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HCD LITERATURE SEARCH
CONCERNING ON THE USE OF PEX
AS POTABLE WATER PIPE
February, 2004

Various suggested contamination issues and mass-product failures were raised to the Department by Mr. Thomas Reid, a consultant for the California Pipe Trades Council on the use of Cross-linked Polyethylene (PEX) potable water tubing. Mr. Reid did not provide the Department with any supporting documentation or citations to scientific health base studies to support the suggested contamination issues and mass-product failures. The Department has performed a follow-up literature search for the existence of any scientific studies or reports supporting the suggested contamination issues and mass-product failures on the use of PEX potable water tubing.

This study included information obtained from the Department of Health Services with the authority to protect the water supplies from the source (e.g., water treatment plant) to the outside of the residential home, the California Structural Pest Control Board with the authority to protect the public's health by regulating the structural pest control industry, the California Department of Pesticide Regulation with the authority to protect human health and the environment by regulating pesticide sales and use, and the Office of Environmental Health Hazard Assessment who adopts Public Health Goals for contaminants in drinking water based exclusively on public health considerations and is also the state agency responsible for implementing the States Proposition 65 Warnings for materials and chemical that contaminates the State's drinking water sources known to cause cancer, birth defects, or other reproductive harm.

The following is a summary of the Department's findings.

A. MECHANICAL FAILURES USING THE PRODUCT PEX

1. PEX is not a similar plastic as PB as suggested by Thomas Reid.
The literature shows that the chemical composition between PB and PEX is different and the two materials cannot be assumed to be the same. PB is a semicrystalline thermoplastic formed by polymerization of 1-butene, PEX, is a family of thermoplastic resins obtained by polymerizing ethylene. Because the chemical structures are different it cannot be assume that the defect found in the use PB water pipe will appear as a similar defect in the use PEX. As discussed below billions of feet of PEX have been installed in the United States and in California and there have been no reports of mass structural failures of PEX water pipe as occurred with PB.

2. PEX is not subject to attack by chlorine in water as suggested by Thomas Reid.

PB's fittings were subject to failure due to chlorine in the drinking water. The literature indicates that this is not the case for PEX or its fittings. PEX piping and fittings are not subject to attack by chlorine, which has been verified in its certification by NSF International to resist attack by chlorine used as oxidizers in the water supply. Since the adoption of the 2001 California Plumbing Code millions of feet of PEX water pipe has been installed in residential homes in California through the alternative material approval process, in manufacture homes as an approved product, as an approved pipe material in the 2001 California Mechanical Code for hydronic heating, and in private buildings such as schools, and office buildings. The Department has found nothing in the record reporting that any of this installed PEX piping has been attacked by chlorine in the water supply causing mechanical failures. The record does not show any mass mechanical failures of this installed pipe.

3. ICBO Evaluation Service approves PEX for Mechanical and Plumbing Codes

Reports by the technical staff from ICBO Evaluation Service, Inc., a subsidiary corporation of the International Conference of Building Officials, have been issued and based upon independent tests or other technical data, have made findings that PEX tube and fittings comply with use in Chapter 12 of the ICBO Uniform Mechanical Code, the International Plumbing Code and the Uniform Plumbing Code. Because of this approval by ICBO Evaluation Services, these codes have been approved in all 49 states and the California Building Standards Commission has approve PEX use in the Mechanical Code for hydronic heating, and in the Plumbing Code for all private building such as office buildings, stores, schools, and may other private buildings.

4. PEX law suit 19 units of a 57 unit Condominium in Seattle.

The California Pipe Trades Council suggested that a class action lawsuit exists against the makers of PEX used for massive failures of hydronic (in-floor) heating systems in Seattle.[1] A February 2003 statement by the law firm representing the PEX manufacture was that there was no class-action lawsuit. A February 2003 Plasco Manufacturing letter stated that evidence suggests that their PEX tubing was not properly handled and installed and there was not a product problem. A November 2003 email from the law firm for the plaintiffs stated that the suit settled and the record establishes that the defendants essentially admitted the tube was defective. Mr. Casey also stated "The class action is or rather was in a bit of a holding pattern until conclusion of my litigation." According to a copy of the complaint HCD obtained, only 19 of the 57 units experience water damage do to the PEX mechanical failures.

