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September 8, 2006

Thomas A. Enslow
Adams, Broadwell, Joseph, and Cardozo
1225 Eighth Street, Suite 550
Sacramento, California 95814-4810

Dear Mr. Enslow:

Attached are my comments on the draft Environment Impact Report (draft EIR) recently produced by the California Department of Housing and Community Development. At your request I have reviewed the worker health and safety elements of these documents, as well as relevant associated materials, and my comments address their technical accuracy and validity.

I appreciate the opportunity to participate in this review. As the lead investigator for a 1989 Department of Health Services study of health hazards associated with CPVC pipe installation, I focused particular attention on whether that study's findings were interpreted appropriately and whether the data from that study were used in the draft EIR to fully and accurately inform the policy making process. In some cases the draft EIR's interpretations and applications of our 1989 data were inappropriate; my comments outline these areas and indicate the appropriate interpretations. My review and my comments built on my earlier review in 1998 of the Draft Environmental Impact Report and of the 2000 Mitigated Negative Declaration and 2005 Addendum.

In my professional opinion, the findings of the current draft EIR are not consistent with available data and with established practices of industrial hygiene and health risk assessment. Workers installing CPVC potable water pipe can be expected to regularly experience exposures in excess of established exposure limits. Such exposures can be expected under conditions of normal use. Exposures will not uncommonly be in the range previously associated with adverse health effects in humans and with cancer in laboratory animals. These exposures, and their potential health effects, must be considered significant.

My detailed comments, analyses, and conclusions are attached.

Sincerely,

Jim Bellows, PhD, MPH

Comments on July 2006 Draft Environmental Impact Report – Statewide Residential Use of CPVC Pipe

Based on a thorough review of the Draft Environmental Impact Report on 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" ("Draft EIR"), along with supporting documents and other relevant materials, my analysis, comments, and conclusions are as follows.

1. The draft EIR fails to acknowledge existing evidence that CPVC pipe installation exposes workers to dermal and inhalation health hazards during typical use.

The best available information regarding worker exposures during CPVC installation remains that from a 1989 study by the California Department of Health Services (DHS), of which I was the principal author.[1] The 1989 study included observation of CPVC pipe installation at 35 construction sites, extensive environmental and biological monitoring, and a review of relevant toxicity information then available.

The report concluded that workers installing CPVC pipe are exposed above legal limits to the combination of solvents in CPVC primer and cement – including tetrahydrofuran (THF), methyl ethyl ketone (MEK), cyclohexanone (CHX) and acetone (ACE). Workers installing CPVC pipe had inhalation exposures 1.8-8.5 times higher than workers installing over types of plastic pipe. The likelihood of overexposure above the full-shift exposure limit was estimated to be 10% for a typical work day of installing CPVC pipe for potable water in residential construction. The likelihood of overexposure above the short-term exposure limit at least once in a typical eight-hour work day was estimated to be 68%. Urine monitoring provided strong evidence that dermal absorption contributed substantially to some workers' overall exposure.

The 1989 DHS study also included exposure monitoring during installation of copper water pipe, and found that exposures to copper, tin, silver, antimony, and lead – the agents of principal concern during soldering – ranged from 0.2% to 4% of established exposure limits.

In the course of analyzing the incomplete 1998 Environmental Impact Report (EIR), the 2000 Mitigated Negative Declaration (MND), and the 2005

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[1] Bellows, et al., 1989; California Department of Health Services.

MND Addendum, I reviewed all available information and found no evidence that contradicted the original DHS conclusion that worker exposures above the legal limits must be expected frequently during installation of CPVC pipe using typical products and work practices. I have now once again reviewed all available information, including a literature search of on-line databases. Once again I find no evidence that contradicts the original DHS conclusion that overexposures above legal limits must be expected. The exposure limits for CPVC primer and cement solvents have not changed since the 1989 report except in the case of acetone, the exposure limit for which has been lowered, and knowledge about the toxicity of these solvents has evolved little. No new information about actual exposure levels during CPVC installation has become available.

In the 1998 Draft EIR regarding CPVC pipe installation, the Department of Housing and Community Development (HCD) at least acknowledged the potential health impact of CPVC installation, stating: "Workers not following safe use recommendations or using improper materials can be injured, and the Lead Agency considers this to be the worst case situation."[2] This was responsive to input from DHS, whose experts then advised HCD: "Case reports point to the likelihood that overexposure related to poor ventilation has already led to illness in pipe workers."[3] The current draft EIR fails to even acknowledge the 1989 DHS study, still the best available information regarding workers exposures, and is apparently not based on any current expert opinion from DHS.

2. The draft EIR bases its worker safety findings on the unrealistic assumption that workers will consistently follow recommended safety procedures.

