Cast Iron Building Drain, Waste and Vent Pipe and Fittings Compared to PVC and ABS Pipe and Fittings in Seismic Events

My Name is William LeVan. I have personal knowledge of the information set forth below through my over 45 years of experience in the plumbing pipe industry. I am past Executive Vice President of the Cast iron Soil Pipes Institute where I continue to work part time. I was Executive Vice President and Secretary Treasurer for the Institute from 1988 through 2014. I was employed by US Pipe, a major manufacturer of cast and ductile iron piping products from 1969 through 1988. I was active in sales, sales engineering, and product engineering positions at US Pipe. I have been the chairman of the ASTM A04.12 subcommittee responsible for cast iron piping standards since 1994, is past chairman of the ASTM Iron Casting Committee, active on other ASTM committees including F17, the ASTM committee for plastic piping. I have served on the IAPMO Plumbing Code Technical committee for over 20 years and have served on the ICC Standards Review Committee for 15 years. I am a member of the American Society of Mechanical Engineers, the International Association of Plumbing and Mechanical Officials, the International Code Council, the American National Standards Institute and the American Society of Sanitary Engineering. Through my work in the piping industry, including my participation in national plumbing standard committees, I am very familiar with the requirements and limitations of cast iron, PVC and ABS drain, waste and vent products and materials.

I am writing to respond to claims made regarding cast iron pipe in the August 2015 Draft Environmental Impact Report, Revisions to the 2016 California Plumbing Code to Allow the Use of Perfluoroalkoxy in Dialysis Branch Lines and Plastic Pipe in Plumbing Applications in OSHPD 1, 2, 3, and 4 Facilities (OSHPD Draft EIR). The OSHPD Draft EIR claims that the flexibility of PVC and CPVC pipe "makes it less vulnerable to earth movements than the materials currently authorized for use in OSHPD 1, 2, 3 and 4 facilities." The OSHPD Draft EIR also claims that "no reason exists to believe that PVC, CPVC, or ABS pipe would be more likely to fail in the event of a seismic-related rupture of a known earthquake fault, thereby exposing people or structures to adverse effects, than the metal pipe currently authorized for use in OSHPD 1, 2, 3, and 4 facilities." Both of these claims are incorrect.

A cast iron pipe DWV system installed in building is substantially less likely to break or rupture than a DWV system construction of PVC or ABS pipe. Moreover, cast iron pipes and fittings have a proven track record in commercial construction for over 100 years, including in hospitals and skilled nursing facilities in California. During the many earthquakes and seismic events that have occurred in the past 100 years, there have been no reports of failure of the cast iron piping systems except those where the structure collapsed.

The performance of building plumbing pipes and fittings during seismic events varies depending on the ductility of the different types of pipes and fittings and on the jointing methods used for the connection of the pipes and fittings within the system. Piping materials and jointing methods can generally be classified as rigid or flexible for determining the advantages and disadvantages for each type of piping materials in seismic events.

ABS and PVC piping materials are thermoplastic materials and although considered flexible utilize a solvent cemented joint that is rigid. Because the ABS and PVC piping materials are flexible these materials have low beam strength and require more horizontal and vertical support than rigid piping materials such as cast iron which has a high beam strength. As a result, both ABS and PVC piping systems require a hanger or support every four feet in order to support the piping from horizontal deflection that could damage or rupture the pipe. A rigid piping material such as cast iron requires support only every ten feet. The cast iron piping has sufficient beam strength to support the pipe and its contents without deflection without additional support.

If plastic piping is used in California health care facilities it is likely to be ABS Schedule 40 cellular core manufactured to ASTM F628, PVC Schedule 40 cellular core manufactured to ASTM F891 or PVC Schedule 40 manufactured to ASTM D 2665. The maximum allowed deflection all of these piping materials is 5% and zero for the solvent cemented joint. The crush load for 4" pipes of each would be 473 pounds per linear foot for the ABS pipes, 540 for cellular core PVC and 837 for solid wall PVC, with diminishing values for larger pipe diameters. Cast iron pipes and fittings are manufactured from gray cast iron having a tensile strength of 21,000 pounds per square inch and a 45,000 modulus of rupture. This high tensile strength and high modulus of rupture allows the cast iron pipe and fittings to be subjected to high crush loads. As an example the crush load of 4 inch cast iron hubless pipe, the type most used in health care facilities in California, is 4,877 pounds per linear foot. Cast iron is easily 10 times stronger than any ABS pipe and 5-8 times stronger than PVC piping.

