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Central Maine Power Company

Progress on the Plan to Remove PCB Contaminated Distribution Line Transformers From Service

A Report to the
Joint Standing Committee on Natural Resources
of the 120th Maine Legislature

12 January, 2001

"A public utility that owns a transformer that contains polychlorinated biphenyls in concentrations at or above 50 parts per million shall submit a report by January 15, 2001 to the joint standing committee of the Legislature having jurisdiction over natural resource matters on:

- 1. The public utility's progress toward removing those transformers that contain polychlorinated biphenyls in concentrations at or above 50 parts per million and that are located within 100 feet of any surface water or school; and*
- 2. A plan for the removal of those transformers that contain polychlorinated biphenyls in concentrations at or above 50 parts per million and that are located in underground vaults."*

Sec.1. 38 MRSA §419-B



January 12, 2001

The Honorable Robert W. Duplessie
2 State House Station
Augusta, ME 04333-0002

Dear Representative Duplessie:

The 119th Legislature enacted LD 665, now Public Law 1999, Chapter 193, "An Act to Protect the Environment by Phasing Out the Use of Old Transformers that are Potential Sources of PCB Pollution". The law set voluntary goals for the removal of PCB-contaminated transformers. This law states:

"A public utility that owns a transformer that contains polychlorinated biphenyls in concentrations at or above 50 parts per million shall submit a report by January 15, 2001 to the joint standing committee of the Legislature having jurisdiction over natural resource matters on:

- 1. The public utility's progress toward removing those transformers that contain polychlorinated biphenyls in concentrations at or above 50 parts per million and that are located within 100 feet of any surface water or school; and*
- 2. A plan for the removal of those transformers that contain polychlorinated biphenyls in concentrations at or above 50 parts per million and that are located in underground vaults."*

Central Maine Power Company is pleased to submit the enclosed progress report in accordance with the law's requirement. The report and supporting appendices describe CMP's methodology, plan, and progress to date for removing PCB-contaminated transformers from service in accordance with the goals.

If you have any questions on the enclosed information, feel free to contact me.

Sincerely,

Mary R. Smith
Environmental Manager

Enclosure

Joint Standing Committee on Natural Resources (3)

Senator John L. Martin, Chair
Representative Scott W. Cowger, Chair
Senator W. Tom Sawyer, Jr.
Senator Kevin L. Shorey
Representative Joseph E. Clark
Representative Robert W. Duplessie
Representative Christina L. Baker
Representative Joanne T. Twomey
Representative Theodore Koffman
Representative Robert A. Daigle
Representative David L. Tobin
Representative James D. Annis
Representative Richard A. Crabtree

Senator Sharon Treat

Senator John M. Nutting

Representative Linda R. McKee

Representative David M. Etnier

cc: Fred Leigh, Bangor Hydro Electric, PO Box 932, Bangor, Maine 04402-0932
William Cyr, Maine Public Service Co., PO Box 1209, Presque Isle, Maine 04769-1209
Scott Whittier, MDEP, State House Station 17, Augusta, Maine 04333
Brook Barnes, Deputy Commissioner, MDEP, State House Station 17, Augusta, Me 04333
Marjorie McLaughlin, MPUC, State House Station 18, Augusta, ME 04333
Stephen G. Ward, Public Advocate, OPA, State House Station 112, Augusta, ME 04333

Background

In May of 1999, the Legislature enacted and the Governor signed a law – attached as appendix 1 - regarding the goal to remove electric transformers which may contain polychlorinated biphenyls (PCBs) at levels at or above 50 parts per million. The law set voluntary goals for the removal of those transformers, with special preference given to those near certain waters and schools. Though the law establishes target dates for utilities to meet, the new law made clear that the goal to remove the transformers and the suggested dates were voluntary.

Prior to 1980, transformers were inadvertently contaminated with PCBs during manufacturing, or, very rarely, during refilling. In reality, a small percentage of transformers are PCB-contaminated but because the contamination was accidental, until the transformer oil is lab analyzed, there is no way of knowing which units contain PCBs. When this law was enacted, CMP's only known option to approach achievement of the goals set forth therein was a prohibitively expensive, system-wide replacement of all suspect transformers which included all of CMP's more than 90,000 pre-1980 transformers. Even then, the capacity of CMP's commercial storage facility, NASC, under its current license would constrain goal achievement. Accordingly, CMP began to investigate possible alternative approaches. During that investigation, CMP personnel discovered a statistical analysis done by Northern Indiana Public Service Company (NIPSCO) which revealed a strong correlation between PCB contamination and the place and time of manufacture. The implications of that analysis seemed extremely promising. CMP retained the services of Michael R. Donihue, Ph.D. of Colby College to study the results from a large sample of recently removed CMP transformers, and compare those results to the NIPSCO study. The report detailing this analysis, "*A Study of PCB Contamination in Distribution Line Transformers, prepared by Central Maine Power Company and Michael R. Donihue, Ph.D., dated April 5, 2000*", is attached as appendix 2. In essence, the work done by Dr. Donihue confirms and validates the NIPSCO findings. This re-confirmed, strong correlation between PCB contamination and transformer origin suggested that a program of targeted transformer replacement might be the most cost effective and time-manageable alternative to work toward the State's goal. It should be noted that CMP promptly shared the information about this statistical correlation with the two other state public utilities in Maine which were subject to this law.

The statistical correlation described above has allowed CMP to designate approximately 9,000¹ out of over 90,000 pre-1980 transformers as highly likely to be PCB contaminated based upon their date and place of manufacture. Those transformers are designated as "Priority A". Additionally, another 12,000 transformers are somewhat less likely to contain PCB contamination. Those are designated as "Priority B". The statistical analysis indicates that approximately 85% of all PCB contaminated transformers in service fall within those two categories.

Plan Overview

CMP has developed a detailed plan to make use of the findings from the statistical research in working toward the voluntary goals of this legislation. "*Central Maine Power Company Operational Plan for Removing PCB-Contaminated Transformers, dated 6/28/00*" is attached as appendix 3. The following is a synopsis of that plan.

¹ The attached April 5, 2000 study predicts that more than 17,000 transformers in CMP's system are highly likely to be contaminated but subsequent verification of local property records and field checks have reduced that number to approximately 9,000. The same is true for the 12,000 Priority B transformers.

CMP's service territory is divided into eleven service areas. CMP is approaching the legislative goal by instituting a four-component plan. The four components are:

1. Removal of priority A transformers within 100 feet of surface water or schools concurrently in all of CMP's service areas.
2. Removal of Priority A transformers regardless of location, one service area at a time.
3. Removal of PCB contaminated underground vault transformers
4. Removal of Priority B transformers that are handled during the normal course of business.

The first component of the plan commenced in 2000. CMP is using plant property records which identify road and pole number locations for Priority A transformers and combining that location information with existing maps and local field knowledge to identify those Priority A transformers within 100 feet of the target resources. Removed transformers are transported to CMP's NASC facility in Augusta for testing and a determination of either reuse or discard.

The second component of the plan is the most concentrated. The first service area to institute component 2 was the Augusta area and it is being used as a test trial to determine the plan's effectiveness. CMP is using a "SWAT" team approach wherein a crew is working on the project removing Priority A transformers previously identified by plant property records solely for the purpose of this legislation. As in the plan's first component, the transformers are being transported to NASC for a determination of either reuse or discard. The details of the procedures used in the Augusta trial are contained in "*Central Maine Power Company Field Operating Procedure Section 1905: PCB Contaminated Transformer Changeout, Dated 7/19/00*" which is attached as appendix 4. Upon completion of the trial test of this methodology, CMP will review the results and modify accordingly before expanding to other service areas.

