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STATE OF IOWA

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TO: Water Well Drilling Contractors
Water Well Pump Installers
Home owners who self-supply water from water supply wells
Local Health Departments
Environmental Health Department Directors
Environmental Health Specialist and Agents

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SUBJECT: Advisory on PCBs in Older Submersible Water Well Pumps

A recent incident in Washington County serves as a reminder to all well owners that there is potential for drinking water contamination and health risks from PCBs (polychlorinated biphenyls) leaking from older submersible water well pumps found in some water supply wells. It is likely that some old well pumps which contain PCBs may still exist within functional drinking water supply wells or in wells that are currently abandoned and not used. Older well pumps that contain PCBs can create a health hazard if not identified and replaced or removed.

Well drillers, pump installers, homeowners and local health departments should notify the Iowa Department of Natural Resources, Private Well Section at 515-725-0462 or at 515-725-0346 when a submersible pump known to have PCBs is encountered.

The precautions and practices described in the attached handouts should be used when servicing or plugging your water supply well when it is discovered that a pump found in a water supply well has an oil filled motor or a two-wire submersible pump manufactured before 1980. The Iowa DNR is posting the following information on its Internet website to inform private well owners, users, contractors, and local Environmental Health Departments about the associated public health threat.

Several two-wire submersible pump motors were manufactured before 1980 that likely contain capacitors which contain dielectric compounds that contain PCBs. Additionally, some submersible pump motors from that era were filled with nonfood grade lubricating oil that may have contained PCBs. The water well industry and health officials first became aware of this problem in 1986 after nationwide publicity of PCB contamination incidents. The majority of the pumps installed before 1980 have likely reached their service life and have previously been replaced as the average life of submersible pumps is approximately 12 years. Although most PCB-laden pumps are likely to have been replaced, contractors will continue to encounter them as they service wells where the pump has provided exceptional service life. Because of the lack of reporting when well pumps sold, installed or replaced, state officials cannot identify the number of potential locations where PCB-laden pumps may remain in service.

Pages 2 through 10 of this document will provide you with additional information regarding the nature of the PCB problem, the associated health risks to PCB exposure, and steps to take when PCB-laden pumps are encountered.

PCB Contamination Potential from Older Submersible Well Pumps

What are PCBs?
Polychlorinated biphenyls (PCBs) are synthetic (man-made) chlorinated hydrocarbons similar to pesticides. There are no known natural sources of PCBs. They are generally colorless to light yellow, odorless, tasteless, have a thick consistency, high density, are insoluble in water, and immobile in soils. Some PCBs are volatile and may exist as vapors in air. Because of their low electric conductance and insulating properties they were used extensively as dielectric fluids in electrical capacitors and transformers. PCBs were also used in hydraulic fluids, plasticizers, fire retardants, and as a component of carbonless copy paper. The manufacture of PCBs was banned by the EPA in 1976 and most uses of PCBs were banned in 1979.

How do PCBs contaminate the well water?
The failure of seals within certain submersible pump motors due to normal wear, lightning strike, electrical power surges, or other damage can release PCB-tainted oil into the household drinking water system. Capacitors within the motors of certain two-wire submersible pump models manufactured before 1980 contain PCBs, which can leak into the surrounding lubricating oil. Oil can leak from an oil-cooled submersible pump motor slowly without notice by the homeowner. The leak may not be apparent until the pump fails and the well is serviced.

By the time that the oil leakage is discovered, water tainted with PCB contamination may have already been consumed. In the case of a lightning strike, oil can be released suddenly from the pump motor which can cause an immediate change in the taste/odor of the drinking water. In most cases the oil is not discovered until the well pump is pulled due to the low density of the oil and the fact that the floating oil rises to the top of the water column where it accumulates on the well casing, the pump pipe, and the pump wire. The oil slowly mixes with the well water and the submersible pump distributes the tainted water into the pressure tank and throughout the household plumbing.

In addition to this problem occurring in older wells that have old pumping system installed that are currently in use, there are likely older, abandoned wells that still contain submersible pumps that contain PCBs that may leak into an aquifer and cause health and water quality problems.

