

INVESTIGATION OF POLYCHLORINATED BIPHENYLS (PCBs) IN NATURAL GAS PIPELINES AND DISTRIBUTION SYSTEMS IN WISCONSIN

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Summary

Between January 28 and February 9, 1981, the Department of Natural Resources collected and analyzed 25 samples of oil from the state's natural gas pipeline supply and distribution system. Twenty-three samples were negative for PCB contamination at detection limits ranging from 1 to 50 mg/kg (p.p.m.). Two samples showed low level PCB contamination, quantified at 10 and 24 mg/kg respectively. Both positive samples were below the hazardous level (defined as 50 mg/kg (p.p.m.) or higher by federal regulations). Both positive samples were oil condensates collected from scrubbers designed to remove contaminants from the natural gas stream. The two scrubbers which yielded positive samples are located on major incoming pipelines that enter Wisconsin from the west and south. They are the first such scrubbers within the state boundary, so contaminants removed at these points came from a source(s) outside the state. This, plus the fact that all lubricating oils used at natural gas compressor stations within the state were negative for PCB, strongly suggests that we do not have a PCB problem in the natural gas distribution system within the state. Rather, the trace amounts identified at 2 peripheral locations on the system suggest out-of-state origin, probably residuals from isolated use of PCB-based lubricants some time in the past at compressor stations upstream from our state boundary. Sampling strategy, analysis, and interpretation of results are discussed in greater detail in the following text.

Introduction

A. Description of the problem

The Wisconsin Department of Natural Resources was contacted by the Region V Toxic Substances Office (TSO), U.S. Environmental Protection Agency, on January 26, 1981. The Department was informed about recent findings regarding PCB contamination of natural gas systems in the states of New York, New Jersey, and Illinois. TSO requested that the Department provide assistance by contacting appropriate utilities and pipeline companies to inform them of the problem.

On January 27, 1981, Department officials called a meeting with officials from the Department of Health and Social Services, representatives from the

natural gas pipeline companies, the utilities, the press and the Wisconsin Public Service Commission. The following companies had representation at the meeting either in person or by conference call:

Michigan — Wisconsin Pipeline Company
 Northern Natural Gas Company
 Midwestern Gas Transmission Company
 Wisconsin Power and Light Company
 Wisconsin Southern Gas Company
 Wisconsin Natural Gas Company
 Madison Gas and Electric Company
 Wisconsin Gas Company
 Wisconsin Public Service Corporation
 Lake Superior District Power
 Wisconsin Fuel and Light Company
 Northern States Power

Department officials outlined the nature of the problem in other states and proposed immediate action to assess the situation in Wisconsin. Michigan—Wisconsin Pipeline Company officials indicated that in preliminary sampling at Sheboygan, Wisconsin and a compression station in Michigan, no PCBs were found. Pipeline officials expressed their eagerness to identify the problem if it existed in Wisconsin, and were very receptive to the sampling plan proposed by the Department.

B. Layout of Wisconsin's natural gas supply

Wisconsin is served by five natural gas pipeline companies (Fig. 1).

1. Great Lakes Gas Transmission Company delivers Canadian gas to Wisconsin from the northeast. Their pipeline enters Wisconsin at Superior, then travels eastward across northern Wisconsin and Upper Michigan. Near Crystal Falls, Michigan, Great Lakes Gas Transmission Company merges with the Michigan—Wisconsin Pipeline Company. The latter company pumps gas southward to Mountain, where the first in-state compressor station is located. Gas flows southward from Mountain.
2. Midwest Gas Transmission Company delivers Canadian gas to Wisconsin from the west. Their pipeline merges with the Michigan—Wisconsin Pipeline Company at Marshfield. The latter company operates the first in-state compressor station on this line at Marshfield. Gas flows north and east from Marshfield.
3. Northern Natural Gas Company delivers Oklahoma gas to Wisconsin from the west and south at five locations in the state: Superior, Osceola, Prescott, LaCrosse, and Hazel Green. Their line coming in at Hazel Green merges with the Michigan—Wisconsin Pipeline Company at Janesville. The latter company operates the first in-state compressor station on this line at Janesville. From Janesville, gas is pumped north and in some cases south in the Michigan—Wisconsin pipeline.
4. Michigan—Wisconsin Pipeline Company delivers Oklahoma and Gulf gas to

