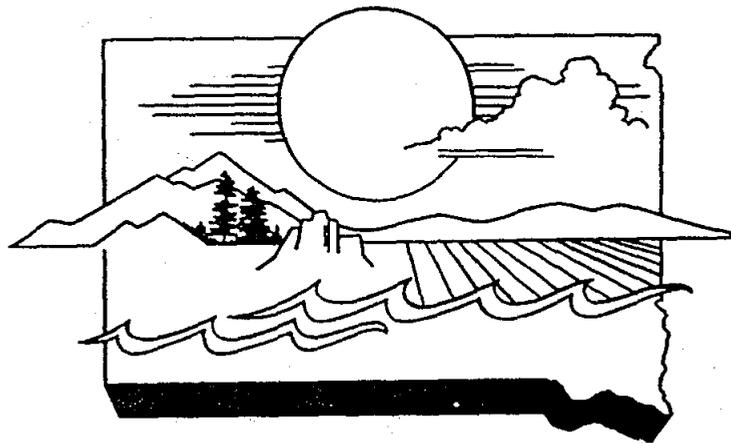


# **PCB, Dioxin/Furan Study Colman, South Dakota**



**South Dakota Department of Environment  
and Natural Resources**

**Division of Environmental Regulation**

**Point Source Control Program**

**November, 1991**



PHASE I

- a. Perform background search
- b. Develop an environmental sampling plan
- c. Perform environmental sampling

PHASE II

- a. Begin air monitoring in Colman
- b. Take additional environmental samples

PHASE III

- a. Stack testing of transformer reclamation furnaces

#### STUDY GOALS

1. Determine environmental contamination levels
2. Confirm 1977 sampling results
3. Determine need for additional regulations

SEPTEMBER, 1977

- SDSU journalism student, Kevin Woster, takes samples
- 3 sites sampled, PCBs found in all samples
- possible cross-contamination of samples

GREICHUS AND DOHMAN - SEPTEMBER, 1977

- took environmental and biologic samples
- Aroclor 1260 (PCB) found in all samples
- PCB levels higher in Colman samples than Brookings samples

SD DER/US EPA/US FDA STUDY - NOVEMBER, 1977

- 42 environmental samples taken
- PCBs found in prevailing wind directions
- No PCBs found in Colman water or food supply

SD DER AQUATIC SAMPLING - MAY, 1979

- 11 fish and 11 crayfish collected from Bachelor Creek
- Analyzed for Aroclors 1260, 1254, and 1242
- Aroclor 1260 found in all samples

SD DER AQUATIC SAMPLING - JUNE, 1980

- Crayfish collected from Bachelor Creek
- Analyzed for Aroclors 1260, 1254, and 1242
- All isomer were non-detectable

CONCLUSIONS FROM 1977-1979 SAMPLING EFFORTS

1. Transformer core and oil burning releasing airborne PCBs
2. EPA recommends upgrades of transformer furnaces
3. Citation issued for discharge of PCBs into sewage lagoon

SD DENR STUDY - 1990

- 8 sampling sites
- Sampled media included soil, sediments, water, surface wipe
- Samples analyzed for PCBs, Dioxins, Furans

SAMPLING SITE 1

- Background site
- Sampled soil, surface wipes, water, sediment
- PCBs and dioxins/furans non-detectable

#### SAMPLING SITE 2

- Bachelor Creek down stream of Colman sewage lagoon
- Sampled water, sediment, and fish
- PCBs and dioxins/furans non-detectable

SAMPLING SITE 3

- South side of Hwy 34 - down stream of T&R Electric
- Sampled water and sediment
- Sediment 630 ppb & 106 ppb PCB - water non-detectable

SAMPLING SITE 4

- Confluence of Bachelor Creek - down stream of Colman
- Sampled water and sediment
- PCBs and dioxins/furans non-detectable

SAMPLING SITE 5

- Colman city park
- Sampled soil and surface wipes
- PCBs and dioxins/furans non-detectable

SAMPLING SITE 6

Roda property south of Ross Electric

Sampled soil and surface wipes

PCBs 2800 ppb & 2080 ppb / Furans less than 1 ppb

SAMPLING SITE 7

- 1 mile north of Hwy 34 and Colman
- Sampled soil and surface wipes
- PCBs and dioxins/furans non-detectable

SAMPLING SITE 8

- 1 mile south of Hwy 34 and Colman city park
- Sampled soil and surface wipes
- PCBs and dioxins/furans non-detectable

#### CONCLUSIONS OF 1990 STUDY

1. Contamination levels found in 1990 are lower than in 1977
2. EPA toxicologist concluded NO threats to human health
3. Additional regulations not needed at this time

SAMPLING SITE 1 - 1990

- Equivalent to sample 41 - 1977
- Sample 41 - less than 2 ppb PCB
- Site 1 - Non-detectable for all analytes

SAMPLING SITE 2 - 1990

- Equivalent to samples 12 & 13 - 1977
- Samples 12 & 13 - 0.5 ppb and 6.8 ppb PCB
- Site 2 - Non-detectable for all analytes

SAMPLING SITE 3 - 1990

- Equivalent to samples 36 & 37 - 1977
- Samples 36 & 37 - 1.25 ppb and 10,370 ppb PCB
- Site 3 - 2 samples showed 630 ppb and 106 ppb PCB

SAMPLING SITE 4 - 1990

- Equivalent to sample 16 - 1977
- Sample 16 - less than 0.2 ppb PCB
- Site 4 - non-detectable for all analytes

SAMPLING SITE 5 - 1990

- No equivalent in 1977 study
- Site 5 - non-detectable for all analytes

SAMPLING SITE 6 - 1990

- Equivalent to sample 10 - 1977
- Sample 10 - 409.9 ppb PCB
- Site 6 - 2 samples 2800 ppb & 2080 ppb PCB/ <1 ppb furan

SAMPLING SITE 7 - 1990

- Equivalent to samples 22 & 23 - 1977
- Samples 22 & 23 - 11.5 ppb and 7.2 ppb PCB
- Site 7 - non-detectable for all analytes

SAMPLING SITE 8 - 1990

- No equivalent in 1977 study
- Site 8 - non-detectable for all analytes



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VIII

999 18th STREET - SUITE 500  
DENVER, COLORADO 80202-2405

OCT 22 1991

Ref: 8AT-TO

Mr. Tim Tollesfrud, Administrator  
Point Source Control Program  
Department of Environment  
and Natural Resources  
Joe Foss Building  
523 East Capitol  
Pierre, South Dakota 57501-3181



Dear Mr. Tollesfrud:

I have reviewed the data sent to me by Mr. Mike Pochop concerning the environmental sampling at Colman, South Dakota, and discussed relevant aspects of the sampling with him. Based on these data, I do not consider these concentrations of PCBs and dibenzofurans, in this context, to represent a significant threat to public health.

PCBs (Aroclor 1260) concentrations of 2.1 and 2.8 ppm, and tetra- and pentachlorinated dibenzofurans estimated to be toxicologically equivalent to from zero to 0.4 ppb tetrachlorinated dibenzodioxin (see Enclosure 2 for a description of the method and calculations) were found in soil on the Roda family farm. In addition, 0.6 ppm Aroclor 1260 was found in sediment from Bachelor Creek south of Highway 34, and there is a potential finding of 0.1 ppm Arochlor 1260 in the Colman sewage lagoon sediment.

In order to evaluate the toxicity of chlorinated dibenzofurans in soil, the U.S. Environmental Protection Agency (EPA) uses a method of relating soil concentrations of these chemicals to "toxicity equivalents" of tetrachlorinated dioxin, or TCDD. One ppb "TCDD equivalents" is used informally as the maximum level acceptable in residential soil. Based on this method the toxicity of the dibenzofuran congeners found at Colman are estimated to be equivalent to that of from 0.0 to 0.4 ppb TCDD, or less than half the concentration generally used as a guideline.

The health hazards of PCBs in soils can be evaluated based either on carcinogenicity or on non-cancer effects (see Enclosure 1 for a summary of the health and environmental effects of PCBs). Usually these risks are estimated for the most sensitive member of the population. For this problem, I chose a child to represent the most sensitive segment of the population. The amount of daily intake of Aroclor 1260 not likely to produce

adverse effects in a child is estimated to be 100 ug per day. This estimate is taken from EPA's Office of Drinking Water Health Advisories, which are guidelines for contaminants in drinking water. As a "reasonable worst case" scenario, I assumed that a child would eat 200 mg of contaminated soil at the Roda farm daily. Children with true pica may eat much more soil, but true pica is exceedingly rare; 200 mg is the more commonly found daily soil intake of normal children at play. At 3 ppm (3 ug/g) PCBs in soil, this is equivalent to 0.6 ug/day, or less than one percent of the Health Advisory. Thus, there is probably no need for concern that the farm soils, though contaminated, present a significant non-cancer hazard through direct ingestion. Exposure to PCBs in soils by other routes, such as by inhalation or via uptake into crops, would be expected to be much less than via ingestion.

The lifetime daily intake (in water) of Aroclor 1260 that represents a cancer risk of  $1 \times 10^{-4}$  is 1 ug/d. Therefore, the child eating 200 mg/d of soil at the Roda farm (containing 0.6 ug Aroclor 1260) would incur a cancer risk of  $0.6 \times 10^{-4}$ , or  $6 \times 10^{-5}$ . This assumes that the "child" would continue to eat soil at that rate for a lifetime of 70 years, and therefore of course represents a very conservative estimate of exposure. Because this conservative exposure scenario still produces what is generally considered a low risk (6 out of 100,000), concern for the cancer hazard these soils would present by direct ingestion should not be great despite the fact that they are contaminated.

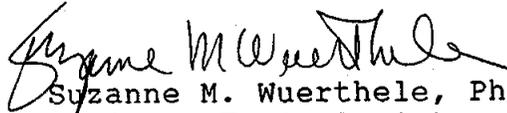
Evaluation of the human health significance of PCB contamination in Bachelor Creek sediments depends in part on the expected pathway to humans. Since the PCB concentrations in sediments are one fourth to one third those in the farm soil, they do not represent a significant threat based on direct ingestion, an unlikely pathway. Again, absorption would be expected to be much less via dermal contact with sediments.

The only potential pathway of concern from sediments to humans would be through fish tissue. PCBs are accumulated in fat tissue of aquatic organisms, and magnified in the food chain (see Enclosure 1). Therefore, if Bachelor Creek is a source of fish used for human consumption, I would recommend that sampling of those types of fish be undertaken to rule out potential exposure. Mr. Pochop mentioned that a bullhead, which is a bottom-feeding species likely to contain bioaccumulated chemicals, was tested and found to have no detectable levels of PCBs. This lessens the concern for this pathway somewhat, although I suggest that you consider the location where the fish was taken, the sample size of one and the amount of fishing in the creek in evaluating whether you should undertake further sampling.

PCBs solubilized in water are quite toxic to aquatic species. Because they are rather insoluble in water, PCBs tend to be most highly concentrated in stream sediments rather than in water, but the finding of 600 ppm in sediments suggests that there may be at least some PCBs measurable in Bachelor Creek water. This is another area that might be worth exploring further.

Please feel free to contact me at (303) 293-0961 if you have any further questions.

Sincerely,



Suzanne M. Wuerthele, Ph.D.  
Regional Toxicologist

Enclosures

cc: Mike Pochop

## ENCLOSURE 1: Health and Environmental Effects of PCBs

The following is a summary of information on health and environmental effects of PCBs, taken from EPA criteria documents and other sources.