Like the incomplete 1998 EIR, the 2000 MND, and the 2005 MND Addendum, the current draft EIR anchors its thresholds of significance and its findings to exposures expected to occur where workers are following safety and precaution recommendations on material labels and Material Safety Data Sheets as well as the regulations in the CPC." These recommended safety precautions include minimizing skin contact with adhesives, using nitrile gloves, and ventilating enclosed spaces.

Existing evidence indicates that these safety precautions are generally not followed in actual use. Use of gloves or forced ventilation was rare at the time of the 1989 DHS study, and extensive skin contact with adhesives was common.

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[2] 1998 Draft EIR, p. 69.

[3] Comments of Elizabeth Katz, MPH, Acting Chief, Hazard Identification System and Information Service, Department of Health Services; June 11, 1998.

Not much has changed since that time, despite some of the recommended safety practices having been incorporated into regulations.

A survey conducted in 2005 revealed that the overwhelming majority of building officials fail to enforce ventilation and glove-use mitigation measures even in the very limited situations in which CPVC is currently approved.[4] Not one of the 33 jurisdictions surveyed fully enforced the ventilation and glove use measures. Six out of thirty-three jurisdictions required contractors to certify that they were aware of these regulations, but did not conduct any inspections to verify compliance. Twenty-seven of the thirty-three jurisdictions (82%) failed to enforce *any* of the mitigation measures. Moreover, a 2005 investigative report has shown that most workers do not follow the worker safety provisions.[5] I am not aware of any contradicting evidence suggesting that recommended safety precautions are widely implemented.

The reasons underlying limited impact of safety recommendations and regulations are well established. Many workers find wearing chemical protective gloves to be uncomfortable and to slow their work. Some workers believe incorrectly that any type of gloves, including permeable cotton work gloves, will provide adequate protection. Workers under pressure to complete a job quickly may not take care to minimize or clean up spills, or to set up ventilation when their CPVC installation must be done in enclosed spaces. Regulatory agencies must stretch constrained enforcement resources.

In light of the ineffectiveness of existing recommendations and regulations in changing actual work practices during plastic pipe installation, basing the draft EIR findings on an assumption that safety precautions will be followed is extremely unrealistic. The point is not that safety recommendations and regulations have no useful role. Indeed, they are essential in preventing overexposure to toxic substances. Rather, the point is that new regulations cannot simply be assumed to be effective in changing work practices, especially when previous regulations have been ineffective. Further study is needed to understand exactly why the previous measures had limited success and what, if anything, can be done to improve the effectiveness of future mitigation measures.

Until the effectiveness of any proposed mitigation measures is demonstrated, the significance of worker health effects must be judged on the

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[4] Mark Capitolo, 2005, Health and Safety Measure Survey Report.

[5] Robert Calone, 2005; investigative report.

basis of observed work practices and exposure levels. As noted above, in the single most reliable study available, the 1989 DHS study, observed work practices rarely aligned with safety recommendations and observed exposure levels regularly exceeded established exposure limits.

3. The protective gloves specified by safety recommendations and regulations would not be effective in controlling dermal exposures.

The worker safety findings in the current draft EIR rely on an assumption that specified nitrile gloves will block dermal absorption of adhesive solvents. Blocking dermal absorption is important, because biological monitoring in the 1989 DHS study suggested that dermal absorption contributed significantly to some workers' total exposure. The regulations the draft EIR relies upon to control dermal absorption (CCR title 24, part 5, appendix I, section 1.2) specify use of 4 mm nitrile gloves. The current draft EIR cites no evidence that such gloves provide adequate protection against dermal absorption of THF, MEK, ACE, or CHX. In fact, the National Institute for Occupational Safety and Health *Recommendations for Chemical Protective Clothing*,[6] does not indicate that nitrile gloves can be recommended for any of these solvents. Numerous other references specifically cite the failures of nitrile gloves for these solvents. For example, Tom Shelley's monograph Hand Protection and Glove Selection reports that ACE breaks through nitrile gloves in just four minutes, and that THF permeates 4 mm nitrile gloves "almost instantaneously".[7] Similarly, the MicroFlex Chemical Resistance Guide indicates that nitrile gloves are not recommended for protection against ACE, CHX, MEK, or THF.[8]

Given the inappropriateness of specifying nitrile gloves for use with these solvents, it is perhaps a good thing that workers have not generally been following the regulation. Use of improperly selected chemical protective clothing has been shown to actual increase exposures, by holding contaminants in intimate contact with the skin after they have penetrated the protection.

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[6] Available at http://www.cdc.gov/niosh/ncpc/ncpc1.html; accessed September 2, 2006.

[7] Shelley T, 1999. Hard Protection and Glove Selection, Including Gove Selection for Some Specific Chemicals. Available at http://people.ccmr.cornell.edu/~cober/complete.chemical.hygiene.plan.2000.pdf (section 11); accessed September 2, 2006.