The third component of the plan is also well underway. CMP has approximately 160 transformers located in the underground. Even before this legislation, CMP was working on a plan to upgrade the underground vault transformers in downtown Portland and has replaced more than 20 units. CMP's current plan is to go beyond the statistical approach of targeting Priority As and Bs for replacement in the underground. CMP has been physically verifying the PCB content of the underground units and has determined that less than 40 are PCB contaminated. CMP's current plan is to remove or retrofill these units well in advance of the voluntary target date set forth in the law.

The fourth component of the plan involves Priority B transformers. During the course of routine operations and maintenance work, whenever CMP has cause to handle Priority B transformers, they will be sent to NASC for a determination of either reuse or discard in a similar manner as Priority A transformers.

Conclusion

CMP has made significant inroads in defining and accurately targeting transformers for removal in accordance with the voluntary goals of this legislation through its statistical approach. The numbers and locations of highly suspect transformers are now known. Plans have been developed to remove those transformers from service within the timeframes suggested in the law. Those plans have been aggressively implemented. Since the law was passed in 1999, CMP has removed from service more than 1,800 Priority A and Priority B transformers.

Appendix 1

*An Act to Protect the Environment by Phasing Out the Use of Old
Transformers that are Potential Sources of PCB Pollution*

PUBLIC LAWS OF MAINE

First Regular Session of the 119th

CHAPTER 193

S.P. 243 - L.D. 665

An Act to Protect the Environment by Phasing Out the Use of Old Transformers that are Potential Sources of PCB Pollution

Be it enacted by the People of the State of Maine as follows:

Sec. 1. 38 MRSA §419-B is enacted to read:

§419-B. Goals for dates of removal of transformers containing polychlorinated biphenyls

The State's goals for the dates of removal of transformers owned by public utilities that contain polychlorinated biphenyls in concentrations at or above 50 parts per million are as follows. For the purposes of this section, removal of a transformer that contains polychlorinated biphenyls may be accomplished through the retrofilling of the transformer with oil that contains polychlorinated biphenyls in concentrations below 50 parts per million.

1. **Transformers near surface waters.** The goal for the date of removal of pole-mounted or pad-mounted transformers owned by public utilities that contain polychlorinated biphenyls in concentrations at or above 50 parts per million and that are located within 100 feet of any surface water or an elementary school or secondary school as defined in Title 20-A, section 1 is October 1, 2005.

For the purposes of this subsection, "surface water" means a wetland mapped by the United States Fish and Wildlife Service under the National Wetlands Inventory project; a great pond as defined in section 480-B; or a river, stream or brook as defined in section 480-B.

2. **Remaining transformers.** Subject to a utility's existing commercial storage facility license for polychlorinated biphenyls issued by the department, the goal for the date of removal of all pole-mounted or pad-mounted transformers, other than those described in subsection 1, owned by public utilities that contain polychlorinated biphenyls in concentrations at or above 50 parts per million is October 1, 2011.

3. **Uninterruptible service.** The dates in this section may be extended to allow for adequate planning for the removal of transformers that provide electrical service to institutions for which service may not be interrupted without extensive planning, including, but not limited to, hospitals and schools.

4. **Exception.** This section does not apply to transformers located in substations.

5. **Voluntary goals.** A public utility is not required to meet the goals in this section.

Sec. 2. Progress report. A public utility that owns a transformer that contains polychlorinated biphenyls in concentrations at or above 50 parts per million shall submit a report by January 15, 2001 to the

joint standing committee of the Legislature having jurisdiction over natural resources matters on:

1. The public utility's progress toward removing those transformers that contain polychlorinated biphenyls in concentrations at or above 50 parts per million and that are located within 100 feet of any surface water or school; and

2. A plan for the removal of those transformers that contain polychlorinated biphenyls in concentrations at or above 50 parts per million and that are located in underground vaults.

Sec. 3. Report; sources of polychlorinated biphenyls in environment. The Department of Environmental Protection shall work within its budgeted resources to gather information on sources of polychlorinated biphenyls that may be released into the environment. In gathering the information, the department shall consult with the United States Environmental Protection Agency. The department shall submit a report by January 15, 2001 to the joint standing committee of the Legislature having jurisdiction over natural resources matters with its findings and recommendations related to polychlorinated biphenyls in the environment.

Effective September 18, 1999, unless otherwise indicated.

<u>Revisor of Statutes Homepage</u>	<u>Subject Index</u>	<u>Search</u>	<u>Laws of Maine</u>	<u>Maine Legislature</u>
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Appendix 2

A Study of PCB Contamination in Distribution Line Transformers

**A STUDY OF PCB CONTAMINATION
IN DISTRIBUTION LINE TRANSFORMERS**

Prepared by Central Maine Power Company

Augusta, Maine

And

Michael R. Donihue, Ph.D.

April 5, 2000



Executive Summary

On May 17, 1999 Governor Angus King approved a law setting a goal that public utilities in the State of Maine remove from operation transformers that contain oil contaminated with polychlorinated biphenyls (PCBs) in concentrations at or above 50 parts per million. PCB contamination is a potential problem for any transformer manufactured before 1980.

As of November 1999, Central Maine Power Company (CMP) operated over 93,000² distribution line transformers manufactured before 1980. Testing each of these transformers for possible PCB contamination would be extremely costly and impractical, particularly since evidence has shown that only a small percentage are likely to be PCB-contaminated.

This report draws extensively from a detailed analytical study by Michael R. Donihue, Ph.D., Associate Professor of Economics at Colby College (Waterville, Maine) of a sample of 12,171² transformers removed from service by CMP and tested for PCB content. Based on this analysis, and a review of a similar study done by Northern Indiana Public Service Company, a strategy for identifying transformers likely to be PCB-contaminated has been developed and tested on a sub-sample of 1,080 recently removed transformers. Some of the key findings of this report include:

- The pattern of PCB contamination found by Northern Indiana Public Service Company and CMP's sample of 12,171 transformers is very similar.²
- CMP transformers currently in service can be traced to 18 different manufacturers.²
- Ninety-seven percent of the contaminated transformers in the CMP sample were manufactured by either General Electric or Westinghouse.²
- Of those, Ninety-four percent were manufactured at either the General Electric plant in Pittsfield, MA or the Westinghouse plant in Sharon, PA.²
- Using the pattern of contamination found in the CMP sample as a guide, 95 of the 100 contaminated units in a sub-sample of 1,080 transformers recently removed from service were manufactured at either GE-Pittsfield or Westinghouse-Sharon.²

Based on the compelling evidence in Dr. Donihue's report, CMP has concluded that by removing 36,211 of the 93,210 candidate transformers from service it could expect to remove 91% of the contaminated units. Similarly, by removing just 17,168 transformers, CMP could expect to remove 76% of the contaminated transformers currently in service.²

² The boxed number that accompanies each numerical result refers to the attached table number in which that result may be found or calculated. The number of sample transformers can be found in Table 2.

BACKGROUND

In May 1999, Maine Public Law 1999, Chapter 193, entitled *An Act to Protect the Environment by Phasing Out the Use of Old Transformers that are Potential Sources of PCB Pollution* was enacted by the House and Senate of the 119th Maine Legislature and signed by the Governor. The law establishes a goal for public utilities to remove or retrofit transformers containing 50 parts per million (ppm) or greater of polychlorinated biphenyls (PCBs). These are so-called PCB-contaminated transformers whose continued use is allowed by State and federal law. The new law sets two separate deadlines for replacement of these transformers.

The first goal is for public utilities to remove or retrofit (to below 50 ppm PCBs) by October 1, 2005, all PCB-contaminated pole-mounted and pad-mounted transformers located within 100 feet of any surface water body¹, elementary school or secondary school.