An important point that should be emphasized to anyone concerned about PCBs is that toxicity caused by PCBs (or any chemical) is dependent on the amount of that chemical to which a person is exposed and absorbs. This in turn is dependent on a pathway (air, food or water, soil, etc) by which the chemical can reach that person. This means that toxicity is not an inevitable result of a chemical being present in the environment.

General chemistry and use of PCBs? Polychlorinated biphenyls (PCBs) are a group of about 200 structurally-related chemical compounds that are used as hydraulic fluid, in heat exchangers and as insulating fluid in electrical equipment such as capacitors and transformers. They are synthetic and do not occur naturally.

PCBs are frequently contaminated with polychlorinated dibenzofurans (PCDFs; furans) because heating occurs under normal conditions of PCB use, and furans are formed when PCBs are heated at temperatures from about 200-600 degrees C. Furans are chemicals that are structurally similar to PCBs and have similar toxicologic properties, although in general they appear to be much more potent (cause toxic effects at much lower doses) than PCBs.

In transformers, PCBs are frequently mixed with the solvent trichlorobenzene. If transformers containing trichlorobenzenes catch fire, polychlorinated dibenzodioxins (PCDDs; dioxins) can be formed from the trichlorobenzene. Like furans, these chemicals have toxic effects at extremely low doses. Thus, smoke and soot from transformer fires can represent a source of serious contamination.

Environmental concerns: There are two major environmental consequences to release of PCBs into the environment: toxicity to aquatic and other organisms, and biomagnification.

PCBs are very toxic to aquatic organisms. The mean acute toxicity values of PCBs to aquatic invertebrates and fish range from 2 to 283 ppb; chronic values range from 0.2 to 15 ppb. This means that both fish and the organisms fish depend on for food can be poisoned by very low concentrations of PCBs. One effect is a reduction in the supply of commercial fish.

PCBs are very persistent. Once they are released, they tend not to break down; instead they take several decades to decompose. As a result of their persistence, PCBs have spread throughout the environment.

Because they are very water-insoluble, PCBs adhere strongly to organic particles in soils and stream sediments. Here they are eaten by microscopic organisms. As another consequence of their water-insolubility, PCBs are readily stored in fat. This process is termed bioconcentration. Bioconcentration factors for invertebrates range from 2,700 to 108,000; for fish the range is 3,000 to 274,000. As a result of bioconcentration, PCBs in water and stream sediments accumulate in the bodies of microscopic aquatic organisms. Larger animals, such as caddis flies and other invertebrates, eat large quantities of these organisms and accumulate the PCBs from them in their own bodies. The invertebrates, in turn, are eaten by fish, and fish are eaten by birds. At each stage of this "food chain", PCBs become more concentrated in animal tissues. The process is called biomagnification. PCB concentrations in fish tissues may be as much as 274,000 times the original concentration in the stream or sediment. This means that fish may become sufficiently contaminated with PCBs that it is not advisable to eat them.

Health effects of PCBs: PCBs can definitely cause adverse health effects, but their mere presence in the environment does not mean that adverse health effects must occur. Toxic chemicals cannot cause adverse effects unless (1) there is exposure to them and (2) they are absorbed by the body. For this to occur, the toxic chemical must be in a form that can be absorbed, either orally, dermally or by inhalation, and a pathway from the source of contamination to humans must be present. PCBs are partially absorbed through the skin and are almost completely absorbed by both the oral and inhalation routes. Absorption of PCBs is efficient because they are very fat-soluble. They may be readily transferred from mother to the fetus as well as to nursing infants through the milk. Another consequence of their high fat solubility is that the half life of PCBs in the body can be very long - approximately 7 years in humans.

The usual pathways by which humans have been exposed to PCBs is through contaminated fish or, for electrical workers, by dermal contact. Because they are not very volatile, inhalation of vapors has been a problem mainly for persons who worked in factories manufacturing them. Measurable amounts of PCBs have been found in human tissue including blood, fat and milk.

Because PCBs found in the environment are often contaminated with furans, controversy exists over what role furans played in symptoms of humans exposed to PCBs. It is clear that furans are extremely potent toxicants and by themselves can cause the symptoms seen; however, animal experiments using reagent grade (pure) PCBs indicate that PCBs are in fact also capable of

creating the same symptoms. By inference, it is reasonable to assume that in human exposures, while symptoms may be attributed in part to PCDF contamination, it is not possible to say that PCBs did not play a role. Taken together, (1) structural similarities between PCBs and their contaminants, (2) animal experiments and (3) human exposure data clearly indicate that PCBs should be regarded as toxic. Furthermore, the fact that in nonexperimental situations PCBs are almost always contaminated with furans should add to the concern over the health effects of PCB mixtures found in transformers or at hazardous waste sites.

A constellation of symptoms has been observed after PCB poisoning in humans. It includes increases in liver size and enzymatic changes in blood suggesting liver damage. The liver is a critical organ. It metabolizes and makes foods available for the body, breaks down toxic chemicals manufactured by the body (e.g., lactic acid) as well as those absorbed from the environment, and manufactures bile acids.

Many case studies demonstrate changes in hepatic (liver) function and chloracne in workers exposed to PCB's, including PCB's in vapor form at levels as low as 0.1 mg/m<sup>3</sup>. For example, in a capacitor manufacturing plant where PCBs were used, 76 out of 168 men and 87 out of 168 women had symptoms associated with PCB exposure, including chloracne, skin darkening, thickening and discoloration of the fingernails, and a rash and burning sensation on the skin. Varying percentages of these workers also had swollen eyelids and abnormal secretions from the eyelids. Liver function tests showed increased serum (liquid fraction of the blood) levels of SGOT, a finding consistent with changes in liver function. Clinical studies on other workers have shown that increased serum concentrations of PCBs were associated with an increased incidence of missed abortions (the retention in the uterus of the products of conception 6 or more weeks after the death of the fetus).

In humans, epithelial tissue (hair, skin, gastrointestinal lining) is also affected by PCB exposure: persons exposed may develop abnormal skin pigmentation, chloracne, hair or nail loss, ulcers and gastrointestinal upset secondary to lesions of the gastrointestinal tract.

There have been two major incidents in which a large number of people were exposed to PCBs in food. What is known about the human response to PCBs is based in large part on these incidents.

In 1968, in what has come to be known as the "Yusho (rice-oil) incident", about 2000 Japanese people ate rice oil contaminated with the PCB mixture Kanechlor 400. Average intake is estimated to have been 633 mg of PCBs and an average of 3 mg of furans which contaminated the PCBs. The initial symptoms documented in over 350 of these people included a general feeling of weakness, swelling of the limbs, swollen eyelids and discharge from the eyes; chloracne, itching, dark brown pigmentation of the

skin and nails, and changes in fat metabolism and liver function. The increased serum triglycerides and decreased bilirubin observed in Yusho patients are signs of altered liver chemistry, and are significant because they represent the first stages of liver damage. The percent distribution of other symptoms reported among Yusho patients are shown in Table 1. Subsequent studies with Yusho patients demonstrated subtle changes in the immune system, including decreased concentrations of T cells and absent or delayed immunological response to skin tests when compared with unexposed persons.

A statistically significant excess risk of liver cancer has been reported in Yusho patients who were studied for a follow-up period of more than 16 years.

Three of four children born to pregnant women who had eaten the contaminated oil were small at birth (both in length and weight), had abnormal gray-brown skin pigmentation (they were locally referred to as "cocoa babies"), had gingival hyperplasia (abnormal gum development), tooth eruption at birth, irregular calcification of the skull, wide fontanelles (spaces between cranial bones in infants), facial edema (swelling) and exophthalmic (bulging) eyes.

School-aged boys, but not girls, exposed to PCBs had retarded height and weight gains when measured a year following the Yusho incident, compared with unexposed children. Eleven years later there was an increased incidence of death from malignant tumors in Yusho patients, and current studies also indicate an increased incidence of death from liver cancer in Yusho patients.

Similar symptoms were seen in approximately 2000 Taiwanese who ate an average of 978 mg PCBs and 4 mg furans in contaminated rice oil in 1979, referred to as the "Ye Cheng incident". Again acne, skin and nail pigmentation, swollen eyelids and discharge from the eyelids, and changes in serum enzymes indicative of altered liver function were reported. Decreased red and increased white cell counts were also seen in the Taiwanese group.

In 1985, 117 children born to women who had been exposed to PCBs in the Ye Cheng incident were examined and compared with 108 unexposed controls. The children exposed transplacentally were shorter and lighter than controls, and had abnormalities of the gums, skin, teeth, nails and lungs more frequently than did controls. They showed delay of developmental milestones, deficits on formal developmental testing and abnormalities on behavioral assessment.

The results of animal experimentation with pure PCBs supports the conclusion that the symptoms seen in the Ye Cheng and Yusho incidents were due at least in part to PCBs. Although the toxic potency of furans suggests that they may have been responsible in part for the outcome in the Ye Cheng and Yusho incidents, it appears that over the spectrum of mammalian species tested, PCBs alone may cause all of the symptoms observed.

**Animal studies:** In animals, acute exposure to PCBs results in effects similar to those following chronic exposure. Changes in thyroid, endocrine (including reproductive) and immune system functions are most prominent in non-primates.

Effects indicative of PCB action on the thyroid include decreased body temperature, decreased appetite and weight loss, decreased thyroxin production, and dermal pigmentation. Microscopic examination reveals histopathology (in rats, follicular cell hypertrophy).

Primates tend to respond much like humans. As expected, there is a spectrum of sensitivity among animal species. LD<sub>50</sub>s (the amount needed to kill 50% of the animals tested) range from 0.5 mg/kg for the most sensitive (guinea pigs) to 10 g/kg for the least sensitive animals (mice).

As in humans, liver changes observed in animals exposed to (fed) PCBs include increased size, increases in serum enzymes indicative of enzyme induction, and increased serum cholesterol and lipids. In addition, microscopic examination reveals histopathologic (i.e., structural damage) changes.

PCBs with less than 54% chlorination induce an estrogenic response; that is, they act like estrogen in the body. Mink and monkeys appear to be the most sensitive to reproductive effects. A number of endocrine changes in exposed animals may indicate increased catabolism (breakdown) of steroids, including changes in testicular weight and chemistry, changes in placental chemistry, uterine atrophy (mink) and lengthened menstrual cycle (monkeys).

PCB-induced immune system changes in animals include atrophy of the thymus, lymphocytopenia (decreased white cell counts), splenic regression, bone marrow hyperplasia (abnormal cell multiplication) and increased susceptibility to infections.

Many of the same effects seen in human epithelial tissue following PCB exposure are seen in animals, particularly primates. Monkeys develop chloracne, alopecia (hair loss), skin ulcerations, and thickening and cysts of the stomach lining. Like humans, they develop gastritis. All of these tissues - hair, skin and stomach lining - have common embryological origins, and appear to be sensitive to PCBs in primates.

Chronic effects of PCBs in animals include carcinogenicity and reproductive effects. Reproductive effects include decreased fertility (rats, mice, rabbits), fetal deaths (mink, guinea pigs, rabbits, rats, monkeys), changes in the estrus cycle (monkeys, mice), changes in testicular weight (rats), abortion (monkeys) and terata (birth defects). These include cleft palate and decreased renal papillae size in mice after exposure to 1 mg/kg/d during the critical stage of pregnancy.

The PCB mixtures Aroclor 1254 and 1260, and Clofen A-60 have been demonstrated to cause liver and other cancers in rats, and Kaneclor 500 is a documented carcinogen in mice. EPA considers PCBs to be "B2", or probable human carcinogens. Often carcinogens are mutagens (have the ability to alter the structure or function of the DNA molecule). Therefore, positive results in a mutagenicity test are considered supportive evidence of carcinogenicity. PCBs produce conflicting results in mutagenicity tests, although one of these, the Ames test, is insensitive to chlorinated hydrocarbons in general.

