RATE		6.5 g/day	
ACTUAL/PLANNED ADOPTION DATE	/ /	02/04/90	/ /

COMMENT
Ohio has proposed health dioxin criteria based on water and fish consumption. The fish consumption criteria will apply on all aquatic life reaches while the water and fish consumption criteria will apply on water supply reaches. The State used EPA Section 304(a) methods.

STATE: WI
EPA REGION: 05

STATUS SUMMARY: NUMERIC CRITERIA ADOPTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):	0.00003 ng/l		
HUMAN HEALTH (Fish Only):	0.00003 ng/l		
HUMAN HEALTH (Water Only):			
RISK LEVEL	10-5		
FISH CONSUMPTION RATE	20 g/day		
ACTUAL/PLANNED ADOPTION DATE	03/01/89	/ /	/ /

COMMENT
The State has adopted an array of dioxin criteria based on consumption of water and fish (in pg/l):

PWS Reaches			Non-PWS Reaches		
WW Fish	CW Fish	Great Lakes	WW Fish	CW Fish	Other Fish
0.097	0.03	0.03	0.1	0.03	450

STATE: AR
EPA REGION: 06

STATUS SUMMARY: NEITHER NUMERIC CRITERIA NOR A TRANSLATOR PROCEDURE ARE ADOPTED/PROPOSED/EXPECTED AT PRESENT

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT

STATE: LA
EPA REGION: 06

STATUS SUMMARY: NEITHER NUMERIC CRITERIA NOR A TRANSLATOR PROCEDURE ARE ADOPTED/PROPOSED/EXPECTED AT PRESENT

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT

STATE: NM
EPA REGION: 06

STATUS SUMMARY: NEITHER NUMERIC CRITERIA NOR A TRANSLATOR PROCEDURE ARE ADOPTED/PROPOSED/EXPECTED AT PRESENT

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT

STATE: OK
EPA REGION: 06

STATUS SUMMARY: NEITHER NUMERIC CRITERIA NOR A TRANSLATOR PROCEDURE ARE ADOPTED/PROPOSED/EXPECTED AT PRESENT

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT

STATE: TX
EPA REGION: 06

STATUS SUMMARY: NEITHER NUMERIC CRITERIA NOR A TRANSLATOR PROCEDURE ARE ADOPTED/PROPOSED/EXPECTED AT PRESENT

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT

STATE: IA
EPA REGION: 07

STATUS SUMMARY: NEITHER NUMERIC CRITERIA NOR A TRANSLATOR PROCEDURE ARE ADOPTED/PROPOSED/EXPECTED AT PRESENT

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT

STATE: KS
EPA REGION: 07

STATUS SUMMARY: NEITHER NUMERIC CRITERIA NOR A TRANSLATOR PROCEDURE ARE ADOPTED/PROPOSED/EXPECTED AT PRESENT

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT

STATE: MO
EPA REGION: 07

STATUS SUMMARY: NUMERIC CRITERIA ADOPTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):	0.000013 ng/l		
HUMAN HEALTH (Fish Only):	0.000014 ng/l		
HUMAN HEALTH (Water Only):			
RISK LEVEL	10-6		
FISH CONSUMPTION RATE	6.5 g/day		
ACTUAL/PLANNED ADOPTION DATE	12/12/87	/ /	/ /

COMMENT
Missouri adopted a human health criterion based on water and fish consumption using EPA Section 304(a) methods on ???, 1989. The criteria apply to all class I (aquatic life) and class II (water supply) reaches.

STATE: NE
EPA REGION: 07

STATUS SUMMARY: NUMERIC CRITERIA ADOPTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):	0.01 ug/l		
FRESH AQUATIC LIFE (Chronic):	0.00001 ug/l		
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	08/24/88	/ /	/ /

COMMENT
Nebraska adopted EPA published LOELs for freshwater aquatic life.

STATE: CO
EPA REGION: 08

STATUS SUMMARY: NUMERIC CRITERIA ADOPTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):	0.01 ug/l		
FRESH AQUATIC LIFE (Chronic):	0.00001 ug/l		
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):	0.00022 ng/l		
RISK LEVEL	10-6		
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	08/07/89	/ /	/ /

COMMENT
Colorado adopted published LOELs for aquatic life protection and a human health criterion based solely on consumption of water. The human health criterion applies only to drinking water supplies and was derived using EPA Section 304(a) methods and current IRIS information.

STATE: MT
EPA REGION: 08

STATUS SUMMARY: NUMERIC CRITERIA ADOPTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):	0.000013 ng/l		
HUMAN HEALTH (Fish Only):	0.000014 ng/l		
HUMAN HEALTH (Water Only):			
RISK LEVEL	10-6		
FISH CONSUMPTION RATE	6.5 g/day		
ACTUAL/PLANNED ADOPTION DATE	09/01/88	/ /	/ /

COMMENT
Montana adopted all EPA criteria by reference to the Gold Book.

STATE: ND
EPA REGION: 08

STATUS SUMMARY: NEITHER NUMERIC CRITERIA NOR A TRANSLATOR PROCEDURE ARE ADOPTED/PROPOSED/EXPECTED AT PRESENT

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT

STATE: SD
EPA REGION: 08

STATUS SUMMARY: NUMERIC CRITERIA ADOPTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):	0.000013 ng/l		
HUMAN HEALTH (Fish Only):	0.000014 ng/l		
HUMAN HEALTH (Water Only):			
RISK LEVEL	10-6		
FISH CONSUMPTION RATE	6.5 g/day		
ACTUAL/PLANNED ADOPTION DATE	10/01/87	/ /	/ /

COMMENT
South Dakota adopted all EPA criteria by reference to the Gold Book.

STATE: UT
EPA REGION: 08

STATUS SUMMARY: NEITHER NUMERIC CRITERIA NOR A TRANSLATOR PROCEDURE ARE ADOPTED/PROPOSED/EXPECTED AT PRESENT

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT

STATE: WY
EPA REGION: 08

STATUS SUMMARY: NUMERIC CRITERIA PROPOSED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):		0.000013 ng/l	
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL		10-6	
FISH CONSUMPTION RATE		6.5 g/day	
ACTUAL/PLANNED ADOPTION DATE	/ /	12/01/89	/ /

COMMENT
Wyoming has proposed to adopt the Gold Book value assuming water and fish consumption. This criterion will apply to all game fisheries and public water supplies.

STATE: AZ
EPA REGION: 09

STATUS SUMMARY: NUMERIC CRITERIA EXPECTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			10-6
FISH CONSUMPTION RATE			20 g/day
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	04/01/89

COMMENT
Arizona is working on numeric criteria for dioxin per a State statutory requirement to adopt criteria for all priority pollutants. It is expected that the State will use the EPA Section 304(a) method, current IRIS information, 10-6 risk, and a 20 g/d ay fish ingestion rate.

STATE: AS
EPA REGION: 09

STATUS SUMMARY: NUMERIC CRITERIA EXPECTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			0.000013 ng/l
HUMAN HEALTH (Fish Only):			0.000014 ng/l
HUMAN HEALTH (Water Only):			
RISK LEVEL			10-6
FISH CONSUMPTION RATE			6.5 g/day
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT
American Samoa submitted draft proposed WQS which incorporated EPA dioxin criteria by reference. The State is expected to select a risk level of 10-6.

STATE: CA
EPA REGION: 09

STATUS SUMMARY: NUMERIC CRITERIA PROPOSED
NUMERIC CRITERIA EXPECTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			???
HUMAN HEALTH (Fish Only):		0.0000039 ng/l	0.0000039 ng/
HUMAN HEALTH (Water Only):			
RISK LEVEL		10-6	10-6
FISH CONSUMPTION RATE		23 g/day	23 g/day
ACTUAL/PLANNED ADOPTION DATE	/ /	04/01/90	04/01/90

COMMENT
California is in the process of adopting a dioxin criterion for marine waters via revisions to the State Ocean Plan and for freshwaters via adoption of Statewide criteria. The State Ocean Plan criterion is expected to be based on fish consumption using EPA methods, current IRIS information, a risk level of 10-6, and a fish consumption rate of 23 g/day. Freshwater dioxin criteria are expected to be similar but based on water and fish consumption.

STATE: GU
EPA REGION: 09

STATUS SUMMARY: NUMERIC CRITERIA ADOPTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):	0.000013 ng/l		
HUMAN HEALTH (Fish Only):	0.000014 ng/l		
HUMAN HEALTH (Water Only):			
RISK LEVEL	10-6		
FISH CONSUMPTION RATE	6.5 g/day		
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT
Guam adopted human health criteria based on water and fish consumption using EPA methods and assumptions on ????, 1984.

STATE: HI
EPA REGION: 09

STATUS SUMMARY: NUMERIC CRITERIA PROPOSED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):		0.01 ug/l	
FRESH AQUATIC LIFE (Chronic):		0.00001 ug/l	
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):		0.000014 ng/l	
HUMAN HEALTH (Water Only):			
RISK LEVEL		10-6	
FISH CONSUMPTION RATE		6.5 g/day	
ACTUAL/PLANNED ADOPTION DATE	/ /	02/04/90	/ /

COMMENT
Hawaii has proposed aquatic life criteria based on EPA-published LOELs and human health criteria based on fish consumption using EPA methods.

STATE: NV
EPA REGION: 09

STATUS SUMMARY: NUMERIC CRITERIA PROPOSED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):		1.0 ug/l	
FRESH AQUATIC LIFE (Chronic):		0.01 ug/l	
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):		0.000013 ng/l	
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL		10-6	
FISH CONSUMPTION RATE		6.5 g/day	
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT
Nevada has proposed to adopt aquatic life and human health criteria. The State held a workshop in August, 1989; however, the adoption scheduled on September 28, 1989 was deferred.

STATE: CM
EPA REGION: 09

STATUS SUMMARY: NUMERIC CRITERIA EXPECTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			0.000013 ng/l
HUMAN HEALTH (Fish Only):			0.000014 ng/l
HUMAN HEALTH (Water Only):			
RISK LEVEL			10-6
FISH CONSUMPTION RATE			6.5 g/day
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	02/04/90

COMMENT
The Northern Marianas Islands are expected to adopt EPA human health criteria based on water and fish consumption for fresh waters and fish consumption only for marine waters.

STATE: TT
EPA REGION: 09

STATUS SUMMARY: NUMERIC CRITERIA EXPECTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			0.000013 ng/l
HUMAN HEALTH (Fish Only):			0.000014 ng/l
HUMAN HEALTH (Water Only):			
RISK LEVEL			10-6
FISH CONSUMPTION RATE			6.5 g/day
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	02/04/89

COMMENT
The Trust Territories are expected to adopt EPA human health criteria based on water and fish consumption for fresh waters and fish consumption only for marine waters.

STATE: AK
EPA REGION: 10

STATUS SUMMARY: NUMERIC CRITERIA ADOPTED
NUMERIC CRITERIA EXPECTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			0.01 ug/l
FRESH AQUATIC LIFE (Chronic):			0.00001 ug/l
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):	0.000013 ng/l		
HUMAN HEALTH (Fish Only):	0.000014 ng/l		
HUMAN HEALTH (Water Only):			
RISK LEVEL	10-6		
FISH CONSUMPTION RATE	6.5 g/day		
ACTUAL/PLANNED ADOPTION DATE	01/07/87	/ /	/ /

COMMENT
Alaska has adopted EPA human health criteria by reference. In next triennial review, the State is expected to clarify WQS to include EPA published aquatic life LOELs by reference.

STATE: ID
EPA REGION: 10

STATUS SUMMARY: NUMERIC CRITERIA EXPECTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			0.000013 ng/l
HUMAN HEALTH (Fish Only):			0.000014 ng/l
HUMAN HEALTH (Water Only):			
RISK LEVEL			10-6
FISH CONSUMPTION RATE			6.5 g/day
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	02/04/90

COMMENT
Idaho is expected to adopt a dioxin criterion for the Clearwater/Snake Rivers by February 4,1990. The criterion is expected to be based on EPA Section 304(a) methods and a risk level of 10-6.

STATE: OR
EPA REGION: 10

STATUS SUMMARY: NUMERIC CRITERIA ADOPTED

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):	0.01 ug/l		
FRESH AQUATIC LIFE (Chronic):	0.00001 ug/l		
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):	0.000013 ng/l		
HUMAN HEALTH (Fish Only):	0.000014 ng/l		
HUMAN HEALTH (Water Only):			
RISK LEVEL	10-6		
FISH CONSUMPTION RATE	6.5 g/day		
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT
Oregon adopted EPA human health criteria and EPA published LOELs for aquatic life on ????.

STATE: WA
EPA REGION: 10

STATUS SUMMARY: NEITHER NUMERIC CRITERIA NOR A TRANSLATOR PROCEDURE ARE ADOPTED/PROPOSED/EXPECTED AT PRESENT

	ADOPTED	PROPOSED	EXPECTED
FRESH AQUATIC LIFE (Acute):			
FRESH AQUATIC LIFE (Chronic):			
MARINE AQUATIC LIFE (Acute):			
MARINE AQUATIC LIFE (Chronic):			
HUMAN HEALTH (Water and Fish):			
HUMAN HEALTH (Fish Only):			
HUMAN HEALTH (Water Only):			
RISK LEVEL			
FISH CONSUMPTION RATE			
ACTUAL/PLANNED ADOPTION DATE	/ /	/ /	/ /

COMMENT

SUMMARY OF STATE DIOXIN CRITERIA FOR HUMAN HEALTH

PAGE: 2

[illegible]				PROPOSED				EXPECTED			
WATER & FISH	FISH ONLY	WATER ONLY	RISK LEVEL	WATER & FISH	FISH ONLY	WATER ONLY	RISK LEVEL	WATER & FISH	FISH ONLY	WATER ONLY	RISK LEVEL
								0.000013 ng/l	0.000014 ng/l		10-6
0.000013 ng/l	0.000014 ng/l		10-6								
	0.001 ng/l										
				0.0004 ng/l	0.00042 ng/l		10-6				
					0.0012 ng/l		10-5				
0.00001 ng/l			10-6								
				0.00012 ng/l	0.00014 ng/l		10-5				

Attachment: 3

DIOXIN TRACKING REPORT 5
SUMMARY OF STATE DIOXIN CRITERIA FOR HUMAN HEALTH

ADOPTED				PROPOSED				EXPECTED			
WATER & FISH	FISH ONLY	WATER ONLY	RISK LEVEL	WATER & FISH	FISH ONLY	WATER ONLY	RISK LEVEL	WATER & FISH	FISH ONLY	WATER ONLY	RISK LEVEL
	0.000014 ng/l		10-4								
				0.000013 ng/l	0.000014 ng/l		10-4				
0.000013 ng/l	0.000014 ng/l		10-4								
							10-5				
				0.0001 ng/l	0.0001 ng/l		10-5				
			10-5								
								0.00013 ng/l	0.00014 ng/l		10-5
				0.00013 ng/l	0.00014 ng/l		10-5				
0.00005 ng/l	0.00045 ng/l		10-5								

DIOXIN TRACKING REPORT 3

SUMMARY OF STATE DIOXIN CRITERIA FOR HUMAN HEALTH

ADOPTED				PROPOSED				EXPECTED			
WATER & FISH	FISH ONLY	WATER ONLY	RISK LEVEL	WATER & FISH	FISH ONLY	WATER ONLY	RISK LEVEL	WATER & FISH	FISH ONLY	WATER ONLY	RISK LEVEL
0.000013 mg/l	0.000014 mg/l		10-6								
		0.00022 mg/l	10-6								
0.000013 mg/l	0.000014 mg/l		10-6								
0.000013 mg/l	0.000014 mg/l		10-6								
				0.000013 mg/l			10-6				
											10-6
								0.000013 mg/l	0.000014 mg/l		10-6
					0.0000059 mg/l		10-6	???	0.0000059 mg/l		10-6
0.000013 mg/l	0.000014 mg/l		10-6								
					0.000014 mg/l		10-6				
				0.000013 mg/l			10-6				

DIOXIN TRACKING REPORT 5
SUMMARY OF STATE DIOXIN CRITERIA FOR HUMAN HEALTH

	ADOPTED				PROPOSED				EXPECTED			
T	WATER & FISH	FISH ONLY	WATER ONLY	RISK LEVEL	WATER & FISH	FISH ONLY	WATER ONLY	RISK LEVEL	WATER & FISH	FISH ONLY	WATER ONLY	RISK LEVEL
H									0.000013 ng/l	0.000014 ng/l		10-6
T									0.000013 ng/l	0.000014 ng/l		10-6
A	0.000013 ng/l	0.000014 ng/l		10-6								
D									0.000013 ng/l	0.000014 ng/l		10-6
I	0.000013 ng/l	0.000014 ng/l		10-6								

DIOXIN TRACKING REPORT
SUMMARY OF STATE DIOXIN CRITERIA FOR AQUATIC LIFE

FRESH ACUTE	FRESH CHRONIC	MARINE ACUTE	MARINE CHRONIC	FRESH ACUTE	FRESH CHRONIC	MARINE ACUTE	MARINE CHRONIC	FRESH ACUTE	FRESH CHRONIC	MARINE ACUTE	MARINE CHRONIC

ADOPTED				PROPOSED				EXPECTED			
FRESH ACUTE	FRESH CHRONIC	MARINE ACUTE	MARINE CHRONIC	FRESH ACUTE	FRESH CHRONIC	MARINE ACUTE	MARINE CHRONIC	FRESH ACUTE	FRESH CHRONIC	MARINE ACUTE	MARINE CHRONIC

DIOXIN TRACKING REPORT 3

SUMMARY OF STATE DIOXIN CRITERIA FOR AQUATIC LIFE

ADOPTED				PROPOSED				EXPECTED			
FRESH ACUTE	FRESH CHRONIC	MARINE ACUTE	MARINE CHRONIC	FRESH ACUTE	FRESH CHRONIC	MARINE ACUTE	MARINE CHRONIC	FRESH ACUTE	FRESH CHRONIC	MARINE ACUTE	MARINE CHRONIC
0.02 ug/l	0.00001 ug/l										
0.01 ug/l	0.00001 ug/l										
				0.01 ug/l	0.00001 ug/l						
				1.0 ug/l	0.01 ug/l						

DIOXIN TRACKING REPORT 3
SUMMARY OF STATE DIOXIN CRITERIA FOR AQUATIC LIFE

ST	ADOPTED FRESH ACUTE	ADOPTED FRESH CHRONIC	ADOPTED MARINE ACUTE	ADOPTED MARINE CHRONIC	PROPOSED FRESH ACUTE	PROPOSED FRESH CHRONIC	PROPOSED MARINE ACUTE	PROPOSED MARINE CHRONIC	EXPECTED FRESH ACUTE	EXPECTED FRESH CHRONIC	EXPECTED MARINE ACUTE	EXPECTED MARINE CHRONIC
N												
T												
X									0.01 ug/l	0.00001 ug/l		
D												
[illegible]	0.01 ug/l	0.00001 ug/l										
A												

Georgia-Pacific Corporation
P.O. Box 1618
Eugene, Oregon
(503) 689-122[illegible]

WATER QUALITY
CONTROL BOARD
REGION I

SEP 28 '89

☐ BK ☐ BB
☐ ☐
☑ ☐
☐ ☐
☐ ☐
☐ ☐
☐ RC ☐ REPLY
☐ ALL STAFF ☑ FILE GP FT. BRAGG, ASH

September 26, 1989

Mr. Mark Neely
Associate Engineering Geologist
California Regional Water
Quality Control Board
North Coast Region
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Neely:

Attached is a completed Report of Waste Discharge (ROWD) form for the continuation of the Little Valley soil amendment site Waste Discharge Requirements.

The fee is calculated at the minimum for a former Class II-2 site, which is $2,000., based on 8,000 tons per year. Due to the short time-frame, the check will follow under separate cover.

On a related matter the final report addressing the low levels of furans in the ash should be ready in about 2 weeks.

If you have any questions or comments, please feel free to call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer
Western Wood Products

KCM:jap

Attachment

cc: Gerald Tice
Don Whitman

WATER QUALITY
CONTROL BOARD
REGION I

STATE OF CALIFORNIA
REGIONAL WATER QUALITY CONTROL BOARD
DEPARTMENT OF HEALTH SERVICES
SOLID WASTE MANAGEMENT BOARD
DEPARTMENT OF FORESTRY

SEP 29 '89

☐ BK ☐ BB
☐ CJ ☐ JG
☐ FR ☐ KD
☐ RP ☐
☐ BJ
☐ SW ☐
☐ RO ☐ REPLY
☐ ALL STAFF ☐ FILE

APPLICATION FOR FACILITY PERMIT/WASTE DISCHARGE

FOR OFFICE USE ONLY
Form 200 Rec'd
Fee (RWQCB) (SWMB)
Waste Discharge
Report Rec'd
Effective Date
Notified
DOHS No.
SWMB No.

This form is to be used for filing a/an: (check all appropriate)

1. ☐ REPORT OF WASTE DISCHARGE (pursuant to Division 7 of the State Water Code)
2. ☐ APPLICATION FOR A HAZARDOUS WASTE FACILITY PERMIT (pursuant to Health and Safety Code Section 25200)
3. ☐ APPLICATION FOR A SOLID WASTE FACILITIES PERMIT (pursuant to Government Code Section 66796.30)
4. ☐ APPLICATION FOR A RUBBISH DUMP PERMIT (pursuant to Public Resources Code Sections 4371–4375 and 4438)

I. FACILITY

A. NAME OF FACILITY: Georgia-Pacific Lumber Mill — TELEPHONE #: (707) 964-5651
ADDRESS: 90 West Redwood, Fort Bragg, Calif. — ZIP CODE: 95437

B. NAME OF LEGAL OWNER OF FACILITY: Georgia-Pacific Corporation — TELEPHONE #: (404) 521-5084
ADDRESS: 133 Peachtree st., N.E., Atlanta, GA. — ZIP CODE: 30303

C. NAME OF BUSINESS OPERATING FACILITY: same — TELEPHONE #: ( )
ADDRESS: — ZIP CODE:

D. TYPE OF BUSINESS OPERATING FACILITY
☐ Sole Proprietorship ☐ Partnership ☒ Corporation ☐ Government Agency

E. NAME OF OWNER(S) OF BUSINESS OPERATING FACILITY: same as above — TELEPHONE #: (707) 964-5651
ADDRESS WHERE LEGAL NOTICE MAY BE SERVED: — ZIP CODE:

II. REASON FOR FILING

CHECK ALL APPROPRIATE:

A. ☐ New discharge or facility
B. ☒ Existing discharge or facility
C. ☐ Increase in quantity of discharge
D. ☐ Change in character of discharge
E. ☐ Change in place or method of disposal
F. ☐ Change in design or operation
G. ☐ Change in business operating facility
H. ☐ Enlargement of existing facility
I. ☐ Other (explain below)

III. TYPE OF OPERATION

CHECK ALL APPROPRIATE:

A. ☐ Transfer station
B. ☐ Solid waste disposal site
C. ☐ Hazardous waste disposal site
D. ☐ Sewage treatment
E. ☐ Industry (on-site disposal facility)
F. ☐ Industry (discharge to sewer)
G. ☐ Woodwaste site
H. ☒ Other (explain below)

This is an ash amending site for increased pasture yield.