The second goal is for public utilities to remove or retrofit all remaining PCB-contaminated pole-mounted and pad-mounted transformers by October 1, 2011. The law requires that public utilities submit a progress report to the Maine Legislature's Natural Resources Committee by January 15, 2001.

Central Maine Power (CMP) serves more than 530,000 customers in an 11,000 square mile service area of central and southern Maine. CMP owns and operates more than 220,000 electrical transformers to provide electric service to its customers. The majority of these are non-PCB-contaminated transformers. That is, they are known to contain less than 50 ppm of PCBs or they were manufactured after 1979 when PCBs were banned from production in the United States. CMP owns and maintains in use approximately 93,210² transformers that were purchased prior to 1980 and therefore may have been contaminated with PCBs in the manufacturing process. The difficulty, however, is that until an oil sample is physically taken from the transformer and subjected to lab analysis, it is unknown exactly which transformers are PCB-contaminated.

¹ For the purposes of this law, "surface water" is defined as a wetland mapped by the United States Fish and Wildlife Service under the National Wetlands Inventory project. This definition includes emergent wetlands, forested wetlands, moss-lichen wetlands, open water, reefs, rocky shores, streambeds, scrub/shrub wetlands, tidal and non-tidal wetlands, Great Ponds (natural inland ponds 10 acres or larger, and artificially formed or increased inland ponds 30 acres or larger), rivers, streams, and brooks (a channel between defined banks where the channel is created by the action of surface water and is characterized by the lack of upland vegetation or the presence of aquatic vegetation and the presence of a bed without topsoil and containing waterborne deposits on exposed soil, parent material or bedrock).

Overview

As CMP began to analyze the potential work associated with the various versions of the proposed legislation, numerous issues were considered and researched including licenses, permits and operational logistics. Generally, to fully meet the goals set forth in the law, all 93,210 pre-1980 transformers would have to be tested. The pole-mounted units would have to be taken down, opened, and sampled, during which time the customer would be taken out of service. The oil sample would be sent to a lab and analyzed for PCB content. Normal lab turn around time to process such a test is one to two weeks. Either a new transformer or a used one known to be non PCB-contaminated would be placed back on the pole. The transformer taken down could then be refurbished and reinstalled if, after the two-week period, the lab analysis showed it to be non PCB-contaminated.

To put this process and volume into perspective, CMP typically changes out a total of 2,000 to 2,400 transformers per year for a variety of reasons including equipment damage or failure, changes in customer load requirements, or line construction and maintenance. Removing 93,210 transformers over an 11-year period equates to more than 8,000 transformers per year or 160 per week. This dramatic increase could not be absorbed in CMP's normal workload.

Testing each of the 93,210 "candidate" transformers presently in operation was considered an impractical matter at best. At a cost of over \$750 per transformer, replacing each transformer placed in service prior to 1980 is not economically feasible. And, based on CMP's own test results (and those of other utilities) only a small percentage of the transformers manufactured prior to 1980 actually contain PCB-contaminated oil.

Purpose and Scope of This Study

CMP requires a method that can be used to identify those transformers currently in service that are most likely to be PCB-contaminated. Based on the results of applying this method, CMP can then develop an action plan for taking transformers suspected of PCB contamination out of service in a cost-effective manner. Dr. Donihue's study examined a 1995 study done by Robert E. Huffman for Northern Indiana Public Service Company (NIPSCO) of PCB-contaminated transformers. It compared the results of the NIPSCO study with readily available data on transformers removed from service at CMP. Dr. Donihue's report then applied the established PCB-contaminated transformer data to CMP's in-service transformers to predict patterns for effectively identifying the PCB-contaminated transformers to be removed.

The NIPSCO Experience

In 1995 NIPSCO developed a method for identifying PCB-contaminated transformers, without deactivating and testing, which they believe to be a "...cost-effective way to eliminate PCBs in the distribution system." Sometime after PCB regulations were enacted in 1978, NIPSCO began accumulating test data on transformers in its distribution system. An analysis of these data enabled NIPSCO to find predictive patterns of PCB contamination. The results of NIPSCO's analysis are summarized below.

- PCB contamination decreased in the 1970s as manufacturers decontaminated their facilities.
- PCBs were rarely, or never, found in products manufactured by Howard Industries, Kuhlman, Line Material, McGraw Edison, A B Chance, and RTE.
- Central Maloney, Hevi Duty Dowser, and Allis Chalmers transformers had a fairly low incidence of PCB contamination.
- The majority of PCBs in NIPSCO's distribution system were traced to transformers made by General Electric (GE), Westinghouse, and Wagner Electric.
- For units manufactured by Westinghouse, the plant in Sharon, PA was responsible for almost all of the PCB contamination. Units made at the Sharon plant during 1965 to 1970 had a 91% rate of PCB contamination according to the NIPSCO report.
- Most of the transformers in NIPSCO's system manufactured by GE at its Pittsfield, MA plant from 1930 to 1969 were contaminated. Almost no contamination was found in units from GE's plants in Shreveport, LA and Hickory, NC.

It is important to note that rigorous measures of statistical precision, hypothesis testing, or statements of statistical confidence cannot be applied to the NIPSCO data because the sample of transformers analyzed was not randomly determined.

The CMP Data in the Context of the NIPSCO Experience

As with the NIPSCO report, it is not possible to develop rigorous statistical measures of the incidence of PCB contamination among CMP's transformers without random sampling of units currently in service. As noted earlier, developing a random sample of sufficient size to reliably make reliable statistical inferences would be a costly proposition. A convenient alternative is available, however, that enables the development of a reasonable method for identifying transformers likely to be PCB-contaminated.

This study examines a sample of 12,171[□] transformers manufactured before 1980 and taken out of service by CMP. Each of these transformers was tested for PCB contamination. From this sample, it is possible to identify patterns of PCB contamination based upon manufacturer, plant location, and date of manufacture. Application of these patterns to transformers currently in service makes it possible to identify a potential strategy for effectively removing PCB-contaminated transformers in service. While rigorous statistical tests as to the validity of this approach are not available, it is possible to validate this strategy using a sub-sample of transformers removed from service between July and October of 1999.

Transformers taken out of service by CMP are first transported to the North Augusta Service Center (NASC). If the transformer is leaking, samples are taken from the transformer by NASC personnel and tested for PCB content. Test results for 2,632 leaking transformers decommissioned between 1986 and 1998 were available directly in a proprietary electronic database.

In addition, data were obtained for 1,082 transformers taken out of service between March 26, 1999 and June 29, 1999 and shipped to TCI for testing and decommissioning. The hand-written records for these data were entered into a database containing the original NASC data.

A sample of 8,186 transformers taken out of service by CMP between April 11, 1995 and February 17, 1999 was obtained from Hevi-Duty Electric Company, where these transformers were tested upon decommissioning.

Finally, a sample of 1,080 transformers removed from service by CMP between June and October of 1999 was included and used as a validation sample for the proposed strategy for identifying transformers currently in service and suspected of being PCB-contaminated. Of the 12,980 units in this database, 809 were removed due to missing or unidentifiable manufacture codes, unknown dates of manufacture, dates of manufacture after 1979, or other data entry errors, leaving a usable sample of 12,171 transformers.[∇]

Table 1 presents a summary of the CMP data on decommissioned transformers in a format that is comparable to the information available from NIPSCO.

[∇] Throughout the remainder of this document "sample" will be used to refer to these 12,171 units.

