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Re: Comments on California Department of Housing and Community Development Draft Environmental Impact Report: Adoption of Regulations Permitting Statewide Residential Use of Chlorinated Polyvinyl Chloride (CPVC) Plastic Plumbing Pipe without First Making a Finding of Potential Premature Metallic Pipe Failure Due to Local Water or Soil Conditions
SCH No. 200612044

Dear Mr. Enslow:

The California Department of Housing and Community Development ("HCD") has published a Draft Environmental Impact Report ("EIR"): Adoption of Regulations Permitting Statewide Residential Use of Chlorinated Polyvinyl Chloride (CPVC) Plastic Plumbing Pipe without First Making a Finding of Potential Premature Metallic Pipe Failure Due to Local Water or Soil Conditions (SCH No. 200612044).

I have been involved in studying the environmental effect of plumbing systems since 1980 and have been a contributor to and commentor on HCD's environmental review process for plastic pipe. On April 21, 2005 I submitted comments on the proposed (and abandoned) Addendum to the November 2000 Final Environmental Mitigated Negative Declaration ("2000 MND") SCH No. 2000091089. Those comments identified a broad range of environmental concerns for expanded use of CPVC pipe in California that are not addressed in the current document.

The current EIR attempts to dodge meaningful public consideration of most environmental issues by defining them as somehow outside the scope of the project's effects. At present, section 604.1 of the California Plumbing Code ("CPC") authorizes local building officials to approve the use of CPVC water pipe inside residential structures as an alternate material to metallic pipe if a finding was made that there is or will be a premature failure of metallic pipe because of corrosive water and/or soil conditions (referred to as the "Findings Requirement").

In the 2000 MND, most potential impacts were dismissed due to the "limited number of anticipated residential installations of CPVC that may be approved as a result of the proposed Project [the Findings requirement]" (MND discussion of air quality p. 6) or "... any uses of CPVC that would be authorized as a result of the proposed project would not otherwise substantially degrade water quality. " (MND discussion of water quality p. 16).

The action subject to the EIR would remove the Findings Requirement, resulting in more widespread use of CVPC plumbing in dwellings. The EIR cites a Noveon representative to conclude that CPVC may expand to a 30% market share. The 2000 MND was predicated on a 2% adoption of findings. Unfortunately, the EIR ignores the issues raised previously and fails to identify adequate mitigation for potentially significant impacts.

As a practical matter, the HCD EIR seems to have involved little or no constructive input from either the plastic pipe manufacturing industries who stand to benefit from removal of the findings requirement or from NSF International, the testing organization relied upon by HCD for health impacts. Both industry and NSF could have provided actual data on formulation and exposure that would allow independent public review.

Given the long history of HCD and the California Environmental Quality Association ("CEQA") review, it is not surprising that the EIR falls into the trap of relying on outdated and incomplete data.

- While there are no new studies of leaching, newly set standards, including those adopted by the National Sanitation Foundation ("NSF"), show solvents from cement leaching at levels exceeding standards even several months after installation. This is an unavoidable adverse impact not mitigated to insignificance by the proposed one-week flushing requirement.
- Changing formulations to meet low VOC regulatory standards introduce compounds and changed proportions of solvents that will change the nature, concentration, and persistence of solvents leaching into drinking water.
- New global concern over health and environmental effects of organotin compounds used at 2% to 4% in CPVC pipe show proposed use may have a significant adverse impact on public health.
- Changes in CPVC Pipe resin manufacturing and world markets show that new constituents or constituents not formerly believed to be in use may now be present in pipe resin. These include human carcinogens or other Proposition 65 chemicals. These substances have not been previously considered and their presence is a potentially significant adverse health impact.
- Other changes indicate a possibly reduced product lifetime or other environmental effects.
- Global concern over the use of chlorinated plastics (primarily PVC and CPVC) reflect the lifecycle environmental impact of manufacture raw materials manufacture, resin manufacture, product manufacture, product use, and end-of-use disposal.

1) The EIR Project Description Is Inadequate to Fully Characterize the Potential for Environmental Impact

The environmental review in the 1980's reflected an understanding of the need to characterize the "plastic" in plastic pipe and entailed a request from the participating industries to supply relevant information to guide leaching testing and other analysis. With industry's withdrawal from the CEQA process, subsequent environmental review (the 1997 Draft EIR and the 2000 MND) essentially abandoned an effort to rigorously characterize the materials present in CPVC plumbing systems that may be installed under HCD approvals.

This problem persists with the EIR. There have been changes in manufacturing methods and resin formulations since the previous EIR and 2000 MND. HCD persists in treating "CPVC" as inert material. The EIR Project Description states that "the terms 'CPVC' and 'CPVC pipe' refer to chlorinated polyvinyl chloride pipe, fittings, and the material used to join CPVC pipe and fittings", but the EIR provides no information in the Project Description about what CPVC pipe and cements contain that are relevant to the air, water, and public health impacts.

The omission of an accurate characterization of "CPVC" in the Project description means the subsequent discussion of environmental impact is incomplete.

The EIR introduces some information about solvent cements in the discussion of air quality (e.g. page 28). Organic compounds are listed as acetone, cyclohexanone, methyl ethyl ketone and tetrahydrofuran. In the discussion of water quality, the same list is repeated (p. 51). The EIR mentions disinfection byproducts (DBP) including trihalomethanes (THM) such as chloroform, without mentioning that chloroform and vinyl chloride monomer may be found in the pipe itself. The EIR makes no mention of organotin compounds, even though they are a significant component of CPVC resin.