The literature search showed that copper tubing was once widely used for radiant floor heating, but the materials tendency to expand and contract caused

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[1] Blueberry HOA v. Plasco MFG, et al, Kings County Superior court, Case No. 01-2-35783-2 KNT.

premature failure and is no longer used.[2] Nearly all floor-heating systems installed in North America (over two billion feet of PEX) are made from PEX and PEX-AL-PEX.

The literature search does not supported the existence of wide spread mechanical failures of PEX radiant heating pipe. Instead, the literature search shows that there are no reports of wide spread failures of the billions of feet of PEX installed in North America, including California, since 1977. Thus, common sense supports the conclusion that the PEX piping failure within 19 units of the 57 unit condominium complex at Blueberry Place appears to be due to handling and installation of the PEX and not an inherent structural problem with the product itself.

The record shows that since the adoption of the 2001 California Plumbing Code millions of feet of PEX water pipe, used for potable water systems, have been installed in residential homes through the alternative approval process provided by statute for cities and counties. Many, if not most cities and counties in California currently permit the installation of PEX using the alternate material approval method.

In the code adoption cycles prior to 2001 and in the 2001 code cycle the California Building Standards Commission adopted PEX for use in hydronic piping systems within the California Mechanical Code. The Commission also adopted in the 2001 California Plumbing Code the permitted use of PEX for water pipe use in all non-state occupancies by the local building officials which include all private office buildings, stores, schools, and may other buildings. The Department has found nothing in the record reporting or making reference to any widespread mechanical problems associated with the PEX installed in any buildings under these statewide approved codes.

B. POTENTIAL ADVERSE HEALTH ISSUES USING PEX POTABLE WATER PIPE.

1. PEX was not a subject of the Department's 1998 EIR for CPVC as suggested by Thomas Reid.

A review of the Department's 1998 EIR for CPVC shows that PEX was not part of that environmental document as has been suggested by Thomas Reid. The EIR focused on issues related to glues and solvents (not applicable to mechanical fittings for PEX piping) and a comparison of health and environmental effects between the use of CPVC and the current approved copper pipe material.

2. PEX literature does not support Mr. Reid's suggestion that the additives used in the formation of PEX and CVPC are similar, and in fact there appears to be very little additives used during the formation of PEX.[3]

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[2] John Siegenthaler, P.E., author of *Modern Hydronic Heating* (Delmar Publishers, 1995), a consulting engineer an associate professor of engineering technology at Mohawk Valley Community college in Utica NY.

3. PEX installation does not have same worker safety issues as CPVC as suggested by Thomas Reid.

A literature search finds that unlike CPVC installation that included solvents and glues for joining sections, PEX tubing is installed with mechanical fittings. The Department has not found any literature suggesting issues of worker safety or other health hazards with the installation of PEX, as suggested by Thomas Reid. PEX installation does not have worker safety exposures similar to other permitted water pipes such as: (1) glues and solvents required to install CPVC and other approved plastic pipe materials, or (2) with fumes generated from the soldered connections for copper pipe installation.

4. PEX meets the required U.S. EPA and California Department of Health Services approved NSF/ANSI 61 standard for "Drinking Water System Components-Health Effects.

(a) The U.S. EPA contracted with a consortium of organizations to develop a consensus standard to replace existing U.S. EPA Additives Advisory Program for drinking water system components[4]. All standards approved through the NSF Joint Committee on Drinking Water Additives must obtain final approval through the NSF Council on Public Health Consultants.[5] The NSF/ANSI 61 standard for "Drinking Water System Components-Health Effects" has insured that PEX for potable water systems have met the acceptable health based concentration limits of the U.S. EPA, Health Canada, California Department of Health Services, and NSF's International peer-review drinking water criteria. The water analysis method requires the use of U.S. EPA methods when available[6]. When there is no EPA method available, NSF/ANSI 61 requires that the analysis be performed in accordance with "Standard Methods for the Examination of Water and Wastewater" which is published jointly by the American Public Health Association, AWWA and the Water Environmental Federation.

(b) U.S. Department of Labor's OSHA recognizes NSF International under its National Recognized Testing Laboratory Program to enforce its programs.

All chemicals, contaminants or impurities in the product that come in contact with the water must be studied using U.S. EPA and California Department of Health Services approved toxicological review and risk assessments.