**Table 1: A Comparison of the CMP Sample
With the NIPSCO Experience**

Manufacturer	CMP Sample			NIPSCO Contamination Rate
	Units Tested	Number Contaminated	% for Manufacturer	
General Electric	2,050 [Ⓜ]	653 [Ⓜ]	31.9%	31.7%
Pittsfield, MA 1930-69	806 [Ⓜ]	607 [Ⓜ]	75.3%	"most"
Hickory, NC	883 [Ⓜ]	2 [Ⓜ]	0.2%	0%
Oakland, CA	13 [Ⓜ]	2 [Ⓜ]	15.4	no data
Shreveport, LA	63 [Ⓜ]	1 [Ⓜ]	1.6%	0%
Westinghouse	7,985 [Ⓜ]	1,185 [Ⓜ]	14.8%	9.0%
Sharon, PA 1965-70	756 [Ⓜ]	672 [Ⓜ]	88.9%	91%
Allis Chalmers	421 [Ⓜ]	15 [Ⓜ]	3.6%	3.9%
Line Material	17 [Ⓜ]	1 [Ⓜ]	5.9%	0.6%
McGraw Edison	708 [Ⓜ]	4 [Ⓜ]	0.6%	0.4%
RTE	277 [Ⓜ]	0 [Ⓜ]	0%	0.3%

The following conclusions can be made about the CMP data in the context of the NIPSCO experience:

- For the transformers in the CMP sample, GE and Westinghouse manufactured the majority of contaminated units (97.2%[Ⓜ]). The contamination rate observed by NIPSCO and CMP for transformers manufactured by GE and Westinghouse is similar.
- According to the NIPSCO report, "...most units made in Pittsfield from 1930 to 1969 were contaminated." From the CMP sample, 75%[Ⓜ] of GE's transformers manufactured in Pittsfield, MA during this period were found to be PCB-contaminated.
- Like the NIPSCO experience, the CMP sample indicates that almost all (95%[Ⓜ]) of the PCB-contaminated GE transformers were manufactured in Pittsfield, MA.
- According to NIPSCO, "...we believe that the actual rate of contamination at the Sharon plant during [1965 to 1970] must have approached 100%." From the CMP sample, of

the 756² Westinghouse transformers manufactured at the Sharon, PA plant during 1965-1970, 672² (89%) were PCB-contaminated.

- Like the NIPSCO experience, PCBs were rarely, or never, found in transformers manufactured by Line Material, McGraw Edison, and RTE.²
- Like the NIPSCO experience, Allis Chalmers transformers had a fairly low incidence of PCB contamination (3.6%).²

Overview of the CMP Data

Tables 2, 3, 4a and 4b provide a detailed breakdown of the CMP sample. The following bulleted points provide a summary of these data.

- CMP currently has 93,210² transformers in service that were manufactured before 1980.
- Of the 12,171 transformers in the sample, Westinghouse manufactured 65.6%. 44.6% of these were manufactured at the Sharon, PA plant.²
- 69.6% of the transformers currently in service were manufactured by Westinghouse, 86.8% of these were manufactured in Sharon, PA.²
- 14,040 (25%) of the Sharon, PA transformers currently in service were manufactured during the 1965-1970 period when contamination rates in the sample averaged 89%.²
- 16.2% of the transformers currently in service were manufactured by General Electric.²
- 16.8% of the transformers in the CMP sample were manufactured by General Electric.²
- 27.3% of GE's transformers currently in service were manufactured in Pittsfield, MA.²
- 2,187 of the GE transformers currently in service were manufactured in Pittsfield, MA during the period of 1937-1969 when contamination rates in the CMP sample averaged 76.7%.²
- 90% of the contaminated units in the CMP sample can be accounted for by just 35% of the total sample.³ These transformers were manufactured by GE and Westinghouse during periods when contamination rates were particularly high.
- 34,266 of the transformers currently in service were manufactured by GE's plant in Pittsfield, or by Westinghouse's facility in Sharon, during this period when contamination rates were highest.³

Validation Study

One way to "test" the validity of the contamination rates found in the sample (and the strategy for removal implicit in Table 3) would be to ask the question: what would CMP's experience have been had the company pursued this strategy earlier, say beginning in July 1999? Such a test, while not statistically rigorous, could be conducted by examining first the contamination rates for the sample excluding the data on transformers removed from service since July 1999, and then examining the pattern of contamination rates for those transformers to see if the rates follow a pattern that is consistent with the results in Table 3.

A "validation" sample of 1,080 transformers removed from service by CMP between July and October 1999 was taken from the overall sample and the strategy proposed in Table 3 was applied to these data. Table 5, and the last two columns of Table 2, provide the results for this validation study. The contamination rates for the sample of transformers excluding the 1,080 transformers in the validation sample are presented in the last two columns of Table 5.[∇] The contamination rates for the CMP sample excluding the validation sample are almost identical to those found in the full sample.

Some features of this validation sample are summarized below:

- Twelve different manufacturers are represented in the validation sample.[Ⓜ]
- 100 (9.3%) transformers in the validation sample were found to be PCB-contaminated.[Ⓜ]
- 12.6% of the units in the validation sample were manufactured by General Electric.[Ⓜ]
- 72% of the units in the validation sample were manufactured by Westinghouse.[Ⓜ]
- 79 of the 100 PCB-contaminated units in the validation sample were manufactured by Westinghouse.[Ⓜ]
- 20 of the 100 PCB-contaminated units in the validation sample were manufactured by GE.[Ⓜ]
- 1 of the 68 transformers in the validation sample manufactured by McGraw-Edison was found to be PCB-contaminated.[Ⓜ]
- 94% of the PCB-contaminated units were identified by examining just 30% of the transformers in the validation sample.[Ⓜ]

The pattern of contamination in the validation sample as presented in Table 5 clearly shows that the strategy for removal of PCB-contaminated transformers outlined in Table 3 would have worked well had it been applied to the transformers removed from service beginning in July 1999. Specifically, this strategy is to review prior analytical data to determine those in-service transformers most likely to be PCB-contaminated (based upon

[∇] These rates can be compared with the contamination rates for the entire sample presented in sixth and seventh columns of Table 3.

manufacturer, manufacturer plant location, and date of manufacture), and to target these for removal.

Summary

PCB contamination among CMP's transformers taken out of service is consistent with the NIPSCO experience. Based on the evidence in this report, CMP could reasonably conclude that by selectively removing 36,211 transformers from service it could expect to remove 91% of the PCB-contaminated units.³ Similarly, by selectively removing 17,168 transformers, CMP could expect to remove 76% of the PCB-contaminated transformers currently in service.³

This report represents a good-faith attempt to develop a sound approach for identifying PCB-contaminated transformers in the absence of random sampling. Whatever strategy is pursued, continued sampling and validation, like that presented here, is recommended to monitor the effectiveness of the removal program.

Notes

1. The Northern Indiana Public Service Company (NIPSCO) study of PCB contamination is entitled "Identifying PCB Contaminated Transformers in Distribution Systems" and was written by Robert E. Huffman in 1995.
2. The data in Tables 3, 4, and 5 do not in all cases equal the totals presented in Table 2 because some transformers were identified by manufacturer only and not by date of manufacture. Also, in some instances transformers were identified by manufacturer but not by manufacturing plant.
3. This study was prepared to provide CMP with an analysis of its installed transformers. This study is not intended to be an exhaustive study of all transformers manufactured/sold in the U.S. CMP does not assume responsibility for the accuracy of the material presented in this study to the extent it is applied or used for other applications. For more information on this report or for permission to copy or distribute this study, please contact Central Maine Power Company's Environmental Services Department at (207) 623-3521 or email inquiries to environmental.services@cmpco.com.