What are the health risks from PCB exposure?
The United States Environmental Protection Agency (USEPA) notes that PCBs have the potential to cause short-term health effects such as acne-like eruptions (chlorachne) and pigmentation of the skin, hearing and vision problems, and spasms. Long-term exposure above the 0.5 parts per billion maximum contaminant level (MCL) can cause irritation of the nose, throat, and gastrointestinal tracts, and changes in liver function. PCBs are known animal carcinogens (cancer-causing) and probable human carcinogens. Few studies associated PCBs with cancers of the liver and biliary tract in workers. PCBs bioaccumulate in the body, primarily in the liver and fatty tissue. PCBs collect in milk fat and can be passed to infants through breast-feeding. There is no evidence of structural birth defects caused by PCBs, but motor skill deficiencies and a decrease in short-term memory have been implicated in children born to mothers who ate PCB-contaminated fish. PCBs have been very common in our environment and almost all adults born before 1980 have had exposure to PCBs. This is due to the wide use of devices that included PCB compounds as dielectric materials. PCBs do not break down naturally in the environment and can persist for years.

What are the drinking water standards for PCBs?
The US EPA established a Maximum Contaminant Level (MCL) of 0.0005 mg/l (ppm) or 0.5 parts per billion. The maximum contaminant level goal for PCBs is zero – at this level there are no known health effects.

Which pumps contain PCBs?
Attached at the back of this document you will find a listing of submersible pump models known to contain PCBs and those with oil-filled motors that may pose a contamination threat. These listings were compiled from the mid-1980s to early 1990's and have been provided by the US EPA for reference on which pumps are most likely to contain PCBs. The accuracy of this information is strictly dependent on the information provided to the US EPA by the manufacturers of well pumps and well pump motors.

If a well has a pump listed as having PCBs or nonfood-grade oil, what should be done?
To reduce exposure risks, well owners with pump models on the attached listing should replace their pumps immediately. If a PCB-laden pump or a pump with nonfood-grade oil is in the well, the water should be analyzed for PCBs and volatile organic chemicals regardless of whether there are signs of pump failure. The homeowner or water well driller should notify the pump manufacturer for assistance.

If a local well contractor, well owner/well user, inspector, or environmental health department agent discovers a probable PCB-laden pump or pump with nonfood-grade oil during pump repair, replacement, or inspection, the condition should be documented and the Iowa DNR, Private Well Section should be contacted immediately at 515-725-0462 or 515-725-0346.

How can well owners tell if their pumps have PCBs?
The model of the pump may be included on the water well record that was filed by the water well contractor. Well owners should contact the pump installer who installed the pumping system or the contractor who most recently performed any kind of maintenance on the well system. <u>If no record of the pump installation can be found, the pump must be removed from the well for inspection to determine if the motor may include components that include PCBs.</u>

The pump model number should then be compared with the attached listing of PCB-laden pumps to determine if the pump/pump motor should be replaced immediately.

It is important to note that PCBs are not a concern in submersible pumps manufactured after 1979 or in pumps with three-wire, water-cooled motors. A three-wire pump uses a separate pump control box usually located near the pressure tank. This control box contains the capacitor that created the problems with the two wire pump installations. If the control box contains the capacitor it means that the capacitor in the pump motor and there should not be any risk of exposure. A two-wire pump has the capacitors within the pump motor and a separate motor control box is not present. Two wire pump installations with pre-1979 pump motors are the installation of concern.

The submersible pumps that are sold today contain water-lubricated parts and do not contain mineral oils or PCB capacitors. If you happen to be the owner/user of shallow-well jets pumps, deep-well jet pumps, centrifugal pumps, or other pumps located outside the well, you do not have to be concerned as PCBs are not a concern with your drinking water with pumps that have the capacitors located outside of the well structure.

What if oil is leaking into a well?
If the water has an oily taste/odor or film the well users should immediately refrain from drinking, cooking with, or bathing in the well water until water testing has been conducted.
Bottled water is recommended as a temporary water supply until testing has confirmed the safety of the well water. If the pump is an oil-filled model, the well water should be analyzed for PCBs and volatile organic chemicals. Oil leakage from the pump means that motors seals are worn or have failed and pump replacement is inevitable.