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[3] See CIBA Specialty Chemical Plastic Additives home page @ www.cibasc.com/constuction and pipes.

[4] The consortium consisted of NSF International, the American Water Works Association Research Foundation, the Association of State Drinking Water Administrators (CA Department of Health Services is a member), the Conference of State Health and Environmental Managers, and the American Water Works Association.

[5] The Council is comprised exclusively of public health representatives and its membership includes representatives from the U.S. EPA, Health Canada, U.S. Public Health Services, the Food and Drug Administration, regional U.S. EPA Offices, various state agencies and local health departments.

[6] 40 CFR Part 141 and Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020.

For a PEX product to be eligible for Certification to NSF/ANSI Standard 61 - Drinking Water System Components - Health Effects, contaminant concentrations must not exceed the total allowable concentrations set by the standard. The total allowable concentrations set by the standards consists of existing health based standards and concentrations of leached materials that result in acceptable toxicological levels and risk assessments results.

(c) The record shows that under California Code of Regulations Title 22, the California Department of Health Services regulations permit the use of PEX as an allowable water pipe for the distribution system from the water source through the streets to the residential home. The Department of Health Services recognizes NSF International expertise in certifying, on a health basis, pipe used for transporting water. The record shows that in the past 30 years most of the water pipe approved by the Department of Health Services for these distribution systems has been various forms of plastic pipe and not metal pipe.

(d) The California Safe Drinking Water Act of 1996 (amended Health and Safety Code, Section 116365) requires the Office of Environmental Health Hazard Assessment (OEHHA) to adopt Public Health Goal (PHGs) for contaminants in drinking water based exclusively on public health considerations. The PHG technical support document provides information on health effects from contaminants in drinking water. The PHG describes concentrations of contaminants at which adverse health effects would not be expected to occur, even over a lifetime of exposure. PHGs are developed for chemical contaminants based on the best available toxicological data in the scientific literature. These documents and the analyses contained in them provide estimates of the levels of contaminants in drinking water that would pose no significant health risk to individuals consuming the water on a daily basis over a lifetime.

There are no PHGs established by OEHHA or proposed PHGs for any potential contaminant in the material of PEX water pipe.

(e) OEHHA is the state agency responsible for implementing the States Proposition 65 Warnings. PEX water pipe and fittings are not subject to Proposition 65 warnings because they have not been found by OEHHA to have materials and chemical that contaminates the State's drinking water sources known to cause cancer, birth defects, or other reproductive harm. See OEHHA Proposition 65 list and proposed studies.

(f) The Pipe Trades Council has argued that the ASTM Standard 876-00 states that "ASTM, in its PEX standard (ASTM876-00) advised regulatory agencies to do their own testing or evaluation regarding the safety of PEX" thus, HCD must do its own health standard evaluation.

After reviewing the ASTM Standard 876-00 and the emails from ASTM it has been concluded that this statement has been misinterpreted by the Pipe Trades

Council concerning this safety standard. The caveat enumerated in section 1.4 of the PEX ASTM standard 876 states "The following safety hazards caveat pertains only to the test methods portion Section 7 of this specification." This hazards caveat is only for the hazards associated with the person performing the testing methods of the standard used to certify the PEX material. It is not a safety hazard caveat concerning the PEX material itself as suggested by the Pipe Trades Council.

5. Leaching of material harmful to health from the use of PEX.

(a) Thomas Reid stated that there is a lawsuit in Scottsdale, Arizona suggesting that PEX pipe has leached MTBE contamination into the water and poisoned the family in concentrations of 15, 17, and 22 PPB—which is 3-4 times the 5 ppb taste and odor threshold and near or above the 20 ppb action level. Mr. Reid also stated that WIRSBO Manufacturing has disclosed that PEX does have chemical leaching problems. Mr. Reid also stated that "Tests by NSF confirmed this problem" and found MTBE in the water flushed through the PEX plumbing. It is noted that under California Code of Regulations Title 22, the California Department of Health Services regulations, PEX is an allowable water pipe for the distribution system from the water source through the streets to the residential home. Also it is important to note that for the past 30 years most of the water pipe used for these distribution systems from the water source to the residential home has been various forms of plastic pipe and not metal pipe.

