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Re: Comments on California Department of Housing and Community Development Code adoption allowing use of ABS and PVC for DWV in buildings of more than two stories.

Dear Mr. Enslow:

The California Department of Housing and Community Development ("HCD") is considering adoption of the Uniform Plumbing Code which would remove the restriction currently in the California Plumbing Code prohibiting use Acrylonitrile butadiene styrene (ABS) and Polyvinyl chloride (PVC) for drain-waste-vent (DWV) in buildings of more than two stories in height.

The current restriction to two story construction dates mainly from unresolved fire safety and worker safety concerns. Removing this restriction could lead to expanded use of plastic pipe for DVW: According to the US census data, 47,600 units in dwellings with three or more units were built in California in 2005; the majority of these are in the state's major urban areas: San Francisco Bay area 21%, Los Angeles County 22%, and San Diego 13%. This class of construction usually exceeds two stories and indicates the potential scope of HCD's proposed project.

Before HCD implements the proposed action, HCD should prepare a systematic environmental assessment of ABS and PVC DWV. There is evidence that expanded use of ABS and PVC DWV will have a potentially significant effect on public health and safety (fire safety, worker safety, sanitation and mechanical failure), air quality, water quality, and solid waste management. It is insufficient for HCD to rely on the general acceptance of ABS and PVC DWV in lower construction: important aspects of its environmental impact in multi-story construction may be significant and unacceptable. Moreover, the environmental impacts of ABS and PVC DWV use in one and two story buildings has never been evaluated.

Beginning in 1980, the state has studied the environmental impact of plastic pipe, including ABS and PVC DWV, and concluded that an Environmental Impact Report (EIR) was needed. A draft EIR was prepared in 1989. The EIR was never made final – industry funding was withdrawn – leaving a number of issues raised, but not fully addressed. The mere passage of time has not informed HCD regarding the environmental effects of ABS and PVC DWV. It is important for HCD to reinstate the EIR process.

1. Potential Public Health and Safety Impacts

ABS and PVC DWV potentially impact public health and safety through three main effects:

1. ABS and PVC DWV significantly increases the risk of fire spread and fire related casualty, particularly in multi-story buildings.
2. ABS and PVC DWV assembly involves large quantities of solvent-based adhesives which impact worker health. The effect is particularly significant with the larger diameters and greater number of joints encountered in multi-story buildings.
3. ABS and PVC DWV mechanical failure poses sanitary health risks, particularly in multi-unit buildings

1.1 Fire Safety

Fire is perhaps the greatest fear for inhabitants of a multi-story building. The higher the building, the more difficult is evacuation, and the vertical utility chases in a milti-story building act as channels to spread fire. There are numerous examples of disastrous high-rise building fires (e.g. MGM Grand), but the truth is that even "low rise" multi-story buildings pose a significantly greater fire risk than buildings two stories and below. Buildings of one or two stories have several advantages: the living level usually has several egress routes for inhabitants and several routes of access for responders, so that virtually any equipment and personnel from the local fire protection responder can evacuate occupants.

1.1.1 Fire Spread

Higher rise structures inevitably incorporate geometry prone to the chimney draft effect which intensifies and spreads fire vertically.

ABS is an extremely flammable material. PVC is less flammable, but both melt and take fire at lower temperatures than wood. The main concern for fire spread is the large penetrations through fire rated walls. Although ABS and PVC DWV can be fire stopped, there is an inescapable vulnerability from a large diameter void in the fire rated wall. Patent devices capable of closing off the penetration as the pipe fails have not been used in low rise construction and are not part of the code.

DWV normally has no water in it; it is to be installed so as to drain fully after use. Thus the DWV has no thermal resistance to heating during a fire. ASTM D648 measures heat deflection properties, i.e. the point at which the pipe will sag under load:

Material	Heat Deflection Temperature
ABS (1208)	190 degrees F
PVC (1120)	158 degrees F

For high rise structure fire rating, ASTM E119 is applied to structure components such as sheet rock. Fire rating is determined by a standard temperature rise curve which replicates the stresses of a typical residential fire. The heat deflection temperature in the

standard test is reached in less than a few minutes. Plastic pipe penetrating fire rated walls will fail mechanically and leave an opening suitable for fire spread.

Most low construction has no fire rating or a short fire rating (e.g. an attached garage). Large diameter ABS and PVC DWV penetrations are more significant in high rise, multi family construction which must maintain a high fire rating.

1.1.2 Toxic Smoke

ABS and PVC DWV use in high rise construction will introduce an additional source of toxic smoke during a structure fire. Toxic smoke will affect occupants and public safety responders.

When this issue has been raised in the past, a stock response has been that there is so much plastic already in a structure and so much smoke already present during a fire that the additional effect from ABS and PVC DWV is insignificant. After a certain advanced stage in a fire this may be true, but HCD should examine the effects of ABS and PVC DWV in the early stages of fire initiation and spread.

