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**Item ID Number** 02287

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**Report/Article Title** Typescript: Transient Liver Pathology in Patients Consuming Water from a Private Well Contaminated by PCBs from a Submersible Water Pump, [nd]

**Journal/Book Title**

**Year**

**Month/Day**

**Color**

**Number of Images** 6

**Description Notes** Typescript of article published in Chemosphere, 1987, vol. 16, no.1, pp.37-42.

TRANSIENT LIVER PATHOLOGY IN PATIENTS CONSUMING WATER FROM  
A PRIVATE WELL CONTAMINATED BY PCBs FROM A SUBMERSIBLE WATER PUMP

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ABSTRACT

Submersible water pumps in private water wells have in some instances been found to contain PCBs in their oil. When these pumps leak they may release PCBs into the drinking water constituting a potential health hazard.

INTRODUCTION

Since 1982, in New York State, and in Wisconsin, a number of private water wells, usually in rural areas, have been found to be contaminated with PCBs. The source of this contamination is thought to be submersible water pumps from several manufacturers where PCBs were apparently found in the oil of the pumps or in their capacitors. Although the manufacturers deny intentionally putting PCBs in these pumps, the presence of PCBs has been documented by State and County Health Departments from 1982 through 1985 in Broome County and adjacent areas in Upstate New York as well as in Wisconsin. PCB levels in drinking water from these wells has been found to be as high as 57 times greater than State PCB drinking water standards at this time. Whether significant health consequences occur depends on the ingested dose of specific PCB isomers with their usually coexisting chlorinated dibenzofurans and less frequently coexisting chlorinated dibenzo-p-dioxins. A medical case study with transiently elevated liver enzymes found in three members of a family after ingestion of PCBs in their drinking water is presented.

FINDINGS

A family of three came to the Upstate Medical Center affiliated Faculty Practice Occupational Medicine Clinic in Binghamton, New York, located at Binghamton General

Hospital, with complaints of feeling sick from documented ingestion of PCBs in their drinking water for at least one week, with accompanying subjective, primarily central nervous system, symptoms of discomfort, a feeling of generalized illness and "dizziness". The family members had noted a chemical odor and a film on the water at times. A Health Department investigation had determined that the source of PCBs and a chemical taste in their water was a submersible water pump of a type shown in Figures 1 and 2, which had been leaking. The pump in question, a Barnes pump from the Barnes Manufacturing Co. of Mansfield, Ohio and Oakland, California, had detectable PCBs when tested by the State Health Department.<sup>(1,2)</sup> Upon review of Health Department records, it was found that Peabody Barnes Pumps were found to have PCBs which leaked in nine instances between 1982 and 1985.<sup>(1,2)</sup> Some pumps were found to have 2.5% PCBs in their oil, when tested by the State Health Department.

In the pump owned by the patients in this case study, there was a finding of 6.6 parts per billion of PCBs in the drinking water. The leaking pump oil was found to have 630,000 parts per billion of PCBs. Analysis for polychlorinated dibenzofurans which so frequently accompany PCBs was not performed.

Patients with PCB contaminated water noted bad odors, peculiar taste, a petroleum-like taste, and a disorientation or "spaced out" feeling after drinking the water. Serum PCB levels in the three patients followed by us, a mother, father and 12 year old son, seen one month after the consumption of water contaminated with PCBs were quite low, below 2 ppb; whereas serum PCB values for adults from this part of Upstate New York are usually about 5-10 ppb. The family's diet was somewhat unusual in that they usually ate "natural" foods, usually vegetables, and also ingested high levels of vitamins. Abnormal (elevated) liver enzymes were found in blood tests performed on all three members of this family who ingested the PCB contaminated water for an estimated one week. These abnormal values, indicative of liver damage, returned to normal levels within one month after the initial values were documented, or two months after ingestion of water contaminated with PCBs, suggesting that the acute injury was a transient one. No clinical or laboratory evidence of hepatitis or drug induced liver damage was found. The patients recovered from their acute medical problems but are being followed for possible delayed onset pathology.

New York State "Safe Drinking Water Guidelines" for PCBs is one part per billion.<sup>(3)</sup> Water from wells contaminated by oil from these pumps, schematically diagramed in Figures 2, 3, and 4, have shown between .25 and 57 parts per billion, according to State records.<sup>(2)</sup> Tests of the oil from the contaminated pumps have shown 630,000 to 24,000,000 parts per billion of PCBs. Tests of the lubricating oil in these pumps have shown that levels of PCBs have been found in pumps more than 20 years old and as new as a 1982 model. To date the brands of pumps involved have been Barnes or Peabody Barnes, Reda and Myers.<sup>(2)</sup>

According to the Water Systems Council, Inc., 50% of private well pumps are above ground units and the remaining 50% are submersible units. Half are oil cooled and half are water cooled. Census figures for 1982 describe 12,000,000 homes connected to private wells in the U.S.A.<sup>(4)</sup>

By way of comparison, the U.S. Food and Drug Administration sets a 2 parts per million PCB tolerance level for fish consumption. The F.D.A. recommends eating fish at this level