(b) WIRSBO Manufacturing responded to Reid statements in September 2003 that the complaint involved taste and odor and not poisoning. They stated that the sources of the complaints were never identified, but that published records from the City of Scottsdale regarding its water supply shows the presence of MTBE in the wells serving Scottsdale. An independent lab certified that the drinking water at the house meets all state and federal guidelines for safe drinking water.

(c) NSF International responded to Reid statements in September 2003 stating that the EPA's action level is based on taste and odor and is not a health based effect level. U.S. EPA does not have a health based level for MTBE. NSF response also stated that NSF/ANSI current health based level for MTBE is 50 ppb. And all PEX approved products are below this level.

(d) No leachable product were found in two separate studies (using PEX piping) by the Army Corps of Engineers, see "Sampling Trace-Level Organics with Polymeric tubing Louise V. Parker and Thomas A. Ranney (October 1996)—Dynamic Studies January 1997". One purpose of these studies was to determine the best type of plastic tubing to extract contaminated groundwater without the plastic pipe leaching contaminates into the sampling water rendering the samples useless.

(e) The Material Safety Data Sheet for polyethylene (the material used for PEX) states that there are no established limits for health hazards. Polyethylene (PE) dust is just treated as a nuisance particulate.

(f) The record shows that since the adoption of the 2001 California Plumbing Code millions of feet of PEX water pipe has been installed in residential homes through the alternative material approval process, or as approved hydronic heating pipe under the Mechanical Code, or PEX pipe approved through the Plumbing Code by local agencies for all private buildings. The Department's search has found no reports of MTBE contamination in California due to any of this installed pipe or found any evidence of health issues associated with the use of PEX water pipes. There have also been no confirmed reports of MTBE contamination in any PEX pipe installed in any of the 49 states that have approved PEX pipe since 2000.

6. Cross-linked polyethylene received FDA clearance for use in artificial hips.

In 1997, cross-linked polyethylene (PEX) received FDA clearance for use in artificial hips. The following year, the American Academy of Orthopaedic Surgeons acknowledged the breakthrough by presenting the Orthopaedic Hospital team with the prestigious Kappa Delta Award, generally considered the "Oscar" in the field of orthopaedic research. Later, in 2002, the team was awarded a third patent in a series for developing the wear-resistant material. The Arthritis Foundation acclaimed as one of the top 10 arthritis research advancements of the year in 2003, the more durable joint replacements, including Orthopaedic Hospital's[7] patented cross-linked polyethylene (PEX), which challenges the long-held practice of reserving artificial joints as a treatment of last resort. As emphasized by the Arthritis Foundation, the cross-linked polyethylene promises to provide a dramatic improvement in the long-term performance of total hip prostheses as thousands of active young adults with arthritis can now benefit from earlier total joint replacement surgery.

7. There is no evidence in California concerning the permeability of termiticide through PEX or other water pipes.

(a) The Pipes Trades Council has suggested that this same house discussed above in the City of Scottsdale has reported to have complained of pesticide contamination with termiticide. The Department has not been able to confirm the existence of termiticide contamination in any Scottsdale house due to the use of PEX water pipe. However, there appears to at least one home in the City of

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[7] The Orthopaedic Hospital research team was led by Dr. McKellop and included Fu-Wen Shen, PhD, and Patricia Campbell, PhD, research scientists at Orthopaedic Hospital, and Ronald Salovey, PhD, professor of Chemical Engineering at the University of Southern California. For over 90 years, Orthopaedic Hospital has been helping children afflicted with crippling conditions receive the finest care in the world regardless of their families' ability to pay. Orthopaedic Hospital is a recognized world leader in research, teaching and patient care in orthopaedic medicine, resulting in an improved quality of life for children and adults with crippling disorders.

Scottsdale where excessive applications of termiticide contaminated the entire structure and the air inside the home.

A literature search found a letter addressed to President Clinton from another home owner in the City of Scottsdale. The letter from a husband discussed that there were 15 other pesticide poisoning in the City of Scottsdale including his own house. The husband said that their home had 400 to 500 gallons of liquid termiticides sprayed under its concrete foundation prior to pouring the concrete and gallons under the slab, 776 gallons into the interior walls and unknown quantity into the master bedroom ceiling and finally 100 gallons into the exterior walls.

The husband complained that this practice is common in the City of Scottsdale and resulted in the poisoning according to doctors of his family and the death of his wife 24 months after they moved in to their home.