[8] Available at http://www.microflex.com/distributor/images/support/misMaterials/miscpdfs/ChemChartLatexNitrile.pdf; accessed September 2, 2006.

4. The draft EIR inappropriately extrapolates conclusions from the 2000 Mitigated Negative Declaration, failing to consider the impact of increased exposures likely to result under the recommended alternative.

The current draft EIR relies heavily on the 2000 MND for its worker safety findings (e.g. "The Mitigated Negative Declaration analyzed the health impacts of CPVC installation on pipe workers."[9]) This reliance is inappropriate in several respects. First, as I noted in my analysis of the 2005 Addendum, the 2000 MND contained no new evidence or meaningful analysis. Instead, the 2000 MND relied heavily on the analysis in the incomplete 1998 EIR, which was itself flawed and withdrawn.

Second, the current draft EIR fails to realistically consider the worker safety impact of a large increase in CPVC use. Based on existing evidence that workers installing CPVC pipe under typical working conditions are regularly exposed above legal exposure limits, regulatory action that expands CPVC use greatly must be expected to result in an increase in the number of workers overexposed. Any realistic analysis would include an estimate of the number of overexposures that are likely to result, and their health consequences. The current draft EIR fails to provide any such analysis.

Third, the current draft EIR fails to consider exposures from concurrent installation of CPVC pipe for drinking water and ABS or PVC pipe for drain, waste, and vent. The 1989 DHS study found that concurrent installation resulted in high exposures. Concurrent installation of CPVC and ABS/PVC has been unlikely under the 2000 MND, with CPVC use sharply limited, but would certainly increase under the recommended alternative of the current draft EIR. As a result, a proportion of newly-allowed CPVC installations would be concurrent with ABS/PVC installation, so the proposed regulatory action would not only increase the number of routine exposures but also the number of concurrent installations and the associated high exposures.

5. The draft EIR inappropriately indicates that use of low-VOC primers and cements will reduce exposures, without any supporting evidence.

The draft EIR states that "changes in the safety profiles of some CPVC products… should result in reduced worker exposure to chemical contaminants,"[10] citing especially the reduction in volatile organic carbon (VOC)

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[9] 2006 Draft EIR, p. 65.

[10] 2006 Draft EIR, page 63.

content in response to air quality regulations. However, the draft EIR provides no data on changes in primer or cement composition, and no evidence or substantive analysis to support its claim that formulation changes have reduced exposures since the 1989 DHS study or that they will do so in the future. In my comments on the 1998 draft EIR, I showed how use of a low-VOC product then on the market could actually increase workers' combined exposure index for all four solvents, largely because the low-VOC product contained more MEK, compared with products in use during the 1989 DHS study. While formulations may well have changed further since 1989, the 1998 analysis illustrates that predicting exposure levels from bulk concentrations is neither simple nor intuitive. The use of higher ACE concentrations in low-VOC adhesives, together with a lowering of the permissible exposure limit for ACE, further complicates the issues. The current draft EIR, however, overlooks these pitfalls and boldly asserts conclusions in the absence of data or analysis.

The one bit of information provided by HCD is that it "is not aware of any regulatory reports of workers being exposed to acetone levels in excess of the new acetone PEL standard."[11] Absent any description of how acetone exposures have been assessed by regulatory agencies, the significance of no "regulatory reports" cannot be meaningfully evaluated. Given the evidence regarding scant enforcement efforts, however, the existence of no reports of overexposure most likely is an indication that exposure levels during CPVC installation have simply not been measured, not that the exposures are below permissible limits. Relying on the absence of overexposure reports as a basis for findings regarding worker safety impacts is illogical and inappropriate.

A better approach to determining whether low-VOC formulations reduce worker exposures would be to go out and measure the exposures at a sample of installation sites under conditions of normal use. This, of course, would follow the model of the 1989 DHS study – replace unfounded assertions and legal positioning with straightforward science. If HCD is truly so confident that exposures have been reduced since 1989, it could demonstrate this quite simply by replicating the 1989 DHS study. Relying instead on unsupported assertions suggests a lack of such confidence.

6. Additional mitigation measures could further reduce the frequency and severity of overexposures.

Any review of worker safety hazards associated with CPVC installation merits consideration of measures that could at least prevent the most severe

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[11] Draft EIR, p. 65.

overexposures. The 2000 MND and ensuing experience with its mitigation measures provide useful information about the limitations of those measures. The following measures have been proposed previously and have not yet been acted upon, or else build on experience with the mitigation measures in the 2000 MND. While each of the following can be expected to reduce exposures, the extent of reduction – particularly whether they reduce exposures below a threshold of significance – would require empirical study.

a. Require one-part no-primer cements.