IV. TYPE OF WASTE

CHECK ALL APPROPRIATE:

A. ☐ Sewage, sewage sludge, and/or septic tank pumpings
B. ☐ Industrial wastes
C. ☐ Municipal solid wastes
D. ☐ Hazardous wastes
E. ☐ Agricultural wastes
F. ☐ Animal wastes
G. ☒ Forest product wastes
H. ☐ Construction/demolition wastes
I. ☐ Inert materials
J. ☐ Dead animals
K. ☐ Tires
L. ☐ Other (explain below)

V. SITE DESIGN CAPACITY

A. PRESENT POPULATION OR CAPACITY	B. DESIGN POPULATION OR ULTIMATE CAPACITY	C. LIFE EXPECTANCY (YEARS)
65 acres	300 acres	3 years

VI. QUANTITY OF WASTES

PRESENT OR PROPOSED DAILY FLOW (IN MGD):	MAXIMUM	AVERAGE	B. DESIGN FLOW (IN MGD)
SOLID WASTE DISPOSAL SITE (IN TONS OR CUBIC YARDS):	DAILY QUANTITY 60 yd³/day	TOTAL IN PLACE QUANTITY 115,000 yds³	B. AREA IN WHICH SOIL WILL BE DISTURBED (IN ACRES) 23 acres/year — TOTAL SITE AREA 300 acres

VII. LOCATION OF POINT OF DISPOSAL OR OPERATION

(DESIGN AND ATTACH MAP, SKETCH, OR LOCATION ON U.S.G.S. QUADRANGLE MAP, 7.5 OR 15 MINUTE SERIES.)
LIST DISTANCES OR BEARING AND DISTANCE FROM SECTION CORNER OR QUARTER CORNER, SECTION, TOWNSHIP, RANGE, BASE AND MERIDIAN

See Attachment

VIII. SOURCE OF WATER SUPPLY (CHECK ALL APPROPRIATE)

A. ☐ MUNICIPAL OR UTILITY SERVICE:

NAME OF WATER PURVEYOR: N/A

ADDRESS OF PURVEYOR:

B. ☐ INDIVIDUAL (Wells)

C. ☐ SURFACE SUPPLY N/A

NAME OF STREAM, LAKE, SPRING, ETC. (IF NAMED)

TYPE OF WATER RIGHTS: ☐ Riparian ☐ Appropriation

WATER RIGHTS PERMIT OR LICENSE #

IX. ENVIRONMENTAL IMPACT REPORT (EIR)

Has an EIR been prepared for this project? ☐ Yes ☒ No

If "Yes", please enclose a copy.

If "No", will an EIR be prepared? ☐ Yes ☒ No

Will a negative declaration be prepared? ☐ Yes ☒ No

If "Yes", please answer the following:

WHO WILL PREPARE THE NEGATIVE DECLARATION?

APPROX. DATE OF COMPLETION

CERTIFICATION

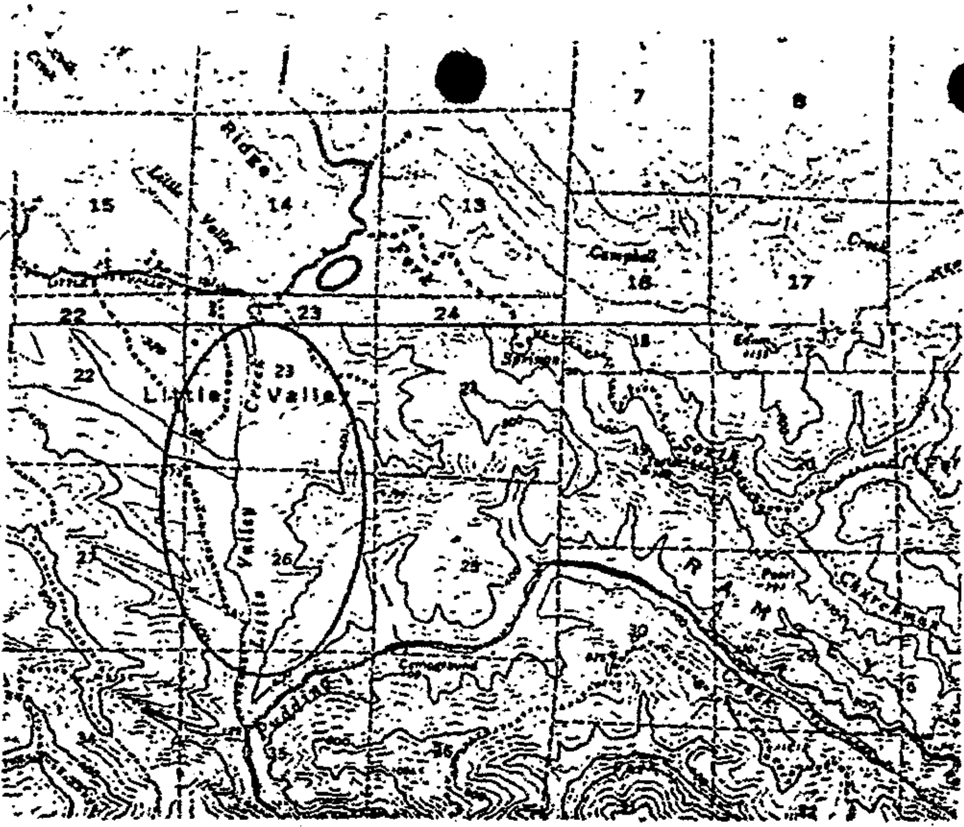
I hereby certify under penalty of perjury that the information provided in this application and in any attachments is true and accurate to the best of my knowledge.

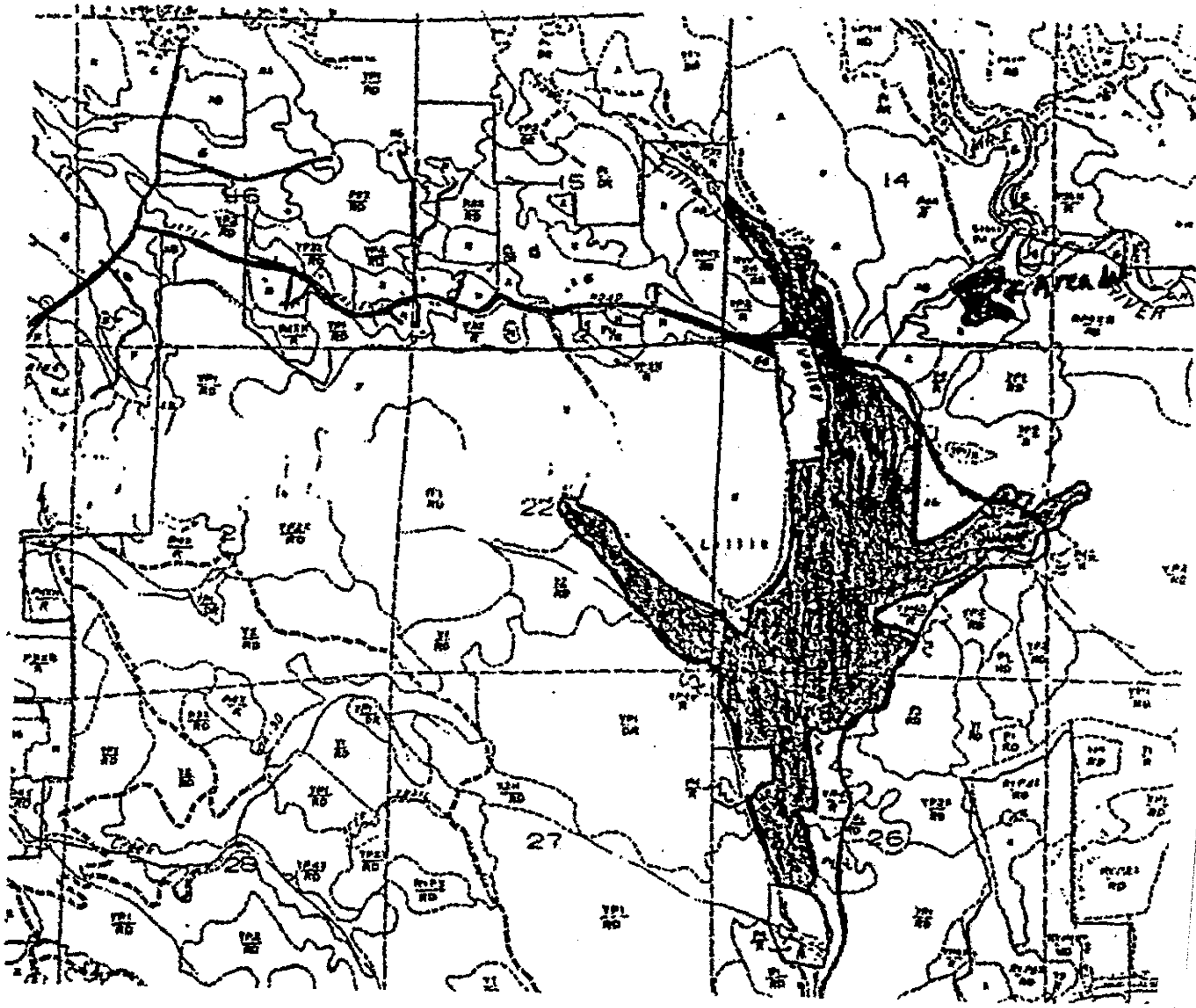
SIGNATURE OF OWNER OF FACILITY	X Donald B. Whitman	SIGNATURE OF OPERATOR OF FACILITY	X Donald B. Whitman
PRINTED OR TYPED NAME	Donald B. Whitman	PRINTED OR TYPED NAME	Donald B. Whitman
TITLE	Lumber Production Manager	TITLE	Lumber Production Manager
DATE	9/27/89	DATE	9/27/89

LIST TITLES OF ANY ATTACHMENTS:

You will be notified of the correctness of filing fee and submittal of any additional information deemed necessary to complete your Report of Waste Discharge pursuant to Division 7, Section 13260 of the State Water Code, or to complete your permit application pursuant to Government Code Section 66796.30 and Health and Safety Code Section 25200.

ATTACHMENT "A"





Georgia-Pacific Corporation
P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

WATER QUALITY
CONTROL BOARD
REGION I

OCT 16 '89

October 13, 1989

☐ BK ☐ BB
☐ CJ ☐ JG
☐ FR ☑ KD K 10-17-89
☐ RT ☐ KKH 10/24/89
☐ JH ☐
☐ SW ☐
☐ RC ☐ REPLY
☐ ALL STAFF ☐ FILE

Mark Neely
California Regional Water
 Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Neely:

Here is the September, ~~1989~~ Monitoring and Reporting Program report, as per order No. 86-3 for Georgia-Pacific Corporation at Fort Bragg, California (Little Valley).

If you have any questions, please call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

KCM:jap

Enclosure

GEORGIA-PACIFIC LITTLE VALLEY REPORT

MONTH OF October, 1989

Monitoring and Reporting Order No. 86-3, Soil Amending Project.

Volume of Ash Deposited (@ Site	Cubic Yards Area A-South	Rainfall Totals
Week of	Yds^3	inches
1 - 7	300	-0-
8 - 14	440	-0-
15 - 21	400	-0-
22 - 28	260	1.30
29 - 31	100	4.30
TOTAL =	1,500 Yds^3	

The total number of treated acres to date = 63 acres

Precipitation

A total of 5.6 inches of rain fell during the month.

Water Monitoring and Testing

Here are the pH levels:

7.2 to 7.7 units

Deposition

All ash is being stockpiled for the winter, in the area located about 1500 feet south of the previous ('88) stockpiling area, as agreed.

F

STATE OF CALIFORNIA

GEORGE DEUKMEJIAN, *Governor*

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—
NORTH COAST REGION**

1440 GUERNEVILLE ROAD
SANTA ROSA, CA 95403
(707) 576-2220

November 13, 1989

Mr. Kent Mayer
Georgia-Pacific Corporation
P. O. Box 1619
Eugene; OR 97440

Dear Mr. Mayer:

We received your Report Of Waste Discharge (ROWD) for the Fort Bragg Ash Soil Amendment site on September 28, 1989. As you know, the issuance of a new permit is contingent upon submission of the bioaccumulation study that was agreed to by Georgia-Pacific and our Executive Officer at a meeting at our office on May 12, 1988. The original submission date for a draft report was to be May 1, 1989. This date was chosen to give our staff, and the staff of the State Water Resources Control Board, time to review the results and then make our decision on whether or not the permit should be reissued.

On June 6, 1989, Mr. Gerald Tice of your Atlanta office officially requested an extension to September 1, 1989, due to problems with the laboratory. We agreed with this. Your transmittal letter with the ROWD stated that the final report should be ready "within a couple of weeks". In response to a phone call from our staff to Mr. Tice on October 31, 1989, he restated the problem with the laboratory, along with a heavy workload in the Atlanta office, and stated that the report would be available in 2-3 more weeks. This would result in a submission date of November 20, 1989.

The series of delays has greatly reduced the time available for staff to review the report before the permit expires on January 30, 1990. A complete review of the report will very likely be impossible in such a short time frame, and all amending and storage activities may have to cease until such time as the Board can make a finding and reissue the permit. It is imperative that the report be submitted as soon as possible, to limit the duration of the cessation of the ash deposition.

Please feel free to call if you have any questions.

Sincerely,

Mark K. Neely
Associate Engineering Geologist

MKN:ba

cc: Don Whitman
Gerald Tice
C. T. Howlett

Georgia-Pacific

ESTERN WOOD PRODUCTS MANUFACTURING DIVISION
RTLAND, OREGON

ATER QUALITY
NTROL BOARD

No. 903194

OW 7333-1 (2-8

CHECK NO.	VENDOR NO.
903194	8752

DATE (MO. / DAY / YEAR)	VENDOR INVOICE NUMBER		INVOICE AMOUNT	REGION	AMOUNT PAID
	Fee for Facility Permit/Waste Discharge per attach			SEP 28 '89	$2,000.00*

☐ BK ____ ☐ BB ____
☐ CJ ____ ☐ JG ____
☐ FR ____ ☐ KD ____
☐ RT ____ ☐ ____
☐ JH ____ ☐ ____
☐ SW ____ ☐ ____
☐ RC ____ ☐ REPLY
☐ ALL STAFF ☐ FILE

Frank - Is this amount OK? Kath

Georgia-Pacific Corporation
P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

WATER QUALITY CONTROL BOARD
REGION I

NOV 15 '89

☐ BK ☐ BB
☐ CJ ☐ JG
☐ FR ☐ KD X 11-15-89
☐ RT ☐ MCN 12/1/89
☐ JH ☐
☐ SW ☐
☐ RC ☐ REPLY
☐ ALL STAFF ☐ FILE

November 13, 1989

Mark Neely
California Regional Board
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Neely:

Here is the October, ~~1989~~ Monitoring and Reporting Program report, as per Order No. 86-3 for Georgia-Pacific Corporation at Fort Bragg, California ~~(Little Valley)~~.

The results for the October soil analysis for CED, % Sat. and pH are not yet available from the laboratory, as of this date.

If you have any questions, please call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

KCM:jap

Enclosure

GEORGIA-PACIFIC LITTLE VALLEY REPORT

MONTH OF NOVEMBER

Monitoring and Reporting Order No. 86-3, Soil Amending Project.

Volume of Ash Deposited (@ Site	Cubic Yards Area A-South		Rainfall Totals
Week of 1 - 4	180	Yds^3	-0- inches
5 - 11	380		-0-
12 - 18	260		-0-
19 - 25	260		1.87
26 - 30	200		.41
TOTALS =	1,380	Yds^3	2.28 inches

The total number of treated acres to date = 63.0 acres

Precipitation

Rainfall has been minimal, especially for this time of the year.

Water Monitoring and Testing

Here are the pH levels:

The ephemeral draws were virtually dry.

Deposition

All ash was stockpiled in the 1989-90 winter stockpile area, as previously described. The total is given above.

Georgia-Pacific Corporation

P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

WATER QUALITY
CONTROL BOARD
REGION 1

NOV 22 '89

November 20, 1989

Mark Neely
California Regional Board
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Neely:

Here are the results for the October soil analysis for CED, % Sat. and pH, as per Order No. 86-3 for Georgia Pacific Corporation at Fort Bragg, California (Little Valley);

	Location				
Test	#5	#6	#7	#8	#9
pH	6.6	6.4	6.7	6.1	6.7
COD	12	24	75	39	33
TSS	14	17	18	17	11

If you have any questions, please call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

KCM:slo

Georgia-Pacific Corporation

P.O. Box 1618
Eugene, Oregon 97440
(503) 689-1221

WATER QUALITY
CONTROL BOARD
REGION I

DEC 1 8 '89

☐ BK ☐ BB
☐ CJ ☐ JG
☐ PN ☐ KD K- 12-19-89
☐ RT ☐
☐ JH ☐ MKW NKY
☐ SW ☐ 1/10/90
☐ RC ☐ REPLY
☐ ALL STAFF ☐ FILE

December 13, 1989

Mark Neely
California Regional Board
Quality Control Board
1440 Guerneville Road
Santa Rosa, CA 95403

Dear Mr. Neely:

Here is the November, 1989 Monitoring and Reporting Program report, as per Order No. 86-3 for Georgia-Pacific Corporation at Fort Bragg, California (Little Valley).

If you have any questions, please call me.

Sincerely,

Kent C. Mayer

Kent C. Mayer
Environmental Engineer

KCM:jap

Enclosure

GEORGIA-PACIFIC LITTLE VALLEY REPORT

MONTH OF December

Monitoring and Reporting Order No. 86-3, Soil Amending Project.

Volume of Ash Deposited (@ Site	Cubic Yards Area A-South	Rainfall Totals
Week of	Yds^3	inches
1 - 2	60	-
3 - 9	300	.10
10 - 16	260	-
17 - 23	420	-
24 - 31	420	-
TOTAL =	1,460 yds^3	.10

The total number of treated acres to date = 63.0 acres

Precipitation

Only .10 inches fell during the month, on December 6th.

Water Monitoring and Testing

Here are the pH levels:

N/A

Deposition

All ash was stockpiled in the 1989-90 winter stockpile area.

TCDF STUDY

ON FLY ASH AMENDED SOIL

AND RELATED ENVIRONMENTAL VECTORS

GERALD-
THIS IS A VERY
IMPRESSIVE JOB-
IT IS QUITE APPARENT
WHY IT TOOK SO LONG

JP

Georgia-Pacific

From The Desk Of GERALD W. TICE

Ted,
I appreciate your
complement very much
but I certainly cannot
take full credit for
this. Lawrence wrote
a large portion of
the text. Without his
help I don't think
I would have gotten
it together. Many thanks
to him. Gerald

GEORGIA-PAC

FORT BRA

LITTLE

DECEMBER 1989

Georgia-Pacific Corporation Eastern Wood Products
Manufacturing Division
P.O. Box 105603
Atlanta, Georgia 30348
Telephone (404) 521-4000
Teletype (810) 751-1000

December 21, 1989

Mr. Benjamin D. Kor
Executive Officer
California Regional Water Quality
Control Board
North Coast Region
1440 Guerneville Road
Santa Rosa, CA 95403

Re: TCDF Fly Ash Study
Fort Bragg, California

Dear Mr. Kor:

Enclosed are two (2) copies of our "TCDF Study on Fly Ash Amended Soil and Related Environmental Vectors". As you know, this study is concerning the fly ash generated at our Fort Bragg, California sawmill and amended into the soil at the Little Valley site.

Please let us know if there are any questions about this report.

VERY TRULY YOURS,

Gerald W. Tice bp

GERALD W. TICE
CHIEF ENVIRONMENTAL ENGINEER
WOOD PRODUCTS MANUFACTURING DIVISION

GWT/bp

Enclosures

cc: Messrs. C. T. Howlett, Jr. w/enclosures (Report incl. Appendices)
K. Mayer w/enclosures (Report incl. Appendices)
D. Whitman w/enclosures (Report incl. Appendices)

bcc: Messrs.	D. K. Mortensen	w/enclosures	(Conclusion Only)
	D. L. Glass	w/enclosures	(Report Only)
	W. L. Duke	w/enclosures	(Report Only)
	D. L. Mobley	w/enclosures	(Report Only)
	A. T. Johnson	w/enclosures	(Report Only)
	L. D. Ambrosini	w/enclosures	(Report Only)
	R. L. Burns	w/enclosures	(Report Only)
	P. M. Fetter	w/enclosures	(Report Only)
	A. F. Hodges	w/enclosures	(Report Only)
	G. F. McCaig	w/enclosures	(Report incl. Appendices)
	L. P. E. Otwell	w/enclosures	(Report incl. Appendices)
	T. Treichelt	w/enclosures	(Report Only)

TCDF STUDY
ON FLY ASH AMENDED SOIL
AND RELATED ENVIRONMENTAL VECTORS

GEORGIA-PACIFIC CORPORATION

FORT BRAGG, CALIFORNIA

LITTLE VALLEY SITE

DECEMBER 1989

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Appendix 4 - Courtney Consultants Modeling Proposal

Appendix 5 - Photos of Amended Sites

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SECTION I

INTRODUCTION

Georgia-Pacific Corporation operates a large sawmill located at Fort Bragg, California which produces primarily redwood and Douglas fir lumber. Steam used in the operation of the sawmill is obtained from three (3) woodwaste fired boilers, two of which are rated at 50,000 pounds of steam per hour each and one which is rated at 82,000 pounds per hour. The woodwaste fuel used in these boilers consists primarily of hogged green sawdust and bark. The emissions from these boilers are controlled by multi-cyclone collectors followed by wet scrubbers. The collected fly ash, after dewatering, is placed in a large dump hopper for disposal. The volume of ash currently generated is approximately 1,400 cu. yards/month (about 500 tons).

Ash disposal at the Fort Bragg mill is accomplished by utilizing the ash as a soil amendment at a site located several miles from the mill. This site, which consists of several hundred acres, is locally known as Little Valley (refer to Figure 1 for the general location.).