PCB's are very toxic to aquatic organisms. The mean acute toxicity values of PCB's to aquatic invertebrates and fish range from 2 to 283 ppb; chronic values range from 0.2 to 15 ppb.

#### References include:

1. Kominsky, J.R. and Melius, J.M., Firefighters' exposure during PCB electrical equipment fires and failures, Presented at the 7th J.P. Redmond Symposium on Occupational Health and Hazards of the Fire Service, Toronto, Canada, Dec 4-8, 1983.
2. Kimbrough, R.D., Human health effects of PCBs and PBBs, Ann Rev Pharm & Tox. 27 (1987) 87-111.
3. Congenital poisoning by PCBs and their contaminants in Taiwan, Science 241 (1988) 334-336.

#### ENCLOSURE 2: Calculation of Toxicity Equivalency Factors for Dibenzofurans:

##### The method:

This is a method the Environmental Protection Agency has devised to estimate the cumulative toxicity of mixtures of congeners of dibenzodioxins and dibenzofurans, such as those commonly found in contaminated soils. The toxicity is expressed in "units" of TCDD (2,3,7,8-dibenzo-p-dioxin; TCDD; dioxin); that is, the toxicities of all congeners identified are expressed as a fraction of the toxicity of TCDD.

In laboratory animals, 2,3,7,8-TCDD, and the related dioxin and furan congeners have varying potential to cause cancer as well as a number of other toxic effects, including mutations and adverse reproductive effects. Because they are so closely related structurally, it is widely believed that they all act by the same biological mechanism (interaction with the AHH receptor) and can be considered additive in effect, although they are not equally potent. Both the cancer and non-cancer effects have been taken into consideration in estimating the relative toxicity of the dioxin and furan congeners relative to 2,3,7,8-TCDD.

The concentration of the particular congeners of dioxins and/or furans actually found in the soil are multiplied by their relative toxicity to TCDD, which is the "TEF", or toxicity equivalency factor. All of the resulting "TCDD units" are then added to give an estimation of the total toxicity in terms of TCDD.

**Reference:**

U.S. EPA, EPA/625/3-89-016, March, 1989, Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxins and -Dibenzofurans (CDDs and CDFs) and 1989 Update.

**Calculation:**

<u>Compound</u>	<u>Soil Conc (ppb)</u>	<u>TEF</u>	<u>Equivalent Conc (ppb)</u>
2,3,7,8-TCDF	?	0.1	?
other TCDFs	?	0.0	?
all TCDFs	0.878	?	?
1,2,3,7,8-PCDF	?	0.05	?
2,3,4,7,8-PCDF	?	0.5	?
all PCDFs	0.692	?	?
other PCDFs	?	0.0	?

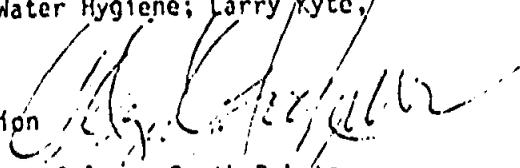
Note that the chemical analysis does not make it clear which PCDF isomers are present in the soil at Colman. Depending on which isomers are present, the toxicity equivalency factors could vary from zero to 0.5 of a "TCDD unit". The worst case, which follows, assumes that all of the contaminant found in the soil was the most potent isomer:

<u>Compound</u>	<u>Soil Conc (ppb)</u>	<u>TEF</u>	<u>Equivalent Conc (ppb)</u>
2,3,7,8-TCDF	0.878	0.1	0.09
2,3,4,7,8-PCDF	0.692	0.5	<u>0.35</u>
<b>TOTAL "TCDD units"</b>			<b>0.44 ppb</b>

37.602

To : Steve Manger, Environmental Specialist; Harold Lenhart, Deputy Secretary; David Holman, Supervisor, Office of Air Quality and Solid Waste; Richard Howard, Supervisor, Office of Water Quality; James Bohls, Supervisor, Office of Water Hygiene; Larry Kyte, Assistant Attorney General

From : Allyn O. Lockner, Secretary  
Department of Environmental Protection



Subject: Report of Polychlorinated Biphenyls at Colman, South Dakota

Date : October 5, 1977

On October 4, 1977, at approximately 9:00 a.m., Mr. Jerry Leslie, who is associated with the Brookings Register (phone 692-6261) informed me by telephone that a student at South Dakota State University, Kevin Woster, who is a journalism major at SDSU, collected on September 9, 1977, samples containing polychlorinated biphenyls (PCB's). The samples were analyzed by Dr. Yvonne Greichus at SDSU. Mr. Woster's home telephone is 692-5523 and his office phone is 688-6164. Mr. Leslie informed me that a news story reporting the following sampling results will be published in the SDSU Collegian on October 4 and distributed on that date and on October 5. Mr. Leslie plans to write his own news article, based on my conversation with him.

Mr. Woster collected samples at four sites. Site No. 1 is located 100 yards south of the incinerator of Ross Electric. The soil sample indicated 23.3 ppm PCB's. The foliage sample indicated 0.60 ppm PCB's. Site No. 2 is located 1/2 mile southwest of the incinerator. The soil sample indicated 0.72 ppm PCB's. The sample from corn leaves indicated 1.66 ppm PCB's. Site No. 3 is located 15 miles north of Colman near the intersection of U.S. Highway 77 and the turnoff to Lake Campbell. The soil sample indicated 0.19 ppm PCB's. The corn leaves indicated 0.26 ppm PCB's.

Mr. Leslie asked me what the Department of Environmental Protection (DEP) is doing about this matter and what is proposed to deal with the situation. After reviewing our files and talking with personnel in DEP and with Mr. Milton Lammering of the U.S. Environmental Protection Agency (EPA), it was decided that DEP will collect samples from the soil and vegetation at the points at which the earlier samples were collected in order to verify the results. It was also decided that samples be collected of the waste coolant from the transformers which are rebuilt at the site of Ross Electric and T&R Electric. Air samples will also be collected utilizing an impinger bubbler type system with the medium to be ethylene glycol. I am informed that one must be certain to drain all the ethylene glycol into sample jars. Samples should also be collected from public and private drinking water supplies adjacent to the sites. A sample to verify the results collected from the stabilization ponds by DEP on May 6, 1977, should be collected and, if the effluent from these

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ponds is discharged to navigable waters for which water quality standards are set, a sample should be collected from that water body. All samples are to be placed in glass jars, rinsed in hexane and aluminum foil liners are to be placed on the cap of the jars. The samples are to be mailed to Mr. Lammering at Region VIII, U.S. Environmental Protection Agency, Denver Federal Center, Building 53, P.O. 25366, Denver, Colorado, 80225. He said results would be available about two or three days after samples are received. We should notify Lammering when the samples will be mailed to him.

At or prior to the time these samples are collected, DEP personnel should visit the site and discuss the process for rebuilding transformers and disposing of water coolant with the owners and/or managers of T&R Electric and Ross Electric. I am informed by Mr. Leslie that there is a similar transformer salvage operation located in or near Madison. We should verify this plant and determine if a site inspection and samples are necessary.

Regarding the legal aspects of this matter, DEP personnel should contact Mr. Gregory Holbert (phone 327-4812) who is with the Enforcement Division of the EPA in Denver. Regarding the technical aspects of this matter, personnel are to contact Mr. Ralph Larsen (phone 327-3926) who is associated with Air and Hazardous Materials Division and is the Toxic Materials Coordinator for that Division within EPA.

I informed Mr. Leslie on October 4 that personnel will arrange to visit the site to determine how transformers are rebuilt and particularly how the waste coolant is disposed of. In this connection, I am informed that Ross Electric ships the wastes coolant to a point in Minnesota for use as or, as additions to fuel oil. Mr. Larsen would like to know the name of the recipient of the waste coolant. I also indicated to Mr. Leslie that we would proceed to collect the samples discussed earlier and to determine whether or not present rather than past operations at the plants are contributing to the concentration of PCB's in the environment if, indeed our sample results verify this concentration. If present operations are found to produce PCB's in the environment, I also informed Mr. Leslie that DEP will work with the owners and managers of these plants in an attempt to obtain very early voluntary compliance. However, if such compliance is not forthcoming, DEP will use its statutory authority of remedies for protecting the environment and for dealing with public nuisances and that personnel are now reviewing the utilization of these statutes.

Please keep me posted on any significant development regarding this matter. Also contact me if I need to make any decisions. LuAnn will know of my whereabouts on October 6 and 7 if you need to reach me.

C2/08

AND ON MICROFILM WHICH MEETS THE RECOMMENDED REQUIREMENTS OF THE NATIONAL BUREAU OF STANDARDS FOR MICROFILM REPRODUCTION. REDUCTION. ROLL NO. 4-9 DATE MICROFILMED

PROCEEDINGS OF THE NOVEMBER 16, 1977 INTERAGENCY MEETING

Subject: PCB Investigation in Colman, South Dakota

Attendees:

South Dakota Department of Environmental Protection

Dr. Allyn Lockner  
Harold Lenhart  
James "Casey" Anderson  
Curtis Hansen

U.S. Environmental Protection Agency

Ralph Larsen  
Larry Wapensky

South Dakota State University of Brookings

Dr. Yvonne Greichus  
Barbara Ammann

U.S. Food and Drug Administration

LeRoy M. Gomez  
William Lynch  
David Jordan  
David Root

The meeting was brought to order at 1:00 p.m. C.S.T.

Dr. Lockner, the moderator of this meeting, requested that the group review all investigational and analytical data obtained thus far. Mr. Gomez provided an overview of FDA's concern and subsequent involvement in the Colman, South Dakota PCB problem. FDA made the initial presentation with Mr. Lynch explaining his investigation in detail. Finally, Mr. Root explained the analytical data accumulated by FDA. Based on these presentations the following conclusions were drawn:

1. The oil at Ross Electric Company, used for heating the plant and selling to a fuel oil company in Minnesota, contains PCB.
2. Based on analysis of soil, stalks and leaves, the PCB contamination is mostly air-borne.
3. The food supply is not in danger.

Next, the EPA data was presented by Mr. Wapensky. He further stated that EPA is concerned about contamination at the 1 ppb level and may soon have regulations dealing with 1 ppt levels. In explaining the presence of Arochlor 1016 in the water from Bachelor Creek, he stated that this PCB is used in the construction of capacitors, and that T & R Electric Company has capacitors on hand. He concluded by saying that EPA will obtain samples from Poison Lake and Mud Lake. Based on these presentations, the following conclusions were drawn:

1. PCB levels in soil are from air-borne and surface contamination.
2. PCB contamination of leaves and stalks is from air-borne contamination.
3. The contamination of Bachelor Creek must be investigated further.

Dr. Greichus then presented her investigative and analytical data. By virtue of her analysis of roots, stalks, leaves, corn and cob, she felt that there may be minimal PCB migration into the plant through the roots. Based on these presentations, the following conclusions were drawn:

1. Soil and subsequently PCB residues move from the Ross Electric Company to the Roda farm.
2. Some contamination is air-borne.

Dr. Greichus then discussed the data developed from the initial investigation by Kevin Woster. These samples were collected by Woster and analyzed by Dr. Greichus. There seemed to be sufficient question regarding the sampling techniques and integrity of samples to provide the following conclusion:

1. The data has served its purpose in bringing the problem to our attention. No further consideration is warranted.

From these individual presentations and subsequent discussions, the following general conclusions were made:

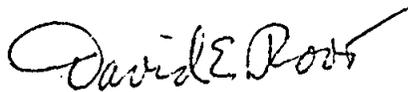
1. PCB's have contaminated the soil, the air, and the water.
2. The source of the PCB is Ross Electric Company and/or T & R Electric Company.
3. The PCB residues found on the corn plants are evidence of air-borne contamination during this latest growing season.