ABS and PVC DWV each produce highly toxic gasses when heated destructively as in the early stage of a fire. ABS produces carbon monoxide, as do most organic fuels, but ABS also produces a high level of cyanide compounds due to the nitrile group in the resin and Acrolein (International Study of the Sublethal Effects of Fire Smoke on Survivability and Health (SEFS): Phase I Final Report NIST Technical Note 1439). PVC produces carbon monoxide, but also a high level of hydrogen chloride (hydrochloric acid). Hydrogen cyanide and hydrogen chloride are toxic at low levels. Although the biological mode of action differs, both gasses will incapacitate exposed persons. Fire originating in or spreading through a wall with ABS and PVC DWV will carry the acutely toxic smoke and may prevent victims escape.

1.2 Worker Health and Safety

Both ABS and PVC pipe systems are joined by solvent based adhesives. Although the formulations differ due to different plastics characteristics, all the solvents pose acute and chronic health risks to exposed workers. ABS cement is typically Methyl Ethyl Ketone (MEK) or for low VOC cements MEK and Acetone. PVC cements contain MEK, Acetone, Tetrahydrofuran (THF), and Cyclohexanone.

There have been a few field studies of worker exposure – all found frequent high levels of solvents in the workers' breathing zone and frequent skin exposure that would lead to solvent absorption. These studies were one reason HCD decided to prepare an EIR. In the intervening years since the HCD Plastic Pipe EIR, the regulatory levels for some of the solvents has been lowered and the formulations of adhesives has changed, introducing new compounds not present at he time of the earlier studies. HCD should bring the worker safety study up to date.

The expanded use will pose a greater exposure problem than the currently allowed low rise ABS and PVC DWV use. Larger structures are likely to use larger diameter pipes

for DWV so that more solvent cement is in use. High rise construction is likely to be more enclosed with less ventilation when plumbing is done (for example windows and fire separation between units will be in place) so that solvent from cements will have higher concentrations.

1.3 Mechanical Failure and Sanitation

Both ABS and PVC DWV are prone to mechanical failure either from breakage or chemical attack. The code requires a completely water tight DWV system, including the vents which normally don't carry liquid. When the DVW system breaks or develops leaks, sanitary waste is released into the walls and ultimately into the occupied space.

Failure from manufacturing defects plagued ABS DVW in the mid 1980's. A typical post on the subject "Over the past 10 years a significant number of homeowners have experienced failures in their ABS(Acrylonitrile-Butadiene-Styrene) DWV(drain waste and vent) pipes. A failing drainage system can create a dangerously unhealthy, and totally unpleasant mess. Replacement is expensive and disruptive. Class action suits are in the courts." (http://www.codecheck.com/abs.htm)

ABS is vulnerable to attack by chlorinated and aromatic hydrocarbons and by esters and ketones, and gradual degradation by alcohols and oils. These may be present in drain cleaner, automotive cleaners, some lubricants (e.g. WD-40), paint thinner, vegetable oil, lamp oil, rubbing alcohol, and nail polish remover.

It is possible that gasoline, MTBE, or other hydrocarbons in soil could weaken ABS sewer pipe so that the additional hydraulic loading in multistory structures could produce rupture. (Note "Failed ABS Line" comment forwarded to Doug Walls, HCD June 1, 2006).

DWV failure in high rise construction has significant public health implications. Waste from multi-family dwelling has a potentially greater potential for pathogens and will expose a larger number of people.

High rise DWV may also be exposed to greater risk of failure due to the greater volume and greater hydraulic head of the waste carried and the prospect that occupants will be less likely to be informed about placing chemicals in the system.

2. Air Quality Impacts

Most of the volume of solvents in the adhesives for ABS and PVC pipe systems are volatile organic compounds (VOC) as defined by California Air Resources Board and the main air quality management entities in the state.

Photochemical, ground level ozone ("smog") is an important health threat in California and a tremendous effort has been made to reduce ozone by limiting the precursors: VOC and nitrogen oxides. Of these two, VOC control has been at the heart of the successes of the past forty years in improving air quality.

The same solvent release problem described above for worker safety applies to air quality. Multi story buildings with larger diameter pipes use more cement and numerous joints. Total cement use and hence solvent release will be a significant increase in total VOC. Considering that most of the new ABS and PVC DWV construction will be in urban areas already in ozone non-attainment – the project is potentially significant.

3. Water Quality Impacts

Although ABS and PVC DWV does not carry potable water, chemical leaching from ABS and PVC DWV is significant for its cumulative impact on the wastewater stream and receiving waters.