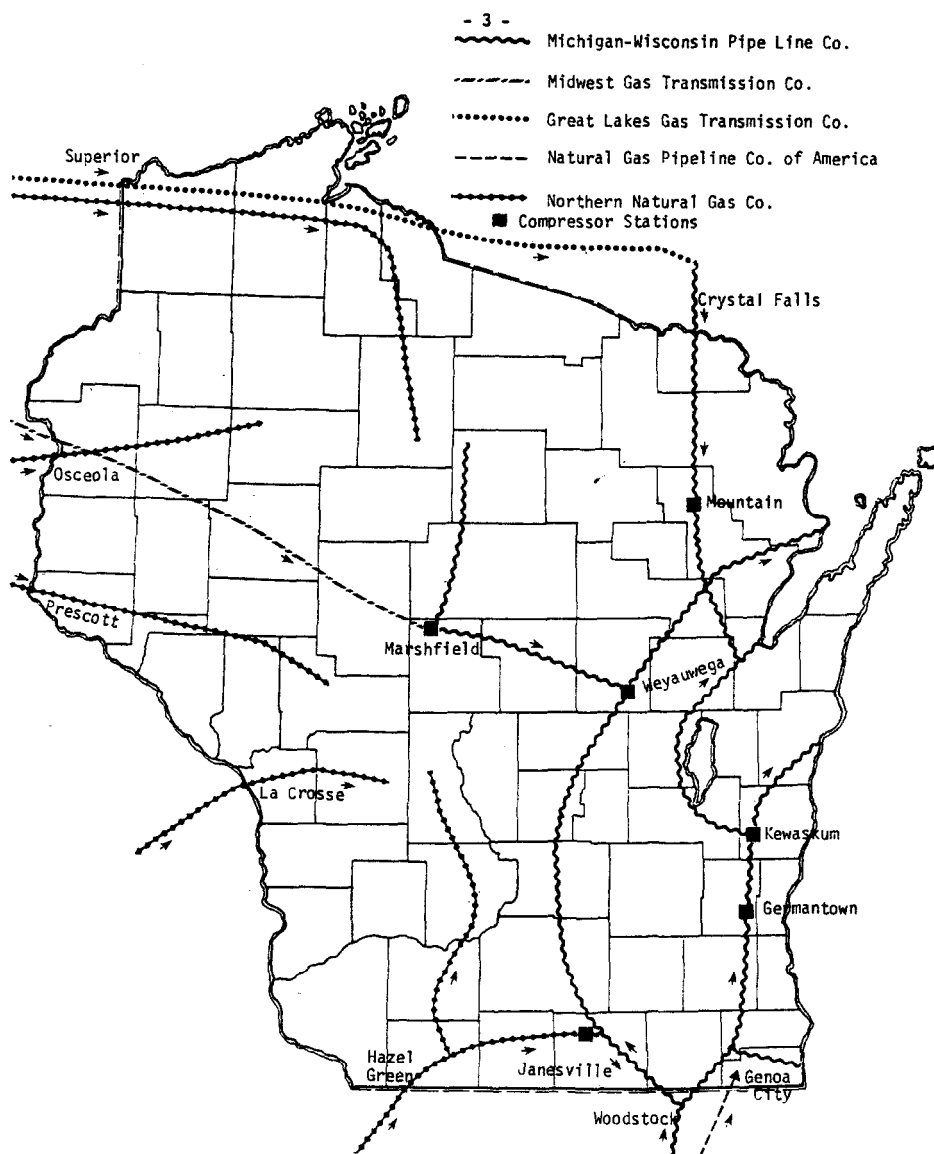


Fig. 1. Major natural gas pipelines and compressor stations in Wisconsin.