4. Time of contamination of the soil cannot be determined.
5. PCB's exhibit no systemic effect in corn plants.
6. The food supply is not generally endangered.
7. More samples are needed in order to evaluate the water-borne contamination problem.
8. The FDA has no authority in this investigation now.

In an effort to complete this investigation and take the necessary remedial steps, the following will be done:

1. EPA will collect wipe samples from public buildings in the area.
2. Dr. Lockner will contact SDSU regarding release of PCB data after Dr. Greichus presents details of this meeting to her superior.
3. Dr. Lockner will contact T & R Electric Company and attempt to get permission for EPA to collect samples on the premises. This is necessary because T & R Electric Company is reluctant to allow further sampling until results of past sampling are provided.
4. FDA will analyze sample of wire and provide results to participants in the investigation.

The meeting adjourned at 4:10 p.m.



David E. Root

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DATE: December 2, 1977.

SUBJECT: PCB Investigation - Colman, S.D.

FROM: Ralph H. Larsen  
TSCA Coordinator

TO: See Below



Attached is the PCB Investigation report for the incident  
at Colman, South Dakota.

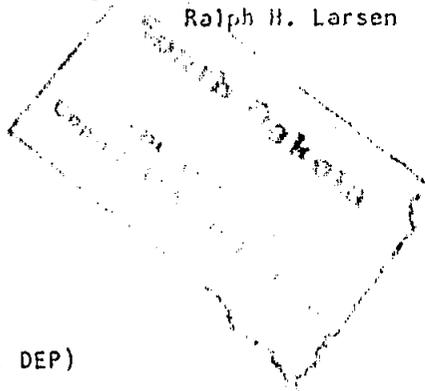
*Ralph H. Larsen*

Ralph H. Larsen

Attachment

Addresses:

- Jim Lehr (8AH)
- Larry Wapensky (8S-TI)
- Milt Lammering (8S-TI)
- Keith Schwab (8S)
- Charles Murray (8W)
- Irwin Dickstein (8E)
- ✓ Dr. Allyn Lockner (S.D. DEP)
- Curtis Foster (OSHA)
- Leroy Gomez (FDA)



PCB INVESTIGATION - COLMAN, S.D.

Monday, November 14, 1977

On Monday, November 14, 1977, Larry Wapensky and I flew to Sioux Falls, South Dakota. At the airport we were met by James "Casey" Andersen, Regional Engineer, and Kurt Hansen, an assistant to "Casey". Both are with the South Dakota Department of Environmental Protection. Also, at the airport we met Leroy Gomez, District Director and David Root from the Food and Drug Administration's Denver Field Office. David Jordan a local FDA investigator was also present.

We all drove to Colman, S.D. where Mr. Andersen showed us a natural drainage culvert, below the Colman Sewage Facility, at the point of entry into Bachelor Creek. He had taken a sample from Bachelor Creek at this point. This had been analyzed earlier by EPA and found to contain 0.94 PCB 1016 (Sample C). At this location, Dr. Yvonne Greichus arrived and presented us with her latest data. This included results from corn plants and soil taken from the Rhoda farm and also a map showing results of other samples taken from the vicinity of Colman, S.D. (see attachment).

Sampling  
site →

We then went to a farm directly west of T&R Electric and Dr. Greichus showed us where she had taken her samples. This farm, we later learned, is owned by T&R Electric Supply. All of us except FDA representatives then went to T&R Electric Supply's office and met with James Thomson, Jr., an employee of the firm. His father, James Thomson, together with Mr. Kenneth Ross are the owners of the firm. FDA wanted to tour the farm area and determine the location of their sampling, such as the dairy herd and grain site.

We asked Mr. Thomson, Jr. if he would take us on a tour of his operation. He said he would be glad to show us around and that T&R was attempting to cooperate as much as possible. I asked if I could take pictures on the tour and Mr. Thomson, Jr. said he did not want any pictures taken. I gave Mr. Thomson, Jr. a copy of the proposed PCB regulations soon to be finalized under TSCA and said I would make sure he received information about TSCA. After questioning, Mr. Thomson, Jr. stated that all drains in the building go to the town sewage treatment facility. He stated that the drainage ditch on the farm directly west originates at T&R and was dug to drain their storage yard.

T&R employs approximately 120-160 people. They obtain salvage and surplus electrical transformers and repair and recondition them. T&R can do all repairs including rewinding of the transformer units. All of the oil removed from transformers at T&R is subsequently filtered and reused in other reconditioned transformers with no surplus oil being generated. The oil is pumped from the incoming transformer into a storage tank.

The oil from this tank is passed through approximately 30 6" X 6" X 1/8" paper filters to remove moisture in the waste oil. This improves its' dielectric properties. It is then passed through a tank containing "Fullers earth" (similar to a water softener tank). This neutralizes any acidity which may have developed in the oil, thereby preventing sludge build-up in the transformer. After this processing, the oil is pumped to another storage tank and ready for use in re-conditioned transformers. Mr. Thomson stated that they had not handled PCB containing transformers for about 3 years. We could not inspect the area where they were stored due to the drifting of snow from an earlier storm.

At T&R, insulation and varnish are also burned off the burned-out transformer units. The burning is done in an incinerator containing an after-burner arrangement. The incinerator contained a temperature controller. Mr. Thomson claimed the furnace reaches about 600-700°F with the after-burner reaching 2,000-2,500°F. He stated that they were in the process of installing thermo couples so that temperatures could be checked. The incinerator is fired by propane gas. The incinerator was not in operation during our visit. Mr. Thomson said they did not operate the incinerator on Mondays. All copper scrap and ash from the incinerator is sold for its' copper value.

While touring the oil processing area, we saw several drums of oil soaked earth. This was the Fullers earth after use. We asked Mr. Thomson, Jr. what was done with the earth after use and at this point an employee standing nearby said it was taken out back and dumped on the driveway. Mr. Thomson, Jr. said we could not rely on the employees information since he had made several mistakes in other areas of the plant. At a later meeting with Mr. Thomson, Jr., he said he had checked with the employee's foreman and the earth was not dumped on the driveway.

After completing the tour at T&R, we went next door to Ross Electric Supply, Inc. and were introduced to Mr. John Ross. We asked Mr. Ross if we could tour his operation and I gave him a copy of the proposed PCB regulations under TSCA. I asked if I could take pictures during the tour. Mr. Ross had no objections. Mr. Ross said they had not worked with PCB transformers for about three years. We learned that all drains go to the Colman Sewage Treatment Facility. There were no direct discharges from the plant to any ditches. Ross Electric employs 11 people. The work performed by Ross Electric is essentially the same as T&R except Ross does not have the capability to rewind transformers.

DATE MICROFILMED

NEWSPAPER

Open burning had been conducted in an open pit several years ago. However, the pit was filled in and the incinerator is presently used. Samples were taken in the old pit area. Some units are received in such condition that they are non-repairable. In these cases, the windings are removed from the transformer case and put in a furnace to burn the insulation off in order to reclaim the copper. The ash was not reclaimed but just dumped on the ground. The oil that becomes surplus is stored in two tank trucks located in the storage yard. This surplus oil is used in several ways:

1. Used as fuel for the oil burner heating system used to heat the main building. They are working on expanding this system to include the scrap handling building.
2. Sold to Hicks Oil Company in Pipestone, Minnesota for use as fuel oil.

According to Mr. Ross, approximately 3 shipments a year are made to Hicks Oil. The Ross incinerator is similar to the one used at T&R except there are no controls on the incinerator. There is no way of knowing if proper temperatures are maintained. Mr. Ken Wanberg, foreman, who conducted our tour said all transformers were drained outside of the building.

We entered the building where several large transformers containing PCB's were stored. They were labeled with a sign "Danger Do Not Use". No transformers were observed leaking.

We completed our tour telling Mr. Ross we would be in the area several days and might contact him if we had further questions.

Tuesday, November 15, 1977

Our first visit on Tuesday was to a farm owned by Mr. Harvey Roda which is directly south and across the highway (34) from Ross Electric and T&R. Our group consisted of myself, Larry Wapensky, and Kurt Hansen from S.D. Department of Environmental Protection.

Our intent was to ask Mr. Roda's permission to take samples on his property. He initially agreed, however, his wife said she did not want us to take samples. She said a number of people had already taken samples and the townspeople were beginning to think they were the cause of all the government activity in the town. We agreed not to sample on their property.

possible  
sample  
site →

INTER-OFFICE

At 10:40 a.m., we then went to Ross Electric Supply, Inc. and asked Mr. Ross for permission to take various samples inside his operation. Mr. Ross said he would have to make a call first. He made his call, came out of his office and said we could take samples. We agreed to provide him with all results. We took a number of samples at Ross Electric (see attachment).

We then returned to Sioux Falls for a meeting at 1:00 p.m. at the Sioux Falls Water Purification plant. Those present at the meeting were as follows:

EPA

Ralph H. Larsen - TSCA Coordinator  
Larry Wapensky - Chemist

FDA

Leroy Gomez - District Director  
David Root - Laboratory Director  
William M. Lynch - Investigator  
David Jordan - Investigator

S.D. Department of Environmental Protection (DEP)

Dr. Allyn Lockner - Secretary DEP  
Harold Lenhart - Deputy Secretary DEP  
James "Casey" Anderson - Regional Engineer DEP  
Kurt Hansen - DEP

South Dakota State University

Dr. Yvonne Greichus  
Barbara Ammann - Assistant to Dr. Greichus

In summary, data possessed by each group was shared and evaluated separately with the following conclusions being drawn by the various parties:

FDA

- possible sample location →*
- Comments:
1. No PCB's present in milk of local dairy herd (Ullom Farm)
  2. When samples were run on the "mass spec", other petroleum products were indicated, not only PCB's.

Conclusions:

1. Based on FDA samples, there was no evidence to indicate that PCB's were getting into food chain.
2. PCB contamination is probably airborne.

EPA

Conclusions:

1. PCB contamination is airborne by presence on leaves.
2. No conclusions on Bachelor Creek.

Dr. Greichus

Conclusions:

1. PCB contamination does not appear to be a PCB that has been in the environment for a long period of time.
2. There is no systemic effect occurring in the corn.
3. Water borne pollution may be from present or past operations.

After each party discussed the results, we all agreed on the following:

1. Water and airborne pollution is occurring from Ross Electric and/or T&R Electric.
2. PCB contamination on the corn leaves is significant when compared to soil values and almost has to be the result of recent air pollution.

We all agreed that we were not ready to approach either company yet until the samples being obtained on this trip are analyzed and evaluated. Dr. Greichus did not want her data released without obtaining permission from South Dakota State University in Brookings. The meeting then adjourned. FDA agreed to provide detailed minutes of the meeting to EPA and the State. Dr. Greichus also stated during the meeting that she would not vouch for any samples picked up by Kevin Wooster, the journalism student who collected the original samples. We also told Dr. Lockner that T&R had refused us permission to take any samples. He said he would call them and see if he could change their decision.

Wednesday, November 16, 1977

We returned to the Colman area and continued taking samples from the area (attachment).

Dr. Lockner had contacted T&R and had convinced them to let us take samples outside the plant but on their property. We returned to T&R at 1:30 p.m. and met with James Thomson, Jr., He provided us with two notices given to drivers instructing them not to pick up transformers containing PCB's. We also obtained a blueprint of the T&R layout showing the ditch system providing drainage for the storage yard. We then took samples at various points on T&R property including their farm adjoining T&R.