The EIR cannot rely on discussion of environmental impact in the 2000 MND unless it can show how the "CPVC" that will find expanded use in California was adequately analyzed then. In fact, there are changes in chemical composition of pipe resin and cements that have not been adequately subject to public environmental review.

a) New Information on Pipe Composition since 2000 MND

Pipe and fittings have many constituents. A recent patent assigned to Noveon Corporation (CPVC successor to BFGoodrich) offers insight on recent or future changes. Attachment A is US patent 20030157321, "Plastic pipes and fittings for home and industrial use." Patent 20030157321 identifies the strengths (high temperature resistance) and weaknesses (low impact resistance, susceptibility to oxidation and thermal degradation at higher, extrusion temperatures). Noveon responds to these liabilities by changing the CPVC resin formulation.

Industry refers to % by weight as "parts per hundred resin (phr)." The pipe resin described there is:

> "[0014] Suitable **CPVC resins**
> [0018] The CPVC formulations according to the invention should contain an impact modifier
> [0019] suitable **impact modifiers** include higher rubber ("butadiene") content and high efficiency methylmethacrylate-butadiene-styrene ("MBS") ... acrylonitrile-butadiene-styrene ("ABS") impact modifiers ... Suitable impact modifiers can be used in an amount of about 3 to about 15 phr, preferably about 5 to about 10 phr.
> [0023] Other components may be present in formulations of the present invention. These include, for example, antioxidants, lubricants, stabilizers, impact modifiers, tinting colorants, blueing agents, pigments, Tg enhancing additives and processing aids, all of which serve various purposes known in the PVC compounding art.
> [0024] Exemplary **lubricants** are polyglycerols of di- and trioleates, polyethylene, oxidized polyethylene, and high molecular weight paraffin waxes and mixtures thereof. Specific examples are oxidized polyethylenes such as those sold under the trade name AC 629 by Allied Signal, the paraffin waxes, such as those sold under the trade name Hostalube 165 by Hoechst Celanese. Lubricants can be used in an amount of about 0.01 to 5, preferably about 0.4 to about 2.0 parts per hundred resin ("phr").

[0025] Suitable **heat stabilizing** ingredients include phosphate stabilizers such as disodium phosphate, maleimides, sulfur compounds and alkyltin compounds. Tin compounds include methyltin, octyltin, mixed metal alkyltins, dialkyl tin dicarboxylates, methyl tin mercaptides, butyltin mercaptides, dialkyl tin bis (alkyl mercaptocarboxylate) including di-n-octyltin-S,S'-bis (isoctyl mercaptoacetate), butyl thiostannoic acid, and other ester tins. Di-C[sub]4-C[sub]8 alkyl tin stabilizers such as C[sub]4 to C[sub]8 alkyl tin carboxylates are preferred. A particularly preferred stabilizer is a tin thioglycolate such as that sold under the trade name Mark 292-S by Witco Chemical. Use levels can be in the range of about 1 to about 5.0, preferably about 2.0 to about 4.0, phr.
[0026] Suitable **processing aides** include acrylic polymers such as methyl acrylate copolymers. A specific acrylic process aid is the acrylate sold under the name Acryloid KM(R) 330, by Rohm and Haas, Inc. Other processing aids are disclosed in The Plastics and Rubber Institute: International Conference on PVC Processing, Apr. 26-28 (1983), Paper No. 17. There are embodiments of the invention containing no such processing aids, but if such processing aids are used they should be added in an amount of up to about 4.0, preferably 0.5 to about 3.0, phr.
[0030] Examples of **antioxidants** include Irganox 1010 (tetrakis[methylene (3,5-di-tert-butyl-4-hydroxyhydrocinnamate)] methane) sold by Ciba Geigy. These components increase thermal stability and are used in the art primarily for cosmetic reasons, i.e., for delaying color changes. If used, such components may be used in an amount ranging from 0.25 to about 5, preferably about 0.5 to about 1.0, phr.
[0031] Suitable **pigments** include, among others, titanium dioxide, calcium carbonate, talc, clay, mica and carbon black. Such pigments can be added in amounts ranging from about 0.001 to about 10.0, preferably about 0.01 to about 5.Q, and most preferably up to about 1.0 phr. " (US patent 20030157321)

These options and the claimed and preferred low and high range of use as a % by weight is shown in the Table below.

Summary of CPVC Pipe Resin Additives (as parts per hundred resin – phr)

Additive	Cited Low	Preferred Low	Preferred High	Cited High
Impact Modifier	3	5	10	15
Lubricants	0.01	0.4	2.0	5
Stabilizers	1.0	2.0	4.0	5.0
Processing Aids	0	0.5	3.0	4.0
Antioxidants	0.25	0.5	1.0	5
Pigments	0.001	0.01	5.0	10.0

Source: US patent 20030157321, Summary by TRA

Other recent patents describe other additives and novel manufacturing processes.

"The most preferred impact modifier is composed of a mixture of a polyorganosiloxane and a polyalkyl(meth)acrylate." (US 6187868)

"The amount of the block chlorinated polyolefin ("b-CPE") is desirably from about 0.1 to about 10 parts by weight, more desirably from about 0.25 to about 5 parts by weight. The amount of the high rubber graft copolymers is desirably from about 1 to about 30 parts by weight and more desirably from about 3 to about 20 parts by weight. The amount of the

> randomly chlorinated polyethylene impact modifier is desirably from about 1 to about 30 parts by weight and more desirably from about 5 to about 15 parts by weight." (US 6277915)
>
> "These chlorinated polyethylenes have been randomly (relatively homogeneously) chlorinated by using a swelling solvent and/or a chlorinating temperature above the crystalline melting temperature of the polyethylene. " (US 6277915)

These methods describe a pipe material that is different from the description in the 2000 MND. Nowhere in the 26-year HCD CEQA record is a listing of these formulation options nor an assessment of the potential public health and environmental impact of their use in potable water plumbing.

b) New Information on Cements since 2000 MND

Similarly, there is pressure to change the pipe bonding method. Usually a two-step primer/cement is used. The solvents of this system are introduced into the drinking water and raise health concerns that have been the subject of previous comment, particularly with regard to tetrahydrofuran ("THF").