This operation consists of transporting the ash to the site, spreading the ash to about a one foot depth and then turning it into the soil with a disc plow. The amended soil is then planted in clover and rye grasses. The project is currently operating under Waste Discharge Requirements Order No. 86-3 issued by the California Regional Water Quality Control Board.

Operating practice at the site is to place the ash developed each year into designated amending areas. Once the ash is spread and amended, no further amending activity is practiced in those areas. Depending on soil conditions, re-amending of a given area may occur in the future. The areas under consideration in this study are the plots amended in 1986, 1987 and 1988. Each of these plots and the selected control area are shown on Figure 2.

In an effort to quantify optimum application rates vs. cover crop yields, Georgia-Pacific cooperated with the University of California Cooperative Extension by establishing a small test plot at the Little Valley site (refer to Figure 2 for location at test plot). Results from this effort have shown a two to three fold increase in biomass yields when compared to yields from unamended soil.

Because of local concerns over the possible dioxin contamination of ash from the Fort Bragg operation, intensive sampling and analysis of the ash was conducted in 1987. As a result of that effort, no dioxin was detected and was, therefore, eliminated as a source of concern. The presence of low quantities of furan was confirmed however, and questions were raised as to it's relative toxicity and fate in the environment.

Pages 2 and 3 appear to be missing from the original

Upon review of the data generated in the fly ash sampling effort, the California Water Resources Control Board concluded that, based on the low levels of TCDF's found and a toxic equivalency factor (TEF) comparison to 2,3,7,8 TCDD, the levels of TCDF found in the ash did not, in themselves, represent a hazard. They did, however, indicate a concern over the possibility of bioaccumulation of non-TCDF (the only isomers found) in the food chain or aquatic system.

As a result, the California Regional Water Quality Control Board, North Coast Region, directed Georgia-Pacific on February 19, 1988 to cease disposing of this ash by incorporation into the soil and required Georgia-Pacific to devise an alternative disposal method. The Regional Board indicated that it intended to rescind Order No. 86-3 at it's board meeting on April 28, 1988. The Board did indicate that because the ash had been determined to be non-hazardous it could be disposed of in a Class III landfill.

Because of Georgia-Pacific's concern with the validity of the Regional Board's determination that the ash from the Fort Bragg operation was not suitable for soil amendment purposes, Georgia-Pacific requested that the rescission of Order No. 86-3 be removed from the Board's April 28, 1988 meeting agenda. At the same time, Georgia-Pacific submitted technical information which it felt adequately addressed the Board's concerns indicating there was "no evidence for translocation of any significant quantities of TCDD-like species [ie., TCDD/TCDF] into the food chain from soil containing levels in the ppt concentration range." Based on Georgia-Pacific's request, the Regional Board agreed not to consider the rescission of Waste Discharge Requirements Order No. 86-3 at the April 28, 1988 Board meeting. Subsequently, (on May 12, 1988) Georgia-Pacific met with representatives of the Regional Board and it was agreed that Georgia-Pacific would conduct a sampling and analysis program that would address the three areas of concern to the Regional Board. These areas included the potential from wind transport of TCDF's in the soil amended with ash, animal exposure to amended soil, and the potential for bioaccumulation of TCDF's in the cover crop available for grazing.

Based on the agreed upon sampling and analysis program and the low potential for significant environmental impact, the Regional Board agreed to allow resumption of the amending activity at the Little Valley site pending the completion of the proposed study.

SECTION II

TEST PROGRAM

As a result of our meeting with the California Regional Water Quality Control Board on May 12, 1988, it was agreed that Georgia-Pacific would propose a protocol for a study which addressed the State's concerns over the fate of non-2,3,7,8-TCDF at Little Valley. Georgia-Pacific retained the services of Dr. Seymour L. Friess, a noted toxicologist and principal in the firm of Drill, Friess, Hays, Loumis, and Shaffer, Inc. to assist in the preparation of the study plan. With his assistance a draft protocol was formulated and transmitted on July 15, 1988 to Mr. Benjamin Kor of the Regional Water Quality Control Board by Mr. C. T. Howlett, Jr., Georgia-Pacific's Vice-President of Government Affairs. Mr. Kor accepted the protocol by letter on August 25, 1988 with a request to include 2,3,7,8-TCDF along with the planned non-2,3,7,8-TCDF analysis of earthworm samples to be taken during the study. This modification was included in the program as requested and, additionally, 2,3,7,8-TCDF analysis was performed on all samples taken in the study.

The program as approved included a Dust Sampling Plan intended to determine if wind-borne particulate could provide a means of transport off-site for furans that may be present in the amended soil; a Terrestrial/Aquatic Animal Exposure Study Plan intended to determine if bioaccumulation of furans occurs in animals who come in contact with amended soil; and a Cover Crop Study Plan intended to determine if furans were taken up and accumulated in Flora and could become available for bioaccumulation in grazing animals.

The Dust Sampling Plan called for Weather Service data to be used to site upwind and downwind sampling locations at both a site amended with ash within the previous six months and an unamended control site. Airborne dust samples were to be taken using particle size differentiating equipment. Samples were to be analyzed for TCDF and this data, along with the particle size distribution data and pertinent weather data, was to be used for computer dispersion modeling of airborne dust transport within the valley.

The Terrestrial/Aquatic Animal Study Plan called for earthworm samples to be taken at two locations each from sites which had been soil-amended with ash within the last six months, 6-18 months, and 4 years as well as an unamended control site. Worm samples were to be analyzed for the presence of TCDF in their body tissues. The aquatic species work was to be deferred until the Dust Study was complete and/or determinations could be made as to whether a stream supporting aquatic life was likely to come in contact with amended soil.

The Cover Crop Study Plan called for both soil and cover crop (grass and clover) to be taken at a site which had been soil-amended with ash within the last 12 months as well as an unamended control site. Soil samples were to be taken to a depth of 30 inches. Both soil and cover crop samples were to be analyzed for TCDF. Cover crop sampling was to be repeated at both the amended and the control sites at approximately six month intervals until two consecutive sampling events yielded non-detectable levels of TCDF for all samples.

As noted in the Cover Crop Study Plan description above, this portion of the overall Little Valley sampling project was to entail at least two phases or sampling periods. Phase I of the proposed sampling protocol was to be conducted during the fall of 1988. In addition to the initial soil and cover crop sampling required by the Cover Crop Study Plan, this field sampling event included the collection of earthworm samples as indicated in the Terrestrial/Aquatic Animal Study Plan. During this trip, a determination of pertinent field details in preparation for initiating the Dust Sampling Plan was planned and the area was to be surveyed to determine the potential for a surface stream to come in contact with amended soil.

Phase I

On November 15, 1988, Gerald Tice, Chief Environmental Engineer of Georgia-Pacific's Wood Products Manufacturing Division; Lawrence Otwell, Senior Environmental Engineer for the Eastern Area of Georgia-Pacific's Wood Products Manufacturing Division, and Kent Mayer, Environmental Engineer for the Western Area of Georgia-Pacific's Wood Products Manufacturing Division met Mr. Martin Lay of Selvage, Heber, Nelson, and Associates, Inc. (SHN) of Eureka, California, our field sampling consultant, to begin preparation for field activities scheduled to commence on the following day. (SHN has provided complete sampling logs of all activities as well as a sampling operations report for each field session. These are included in Appendices 1 & 2 for reference.)

Historical weather data for the Fort Bragg area was reviewed to provide a basis for selecting an upwind control site to be used in the Dust Sampling Plan as well as for control samples of soil, cover crop, and earthworms; however, it was found that the primary wind direction vector for the area was countered by a secondary vector which was 180 degrees from the primary. This indicates that wind direction reversals are frequent and that any site upwind of the amended area would also be frequently downwind of the amended area. In order to avoid this a site was chosen which was cross wind or perpendicular to the most frequent wind vectors and in the direction least likely to be downwind of the amended site. It was felt that this sort of analysis was adequate to provide a control for the soil, cover crop, and earthworm sampling; however, complicating local weather factors such as the high hills surrounding Little Valley were seen as severely limiting the Fort Bragg historical data's usefulness for siting and operating an upwind/downwind dust sampling project. It appeared that a local weather monitoring station would be needed in Little Valley to provide site specific data and that the weather monitoring equipment would need to be capable of operating the dust samplers such that they would only operate in a true upwind/downwind configuration. This was seen as having the potential to prolong sampling beyond practical limits and it was decided that the advise of a qualified meteorological/air quality consultant should be sought before proceeding further with the Dust Sampling Plan.

Actual field work began on November 16, 1988 with rainy skies and chilly temperatures. The field work was largely uneventful(see the Sampling Operations Reports and Sampling Logs contained in Appendices 1 & 2 for complete field sampling details and notes) except for two areas which required field amendment to the program protocols. First was in the area of the soil samples. As noted earlier, the original protocol stated that "... soil samples will be taken to a depth of 30 inches...". As the field effort began, discussions were held and it was generally agreed that this meant that samples were to be taken at approximately 30" depth since this would represent the soil beneath the amended zone (which, due to the presence of ash, would be expected to contain a small amount of TCDF) and would indicate the potential for downward transport of TCDF in the soil. Additionally, to obtain a sufficient sample size of earthworms in both control and amended plots, worm samples as a composite were taken from a number of individual locations in each study area.

Subsequent to the first field effort, a critical review of the field procedures and data was made. It was suggested that, although the soil samples taken at the 30" depth did give an accurate representation of subsoil conditions, they did not provide information on the TCDF levels in the actual amended soil. It was decided that during the second sampling phase (Phase II) soil samples would be taken and would include both a composite sample of a core from 0" - approx. 30" and an individual sample taken at approximately 30" depth at both the control and amended plot.

During this period, Courtney Consultants, Inc. of Atlanta, Ga. was contacted in reference to the problems anticipated in going forward with the Dust Sampling Plan as originally envisioned. They responded with an estimate of the time required to collect the required 10 grams of sample on ambient monitor filters when operated in a true "upwind/downwind" configuration. Based on their work it appeared that an absolute minimum time period would be almost two years with a more realistic time frame of about 5 and a half years. Please see Appendix 3 for a copy of Courtney's assessment. They went on to suggest that a computer modeling effort would be more appropriate. In a letter dated February 1, 1989, Courtney Consultants provided a proposed work scope and cost estimate (see Appendix 4) for a modeling effort

Dust Monitoring Plan. After discussions with Mr. Mark Neely of the Regional Water Quality Control Board, it was decided to go forward with the development of this option.

Phase II

As noted earlier, Phase II of the now-amended sampling protocol called for both soil and cover crop samples to be taken at both the amended plot and the unamended control plot that were sampled during Phase I. The Phase II sampling was conducted on March 20, 1989 by Mr. Martin Lay and Mr. John Harrie of SHN and Mr. Kent Mayer of Georgia-Pacific. Weather for this field work was much better than for Phase I and was again largely uneventful. (See the Sampling Operations Report and Sampling Logs contained in Appendices 1 & 2 for complete field sampling details and notes.)

As with Phase I, a critical review of Phase II's field procedures and data was made. Since analytical data from Phase II indicated detectable levels of both 2,3,7,8 and total TCDF in the 0"-28 1/2" soil sample taken at the amended plot (see Analytical Results and Conclusions sections for a complete discussion), it was decided that a Phase III sampling effort would be appropriate. Since it had been observed in the field that soil/ash mixing in the amended area was not always homogenous, it was felt that multiple core samples should be taken and composited to provide a better, overall picture of TCDF levels in the amended field. Additionally it was felt that cover crop sampling should also be repeated in Phase III in order to preserve the continuity of matching soil/cover crop samples.

Phase III

The Phase III sampling was conducted on July 18-19, 1989 by Mr. Martin Lay and Mr. John Harrie of SHN and Mr. Gerald Tice of Georgia-Pacific. Excellent weather occurred on both sampling days. As noted above, composite samples were taken of both cover crop and soil. Six individual samples were taken on both the East and West halves of the amended field. The individual samples were composited into two samples each of grass, 0"-30" soil, and 30"-32" soil. (Please refer to the Sampling Operations Report and Sampling Log contained in Appendices 1 & 2 for complete field sampling details and notes.) Additionally a surface soil sample was taken from both the East and West halves of the amended field. The surface soil samples were intended to be analyzed for soil density, moisture content, and particle size distribution and the data was to be used in the modeling effort then envisioned as representing the Dust Sampling Plan. Some difficulty was encountered in obtaining these samples, however, in that a dense thatch of turf was required to be peeled back to expose the surface soil. (Please refer to Appendix 5 for photos of the sample locations and turf/soil conditions.) It was abundantly clear from the lush overgrowth of turf on the site that any significant entrainment of windblown dust from the site was a virtual impossibility. Because of this, these samples have not been analyzed but have been retained pending a judgement from the Regional Water Control Board regarding the need to pursue windblown dust concerns any further.

SECTION III

ANALYTICAL RESULTS

The analytical results from each phase of this study have been summarized and are presented in Tables 1, 2 and 3. The approximate sampling locations for each phase are illustrated on photocopies of an aerial photograph of the Little Valley ash amendment site. (Please refer to Figures 3, 4 and 5) Included in Appendix 6 is a copy of the lab reports and completed chain-of-custody record forms. As already indicated, sampling logs and sampling operations reports are included in Appendices 1 & 2.

Phase I

The results of Phase I sampling showed no detectable levels of both 2,3,7,8 TCDF and total TCDF for all samples. During the Phase I sampling event, it will be noted in the sampling log that soil samples No. 11 and No. 12 are both indicated as being obtained from LVT1 (1988 plot) and that no soil sample is indicated as having been taken from LVT2. In a subsequent conversation with Mr. Martin Lay of SHN, Inc., he indicates that sample No. 11 was most probably mis-labeled as LVT1 and that it should have been labeled as LVT2. Since the sampling protocol specifies that soil samples be taken from two different locations in the 1988 plot, Mr. Lay states there would have been no reason to obtain two soil samples at the same depth from the same sampling hole.

The description for sample No. 12 in the sampling log does not indicate the depth at which this soil sample was obtained, however, as verified by Mr. Lay, during the Phase I sampling event all soil samples were taken at about the 26" - 30" depth.

Phase II

Phase II sampling shows positive results for soil sample No. 108 (.49 pg/g 2,3,7,8 TCDF and 4.9 pg/g total TCDF). Since this sample was a composite from the 1988 amended plot taken from 0" - 28 1/2" depth and is a mixture of ash and soil, it would be expected to show the presence of TCDF. All other results were non-detect.

Phase III

Phase III sampling shows positive results for soil sample No. LV-204 and LV-207 (LV-204 @ 1.9 pg/g 2,3,7,8 TCDF and 26 pg/g total TCDF; LV-207 @ 1.8 pg/g 2,3,7,8 TCDF and 25 pg/g total TCDF). Both of these samples were composites of amended soil from the 1988 plot taken from 0"-30" depth and would be expected to show the presence of TCDF.

During the Phase III sampling event it was observed that some ash was present on some soil samples taken at the 30"-32" depth. The was caused by the variability in surface conditions and the varying depth that the disc plow achieved during the discing operation. This most likely explains the positive results on soil sample No. LV-205 which was taken at the 30"-32" depth (1.9 pg/g total TCDF).

TABLE 1

PHASE I
TCDF SAMPLING RESULTS
LITTLE VALLEY SITE
GEORGIA-PACIFIC CORPORATION
(Samples Obtained November 1988)

Sample Area	Sample Type	Sample Location	Sample Number	2,3,7,8 TCDF	Total TCDF	Comments
Control Plot	Grass	LVC1	3	ND	ND	
Control Plot	Grass	LVC2	7	ND	ND	
Control Plot	Soil	LVC1	4	ND	ND	Taken at 1" Depth
Control Plot	Soil	LVC1	6	ND	ND	Composite taken at 26" - 30" Depth
Control Plot	Soil	LVC2	8	ND	ND	Composite taken at 27" - 30" Depth
Control Plot	Worms	LVC1	5	ND	ND	Samples Obtained from LVC2 also.
1988 Plot	Grass	LVT1	9	ND	ND	
1988 Plot	Grass	LVT2	10	ND	ND	
1988 Plot	Soil	LVT2	11	ND	ND	Composite taken at 27" - 31" Depth
1988 Plot	Soil	LVT1	12	ND	ND	Composite taken at 26" - 30" Depth (See comments in report)
1988 Plot	Worms	LVT1	14	ND	ND	Worm Samples Obtained Throughout 1988 Plot.
1987 Plot	Worms	LVT3	13	ND	ND	Worm Samples Obtianed Throughout 1987 Plot.
1986 Plot	Worms	LVT4	15	ND	ND	Worm Samples Obtained Throughout 1986 Plot.

ND = Not Detected

TABLE 2

PHASE II
TCDF SAMPLING RESULTS
LITTLE VALLEY SITE
GEORGIA-PACIFIC CORPORATION
(Samples Obtained March 1989)

Sample Area	Sample Type	Sample Location	Sample Number	2,3,7,8 TCDF	Total TCDF	Comments
Control Plot	Grass	LVC101	101	ND	ND	
Control Plot	Grass	LVC102	102	ND	ND	
Control Plot	Soil	LVC103	103	ND	ND	Composite From 29" - 30" Depth
Control Plot	Soil	LVC104	104	ND	ND	Composite from 0" - 29" Depth
1988 Plot	Grass	LV105	105	ND	ND	
1988 Plot	Grass	LV106	106	ND	ND	
1988 Plot	Soil	LV107	107	ND	ND	Composite from 28 1/2" - 30" Depth
1988 Plot	Soil	LV108	108	.49	4.9	Composite from 0" - 28 1/2" Depth

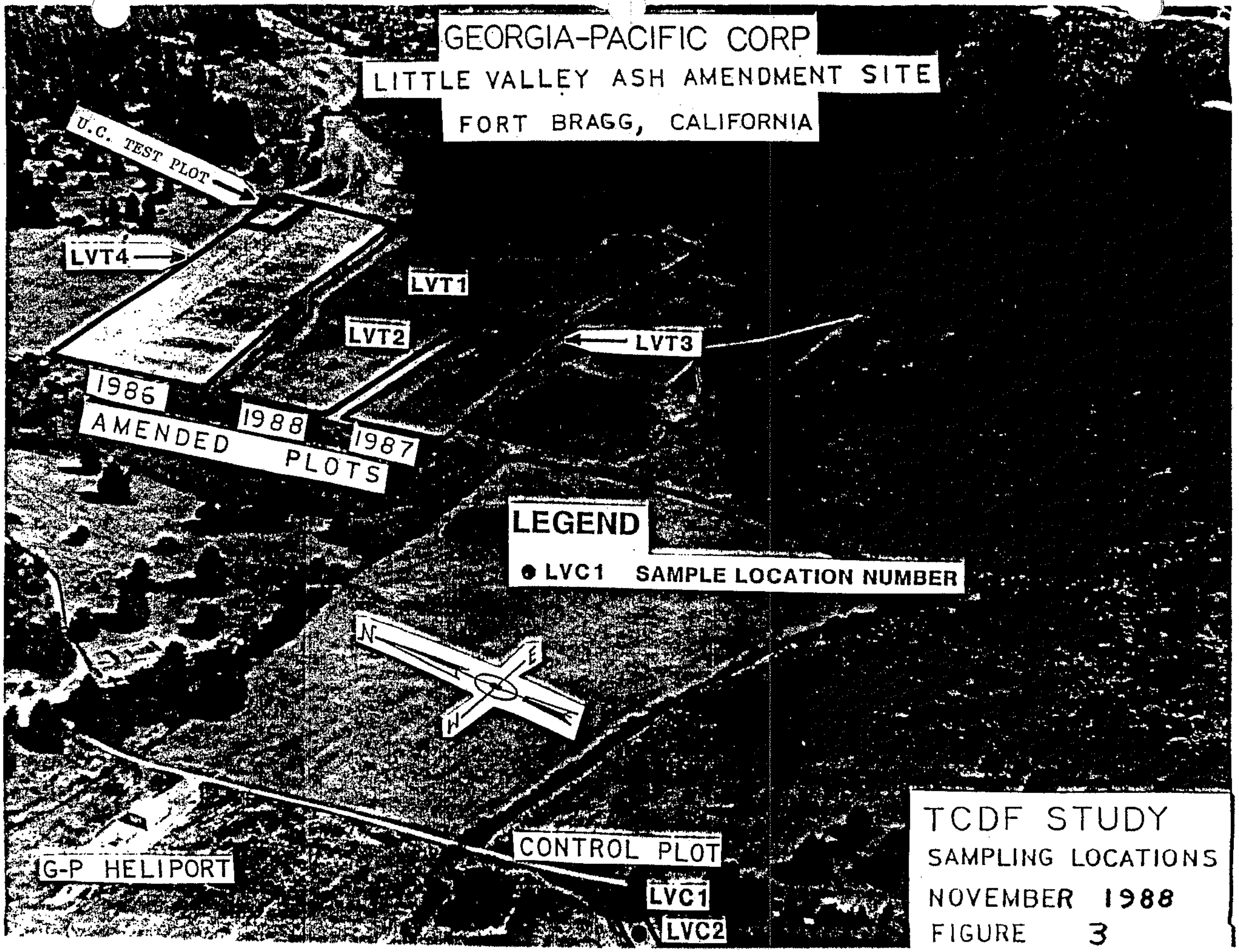
ND = Not Detected
Results Reported as pg/g
(Equilivant to parts per trillion)