Table 2: Summary of Data by Manufacturer
(Proprietary and Confidential Business Information)

Manufacturer	Units in Service		Units in Sample		Not Contaminated		Contaminated		Validation Sample	
	Number	% of Total	Number	% of Total	Number	% for Mfr	Number	% for Mfr	Number	Contaminated
Allis Chalmers	3548	3.8%	421	3.5%	406	96.4%	15	3.6%	46	0
American	0	0.0%	1	0.0%	0	0.0%	1	100.0%	0	0
Asea Brown Boveri	7	0.0%	13	0.1%	13	100.0%	0	0.0%	1	0
Carte	0	0.0%	97	0.8%	97	100.0%	0	0.0%	0	0
Chance	4	0.0%	9	0.1%	8	88.9%	1	11.1%	0	0
Cooper	0	0.0%	5	0.0%	5	100.0%	0	0.0%	1	0
Davis	3	0.0%	3	0.0%	3	100.0%	0	0.0%	0	0
Delta Star	0	0.0%	6	0.0%	5	83.3%	1	16.7%	0	0
Fort Wayne	7	0.0%	0	0.0%	0		0		0	0
General Electric	15135	16.2%	2050	16.8%	1397	68.1%	653	31.9%	136	20
Hickory, NC	10500	69.4%	883	43.1%	881	99.8%	2	0.2%	84	0
Oakland, CA	44	0.3%	13	0.6%	11	84.6%	2	15.4%	0	0
Pittsfield, MA	4133	27.3%	968	47.2%	350	36.2%	618	63.8%	50	20
Shreveport, LA	455	3.0%	63	3.1%	62	98.4%	1	1.6%	2	0
No plant code	3	0.0%	123	6.0%	93	75.6%	30	24.4%	0	0
Howard	191	0.2%	185	1.5%	184	99.5%	1	0.5%	14	0
Kuhlman	383	0.4%	52	0.4%	51	98.1%	1	1.9%	7	0
Line Material	5	0.0%	17	0.1%	16	94.1%	1	5.9%	1	0
Maloney	364	0.4%	30	0.2%	28	93.3%	2	6.7%	0	0
McGraw Edison	5245	5.6%	708	5.8%	704	99.4%	4	0.6%	68	1
Niagra	0	0.0%	2	0.0%	2	100.0%	0	0.0%	0	0
Pauwels	0	0.0%	2	0.0%	2	100.0%	0	0.0%	0	0
Pittsburg	11	0.0%	0	0.0%	0		0		0	0
Pole Star	37	0.0%	4	0.0%	4	100.0%	0	0.0%	2	0
Porter	1	0.0%	3	0.0%	2	66.7%	1	33.3%	0	0
RTE	2497	2.7%	277	2.3%	277	100.0%	0	0.0%	17	0
Stanley	4	0.0%	6	0.0%	6	100.0%	0	0.0%	0	0
Wagner	928	1.0%	140	1.2%	139	99.3%	1	0.7%	9	0
Westinghouse	64840	69.6%	7985	65.6%	6800	85.2%	1185	14.8%	778	79
Athens, GA	8314	12.8%	4073	51.0%	4021	98.7%	52	1.3%	412	2
Jefferson City	62	0.1%	12	0.2%	12	100.0%	0	0.0%	1	0
Sharon, PA	56306	86.8%	3563	44.6%	2456	68.9%	1107	31.1%	327	75
Sunnyvale, CA	158	0.2%	36	0.5%	30	83.3%	6	16.7%	8	0
No plant code	0	0.0%	301	3.8%	281	93.4%	20	6.6%	30	2
Unknown Manufacturer	0	0.0%	155	1.3%	131	84.5%	24	15.5%	0	0
TOTAL	93210	100%	12171	100%	10280	84%	1891	16%	1080	100

Table 3: A Strategy for Examining Transformers in the Sample
(Proprietary and Confidential Business Information)

If you took from the sample this many transformers...	...manufactured by...	...during this period.	You would have examined this portion of the sample		...and found this many to be contaminated...		...representing this % of the contaminated units in the sample	Corresponding Units in Service	
								Number	Cumulative
790	General Electric @ Pittsfield	1937-1969	790	6%	606	77%	32%	2187	2187
756	Westinghouse @ Sharon	1965-1970	1546	13%	672	89%	68%	14040	16227
222	Westinghouse @ Sharon	1957	1768	15%	165	74%	76%	941	17168
1843	Westinghouse @ Sharon	1916-1956	3611	30%	201	11%	87%	8758	25926
624	Westinghouse @ Sharon	1958-1964	4235	35%	62	10%	90%	8340	34266
170	General Electric @ Pittsfield	1920-36; 1970-76	4405	36%	12	7%	91%	1945	36211
118	Westinghouse @ Sharon	1971-1979	4523	37%	7	6%	91%	24221	60432
684	GE @ Oakland, Shreveport, & Hickory	1943-1979	5207	43%	5	1%	91%	10999	71431
4107	Westinghouse @ Sunnyvale & Athens	1945-1979	9314	77%	58	1%	95%	8472	79903
2857	All Other Transformers in Sample	Various Years (Some Unknown)	12171	100%	103	4%	100%	13307	93210
12171	TOTALS				1891	16%			

Table 4a: Transformers Manufactured by General Electric
(Proprietary and Confidential Business Information)

Date of Mfr	Oakland, CA			Pittsfield, MA				Shreveport, LA			Hickory, NC		
	In Service	Tested	Contaminated	In Service	Tested	Contaminated		In Service	Tested	Contaminated	In Service	Tested	Contaminated
1920					5	0	0%						
1921				280	16	1	6%						
1922				68									
1923				58	2	0	0%						
1924				37	2	0	0%						
1925	5			20									
1926	1			85	5	0	0%						
1927				15									
1928				22	3	0							
1929				58	2	2	100%						
1930				17	3	0	0%						
1931				36	2	1	50%						
1932				5									
1933				60	1	0	0%						
1934				20	2	0	0%						
1935	1			23	2	0	0%						
1936				99	6	0	0%						
1937				80	10	3	30%						
1938				76	11	8	73%						
1939				39	10	8	80%						
1940	1			97	21	17	81%						
1941				120	25	16	64%						
1942				10	1	1	100%						
1943		1	1	100%	7						1		
1944				43	12	11	92%						
1945				45	8	8	100%						
1946				70	30	29	97%						
1947				158	45	27	60%						
1948				80	10	3	30%						
1949				0	4	1	25%						
1950				8	10	10	100%						
1951	1			50	6	6	100%						

Table 4a: Transformers Manufactured by General Electric
(Proprietary and Confidential Business Information)

Date of Mfr	Oakland, CA				Pittsfield, MA				Shreveport, LA				Hickory, NC			
	In Service	Tested	Contaminated		In Service	Tested	Contaminated		In Service	Tested	Contaminated		In Service	Tested	Contaminated	
1952	4				52	16	14	88%								
1953					30	25	22	88%								
1954		1	0	0%	63	67	50	75%								
1955					118	50	39	78%								
1956					524	149	92	62%					1			
1957	1				52	33	19	58%					9	1	0	0%
1958					74	17	14	82%					1	1	0	0%
1959					1	22	16	73%					9	1	0	0%
1960					39	25	24	96%					14	1	0	0%
1961		6	0	0%	30	13	13	100%					39	8	0	0%
1962					56	28	24	86%					39	5	0	0%
1963		1	1	100%	42	27	26	96%					18	2	0	0%
1964	1				50	10	10	100%					36	5	0	0%
1965					18	12	7	58%					81	12	0	0%
1966					46	15	15	100%					88	19	0	0%
1967					47	42	40	95%					98	8	0	0%
1968					43	20	20	100%					93	18	0	0%
1969					19	16	13	81%					257	21	1	5%
1970	3				24	14	0	0%					72	48	0	0%
1971	26	4	0	0%	25	13	0	0%	23	3	0	0%	954	43	0	0%
1972					24	11	0	0%	26	7	0	0%	797	38	0	0%
1973					487	38	1	3%	89	9	0	0%	473	46	0	0%
1974					445	39	7	18%	213	10	1	10%	434	35	0	0%
1975									2				759	34	0	0%
1976					37	4	0	0%	16	2	0	0%	1,101	67	0	0%
1977					1				18	9	0	0%	1,785	95	1	1%
1978									20	4	0	0%	1,979	57	0	0%
1979									48	9	0	0%	1,362	53	0	0%
TOTALS	44	13	2	15%	4,133	960	618	64%	455	53	1	2%	10,500	618	2	0%