The 1989 DHS study noted that the highest worker exposures occurred with heavy use of primers. The incomplete 1998 EIR asserted that one-part cements eliminated the need for primers and thus could reduce worker exposures during CPVC installation, but did not take the obvious step of requiring such cements as a mitigation measure. As a result, primers continue to be used, and associated exposures continue.[12] Banning primers would seem to be an obvious step to take to protect workers from undue health impacts.

b. Require small containers and small daubers.

The 1989 DHS study also noted that high exposure sometimes occurred when workers used large daubers for primer or cement – because large daubers transport more solvents out of their containers into workers' breathing zones – and that high exposures sometimes occur when containers spill. But neither the incomplete 1998 EIR nor the 2000 MND specifically required small containers or small daubers. Requiring small containers and small daubers is unlikely to have dramatic effect on worker exposures, but at least would have the advantage of being enforceable without observation of work practices. A local building official or Cal/OSHA compliance officer would only need to inspect a contractor's supplies to assure compliance.

c. Require Use of chemical protective gloves, providing that gloves can be identified that give reliable lasting protection.

It is now clear that the use of 4 mil nitrile gloves do not provide reliable protection against liquid THF, MEK, CHX and ACE. Indeed, the use of these gloves may worsen the problem. Further study is necessary to determine appropriate glove use measures, if any.

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[12] Robert Calnone, 2005; investigative report.

The DEIR should determine if chemical protective gloves exist that would, in fact, give reliable, lasting protection against liquid THF, MEK, CHX and ACE. The DEIR should also determine if current glove use practices increase worker exposure to these contaminants. If feasible and effective protective glove use practices can be identified, these practices should be required.

d. Improve and expand worker training.

Most other mitigation measures, including use of gloves and ventilation or respiratory protection, will ultimately be most effective if the affected work force understands the hazards associated with CPVC installation and the importance of following all required or recommended worker safety provisions. The best path to understanding is regular, high-quality worker safety training. The training provisions of the 2000 MND were laudable, but they were apparently inadequate to accomplish the objective of getting workers sufficiently trained that they comply with the worker safety provisions. One option for improving the quality of worker safety training programs would be to set specific minimum standards for the content of training programs and require that the programs be certified. This approach has been used in regulating training for exposures associated with lead paint abatement, another toxic exposure that occurs in dispersed construction sites rather than a fixed manufacturing facility.

e. Establish adequate funding or personnel to ensure genuine enforcement of required mitigation measures.

To date of neither Cal/OSHA nor local building officials have apparently been successful in changing worker practices during CPVC installation, even though both have regulations requiring improved practices. In all likelihood, a key limitation is that Cal/OSHA and local building officials face the challenge of trying to enforce many regulations with severely constrained resources. If HCD truly intends to reduce worker health impacts by improving compliance with worker safety provisions, it will need to assure that adequate enforcement resources are make available.

f. Establish a monitoring system to improve enforcement of all relevant standards, especially those regarding gloves and ventilation.

One lesson of experience with the 2000 MND mitigation measures is that the may not have the desired impact, regardless of how well intentioned they may be. To the extent that any new action allowing expanded use of CPVC relies on mitigation measures to control worker health impacts, it will be essential to establish a mechanism for monitoring the measures' effectiveness over time and

for making any modifications that may be necessary to achieve the measures' objectives.

7. Conclusion

Understanding of the worker health impacts associated with CPVC pipe installation has evolved little over the sixteen years since comprehensive 1989 DHS study. Legal arguments and expert opinions have accumulated, but there is little new evidence and there have been no subsequent in-depth investigations or analyses. The most significant new evidence available since the incomplete 1998 EIR and the 2000 MND is that mitigation measures – written into IAPMO standards and the California Plumbing Code – seem to have had little effect in changing typical CPVC installation practices.

As a result, conclusions based on this evidence can be no different than in previous analyses: Workers who install CPVC pipe are likely to be overexposed to toxic primer and cement solvents above the legal limits on a regular basis. These overexposures above legal limits must be considered significant.

The mitigation measures imposed by the 2000 MND have not been effective in changing work practices to date, and there exists no evidence that they will be more effective in the future. Use of nitrile gloves as specified in the worker safety standards would provide no real protection against dermal exposure to ACE, CHX, MEK, or THF, and could actually increase absorption of contaminants. The draft EIR fails to consider an important impact of the recommended alternative – namely a substantial increase in the number of workers who will be overexposed to toxic chemicals on a regular basis during conditions of normal use, and the health effects of their more-frequent exposure. The draft EIR inappropriately indicates, without any supporting data or substantive analysis, that use of low-VOC formulations will reduce worker exposures, when in fact they may not. And the draft EIR draws inappropriate conclusions from the absence of "regulatory reports" of overexposure during CPVC installation.

As in the previous versions, the current draft EIR fails to cite relevant evidence of worker overexposures during normal use, reaches conclusions that are not supported by existing data or analysis, and fails to provide any new data or analyses.