Wisconsin from the south. This pipeline divides near Woodstock, Illinois. The western line proceeds toward Janesville. The eastern branch proceeds toward Racine, Kenosha, Milwaukee, the Fox Valley, and eventually ties in with the Michigan-Wisconsin line coming from Mountain. The first in-state compressor station on the eastern branch is at Germantown.

5. Natural Gas Pipeline Company of America delivers Oklahoma and Gulf gas to southeastern Wisconsin from the south. The line enters Wisconsin near Genoa City and supplies Wisconsin Southern Gas Utility. There is no in-state compressor station on this line.

Sampling strategy

A. Background

Under Federal regulation, natural gas pipeline compressor oils containing PCBs could no longer be used after May 1, 1980 (40 CFR, Section 761.3(i)). According to federal officials, the use of PCBs as fire-resistant lubricating oils in gas compressors prior to May, 1980, could be responsible for the PCB material now being found. Therefore, the first phase of sampling was directed toward lubrication oils used at the six natural gas compressor stations located in Wisconsin (Fig. 1).

The second phase of sampling was directed at a limited number of gate or metering stations downstream from compressor sites. At gate stations, the pipeline companies deliver gas to their customers, gas utilities. Due to significant pressure changes at gate stations, oil condensates sometimes accumulate.

If PCBs were found in sufficient quantities at the compressor sites, or at gate stations, further testing of local distribution systems was planned, including tests of the gas stream itself. Testing for PCBs in the natural gas supply to communities would constitute phase three of the sampling plan.

B. Sample collection and analysis

Phase 1, compressor stations

A representative from the Department accompanied officials from the Michigan—Wisconsin Pipeline Company to the six compressor stations in the state. All available oils were sampled at each site, including crankcase oil, compressor lubricating oil, and oil condensate from scrubbers located on the incoming gas stream. In most cases, duplicate samples were taken, one for Pipeline Company analysis and one for Department analysis.

Phase 2 and 3, gate (metering) stations and residential distribution system

Oil condensate from metering stations and community distribution systems were collected whenever possible during sampling trips to compressor stations. Samples were obtained from Janesville, Genoa City, and the New Berlin gate stations, and from the distribution systems in Elkhorn and Superior.

Analysis

Samples were collected in clean glass jars and capped with aluminum foil lined covers. Analysis was performed by the Wisconsin State Laboratory of

Hygiene using USEPA recommended procedures*. Sulfur compounds which interfere with gas chromatography analysis were eliminated in most cases by precipitation with elemental mercury under acidic conditions. When sulfur interference persisted, a Hall Detector was used in place of the electron capture detector normally used on the gas chromatograph. Sample values reported at detection limits of 20 mg/kg (p.p.m.) or higher were re-evaluated using the Hall detector in an attempt to get better resolution.

Interpretation of results

Sample descriptions and analytical results are listed in Table 1.

Janesville Compressor Station and Gate Station

Scrubber condensate from the incoming gas stream was negative for PCBs. All lubricating oils used on-site were negative for PCBs. Condensate from the Janesville Metering Station was negative for PCB. The findings indicate that: (1) the incoming gas stream supplied by Northern Natural Gas Company is not contaminated with PCB, (2) PCBs are not entering the gas stream at the compressor station, and (3) the supply of gas to the community of Janesville is free of PCB contamination.

Genoa City Metering Station and Elkhorn Distribution Systems

Pipeline condensates at gates 627 and 643 were negative for PCBs. Condensates from the Elkhorn distribution system and a residential meter were negative for PCBs. These findings indicate that: (1) the incoming gas stream supplied by Natural Gas Pipeline Company of America is not contaminated with PCB, and (2) the supply of gas to the community of Elkhorn is free of PCB contamination.

Marshfield Compressor Station

Scrubber condensate from the incoming gas stream was positive for PCBs. All lubricating oils used on-site were negative for PCBs. These findings indicate that: (1) the incoming gas stream supplied by Midwest Gas Transmission Company has low level PCB contamination and (2) PCBs are not entering the gas stream at the compressor station.