Table 4b: Transformers Manufactured by Westinghouse

(Proprietary and Confidential Business Information)

Date of Mfr	Sharon, PA				Sunnyvale, CA				Athens, GA		
	In Service	Tested	Contaminated		In Service	Tested	Contaminated		In Service	Tested	Contaminated
1911	2										
1912	2										
1913	1										
1914	1										
1916	3	1	0	0%		1	0	0%			
1917	6	1	0	0%							
1919	3					1	0	0%			
1920	18	2	0								
1921	7										
1922	14	5	0	0%							
1923	11										
1924	6										
1925	12										
1926	2										
1927	7										
1928	1				1						
1929					1						
1930					1						
1931											
1932											
1933	17	1	0	0%							
1934	3										
1935					1						
1936	14	2	1	50%							
1937	60	7	1	14%							
1938	63	10	0	0%							
1939	75	14	0	0%							
1940		6	1	17%	1						
1941	516	83	10	12%	4						
1942	11	3	0	0%							
1943	14	2	1	50%							
1944	27	8	0	0%							
1945	15	12	2	17%	143	26	6	23%			
1946	124	50	6	12%							

Table 4b: Transformers Manufactured by Westinghouse

(Proprietary and Confidential Business Information)

Date of Mfr	Sharon, PA				Sunnyvale, CA				Athens, GA			
	In Service	Tested	Contaminated	%	In Service	Tested	Contaminated	%	In Service	Tested	Contaminated	%
1947	564	140	6	4%		4	0	0%				
1948	948	229	11	5%	2							
1949	205	61	5	8%								
1950	560	114	2	2%		1	0	0%				
1951	1,278	241	24	10%	2	1	0	0%				
1952	540	93	2	2%	1							
1953	450	121	14	12%								
1954	748	166	61	37%								
1955	1,222	243	31	13%					1	2	0	0%
1956	1,214	228	23	10%								
1957	941	222	165	74%								
1958	1,245	190	17	9%					3			
1959	1,117	141	10	7%					43	23	1	4%
1960	916	92	2	2%					55	56	1	2%
1961	1,119	63	2	3%					127	127	0	0%
1962	1,193	72	20	28%					91	149	0	0%
1963	1,279	48	3	6%					180	183	0	0%
1964	1,471	18	8	44%					210	254	1	0%
1965	1,706	81	73	90%					186	200	0	0%
1966	1,520	39	35	90%					206	162	0	0%
1967	2,454	207	194	94%					115	49	0	0%
1968	2,855	232	218	94%					224	129	0	0%
1969	2,812	100	81	81%		1	0	0%	257	217	0	0%
1970	2,693	97	71	73%					880	273	42	15%
1971	3,198	18	4	22%					758	387	5	1%
1972	3,299	8	1	13%	1				628	255	0	0%
1973	4,234	18	0	0%					1004	461	0	0%
1974	4,569	9	0	0%					1243	431	1	0%
1975	1,489	5	0	0%					942	196	0	0%
1976	2,126	21	1	5%					335	147	0	0%
1977	1,745	13	0	0%					230	119	1	1%
1978	2,673	19	1	5%					439	172	0	0%
1979	888	7	0	0%		1	0	0%	157	79	0	0%
TOTALS	56,306	3,563	1107	31%	158	36	6	17%	8,314	4071	52	1%

Table 5: Applying the Strategy in Table 3 to the Validation Sample of Transformers
(Proprietary and Confidential Business Information)

If you took from the validation sample this many transformers...	...manufactured by...	...during this period...	You would have examined this portion of the new sample		...and found this many to be contaminated..		...representing this % of the contaminated units in the sample.	Corresponding contaminated units in the sample <i>excluding</i> the validation sample	
34	General Electric @ Pittsfield	1937-1969	34	3%	20	59%	20%	586	78%
61	Westinghouse @ Sharon	1965-1970	95	9%	51	84%	71%	621	89%
11	Westinghouse @ Sharon	1957	106	10%	8	73%	79%	157	74%
164	Westinghouse @ Sharon	1916-1956	270	25%	14	9%	93%	187	11%
56	Westinghouse @ Sharon	1958-1964	326	30%	1	2%	94%	61	11%
16	General Electric @ Pittsfield	All other years	342	32%	0	0%	94%	12	8%
35	Westinghouse @ Sharon	1971-1979	377	35%	1	3%	95%	6	7%
86	GE @ Oakland,Shreveport,& Hickory	All Years	463	43%	0	0%	95%	5	1%
420	Westinghouse @ Sunnyvale & Athens	All Years	883	82%	2	0%	97%	56	2%
197	All Other Transformers in Sample	Various Years (Some Unknown)	1,080	100%	3	2%	100%	100	5%
1080	TOTALS				100	9%		1791	16%

Appendix 3

*Central Maine Power Company
Operational Plan for Removing PCB-Contaminated Transformers*

Central Maine Power Company
Operational Plan for Removing PCB-Contaminated Transformers
6-28-00

Background

In May 1999, Maine Public Law 1999, Chapter 193, entitled *An Act to Protect the Environment by Phasing Out the Use of Old Transformers that are Potential Sources of PCB Pollution* (attached) was enacted. The law establishes a goal for public utilities to remove or retrofit transformers containing 50 parts per million (ppm) or greater of polychlorinated biphenyls (PCBs). These are so-called PCB-contaminated transformers whose continued use is allowed by State and federal law. The new law sets two separate goal deadlines for replacement of these transformers.

The first goal is for public utilities to remove or retrofit (to below 50 ppm PCBs) by October 1, 2005, all PCB-contaminated pole-mounted and pad-mounted transformers located within 100 feet of any surface water body (as defined in the law), elementary school or secondary school.

The second goal is for public utilities to remove or retrofit all remaining PCB-contaminated pole-mounted and pad-mounted transformers by October 1, 2011. The law requires that public utilities submit a progress report to the Maine Legislature's Natural Resources Committee by January 15, 2001.

CMP owns and operates more than 220,000 electrical transformers to provide electric service to its customers. The majority of these are non-PCB-contaminated transformers. That is, they are known to contain less than 50 ppm of PCBs or they were manufactured after 1979 when PCBs were banned from production in the United States. CMP owns and maintains in use approximately 93,000 transformers that were purchased prior to 1980 and therefore may have been contaminated with PCBs in the manufacturing process. The difficulty, however, is that until an oil sample is physically taken from the transformer and subjected to lab analysis, it is unknown exactly which transformers are PCB-contaminated.

Overview of CMP's Approach

CMP has decided to work toward the goal established in the new law primarily by using the statistical approach outlined in "A Study of PCB Contamination in Distribution Line Transformers" prepared by CMP and Michael R. Donihue, Ph.D. dated April 5, 2000

(attached). Specifically, based on the likelihood of these units being PCB-contaminated, CMP intends to actively target the following transformers for early retirement:

- General Electric transformers manufactured in Pittsfield, Massachusetts during 1937-1969 (approximately 2,200 total);
- Westinghouse transformers manufactured in Sharon, Pennsylvania in 1957 or during 1965-1970 (approximately 15,000 total); and
- PCB-contaminated transformers in the underground.