If the pump motor is water-lubricated and an oily taste/odor/film is present, other possible causes should be investigated. A fuel storage tank leaking into the aquifer or a bacterial infestation in the well may be the cause of the oily taste/odor problem. We recommend that you have the well water tested for volatile organic compounds and/or iron bacteria, sulfate-reducing bacteria, pseudomonads and coliform microorganisms to help determine any risk.

Where can a water analysis for PCBs be obtained?
The local county environmental health office can help arrange the needed testing for PCBs in private drinking water well water. In many instances, this testing will qualify for the extended testing under the Grants to Counties Well Program managed by the Iowa Department of Public Health. You can obtain a listing for the local county environmental health office at the following Iowa DNR web site: http://www.iowadnr.gov/Portals/idnr/uploads/water/wells/co_sanitarians.pdf.

Some private laboratories may also perform PCB analyses. A listing of private laboratories is available on the State Hygienic Laboratory at: http://www.shl.uiowa.edu/labcert/idnr/index.xml.

What safety precautions should a well drilling contractor or well owner take when servicing a well with a pump that is leaking oil or suspected of containing PCBs?
To protect contractors and their employees, protective clothing and eyewear should be worn while handling a pump that is leaking oil unless it has been confirmed that the pump does not contain PCBs, has food-grade oil, or it is determined that the motor uses the newer water cooled design. Use disposable rubber gloves to handle the pump and drop pipe. If skin contact occurs, immediately wash with strong soap and water.

When a PCB-laden pump is removed from a well, the pump should be carefully inspected to be sure that all pump components are intact. If the capacitor or capacitor housing are left in the well, residual PCB contamination could occur. If this is the case, retrieving the lost components is the only way to ensure that the well has the best chance to produce drinking water once again.

Any free oil product that is cleaned from the well or pump should not be allowed to spill onto soil or pavement. If a spill occurs, it should be cleaned up immediately with oil-soaking absorbents, bentonite clay, or cat litter and the absorption product then placed in a sealed container for proper disposal.

What if a suspected PCB pump is stuck in the well?
A diligent attempt must be made to remove the pump, but caution is warranted. Leaving the pump in the well can result in contamination, but excessive force while fishing for the pump can cause physical damage and oil can be released into the well. Observing the position of the pump by inspection with a down-hole TV camera can aid in selecting the proper fishing tools. If fishing is unsuccessful, entombing the pump in cement grout or pump/casing extraction by over-drilling may be necessary.

If a PCB-laden pump is stuck down hole, the well contractor should contact the Iowa DNR at 515-725-0462 for advice before proceeding.

Where can a PCB-contaminated pump be disposed?
Well pumps that contain PCBs require "demanufacturing" to remove the PCB laden capacitor and oil and properly disposes of the wastes. To transport the pump, you can place the submersible pump in a container such as a length of pipe with leak-proof caps or wrap the pump in multiple layers of plastic sheeting (at least 10 mil. thickness) and tightly tape the entire pump. There are many locations that that collect old appliances and devices that may contain PCB components. You should contact your local solid waste landfill to obtain more information on who accepts PCB components in your area or see the following web page: http://www.iowadnr.gov/Environmental-Protection/Land-Quality/Solid-Waste.

How is a PCB/oil-contaminated water system restored?
Restoration of a PCB/oil-contaminated well can be labor intensive and costly. The basic steps are:

- Skim free oil product off water surface using a bailer or absorbent "socks." Retain oil and oil-soaked absorbent materials in container for proper disposal at a facility as listed above.
- Use well cleaning chemicals (surfactants or dispersants) formulated for oil removal. Well rehabilitation chemicals shall be listed in compliance with *ANSI/NSF Standard 60 – Drinking Water Treatment Chemicals – Health Effects*).
- Use swabbing tool, brush, or high pressure-washing to scrub casing after cleaning solution is added.
- Re-circulate cleaning solution in well for at least 2 hours – wash down inside of casing – perform this at least two separate times using clean potable treated water.
- Run cleaning solution into plumbing to capture oil residue in pipes.
- Flush cleaning solution through a granular activated charcoal filter and discharge wastewater to an appropriate site at least 100 feet from surface water.
- Collect water samples for PCB and volatile organic chemical (VOC) analysis.
- Do not return the well to service until PCBs and VOCs are not detected (or below MCLs) after successive water testing.
- Retain spent PCB-laden charcoal filter material for disposal along with pump and other contaminated materials at an approved facility or with a licensed waste-hauler.

For further assistance:
Iowa Department of Natural Resources
Water Supply Engineering - Private Wells
502 East 9th Street
Des Moines, IA 50319
Phone: 515-725-0462
Fax: 515-725-0348
www.iowadnr.gov/privatewells

References:

Advisory on PCBs in Older Submersible Water Well Pumps, Michigan Department of Environmental Quality, Well Construction Unit, Drinking Water and Environmental Health Section, Lansing Operations Division, 2005, Internet website.

EPA Inspection Manual, US EPA, Office of Compliance, Office of Enforcement and Compliance, 2004, Publication - EPA-305-X-04-002

The Potential for Drinking Water Contamination from Submersible Well Pumps, Wisconsin Department of Natural Resources, Bureau of Water Supply, Publication WS-025-92, 1992.

Technical Factsheet on Polychlorinated Biphenyls (PCBs), U.S. Environmental Protection Agency, Ground Water & Drinking Water, 2005, Internet website.

Toxicological Profile for Polychlorinated Biphenyls (PCBs), Agency for Toxic Substances and Disease Registry, November 2000, Internet website.

Removing PCB-Laden Pumps, Huntoon, Edwin, Ground Water Age, January 1993.
Michigan Department of Public Health, Ground Water Quality Control Section, Memorandum of June 30, 1986.

SUBMERSIBLE PUMP UNITS KNOWN TO CONTAIN PCBs

The following manufacturer's models and serial numbers have been compiled from literature searches and information supplied by pump installers and pump manufacturers. This information represents the best descriptions currently available.

Please be aware that the list is not complete with regard to all manufacturers and brand names and the information has not been confirmed in all cases. Although the list is the best available, its accuracy cannot be guaranteed.

The available information is for pumps manufactured after 1960. Some brand contained PCBs prior to 1960 but did not contain PCBs after 1960.

The following units are those identified as sources of PCB contamination in well water:

Dempster Industries: Before 1964 Dempster may have distributed pump units manufactured by REDA and Sta-Rite that may have contained PCBs. Use the REDA and Sta-Rite identification data for those pump units.

F.E. Myers: Models SF and SF-2, 2-wire units manufactured from 1964 through 1970 in 1/3 to 1 horsepower (HP)and Models SG and S2G, 2-wire units manufactured from 1970 through 1976 in 1/3 to 1 HP with date codes prior to 1976. Some SX2 models manufactured before 1979 had capacitors containing less than 50 parts per million of PCBs. The date code is located on the motor casing and on a nameplate or tag in the format MMYY (Example: "1177" = November 1977).

Fairbanks Morse: Two-wire units manufactured from 1964 through January 1979 gave a coded alpha-numeric date code found on the nameplate. Included are the Colonial series and the Chateau series units with date codes of A___ , B___ ,C___ , J___ , K___ , L___ , M___ , N___ , P___ , R___ , S___ , T___ ,V___ , W___ , X___ , and DA___ . The blanks are filled in with additional characters.