Industry apparently shares these concerns: "Further, tetrahydrofuran (THF), which has been a major component of PVC and CPVC adhesive compositions (typically, 25 to 75 wt %), has been found by the National Toxicology Board to have a slight carcinogenicity in animal testing. As a result, THF is under extensive investigation, both with regard to worker health (exposure during pipe assembly) and potable water issues." (US 6372821)

One example of a group of efforts at reformulating cements is "Low VOC (volatile organic compounds), dimethyl-2-piperidone solvent-based, PVC and CPVC pipe and component adhesives and primers containing minimal or no tetrahydrofuran," IPS Corporation, Gardena, CA US 6372821.

The HCD EIR states "CPVC pipe and fittings are joined together using cements and sometimes primers that contain solvents, including acetone, tetrahydrofuran, methyl ethyl ketone, and cyclohexanone." (EIR, p. 51.) This statement shows the lack of any effort to bring the project description up to date. Other solvents are being used or sought for use, largely to reduce the air quality effects of volatile organic compounds.

According to the patent literature, "many PVC and CPVC pipe adhesives are formulated with N-methyl pyrrolidone ("NMP"), a very effective solvent for PVC and CPVC resins."
"Other thermoplastic pipe adhesives are formulated with large amounts of low vapor pressure solvents blends, such as di-methyladipate (available from E. I. DuPont de Nemours as DBE-6) and NMP and/or alkyl-substituted naphthalene ..." (US 6372821) and there are proposals for cyclopentanone and dimethyl-2-piperidone ("DMPD") (US 6372821).

Nowhere in the 26-year HCD CEQA record is a listing of these alternate cement materials nor an assessment of the potential public health and environmental impact of their use in potable water plumbing.

c) Proposed CPVC Approval Includes no Control of Future Change or Manufacture

In earlier comments, we raised the issue of sufficiency of NSF listing for adequate protection. Not all plumbing materials sold in California are NSF listed. Some are nominally intended for other uses, such as PVC for non-pressure use. Schedule 40 fittings are found without the NSF stamp.

CPVC is expensive. With a wider market for CPVC, we expect suppliers to enter materials that may be cheaper to manufacture, possibly involving older manufacturing methods that introduced the carcinogen, chloroform, into the pipe resin. Montgomery Laboratories measured chloroform at levels of health concern in leaching tests in 1980.

Noveon informs us in 2003 that "CPVC can be made by any commercial chlorination process or the like, such as by a solution process, a fluidized bed process, water slurry process, thermal process, or a liquid chlorine process. (US patent 20030157321 [0015]) Some of these methods have been associated with the use of swelling solvents.

CPVC is now being manufactured in Taiwan and in China. Hangzhou Xiaoshan Qianjin Chemical Co., Ltd. apparently makes CPVC resin "from PVC resin chlorinated by chlorine gas in solvent surrounding." (http://www.made-in-china.com/products/show/freemember/ prod/TAwMDExNTI0N/mic/Chemicals_Rosin_Forest_Chemical_CPVC_Resin.html). Dandong Decheng Chemical Co., Ltd. and Zhejiang Yonggao Plastic Industry Development Co., Ltd. also manufacture CPVC resin, and the latter CPVC plumbing materials.

A flaw in HCD CEQA process all along is the association of the "project" with the materials supplied by only one manufacturer, BFGoodrich, now Noveon. The current CEQA compliance process began in the early 1980's when BFGoodrich was one of a few active industry participants. All the studies and all the subsequent CEQA analysis are based on BFGoodrich's technology. With expanding California markets, that will no longer be an adequate basis for the state's proposed action.

d) Significance of New Information

This information shows that additives may comprise 10% to 20% of the weight of the pipe resin, governed by the need to meet mechanical performance tests. Noveon , the only North American manufacturer, says, "CPVC compounds are approximately 85% CPVC resin and 15% additives." (http://www.corzancpvc.com/pdfs/FactSheet.pdf.) This is significant new information for the State's CEQA review:

1. These substances are not minor constituents – there is significant leaching potential.
2. Some of the additives raise public health concerns. Unreacted monomer from impact modifiers may contain butadiene or acrylonitrile, which are carcinogens.
3. The new deliberate additives raises questions about NSF testing sufficiency.
4. The ongoing emphasis on product improvement raises concerns over product reliability and mechanical failure.

It is also significant that this information was not produced by industry during the earlier phase of environmental review leading to the (abandoned) Draft EIR. Our earlier comments about the futility of the state's environmental review of a "project" which was being kept secret by industry is still relevant. Does HCD know what "CPVC" pipe is? Does HCD have any way to track changes in the CPVC plumbing system that may affect public health, worker safety, consumer protection, or other potential environmental effects?

2) Reliance on NSF International Is Insufficient to Meet CEQA Purpose of Full Disclosure and Public Review

Chemicals present in the CPVC plumbing system may leach out into drinking water. HCD's CEQA record defers in-depth consideration of public health effects to the NSF International listing process. NSF has emerged as the main third party listing organization for plumbing materials. NSF sets or references standards for mechanical performance for pipes, fittings, and cements. NSF undertakes a limited chemical testing program for potential leaching.

NSF is a legitimate and valuable organization. Without its equivalent, the public's health would be ill served. That does not mean that NSF product listing is sufficient to substitute for independent review by the state. NSF includes government and consumer participants, but is fundamentally organized around its industry clients and substantially operates out of public view.