For internal purposes, CMP is designating the transformers (approximately 17,200) in the first two bullets above as priority A.

In addition, whenever CMP is working at a field location on any of its more than 17,000 Westinghouse transformers manufactured in Sharon, Pennsylvania during 1916-1956 or 1958-1964 (internally designated as priority B) during normal operations and maintenance, those transformers will be removed and sent to CMP's licensed TSD facility (NASC) and tested for PCB contamination. NASC will decide whether those that are found to be PCB-contaminated will be reused (i.e. refurbished by CMP or others) or discarded.

CMP's service territory is divided up into eleven service areas. CMP intends to approach the goal with four distinct components, test trialing a portion in the Augusta service area. The trial will be evaluated both from a statistical approach as well as an operational approach. CMP will evaluate this trial before deciding whether to expand the removal program into other service areas over a period of years.

Optimizing operational efficiency such that the maximum amount of PCBs are being removed in the most efficient manner is a key element of this project. This removal program will continually be evaluated for efficiency, effectiveness, compliance with laws and regulations, as well as its overall merits. The program will be revised and adjusted over time as deemed appropriate.

The Four Components

CMP's removal program consists of four components:

1. Removal of priority A transformers within 100 feet of surface waters or schools in all of CMP's service area;
2. Removal of priority A transformers regardless of location, one service area at a time;
3. Removal of PCB-contaminated underground vault transformers; and

4. Removal of priority B transformers that are handled during the normal course of business.

The first component of the removal program targets those priority A transformers located within 100 feet of any surface water body (as defined in the law), elementary school or secondary school. This would include a subset of the approximately 17,200 priority A transformers that are located within 100 feet of the target resources. CMP personnel will work toward removing these transformers on a continual basis in all eleven service areas with the intent of completing these removals by October 2005. CMP personnel can use existing maps which identify surface water bodies, elementary and secondary schools, along with local field knowledge, to identify those transformers within 100 feet of the target resources.

CMP is in the process of GIS locating and developing a mapping database for its poles and transformers. Once this database is fully operational, the method of identifying the priority A transformers for removal should be more efficient. CMP will use its normal operating procedures to replace these transformers, sending each transformer to NASC for PCB testing and a final determination of reuse or discard. Consistent with current business practice and in accordance with current law, all PCB-contaminated transformers destined for disposal will be shipped out of NASC as hazardous waste.

The second component of the removal program is the largest and most concentrated. It is the component that CMP will trial in the Augusta service area. CMP intends to do a bulk transformer replacement program in each service area, one service area at a time. For example, the Augusta service area, which includes all of 17 towns and parts of 10 additional towns, has approximately 1,550 priority A transformers that will be targeted. Once the Augusta service area is complete, another service area will be targeted. A more detailed description of this concentrated replacement program is further described below.

The third component of the replacement program targets underground vault transformers, which have unique characteristics and require more cumbersome work processes as compared to pole mounted units. Those differences along with other factors resulted in CMP beginning an aggressive underground transformer replacement program in 1999. This work is being done primarily by CMP crews using CMP's normal operational and maintenance procedures. CMP will be providing a status report on the underground program in January 2001 as required in the new law.

The fourth component of the removal program involves the priority B transformers (Westinghouse transformers manufactured in Sharon, Pennsylvania during 1916-1956 or 1958-1964). During the course of its routine operations and maintenance work, whenever CMP has cause to handle priority B transformers, these transformers will be sent to CMP's NASC facility and tested for PCB contamination. Consistent with normal practices and as described above for the priority A transformers, CMP will use its normal operating procedures to replace these transformers, sending each to NASC for PCB testing and a final determination of reuse or discard.

A More Detailed Look at the Augusta Pilot Program

CMP has identified the priority A transformers and their locations in the Augusta service area. CMP's current plan is to start replacing those priority A transformers in early August. For a small number of the largest size priority A transformers, CMP may sample the oil in the field and lab test it for PCB contamination to determine if removal or refilling is warranted. A line crew will transport the priority A transformers to the Augusta Service Building, located on the Old Winthrop Road in Augusta, where they will be secured onto pallets and tracked through CMP's computerized Work Management and Material Management systems. The transformers will then be transported to NASC either on a CMP freight truck, as is currently done for routine transformer changeouts, or on a dedicated truck or trailer specifically assigned to this project. Although not required, but as a best management practice, CMP currently intends to utilize a licensed and properly trained hazardous waste driver as well as hazardous waste licensed vehicles to transport these units to NASC.

CMP anticipates that the transformers would be shipped to NASC at various intervals, from daily to bi-weekly depending on various factors. If during the changeout process, a transformer is damaged and a leak occurs, the spill will be reported and cleaned up in accordance with CMP's normal spill response procedures. The leaking transformer will be taken directly to NASC, as opposed to the district service center. If, during the handling and transporting of the transformers, minor weeping commences, the transformer will be placed in a secondary container (such as a barrel or polyethylene bag). Such weeping units would be shipped to NASC during the next scheduled shipment, along with the other removed transformers.

Once the transformers are at NASC, a sample of the oil will be taken and lab analyzed for PCB content. A determination will be made by NASC personnel as to whether to reuse or discard the transformer. CMP anticipates that most transformers determined to be PCB-

contaminated will be discarded. There may be some cases, however, where there is value in retrofilling and refurbishing the unit for reuse. These decisions will be made exclusively by the authorized NASC personnel. Various factors will be taken into account in evaluating transformers for reuse or discard such as PCB content, unit type, size, age, and physical condition.


The PCB-contaminated transformers being discarded will be manifested out of NASC as hazardous waste and shipped to a properly licensed treatment, storage, and disposal facility.

Summary

Based on the statistics and conclusions in "A Study of PCB Contamination in Distribution Line Transformers" prepared by CMP and Michael R. Donihue, Ph.D. dated April 5, 2000, CMP's plan as described above targets for removal approximately 76% (priority A's) to 90% (priority A's plus priority B's) of the PCB-contaminated transformers in CMP's system. CMP's current intent is to trial this removal approach, evaluating and making revisions as appropriate.

Appendix 4

*Central Maine Power Company
Field Operating Procedure Section 1905:
PCB Contaminated Transformer Changeout*

	PCB Contaminated Transformer Changeout	
	Section 1905	Original Date: July 19, 2000

Overview

The following procedure has been developed to meet the goals of Public Law 193, "An Act to Protect the Environment by Phasing Out the Use of Old Transformers that are Potential Sources of PCB Pollution". CMP's Operational Plan for removing PCB contaminated transformers, as presented to the DEP, provides background information, basis of approach used, the four components, and an overall summary of the program.

Priority A transformers, as defined in the Operational Plan, include:

- General Electric transformers manufactured in Pittsfield, Massachusetts during 1937-1969 (approximately 2,200 total).
- Westinghouse transformers manufactured in Sharon, Pennsylvania in 1957 or during 1965-1970 (approximately 15,000 total).

Priority B transformers include:

- Westinghouse transformers manufactured in Sharon, Pennsylvania during 1916-1956 or 1958-1964 (approximately 17,000 total).

Nothing in this procedure supercedes CMP's normal spill response procedures. If during the changeout process, a transformer is damaged and a leak occurs, the spill will be reported and cleaned up in accordance with CMP's normal spill response procedures.