While PVC and ABS pipe are flexible that doesn't make them more reliable during seismic events. PVC and ABS are installed using solvent cements which create rigid joints. No deflection or movement can occur without the potential failure of the joint. This is particularly critical at fittings having branch openings such as tees and wyes where the fittings are rigidly joined with piping from different directions. A movement at the branch openings of these fittings potentially can create a stress fracture and result in a joint leak or separation.

These rigid joints thus turn the flexibility of PVC and ABS pipe into a liability. In buildings, DWV pipe is often hung and it must be able to support its own weight. The flexibility of the PVC and ABS pipe makes it more difficult to support their own weight and puts added stress on the rigid connection joints. As a result, PVC and ABS pipe must be supported every 4 feet with hangers. Because of the flexibility of PVC and ABS pipe, they may deflect more easily during seismic events when hanging from fittings than cast iron pipe, resulting in separation or cracks at the rigid connection joints.

Because cast iron pipe has very good beam strength, it only requires support within 18 inches of each joint. In addition to cast iron pipes having greater tensile strength, they also provide much greater protection at connections joints than PVC and ABS pipe. Cast iron pipe has a flexible joint which deflects under loads and does not separate or leak.

Jointing of cast iron soil pipes and fittings is accomplished with a flexible rubber gasket and stainless steel coupling. The joints allow up to 5 degrees of deflection without failure. This enables the joint to remain flexible during seismic events with less chance of joint failures than the rigid cemented joints of PVC or ABS pipe. Joints at cast iron fittings with branch openings such as tees and wyes remain flexible reducing the chance of shear breaks or separations during

seismic events. These couplings are tested daily during production using shear and deflection tests of the pressurized pipes to be sure they will not leak during failures of the supports or hangers that might occur during a seismic event. Because the joints are strong enough to support a full 10 foot length of pipe filled with water under pressure without any support the joints can be relied on to support a partially filled or empty pipe in the event of failure of the hangers as might happen in a seismic event. In addition, the higher tensile strength of cast iron pipe helps to protect it when its flexible joint deflects, as opposed to the rigid PVC or ABS fitting that is easily damaged when deflected.

The integrity of plumbing joints during seismic events should be an important consideration when constructing healthcare facilities as failures can create significant safety problems for healthcare facilities. These failures could result in separation and cause the plastic DWV piping to fall damaging the fire sprinkler systems or causing the blocking of escape routes. Failure of the plastic joints during a seismic event could allow the discharge of waste contaminated liquids into areas where this could be catastrophic during a natural disaster causing the health care facility being unable to provide medical support when most needed.

One of the reasons that cast iron pipes and fittings are the primary piping materials used for health care facilities in the US and have long been prohibited in California health care facilities is that plastic piping is not able to meet the smoke and flame spread ratings of 25 and 50. Recent modified testing of plastic piping for smoke and flame spread ratings has been used by plastic piping manufacturers to claim compliance with these smoke and flame spread ratings. But at their meeting on October 1, 2015, the ICC membership voted overwhelmingly to prohibit the use of these modified tests for proof of compliance with these smoke and flame spread ratings.

Plastic piping can also be problematic because of the California Code of Regulations, Title 22, requires hospital lines to be washed at a minimum temperature of 160 degrees and dishes to be washed at a minimum temperature of 180 degrees. (Sections 70825 & 70863). This can result in waste and drain pipes receiving waste that exceeds the 140 degree temperature limit of PVC and ABS pipe. Cast iron, on the other hand, is rated to receive wastewater with temperatures as high as 212 degrees. Cast iron is also resistant to most common chemicals and compounds discharged into waste systems in hospitals. Only low Ph waste is corrosive to cast iron and its fittings. A copy of Charlotte Plastics Chemical resistant sheet is attached. Alcohol, acetone, and other agents found in hospitals are not compatible for plastic piping but have no effect on cast iron or the neoprene gaskets used to join the products together.

Sincerely,

William H. LeVan
Cast Iron Soil Pipe Institute