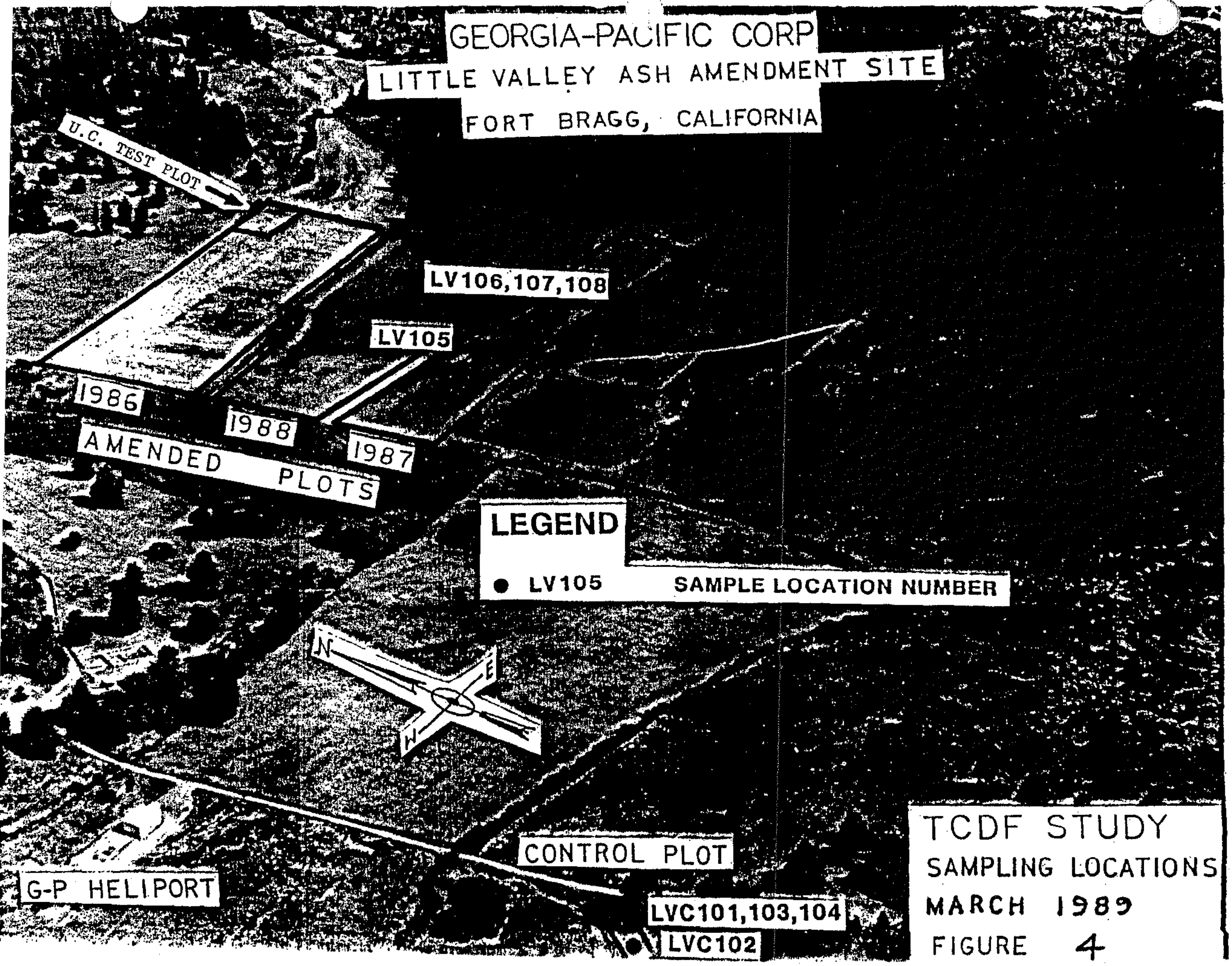
TABLE 3

PHASE III
TCDF SAMPLE RESULTS
LITTLE VALLEY SITE
GEORGIA-PACIFIC CORPORATION
(Samples Obtained July 1989)

Sample Area	Sample Type	Sample Location	Sample Number	2,3,7,8 TCDF	Total TCDF	Comments
1988 Plot	Grass	88W	LV-203	ND	ND	
1988 Plot	Grass	88E	LV-206	ND	ND	
1988 Plot	Soil	88W	LV-204	1.9	26	Composite from 0" - 30" Depth
1988 Plot	Soil	88W	LV-205	ND	1.9	Composite from 30" - 32" Depth (See comments in report)
1988 Plot	Soil	88E	LV-207	1.8	25	Composite from 0" - 30" Depth
1988 Plot	Soil	88E	LV-208	ND	ND	Composite from 30" - 32" Depth

ND = Not Detected
Results Reported as pg/g
(Equilivant to parts per trillion)


GEORGIA-PACIFIC CORP
LITTLE VALLEY ASH AMENDMENT SITE
FORT BRAGG, CALIFORNIA
U.C. TEST PLOT
LVT4
LVT1
LVT2
LVT3
1986
1988
1987
AMENDED PLOTS
LEGEND
● LVC1 SAMPLE LOCATION NUMBER
N
E
W
CONTROL PLOT
G-P HELIPORT
LVC1
LVC2
TCDF STUDY
SAMPLING LOCATIONS
NOVEMBER 1988
FIGURE 3


GEORGIA-PACIFIC CORP
LITTLE VALLEY ASH AMENDMENT SITE
FORT BRAGG, CALIFORNIA
U.C. TEST PLOT
LV106,107,108
LV105
1986
1988
1987
AMENDED PLOTS
LEGEND
● LV105 SAMPLE LOCATION NUMBER
N
E
W
CONTROL PLOT
G-P HELIPORT
LVC101,103,104
LVC102
TCDF STUDY
SAMPLING LOCATIONS
MARCH 1989
FIGURE 4

Appendix 1

Sampling Logs

1988

SAMPLING LOG

FOR

GEORGIA PACIFIC CORPORATION

FORT BRAGG (area), CA.

PHASE I AND II

Date	Description	Page
	INDEX	1
11/16/88	TCDF STUDY GENERAL INFO	4
Through	FIELD SAMPLES – log & descriptions	5
	STORAGE & comments for 11/16/88	9
11/18/88	SHIPPING INFORMATION – END LOG	10

Prepared by MARTIN LAY
Selvage Heber Nelson & Associates
2630 HARRISON Ave.
Eureka, CA 95501
(707) 444-0427

REGISTERED PROFESSIONAL ENGINEER
MARTIN E. LAY
Martin E. Lay
No. 28031
Exp. 3-31-90
CIVIL
STATE OF CALIFORNIA

Date	Description	Page
	MARCH 1989	11
3-20-89	TCDF – 2nd Round Study – GENERAL INFO	11
	FIELD SAMPLES – log & descriptions	11
	SHIPPING INFORMATION	12

SAMPLING LOG

FOR

GEORGIA PACIFIC CORPORATION

FORT BRAGG (area), CA.

PHASE I NOVEMBER 1988

GENERAL INFO 11/16/88
& 11/17/88

WEATHER: Overcast with light to moderate rainfall, breaks to drizzle, continues rain (Am) ~ 50°F ±
Rain continues intermittent during afternoon – breaking up late (1630) afternoon
11-17-88 →

PURPOSE OF SAMPLING: Ash soil ammendment
Total & 2,3,7,8 TETRACHLORODIBENZO FURAN ~~Tetrachlorodibenzo Dioxin~~ (TL;
characterization of soil ammended areas

FIELD CONTACT: KENT MAYER, Georgia Pacific Corporation, Eugene, Or. (503) 689-1221
on site with: Lawrence OTWELL / GERALD TICE
both GP – Atlanta, Georgia

PRODUCER OF WASTE:
Georgia Pacific Corporation, Fort Bragg, CA.

PROCESS OF PRODUCTION:
Ash production from boiler used for lumber (wood) production

TYPE OF WASTE: Ash ammended by discing into soil & mixing for Agric.

DECLARED WASTE COMPONENTS:
declared non-hazardous by Cal. DHS (per Kent Mayer)

NUMBER OF SAMPLES TAKEN:
20 samples taken (includes blanks)
(duplicates on #'s: 3,4,6,7,8,9,10,11,12,16,17,18,19 & 20)

DISTRIBUTION OF SAMPLES:
ALL 20 Samples to Cal Analytical for Analysis
Dup Samples 3,6,7,8,9,10,11,12,16,17,18,19 & 20 TO

FIELD SAMPLES

LAB SAMPLE #

SHELTER COVE 11/15/88
sampling by KENT MAYER

SC1 TREE - surface sample 1
TO: CAL ANALYTICAL (CA), one jar
TOTAL, & 2,3,7,8 TCDF
char, soil mix

SC2 STUMP - surface sample 2
TO: CA, one jar
TOTAL, & 2,3,7,8 TCDF
char, soil mix

LITTLE VALLEY 11/16/88
Sampling by M. LAY (SHN ENGR.)

LVC1 Grass Clippings TOP TO BOTTOM 3
Two Jars: 1 CA & 1 GP
TOTAL TCDF & 2,3,7,8 TCDF
C9CC1 Lower slope 5-8% NE ASPECT

LVC1 Soil @ 1 inch depth black sandy loam 4
C92C1 ~~ONE~~ TWO AL. JARS: CA & GP
TOTAL TCDF & 2,3,7,8 TCDF

LVC1 Worms @ near surface (1-2 in depth) 5
C93C- ~~Two~~ one (ML) jars ~~Deep~~ (AL) 1 CA
JAR (orig) TO Plastic Bag TO Jar (New) TOTAL TCDF & 2,3,7,8 TCDF
few worms encountered, all
shallow; small - Worms from
LVC1 & LVC2 (Predom. LVC2)

LVC1 Soil 26-30 in Depth yellow sandy clay w/oxides 6
Two Jars: CA & GP
1045 mixed, split & quartered diagonally
Total TCDF

LAB
#

LVC2 GRASS CLIPPINGS Top to Bottom 7
Two jars: 1 CA & 1 GP
1130 TOTAL TCDF & 2,3,7,8 TCDF

Upper Slope NE aspect = 6-8% varies
250 feet vertically above LC1, & Bottom.
LVC2 Soil Sample @ 27-30 (ML) 8
Two JARS: 1 CA & 1 GP
1150 TOTAL TCDF & 2,3,7,8 TCDF
sandy clay, yellowish gray, stiff
mixed, split, & quartered diagonally

Cleanup & Lunch break
ON SITE LVT1 area 1400 hrs.

LVT1 Grass clippings Top to Bottom 9
Two jars: 1 CA & 1 GP
1430 Total TCDF & 2,3,7,8 TCDF
short grass, 2"± max young, & sprout clover
1/4 East, Plot 88A, Center of N-S arm, Flat =
LVT2 Grass Clippings, Top to Bottom short per LVT1 10
Two jars: 1 CA & 1 GP
Total TCDF & 2,3,7,8 TCDF
1/4 West, Plot 88A, N 1/3 section Flat
1500 Grass clipping at LVT1 & LVT2
covered area of 300 sq ft + each location
LVT1 ≥ 350 feet horiz. sep from LVT2

LVT1 Soil Sample 27-31 in. dpth 11
Two jars: 1 GP, 1 CA
1600 Total TCDF & 2,3,7,8 TCDF
Mixed, split, & quartered diagonally
yellowish brown clay w/ gray mottling, stiff

LVT1 Soil Sample #12
Two jars: 1 GP, 1 CA
1635 Total TCDF & 2,3,7,8 TCDF
for location see Sample #9 description
brown/yell. brown: clay, stiff, very stiff

LVT3 Worm Sample 1987 Plot 13
one jar CA
~~1400±~~
1830± * Total TCDF & 2,3,7,8 TCDF
incomplete sample to be completed 11-17
Site on sidehill, 6%± West aspect, 300' South LVT2

LVT4 Worm Sample 1988 A Plot 14
one jar to CA
1500± TOTAL TCDF & 2,3,7,8 TCDF

11/17/88

LVT4 Worm Sample 1986 Plot 15
(East to MID (E-W) area / N & S to perimeter.
one Jar to CA
1000 TOTAL TCDF, & 2,3,7,8 TCDF

"BLANK" DISTILLED RINSE WATER 16
1030 1 CA, 1 GP : Two Jars

"BLANK" ACETONE 17
Two Jars 1 CP & 1 GP

"BLANK" HEXANE 18
Two Jars 1 CP & 1 GP

FLD BLANK Liquinox Soln. 19
Field Wash soap
Two Jars 1 CP & 1 GP

* Worm sample 13 completed C 815 hrs
on 11-17-88 3/4 sample collected 11-17

Wtu
#
LYC2 Ash Sample, Mckernicker State Park 20
1140 Eastside old GP Haul Road @
West side park campground ⇒
≈ 150 yds. South of end of road (Gate)
Sampled by Kent Mayer w/ M. Lily observing
TOTAL TCDF & 2,3,7,8 TCDF
Two Jars 1 GP, & 1 CA

END SAMPLES

SAMPLING EQUIPMENT

1. STAINLESS STEEL 2 in. SCISSORS; autoclave & ethylene oxide sterilized, packed individually in sealed envelopes by Hospital
* 2. Steel cement trowels
* 3. Steel soil auger (3½ in ø)
* 4. Brass tubes (2½ in OD, 2⅜ in. I.D., x 7 in. long)
5. Glass jars, 8 oz, with ~~teflon~~ lined bakelite caps — Laboratory prepared
6. Liquinox washing soap (prep & field wash as reqd
7. Distilled water (rinse)
8. Toluene — prep wash, pre field
9. Acetone — field wash —
10. Hexane — field wash following Acetone —

* These items pre washed with liquinox solution,

SECTION IV

CONCLUSIONS

Phase I

As noted in the Test Program and Analytical Results sections pertaining to Phase I, all results were non-detect for 2,3,7,8 TCDF and total TCDF on all samples.

The worm samples taken from the 1986, 1987 and 1988 amended areas represent varying degrees of long term exposure to TCDF in the amended soil, however, sample results indicate no bioaccumulation effect. Grass samples taken from the 1988 amended site show no initial uptake of TCDF in the emerging cover crops. Soil samples taken at the 30" depth also indicate no leaching potential into the subsoil.

During the Phase I sampling it was observed that there were no nearby streams which were likely to be impacted by potential wind blown dust or would come in contact with the amended fields themselves. As noted in the Test Program discussion, geographical details and historical weather data for the area indicated that direct wind borne sampling would be difficult if not impossible. At this point in the study it was concluded that a mathematical model approach would be more appropriate.

Phase II

Grass samples obtained during Phase II from the 1988 amended plot show non-detect for 2,3,7,8 TCDF and total TCDF. These results, as with the earlier tests, continue to confirm no uptake of TCDF in the now maturing cover crop. (It is noted that for all grass samples from the amended plot analyzed in this study the detection limit was less than 1/2 parts per trillion).

Soil samples taken at the 30" depth continue to indicate no potential for leaching or transport of TCDF to the subsoil or groundwater. The low level of 2,3,7,8 TCDF and total TCDF in the amended composite soil sample (No. 108) taken from 0" - 28 1/2" confirms previous observations that low levels of TCDF are present in the ash itself.

Phase III

Grass samples taken during the Phase III sampling event again show non-detect for 2,3,7,8 TCDF and total TCDF. These results are further indication of no uptake or bioaccumulation in the cover crop.

Composite soil samples taken in the amended soil (0"-30" depth) continue to confirm the presence of TCDF in the ash as amended.

Composite soil samples taken at the 30"-32" depth indicate non-detect except sample No. LV-205 which indicates a very slight amount (1.9 pg/g) of total TCDF. As noted in the Analytical Results section, a small amount of ash was observed in some samples taken at this depth because of uneven surface conditions and resulting variations in tillage depth. This is the most likely explanation for the positive results in this sample.

In preparation for the modelling study, which was intended to supply the data required by the Dust Sampling Plan, dust samples were taken with the intent to analyze for particle size distribution, soil density and moisture content. As indicated in the Test Program section, these samples could only be obtained by peeling back the thick thatch cover provided by the cover crop. It was then abundantly clear that this dense barrier would make the entrainment of wind blown dust an impossibility. This lead us to conclude that, although wind blown dispersion of TCDF laden top soil is a valid theoretical concern, physical conditions at the site indicate that this possibility is simply not a practical consideration.

Overall Conclusions

In summary, our original test program was intended to answer several questions:

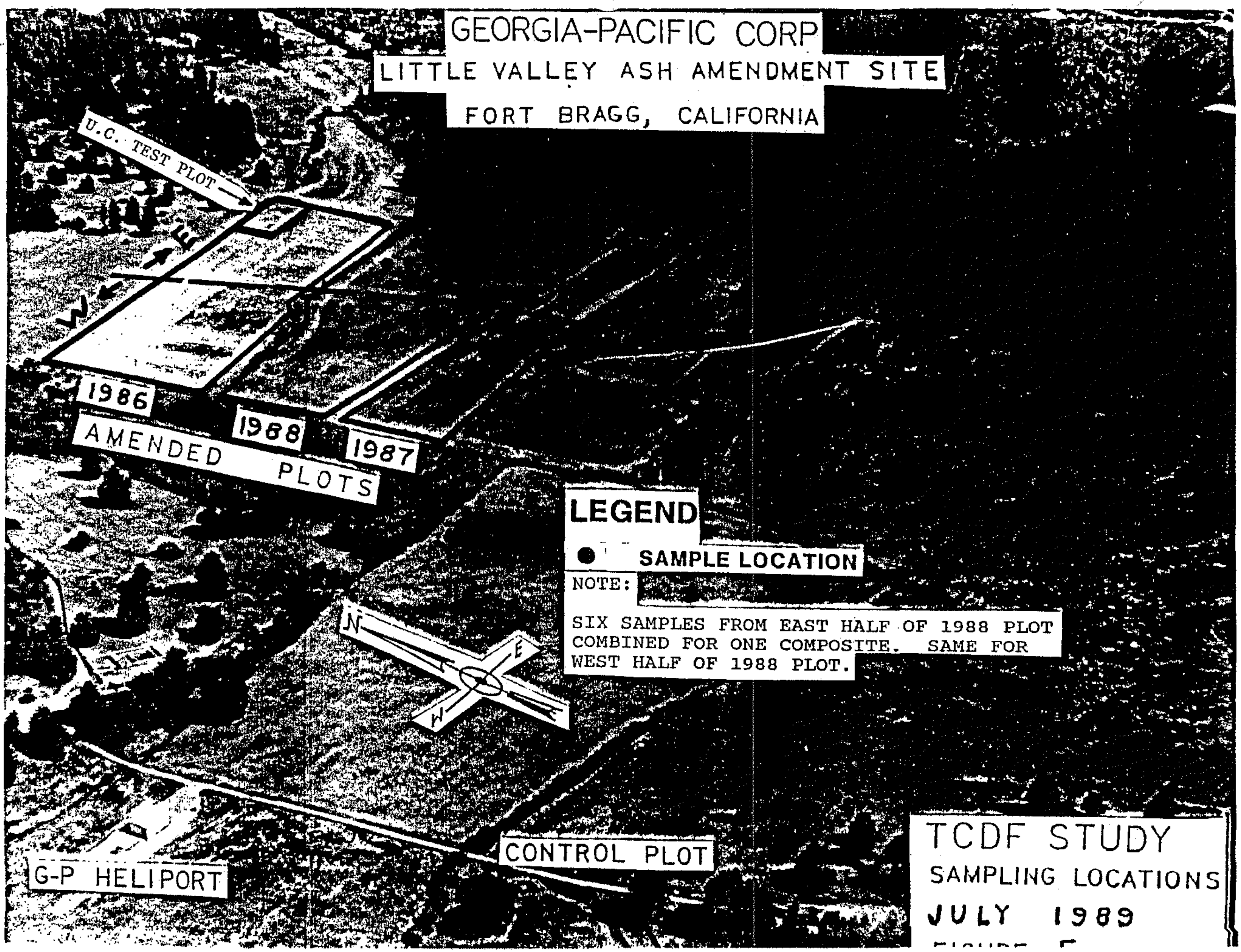
- Could wind blown dust from the amended sites provide a means of transport off-site for TCDF's?

- Could bioaccumulation of TCDF's occur in animals that come into contact with the amended soils?

- Could TCDF's be taken up and accumulated in cover crops and therefore became available to grazing animals?

As noted in each sampling phase, all data and other information indicate the answer to each question is no. Furthermore, as indicated by the test plot studies conducted by Mr. Rod Shippey of the University of California Cooperative Extension, the crop response to the amended soil is very positive and indicates a highly beneficial effect on soils amended with ash in this area.

Since this utilization of this ash material provides Georgia-Pacific with a beneficial outlet for this material, which would otherwise have to be disposed of as a waste and therefore occupy scarce community landfill space, this soil amending activity is seen as having an overall beneficial effect to the community as a whole and should be allowed to continue at this site and encouraged at others.


GEORGIA-PACIFIC CORP
LITTLE VALLEY ASH AMENDMENT SITE
FORT BRAGG, CALIFORNIA
U.C. TEST PLOT
E
W
1986
1988
1987
AMENDED PLOTS
LEGEND
SAMPLE LOCATION
NOTE:
SIX SAMPLES FROM EAST HALF OF 1988 PLOT COMBINED FOR ONE COMPOSITE. SAME FOR WEST HALF OF 1988 PLOT.
N
E
W
CONTROL PLOT
G-P HELIPORT
TCDF STUDY
SAMPLING LOCATIONS
JULY 1989

SAMPLING LOG

for

GEORGIA-PACIFIC CORPORATION

FT. BRAGG, Little RIVER TCDF

STUDY

PHASE III JULY 1989

Date	Description	Page
7/18 & 19/09	General Information	1
	Sample Listing Summary	2
	Distribution of Samples	2
	Field Sampling Data	3
	Sampling Equipment	5
	Sampling Technique	6
	Field Sampling Data (contd.)	7
	Transport Data	8
	Shipping Data	9

Pte GENERAL INFORMATION

WEATHER

7/18/89 @ GP - Fog AM: @ Little Valley, Sun - warming to 70-75°F
7/19/89 @ Little Valley - sun, breeze, 70°F+

PURPOSE OF SAMPLING

Ash soil ammendment site area samples to be analyzed for Total and 2,3,7,8 TETRACHLORODIBENZOFURAN (TCDF)

FIELD CONTACTS

GERALD TICE* (G-P — Atlanta, Georgia)
KENT MAYER (G-P — Eugene, Oregon)
DON WHITMAN (G-P — Ft. Bragg, CA.)

PRODUCER OF WASTE

Georgia-Pacific Corp., Ft. Bragg, CA.
(Mill boiler ash)

PROCESS OF PRODUCTION

Ash produced from hogged wood fuel used in boiler for lumber production activities.