After completing our sampling at T&R, we took a wipe sample and a water sample from the U.S. Post Office in the center of Colman. We contacted the Mayor of Colman for permission to take samples at the sewage treatment facilities and then went to the facility and completed our sampling.

General Comments

1. Eight trailer loads of transformers leave T&R each week.
2. The U.S. Government seems to be their largest source of transformers.
3. At the end of the investigation, some residents including the Mayor expressed a desire for someone to give a presentation about the incident.
4. We have asked the State to pick up additional samples from the Big Sioux River - Bachelor Creek area.
5. OSHA had recently been to both facilities and, according to Mr. Ross, was planning to return soon.

Sample  
Locations →  
↓

T & R DATA

T & R Electric Supply Company, Inc.  
P.O. Box 180  
Colman, South Dakota 57017

<u>Sample Number</u>	<u>Description</u>	<u>Amount PCB 1260</u>
24	Water from west end of T & R farm, by main road (34) at culvert.	6.9 ppb*
25	Sediment from west end of T & R farm, by main road (34) at culvert.	228.4 ppb
26	Vegetation from west end of T & R farm, by main road at culvert.	47.5 ppb
27	Water from T & R farm ditch on west side of farm house road.	28.9 ppb
28	Sediment from T & R farm ditch on west side of farm house road.	11,472 ppb
29	Water sample, west side of T & R fence in ditch.	24.8 ppb
30	Wipe sample from T & R fence, west side.	trace,?
31	Sediment, west side of T & R fence approximately 20 feet.	168.7 ppb
32	Vegetation, west side of T & R fence approximately 20 feet.	387.9 ppb

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LAW 1-27-71. IT IS FURTHER CERTIFIED THAT THE MICROGRAPHIC PROCESS USED FOR REPRODUCING  
AND ON REPRODUCTION WILL BE THE MOST ADVANCED EQUIPMENT OF THE MICROFILM CENTER  
REPRODUCTIONS OF ORIGINAL RECORDS AND INKS MICROFILMED IN THE FEDERAL OFFICE OF BUSINESS ADMINISTRATION  
DATE MICROFILMED



<u>Sample Number</u>	<u>Description</u>	<u>Amount PCB 1260</u>
33	Soil, approximately 50 yards west of T & R fence.	40.2 ppb
34	Water, 35 feet from east fence, 50 yards from railroad, and 50 yards from culvert.	0.10 interference
35	Wipe sample, south side of T & R fence.	200 ng/area**

Definitions:

\*ppb - parts per billion  
\*\*ng - nanogram

L

J

① = possible sampling sites for present (9/90) study.

SAMPLES

Sample Number

Description

1	Sample from Ross Electric oil tank used to heat building.
2	Dirt and water from various locations in area behind office and shop building - Ross Electric.
3	Ross Electric - West Shop - took swab of dirt and grease on floor drain.
4.	Ross Electric - Dirt sample from driveway in front of incinerator.
5	Ross Electric - swab from 3 windows on building next to incinerator.
6	Ross Electric - swab from window on south side of West shop building.
7	Ross Electric - water sample from tap (city water).
8	Ross Electric - wipe sample from metal door in Main shop.
9	Ross Electric - dirt sample from various locations in old pit area.
10 ✓	Ross Electric - Dirt sample at highway, approximately 30 feet in. Along probable drainage from old pit.
11.	Ross Electric - soil and water at drainage pipe under road and across road.
✓ 12.	Water sample approximately 200 yards south ditch draining into Bachelor Creek.
✓ 13.	Sediment from Bachelor Creek approximately 200 yards. South of ditch draining into Bachelor Creek.

<u>Sample Number</u>	<u>Description</u>
✓ 14	Vegetation along County road, 1 mile south of T&R.
✓ 15	Dirt sample, 1/8" deep taken along County road, 1 mile south of T&R.
✓ 16	Water and sediment sample, Bachelor Creek at bridge, 2 miles south of Colman.
17	Corn leaves and stalk from field south of barn on Ullom Farm.
18	Soil sample from field south of barn on Ullom Farm.
19	Water and sediment from Bachelor Creek, 1/4 mile upstream from ditch entering creek - Ullom Farm.
20	Sediment and water from Bachelor Creek, 1/2 mile upstream from junction with ditch - Ullom Farm.
21	Water sample from ditch right where it joins Bachelor Creek on Ullom property.
✓ 22	Soil and vegetation, 1 mile north of Colman in line with T&R.
✓ 23	Soil, grass, roots, 1 mile north of Colman in line with T&R.
✓ 24	Water from west end of T&R farm, by main road (34) at culvert.
✓ 25	Sediment from west end of T&R farm, by main road (34) at culvert.
✓ 26	Vegetation from west end of T&R farm by main road at culvert.
✓ 27	Water from T&R farm ditch on west side of farm house road.

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<u>Sample Number</u>	<u>Description</u>
28	Sediment from T&R farm ditch on west side of farm house road.
29	Water sample, west side of T&R fence, in ditch.
30	Wipe sample from T&R fence, west side.
31	Sediment, west side of T&R fence, approximately 20 feet
32	Vegetation, west side of T&R fence, approximately 20 feet.
33	Soil, approximately 50 yards west of T&R fence.
34	Water, 35 feet from east fence, 50 yards from railroad, and 50 yards from cluvert.
35	Wipe sample, south side of T&R fence.
36	Water and sediment from ditch to west of lagoon at Colman Sewage Facility.
37	Sediment from ditch, west of lagoon at Colman Sewage Facility.
38	Tap water from U.S. Post Office in Colman, S.D.
39	Wipe sample from north windows at U.S. Post Office, Colman.
40	Water and sediment at discharge point of Colman Sewage Facility.
41	Soil, 1 mile west on north side of 34.
42	Corn foliage, 1 mile west of T&R, north side of 34.



Therefore, there are at least three discrete areas of PCB entry into the local surface water system that represent clear violations of the FWPCA. These violations could provide the basis for an enforcement action against both T & R Electric and Ross Electric.

Concerning the content of permits for direct discharges from these facilities or for pretreatment control prior to discharges to the municipal lagoon system, it appears that an outright prohibition of PCB's is appropriate in these cases. It has been determined by EPA that such a prohibition is warranted for direct discharges from plants manufacturing PCB's, electrical capacitors, and electrical transformers. These prohibitions have been promulgated as to CFR 129.105 (Federal Register, February 2, 1977). Any permit for a direct discharge from the plants or for plant floor drains should therefore contain a direct prohibition on PCB's. While investigations on this matter will be continuing, future discharges must be prevented and orders prohibiting such discharges will be issued.

B. Toxic Substances Control Act (TSCA)

There is some authority under the Toxic Substance Control Act (TSCA) to deal with PCB's. Disposal of PCB mixtures will be regulated by regulations that are expected to be promulgated in final form in the near future. The term "PCB mixture" is defined to include any object, such as waste oils, soil, or rags that contain in excess of 500 ppm of PCB. Such items may be disposed of only in approved chemical waste landfills or by incineration. It does not appear at this time that the 500 ppm threshold limit will be met or exceeded in the areas around Colman; however, if it is, the persons in possession of the PCB mixture, or responsible for its discharge, must comply with the disposal regulations.

Where the use, storage, or disposal of a chemical substance creates an imminent hazard to health or the environment, Section 7 of TSCA, 15 U.S.C. 2606, authorizes seizure of the chemical substance and such equitable relief as may be necessary to abate the hazard. The term "imminently hazardous chemical substance or mixture" is defined in Section 7(f). Based on the facts that are now known, it does not appear that the Section 7 authority can be utilized.

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C. Resource Conservation Recovery Act (RCRA)

Section 7003 of the Resource Conservation and Recovery Act, 42 U.S.C. 6793, contains authority similar to Section 7 of TSCA. It authorizes broad equitable relief to abate an "imminent and substantial endangerment to health or the environment". However, as with Section 7 discussed above, it does not appear that an action under Section 7003 will lie based on the facts that are known now.

D. Clean Air Act

The Clean Air Act does not contain any provision specifically directed toward the regulation of PCB's. Control of that toxic substance can not now be had through the criteria pollutant nor the hazardous pollutants (Section 112) approach. However, should there be a determination that air emissions at this source cause an "imminent and substantial endangerment to the health of persons", Section 303 of the Act could provide the necessary relief.

In conclusion, I feel the Agency has gathered evidence which indicates that three sources in the Colman, South Dakota area, Ross Electric, T & R Electric and the Colman Wastewater Treatment Lagoon are contributing PCB's to the environment. Our staff is initiating immediate follow-up action to document supplementary information, such as, where the floor drains to T & R and Ross leads, whether PCB's are present in the water and sediment in the lagoons, etc. Obviously, this will require additional sampling and we invite you to accompany us on this visit.

Although I would prefer to achieve a proper resolution of all three problem sources without time consuming litigation, we must proceed with an enforcement action. At this time, evidence indicates that T & R Electric Company is discharging PCB's without a permit and an order requiring immediate cessation of this discharge is appropriate. We also recommend to you that you investigate your enforcement options for bringing this source under control. We will be very happy to assist you in this effort. If my staff can

DATE MICROFILMED

ULLOM FARM DATA

Ullom Farm  
Box 91, Rt. 1  
Colman, South Dakota 57017

<u>Sample Number</u>	<u>Description</u>	<u>Amount PCB 1260</u>
17	Corn leaves and stalk from field south of barn on Ullom farm.	less than 9.4 ppb*
18	Soil sample from field south of barn on Ullom farm.	less than 6.0 ppb
19	Water from Bachelor Creek, ¼ mile upstream from junction with ditch - Ullom farm.	less than 0.11 ppb
20	Sediment from Bachelor Creek, ¼ mile upstream from junction with ditch - Ullom farm.	8.8 ppb**
21	Water sample from ditch right where it joins Bachelor Creek on Ullom property.	0.14 ppb

Definitions:

- \* less than - none detected at that level
- \*\* ppb - parts per billion



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VIII  
1860 LINCOLN STREET  
DENVER, COLORADO 80203

FEB 8 1978

REF: 8AH-P

Dr. Allyn O. Lockner  
South Dakota Department of Environmental Protection  
Joe Foss Building  
Pierre, South Dakota 57501

Dear Dr. Lockner:

I am pleased that my office has been able to assist your investigation into the PCB problems in Colman, South Dakota. This letter summarizes some of our findings to date and transmits the data we have obtained. In addition to the data on the samples gathered by EPA, data is included for samples picked up by Curt Hansen of your Department. Details on analytical methodology are available upon request.

I have also included some initial recommendations for your consideration as you review the findings of this investigation. I am aware that FDA and OSHA have also assisted in this matter and I will continue to work with them and you in whatever can best help rectify this problem.

Our conclusions and recommendations concerning this investigation are as follows:

Findings and Conclusions

A. General

1. Results from various soil and vegetation samples provided evidence of aerial dispersion of PCB's (Samples 15, 22, 23, 26, 32). PCB's were also detected on various wipe samples (Samples 5, 6, 35, 39) with the results generally according to the prevailing wind direction. Southerly winds prevail in summer and early fall, but during the late fall and winter northwesterly winds often prevail. PCB's were found in areas north and south of Colman but not detected east or west of town (Samples from east taken by FDA, INV 78-117-248).