Priority A Transformers Within 100 Feet of Surface Waters or Schools in All of CMP's Service Centers

The goal is to remove all Priority A transformers located within 100 feet of any surface water body (as defined in the law), elementary school or secondary school within CMP's service territory by October 1, 2005. Service Center personnel may use any means available to them in locating and identifying those transformers within 100 feet of the target resources. This may include maps, GIS database, surveys, local knowledge, etc.

Once identified, normal operating procedures to replace these transformers will be followed. The Service Center will create a WMS design job and units will be identified as being within 100 feet of water (by coding as "N") or schools (by coding as "S"). Once removed, the transformer will be brought back to the Service Center, tagged and prepared for shipment to NASC with appropriate documents (notice of transfer and transformer card). Once received at NASC, they will be tested for PCB content and a final determination of reuse or discard will be made.

Priority A Transformers Regardless of Location

The majority of Priority A transformers fall into this category and a concentrated, efficient process will be utilized so that the removal goal of October 1, 2011 may be met.

The anticipated schedule for removing these transformers by October 1, 2011 is as follows:

<i>Service Center(s)</i>	<i>Priority A Transformers</i>	<i>Target Date</i>
Augusta	1550	Aug. 1, 2000 - Aug. 1, 2001
Waterville	1322	Aug 1, 2001 - Aug. 1, 2002
Brunswick	2842	Aug. 1, 2002 - Aug. 1, 2003
Portland	1928	Aug. 1, 2003 - Aug. 1, 2004
Rockland/Belfast	1915	Aug. 1, 2004 - Aug. 1, 2005
Alfred	1859	Aug. 1, 2005 - Aug. 1, 2006
Farmington	1322	Aug. 1, 2006 - Aug. 1, 2007
Lewiston	1294	Aug. 1, 2007 - Aug. 1, 2008
Bridgton	1090	Aug. 1, 2008 - Aug. 1, 2009
Dover	872	Aug. 1, 2009 - Aug. 1, 2010
Skowhegan	808	Aug. 1, 2009 - Aug. 1, 2010

The Augusta Service Center is conducting a pilot program to determine the most cost effective method of removing these transformers in a timely fashion. The following outlines the general procedures to be used, while the details of the [Augusta Pilot](#) can be found at the end.

The majority of these Priority A transformers will be removed and sent to NASC except for the largest sizes, where it would be more efficient to take an oil sample in the field and have it lab tested for PCB content. These larger units will only be removed if they are found to contain 50 PPM or greater PCB's. If found to be less than 50 PPM PCB's, these units will be permanently tagged as "NON-PCB" transformers.

The Service Center will create a design work request using request type "TF" (MP238631), for changing out all of these transformers. A dedicated crew or crews will be assigned to work solely on this project (except for emergencies). The crew(s), utilizing the transformer list, will change out the Priority A transformers on a town by town basis (towns will be done alphabetically) charging the generic work request number. These jobs will be done as "as built" and reported daily.

The transformers will be brought back to the Service Center, placed in a segregated area, tagged and palletized for shipment. The notice of transfer is to be prepared and included with the transformer cards to accompany the transformers during shipment.

If during the removal process a transformer is damaged and a leak occurs, the spill will be reported and cleaned up in accordance with CMP's normal spill response procedures. The leaking transformer will be taken directly to NASC and not brought back to the Service

Center.

If during the handling and transporting of the transformers minor weeping commences, the transformer will be placed in a secondary container (such as a barrel or polyethylene bag). Such weeping units would be shipped to NASC during the next scheduled shipment, along with the other removed transformers.

Removed Priority A transformers will be shipped to NASC at various intervals depending on various factors including volume and personnel. Licensed and properly trained hazardous waste drivers as well as hazardous waste licensed vehicles will be used to transport these units to NASC.

Once at NASC, a sample of the oil will be taken and lab analyzed for PCB content. A determination will be made by NASC personnel as to whether to reuse or discard the transformer.

Underground Vault Transformers

The unique characteristics of underground vault transformers require more cumbersome work processes as compared to pole mounted units. The testing and replacement program begun in 1999 continues with CMP personnel following normal operating and maintenance procedures.

Priority A & B Transformers Handled During the Normal Course of Business

During the normal course of business, whenever a Priority A or B transformer is handled, it will be removed, sent to NASC and tested for PCB content. Normal operating procedures will be used to replace the transformer and ship it to NASC unless the Service Center is in the process of mass removing and shipping Priority A transformers as shown in the above schedule. In this case, the Priority B transformers will be handled and shipped as outlined under Priority A transformers.

Additionally, Field Planners need to check adjacent transformers whenever they are engineering a job. If a Priority A or B transformer is found, the appropriate SX is to be created for changing this transformer.

Augusta Pilot

The following outlines the detailed procedures established for removing Priority A transformers (regardless of location) within the Augusta service area. These procedures will be refined throughout this pilot program to improve efficiency before implementation begins in the other Service Centers.

Vivian Dennett/Tim Robbins -- responsible individuals

- Created DL/TF work request on WMS (0001129967). The accounting in WMS for 'TF' jobs is MP #238631, FERC #583010. This job currently estimated for the labor and vehicle to replace approximately 1554 transformers. Material cost needs to be estimated and included. Dick Libby can run a query on the costs.
- When creating the w/r on WMS, Tim used the standard labor hours for installing/removing energized transformers for CU's xd1hubp (10kva) and xdIp1ph (installation package) times 1554 transformers to calculate how many xdlabor units (1/2 hr increments) to design. Tim estimates roughly 40 minutes to change out a typical transformer. (If actual transformer quantities by KVA are used in the estimate, the original labor CU's will be eliminated.)

- Augusta Line Supervisor has the list of transformers to be changed out.
- The list (run from AMPS) will be compared to the card file and any differences will be field checked. Plant Accounting will be involved in updating the AMPS system with any corrections.
- The corrected list will be downloaded to an ACCESS database sheet with the following format:
 - T/R/P, KVA, voltage, stock code, make, serial #, installed or removed, date done and crew id. Also, a blank field will be created for the timekeeper to record the 'point number' on which it was installed (for future reference).
- Before the end of August, the Augusta Line Inspector will sample oil to determine the PCB content of the larger transformers in order to determine if they actually need to be changed out. If found to be less than 50 PPM PCB's, these units will be permanently tagged as "NON-PCB" transformers.
- Transformers will be changed out at an average rate of 5 to 10 per day and will be reported daily 'as-built'.
- Plant Accounting will be available to verify or 'fix' the system if need be in order not to hold up the daily reporting. This will be mostly on retired transformers not matching the system.

Mike Keliher -- responsible individual

Service Centers must clear all transformers into their idle inventory through the WMS and MMS process. NASC will move the idle transformers into these locations, CL 093 under 500 kva and CL 173 for 500 kva and over, through MMS.

- Tag all transformers with the red tag, failed transformer tag, form # 2975. This tag will have information consisting of: road code, pole #, town, make, size, and serial #.
- Transport these units to the service center for storage in a box trailer or box truck.
- Transformer storage vehicle will be equipped with spill material and containment equipment.
- The stock handler will maintain a log and perform daily inspection of this vehicle.
- Design a work sheet that will contain all the information from the red tags. This will be used to audit the in coming units. This sheet will also act as a transportation sheet along with the transportation shipper.
- Transport weekly (or some other frequency) to NASC.
- Return this vehicle to the site for refilling.
- Double check S/N's with the return transportation sheet.
- NASC will do the 60 transaction (shipping) and the 40 transaction (receiving) for the MMS process.
- NASC will take oil samples to determine the PCB content of the transformers, reuse or discard.
- NASC will track the number of units coming in to stay within the 4400 unit annual license restraints.

[Return to Field Operating Procedures Index](#)