Solvent from pipe joints is leached from DWV. Due to the construction process, most of the solvent will be relapsed to the air as joints cure in an open, vented system. There is enough solvent retained in the joint that some will enter waste flow and be carried to the wastewater treatment plant (WWTP). Most of the solvents are not biodegraded under the conditions of wastewater treatment and the relatively short residence time and they will be discharged to the ultimate receiving water. Further, most urban WWTP use chlorination to disinfect discharge for water reuse or to protect receiving waters from pathogens. Some of the solvent may be converted to chlorinated organic compounds.

Both ABS and PVC contain small amounts of unreacted monomer – acrylonitile, butadiene, styrene, vinyl chloride – all are carcinogens. Some of these volatile compounds will be released into the air; some into the water. PVC has a roughly 1% organotin added to the resin as a stabilizer to prevent free chlorine formed during high temperature extrusion from degrading the finished product.

Organotin compounds are universally toxic. Generally the higher alkyl substituted tins are more toxic, so that tri alkyl tins were formerly used for biocides and dialkyl tins are preferred for PVC stabilization. The greater concern so far for organotins has been direct human exposure through potable water carried by PVC or CPVC pipes.

Although the disparity may reflect limited research on dialkyltin, organotins are found to have an even more dramatic toxic effect on aquatic organisms than on humans. These include demonstrated low level endocrine disruptor effects. Nearly all biocide organotin use has been curtailed in the last two decades as the persistent marine impacts were discovered. The effect is subject to US EPA and corresponding European health agency regulation. I incorporate by reference the comments made on CPVC – indeed, HCD needs to consider the cumulative impact of increased organotin discharge from PVC DWV along with organotin from PVC and CPVC potable water piping.

4. Solid Waste Impacts

Solid Waste Management is important to California. Construction waste and demolition debris are a major portion of the waste stream and much effort has been made in the past decade to increase the amount of construction materials that can be recycled or otherwise diverted from the landfill.

Technically, ABS and PVC plastic waste can be reused, but recycling for construction waste is rarely done. Neither ABS or PVC have a high value (c.f. PET, HDPE, or metals) so there is little economic incentive to recycle. The Plastic Pipe Alternatives Assessment, Center for Environmental Health, 2005, prepared for the San Francisco Department of the Environment found that "Little recycling is being done with any plastic pipes."

ABS pipe mechanical problems were largely attributable to use of poor quality resin contaminated by recycled material. Most ABS pipe now needs to be made from virgin resin and the finished pipe waste can no longer be put back into the manufacturing process. PVC has a similarly low recycle potential. In fact, ubiquitous PVC is seen as a hindrance to recycle for other plastics because it is chemically incompatible with PE and PET.

The HCD proposal will result in greater use of PEX and PVC and will increase the solid waste impact of construction and demolition materials.

5. Global and Local manufacturing and Lifecycle Effects

A California State agency such as HCD is in a premier situation to consider the global and local manufacturing and lifecycle effects of ABS and PVC DWV. The routine application of CEQA by local land use permitting agencies has distracted the state from its original legacy. Following only one year after the National Environmental Policy Act (NEPA), the California Environmental Protection Act urged state and other agencies to look down the road when making decisions that may affect the physical environment.

Both ABS and PVC DWV use petrochemical resources. Further, PVC uses vast amounts of elemental chlorine. The petrochemical and chlor-alkalai precursor based industries have a well documented environmental effect spreading beyond the mere vicinity of the manufacturing site. Some of these global effects reach California, for example mercury in ocean fish affected by the mercury emissions for chlor-alkalai plants.

Although little of the resin is likely to be made in California, ABS and PVC DWV pipe itself is already made in California and it is quite likely that California makes the pipe material that would serve the incremental installation resulting from the HCD project. These local manufacturing sites have an increased exposure to ABS and PVC monomers and contaminants, and thus have health effects.

World wide, most particularly in Europe, plastics and chlorinated plastics especially have been subject to great scrutiny as to the persistent, long term, and cumulative effects of the full lifecycle from raw material extraction, to manufacture, to use, to disposal. California HCD should recognize the opportunity to question deeply whether the state should be the guardian of the citizens' environment or merely a shill for private industry.

The preceding comments deal with the impacts of installation, use, and disposal. HCD should consider the product lifecycle as a whole. Is this expanded use wise? Does it benefit the citizenry? What are the unintended consequences of this regulatory action?

The California Environmental Quality Act sets a high but achievable standard, and HCD should follow it.

* * *

In conclusion, expanding ABS and PVC DWV use into structures over two stories will have potentially significant environmental effects on several aspects of the environment. It is insufficient to dismiss these effects as minor additions to the currently accepted effects from ABS and PVC DWV in low rise construction: there are technical reasons why the effects will be more pronounced and there are reasons the ABS and PVC DWV project along with other HCD actions will be cumulatively significant. HCD should undertake an EIR to investigate these issues and develop possible mitigation for the effects.

Sincerely,

Thomas S. Reid