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2. Special efforts were made to analyze for low levels of PCB's in tap water samples (Sample 7,38). Results indicated no PCB contamination of the Colman drinking water supply.
3. Direct surface runoff and discharges from the Colman sewage treatment lagoon both contribute to PCB contamination in the surrounding area, Bachelor Creek, and possibly the Big Sioux (Sample 46,47).
4. Several samples with large amounts of PCB 1260 present may have had other PCB's present but were masked by the principle constituent.

B. Ross Electric

1. Data from Ross Electric suggests that PCB's may have been emitted from the incinerator (FDA sample INV 78-117-249). Air emissions could also result from heating the office building and shop area with contaminated fuel oil (Sample 1).
2. Wipe sample No. 3 data indicates that there have been discharges of PCB 1260 into the Colman Sewage Treatment Plant.
3. The data showed PCB's present on Ross Electric property (Samples 2,4,9).

C. T & R Electric Supply

1. The data showed PCB's present on the T & R farm adjacent and west of the company (Samples 24,25,26,27,28,29,31,32,33).
2. The data showed there is a surface runoff type discharge of PCB's from T & R Electric property into the area contiguous with the northern ~~most~~ side of the Colman Sewage Treatment Plant (Samples 36,37).
3. No assessment was possible as to the presence of PCB's on the facility since sampling was not allowed inside the T & R operation.

D. Colman Sewage Treatment Plant

The Colman Sewage Treatment lagoon had a discharge of PCB 1260 (Sample 40). Considering the drainage by the lagoon and that the PCB detected in samples 36 and 37 most likely comes from T & R Electric Supply, it is conceivable that both contribute PCB input to Bachelor Creek.

E. Bachelor Creek

1. Sample 20, upstream from the drainage of the Colman Sewage Treatment Plant into Bachelor Creek, had PCB's present in the sediment.
2. Bachelor Creek had PCB's in the water and sediment downstream of the ditch where it joins Bachelor Creek (Samples 12,13,21,46).

Significance of Results

Finding PCB's in the soil around Colman is significant from an environmental standpoint since it normally would not be detected in an agricultural area. Of the 1,556 soil samples collected in 1972, as part of the National Soils Monitoring Program, only 2 samples or 0.1 percent contained detectable levels of PCB's. The occurrence of these compounds is more prevalent in metropolitan areas, particularly within city limits.

Polychlorinated biphenyls are highly persistent environmental contaminants that bio-accumulate in food chains and produce acute and chronic effects as well as subtle impact on growth, reproduction, behavior, and health of fish, birds, and mammals.

PCB's have been an environmental concern for some time and have resulted in several major control measures to minimize impacts on public health and the environment. The EPA Administrator in the Federal Register, Volume 42, February 2, 1977, established an ambient water criterion for PCB's in navigable waters at 0.001 microgram per liter (1 part per trillion). This regulation was issued for PCB manufacturers, electrical capacitor manufacturers and electrical transformer manufacturers. The compliance date for this standard is February 2, 1978.

In May, 1977, the Agency proposed regulations prescribing disposal and marking requirements for PCB's and articles and equipment which contain PCB's. The intent of these regulations is to protect the environment from further contamination by PCB's resulting from improper handling and use and from release of PCB's to the environment following disposal. These regulations are expected to become final in February, 1978.

In September, 1977, the National Institute for Occupational Safety and Health (NIOSH) recommended that occupational exposure to polychlorinated biphenyls (PCB) should be controlled so that no worker is exposed to PCB's at a concentration greater than 1.0 microgram total PCB's per cubic meter of air (1 part per billion) determined as a time-weighted average (TWA) concentration, for up to a 10 hour workday, 40 hour work week. If an ambient air standard existed, it would undoubtedly be much lower.

The Food and Drug Administration has set tolerances for PCB's contamination of animal feeds, foods, and food packaging in its final rulemaking document published on July 6, 1973, (Federal Register, Volume 38, No. 129). These tolerances, expressed as parts per million (ppm) are as follows:

1. Milk (fat basis)	2.5 ppm
2. Dairy products (fat basis)	2.5 ppm
3. Poultry (fat basis)	5.0 ppm
4. Eggs	0.5 ppm
5. Complete and finished animal feeds for food producing animals	0.2 ppm
6. Animal feed components	2.0 ppm
7. Fish and shellfish (edible portion)	5.0 ppm
8. Infant and Junior food	0.2 ppm
9. Paper food - packaging material	10.0 ppm

#### Recommendations

1. Both T & R and Ross Electric should upgrade the incineration operation according to guidelines required in the forthcoming PCB regulations under the Toxic Substances Control Act if PCB containing equipment is to be handled.
2. Ross Electric should stop using waste oil containing PCB's for heating their buildings. Either the oil or the storage tanks or both are contaminated.

3. Careful evaluation should be made as to what clean up and prevention measures are appropriate and needed to ensure no further discharge.
4. Each batch of oil burned or shipped off premises should be sampled and confirmed to be PCB free.
5. The County Health Officer, after review of the worker medical examinations required by OSHA citations, should recommend any additional health monitoring or clean up programs which may be required.

#### EPA Enforcement Options

##### A. National Pollutant Discharge Elimination System (NPDES)

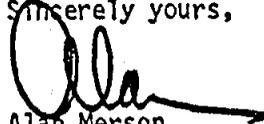
As you know, the National Pollutant Discharge Elimination System (NPDES) provides the only means by which the point source discharge of pollutants to waters of the United States may be authorized. PCB's have been identified in significant amounts in Bachelor Creek and at the confluence of the Creek with the Big Sioux River. There are a number of point source discharges that have been identified and associated with Ross Electric and T & R Electric operations which are PCB sources. No discharges of PCB's have been authorized under the NPDES permit program; therefore, a number of both identified and otherwise probable unauthorized discharges have occurred and constitute violations of the requirements of the Federal Water Pollution Control Act (FWPCA).

Discharges likely in violation of the FWPCA include: 1) The drainage ditch off of the T & R property since this ditch intercepts runoff from T & R property contaminated by PCB's; 2) The discharges from both T & R and Ross Electric that enter the Colman Sewage Treatment Plant and collection system (pre-treatment violations) and; 3) Any discharge from the Colman lagoon containing PCB's, since the Colman NPDES permit does not authorize such discharge.

It should be noted that upon identifying the PCB source for the PCB discharge from the City's lagoon, any violation of the City's permit could prorate the basis for any enforcement action that would reach through the City to the source. In fact, the point of entry of the PCB's into the City sewer system could be considered a point source in itself under certain circumstances.

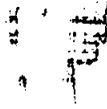
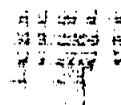
provide either technical or legal assistance in this effort, please do not hesitate to contact me. Regardless of who takes action we should continue to keep each other apprised of additional information which may come to light.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Alan", with a long horizontal stroke extending to the right.

Alan Merson  
Regional Administrator

Attachments

A faint, illegible handwritten mark or scribble.A faint, illegible handwritten mark or scribble.

L

J

SAMPLES

<u>Sample</u>	<u>Description</u>	<u>Amount PCB 1260</u>
1	Sample from Ross Electric oil tank used to heat building.	41,946 ppb*
2	Dirt and water from various locations in area behind office and shop building - Ross Electric.	18.8 ppb (Water)
3	Ross Electric - West Shop - took swab of dirt and grease on floor drain.	67,149 ng/area**
4	Ross Electric - Dirt sample from driveway in front of incinerator.	31,352 ppb
5	Ross Electric - swab from 3 windows on building next to incinerator.	14,315 ng/area
6	Ross Electric - swab from window on south side of west shop building.	729 ng/area
7	Ross Electric - water sample from tap (city water).	less than 0.02 ppb***
8	Ross Electric - wipe sample from metal door in main shop.	7,750 ng/area
9	Ross Electric - dirt sample from various locations in old pit area.	8,478 ppb
10	Ross Electric - Dirt sample at highway, approximately 30 feet in along probable drainage from old pit.	409.9 ppb
11	Ross Electric - water at drainage pipe under road and across road.	less than 0.2 ppb
12	Water sample approximately 200 yards south of ditch draining into Bachelor Creek.	0.5 ppb
13	Sediment from Bachelor Creek approximately 200 yards south of ditch draining into Bachelor Creek. (Same location as 12)	6.8 ppb

Site #6  
approx \*

Site #25 \*

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 NATIONAL ARCHIVES  
 COLLEGE PARK, MARYLAND 20740



<u>Sample</u>	<u>Description</u>	<u>Amount PCB 1260</u>
28	Sediment from T & R farm ditch on west side of farm house road.	11,472 ppb
29	Water sample, west side of T & R fence, in ditch.	24.8 ppb
30	Wipe sample from T & R fence, west side.	trace,?
31	Sediment, west side of T & R fence, approximately 20 feet.	168.7 ppb
32	Vegetation, west side of T & R fence, approximately 20 feet.	387.9 ppb
33	Soil, approximately 50 yards west of T & R fence.	40.2 ppb
34	Water, 35 feet from east fence, 50 yards from railroad, and 50 yards from culvert.	less than 0.10 interference
35	Wipe sample, south side of T & R fence.	200 ng/area
36	Water and sediment from ditch to west of lagoon at Colman Sewage Facility.	1.25 ppb
37	Sediment from ditch, west of lagoon at Colman Sewage Facility.	10,370 ppb
38	Tap water from U.S. Post Office in Colman, S.D.	less than 0.02 ppb
39	Wipe sample from north windows at U.S. Post Office, Colman.	173 ng/area
40	Water and sediment at discharge point of Colman Sewage Facility.	1.75 ppb
41	Soil, 1 mile west on north side of 34.	less than 2 ppb
42	Corn foliage, 1 mile west of T & R, north side of 34.	less than 20 ppb

Site 3 \*

Site 3 \*

Site 1  
April \*

L

J

# = possible sample site locations for present (9/90) study

<u>Sample</u>	<u>Description</u>	<u>Amount PCB 1260</u>
✓ 143	Water from Bachelor Creek 100 yards upstream before confluence with Big Sioux, 11/30/77.	less than 1.10 ppb
144	Water from Big Sioux, 100 yards upstream before joining Bachelor Creek, 11/30/77.	less than 0.10 ppb
145	Water, 100 yards downstream of confluence to Big Sioux and Bachelor Cree, 11/30/77.	less than 0.10 ppb
✓ 146	Sediment, Bachelor Creek, 100 yards upstream of joining with Big Sioux, 11/30/77.	5.6 ppb
✓ 147	Sediment at confluence of Big Sioux and Bachelor Creek, 11/30/77.	31.2 ppb
148	Sediment, 100 yards downstream of confluence of Bachelor Creek and Big Sioux, 11/30/77. Sample is mostly large pebbles and rocks.	less than 1.6 ppb

Definitions:

- <sup>1</sup> - Samples 43 - 48 collected by C. Hansen, South Dakota Department of Environmental Protection.
- \*ppb - parts per billion
- \*\*ng - nanogram
- \*\*\*less than - none detected at that level

<u>Glass Plates</u>	<u>Description</u>	<u>Amount PCB 1260</u>
<sup>1</sup> 1	¼ mile NW of Colman along railroad tracks.	less than 80 ng/area*
<sup>1</sup> 2	½ mile W of T & R Electric, past the mile road and about 60 yards N of Highway 34	less than 80 ng/area
<sup>1</sup> 3	¼ mile S-SW of T & R - cemetery gates.	less than 80 ng/area
<sup>1</sup> 4	Colman City Park - along Highway 34 about 200 yards into park.	less than 80 ng/area

Definition:

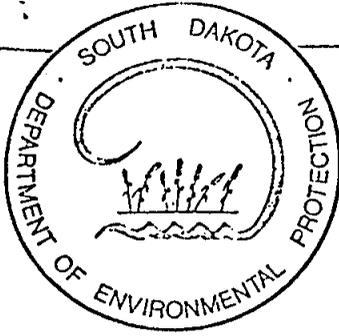
- <sup>1</sup> - Samples 1-4 collected by C. Hansen, South Dakota Department of Environmental Protection.  
\*ng - nanogram



We do not believe any significance can be attached to the glass plates data. They were exposed to the environment for 15 days. If it rained or snowed on them, most likely, any PCB adsorbed on the ethylene glycol was washed off.