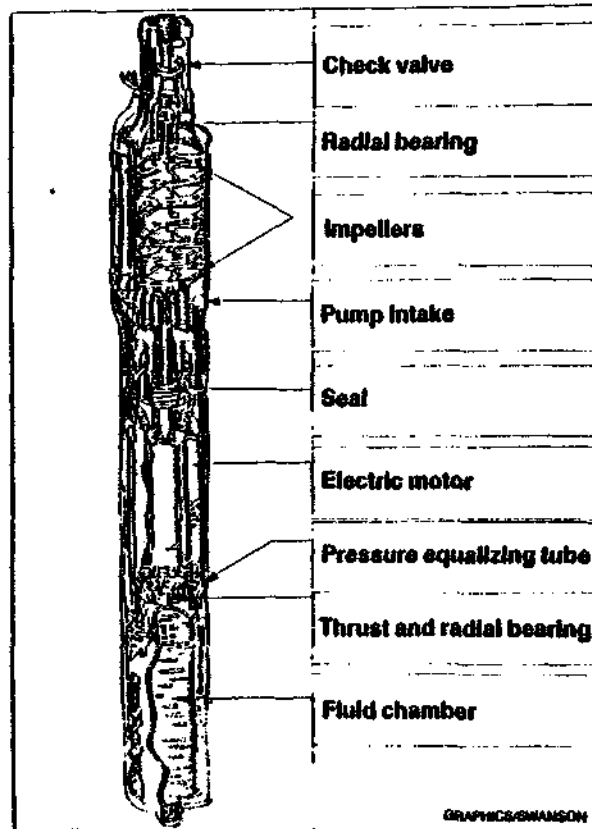


Fig. 2 - This schematic diagrams the internal components of a submersible water pump.



Fig. 1 - A Health Department technician is shown holding a PCB contaminated submersible water pump.

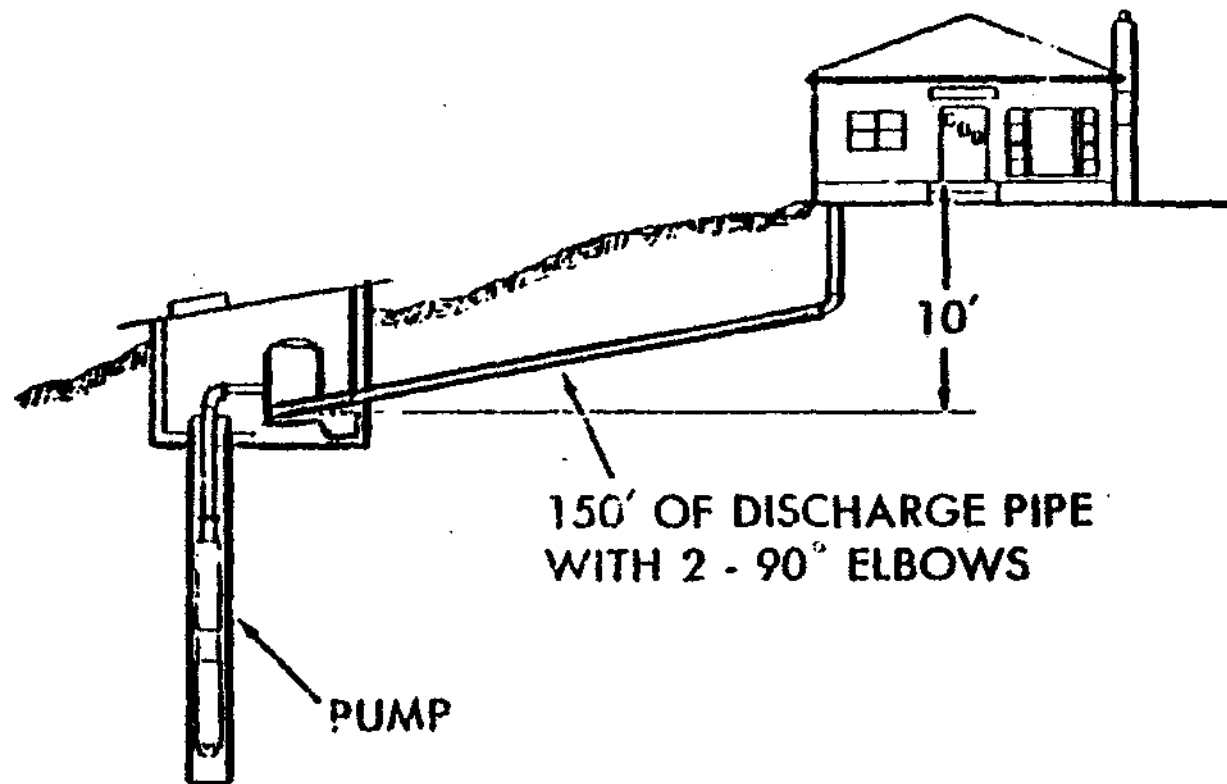


Fig. 3 - A typical arrangement of a submersible water pump, well, and pipe fixtures leading to a home is shown here.

no more than once per week.<sup>(5)</sup> A half pound or eight ounce serving of fish contaminated at this limit would contain 500 micrograms of PCBs.