As an example of disclosure needs, NSF does not release the results of leaching tests (what compounds were found); NSF does not identify which products do not pass testing; and NSF's method of setting levels for non-regulated compounds (e.g. organotin) is not subject to adequate disclosure and certainly unknown to California and is not disclosed in the EIR.

This industry orientation causes NSF to take a reactionary approach to water quality, public health and leaching issues. Many of the tests now done routinely were instigated only because of outside pressure – from the US EPA and from the California CEQA process.

NSF originally listed plastic pipe with no leaching tests. Concern over possible vinyl chloride monomer ("VCM") as a carcinogen was late in prompting industry and ultimately NSF testing. The concern over chloroform in CPVC in the 1980's finally led to NSF enquiring of manufacturers regarding its use and its explicit leaching testing. The concern over organotin compounds led NSF to begin leaching testing for that, despite its long known use in PVC and CPVC.

The State of California could use the NSF process if NSF disclosed information relevant to public health on an ongoing basis. Then the state could subject the information to the state's independent review, determine its adequacy and any additional information needed, and demonstrate to the public that the NSF process was sufficient. Merely citing the NSF listing code reference is not independent review.

As it turns out, available information shows that the NSF process is not a sufficient basis for the findings in the EIR.

NSF has a limited test protocol for pipe compound and possible drinking water leaching. As far as can be determined, NSF does <u>not</u> test CPVC leachate for butadiene or acrylonitrile, even though those known carcinogens are used in impact modifiers in CPVC pipe resin (see comments on project description above).

There is a growing global concern over the health and environmental effects of organotin compounds used as stabilizers in PVC and CPVC plastic. The main concern so far has been on the trialkyl tin compounds. NSF does not test for the presence of trialkyl tin because the manufactures' information only lists the dialkyl form as an additive. The trialkyl form is always present as a contaminant of the dialkyl product and is present in CPVC pipe leachate. NSF does not report this.

NSF tests cements for some material, such as dimethylformamid, but does not test for organotin or its potential for leaching from cemented joints. CPVC cement contains added CPVC resin as a component to thicken and fill gaps in the joint. The added resin is fully formulated CPVC pipe resin and hence contains the additives found in pipe resin, including the organotin compounds. This is a significant additional source of organotin exposure.

NSF tests pipe for leaching in a test assembly, not with solvent-cemented joints. Obviously NSF does not want to test multiple products at once (pipe, fitting, cement), but it appears to be the case that solvent in water may mobilize organotin additives in the pipe. The role of solvent should at least be evaluated in NSF setting action levels for organotin. The organotin leaching potential may be understated.

3) The Project Would Result in Significant Public Health Impacts From Drinking Contaminated Water

The EIR ignores the issue of what substances and at what levels leach into drinking water in CPVC plumbing. The EIR concludes that "The 2000 MND analyzed the impacts associated with conditional CPVC use ... That analysis included potential impacts on water quality." (EIR p. 51).

The 2000 MND does not actually analyze potential impacts on water quality and public health. It mentions solvents and organotins (MND p. 13); it concludes that the flushing requirement is adequate mitigation without reference to the abundant data that shows solvent and organotin levels persisting way beyond the one-week flush period.

The only analysis of the public health impacts of leachates apparent in the HCD CEQA record is an analysis in the 1983 Environmental Assessment ("1983 EA"), the 1987 Risk Assessment (CH2M Hill, Inc., Metal v. Plastic Pipe: A Comparative Health Risk Assessment on Drinking Water Quality, 1987, prepared for industry), and a summary of the 1987 RA in the 1998 EIR. The EIR and the 2000 MND that it relies on do not contain any analysis, apparently relying on these earlier documents.

There is now new information on both the chemicals present in leachate and the levels at which they cause significant public health impacts that were not known and could not have been known with reasonable diligence in September 2000 when the prior analyses that the 2000 MND relies on were conducted.

The new information comprises reduced, more protective standards for leachate chemicals and more information about the amount of leaching. Based on this information, CPVC pipe systems exceed adopted standards or guidelines that would reasonably be used by HCD as a threshold of significance if it were to analyze project impacts under current conditions.

Ongoing study since the 2000 MND has produced a longer list of potential leachates. In 2003, the American Water Works Association Research Foundation identified materials and chemicals

that imparted tastes and odors to drinking water are identified. "The exhaustive list of chemicals found by NSF to leach from system components is provided below.
PVC/CPVC. 1,3-butadiene; antimony; calcium carbonate; calcium stearate; carbon black; chlorophenol; cyclohexanone; dibutyltin; diethylhexylphthalate; disononyl phthalate; ethyl acrylate; formaldehyde; monobutyltin; paraffin wax; polyethylene wax; titanium dioxide; tributyltin; vinyl chloride monomer." ("Materials used in drinking water distribution systems: contribution to taste-and-odor"; P. Tomboulian*, L. Schweitzer*, K. Mullin*, (Oakland University, Rochester, MI, USA), J. Wilson NSF International, Ann Arbor, MI, USA and D. Khiari; Water Science and Technology Vol 49 No 9 pp 219–226 © IWA Publishing 2004).

The potential public health impacts of these new chemicals and new health-based thresholds should have been evaluated in the EIR. As discussed below, the concentrations of some chemicals leached from CPVC-piped systems exceed drinking water standards and other metrics set to protect public health. This is a new impact not disclosed in the EIR. The HCD should conduct additional studies on the leaching potential of CPVC and evaluate the public health impacts.

a) Organotins Leached From CPVC Drinking Water Systems Would Result in Significant Public Health Impacts

The HCD EIR does not acknowledge the health risk from organotin leaching. Although organotin compounds, typically dibutyltin in North America, have long been used as stabilizers in the 2% to 4% range, the industry information did nothing to alert HCD to this potential public health issue. For this reason, the Cooper study and others did not look at organotin leaching.