LM 12/7/78  
AND A REPORT WHICH SET FORTH THE RECOMMENDED REPAIRS OF THE  
REPAIRS  
SECTION  
MAY 1978  
MAY 1978





SOUTH DAKOTA DEPARTMENT OF  
**Environmental  
Protection**

Contact:  
Public Information  
Department of  
Environmental Protection  
Joe Foss Building  
Pierre, South Dakota 57501  
605-224-3351

PRESS RELEASE NOT FOR RELEASE PRIOR TO FEB. 20, 1978 2/23/78

Pierre:

The U.S. Environmental Protection Agency (EPA) has notified the South Dakota Department of Environmental Protection (DEP) of the results of laboratory analysis for polychlorinated biphenyls (PCBs) of samples collected in November, 1977, by EPA and DEP personnel in and around Colman, South Dakota.

The general findings and conclusions from the sample analysis indicate aerial dispersion of PCB's as evidenced from various soil and vegetation samples; no PCB contamination of the Colman drinking water supply as evidenced from tap water samples; both direct surface runoff and discharges from the Colman sewage treatment lagoon contribute to PCB contamination in the surrounding area, Bachelor Creek and possibly the Big Sioux River; and the principal constituent of contamination is PCB 1260.

Suspected sources of PCB emissions into the ambient environment, as indicated from sample data and analysis, are the Colman sewage treatment plant, T & R Electric and Ross Electric. Sample data of incinerator ash

from Ross Electric suggests that PCB's may have been emitted from the incinerator. Air emissions could also result from heating the office building and shop area with PCB contaminated fuel oil. Soil, dirt and grease sample results also showed PCB's present on Ross Electric property.

Water sediment and vegetation sample data from T & R Electric showed PCB's present on the T & R farm adjacent and west of the company. Water and sediment sample results also showed a surface runoff type discharge of PCB's from T & R Electric property into the area contiguous with the northern most side of the Colman Sewage Treatment Plant.

Sample analysis of the water and sediment at the discharge point of the Colman Sewage Treatment Plant showed a presence of PCB 1260. The presence of PCB's in the Colman Sewage Treatment Plant may be attributed to the discharge of wastewater from T & R Electric and Ross Electric.

Finding PCB's in the soil around Colman is significant from an environmental standpoint since it normally would not be detected in an agricultural area. The occurrence of these compounds is nationally more prevalent in metropolitan areas, particularly within city limits.

PCB's have been an environmental concern for some time and have resulted in several major control measures to minimize impacts on public health and the environment through the development of criteria for their use and disposal and concentration in navigable waters and the food supply.

PCB's are highly persistent environmental contaminants that bio-accumulate in food chains and produce acute and chronic effects as well as subtle impact on growth, reproduction, behavior and health of fish, birds and mammals.

"DEP's concern," says Secretary Allyn O. Lockner, "is not so much with the acute, or near-term effects of PCB's on the general public health and welfare of the Colman area residents, but the potential chronic or long-term effects from exposure to PCB's. Results of sampling performed in October, 1977, do not substantiate PCB contamination of the food supply and the result of samples of Colman's drinking water supply showed no PCB contamination."

PCB contamination of the workplace and potential health effects to workers exposed to PCB's is under the jurisdiction of the U.S. Occupational Safety and Health Administration (OSHA).

"OSHA will have to assess the severity of the problem and the health implications to the workers at T & R Electric and Ross Electric and determine what corrective actions are necessary with respect to the workplace," said Lockner, "DEP is focusing its attention to PCB contamination of the ambient environment (outside the work place) and what recourse is necessary in the near future to correct the problem."

"Although our enforcement options under the law must remain viable, DEP will make every effort to cooperate with T & R Electric and Ross Electric under the statutes and rules for which we are responsible in achieving an effective, smooth and expeditious solution to this problem," concluded Lockner.

###

A2/06

March 11, 1980

Irwin Dickstein, Director  
Enforcement Division  
U.S. Environmental Protection Agency  
1860 Lincoln Street  
Denver, Colorado 80295

Dear Mr. Dickstein:

As a result of the Colman area PCB investigation conducted in late 1977, much attention was focused on the PCB levels immediately surrounding T & R Electric and Ross Electric. That survey investigated PCB levels in soils, corn, stream sediments, and the municipal water supply among others. The survey did not address the level of PCB's bioaccumulated in aquatic organisms and the possible public health threat possible from consuming contaminated fish downstream in Bachelor Creek and the Big Sioux River. Our Department did a preliminary biological sampling survey in May of 1979. The results of that sampling are enclosed. As can be seen, the analysis from the Crayfish is very high and in our opinion, warrants at least some additional monitoring in order to determine if this does constitute a public health hazard.

Efforts by our Department to enlist help and guidance for further study of the problem through the EPA Toxics Integration Committee have not resulted in anything tangible. As indicated in the enclosed copy of an August 29, 1979 letter to Lee Baron from Wanda Taunton, the end of October, 1979, was the target for development of a sampling protocol. No word has since been received.

To get the study underway we would like your assistance in the form of laboratory analysis for PCB identification.

Irwin Dickstein  
Page 2  
March 11, 1980

Possible  
Sampling  
Site

Our Department would conduct a survey to collect samples of sediment water and fish flesh at four to five sites from the lower end of Bachelor Creek downstream on the Big Sioux River to the Big Sioux River Diversion Dam, just north of Sioux Falls. The collected samples would be shipped to EPA for analysis. Further delineation would be made later.

Please contact me on this request as soon as possible as the survey should be scheduled this spring.

Sincerely,

James D. Nelson  
Deputy Division Director  
Division of Water Quality  
Phone: (605) 773-3351

A32107LB



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VIII  
1860 LINCOLN STREET  
DENVER, COLORADO 80203

Ref: 8S-TI

July 18, 1979

D. Miller  
Office of Water Quality  
South Dakota Department of  
Environmental Protection  
Pierre, South Dakota 57501

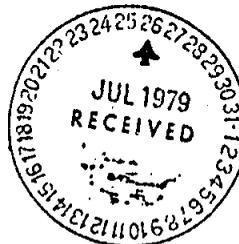
Dear Mr. Miller:

Attached are the PCB results for fish and crayfish collected from Bachelor Creek. As noted in the analytical report, the data refer to "whole" organism analyses.

The high result for the single crayfish sample from Station 6 is surprising. However, all aspects of the analysis were rechecked without any indication of analytical error. A second sampling to verify this finding might be beneficial.

Sincerely yours,

Milton W. Lammering, Chief  
Technical Investigations Branch  
Surveillance and Analysis Division



### SAMPLE ANALYSIS & RESULTS

The fish and crayfish samples were analyzed using Food and Drug Method PAM Vol. I (Foods and Feeds 211.13f fish). The whole organism was used in the analysis.

There were two sampling sites and from each site fish and crayfish were analyzed for PCB's 1260, 1254 and 1242.

Including spikes, duplicates and a blank - 9 analyses were performed. Sample size ranged from 9g-30g depending upon amount of sample available.

Sample	PCB 1260
Fish - 5	100 ppb
Crayfish - 5	40 ppb
Fish - 6	.130 ppb
Crayfish - 6	28.7 ppm

PCB's 1254 and 1242 were also analyzed for (none detected) if present, it exists at or below <10 ppb.

All samples were analyzed by gas chromatograph: HP7610A.

Detector: EC (Ni<sup>63</sup>)  
Collumn: 4%SE30/6%OV210 - 210°C  
Attn: 2X10<sup>4</sup>

All samples were qualitatively cross checked on MT220.

Detector: EC(Ni<sup>63</sup>)  
Collumn: 3%OV-1 - 190°C  
Attn: 16-1X10<sup>2</sup>

Sample spikes:

Sample	Spike level(ppm)	Detected 1260(ppm)	% Recovery
Fish - 5	2.43	2.7	111%
Crayfish - 5	2.19	2.3	103%

*Gregory J. Saunders*  
Gregory J. Saunders

Polychlorinated Biphenyl Contamination of Areas Surrounding  
Two Transformer Salvage Companies, Colman,  
South Dakota—September 1977<sup>1</sup>

Yvonne A. Greichus<sup>2</sup> and Barbara A. Dohman<sup>3</sup>

~~Thomas~~

ABSTRACT

Soil, corn plants, and foliage from areas surrounding two electrical salvage companies involved in reconditioning old transformers had unusually high levels of polychlorinated biphenyls (PCBs). Levels decreased as distance from the factories increased. PCBs were dispersed into the air through incineration of waste oils; water and soil contamination was caused by runoff from the factories. PCBs found in the contaminated areas closely resembled Aroclor 1260 as did the PCBs in the waste oil, whereas PCBs in other areas were more similar to Aroclor 1254. PCBs on surface soils taken from an unplowed pasture near the factories also resembled Aroclor 1260, whereas samples taken from depths of 2–4 inches showed degradation of some PCB isomers. PCB concentrations in corn cobs and kernels were < 0.05 ppm, whereas leaves contained PCB levels of up to 2.2 ppm. PCB levels in earthworms and small rodents collected near the factories were considerably higher than levels in the same types of animals collected from other areas.

Introduction

Polychlorinated biphenyls (PCBs) have become significant environmental pollutants which are residual and toxic. Their accumulation in the food chains of many animals produces both acute and chronic effects on reproduction, growth, and behavior (3, 6, 8). PCBs have been used extensively in the past as a dielectric base for transformers and capacitors. Although PCBs are no longer manufactured in the United States, the U.S. Environmental Protection Agency (EPA) has estimated that, since their introduction in 1929, 1.25 billion pounds have been used. Of this amount, 60 percent is still in use and 4.4 percent has been destroyed. The rest remains in the environment (9). Movement of PCBs through the atmosphere has been demonstrated, and

industrial or metropolitan areas are the suspected sources of the PCB contamination (4, 7). Bailschmitter et al. (1) have shown that certain isomers of PCBs occurred in the environment in the same ratios as measured in commercial PCB mixtures: Aroclors 1254 and 1260. They have presented evidence that the degradation of these isomers in the ecosphere, over 20–40 years, has been too small to produce observable changes, indicating that these isomers are extremely persistent. To further complicate matters, PCBs contain some highly toxic polychlorinated dibenzofurans (10). Aroclor 1254 and Aroclor 1260 contain 5.6 ppm and 2.2 ppm, respectively, of a combination of the tetra-, penta-, and hexachlorinated dibenzofurans (5).

When the environment has been found to be contaminated with PCBs, several important questions must be considered. If possible, the source of the contamination should be located; the method of dispersion into the environment by air, water, soil, etc., needs to be examined; and the extent of the area of pollution must be determined. Whether the contamination is of recent and/or past origin, the potential harm to the environment due to accumulation in the food chain of animals should be studied. This paper discusses an incident in which PCBs entered the environment through activities of two transformer salvage companies, and it presents methods and supporting data for answering the above questions.