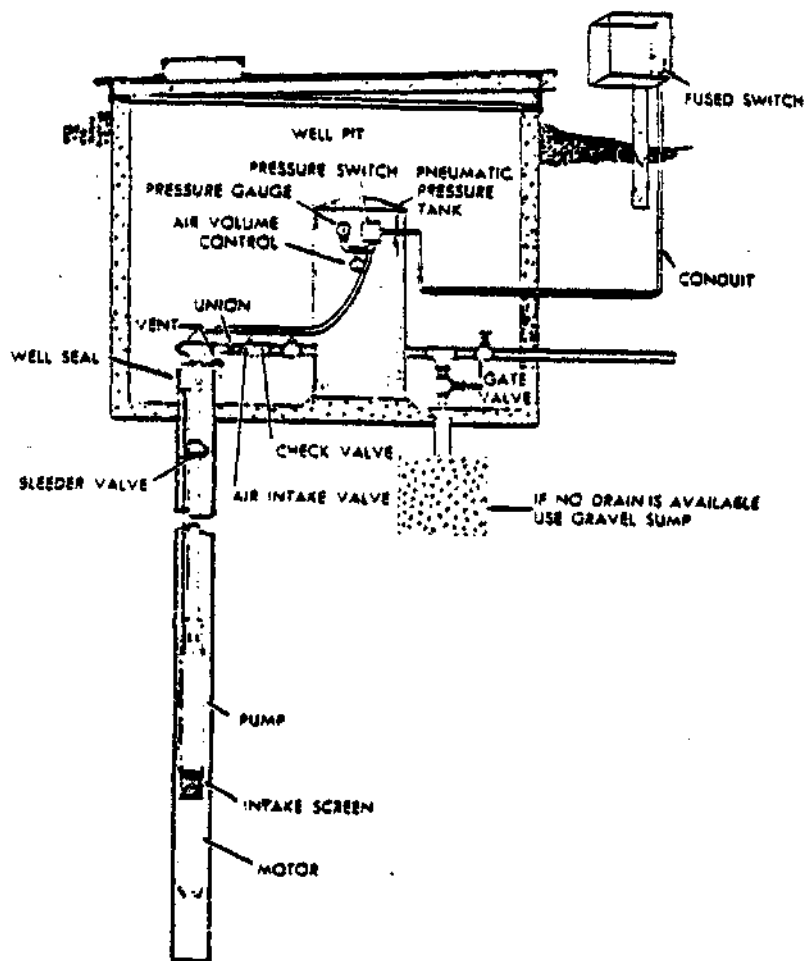


Fig. 4 - This schematic depiction details the apparatus immediately related to the pump and well.

Also, for comparison, if two liters of water at the New York state Drinking Water PCB Guidelines are consumed for 70 years with a one part per billion PCB level this has been calculated to lead to one additional cancer death per 10,000 persons according to State Health Department calculations.<sup>(4)</sup>

Additional concern has been raised by an EPA study performed under contract by Versar, Inc., of Springfield, VA, in 1980 which estimated that 1,100,000 wells may have PCB capacitors in the well motors.<sup>(6)</sup> This is different from the current findings of PCBs in the oil of the motors or pumps themselves, rather than the capacitors.

## SUMMARY AND RECOMMENDATIONS

Submersible water pumps in private wells are widespread, especially in rural areas, and may constitute a potential health hazard, especially if they contain PCBs with the usually concomitant chlorinated dibenzofurans and occasional chlorinated dibenzo-p-dioxins. These leaking pumps have been demonstrated to contaminate drinking water above levels considered safe for human consumption. PCBs apparently were used in these pumps from at least three known manufacturers at least in the United States without the admitted knowledge of the presence of PCBs, except in the capacitors, by any party.<sup>(4)</sup> The extent of these contaminated pumps remain to be documented. To date the only incidents known to us are the nine pumps in and around the Broome County, New York area, where the public and health department are especially sensitive to the possible presence of PCBs since the PCB, dioxin and furan contaminated State Office Building incident of February 1981,<sup>(7)</sup> and in Wisconsin where the Wisconsin Department of Natural Resources (WDNR) has also detected PCB contamination in private well water with submersible water pumps as the probable source. It is unclear as to whether only the capacitors contain PCBs or whether the pump oil itself, usually pharmaceutical grade mineral oil, also contains PCBs. News releases to the public and a notice to well drillers and installers have been issued in Wisconsin by the WDNR. Further sampling of lubricating oil from additional pumps and water from more wells is planned in Wisconsin. However, the nationwide distribution of these pumps suggests that other instances will be documented when the possibility of PCB contamination exists in similar submersible water pumps elsewhere in the world. Because of the large number of such pumps in the United States and worldwide, it is possible that these may constitute a potential human health hazard. Further chemical testing of suspect pumps and water is indicated and appropriate medical evaluation of patients exposed to PCB contamination is indicated, including routine blood screening tests as well as blood PCB levels, serially obtained wherever the possibility of a transient elevation above the patient's baseline exists.

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