Series Model Numbers
Colonial A2-2507 C2-3306 E2-7509 G2-1009 A2-3309 C2-7511 E2-10011 A2-5012

Chateau A2S-3309 C2S-3306 E2S-7509 G2S-1009 273 A2S-5012 C2S-5008 E2S-10011 G2S-15012 275 A2S-7517 C2S-7511 E2S-15015 277 A2S-10021 C2S-10014

Johnston Water Systems: These pumps were manufactured by Peabody Barnes and are identified as noted under Peabody Barnes listing. Models include:V507-31 V513-52 V909-51 VSP913-75 V317-150 V507-32 V523-100 V909-52 VSP909-52 V1306-51 V509-31 V531-100 V913-75 VSP909-51 V1307-52 V509-32 V906-31 V917-100 VSP1309-75 V1809-100 V513-51 V906-32 V923-150 VSP313-100 V1813-150

Montgomery Ward: These pumps were manufactured by Peabody Barnes from 1962 to 1972 and are identified as noted under Peabody Barnes listing. Models include: 3677A 3679A 3681C 3682E 3684D 24623 3677B 3679B 3681D 3683C 3675A 24625 3678A 3680C 3682C 3683D 3675B 3678B 3680D 3682D 3684C 3675C

Peabody Barnes: Two-wire units are identified with the letter "W" as part of the model

number (Example: “409W52”). In 1977, the letter “N” was added to the model number (Example: “409W52” became “409WN52”). The date codes are the last 3 or 4 digits of the coding, showing month, then year of manufacture (Example: “409WN52-67753-1279” is a 2-wire unit made in December 1979). Codes are found on a stainless steel band around the discharge neck of the pump.

REDA: Two-wire units have a date code on the nameplate with the format MMYY (Example: “0877” is August 1977) All models listed below with a year code of 1979 or earlier are included. All motors had the serial number stamped on the head of the motor preceded by the 4-digit date code. 41100 41101 41120 42070 42090 42091 42121 42131 42171 42181 42251 43091 43121 43131 43171 43181 44091 43251 4D35P101 6D35P151 7D9P030 7D9P031 7D18P071 9D5P031 9D6P030 9D9P050 9D9P051 10D18P101 12D5P050 12D5P051 12D9P071 14D18P151 17D5P071 17D9P101 23D5P101 23D9P151 312X7P050 14X4P050 320X4P050 32D5P151

Red Jacket: The capacitor is encapsulated in a plastic housing and the unit is fastened to the bottom of the motor. Although these units may be less likely to leak PCBs, there are confirmed well contamination cases from Red Jacket pump motors. Motor models include designations “BV,” “BVC,” “W,” and “RW,” 1/3 through 1-1/2 HP. The model designation appears as the first part of the identification number (Example: BV 300-2 or 50W0-9BC). The date of manufacture is found on the motor housing and on the pump and include the following codes:
1968 MC and NC 1969 AD through ND
1970 AE through NE 1971 AF through NF
1972 AG through NG 1973 AH through NH
1974 AK through NK 1975 AL through NL
1976 AM through NM 1977 AN through NN
78 (Examples: “20378” is 2nd week of March 1978) “3FHR” is 3rd week of June 1973.

Sta-Rite: Two-wire units have a date code on the nameplate with the format MYY. The month is coded as a letter from “A” to “M” and the year is a number. (Example: “B77” is February 1977). Units dated 1979 or earlier are included.
(Note: Some 3-wire motors with Sta-Rite labels have been verified containing PCB.)
(Source: Wisconsin Department of Natural Resources)

IDENTIFYING OIL- FILLED MOTORS

The following list of oil filled submersible pump motors that we have documented below was compiled by the Wisconsin Department of Natural Resources and was obtained from manufacturers, well drillers, pump installers, technical journals, sales literature, field examination, and limited analytical analysis. The list is not exhaustive. Because of the variability of petroleum products and the motor manufacturing process, it is impossible to provide greater accuracy at this time. It is important to note that in most cases, specific model identification or serial numbers were not provided making identification of specific motor units difficult.

A.O.SMITH – Representatives of this company state that their records indicate that oils recognized as food-grade by the FDA were used in submersible pump motors. However, they did not provide any supporting documentation or copies of their records.

BARNES – Also known as Peabody Barnes, Inc., this company was acquired by Burks Pumps, Inc. Representatives of Burks Pumps state that the oils used in Barnes submersible motors was paraffinic type oil. No documentation was provided to indicate whether the oil used in these

submersible pump motors was food-grade. Limited analytical data suggests that oils used in Peabody Barnes submersible motors were unlikely food-grade. Montgomery Ward and Johnston Water Systems used motors supplied by Barnes at various times.