The June 1998 DEIR (pp. 39-40) is the first discussion. The 1998 DEIR evaluated mono- and dibutyltin compounds using a maximum drinking water level ("MDWL") of 20 ug/L and a short-term exposure level ("STEL") of 100 ug/L, based on information from NSF Standard 61. (1998 DEIR, pp. 22, 40.) However, I have found no analysis of any other organotin compounds, most notably the highly toxic tributyltin compounds. This class of compounds was cavalierly dismissed as "just not there" (1998 DEIR).

At the time the 1998 DEIR was published, the EPA had questioned the NSF's organotin exposure levels and concluded that there were concerns that warranted continuing to list organotins as contaminants of concern in drinking water. In its announcement of the Drinking Water Contaminant Candidate List ("CCL") and response to comments that organotin compounds should be delisted, EPA wrote:

> "The Agency is aware of the NSF certification program, and has noted that many States require the use of NSF-certified material in the construction of new buildings. The Agency agrees with the NDWAC Working Group recommendation that an assessment of the toxicological data underlying the action levels established by the NSF needs to be made along with assessment of other available information on organotins, before these compounds can be disregarded as of concern. The Agency requested this information from the NSF, and learned that due to confidentiality agreement, NSF cannot disclose this information, therefore we have not yet been able to assess the toxicological data.

"There are numerous concerns about the occurrence and toxicological significance of various species of organotins in drinking water. A recent report indicates that unlike PVC systems, new CPVC systems have the potential to contaminate drinking water with organotin compounds for a longer period of time after installation []. There has been a report concerning tributyltin contamination of drinking water from PVC pipes, and tributyltin is of far more toxicological significance than mono- and di-organotins []. There is also concern about the recent reports of teratogenic potential of dibutyltin []. The Canadian Government is concerned about organotin contamination of drinking water and has launched a national survey.

"In view of these concerns, the Agency believes that organotins, including mono- and diorganotins, should remain on the CCL until the Agency can perform its own in-depth evaluation of the occurrence and toxicological data of the contaminants of this class."

(Federal Register, Announcement of the Drinking Water Contaminant Candidate List; Notice, March 2, 1998, v. 63, no. 40, pp 10274-10278 (references omitted).)

It is not clear how HCD could conclude that organotin compounds were not a concern in drinking water in the 2000 MND when the Agency responsible for drinking water regulation could not make this conclusion. Since the March 1998 Federal Register notice, governmental agencies have lowered the level of organotins judged to be safe in drinking water, compared to those evaluated in the 1998 EIR.

The most recent data indicates that the concentrations of organotin compounds in CPVC-piped drinking water systems exceed the levels judged to be safe. Therefore, based on this new information, drinking water impacts of the proposed Project are significant. The basis for this conclusion is set out below.

1. Public Health Standards Have Been Lowered

There are no formal drinking water standards for tin compounds in water. However, organotin compounds remain on the CCL. Drinking water goals, equivalent to NSF-61's total allowed concentration ("TAC"), can be calculated from reference doses published by other agencies. Reference doses are reported in mass of material ingested per amount of body weight per day.

The German Federal Institute for Health Protection of Consumers and Veterinary Medicine published a tolerable daily intake of 0.25 micrograms per kilograms of body weight per day ("ug/kg-day") in March of 2000, which it recommends for both dibutyltin and tributyltin compounds. (BgVV, Risikoabschätzung zu Tributylzinn ("TBT") und anderen zinnorganischen Verbindungen in Lebensmitteln und verbrauchernahen Produkten, March 6, 2000; http://www.bgvv.de/cm/208/tributylzinn_tbt_und_andere_zinnorganische_verbindungen.pdf, accessed April 18, 2005.) This value was reported in an English-language journal for the first time in 2003. (Heinz Rudel, Case Study: Bioavailability of Tin and Tin Compounds, Ecotoxicology and Environmental Safety, v. 56, 2003, pp. 180-189.)

A TDI of 0.25 ug/kg-day corresponds to a drinking water concentration of 8.75 ug/L for a 70 kg human drinking 2 liters of water per day, based on the same procedure recommended by NSF-61. This is two times lower than the value of 20 ug/L that was relied on in the 1998 DEIR. The drinking water concentration that would be protective of an infant is even lower, about 4.9 ug/L.

The Agency for Toxic Substances and Disease Registry ("ATSDR") publishes peer-reviewed toxicological profiles for chemicals. (42 U.S.C. 9604.) These profiles identify the adverse health effects of hazardous substances and present MRLs. An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over a specified duration of exposure.

The 1993 toxicological profile for tin, which was the applicable version when the 1998 FEIR was certified and the 2000 MND was adopted, concluded that there was not sufficient information to establish an MRL for organotin compounds. (Agency for Toxic Substances and Disease Registry, Toxicological Profile for Tin, September 1992.) The ATSDR recommended MRLs for organotin compounds in September 2003. (http://www.atsdr.cdc.gov/mrls.html.) The current intermediate-duration (15-364 days) oral MRL for dibutyltin is 0.005 mg/kg-day. (Ibid.). This corresponds to a drinking water concentration of 175 ug/L for a 70 kg adult drinking 2 L per day of water. The chronic-duration oral MRL for tributyltin is 0.0003 mg/kg-day. (Ibid.) This corresponds to a drinking water concentration of 10.5 mg/L for a 70 kg adult. The concentrations would be lower for an infant, 5.9 ug/L.

In sum, since 1998 when the FEIR was published and September 2000 when the MND was sent to the State Clearinghouse, agencies have lowered the levels of organotin that they consider to be safe for humans to consume. Thus, the HCD should have re-evaluated the drinking water risks of approving up to 100% use of CPVC pipe in residential construction. The concentrations of organotin compounds that have been measured in drinking water exceed these thresholds, even after flushing. (See Comment below.) Therefore, public health impacts of the Project are significant.