TYPE OF WASTE MATERIAL

Boiler ash/native soil mixed to varying degrees by discing into soil on site

DECLARED WASTE COMPONENTS

Declared non-hazardous by CAL DOHS (per KENT MAYER)

NUMBER OF SAMPLES TAKEN - Summary

52 jars total with 26 "samples"

GP-201	LV-207	LV-213	LV-219	LV-225
GP-202	208	214	220	226
LV-203	209	215	221	
LV-204	210	216	222	
LV-205	211	217	223	
LV-206	212	218	224	

DISTRIBUTION OF SAMPLES - Summary

	T	A		T	A
GP-201	–	1	LV-214	–	2
GP-202	1	–	LV-215	–	2
LV-203	1	2	LV-216	–	2
LV-204	1	2	LV-217	–	2
LV-205	1	2	LV-218	–	2
LV-206	1	2	LV-219	–	2
LV-207	1	2	LV-220	–	2
LV-208	1	2	LV-221	–	2
LV-209	1	1	LV-222	–	2
LV-210	–	2	LV-223	–	1
LV-211	–	2	LV-224	–	1
LV-212	–	2	LV-225	–	1
LV-213	–	2	LV-226	–	1
TOTALS	8	22		0	22

FIELD SAMPLING

DATE	# Seq.	SAMPLE #	TIME	DESCRIPTION	Pkgd. FOR
7/18/89	(1)	GP-201	0847	Boiler Ash from infeed conveyor bin N(201) S(202)	ARC (1)
	(2)	GP-202	0848	as used for soil ammendment	TEST (1)
				1 Jar each to archive & test	
	(3)	LV-203	1105	Grass Samples - 3 jars @ 8oz -	T (1)
				2 archiv - 1 Test. Composite 6 sites	A (2)
				West '88 Plot (Top to Bottom)	
	(4)	LV-204	1215	Soil - 0-30in± - composite	T (1)
				6 sites (16oz) - West '88 plot	A (2)
				Soil (clay & loam) w/ash - Shovel	
	(5)	LV-205	1300	Soil @ 30-32± composite 6 sites	T (1)
				West '88 Plot (8oz)	A (2)
				Clay, yellow brown w/sone - Auger	
	(6)	LV-206	1415	Grass Samples - 3 jars @ 8oz	T (1)
				East ½ of '88 plot - Top	A (2)
				to Bottom Composite 6 sites	
	(7)	LV-207	1510	Soil/Ash samples 0-30in±,	T (1)
				composite 6 sites East ½	A (2)
				of '88 site - 3 jars @ 16oz ea.	
				Auger column & mix all	
	(8)	LV-208	1550	Soil, native, 30±-32 in.	T (1)
				composite 6 sites, 8 oz jars (3)	A (2)
				East ½ '88 plot - Auger	
				samples, cleaned, mixed - 6 sites	
	(9)	LV-209	1615	Soil - surface upper root zone	T (1)
				immed. below ground cover 0-¾"±	A (1)
				Composite "88" EAST & WEST	
				(12 sites) - 16oz jars (2)	
	(10)	LV-210	1705	Grass "87" WEST ½, 6 sites,	A (2)

FLD SAMPLING (cont'd)

DATE	#	SAMPLE #	TIME	DESCRIPTION	Pkgd. FOR
7/19/89	(11)	LV-211	0910	Soil ash composite, 0-30in±, 6 sites, West ½ '87' plot - 8oz jars	A(2)
	(12)	LV-212	0950	Soil, native (est) 30-32in±, 6 sites composite, 2 jars @ 8oz yellowish brown clay, silty clay	A(2)
	(13)	LV-213	1025	Grass - East ½ "87" plot, six sites, composite, top to bottom 2 jars @ 8oz,	A(2)
	(14)	LV-214	1120	Soil/Ash 0-30in, composite 6 sites, East ½ "87" plot 8 oz jars (2)	A(2)
	(15)	LV-215	1145	Soil 30-32in±, 6 site composite, EAST ½ "87" varies loam to clay, 2 jars 8oz	A(2)
	(16)	LV-216	1320	Grass "86", 6 sites composite East ½ "86" - Top to bottom, 8oz	A(2)
	(17)	LV-217	1430	Soil/Ash, 0-30in±, composite 6 sites "86" East ½, 8oz (2)	A(2)
	(18)	LV-218	1520	Soil, 30"-32", six sites East ½ "86" - clay - 8oz jars	A(2)
	(19)	LV-219	1600	Grass - West ½ '86' - 6 site composite, tops/bottoms/8oz	A(2)
	(20)	LV-220	1710	Soil-Ash, 6 site composite, 0-30" West ½ '86' - 8oz (2)	A(2)
	(21)	LV-221	1800	Soil - 30-32"±, 6 site composite, WEST ½ "86", clay/silt/loam 8oz jars (2)	A(2)
	(22)	LV-222	1830	Bailed Hay - "88" site composite [illegible]	A(2)

SAMPLING EQUIPMENT

1. Stainless steel scissors – autoclave and ethylene-oxide sterilized – Hospital packaged in sealed envelopes

2. Stainless steel splitting and quartering spatulas

3. Stainless steel mixing bowl

4. Split spoon sampler 1 3/8 in. ID x 24 in. long

5. LAB Prepared sampling jars – 8oz & 16oz w/ Teflon lined bakelite caps

6. Shovels, picks, steel sampling trowels, hand auger 3 1/2 in ø

7. Distilled Water – rinse & wash → field (0 & 4)
   Liquinox soap solution if deemed necessary (1)
   Acetone – wash, field (2)
   Methanol – wash, " (1A)
   Hexane – wash, " (3)

SAMPLING TECHNIQUE

88 West - Shovel holes - Sample grass, then excavate pit 1' x 1½-2' x 30 in. ± deep - Sample 0-30 by cleaning fresh face of pit and using decon trowel to sample into bowl - Composite 6 sites - repeat decon & proceed with 30-32 in sample retrieval

88 EAST - Auger columns, mix, split out * quarter into jars (16 oz) for 0-30 in. Decon auger - Auger 30-36± - Core 30-32± and clean edges, place in mixing bowl for 6 site composition - mix, split, quarter, sample to jars

"88" Surface - "Wind blow" - scrape vegetation to crop at soil/veg interface - peel 0 - ¾ in ±, sample w/ shovel (including fine roots) (decontaminated)

"87" West & East per "88" East procedure except using 8 oz jars for archive
Ash soil mix generally sporadic to 20-24 in as low as 16 to clay & as deep as 28 in.

'86' Same as "87" but "86" West ½ soil sampling composites done on aluminum foil decontaminated with hexane and distilled water rinse, per request of Gerald Tice.
East - clay @ 16 in ± / WEST - CLAY @ 20 in *

FLD SAMPLING (Contd.)

DATE	#	SAMPLE	TIME	DESCRIPTION	Pkgd. FOR
7/19/89	(23)	LV-223	1810	Field Distilled water rinse travel w/samples - 8oz	A(1)
	(24)	LV-224	1810	Field Methanol rinse travel w/ samples - 8 oz	A(1)
	(25)	LV-225	1810	Field Acetone rinse travel w/ samples - 8oz	A(1)
	(26)	LV-226	1810	Field Hexane rinse travel w/ samples - 8oz	A(1)

— END SAMPLING —

TRANSPORT DATA

Samples stored in coolers overnight of 7/18-19 & 7/19-20 → LAB; and 7/18-19, 7/19-20, 7/19-24 → ARCHIVE.

SAMPLES transported in coolers from Ft. BRAGG to Eureka, CA., on 7/20/89 & prepped for shipping by MARTIN LAY. Samples kept in cooler w/ ice packs and sent w/ ice packs in shipping coolers.

SHIPPING DATA

LABORATORY SAMPLES
1ea. GP202
LV-203 SENT: GREYHOUND BUS LINES,
LV-204 July 20, 1989 to ENSECO
LV-205 CAL-LAB; Cooler 4-4
LV-206 Bill of Laden 501-005-181-2772
LV-207 Custody Seal 04325
LV-208 (Container blue w/ white top 16qt.±)
LV-209 ATTN Bill Luxemberg
8 TOTAL (916) 372-1393

ARCHIVE SAMPLES

#	Desc.	#	Desc.	#	Desc.
1	GP-201	2	LV-211	2	LV-220
2	LV-203	2	LV-212	2	LV-221
2	LV-204	2	LV-213	2	LV-222
2	LV-205	2	LV-214	1	LV-223
2	LV-206	2	LV-215	1	LV-224
2	LV-207	2	LV-216	1	LV-225
2	LV-208	2	LV-217	1	LV-226
1	LV-209	2	LV-218		
2	LV-210	2	LV-219		
16		18		10	= 44 TOTAL

Sent: Greyhound Bus Lines July 24, 1989
To: ED DAHLGREN, G-P, Bellingham, Wa - ARCHIVE
CAL LAB cooler BMF-90
Bill of Laden 501 005 181 278 3
Custody Seal No. 05826

SHIPPING INFORMATION

Date: 3-21-89

TO Georgia Pacific
ATTN Mr. ED DAHLGREN
300 Laurel ST.
Bellingham, WA. 98225
(206) 676-2220

SHIPPED; FED X
Airbill; 9406150065
Cooler; 82WHH 10qt ± Coleman white w/ blue lid
Custody Seals C+L 1140 02326
02327

TO ENSECO - CAL LAB
2544 Industrial Blvd.
West Sacramento, CA
95691 (916) 372-1393
ATTN. Bill Luxemberg
SHIPPED; FED X
AIRBILL; ~~[illegible]~~ 2098098741 called Fri. p.m.
Cooler; C-01 10qt ±, Coleman white w/ blue lid
Custody Seals C2328
C2329

END MARCH DATA

REGISTERED PROFESSIONAL ENGINEER
MARTIN E. LAW
No. 26031

SAMPLING LOG

FOR

GEORGIA PACIFIC CORPORATION

FORT BRAGG (area), CA.

PHASE II MARCH 1989

3-20-89 REFER TO Page 4 for background

SAMPLE LABELING

LVC101 - Control area
LV 105 - Test Plot
> sample #, Typ

WEATHER

Light high partial overcast, warm 60-65°F, no breeze at control, light breeze at test plot. Sun breakthrough periodically

PERSONNEL

KENT MAYER → Georgia-Pacific

Sampling Team < MARTIN LAY, JOHN HARRIE > Selvage, Heber, Nelson & Assoc.

Number of Samples Taken

8 w/ Duplicate	=	16	D
4 w/o/ Duplicate	=	4	Single
	TOTAL	20	

Distribution of Samples

GP Archive		Enseco-CAL LAB	
LVC 101		101	
102		102	
103		103	
104		104	
105		105	
106		106	
107		107	
108		108	
110	S	109	S
111	S		
112	S		

FIELD SAMPLES	LAB NO.
LVC 101 Grass clippings, Top to bottom Two jars; GP & CAL Lab Time: 1035 Test: Total & 2,3,7,8 TCDF	101
LVC102 Grass Clippings, Top to bottom Two jars; GP & CAL LAB Time: 1054 TEST: Total & 2,3,7,8 TCDF	102
LVC 103 Soil, 29-30in. Two Jars; GP & CAL Lab Time 110? TEST 2,3,7,8 & Total TCDF	103
LVC 104 Soil, 0-29in. Two Jars, GP & CAL LAB Time 1108 Test Total & 2,3,7,8 TCDF Composite, quartered & mixed, split to two jars Topsoil to B horizon	104
LV 105 Grass, NW, plot '88, Top to Bot. Two Jars, GP & CAL LAB Time 1206 Test. Total & 2,3,7,8 TCDF	105
LV 106 Grass, NE, plot '88, Top to Bot. Two Jars; GP & Cal LAB Time; 1215 Test; Total & 2,3,7,8 TCDF	106

LV107 Soil 28½-30in depth, clay - 107
Two jars, GP & Cal. Lab
mixed, quartered, split
Time 1245

LV108 Soil ash composite 0-30in 108
mixed, split, quartered -
GW @ 18in depth -
Time 1240

LV109 ash sample off stock pile 109
composite of 3 locations by
Kent Mayer
Time 1215 ±
One jar to Lab

| offsite 1310 ± |

LV 110	Distilled water blank	GP archive only	110
LV 111	Acetone wash blank		111
LV 112	HEXANE wash blank		112

SAMPLING EQUIPMENT

1. Stainless steel scissors - autoclave & ethylene oxide sterilized; Hospital packaged in sealed envelopes
2. Steel cement towel, stainless steel quartering spatula, stainless steel quartering tray
3. Split spoon; steel sampling 1⅜ ID by 24in. long
4. Brass modified shelby tube 2⅜ ID x 7in long
5. Lab prepared glass sampling jars - 9oz with Bakelite lid / teflon lined
6. Distilled water rinse & wash - field
7. Acetone rinse - field
8. Hexane rinse - field, following acetone

SHIPPED VIA

SHIPPING INFORMATION

	CA	GF
UPS 1650 lbs 11/17/88	cooler E159 129C 9397 997 ship # Seal 05222	cooler # 34 SHN 129C 9396 445 ship # Seal 5223 5221

all except Acetone & Hexane which must be shipped separately in proper DOT or delineated carrier containers

FEDERAL EXPRESS 11/18/88	cooler S-35 9406180663 Airbill Seal 08258 08259	cooler S-36 9406180652 Seal 05224 08254

← Acetone & Hexane →

Coleman "6 pak" Type   Coleman "6 pak" Type
beige w/maroon lid; handle beige (TJP)

REGISTERED PROFESSIONAL ENGINEER
MARTIN E. LAKE
No. 28031
Exp. 3-31-90
CIVIL
STATE OF CALIFORNIA

OVERNIGHT 11-16-88

Sample Store/SPLIT

CA Cooler # E159

GP Cooler Red & White 1710 hrs START

Block Ice cool, in truck, locked

CA	GP
1	[redacted] . NL.
2	3
3	4
4	6
5	7
6	8
7	9
8	10
9	11
10	12
11	[redacted]
12	
13 (Incomplete)	
14	

1730 END

Worm samples CA 5, CA13, & CA14

Frozen @ 2145 hrs. on 11-16-88

Removed from freezer to cooler 0630, 11-17

Appendix 2

Sampling Operations Reports

1988

Sampling Operations Report

Phase I

November 1988

SHN

SELVAGE • HEBER • NELSON & ASSOCIATES, INC.
CONSULTING ENGINEERS

REFERENCE:
88298

GEORGIA-PACIFIC CORPORATION

FORT BRAGG, CALIFORNIA

LITTLE VALLEY TCDF STUDY

SAMPLING OPERATIONS REPORT

NOVEMBER, 1988

2630 HARRISON AVENUE • EUREKA • CA 95501 • (707) 444-0427
480 HEMSTED DRIVE • REDDING • CA 96002 • (916) 221-5424

INTRODUCTION

Selvage, Heber, Nelson & Associates (SHN) was retained by Mr. Kent Mayer, Environmental Engineer for Georgia-Pacific Corporation, Eugene, Oregon, to act as an objective sampler in a soil amendment sampling plan. The sampling location is known as the Little Valley area north of the Georgia-Pacific, Fort Bragg, California, mill complex.

Wood ash, from the Fort Bragg mill woodwaste fired cogeneration facility, has been deposited on test plots of valley soils to provide a soil amendment for growing rye and clover pasture grasses. The ash has been worked into the soil by varying methods of ripping and discing operations.

A tentative sampling plan was provided to SHN by Mr. Mayer that included a scope of work and protocol for sampling soil vegetative cover, soil macro animals (earthworms), and the soil-ash complex. SHN was expected to provide the equipment and personnel required to perform the sampling at locations and depths designated by Georgia-Pacific Corporation. Additionally, SHN was expected to maintain the sampling log books, chain of custody forms, packing and shipping of the sample containers to the designated testing laboratory and the designated archive depository.

This report will detail the sampling operation from coordination and setup through sampling to shipping of the samples to the designated destinations.

SUMMARY

Prior to actual field work, SHN reviewed the tentative sampling protocol received from Kent Mayer and contacted Enesco-Cal Lab of West Sacramento, California, the designated testing laboratory. Decontamination procedures and sample size required were discussed between SHN and Cal Lab personnel to minimize potential cross contamination while sampling and provide more than adequate sample for laboratory analysis. The potential for detectable Tetrachlorodibenzofuran (TCDF), total and 2, 3, 7, 8 constituents in the ash amendment was the basis for the sampling operation. The sampling operation and procedures were thus set up to the TCDF parameter.

Sampling gear and sample containers were brought to the site by SHN in a decontaminated state. Martin Lay (SHN), a registered

Civil Engineer in California and active in sampling for wood preservative site assessments, met with Kent Mayer, Gerald Tice, and Lawrence Otwell, all involved with Georgia-Pacific Corporation, to discuss their selected sampling locations and the sampling procedures that would be attempted during the sampling operation.

Sampling of vegetative cover, earthworms, and the soil-ash complex was conducted on November 16 and 17 amidst continuous rainfall at the various sampling locations. A control "background" sampling was performed, westerly across Little Valley from the amendment sites. The sampling operation then moved onto the designated amended sampling sites, situated along the east side of Little Valley. Sampling gear was decontaminated between site moves and specific site sampling operations (see methodology section).

Samples collected on November 16 were logged, sorted, and placed in iced coolers locked in a vehicle for secure overnight storage. The remaining Little Valley samples were collected on November 17, and field blanks, of the various wash and rinse cleaning solutions, were taken for lab analyses and archiving. All samples were packaged for transport by Mr. Lay to Eureka, California.

Mr. Lay completed the required chain of custody records, packaged the coolers for shipping, separating the volatile cleansers for separate shipment, and affixed security seals. The non-volatile samples were shipped November 17 via United Postal Express overnight delivery to Cal-Lab and the Georgia-Pacific archive office in Bellingham, Washington. Mr. Lay stored the volatile cleansers (acetone and hexane) in a secure refrigerator at the SHN office for overnight holding. The volatile cleansers were appropriately containerized, logged, sealed, and shipped, via Federal Express on November 18, to Cal-Lab at Sacramento and Georgia-Pacific at Bellingham.

As of this report writing, completed chain of custody copies have been received by SHN from Georgia-Pacific, with the note of Georgia-Pacific reception of sample #4 included in the log book but missing from the chain of custody to Georgia-Pacific. Verbal acknowledgement of the receipt, by Cal-Lab, of all 20 samples was received form Bill Luxemberg (Cal-Lab) by Martin Lay (SHN). A log book was kept by Mr. Lay and will be transmitted separate from this report to Georgia-Pacific for sampling operational documentation.

SPECIFIC OPERATIONAL PROCEDURE

Preparation

Field sampling gear and decontaminating cleansers were inventoried by Mr. Lay at the SHN Eureka office. Stainless steel scissors for shearing grass were obtained from a local hospital. The scissors were autoclaved, sterilized with ethylene oxide, and individually seal packaged by the hospital and delivered to SHN. The brass soil sampling tubes (2-1/2 inch O.D., 2-3/8 in. I.D., x 7 in. long) were washed in a liquinox-distilled water solution, rinsed with distilled water, and then washed with Toluene for transport to the sampling site. Hand trowels and auger (3-1/2 inch dia.) heads were treated the same as the brass sampling tubes. Liquinox, acetone, hexane, and distilled water were packed for use in field decontamination procedures; Liquinox for initial wash solution if required, distilled water for rinsing, acetone for wash and waste removal, and hexane for final wash.

Glass jars (8 oz.) with teflon liner bakelite caps were the sample receiving vessels prepared and shipped to SHN by Cal-Lab.

Sampling Methodology

General:

The sampling sites in Little Valley were located by Georgia-Pacific personnel. Mr. Lay was directed to these sites by Mr. Kent Mayer and all sampling specific to a site was conducted prior to moving into the next sampling area. The hierarchy of sampling was grass clippings, worms, and then soil. Worm sampling continued on all sites, subsequent to grass and soil sampling, in order to find sufficient worms for site representative lab analysis. Sample jar lab identification was kept numerically increasing from No. 1. The sample location, site, and sample data was kept in the log book to allow referencing a lab number with a specific site and item by future project reviewers. The lab sample jar label contained only a numerical number, the specific analysis required, and the date the sample was collected. Mr. Mayer, Mr. Tice, and Mr. Otwell assisted Mr. Lay in preparation for sampling, sample bottling, and worm collection, as well as providing specific information as to the potentials of TCDF cross contamination and particular field soil quartering cutting "tray" materials. Site identification nomenclature was established, sampling bottles labeled at each sampling site, and, immediately upon sampling, jars were logged by Mr. Lay.

Grass Clipping - Vegetation Sampling

Vegetation and grass clipping sampling commenced with Mr. Lay donning new nitrile-latex gloves (trademark = Solvex), and being assisted in washing with distilled water, acetone, and hexane. The person assisting Mr. Lay would tear open the sealed scissors "envelope" at the handle end and Mr. Lay would remove the scissors by grasping the handle. Grass clippings were cut and allowed to fall into the sample jar if the grass was high enough, otherwise clippings would be cut and held with Mr. Lay's free hand. Cuttings were then pressed into the bottle, to allow sufficient sample sizes, 10 grams $\pm$, of green grass and clover to be accumulated. The cap was then placed on the jar by Mr. Lay, and the jar was identified, logged, and placed in the receiving cooler.

Worm Sampling

Sampling worms proved tedious and time consuming as it required careful searching, extensive area coverage for representation, and surficial cleaning of worms prior to final sample jar sealing. Areas of ground were turned over by shovel and pick by one person while another team member assisted in breaking clods and root wads in search of worms. Worms were placed in a carrying jar with decontaminated scissors or a gloved hand. Worms were generally found in the more moist areas of soil complex within the root zone transition to soil-ash. Approximately 10-15 grams (20-30 worms)± of worms were collected in a temporary glass holding jar. The worms were then rinsed with distilled water of surficial soil/ash and deposited in a clean glass sample jar. Worms collected on November 16 were frozen overnight, and worms collected November 17 were immediately iced subsequent to their being cleaned.

Soil Sampling

Soil sampling holes were advanced immediately adjacent to or underneath grass/vegetation sampling points as designated by Georgia-Pacific personnel. The sampling plan presented by

Georgia-Pacific and approved by North Coast Regional Water Quality Control Board indicated soil samples to be taken to a depth of 30 inches below existing ground surface. A soil auger was used to advance a bore hole to a depth of 24$\underline{+}$ inches. A brass tube was then prepared by washing with acetone followed by a hexane wash. The brass tube (modified California Shelby tube), being attached to a 3/4 inch galvanized iron pipe driving stem with a bronze shoe, was then driven with a slide hammer from 24$\underline{+}$ to 31$\underline{+}$ inches in depth. Removal of the brass tube from the driving stem was followed by field extrusion of the sample from the tube onto an aluminum foil sheet laid on a plastic lid. The aluminum foil was decontaminated with an acetone and hexane wash prior to receiving the soil sample. Extruding soil cores necessitated trimming the soil prior to full extrusion so that the upper 24 inch depth range was not included, thus minimizing contamination from bore hole rubble and debris. Soil cores were then mixed, split, quartered, and placed in glass sampling jars using an acetone-hexane washed trowel. Approximately 200 grams + of soil per jar constituted a lab/archive sample. Sample jars were identified, logged, and placed in coolers for onsite storage.

CONCLUSION

Several comments are in order for concluding this summary report of the Little Valley TCDF Study sampling operation. Continuous rainfall and site locations necessitated field sampling to be completed under less than ideal laboratory conditions. Care was taken by all involved to maintain clean equipment and minimize risks for any potential sample cross contamination. Proper sample preparation and homogenization for analyses was left by the sampler to be performed at the laboratory under proper and controlled conditions. Turnaround time for transport to the testing laboratory by the sampler was conditional upon the remoteness of the area and the available transport carriers. All samples were kept in iced down covered coolers during transport from the field to the repackaging and shipping point in Eureka, California. The original field log book will be sent to Mr. Kent Mayer, Georgia-Pacific Corporation, Eugene, Oregon, and chain of custody forms remain with the respective Cal-Lab and Georgia-Pacific archive personnel.