BYRON JACKSON – Currently known as BW/IP International, Inc., documentation was provided indicating that submersible pump motors currently produced by this company contain food-grade oil. Documentation indicating whether oils were food-grade was not provided for motors produced before 1990.

CENTURY – Century Electric Motors was previously a division of Transamerica/Delavall, now known as IMO. Century motors were used on many submersible pump brands including but not limited to Aeromotor, Berkeley, Tait, Pumptron, Red Jacket, Rapidayton, Webtrol, Flint & Walling, and Teel/Granger. Century Motors ceased operation in 1986 though many of the brands that used Century motors are still available. Manufacturers who purchased name brands associated with Century Motors have provided documentation indicating that food-grade oil was used from 1978 to 1986 and state that oil used between 1962 and 1978 was food-grade though they did not provide sufficient supporting documentation. Limited analytical data suggests that at least some of the oil used in at least some pre-1978 motors was probably non-food-grade.

EXODYNE – Exodyne purchased the assets of Magney Electric Motors, Inc. Documentation was provided indicating that submersible pump motors currently produced by Exodyne contain food-grade oil. Documentation for motors produced by Magney Electric Motors before 1991 was not available.

F.E. MYERS – Documentation provided by F.E. Myers and analytical data confirm that non-food grade oil has been used in oil-filled submersible pump motors manufactured by Myers. Between 1981 and 1983, Myers discontinued oil-filled motors and converted to water – filled motor technology. All Myers submersible motors since 1983 use a water-filled design.

FAIRBANKS MORSE – Except for pumps utilizing Franklin water-cooled motors, all motors contain oil. Fairbanks Morse has provided documentation indicating that food-grade oil was used in motors manufactured from 1978 to 1990. Company representatives state that "Information available to Fairbanks Morse is that from 1969 to 1978 oils which were used were FDA approved and non-toxic." Documentation provided by Fairbanks Morse does not indicate that the oil used from 1969 to 1978 was FDA-approved, food-grade material.

GENERAL ELECTRIC – General Electric (GE) indicated that they were not going to review their records to determine what types of oil were used in the various submersible pump motors they manufactured. PCBs have been found in GE submersible pump motor oil, the presence of which require a nonfood-grade classification. GE motors were used on various brands of submersible pumps, e.g. Hoosier.

RED JACKET – Currently, Red Jacket is a division of the Marley Pump Company. Submersible pump motors manufactured by Red Jacket are water cooled and do not contain oil. However, Century Electric submersible pump motors were used on 3,000 of the Red Jacket pumps nationwide between 1978 and 1981. Documentation has been provided indicating that food-grade oil was used in these motors. See the Century Motor section relative to these motors.

REDA, A CAMCO COMPANY – REDA was previously a division of TRW. Representatives of REDA state that REDA has not manufactured a submersible pump for use in potable water supply wells since 1979. Documentation has been provided indicating that food grade oil was

used in motors designed for use in potable water supply wells from 1965 through 1979. REDA has also manufactured motors for purposes other than potable water supply wells that do not contain food-grade oil. They state that they do not know whether some of these motors may have been installed in potable water supply wells. Prior to 1965, REDA motors contained nonfood-grade oil. REDA motors were supplied to various manufacturers during the 1950s including Clayton-Mark, Dempster, Duro, Flint and Walling, Rapidayton, Red Jacket, Rom, and Woodmansey.

STA-RITE – Documentation was provided indicating that food-grade oils were used in submersible pump motors manufactured between 1961 and 1966 and from 1975 through1991. Representatives of STA-RITE state that food-grade oils were always used in submersible motors but did not provide sufficient conformational documentation for motors manufactured prior to 1961 and between 1966 and 1975. However, limited analytical data suggests that food-grade oil was used. STA-RITE also supplied motors to Sears, Roebuck and Company.
(Source: Wisconsin Department of Natural Resources)