2. Levels of Organotin in Drinking Water Exceed Safe Intake Levels

NSF screening data for CPVC materials, pipes, and fittings for product certification indicate that the concentration of dibutyltin ranged from 0.0013 ug/L to 140 ug/L and averaged 11 ug/L (values "normalized" by NSF to reflect actual exposure). (Clifton J. McLellan, Director of Toxicology Services, NSF International, The Decrease of Tin Extraction from Chlorinated Polyvinyl and Polyvinyl Chloride Pipe, Fittings and Materials After Continuous Exposure to Potable Water, Organotin Environmental Programme – World Meeting, Japan, April 19, 2002.) NSF-61 screens products by measuring total tin and converts it to dibutyltin, based on molecular weights, assuming 100% of the tin is in the dibutyl form.

The data reported by NSF, when screened using the German tolerable intake level of 0.25 ug/kg-day for dibutyltin, indicates that leaching of organotin compounds could result in a significant public health impact. The average concentration of dibutyltin exceeds the German tolerable daily intake level of 8.75 ug/L in 6% of the samples after 21 days of leaching. (Ibid.) Thus, the proposed flushing mitigation measure would not eliminate this impact.

3. Levels of Organotins in Drinking Water Are Cumulatively Significant

The exposure levels discussed above (MRL, STEL, TDI) assume that 100% of the exposure is from drinking water. There are many other sources of organotin compounds, including packaged foods (leached from plastic containers), seafood (highly bioaccumulated), bottled drinks (leached from plastic containers), and swimming in contaminated waters (many receiving waters in California have elevated levels).

A threshold applicable to a single product can be derived based on NSF-61. This standard establishes requirements for the testing and evaluation of contaminants that are extracted (leached) from water that has been exposed to products that convey potable water. It sets two significance thresholds for drinking water. The TAC is the maximum concentration allowed in a public drinking water supply from all sources of contamination. A single product allowable concentration ("SPAC") is the maximum concentration that a single product is allowed to contribute. The SPAC is intended to account for potential contribution by multiple products or materials in the drinking water system.

The single product allowable concentration, based on NSF-61, is designed to account for potential contribution by other sources. (NSF-61, Sec. A.7.4, p. A13.) For dibutyltin compounds, the NSF calculated the SPAC by multiplying the TAC by 20%. NSF-61, Table E1. Using the same approach, the SPAC for dibutyltin, based on the German TDI value would be 1.75 ug/L for an adult and 0.59 ug/L for an infant. The leaching data reported by the U.S. EPA (0.8 – 2.6 ug/L) and by TRA (33 ug/L) indicate that dibutyltin levels in drinking water in CPVC-piped systems can exceed these levels, for both adults and infants.

b) Solvents Leached From CPVC Drinking Water Systems Would Result in Significant Adverse Public Health Impacts

A number of solvent chemicals are present at very high concentrations in the primers and cements that are used to join CPVC. The Material Safety Data Sheets ("MSDS") and product labels indicate that the principal ingredients are: methyl ethyl ketone (30-85%); cyclohexanone (5-15%); tetrahydrofuran (4-40%); and acetone (0-1%).

The HCD previously relied on MDWLs and short-term exposure levels ("STEL") to evaluate the public health impact of these contaminants in drinking water (1998 DEIR, p. 36, citing HCD 1982). These values were apparently based on NSF-61. The NSF and the 1998 EIR, amazingly, rely on the TAC to assess single products. This assumes that 100% of the chemical comes from a single source which is nonsensical.

The safe levels of these solvent chemicals, both the TACs and SPACs, have been lowered significantly – nearly 100-fold -- since they were previously evaluated by the HCD, as summarized below:

Acetone: NSF-61 TAC = 6 ppm; SPAC = 0.6 ppm (adopted 5/29/03)

Cyclohexanone: NSF-61 TAC=30 ppm; SPAC=3 ppm (adopted 4/26/02)

Methyl ethyl ketone: NSF-61 TAC=4 ppm; SPAC=0.4 ppm (adopted 9/10/03)

Tetrahydrofuran: NSF-61 TAC =1 ppm; SPAC =0.37 ppm (issued 1/26/96)

Studies have demonstrated that these chemicals leach into drinking water for long periods of time. The SPAC is the most relevant standard because the solvents are deliberately and clearly in a mixture.

The only longer-term studies are McKesson, conducted for the Vinyl Institute, and Cooper, conducted for the HCD EIR. Each found concentrations of THF and MEK are well above the new NSF-61 SPACs well after the 7-day flush proposed to mitigate drinking water impacts.

Cooper found levels of THF and MEK above the respective SPAC until day 50 in some test cells. McKesson, using the same test procedure, found that THF levels never fell below the SPAC in the 75 days of testing and levels of MEK stayed below its SPAC only after 30 days. These are relevant studies; the test protocol agreed to by industry (BFGoodrich as CPVC manufacturer) had 20 pipe volumes flushed each day, with the sample taken after only a 24-hour dwell. These results are strongly indicative of the persistent leaching and the insufficiency of current HCD flushing as mitigation.

Thus, the public health impacts of drinking water supplied by CPVC-pipe systems are cumulatively significant. NSF adopted all of these SPACs after the 1987 Risk Analysis, upon which all subsequent documents rely, indeed all but THF were adopted after the 2000 MND was sent to the State Clearinghouse. In light of the expanded CPVC use, the current relevant standards should be used – these show an unavoidable adverse impact on public health.