Methods and Materials

During September 1977, two samples each of soil and corn leaves collected near two electrical salvage companies near Colman, South Dakota, were found to have unusually high levels of PCBs. Samples were collected in chemically cleaned glass jars or hexane-washed aluminum foil and were frozen until being analyzed. The samples were extracted and subjected to Florisil column cleanup according to the method of Greichus et al. (2). Instrument parameters and operating conditions for gas chromatographic analysis were as follows:

<sup>1</sup> This paper is published with the approval of the Director of the South Dakota Agricultural Experiment Station as Journal Series Publication No. 1645.

<sup>2</sup> Present address: Biochemical Services Division, Rocky Mountain Geochemical Corp., Suite 343, 1400 53rd Street, Emeryville, Calif. 94608.

<sup>3</sup> Station Biochemistry Section, Chemistry Department, South Dakota State University, Brookings, S.D. 57007.



of < 0.1 ppm PCBs as Aroclor 1254. Therefore, the PCB levels were above expected concentrations at distances from the factories at least 0.25 mile north, less than 2.5 miles west (soil), and up to 10 miles south (corn leaves) (Fig. 1). One mile south of the factories, the soil contained < 0.025 ppm PCBs, the expected background level, although at 10 miles south of the factories, corn leaves contained 0.12 ppm PCBs, whereas the PCB levels in soil were still < 0.025 ppm, indicating airborne contamination of the leaves. This conclusion was further supported by the analysis of two entire corn plants and the soil on their roots taken 50 yards south of the factory lot (Table 1). The outer leaves contained 1.1 ppm and 2.2 ppm PCBs, the inner leaves contained 0.25 ppm and 0.34 ppm, and the ker-

nels and cobs contained < 0.05 ppm. The 0.29 ppm and 0.53 ppm PCB levels in the roots were somewhat higher than levels in the soil on the roots, but the low levels in the stocks, cobs, and kernels did not indicate significant transport of the PCBs from the roots to the outer leaves. PCBs in the soil could be due to water drainage from one of the factories as well as from air and dust-borne material, since there was drainage from one factory into this area.

PCBs in surface soils and in corn leaves closely resembled commercial Aroclor 1260 as shown by gas chromatograms in Figure 2. The type of PCB found in waste oils (42 ppm) from one factory also resembled Aroclor 1260 (personal communication, U.S. EPA, Denver, Colo.), whereas PCBs in soils and bottom sediments

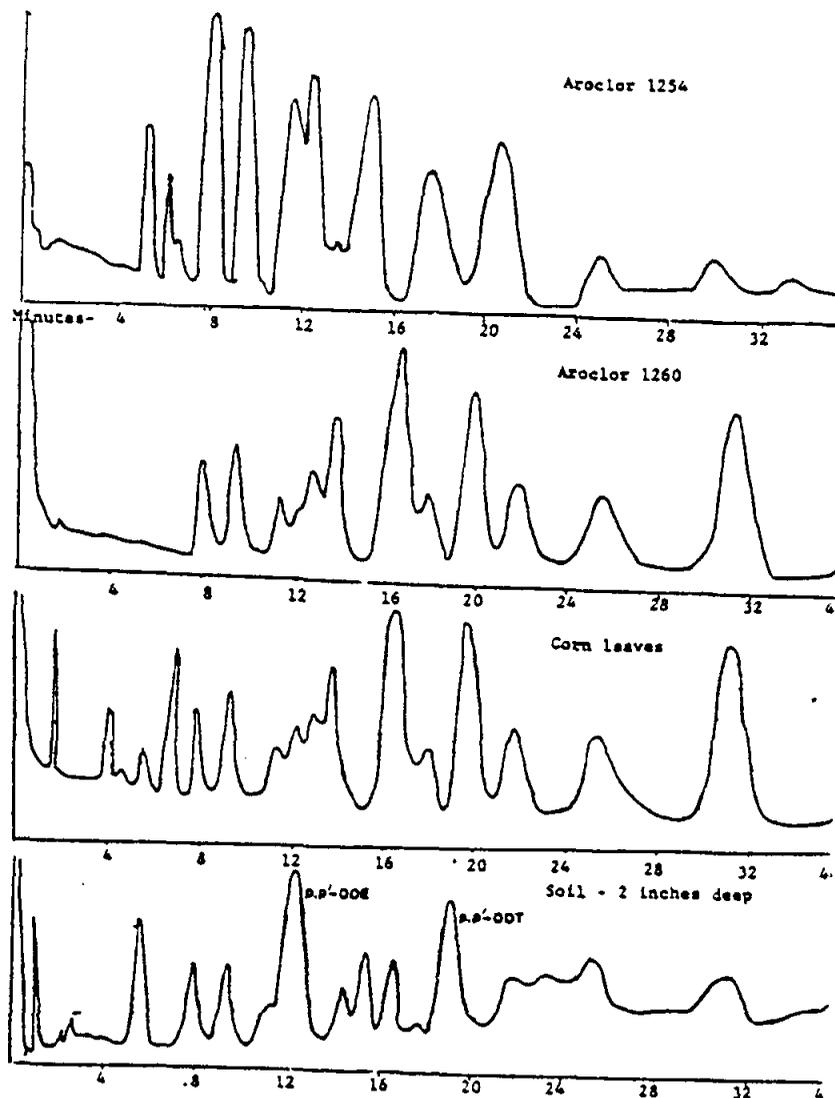


FIGURE 2. Chromatograms of samples compared to standards of Aroclor 1254 and 1260. See text for instrument parameters and operating conditions.

TABLE 1. PCB levels (as Aroclor 1260) in corn plants and soil on roots, 50 yards south of the factory lot, Colman, South Dakota—September 1977

SAMPLE TYPE	PCBs, PPM DRY WT	
	SAMPLE No. 1	SAMPLE No. 2
Soil on roots	0.22	0.24
Roots	0.29	0.53
Stock		
Bottom	0.12	<0.1
Middle	0.14	<0.1
Top	0.23	<0.1
Cob	<0.05	<0.05
Kernels	<0.05	<0.05
Inner leaves on ear	0.25	0.34
Leaves on plant	1.1	2.2

NOTE: Samples 1 and 2 each consists of one entire corn plant approximately 10 feet apart.

from other areas in South Dakota did not. Soil taken at 2–4-inch depths from a pasture across the road from one factory, which had not been plowed since 1960, averaged 0.16 ppm PCBs. In the past, both factories had disposed of surplus transformer oil by incineration, and one factory used waste oil to heat the office building and the shop area (personal communication, U.S. EPA, Denver, Colo.). About four years ago, special furnaces were equipped with afterburners to destroy the PCBs. However, the presence of high levels of PCBs on the corn leaves suggests afterburners may not be efficient.

Samples taken from around one factory and analyzed by the U.S. EPA Laboratory in Denver, Colorado, contained PCBs resembling Aroclor 1260 in the following amounts: water collected from the area behind one shop building, 19 ppb; dirt from in front of an incinerator, 31 ppm; and swabs from three windows on a building next to the incinerator, 14  $\mu\text{g}/\text{area}$ . There was no contamination of the Colman drinking water. Soil and vegetation taken one mile north of the factories contained 0.011 ppm PCBs. Sediment and vegetation collected about 20 ft west of a fence around one factory contained 0.17 ppm and 0.39 ppm PCBs, respectively. Soil and corn foliage taken 1 mile west of the factories, from the north side of the highway, contained < 0.02 ppm PCBs. No PCBs were detected on corn, cornstalks, and leaves taken about 1 mile east of the factories (personal communication, Food and Drug Administration, Denver, Colo.).

Earthworms and small rodents were collected from the north and south of the factories and from areas near Brookings, South Dakota, believed to be relatively free of PCBs. Earthworms near the factories and near Brookings contained average PCB levels of 1.96 ppm and 0.77 ppm, respectively, with a ratio of levels in the factory area to levels in the Brookings area of 2.5 (Table 2). PCB levels in rodents near the factories ranged from 4.85 to 17.2 ppm in liver tissues and from 3.42 to 6.87

TABLE 2. PCB levels in earthworms and rodents collected near Colman factories and in the Brookings, South Dakota, vicinity, September 1977

DESCRIPTION	PCBs, PPM		
	FACTORY AREA	BROOKINGS AREA	RATIO OF FACTORY/BROOKINGS
Earthworms <sup>1</sup> ( <i>Oligochaeta terrestris</i> )	1.85	0.84	2.5
	2.07	0.67 0.54	
Vole ( <i>Microtus</i> sp.) Liver	9.17	4.67	1.5
	4.85		
Muscle	5.68	2.60	1.7
	3.42		
Field mouse ( <i>Peromyscus</i> sp.) Liver	9.52	2.95	4.7
	9.10	2.20	
Muscle	17.2		3.1
	3.77	1.80	
13-Lined ground squirrel ( <i>Spermophilus</i> sp.) Liver	6.87	1.72	3.1
	5.91		
Muscle	8.71	0.41	8.4
		1.29 1.44	
Muscle	2.89	0.72	3.2
		1.11 0.86	

<sup>1</sup> Each sample consisted of 2.6 g dry weight of worms.

ppm in muscle tissues. PCB levels in rodents collected near Brookings ranged from 2.20 to 4.67 ppm in liver tissues and from 1.72 to 2.60 ppm in muscle tissues.

### Conclusions

The sources of the PCBs in the Colman area were related to operations involved in electrical salvage as evidenced by the predominance of Aroclor 1260 in the factory oil and in surrounding areas and by the fact that the highest levels were near the factories and became increasingly lower as the distance from the factories increased.

PCBs were dispersed by wind, water, and silt runoff in the immediate area. More distant PCB contamination was primarily airborne because PCB levels in outer corn leaves were unexpectedly high whereas soil levels were very low. Airborne contamination extended at least 0.25 mile north and 10 miles south of the factories.

The contamination was of both past and of recent origins. Levels of PCBs (Aroclor 1260) on outer corn leaves proved recent origin, and PCB levels in soil samples taken 2–4 inches deep from a pasture which had not been plowed since 1960 suggested past contamination.

Bioaccumulation is occurring because PCB levels in earthworms and small rodents collected near the factories were considerably higher than levels in the same types of animals collected from other areas.

ne 0.39 ppm  
somewhat high  
at the low levels  
indicate significant  
variance

#### LITERATURE CITED

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UNITED STATES  
ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

REPORT OF ANALYSIS

1. SAMPLE NO	2. DATE COLLECTED
3. REGION	4. EPA REG. NO.
8	N/A
5. ESTABLISHMENT NO.	

6. DESCRIPTION OF SAMPLE  
**Crayfish (frozen)**

7. NAME AND ADDRESS OF ESTABLISHMENT WHERE SAMPLE WAS COLLECTED (include ZIP code)	8. PRODUCT NAME
J.C. Anderson - Regional Office Supervisor So. Dakota Dept. of Water & Natural Resources Suite 200, 114 1/2 South Main Street Sioux Falls, South Dakota 57102	PCB's
	9. LOT OR CODE NUMBER(S)
	N/A

10. NAME AND ADDRESS OF PRODUCER (if different from 7 above)  
Collected from Bachelor Creek near Colman.

11. RESULTS OF ANALYSIS

Method: GC/ECD

Sample	Aroclor Species 1242	1254	1260
Sub. 1	< 5ppm	< 3ppm	< 2ppm

Analyst: Gregory J. Saunders Date: 3 Nov 80

No PCB's were found at the reported detection limits (above).

12. LABORATORY COMMENTS

1. Samples picked up from airport on 6/13/80 (frozen on dry ice).
2. Send analytical results to State (Item 7).

13. SIGNATURE OF LAB SUPERVISOR <u>John R. Tolstra</u>	14. LABORATORY <u>Reg. 8</u>	15. DATE <u>11/13/80</u>
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