SHN

SELVAGE • HEBER • NELSON & ASSOCIATES, INC.
CONSULTING ENGINEERS

REFERENCE: 88298

December 6, 1988

Georgia-Pacific Corporation
P.O. Box 1618
Eugene, Oregon 97440

Attention: Mr. Kent Mayer

SUBJECT: GEORGIA-PACIFIC CORPORATION
LITTLE VALLEY TCDF STUDY
FORT BRAGG, CALIFORNIA

Dear Mr. Mayer:

Transmitted herewith please find two copies of the Little Valley TCDF study summary of sampling operations. I have presented the summary of field operations, performed November 15, 16, and 17, in sufficient detail for review or examination by involved regulatory agencies.

The original field sampling log book is also enclosed for your use and safekeeping. I understand that Georgia-Pacific will prepare site sampling location maps, so I have not included such in my summary or log book.

Subsequent to your review of the enclosed information, please contact me if you have any questions or require further clarification of any reported item. Thank you for allowing Selvage, Heber, Nelson & Associates to be of service to you, and I look forward to working with you again in the future.

Sincerely,

SELVAGE, HEBER & NELSON

Martin Lay

Martin Lay

ML:ls
Enclosures

2630 HARRISON AVENUE • EUREKA • CA 95501 • (707) 444-0427
480 HEMSTED DRIVE • REDDING • CA 96002 • (916) 221-5424

SHN

SELVAGE • HEBER • NELSON & ASSOCIATES, INC.
CONSULTING ENGINEERS

Reference: 88298.002

GEORGIA-PACIFIC CORPORATION

FORT BRAGG, CALIFORNIA

LITTLE VALLEY TCDF STUDY

THIRD ROUND SAMPLING

JULY 18 AND 19, 1989

REGISTERED PROFESSIONAL ENGINEER
MARTIN E. LA
Martin E. Law
No. 28031
Exp 3-31-90
CIVIL
STATE OF CALIFORNIA

2630 HARRISON AVENUE • EUREKA • CA 95501 • (707) 444-0427 • FAX (707) 444-0193
480 HEMSTED DRIVE • REDDING • CA 96002 • (916) 221-5424

INTRODUCTION

Selvage, Heber, Nelson & Associates (SHN) was retained by Mr. Gerald Tice, Chief Environmental Engineer for Georgia-Pacific Corporation (GP), Atlanta, Georgia to act as an objective sampler in the third round sampling for the ash soil amendment characterization plan. This third round sampling was to include soil and grass sampling covering the 1986, 1987, and 1988 amended sites. Samples from the 1988 site were to be tested and archived, while samples from the 1986 and 1987 sites were only to be archived.

SHN was expected to provide the equipment and personnel required to perform soil, soil-ash, and vegetation sampling at locations and depths designated by Georgia-Pacific Corporation. Additionally, SHN was expected to maintain a sampling log book, prepare chain-of-custody forms, and pack and ship retrieved samples to the designated testing laboratory and the designated archive depository.

SUMMARY

Similar to first and second round sampling, ENSECO-Cal Lab of West Sacramento, California was to be the designated testing laboratory, and Georgia-Pacifics' Bellingham, Washington office was to be the recipient of archive samples. The basis for sampling operations was to retrieve and test samples for the constituents of total and 2, 3, 7, 8 Tetrachlorodibenzofuran (TCDF). The sampling operation and procedures were thus set up to the TCDF parameter.

Sampling gear and containers were brought to the site by SHN in a decontaminated state. Martin Lay (SHN), a registered Civil Engineer, was accompanied by John Harrie (SHN), both OSHA 29 CFR 1910-120 certified and having conducted previous Little Valley sampling.

Martin Lay and John Harrie met Gerald Tice on July 17 to discuss sampling operations. Mr. Tice expanded sampling operations to include additional archive duplicates and 30 inch ± depth discreet samples from all sample locations. Sampling was performed at the direction of Mr. Tice on July 18 and 19 at the Little Valley amended sites, and no Control Area samples were taken this sampling round. Sampling gear was decontaminated between site moves and specific site sampling operations.

Collected samples were logged, sorted, and placed in iced coolers for transport by SHN to Eureka for subsequent shipment to the designated sample receiving locations. Mr. Lay completed the required chain-of-custody records, properly packaged the samples for bus line shipment in iced coolers, and affixed security seals. Samples were sent July 20 to ENSECO, and July 24, to GP.

As of this writing (August 2), completed chain-of-custody forms have not been received by this office, but verbal contact has been made with ENSECO and GP archive for reported receipt of intact samples.

SPECIFIC OPERATIONAL PROCEDURE

Preparation

Field sampling gear and decontamination cleansers were inventoried by Mr. Lay and Mr. Harrie at the SHN Eureka office. Stainless steel scissors for shearing vegetative cover were again obtained from a local hospital. The scissors were autoclaved, sterilized with ethylene oxide, and individually seal packaged by the hospital. All sampling gear was liquinox washed, rinsed with distilled water and final rinsed with methanol in preparation for transport to the project site. Liquinox solution, methanol, acetone, hexane, and distilled water were packaged for on-site sample gear decontamination procedures; Liquinox solution for initial site change washing if required, distilled water for rinsing, methanol and acetone for intermediate wash and hexane for final wash followed by distilled water rinse. Initial glass sampling jars, with teflon lined bakelite caps, were laboratory prepared and shipped to SHN by ENSECO Cal-Lab in sampling coolers. Additional jars required were laboratory prepared by North Coast Laboratories, located in Arcata, CA, and shipped by SHN via Greyhound Bus to Willits. A GP employee then transported the jars back to the sampling area.

SAMPLING METHODOLOGY

General

The sampling locations were established on the Little Valley study amended areas by Mr. Gerald Tice. The sampling hierarchy consisted of vegetation sampling followed by soil sampling on each specific area prior to a move to the next sampling area.

Sample jar identification was kept numerically increasing from 201. The sample location, site, and sample data was kept in the log book to allow referencing a specific lab number with a specific site and item by future project reviewers. Lab sample jar labels contained an identification number, date, time, and the required specific analysis. Jars were logged immediately following sampling by Mr. Lay or Mr. Harrie.

Sampling Location Layout

Soil amended sites of 1986, 1987, 1988 were each divided into two, approximately equal, areas east and west of a "halfway" line. Six random sampling locations were designated in each of the "half" area units and sampling was completed in each half unit prior to moving and decontamination for sampling the next unit.

Vegetation Sampling

A large decontaminated stainless steel bowl was used in which to deposit vegetation clippings cut with the stainless steel scissors. Clippings were obtained from top to bottom portions of actively growing vegetation, located at and around each of the six designated sampling points, in a specific area unit. Decontaminated Nitrile latex gloves were worn by the sampler and the composite sampling was thoroughly mixed and field rinsed with distilled water prior to quartering into the glass sampling jars.

Soil Sampling

The soil and soil-ash encountered this sampling round was dry surface soil-ash to damp clay at 20± to 30± inches depth. Several soil extraction methods were conducted prior to establishing the most time efficient method. Initial samples from the 1988 west half were obtained by hand excavating a small hole with a decontaminated shovel to a depth of 30 inches. Soil samples were retrieved by a decontaminated nitrile latex gloved sampler using a decontaminated trowel. Soil was freshly scraped, from top to bottom of the 0-30± inch column, and placed in the decontaminated stainless steel mixing bowl. The scraping process was repeated at the remaining five locations in a specific unit area for obtaining a composite area sample. The sample thus obtained was field mixed with decontaminated steel trowels and quartered. Sample jars were filled with portions of each quarter of soil sufficient to fill the jar and for obtaining the appropriate number of jars for laboratory and/or archive requirements.

The process was repeated for the 30 to 32 inch depth discrete sample after decontaminating sampling equipment.

The remaining area units were sampled by hand augering and retrieved core splitting. At a specific unit area a decontaminated auger was advanced to 30 inches in depth. The soil retrieved was placed in the unit areas' decontaminated mixing bowl, field mixed, quartered, and split into aluminum foil in a size (1,000 grams ±) to allow future mixing with the additional soil from the remaining five sites in the unit area. Sample jars were finally filled, with soil, of all six sites in a unit area, mixed together in the stainless steel bowl, quartered, and placed into the appropriate number of sampling jars. The process was amended on the 1986 west 1/2 unit area (last unit sampled) by cleansing the aluminum foil with hexane and a distilled water final rinse. Discrete soil samples from the 30-32 inch depth were similarly sampled with the hand auger. A core was retrieved, shaved with a decontaminated trowel, and placed in the unit areas' decontaminated stainless mixing bowl for future mixing with the other five sites soil. Final mixing and quartering enabled the sampler to fill the appropriate number of sample jars with the 30-32 inch depth soil. A surface "wind blow" composite was taken from the 1988 amended site from all twelve (east and west) '88 sample site locations previously sampled this round. Surface vegetation was scraped clear at the soil-vegetation interface with a decontaminated shovel, and a shallow (1/2 to 3/4 inch) depth sheet sample was collected. The soil, including some vegetation fine roots, from the 12 sites was put in the decontaminated mixing bowl, mixed, quartered and placed into sampling jars.

Conclusions

Several observational comments are in order for concluding this summary report of the third round Little Valley TCDF sampling program. Crop vegetation on the 1988 and 1987 sites had been cut, windrowed, and the bailing operation was in progress. New vegetation was actively growing on all three sites. The 1986 site had not been cut and the rancher indicated that the site would probably only be grazed this year. No groundwater was encountered on any amended area where soil samples were taken, and soil moisture was low even at depth. Native clay/silty clay soils were stiff, sticky, and plastic at the moisture encountered. The plow layer (to native soil) varied from site to site with generally deeper plowing encountered on the 1988 site (24-28), lesser on 1987 (20-24±) and minimum on the 1986 (18-24±). Considerable variation in mixing was observed on all three amended sites and generalities will not be presented due to the continual variations observed by the samplers.

Care was taken by all involved to maintain clean equipment and minimize risks for any potential sample cross contamination. Proper sample preparation and homogenization for analyses was left by the sampler to be performed at the laboratory under proper and controlled conditions. Turnaround time for transport to the testing laboratory by the sampler was conditional upon the remoteness of the area and the available transport carriers. All samples were kept in iced down covered coolers during transport from the field to the repackaging and shipping point in Eureka, California. The original field log book will be sent to Mr. Kent Mayer, Georgia-Pacific Corporation, Eugene, Oregon, and chain-of-custody forms remain with the respective Cal-Lab and Georgia-Pacific archive personnel.

SHN

SELVAGE • HEBER • NELSON & ASSOCIATES, INC.
CONSULTING ENGINEERS

Reference: 88298.002

August 17, 1989

Mr. Kent Mayer
Georgia-Pacific Corporation
P.O. Box 1618
Eugene, Oregon 97440

SUBJECT: LITTLE VALLEY TCDF STUDY, FORT BRAGG, CALIFORNIA
THIRD ROUND SAMPLING - JULY 18 & 19, 1989

Dear Mr. Mayer:

Transmitted herewith please find three copies of the field report and the original field notebook relative to the subject project. I am also sending one copy each (log book and report) to Gerald Tice for his records.

Selvage, Heber, Nelson & Associates (SHN) is preparing, at the request of Mr. Tice, a series of location maps indicating relative and area specific Little Valley sampling locations. I will be sending Mr. Tice preliminary copies for his review and comment within the coming week. Please review the enclosed information and contact me at your convenience if you have any questions or comments.

I appreciate your allowing SHN to continue with this interesting sampling study and I trust we have performed to your satisfaction.

Sincerely,

SELVAGE, HEBER & NELSON

Martin Lay

Martin Lay

ML:bb

Enclosures
cc: Gerald W. Tice

2630 HARRISON AVENUE • EUREKA • CA 95501 • (707) 444-0427 • FAX (707) 444-0193
480 HEMSTED DRIVE • REDDING • CA 96002 • (916) 221-5424

Sampling Operations Report

Phase III

July 1989

INTRODUCTION

Selvage, Heber, Nelson & Associates (SHN) was retained by Mr. Kent Mayer, Environmental Engineer for Georgia Pacific Corporation (GP), Eugene, Oregon, to act as an objective sampler in the second round sampling for the soil amendment sampling plan. This second round sampling was to be similar to round one sampling completed in November, 1988, with the exception of no earthworm testing.

SHN was expected to provide the equipment and personnel required to perform soil, soil-ash, and vegetation sampling at locations and depths designated by Georgia-Pacific Corporation. Additionally, SHN was expected to maintain the sampling log book, perpare chain of custody forms, and pack and ship retrieved samples to the designated testing laboratory and the designated archive depository.

SUMMARY

Similar to first round sampling, ENESCO-Cal Lab of West Sacramento, California was to be the designated testing laboratory, and Georgia-Pacifics' Bellingham, Washington office was to be the recipient of archive samples. The basis for sampling operations was to retrieve and test samples for the constituents of total and 2, 3, 7, 8 Tetrachlorodibenzofuran (TCDF). The sampling operation and procedures were thus set up to the TCDF parameter.

Sampling gear and containers were brought to the site by SHN in a decontaminated state. Martin Lay (SHN), a registered Civil Engineer, and previous round sampler, was accompanied by John Harrie (SHN) also OSHA 29 CFR 1910-120 certified and familiar with sampling potentially hazardous materials.

Martin Lay and John Harrie met Kent Mayer on March 20, 1989, with relatively clear weather and prevailing moderate temperatures (65 + degrees F). A control "background" sampling was performed, westerly across Little Valley from the amended sites, and the sampling operation then moved onto the 1988 amended designated sampling site. Sampling gear was decontaminated between site moves and specific site sampling operations.

Collected samples were logged, sorted, and placed in iced coolers for transport by SHN to Eureka for subsequent shipment to the designated sample receiving locations. Mr. Lay completed the required chain of custody records, properly packaged the samples for air freight shipment in iced coolers, and affixed security seals. Samples were sent March 21 to their respective destinations.

As of this report writing, completed chain of custody forms have been received by SHN from GP. Telephone confirmation of sample receipt by CAL-LAB was made by Martin Lay. The previously kept log book was extended to include information from this second round sampling and will be transmitted separately from this report to Mr. Kent Mayer for Georgia-Pacific sampling documentation.

SPECIFIC OPERATIONAL PROCEDURE

Preparation

Field sampling gear and decontamination cleansers were inventoried by Mr. Lay and Mr. Harrie at the SHN Eureka office. Stainless steel scissors for shearing vegetative cover were again obtained from a local hospital. The scissors were autoclaved, sterilized with ethylene oxide, and individually seal packaged by the hospital. Brass sampling tubes (2-3/8 inch I.D. x 7 and 13 inches long) as well as the 1-3/8 inch I.D. steel split spoon sampler were washed in a liquinox distilled water solution, rinsed with distilled water, and then washed with Toluene for transport to the sampling site. Steel hand trowels and auger heads were similarly treated for transport. Liquinox, acetone, hexane, and distilled water were packed for field decontamination procedures; Liquinox for initial wash solution if required, distilled water for rinsing, acetone for wash and water removal, and hexane for final wash. Glass jars (9 oz.) with teflon lined bakelite caps were the sample receiving vessels prepared and shipped to SHN by CAL-LAB.

SAMPLING METHODOLOGY

General

The sampling sites were located in Little Valley by Mr. Kent Mayer. The sampling hierarchy consisted of vegetation sampling followed by soil sampling. Sample jar identification was kept numerically increasing from No. 101. The sample location, site, and sample data was kept in the log book to allow referencing a lab number with a specific site and item by future project reviewers. Lab sample jar labels contained a numerical number, the specific analysis required, and the sample date and time. Jars were logged immediately following sampling by Mr. Lay or Mr. Harrie.

Grass Clipping - Vegetation Sampling

Vegetation and grass clipping sampling was conducted identically to round one sampling procedures.

Soil Sampling

Soil samples, as in round one sampling, were obtained immediately below the area grass-vegetation sampling sites. Depth of sampling for round two, as prescribed by Georgia-Pacific, required a composite sample from the surface to 30 inch depth, and a discreet sample from the 30 inch depth.

The 0-6 inch depth range was hand sampled with decontaminated equipment and set on a decontaminated stainless steel quartering tray for composite mixing with the subsequent split spoon sample. The decontaminated split spoon sampler was then driven from the 6 inch depth to the 30 inch depth and retrieved to provide an in-situ column of soil 24 inches ± long. The wet spongy soil-ash conditions encountered at the ammended site necessitated a separate shelby tube sample from 26-34± inches to allow obtaining a discreet 30 inch depth sample. The 29-30 inch depth was placed in an appropriate sample jar, and the 6± to 29 inch column was placed with the 0-6 inch depth sample on the quartering tray. The soil on the tray was then mixed, quartered, split with a decontaminated stainless steel spatula, and placed in the appropriate sampling jars. Composite samples consisted of approximately 200 grams of soil per jar for lab and archive samples. The 30 inch ± depth discreet samples consisted of approximately 50 grams of soil per jar, except as noted for the ammended site, for lab and archive samples. Sample jars were identified, logged, and placed in coolers for onsite storage.

Conclusions

Several comments are in order for concluding this summary report of the second round Little Valley TCDF Study sampling operation. The extremely wet to saturated soil-ash conditions encountered on the soil amended sampling site necessitated utilizing both the split spoon sampler for composite sampling, and a brass, modified shelby tube for discreet sampling of the 30 inch depth sample. Perched water was observed at 18 inches depth and did not appear to significantly penetrate the more clayey undisturbed native soil below the disturbed plow layer (33 inches depth±).

Care was taken by all involved to maintain clean equipment and minimize risks for any potential sample cross contamination. Proper sample preparation and homogenization for analyses was left by the sampler to be performed at the laboratory under proper and controlled conditions. Turnaround time for transport to the testing laboratory by the sampler was conditional upon the remoteness of the area and the available transport carriers. All samples were kept in iced down covered coolers during transport from the field to the repackaging and shipping point in Eureka, California. The original field log book will be sent to Mr. Kent

Meyer, Georgia-Pacific Corporation, Eugene, Oregon, and chain of custody forms remain with the respective Cal-Lab and Georgia-Pacific archive personnel.

Enseco

2,3,7,8-TCDF plus Total TCDF

HIGH RESOLUTION

Soil
(Composite 6 sites West 1988 plot)

30/32 inches

Client Name: Georgia Pacific Corp.
Client ID: LV-205 Soil
Lab ID: 048360-0004-SA Enseco ID: 111797
Matrix: SOLID Sampled: 18 JUL 89 Received: 24 JUL 89
Authorized: 24 JUL 89 Prepared: 28 JUL 89

Sample Amount: 10.0 G
Percent Moisture: NA

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-225			
Analyzed: 04 AUG 89			
2,3,7,8-TCDF	ND	pg/g	0.035
Total TCDF	1.9	pg/g	--

	% Recovery
13C-2,3,7,8-TCDF	93

ND=Not Detected
NA=Not Applicable

Reported by: Mike Filigenzi Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

Enseco

2,3,7,8-TCDF plus Total TCDF

HIGH RESOLUTION

Soil
(Composite 6 sites East 1/2 1988 plot)
0 – 30 inches

Client Name: Georgia Pacific Corp.
Client ID: LV-207 Soil
Lab ID: 048360-0006-SA Enseco ID: 111799
Matrix: SOLID Sampled: 18 JUL 89 Received: 24 JUL 89
Authorized: 24 JUL 89 Prepared: 28 JUL 89

Sample Amount: 10.1 G
Percent Moisture: NA

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-225			
Analyzed: 04 AUG 89			
2,3,7,8-TCDF	1.8	pg/g	--
Total TCDF	25	pg/g	--

	% Recovery
13C-2,3,7,8-TCDF	53

ND=Not Detected
NA=Not Applicable

Reported by: Mike Filigenzi Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

Enseco

2,3,7,8-TCDF plus Total TCDF

HIGH RESOLUTION

Soil
(Composite 6 sites
East 1/2 1988 plot)
30/32 inches

Client Name: Georgia Pacific Corp.
Client ID: LV-208 Soil
Lab ID: 048360-0007-SA Enseco ID: 111800
Matrix: SOLID Sampled: 18 JUL 89 Received: 24 JUL 89
Authorized: 24 JUL 89 Prepared: 28 JUL 89

Sample Amount: 10.1 G
Percent Moisture: NA

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-225			
Analyzed: 04 AUG 89			
2,3,7,8-TCDF	ND	pg/g	0.035
Total TCDF	ND	pg/g	0.14

	% Recovery
13C-2,3,7,8-TCDF	89

ND=Not Detected
NA=Not Applicable

Reported by: Mike Filigenzi Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

SHN

SELVAGE •HEBER •NELSON & ASSOCIATES, INC.
CONSULTING ENGINEERS

Reference: 88298.001

GEORGIA-PACIFIC CORPORATION

FORT BRAGG, CALIFORNIA

LITTLE VALLEY TCDF STUDY

SECOND ROUND SAMPLING

MARCH 20, 1989

REGISTERED PROFESSIONAL ENGINEER
MARTIN E. LAY
No. 28031
Exp. 3-31-90
CIVIL
STATE OF CALIFORNIA

2630 HARRISON AVENUE • EUREKA • CA 95501 • (707) 444-0427 • FAX (707) 444-0193
480 HEMSTED DRIVE • REDDING • CA 96002 • (916) 221-5424

TEL No. 707 444 0193 Nov 30,89 10:51 P.03

SELVAGE, HEBER, NELSON & ASSOCIATES, INC.
Consulting Engineers
2630 Harrison Avenue
EUREKA, CALIFORNIA 95501

(707) 444-0427

LETTER OF TRANSMITTAL

DATE	JOB NO.
4-8-89	88298.001
ATTENTION Mr. Kent Mayer	
RE: G-P Ft. Bragg	
Little River TCDF Study	
Second Round Sampling	

TO Georgia Pacific Corporation
P.O. Box 1618
Eugene, Oregon 97440

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via ______ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☒ Report

COPIES	DATE	NO.	DESCRIPTION
2	3-20-89		Second Round TCDF Sampling Report
1			Original: First & Second round TCDF Log Book

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit ___ copies for approval

☒ For your use ☐ Approved as noted ☐ Submit ___ copies for distribution

☐ As requested ☐ Returned for corrections ☐ Return ___ corrected prints

☐ For review and comment ☐ ______

☐ FOR BIDS DUE ______ 19___ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS Kent

Review report for conformance with your requirements. If report is acceptable I will forward more copies, as you request, for your use. Otherwise, I can revise report to add more detail if such is required.