New products are under development that attempt to reduce the use of THF, but these themselves contain a cocktail of other solvent chemicals that have not been tested for their public health impacts.

c) The current EIR includes a state-wide requirement of Low VOC cements and primers but contains no health analysis of those materials

Low VOC cements and primers achieve regulatory limits by replacing VOC constituents with exempt acetone. They add other solvents to maintain performance, notably dimethyl-2-piperidone or N-Methyl-2-pyrrolidone (Hercules CPVC Cement, MATERIAL SAFETY DATA SHEET # 95, Last Reviewed: 23-Jan-02, bears the annotation "This MSDS is for LOW VOC Product") (IPS Corporation, Low VOC (Volatile Organic Compounds), Dimethyl-2-piperidone Solvent-based, PVC and CPVC Pipe and Component Adhesives and Primers Containing Minimal or No Tetrahydrofuran, June 30, 2004.)

The 2000 MND does not address low VOC cements or primers. The regulatory changes since 2000 make these materials more important. The low VOC formulation changes the proportion of solvents present which will change the concentration and persistence of compounds leaching into drinking water. These changes in composition have not been considered in the HCD record and are missing from the current draft EIR.

d) Polyvinyl Chloride or Other Monomers Leached From CPVC Drinking Water Systems Would Result in Significant Public Health Impacts

Other studies have demonstrated that PVC, the parent compound of CPVC, leaches vinyl chloride monomer ("VCM") into drinking water. This compound is listed as a carcinogen by California, as well as the Occupational Safety & Health Administration ("OSHA") and the National Institute of Environmental Health ("NIH"). (National Institute of Environmental Health, Eighth Report on Carcinogens, Perspectives, v. 105, no. 9, September 1997.) Vinyl chloride has been associated with tumors of the liver, brain, lung, lymphatic and haematopoietic system.

Polyvinyl chloride is produced from VCM via a polymerization process; the reaction is terminated when about 90% of the VCM has polymerized. The leftover gaseous and highly volatile VCM is drawn off using a vacuum and subsequently air-stripped to remove most of the residual monomers. However, traces of VCM are found in all PVC materials, with most outgassing occurring right after the polymerization reaction.

A study found that after 30 days of exposure, vinyl chloride concentrations leached from PVC pipe were generally greater than 2.5 ug/L. (M.H. Al-Malack, Effect of Water Quality Parameters on the Migration of Vinyl Chloride from Unplasticized PVC Pipes, Water, Air & Soil Pollution, v. 120, no. 1-2, 2000.) The concentrations reported in these studies [range] exceed California drinking water standards (0.5 ug/l), and significantly exceed California public health guidelines and goals (0.05 ug/L). Some exceed the federal primary drinking water standard of 2 ug/L.

NSF now tests for the presence of residual VCM in pipe. Other monomers may be introduced by newer formulations described in these comments. If NSF does not specifically show these substances to be absent, there may be yet another leaching chemical concern.

4) Proposed Expansion of Use Relies on Inadequate Flushing Protocol

The obvious and intended effect of the proposed project is to expand use of CPVC in California. The HCD CEQA record clearly establishes the high chemical leaching rates after installation and relies on a simple flushing protocol as mitigation. The protocol is a flush after installation, a one-week static dwell (water sitting in the pipe), followed by one flush. Even apart from the problem of whether this simple protocol is in fact used, the one-week flush is not sufficient to protect public health.

a) Original 1986 Industry Proposal Was 2 Weeks, Not Current 1 Week

In the CEQA process of the 1980's, industry was an active participant. The preliminary test results from Montgomery Laboratories (1980) and common sense told the state that some initial flushing was needed. The leaching test protocol established by the state with industry cooperation used a <u>two-week</u> pre-occupancy period with flushing, not a one-week flush as now relied on by the state. This two-week period is clearly established in the 1987 Draft EIR and in the tests it reports (Cooper).

HCD should explain how the one-week mitigation protocol was determined to be sufficient.

b) Actual Data on Short Term Leaching Clearly Indicate a Much Longer Period Is Needed

Occupancy simulation results from Cooper and McKesson show levels of solvent many times above the NSF SPAC at the end of one week. Levels of MEK are unacceptable for a month or more; levels of THF were still unacceptable after 75 days of testing. This persistent phenomenon is reported in 2-Butanone and Tetrahydrofuran Contamination in the Water Supply" (T.C. Wang and J.L. Bricker, Bull. Environm. Contam. Toxicology 23,620-623 (1979)), which found THF at 1.0 ppm in water that was standing only 4 hours in pipe, 6 months after installation of PVC pipe.

THF levels for 24-hr dwell were 8.9 ppm at 6 months and 3.7 ppm at 8 months. The solvent behavior in CPVC will be similar to PVC: one week is clearly not enough.

The only longer term organotin leaching test is from NSF, reported in a presentation to the Organotin Environmental Programme – World Meeting, April 19; 2002, The Decrease of Tin Extraction from Chlorinated Polyvinyl Chloride Pipe, Fittings and Materials After Continuous Exposure to Potable Water, C.J. McLellan, Director of Toxicology Services, NSF International. This report shows results from 49 CPVC tin samples. After 21 days of flushing, organotin levels had fallen between 80% and 90% in 3 samples and more than 90% in the rest. This still produced lab samples for over two-thirds of the samples with organotin levels above 1 ppb at 21 days, and 6% with organotin levels above 10 ppb. These are clearly too high and show that even a three-week preoccupancy flushing would not mitigate public health impacts to insignificance.

HCD should use a rational method to determine a mitigation requirement that would be health protective under a wide range of conditions. This method would use the more conservative results of Cooper and NSF to establish a safe, outside limit on pre-occupancy flushing.

5) Uncertainty in Composition and Leaching Has Potential Environmental Effects on Wastewater Discharge

The toxicology of solvents, organotin compounds or other leachates focuses on the dose delivered to the public due to consumption of a certain amount of potable water (usually 2 liters for an adult). Note, however, that essentially all water use within a residence will be discharged to the sewer and, therefore a much higher dose of contaminants will enter treatment plants, persist in treated effluent and pass into receiving waters.