This letter supports a potential problem in City of Scottsdale where there may have been either excessive or illegal applications of termiticide in some homes which brings into question the validly of the Pipe Trades Council suggestion that the permeability of PEX was source of the alleged problem of this house. The records shows that the manufactures of copper or galvanize pipe recommend in their installation standards not to place the pipe in contaminated soils such as soils contaminated with termiticide. This is because placing copper or galvanized pipe in termiticide contaminated soils could cause drinking water contamination where there are mechanical fittings and pin hole leaks in the pipes[8].

(b) The record shows that since the adoption of the 2001 California Plumbing Code millions of feet of PEX water pipe have been installed in residential homes through the alternative material approval process and there have been no reports of any contamination of the drinking water, including termiticide contaminated soils, due to use of PEX water pipe. There have also been no reports of contamination with the PEX pipe installed as an approved pipe material in the 2001 California Mechanical Code for hydronic heating or PEX approved through the Plumbing Code for water pipe in private buildings such as schools, and office buildings.

(c) The California Structural Pest Control Board, created in 1935, highest priority is to protect and benefit the public by regulating the structural pest control industry[9]. The Structural Pest Control Board is a national leader in creating an environment where the public is fully protected and well informed in the control of household pests (including but not limited to rodents, vermin and insects) and

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[8] The record reflects that pin hole leaks have been a major problem in copper pipe failures in California which has resulted in millions of feet of copper pipe needing replacement in residential homes.

[9] In 1935 Assembly Bill 2382, which created "An act to regulate the practice of structural pest control; to create the Structural Pest Control Board; to provide for the registration and licensing of persons engaged in such practice, and for the protection of the public in the practice of structural pest control", was passed by the California State Legislature. The bill was signed by the Governor on July 20, 1935, and became law on September 15, 1935.

wood-destroying pests and organisms or such other pests which may invade households or structures, including railroad cars, ships, docks, trucks, airplanes, or the contents thereof.

The Department staff has consulted with the California Structural Pest Control Board to determine if they have any information concerning incidents of termiticide contamination of drinking water through any type of pipe material in California. They responded that they have no information concerning water pipes being contaminated by the use of any pesticide use in California.

(d) The California Department of Pesticide Regulation (DPR) within the California Environmental Protection Agency protects human health and the environment by regulating pesticide sales and use and by fostering reduced-risk pest management. DPR's strict oversight begins with product evaluation and registration, and continues through statewide licensing of commercial applicators, dealers and consultants, environmental monitoring, and residue testing of fresh produce. In 2001, DPR had an annual budget of approximately $60 million, with a staff of about 460, including scientists from many disciplines. Their work is augmented by approximately 400 biologists working for County Agricultural Commissioners in all 58 counties on local pesticide enforcement.

Department staff has contacted the California Department of Pesticide Regulation to determine if they have any information concerning termiticide contamination of drinking water through any type of pipe material in California. There response was that they have no information on drinking water being contaminated by pesticide use in and around water pipes.

(e) The California Department of Health Services, Division of Drinking Water and Environmental Management, promotes and maintains a physical, chemical, and biological environment for water systems that contributes positively to health, prevents illness, and assures protection of the public's water supplies. They regulate public water systems; oversee water recycling projects; permit water treatment devices; certify drinking water treatment and distribution operator; support and promote water system security; provide support for small water systems and for improving technical, managerial, and financial (TMF) capacity: provide subsidized funding for water system improvements under the State Revolving Fund (SRF).

They are also responsible for conducting evaluations of water quality findings on a local, regional and statewide basis and to evaluate Health Hazard Assessment on the evaluation of risk assessment of chemicals in drinking water. The Department of Health Services has adopted regulations in the California Code of Regulations, Title 22, that permit the use of PEX as an allowable water pipe for the distribution system from the water source through the streets to the residential home. The record shows that for the past 30 years most of the water pipe approved by Department of Health Services for use in distribution systems

from the water source to the residential home have been various forms of plastic pipe.

The Department staff has consulted with the Division of Drinking Water and Environmental Management to determine if they have any information concerning incidents of termiticide contamination of drinking water through any type of pipe material in water distribution systems in California. They responded that they have no information concerning water being contaminated through pipe distribution systems because of pesticide contaminated soils in California.