I enjoyed working with you and I would be most interested in hearing of the test results.

COPY TO ______

SIGNED: [signature]

If enclosures are not as noted, kindly notify us at once.

Sampling Operations Report

Phase II

March 1989

Appendix 3

Courtney Consultants Assessment

On-Site TSP Sampling

Appendix 4

Courtney Consultants

Modeling Proposal

Courtney Consultants Inc.
520 Carriage Drive Atlanta, Georgia 30328 404-256-2487

February 17 1989

Ref Fort Bragg, California
Proposed Modeling Study
or Study of the
Distribution and Concentration
of Furan/Dioxins Downwind

Supplement to Proposal
FTB-21

Mr. Lawrence Otwell
Sr Environmental Engineer
Eastern Wood Products Division
Georgia-Pacific Corporation
P O Box 105603
Atlanta GA 30348

Dear Mr. Otwell:

In response to your request we hereby submit the rationale on the difficulty of collecting 10 grams of TSP mass sample at the Fort Bragg, California area site.

If the actual daily collection method is not used and limit-thinking modeling is, we believe the study can be completed to one-half of what we formerly quoted; in other words, about $12,500.00 in this case. It would take about a month to do it once we were given a go-ahead.

We await your pleasure as to what you would like to do in this instance.

Sincerely,

For COURTNEY CONSULTANTS INC.

F E Courtney

F E Courtney, Sr Scientist

FEC/npw

Attachment: Discussion on TSP Filter Loading
until Mass raches 10 grams

Georgia-Pacific Corporation Fort Bragg, California
Attachment to Ltr 2/17/89

The Loading of a TSP Filter Until a Quantity of Ten Grams of Particulate has been collected

A reasonable approximation of the average loading on a TSP filter in the Little Valley Area in a 24-hr period is about 40 ug/m^3. This means that about 100 mgms has to be collected on the filter itself since the former unti is a unit of dust per unit volume and not just mass of dust.

There are 10000 mgms in 10 gms.

Thus to determine how many sampling event days one would have to sample to acquire a 10 gram mass, one simply divides the 100 mgms into 10000 mgms and determines that there would have to be a minimum of 100 event days.

BUT, the wind only blows downwind a maximum of about 15% of the time. Therefore, the following calculation is appropriate to determine how many sampling event days would be required to collect 10 gms of TSP mass.

100 event days x 100/15 (Increased no. of events required to collect mass due to wind directional frequency) = 667 events

If samples were collected <u>every day</u> this would mean that it would take 667/365 or 1.83 years to do this.

Since sampling is often NOT DONE EVERY DAY it would take longer if there was a gap in sampling day intervals.

There is also a further correction which makes the collection time longer. Dust becoming airborne is often a function of wind speed. If we go so far as to suggest a reasonable assumption that it takes a 10 mph wind speed or more to cause airborne dust over the area (perhaps it should be a higher speed to account for a grassy plot surface) then the dust becomes airborne only some fraction of the 15% that the wind blows exactly downwind. Data for the western coastal area suggests that only half of the wind or less would exceed 10 mph. Let us say for practical purposes that the fraction which is of concern here is now only 5% of the time.

Then the period of time required to "see" these events would now be 3 times that shown above or 5.5 years to collect a 10 gram sample.

If sampling is done at greater intervals rather than daily, the period for collection obviously increases further. For example, for every other day it would take 11.0 years; for every sixth day (the normal sampling rate) it would take 33.0 years.

Thus we suggest that the collection of a 10 gram sample of particulate mass is not only tedious and time-consuming but of little merit compared with modeling some typical values.

Appendix 6

Laboratory Reports

LABORATORY REPORTS

PHASE I

NOVEMBER 1988

Courtney Consultants Inc.
520 Carriage Drive Atlanta, Georgia 30328 404-256-2487

Feb 1 1989

Ft Bragg CA Proposal

FTB-21

Mr. Lawrence Otwell
Sr Environmental Engr
Eastern Wood Products Division
Georgia Pacific Corporation
16th Floor, 133 Peachtree St.,
Atlanta GA 30348

Dear Mr. Otwell: Here is our cost estimate for the proposed work scope; we prefer that GP make separate negotiations for particle sizing and Furan analysis of the soils.

1 Visit site; install met gear; measure roughness lengths in the field; photograph specific locations on site for report.

2. Procure long-term weather data set; adjust this set based on site-specific met data; develop input to model based on Chatten Cowherd's methods for assessing ground cover effects.

3. Using the ISCLT model, model in the Area Source Mode to predict location of maximum impact at selected points over an extensive data base (at least 5 years). The report will produce the deposition of the ash and its distribution; particularly with regard to nearby streams.

4. Prepare report to address these issues and indicate what risk might be for locations at maximum impact points.

Estimated total cost $25,000.00. This would be the turnkey cost estimate for all of the above.(Costs might be lower if only one person from CCI goes into the field.)
The above costs include a trip to the site for instrument removal at the close of the project. This would also allow any further site-specific measurements at the end of the effort. We propose that the weather instrument remain in the field a minimum of 3 months. We propose that the project extend over 4 months from date of go-ahead. Billing would be in equal increments - 25% per month.

Thank you for the opportunity to propose on this effort.

Sincerely,

For COURTNEY CONSULTANTS INC.

FECourtney

F E Courtney, President

FEC/npw
GP-Proposal FTB CA

Enseco

August 23, 1989
Lab ID: 048360

Kent Mayer
Georgia Pacific Corp.
P.O. Box 1618
1900 Irving Rd.
Eugene, Oregon 97440

Dear Mr. Mayer:

Enclosed is the report for the two grass, one ash, and five soil samples which were received at Enseco-Cal Lab on 24 July 1989.

The report consists of the following sections:

I Sample Description
II Analysis Request
III Quality Control Report
IV Analysis Results

If you have any questions, please feel free to call.

Sincerely,

William J. Luksemburg
Principal Scientist

ak

Enseco Incorporated
2544 Industrial Boulevard
West Sacramento, California 95691
916/372-1393 Fax: 916/372-1059

Georgia-Pacific Corporation Eastern Wood Products
Manufacturing Division
P.O. Box 105603
Atlanta, Georgia 30348
Telephone (404) 521-4000
Teletype (810) 751-1000

BY WAY OF EXPLANATION

SAMPLE NO. 202 AND NO. 209 WERE TAKEN AS A MATTER OF GENERAL INTEREST AND WERE OUTSIDE THE SCOPE OF THIS STUDY. THEREFORE THESE RESULTS ARE NOT INCLUDED IN THIS REPORT. ALSO, ADDITIONAL SAMPLES WERE TAKEN ON THE 1986 AND 1987 AMENDED PLOTS, HOWEVER, THESE SAMPLES WERE ARCHIVED AND NOT ANALYZED.

I Sample Description

See the attached Sample Description Information.

The samples were received under chain-of-custody.

II Analysis Request

The following analytical tests were requested.

Lab ID	Analysis Description
048360-1 Thru 8	2,3,7,8-TCDF plus Total TCDF

III Quality Control

A. Project Specific QC. No project specific QC (i.e., spikes and/or duplicates) was requested.

B. Method Blank Results. A method blank is a laboratory-generated sample which assesses the degree to which laboratory operations and procedures cause false-positive analytical results for your samples.

No target parameters were detected in the method blanks associated with your samples at the reporting limit levels noted on the data sheets in the Analytical Results section.

IV Analysis Results

Test methods may include minor modifications of published EPA Methods such as reporting limits or parameter lists. Reporting limits are adjusted to reflect dilution of the sample, when appropriate. Solid and waste samples are reported on an "as received" basis; i.e., no correction is made for moisture content, unless the method requires or the client requests that such correction be made.

Results are on the attached data sheets.

Enseco

2,3,7,8-TCDF plus Total TCDF

HIGH RESOLUTION

Grass
(Composite 6 sites
West 1988 plot)

Client Name: Georgia Pacific Corp.
Client ID: LV-203 Grass
Lab ID: 048360-0002-SA   Enseco ID: 111793
Matrix: SOLID   Sampled: 18 JUL 89   Received: 24 JUL 89
Authorized: 24 JUL 89   Prepared: 08 AUG 89

Sample Amount: 10.0 G
Percent Moisture: NA

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-225			
Analyzed: 19 AUG 89			
2,3,7,8-TCDF	ND	pg/g	0.14
Total TCDF	ND	pg/g	0.14

	% Recovery
13C-2,3,7,8-TCDF	110

ND=Not Detected
NA=Not Applicable

Reported by: Mike Filigenzi   Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

2,3,7,8-TCDF plus Total TCDF

HIGH RESOLUTION

Blank

Client Name: Georgia Pacific Corp.
Client ID: Method Blank
Lab ID: 048360-0001-MB Enseco ID: 111792
Matrix: SOLID Sampled: NA Received: NA
Authorized: NA Prepared: 28 JUL 89

Sample Amount: 10.0 G
Percent Moisture: NA

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-225			
Analyzed: 04 AUG 89			
2,3,7,8-TCDF	ND	pg/g	0.12
Total TCDF	ND	pg/g	1.37

	% Recovery
13C-2,3,7,8-TCDF	110

ND=Not Detected
NA=Not Applicable

Reported by: Mike Filigenzi Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

LABORATORY REPORTS

PHASE III

JULY 1989

Enseco

2,3,7,8-TCDF plus Total TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Co.
Client ID: 108 Soil/Ash
Lab ID: 046295-0008-SA Enseco ID: NA
Matrix: SOLID Sampled: Unknown Received: 22 MAR 89
Authorized: 22 MAR 89 Prepared: 05 APR 89

Sample Amount: 10.3 G
Percent Moisture: NA

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-225			
Analyzed: 17 APR 89			
2,3,7,8-TCDF	0.49	pg/g	--
Total TCDF	4.9	pg/g	--

	% Recovery
13C-2,3,7,8-TCDF	70

ND=Not Detected
NA=Not Applicable

Reported by: Mike Filigenzi Approved by: Bill Luksemburg

The cover letter is an integral part of this report.

2,3,7,8-TCDF plus Total TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Co.
Client ID: 107 Soil
Lab ID: 046295-0007-SA   Enseco ID: NA
Matrix: SOLID   Sampled: Unknown   Received: 22 MAR 89
Authorized: 22 MAR 89   Prepared: 05 APR 89

Sample Amount: 10.6 G
Percent Moisture: NA

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-225			
Analyzed: 14 APR 89			
2,3,7,8-TCDF	ND	pg/g	0.10
Total TCDF	ND	pg/g	0.20

	% Recovery
13C-2,3,7,8-TCDF	77

ND=Not Detected
NA=Not Applicable

Reported by: Mike Filigenzi   Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

Enseco

2,3,7,8-TCDF plus Total TCDF

HIGH RESOLUTION

Amended

Client Name: Georgia Pacific Co.
Client ID: 106 Grass
Lab ID: 046295-0006-SA Enseco ID: NA
Matrix: SOLID Sampled: Unknown Received: 22 MAR 89
Authorized: 22 MAR 89 Prepared: 07 APR 89

Sample Amount: 6.36 G
Percent Moisture: NA

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-225			
Analyzed: 17 APR 89			
2,3,7,8-TCDF	ND	pg/g	0.23
Total TCDF	ND	pg/g	0.23

	% Recovery
13C-2,3,7,8-TCDF	84

N.D. = Not Detected
N.A. = Not Applicable

Reported by: Mike Filigenzi Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

2,3,7,8-TCDF plus Total TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Co.
Client ID: 105 Grass
Lab ID: 046295-0005-SA Enseco ID: NA
Matrix: SOLID Sampled: Unknown Received: 22 MAR 89
Authorized: 22 MAR 89 Prepared: 07 APR 89

Sample Amount: 5.61 G
Percent Moisture: NA

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-225			
Analyzed: 17 APR 89			
2,3,7,8-TCDF	ND	pg/g	0.42
Total TCDF	ND	pg/g	0.42

	% Recovery
13C-2,3,7,8-TCDF	77

ND=Not Detected
NA=Not Applicable

Reported by: Mike Filigenzi Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

Enseco

2,3,7,8-TCDF plus Total TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Co.
Client ID: METHOD BLANK
Lab ID: 046295-0004-MB Enseco ID: NA
Matrix: SOLID Sampled: Unknown Received: 22 MAR 89
Authorized: 22 MAR 89 Prepared: 05 APR 89

Sample Amount: 10.0 G
Percent Moisture: NA

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-5			
Analyzed: 10 APR 89			
2,3,7,8-TCDF	ND	pg/g	0.090
Total TCDF	ND	pg/g	0.090

	% Recovery
13C-2,3,7,8-TCDF	61

ND=Not Detected
NA=Not Applicable

Reported by: Mike Filigenzi Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

2,3,7,8-TCDF plus Total TCDF

Enseco

HIGH RESOLUTION

Client Name: Georgia Pacific Co.
Client ID: 104 Soil/Ash
Lab ID: 046295-0004-SA Enseco ID: NA
Matrix: SOLID Sampled: Unknown Received: 22 MAR 89
Authorized: 22 MAR 89 Prepared: 05 APR 89

Sample Amount: 10.0 G
Percent Moisture: NA

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-5			
Analyzed: 10 APR 89			
2,3,7,8-TCDF	ND	pg/g	0.11
Total TCDF	ND	pg/g	0.22

	% Recovery
13C-2,3,7,8-TCDF	83

Note: Sample No. 104 was incorrectly labeled on the chain-of-custody record as Soil/Ash. This sample was taken at the Control Plot and no ash is present at that location.
D. W. Lice (Georgia Pacific)
12-20-89

ND=Not Detected
NA=Not Applicable

Reported by: Mike Filigenzi Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

Enseco

2,3,7,8-TCDF plus Total TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Co.
Client ID: METHOD BLANK
Lab ID: 046295-0003-MB Enseco ID: NA
Matrix: SOLID Sampled: Unknown Received: 22 MAR 89
Authorized: 22 MAR 89 Prepared: 05 APR 89

Sample Amount: 10.0 G
Percent Moisture: NA

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-5			
Analyzed: 10 APR 89			
2,3,7,8-TCDF	ND	pg/g	0.11
Total TCDF	ND	pg/g	0.11

	% Recovery
13C-2,3,7,8-TCDF	75

ND=Not Detected
NA=Not Applicable

Reported by: Mike Filigenzi Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

2,3,7,8-TCDF plus Total TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Co.
Client ID: 103 Soil
Lab ID: 046295-0003-SA   Enseco ID: NA
Matrix: SOLID   Sampled: Unknown   Received: 22 MAR 89
Authorized: 22 MAR 89   Prepared: 05 APR 89

Sample Amount: 10.2 G
Percent Moisture: NA

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-5			
Analyzed: 10 APR 89			
2,3,7,8-TCDF	ND	pg/g	0.092
Total TCDF	ND	pg/g	0.18

	% Recovery
13C-2,3,7,8-TCDF	74

ND=Not Detected
NA=Not Applicable

Reported by: Mike Filigenzi   Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

Enseco

2,3,7,8-TCDF plus Total TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Co.
Client ID: 102 Grass
Lab ID: 046295-0002-SA Enseco ID: NA
Matrix: SOLID Sampled: Unknown Received: 22 MAR 89
Authorized: 22 MAR 89 Prepared: 07 APR 89

Sample Amount: 2.97 G
Percent Moisture: NA

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-225			
Analyzed: 12 APR 89			
2,3,7,8-TCDF	ND	pg/g	0.57
Total TCDF	ND	pg/g	1.4

	% Recovery
13C-2,3,7,8-TCDF	18

ND=Not Detected
NA=Not Applicable

Reported by: Mike Filigenzi Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

2,3,7,8-TCDF plus Total TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Co.
Client ID: METHOD BLANK
Lab ID: 046295-0001-MB Enseco ID: NA
Matrix: SOLID Sampled: NA Received: NA
Authorized: NA Prepared: 07 APR 89

Sample Amount: 5.00 G
Percent Moisture: NA

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-5			
Analyzed: 12 APR 89			
2,3,7,8-TCDF	ND	pg/g	0.47
Total TCDF	ND	pg/g	0.47

	% Recovery
13C-2,3,7,8-TCDF	46

ND=Not Detected
NA=Not Applicable

Reported by: Mike Filigenzi Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

Enseco

2,3,7,8-TCDF plus Total TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Co.
Client ID: 101 Grass
Lab ID: 046295-0001-SA   Enseco ID: NA
Matrix: SOLID   Sampled: Unknown   Received: 22 MAR 89
Authorized: 22 MAR 89   Prepared: 07 APR 89

Sample Amount: 2.85 G
Percent Moisture: NA

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-225			
Analyzed: 12 APR 89			
2,3,7,8-TCDF	ND	pg/g	1.4
Total TCDF	ND	pg/g	1.5

	% Recovery
13C-2,3,7,8-TCDF	25

ND=Not Detected
NA=Not Applicable

Reported by: Mike Filigenzi   Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

Georgia-Pacific Corporation Eastern Wood Products
Manufacturing Division
P.O. Box 105603
Atlanta, Georgia 30348
Telephone (404) 521-4000
Teletype (810) 751-1000

BY WAY OF EXPLANATION

SAMPLE NO. 109 WAS TAKEN AS A MATTER OF GENERAL INTEREST AND WAS OUTSIDE THE SCOPE OF THIS STUDY. THEREFORE THESE RESULTS ARE NOT INCLUDED IN THIS REPORT.

Enseco Page 1 of 1

CHAIN-OF-CUSTODY RECORD

SAMPLER: (Signature) [signature]
Phone (707) 444-6427
Date Shipped 3-21-99
Carrier FED X
Airbill No. ~~[illegible]~~ 209809874 (ML)
Cooler No. C-01

SHIP TO:
Enseco-Cal Lab
2544 Industrial Blvd.
West Sacramento, CA 95691
(916) 372-1393
ATTENTION: Mr Bill Luxemberg

SEND RESULTS TO:
Client Name GEORGIA PACIFIC CORP.
~~Company~~ Attn: Mr Kent Mayer
Address
Phone

PROJECT NAME LITTLE VALLEY TCDF STUDY PROJECT NO. P.O. NO.

Relinquished by: (Signature)	Received by: (Signature)	Date	Time
[signature]			
Relinquished by: (Signature)	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Received at lab by: (Signature) [signature]	3-22-99	840
Relinquished from lab by: (Signature)	Received by: (Signature)	Date.	Time

ANALYSIS REQUEST

Sample ID Number	Sample Description	Date/Time Sampled	Analysis Requested	Sample Condition Upon Receipt
	101 Grass	3/20/99 1035	Total and 2,3,7,8 TCDF	good
	102 Grass	1054		
	103 Soil	1108		
	104 Soil/ash	1108		
	105 Grass	1206		
	106 Grass	1215		
	107 Soil	1245		
	108 Soil/Ash	1240		
	109 Ash	1215		

Special Instructions/Comments:

NOTE: UNUSED PORTIONS OF NON-AQUEOUS SAMPLES WILL BE RETURNED TO CLIENT

Expected
Typical ___ Immediate
TAT's: ___ Attention (200% surcharge) ___ RUSH (50-100% surcharge) X Standard

Cal Lab ID Number: *(for lab use only)*
UF295

Client Retains White Copy Only (Revised 1/87)

SAMPLE DESCRIPTION INFORMATION
for
Georgia Pacific Corp.

Lab ID	Client ID	Matrix	Sampled Date	Sampled Time	Received Date
046295-0001-SA	101 Grass	TISSUE	20 MAR 89	10:35	22 MAR 89
046295-0001-MB	Method Blank	TISSUE			22 MAR 89
046295-0002-SA	102 Grass	TISSUE	20 MAR 89	10:54	22 MAR 89
046295-0003-SA	103 Soil	SOLID	20 MAR 89	11:08	22 MAR 89
046295-0003-MB	Method Blank	SOLID			22 MAR 89
046295-0004-SA	104 Soil/Ash	SOLID	20 MAR 89	11:08	22 MAR 89
046295-0004-MB	Method Blank	SOLID			22 MAR 89
046295-0005-SA	105 Grass	TISSUE	20 MAR 89	12:06	22 MAR 89
046295-0006-SA	106 Grass	TISSUE	20 MAR 89	12:15	22 MAR 89
046295-0007-SA	107 Soil	SOLID	20 MAR 89	12:45	22 MAR 89
046295-0008-SA	108 Soil/Ash	SOLID	20 MAR 89	12:40	22 MAR 89
046295-0009-SA	109 Ash	SOLID	20 MAR 89	12:15	22 MAR 89

I Sample Description

See the attached Sample Description Information.

The samples were received under chain-of-custody.

II Analysis Request

The following analytical tests were requested.

Lab ID	Analysis Description
046295-1 Thru 9	2,3,7,8-TCDF plus Total TCDF

III Quality Control

A. Project Specific QC. No project specific QC (i.e., spikes and/or duplicates) was requested.

B. Method Blank Results. A method blank is a laboratory-generated sample which assesses the degree to which laboratory operations and procedures cause false-positive analytical results for your samples.

No target parameters were detected in the method blanks associated with your samples at the reporting limit levels noted on the data sheets in the Analytical Results section.

IV Analysis Results

Test methods may include minor modifications of published EPA Methods such as reporting limits or parameter lists. Reporting limits are adjusted to reflect dilution of the sample, when appropriate. Solid and waste samples are reported on an "as received" basis; i.e., no correction is made for moisture content. All data is "blank corrected" by subtracting the level of contamination, if any, found in the laboratory method blank from the analytical result before it is reported.

Results are on the attached data sheets.

Enseco

April 20, 1989
Lab ID: 046295

Kent Mayer
Georgia Pacific Corp.
P.O. Box 1618
Eugene, Oregon 97440

Dear Mr. Mayer:

Enclosed is the report for the four tissue, two soil, and three ash samples for your Little Valley TCDF Study which were received at Enseco-Cal Lab on 22 March 1989.

The report consists of the following sections:

I Sample Description
II Analysis Request
III Quality Control Report
IV Analysis Results

If you have any questions, please feel free to call.