6) CPVC Will Frustrate Efforts to Increase Recycling of Construction Materials and Impact Solid Waste Management in California

Theoretically, waste CPVC pipe can be ground up and remelted and hence be recycled, but it will not occur in practice. Copper pipe is routinely recycled so that a large portion of new copper pipe is made from recycled material; this is so-called closed-loop recycling where a raw material is largely captured in a cycle of use-reuse. This is not true for PVC or CPVC pipe.

"Using a lifecycle framework, several stages are worth noting. For raw material feedstock, recycled content as a single attribute reveals a range … about 64 percent recycled content for copper pipe, … Using virgin feedstock, PVC is distinguished as being the only chlorinated compound, representing unique environmental and health exposures including the unavoidable dioxin releases during manufacture of the raw material feedstocks and in the event of combustion." (Greening Divisions 15 & 16; Gail Vittori, Presented at GreenBuild Conference Pittsburgh, PA November 2003)

Recycled materials are inevitably less than 100% pure. Used CPVC would have undergone degradation during the high temperature forming process and during aging. The impurities would make such material unsuitable for reuse as plastic pipe and probably unsuitable for any other use that seeks the higher performance of CPVC as opposed to cheaper plastics.

This effect is noted the state's own review of recycling: "Contaminants such as other resin grades (especially PVC), … require extensive sorting and cleaning. If not removed, the contaminants reduce the value of recycled plastics." ("Plastics White Paper, Optimizing Plastics Use, Recycling, and Disposal in California"; May 2003; Integrated Waste Management Board P. 15) CPVC would pose the same problem as PVC.

In US patent 20030157321, Noveon addresses blending: "Again, however, no amount should be added which would affect properties of the resin .... It is preferred that a blend of CPVC resins not be used." Because of the great difficulty of CPVC meeting its engineering objectives, it is extremely unlikely that a responsible manufacturer would use recycled pipe in making new material.

HCD should ask industry if it would be able to use "old" CPVC pipe and still meet reliability standards for new CPVC pipe.

Conversely, CPVC waste cannot be recycled by use in the less demanding applications of PVC. Bits of CPVC waste pipe would not melt at the temperature of PVC and would affect normal product extrusion. Because the included CPVC would likely interfere with the extrusion process, CPVC in the waste stream may actually frustrate a growing effort to recycle PVC.

Interestingly, there is an industry estimate of plumbing system life that is substantially shorter than the values relied on in the HCD CEQA review process. "This provides a high degree of long-term durability for the piping system, often up to 30 to 40 years of useful life. This is essential for these systems which are built into the structures of homes and buildings, or are buried underground."

This suggests that the problem of replacement and disposal of old CPVC pipe may be more significant than previously considered. The EIR takes the position that there is so much plastic in the waste stream and so little is recycled that the increment from CPVC is insignificant. CPVC (as separate from PVC) has not been addressed by the recycling community and poses new issues that may aggravate rather than ameliorate a significant problem for California.

7) CPVC has broad global effects, including potential impacts on California

Chlorinated plastic resins, notably PVC and CPVC have a broad range of lifecycle environmental effects; the lack of recycling is only a part of the problem. From manufacture through disposal, chlorinated plastics produce persistent toxic wastes. Although the primary site of CPVC manufacture is outside of California, environmental concerns such as mercury and dioxin are global in extent and reach California and Californians through the air, the water, and food, notably mercury in ocean fish. The EIR needs to acknowledge this issue in the same way that it needs to acknowledge CPVC's cumulative impact on solid waste management.

Numerous sources have documented the impact of PVC, and by extension CPVC. "Environmental Impacts of Polyvinyl Chloride Building Materials" Joe Thornton, Ph.D., A Healthy Building Network Report; http://www.healthybuilding.net/pvc/Thornton_Enviro_Impacts_of_PVC.pdf provides a good summary. The problems include the chlor-alkalai industry which produces chlorine for the raw materials of CPVC and mercury emissions, vinyl chloride monomer manufacture and hazardous organochlorine by-products, disposal and combustion of PVC and CPVC producing dioxin and other chlorinated waste products.

8) Mechanical Failure Is a Risk

The real question of CPVC plumbing system lifetime has been raised before. The increase in additives, compared with previous formulations, strongly suggests the manufacturer's concern over the long-term performance of the pipe. We note the inclusion of antioxidants for "cosmetic" purposes on a product that is always hidden from view when installed. Irganox 1010 is the same antioxidant that is mandatory in protecting polyethylene tubing.

CPVC and PVC used in pipe is "rigid" contrasted with the same resin "plasticized" by admixture with low volatility organic "oils" such as diethylhexylphthalate ("DEHP"). Plasticized CPVC loses the pressure and temperature resistance of rigid CPVC that make it suitable for use in plumbing. If rigid CPVC is exposed to any of a large class of oils they may be incorporated into the pipe matrix, effectively platicizing the rigid CPVC and adversely affecting lifetime.

Noveon offers a long list of substances which are incompatible with CPVC pipe. Examples are oil-based caulk, plasticized PVC (electric wire insulation), or carriers for pesticides. The patent literature shows Noveon trying to modify CPVC pipe resin to improve impact resistance and cautioning how sensitive the mechanical properties are to the admixture of other materials. These new impact resistant resin formulae may in fact be less chemically resistant to oils and adverse effects of construction materials.

* * *

Given the history of plastic pipe in California, HCD would be prudent to heed these comments and take the time to get a full disclosure on the material subject to the expanded use approval and formulate effective mitigation to minimize public health and environmental impacts.

Sincerely,

Thomas S. Reid