Mountain Compression Station (Compressor normally operates only during January, February and March each year)

No scrubber condensate had accumulated so obtaining a sample was im-

*Interim method for sampling and analysis of PCBs in natural gas, USEPA Environmental Monitoring Support Laboratory, 536 S. Clark St., Chicago, IL 60605 (U.S.A.), 12 February 1981, pp. 8.

TABLE 1

PCB sampling results; natural gas pipelines and distribution systems in Wisconsin

DNR Sample Number	Sampling Date	Location	Sample Description	Total PCB Content mg/kg (p.p.m.)	Species of Aroclor (PCB) Detected
1	28-1-81	Janesville Compressor Station, Michigan—Wisconsin Pipeline Company	Scrubber Oil Condensate	none detected (at 2 mg/kg detection limit)	—
2	28-1-81	Janesville Compressor Station, Michigan—Wisconsin Pipeline Company	Compressor Crank Case Oil	none detected (at 1 mg/kg detection limit)	—
3	28-1-81	Janesville Compressor Station, Michigan—Wisconsin Pipeline Company	Compressor Lube Oil	none detected (at 1 mg/kg detection limit)	—
4	28-1-81	Janesville Compressor Station, Michigan—Wisconsin Pipeline Company	Scrubber Oil Condensate	none detected (at 2 mg/kg detection limit)	—
5	28-1-81	Janesville Metering Station; Wisconsin Power & Light meter run	Oil Condensate from pipeline	none detected (at 5 mg/kg detection limit)	—
6	30-1-81	Stations 627 and 643 Genoa City, Natural Gas Pipeline Co. of America	Oil Condensate from pipeline	none detected (at 1 mg/kg detection limit)	—
7	30-1-81	Centralia Street, Elkhorn, WI; Wisconsin Southern Gas co.	Oil Condensate from pipeline	none detected (at 2 mg/kg detection limit)	—
8	30-1-81	Residential meter, 215 E. Marshal Street Elkhorn, WI; Wisconsin Southern Gas Co.	Oil condensate from gas meter	none detected (at 2 mg/kg detection limit)	—
9	30-1-81	Centralia Street, Elkhorn, WI; Wisconsin Southern Gas co.	Oil Condensate from pipeline	none detected (at 2 mg/kg detection limit)	—
10	3-2-81	Marshfield Compressor Station, Michigan—Wisconsin Pipeline Company	Micro-lube Compressor Oil	none detected (at 1 mg/kg detection limit)	—
11	3-2-81	Marshfield Compressor Station, Michigan—Wisconsin Pipeline Company	Scrubber #3 oil condensate	24 mg/kg	1242 1254

TABLE 1 (continued)

12	3-2-81	Marshfield Compressor Station, Michigan—Wisconsin Pipeline Company	“Oil Cooler” Compressor Crank Case oil	none detected (at 1 mg/kg detection limit)	—
13	3-2-81	Marshfield Compressor Station, Michigan—Wisconsin Pipeline Company	“Oil cooler” Compressor Crank Case oil	none detected (at 1 mg/kg detection limit)	—
14	3-2-81	Mountain Compressor Station, Michigan—Wisconsin Pipeline Company	Compressor Lube Oil	none detected (at 1 mg/kg detection limit)	—
15	3-2-81	Mountain Compressor Station, Michigan—Wisconsin Pipeline Company	Compressor Crank Case Oil	none detected (at 1 mg/kg detection limit)	—
16	3-2-81	Weyauwega Compressor Station, Michigan—Wisconsin Pipeline Company	Compressor Lube oil	none detected (at 1 mg/kg detection limit)	—
17	3-2-81	Weyauwega Compressor Station, Michigan—Wisconsin Pipeline Company	Scrubber oil condensate	none detected (at 1 mg/kg detection limit)	—
18	6-2-81	Germantown Compressor Station, Michigan—Wisconsin Pipeline Company	Turbine Lube Oil	none detected (at 1 mg/kg detection limit)	—
19	6-2-81	Germantown Compressor Station, Michigan—Wisconsin Pipeline Company	Compressor Lube Oil	none detected (at 1 mg/kg detection limit)	—
20	6-2-81	Germantown Compressor Station, Michigan—Wisconsin Pipeline Company	Scrubber Oil Condensate	10 mg/kg	1242 1248 1254
21	6-2-81	Kewaskum Compressor Station, Michigan—Wisconsin Pipeline Company	Crank case and Compressor Lube Oil	none detected (at 1 mg/kg detection limit)	—
22	6-2-81	Gate Station, New Berlin, WI (Michigan—Wisconsin Pipeline Company delivers to Wisconsin Natural Gas Co.)	Oil Condensate from pipeline	none detected (at 5 mg/kg detection limit)	—
23	9-2-81	Superior Water Light and Power distribution Lines, Superior, WI	Watery pipeline infiltrate, East 5th St.	none detected (at 10 µg/l detection limit)	—
24	9-2-81	Superior Water Light and Power distribution Lines, Superior WI	Watery pipeline infiltrate Hammond Ave N. 24th St.	none detected (at 10 µg/l detection limit)	—