Sincerely,

William J. Luksemburg
Principal Scientist

ddr

Enseco Incorporated
2544 Industrial Boulevard
West Sacramento, California 95691
916/372-1393 Fax: 916/372-1059

LABORATORY REPORTS

PHASE II

MARCH 1989

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: Method Blank
Lab ID: 044527-0019-MB Enseco ID: NA
Matrix: AQUEOUS Sampled: NA Received: NA
Authorized: NA Prepared: 07 DEC 88

Sample Amount: 0.150 L

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-5			
Analyzed: 24 JAN 89			
2,3,7,8-TCDF	ND	pg/L	18
Total TCDF	ND	pg/L	18

	% Recovery
13C-2,3,7,8-TCDF	83

ND=Not Detected
NA=Not Applicable

Reported by: Chuck Pudwill Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

Enseco

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: 19
Lab ID: 044527-0017-SA Enseco ID: 78854
Matrix: AQUEOUS Sampled: 17 NOV 88 Received: 19 NOV 88
Authorized: 23 NOV 88 Prepared: 10 JAN 89

Sample Amount: 0.050 L

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-5			
Analyzed: 24 JAN 89			
2,3,7,8-TCDF	ND	pg/L	99
Total TCDF	ND	pg/L	99

	% Recovery
13C-2,3,7,8-TCDF	69

ND=Not Detected
NA=Not Applicable

Reported by: Chuck Pudwill Approved by: Bill Luksemburg

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Version 070187

Enseco

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: 18
Lab ID: 044527-0020-SA Enseco ID: 78857
Matrix: AQUEOUS Sampled: 17 NOV 88 Received: 19 NOV 88
Authorized: 23 NOV 88 Prepared: 07 DEC 88

Sample Amount: 0.163 L

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-225			
Analyzed: 27 JAN 89			
2,3,7,8-TCDF	ND	pg/L	24
Total TCDF	ND	pg/L	24

	% Recovery
13C-2,3,7,8-TCDF	121

ND=Not Detected
NA=Not Applicable

Reported by: Chuck Pudwill Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

Enseco

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: 17
Lab ID: 044527-0019-SA Enseco ID: 78856
Matrix: AQUEOUS Sampled: 17 NOV 88 Received: 19 NOV 88
Authorized: 23 NOV 88 Prepared: 07 DEC 88

Sample Amount: 0.130 L

Parameter	Result	Units	Detection Limit
Furans Column Type: DB-5 Analyzed: 24 JAN 89			
2,3,7,8-TCDF	ND	pg/L	23
Total TCDF	ND	pg/L	23

	% Recovery
13C-2,3,7,8-TCDF	96

ND=Not Detected
NA=Not Applicable

ported by: Chuck Pudwill Approved by: Bill Luksemburg

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Version 070187

Enseco

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: Method Blank
Lab ID: 044527-0016-MB Enseco ID: NA
Matrix: AQUEOUS Sampled: NA Received: NA
Authorized: NA Prepared: 07 DEC 88

Sample Amount: 0.500 L

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-5			
Analyzed: 24 JAN 89			
2,3,7,8-TCDF	ND	pg/L	52
Total TCDF	ND	pg/L	52

	% Recovery
13C-2,3,7,8-TCDF	72

ND=Not Detected
NA=Not Applicable

Reported by: Chuck Pudwill Approved by: Bill Luksemburg

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Enseco

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: 16
Lab ID: 044527-0016-SA Enseco ID: NA
Matrix: AQUEOUS Sampled: 17 NOV 88 Received: 19 NOV 88
Authorized: 23 NOV 88 Prepared: 07 DEC 88

Sample Amount: 0.191 L

Parameter	Result	Units	Detection Limit
Furans Column Type: DB-5 Analyzed: 24 JAN 89			
2,3,7,8-TCDF	ND	pg/L	34
Total TCDF	ND	pg/L	34

	% Recovery
13C-2,3,7,8-TCDF	75

ND=Not Detected
NA=Not Applicable

Reported by: Chuck Pudwill Approved by: Bill Luksemburg

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Enseco

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: 15
Lab ID: 044527-0015-SA Enseco ID: 78851
Matrix: TISSUE Sampled: 17 NOV 88 Received: 19 NOV 88
Authorized: 23 NOV 88 Prepared: 11 JAN 89

Sample Amount: 10.00 G

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-225			
Analyzed: 25 JAN 89			
2,3,7,8-TCDF	ND	pg/g	0.24
Total TCDF	ND	pg/g	0.24

	% Recovery
13C-2,3,7,8-TCDF	111

ND=Not Detected
NA=Not Applicable

Reported by: Pat Buddrus Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
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2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: 14
Lab ID: 044527-0014-SA   Enseco ID: 78850
Matrix: TISSUE   Sampled: 16 NOV 88   Received: 19 NOV 88
Authorized: 23 NOV 88   Prepared: 11 JAN 89

Sample Amount: 9.5 G

Parameter	Result	Units	Detection Limit
Furans Column Type: DB-225 Analyzed: 25 JAN 89			
2,3,7,8-TCDF	ND	pg/g	0.23
Total TCDF	ND	pg/g	0.23

	% Recovery
13C-2,3,7,8-TCDF	121

ND=Not Detected
NA=Not Applicable

Reported by: Pat Buddrus   Approved by: Bill Luksemburg

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Version 070187

Enseco

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: 13
Lab ID: 044527-0013-SA Enseco ID: 78849
Matrix: TISSUE Sampled: 16 NOV 88 Received: 19 NOV 88
Authorized: 23 NOV 88 Prepared: 11 JAN 89

Sample Amount: 10.0 G

Parameter	Result	Units	Detection Limit
Furans Column Type: DB-5 Analyzed: 24 JAN 89			
2,3,7,8-TCDF	ND	pg/g	0.37
Total TCDF	ND	pg/g	0.37

	% Recovery
13C-2,3,7,8-TCDF	101

ND=Not Detected
NA=Not Applicable

Reported by: Chuck Pudwill Approved by: Bill Luksemburg

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Enseco

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: 12
Lab ID: 044527-0012-SA Enseco ID: NA
Matrix: SOLID Sampled: 16 NOV 88 Received: 19 NOV 88
Authorized: 23 NOV 88 Prepared: 30 NOV 88

Sample Amount: 10.5 G

Parameter	Result	Units	Detection Limit
Furans Column Type: DB-5 Analyzed: 19 NOV 88			
2,3,7,8-TCDF	ND	pg/g	0.76
Total TCDF	ND	pg/g	0.76

	% Recovery
13C-2,3,7,8-TCDF	23

ND=Not Detected
NA=Not Applicable

Reported by: Pat Buddrus Approved by: Bill Luksemburg

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Version 070187

Enseco

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: 11
Lab ID: 044527-0011-SA   Enseco ID: 78847
Matrix: SOLID   Sampled: 16 NOV 88   Received: 19 NOV 88
Authorized: 23 NOV 88   Prepared: 30 NOV 88

Sample Amount: 10.0 G

Parameter	Result	Units	Detection Limit
Furans Column Type: DB-5 Analyzed: 19 JAN 89			
2,3,7,8-TCDF	ND	pg/g	0.88
Total TCDF	ND	pg/g	0.88

	% Recovery
13C-2,3,7,8-TCDF	41

ND=Not Detected
NA=Not Applicable

Reported by: Pat Buddrus   Approved by: Bill Luksemburg

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Version 070187

Enseco

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: 10
Lab ID: 044527-0010-SA   Enseco ID: 78846
Matrix: TISSUE   Sampled: 16 NOV 88   Received: 19 NOV 88
Authorized: 23 NOV 88   Prepared: 11 JAN 89

Sample Amount: 9.1 G

Parameter	Result	Units	Detection Limit
Furans Column Type: DB-225 Analyzed: 25 JAN 89			
2,3,7,8-TCDF	ND	pg/g	0.20
Total TCDF	ND	pg/g	0.20

	% Recovery
13C-2,3,7,8-TCDF	124

ND=Not Detected
NA=Not Applicable

Reported by: Pat Buddrus   Approved by: Bill Luksemburg

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Version 070187

Enseco

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: 9
Lab ID: 044527-0009-SA Enseco ID: 78845
Matrix: TISSUE Sampled: 16 NOV 88 Received: 19 NOV 88
Authorized: 23 NOV 88 Prepared: 11 JAN 89

Sample Amount: 10.1 G

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-225			
Analyzed: 25 JAN 89			
2,3,7,8-TCDF	ND	pg/g	0.23
Total TCDF	ND	pg/g	0.23

	% Recovery
13C-2,3,7,8-TCDF	114

ND=Not Detected
NA=Not Applicable

Reported by: Pat Buddrus Approved by: Bill Luksemburg

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Version 070187

Enseco

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: 8
Lab ID: 044527-0008-SA Enseco ID: NA
Matrix: SOLID Sampled: 16 NOV 88 Received: 19 NOV 88
Authorized: 23 NOV 88 Prepared: 28 DEC 88

Sample Amount: 10.2 G

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-5			
Analyzed: 10 JAN 89			
2,3,7,8-TCDF	ND	pg/g	5.2
Total TCDF	ND	pg/g	6.6

	% Recovery
13C-2,3,7,8-TCDF	12

ND=Not Detected
NA=Not Applicable

Reported by: Mike Filigenzi MM Approved by: Bill Luksemburg

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Version 070187

Enseco

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: 7
Lab ID: 044527-0007-SA Enseco ID: 78843
Matrix: SOLID Sampled: 16 NOV 88 Received: 19 NOV 88
Authorized: 23 NOV 88 Prepared: 11 JAN 89

Sample Amount: 7.00 G

Parameter	Result	Units	Detection Limit
Furans Column Type: DB-225 Analyzed: 25 JAN 89			
2,3,7,8-TCDF	ND	pg/g	0.36
Total TCDF	ND	pg/g	0.36

	% Recovery
13C-2,3,7,8-TCDF	123

ND=Not Detected
NA=Not Applicable

Reported by: Pat Buddrus Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

Enseco

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: 6 Duplicate
Lab ID: 044527-0006-DU Enseco ID: 79392
Matrix: SOLID Sampled: 16 NOV 88 Received: 19 NOV 88
Authorized: 23 NOV 88 Prepared: 30 NOV 88

Sample Amount: 10.0 G

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-5			
Analyzed: 19 JAN 89			
2,3,7,8-TCDF	ND	pg/g	0.85
Total TCDF	ND	pg/g	0.85

	% Recovery
13C-2,3,7,8-TCDF	55

ND=Not Detected
NA=Not Applicable

Reported by: Pat Buddrus Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

Enseco

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: 6
Lab ID: 044527-0006-SA Enseco ID: 78842
Matrix: SOLID Sampled: 16 NOV 88 Received: 19 NOV 88
Authorized: 23 NOV 88 Prepared: 30 NOV 88

Sample Amount: 10.0 G

Parameter	Result	Units	Detection Limit
Furans			
Column Type: DB-5			
Analyzed: 18 JAN 89			
2,3,7,8-TCDF	ND	pg/g	0.59
Total TCDF	ND	pg/g	0.59

	% Recovery
13C-2,3,7,8-TCDF	51

ND=Not Detected
NA=Not Applicable

Reported by: Pat Buddrus Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

Enseco

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: 5
Lab ID: 044527-0005-SA   Enseco ID: 78840
Matrix: TISSUE   Sampled: 16 NOV 88   Received: 19 NOV 88
Authorized: 23 NOV 88   Prepared: 11 JAN 89

Sample Amount: 7.30 G

Parameter	Result	Units	Detection Limit
Furans Column Type: DB-225 Analyzed: 25 JAN 89			
2,3,7,8-TCDF	ND	pg/g	0.30
Total TCDF	ND	pg/g	0.30

	% Recovery
13C-2,3,7,8-TCDF	105

ND=Not Detected
NA=Not Applicable

Reported by: Pat Buddrus   Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

Enseco

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: 3
Lab ID: 044527-0003-SA Enseco ID: 78838
Matrix: SOLID Sampled: 16 NOV 88 Received: 19 NOV 88
Authorized: 23 NOV 88 Prepared: 11 JAN 89

Sample Amount: 8.20 G

Parameter	Result	Units	Detection Limit
Furans Column Type: DB-225 Analyzed: 25 JAN 89			
2,3,7,8-TCDF	ND	pg/g	0.32
Total TCDF	ND	pg/g	0.32

	% Recovery
13C-2,3,7,8-TCDF	104

ND=Not Detected
NA=Not Applicable

Reported by: Pat Buddrus Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

Enseco

2,3,7,8-TCDF and TOTAL TCDF

HIGH RESOLUTION

Client Name: Georgia Pacific Corp.
Client ID: Method Blank
Lab ID: 044527-MB Enseco ID: NA
Matrix: SOLID Sampled: NA Received: NA
Authorized: NA Prepared: 30 NOV 88

Sample Amount: 10.0 G

Parameter	Result	Units	Detection Limit
Furans Column Type: DB-5 Analyzed: 18 JAN 89			
2,3,7,8-TCDF	ND	pg/g	0.18
Total TCDF	ND	pg/g	0.18

	% Recovery
13C-2,3,7,8-TCDF	61

ND=Not Detected
NA=Not Applicable

Reported by: Pat Buddrus PB Approved by: Bill Luksemburg WJL

The cover letter is an integral part of this report.
Version 070187

Enseco

2,3,7,8-TCDF

QUALITY CONTROL SUMMARY

Client Name: Georgia Pacific Corp.
Client ID: 1 Method Blank Native Spike
Lab ID: 044527-0001-MBNS Enseco ID: NA
Matrix: SOLID Sampled: 15 NOV 88 Received: 19 NOV 88
Authorized: 23 NOV 88 Prepared: 30 NOV 88 Analyzed: 19 JAN 89

Sample Amount: 10.0 G
Column Type: DB-5

Parameters	Total ng Found in Sample	Total ng Spiked	Total ng Found in NS Sample	% Recovery
Furans				
Tetra (2378)	ND	1000	1000	100

	% Recovery
13C-2,3,7,8-TCDF	69

ND=Not Detected
NA=Not Applicable

Reported by: Pat Buddrus Approved by: Bill Luksemburg

The cover letter is an integral part of this report.
Version 070187

Georgia-Pacific Corporation *Eastern Wood Products*
Manufacturing Division
P.O. Box 105603
Atlanta, Georgia 30348
Telephone (404) 521-4000
Teletype (810) 751-1000

BY WAY OF EXPLANATION

SAMPLES NO. 1, NO. 2, NO. 4 AND NO. 20 WERE TAKEN AS A MATTER OF GENERAL INTEREST AND WERE OUTSIDE THE SCOPE OF THIS STUDY. THEREFORE THESE RESULTS ARE NOT INCLUDED IN THIS REPORT.

Enseco

CHAIN-OF-CUSTODY RECORD

SAMPLER: (Signature) Martin E. [signature]
Phone (707) 444-0427

Date Shipped 11-17-88
UPS No. 1290 9397 997

Carrier United Postal Service
Cooler No. E159

SHIP TO:
Enseco-Cal Lab
2544 Industrial Blvd.
West Sacramento, CA 95691
(916) 372-1393
ATTENTION: Bill Luxemburg

SEND RESULTS TO:
Client Name Attn: Kent Meyer
Company Georgia-Pacific Corp.
Address P.O. Box 1618
Eugene, OR 97440
Phone (503) 689-1221

PROJECT NAME Little Valley TCDF Study PROJECT NO. — P.O. NO.

Relinquished by: (Signature)	Received by: (Signature)	Date	Time
Martin E. [signature]			
Relinquished by: (Signature)	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Received at lab by: (Signature)	Date	Time
	Kelly B[signature]	11-19-88	930
Relinquished from lab by: (Signature)	Received by: (Signature)	Date	Time

ANALYSIS REQUEST

Sample ID Number	Sample Description	Date/Time Sampled	Analysis Requested	Sample Condition Upon Receipt
11	Soil	11/16/88	Total + 2,3,7,8 TCDF	Good
12	Soil	11/16/88	" " "	
13	Worms	11/17/88	" " "	
14	Worms	11/16/88	" " "	
15	Worms	11/17/88	" " "	
16	Distilled Water Field Blank	11/17/88	" " "	
~~17~~	~~Acetone Field Blank~~	~~11/17/88~~	~~" " "~~	
~~18~~	~~Hexane Field Blank~~	~~11/17/88~~	~~" " "~~	
19	Liquinox Field Blank	11/17/88	" " "	
20	Char/soil	11/17/88	Total " "	

Special Instructions/Comments:
* # 18 → Hexane & Acetone blanks to be shipped separately
\# 17 → Analyze all samples as noted

NOTE: UNUSED PORTIONS OF NON-AQUEOUS SAMPLES WILL BE RETURNED TO CLIENT

Expected Analytical T.A.T's: ____ Immediate Attention (200% surcharge) ____ RUSH (50-100% surcharge) X Standard

Cal Lab ID Number: *(for lab use only)*

Enseco

CHAIN-OF-CUSTODY RECORD

SAMPLER: (Signature) Martin E. Fay
Phone (707) 444-0427

Date Shipped 11-17-88
Airbill No. 1290 9397 997
UPS

Carrier United Postal Service
Cooler No. E159

SHIP TO:
Enseco-Cal Lab
2544 Industrial Blvd.
West Sacramento, CA 95691
(916) 372-1393
ATTENTION: Bill Luxenburg

SEND RESULTS TO:
Client Name Attn: Kent Mayer
Company Georgia-Pacific Corp.
Address P.O. Box 1618
Eugene, OR 97440
Phone (503) 689-1221

PROJECT NAME Little Valley TCDF Study PROJECT NO. N/A P.O. NO.

		Date	Time
Relinquished by: (Signature) Martin E. Fay	Received by: (Signature)		
Relinquished by: (Signature)	Received by: (Signature)		
Relinquished by: (Signature)	Received at lab by: (Signature)	11-19 88	930
Relinquished from lab by: (Signature)	Received by: (Signature)		

ANALYSIS REQUEST

Sample ID Number	Sample Description	Date/Time Sampled	Analysis Requested	Sample Condition Upon Receipt
1	char/soil	11/15/88	Total + 2,3,7,8 TCDF	Good
2	char/soil	11/15/88	" " "	
3	Grass	11/16/88	" " "	
4	Soil	11/16/88	" " "	
5	Worms	11/16/88	" " "	
6	Soil	11/16/88	" " "	
7	Grass	11/16/88	" " "	
8	Soil	11/16/88	" " "	
9	Grass	11/16/88	" " "	
10	Grass	11/16/88	" " "	

Special Instructions/Comments:

Analyze all samples as noted

NOTE: UNUSED PORTIONS OF NON-AQUEOUS SAMPLES WILL BE RETURNED TO CLIENT

Expected Analytical T.A.T's: ____ Immediate Attention (200% surcharge) ____ RUSH (50-100% surcharge) X Standard

Cal Lab ID Number: (for lab use only)

CALLAB-044527

nseco, Inc. - Cal Lab Analytical
544 [illegible]dustrial Bvd.
e[illegible]cramento, California 95691
9[illegible] 372-1393

Date Received : 18 NOV 88 08:45

---

r. Kent Mayer
eorgia Pacific Corp. -
.O. Box 1618
ugene, Oregon 97440

503) 689-1221

Project ID,
EPA Case, RMA Lot : GEPOR01 Little Valley TCDF Study
P.O. Number :
Delivered By :
Storage Location : F2 R1
Logged in by : KGONYEA

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0 samples (12 solids, 4 liquid, & 4 tissues) were received under
hain of custody in 8oz. CGJ. (20). Delivered by Fed. Ex.

AL ID	Enseco ID	Client's label info	Date/Time Samp.	Containers
44527-0001-SA	78835	1	15 NOV 88	8oz. CGJ
44527-0001-MB	78836	Method Blank		
44527-0002-SA	78837	2	15 NOV 88	8oz. CGJ
445[illegible]-0003-SA	78838	3	16 NOV 88	8oz. CGJ
44[illegible]0004-SA	78839	4	16 NOV 88	8oz. CGJ
4[illegible]-0005-SA	78840	5	16 NOV 88	8oz. CGJ
44527-0005-MB	78841	Method Blank		
44527-0006-SA	78842	6	16 NOV 88	8oz. CGJ
44527-0007-SA	78843	7	16 NOV 88	8oz. CGJ
44527-0008-SA	78844	8	16 NOV 88	8oz. CGJ
44527-0009-SA	78845	9	16 NOV 88	8oz. CGJ
44527-0010-SA	78846	10	16 NOV 88	8oz. CGJ
44527-0011-SA	78847	11	16 NOV 88	8oz. CGJ
44527-0012-SA	78848	12	16 NOV 88	8oz. CGJ
44527-0013-SA	78849	13	16 NOV 88	8oz. CGJ
44527-0014-SA	78850	14	16 NOV 88	8oz. CGJ
44527-0015-SA	78851	15	17 NOV 88	8oz. CGJ
44527-0016-SA	78852	16	17 NOV 88	8oz. CGJ
44527-0016-MB	78853	Method Blank		
44527-0017-SA	78854	19	17 NOV 88	8oz. CGJ
44527-0018-SA	78859	20	17 NOV 88	8oz. CGJ
44527-0019-SA	78856	17	17 NOV 88	8oz. CGJ
44527-0020-SA	78857	18	17 NOV 88	8oz. CGJ

Samples not destroyed in testing are retained a maximum of thirty (30) days unless otherwise requested.

lient Manager: Bill Luksemburg

I Sample Description

See the attached Sample Description Information.

The samples were received under chain-of-custody.

II Analysis Request

The following analytical test was requested.

Lab ID	Analysis Description
044527-0001 through 20	2,3,7,8-TCDF and Total TCDF

III Quality Control

A. **Project Specific QC.** As requested, QC matrix spikes were performed using your samples. Results are on the attached data sheets.

B. **Method Blank Results.** A method blank is a laboratory-generated sample which assesses the degree to which laboratory operations and procedures cause false-positive analytical results for your samples.

No target parameters were detected in the method blanks associated with your samples at the reporting limit levels noted on the data sheets in the Analytical Results section.

IV Analysis Results

Test methods may include minor modifications of published EPA Methods such as reporting limits or parameter lists. Reporting limits are adjusted to reflect dilution of the sample, when appropriate. Solid and waste samples are reported on an "as received" basis; i.e., no correction is made for moisture content. All data is "blank corrected" by subtracting the level of contamination, if any, found in the laboratory method blank from the analytical result before it is reported.

Results are on the attached data sheets.

Enseco

January 30, 1989
Lab ID: 044527

Kent Mayer
Georgia Pacific Corporation
P. O. Box 1618
Eugene, OR 97440

Dear Mr. Mayer:

Enclosed is the report for the twelve solid, four tissue, and four liquid samples for your Little Valley TCDF Study which were received at Enseco-Cal Lab on 18 November 1988.

The report consists of the following sections:

I Sample Description
II Analysis Request
III Quality Control Report
IV Analysis Results

Your samples "4" and "8" had lower than normal recoveries of the internal standards. These samples are being re-extracted and will be reported as soon as the data are available. Also, the Cl_4-Cl_8 analysis which you requested on your samples will be reported when that analysis is complete.

If you have any questions, please feel free to call.

Sincerely,

William J. Luksemburg
Principal Scientist

gwm

Enseco Incorporated
2544 Industrial Boulevard
West Sacramento, California 95691
916/372-1393 Fax: 916/372-1059