TABLE 1 (continued)

DNR Sample Number	Sampling Date	Location	Sample Description	Total PCB Content mg/kg (p.p.m.)	Species of Aroclor (PCB) Detected
25	9-2-81	Superior Water Light and Power distribution Lines, Superior WI	Watery pipeline infiltrate, Maryland Ave between N23rd and 24th Street	none detected (at 10 µg/l detection limit)	—

possible. Lubricating oils used on-site were negative for PCB. These findings indicate that PCBs are not entering the gas stream at the compressor station.

Weyauwega Compressor Station

Scrubber condensate was negative for PCBs. Lubricating oils used on-site were negative for PCBs. These findings indicate that: (1) the incoming gas stream (from Marshfield, Mountain, or Janesville) is not contaminated with PCB, and (2) PCBs are not entering the gas stream at the compressor station.

Germantown Compressor Station (Compressor has not been operated for several years)

Scrubber condensate from incoming gas was positive for PCBs. All lubricating oils used on-site were negative for PCBs. These findings indicate that: (1) the incoming gas stream supplied by the Michigan—Wisconsin Pipeline Company (from Woodstock) was, at sometime in the past, contaminated with PCBS (Since the compressor has not been operated in several years, contaminated condensate does not characterize present gas stream), and (2) PCBs are not entering the gas stream at the compressor station.

Kewaskum Compressor Station

No scrubber condensate had accumulated so obtaining a sample was impossible. Lubricating oil used on-site was negative for PCBs. These findings indicate that PCBs are not entering the gas stream at the compressor station.

New Berlin Gate Station

Oil condensate from the pipeline was negative for PCBs. This finding suggests that the incoming gas stream (from Woodstock) is not presently contaminated with PCB. (Evidence from the Germantown compressor station which is downstream from New Berlin does indicate contamination sometime in the past.)

Superior Natural Gas Distribution System

Watery pipeline infiltrate was negative for PCBs. These findings indicate

that the incoming gas stream (Northern Natural Gas Company) is not contaminated with PCBs and, therefore, community distribution system is free of PCB contamination.

Summary and recommendations for further study

The Wisconsin Department of Natural Resources was asked to provide assistance by the U.S. Environmental Protection Agency, in determining whether a PCB problem existed in the state's natural gas supply and distribution system. The Department has checked lubricating oils used at all compressor stations in the state, and has checked oil condensates from selected gate stations and community distribution systems in Wisconsin.

Only 2 of the 25 samples were positive for PCBs, and in both cases, the levels were below the hazardous level defined by federal regulation. Based on these findings, Wisconsin does not have a PCB contamination problem in its natural gas supply and distribution system.

The evidence collected during this study suggests that the trace amounts of PCB identified at two peripheral locations on the system originated outside the state. It is recommended that the companies whose pipelines produced PCB-contaminated scrubber condensates pursue the source of this contamination by thoroughly testing lubricants and scrubber condensates from compressor stations and filter stations located upstream from the Wisconsin border. Specifically, the Department would like monitoring results from:

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