Comments of

COALITION FOR SAFE BUILDING MATERIALS

(California Pipe Trades Council, California Professional Firefighters, Consumer Federation of California, Planning and Conservation League, Center for Environmental Health, Sierra Club of California and Communities for a Better Environment)

In Opposition To

The Proposed Amendment of CPC Sections 604.1, 604.1.1, 604.11, 604.11.1, 604.11.2, 604.13, 604.13.1 and 604.13.2 to Allow the Statewide Approval of PEX and PEX-AL-PEX Drinking Water Pipe

VOLUME II

APPENDICES TO THE COMMENTS OF ADAMS BROADWELL JOSEPH & CARDOZO

August 1, 2005

Westlaw

124 Cal.App.4th 1390, 22 Cal.Rptr.3d 393, 04 Cal. Daily Op. Serv. 11,090, 2004 Daily Journal D.A.R. 14,920

(Cite as: 124 Cal.App.4th 1390, 22 Cal.Rptr.3d 393)

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Briefs and Other Related Documents

Court of Appeal, Second District, Division 3, California.
PLASTIC PIPE AND FITTINGS ASSOCIATION, Plaintiff and Respondent,
v.
CALIFORNIA BUILDING STANDARDS COMMISSION et al., Defendants and Appellants.
No. B166499.

Dec. 15, 2004.

Background: Plastic pipe and fittings association filed petition for writ of administrative mandate, challenging decision by Building Standards Commission and state building agencies to modify adoption of uniform plumbing code by excluding provisions allowing use of cross-linked polyethylene (PEX) pipes, based on public health concerns. The Superior Court, Los Angeles County, No. BS076413, Dzintra I. Janavs, J., granted petition. Commission and agencies appealed.

Holdings: The Court of Appeal, Croskey, J., held that:
(1) substantial evidence supported decision to disallow PEX use;
(2) decision was not procedurally unfair; and
(3) substantial evidence supported Commission's decision to defer approval of PEX pending environmental review under California Environmental Quality Act (CEQA).
Reversed with directions.

West Headnotes

[1] Health 392
198Hk392 Most Cited Cases
Building Standards Commission's approval of building standards under the Building Standards Law is a quasi-legislative act of administrative rulemaking. West's Ann.Cal.Health & Safety Code § 18901 et seq.

[2] Administrative Law and Procedure 676
15Ak676 Most Cited Cases

[2] Administrative Law and Procedure 791
15Ak791 Most Cited Cases
A court cannot disturb an administrative agency's decision if substantial evidence in the administrative record supports the decision, and the court's review is limited to evidence in the administrative record. West's Ann.Cal.C.C.P. § 1085.

[3] Administrative Law and Procedure 797
15Ak797 Most Cited Cases
A court reviewing an administrative agency's quasi-legislative act cannot reweigh the evidence or substitute its own judgment for that of the agency.

[4] Administrative Law and Procedure 763
15Ak763 Most Cited Cases
A reviewing court independently determines whether an administrative agency acted within the scope of its statutory authority.

[5] Administrative Law and Procedure 683
15Ak683 Most Cited Cases
On appeal, reviewing court independently reviews a challenged administrative agency's decision and applies the same standard of review that governs the superior court.

[6] Administrative Law and Procedure 791
15Ak791 Most Cited Cases
For purposes of a reviewing court's determination whether an administrative agency's decision is supported by substantial evidence, the evidence is substantial if a reasonable trier of fact could conclude that the evidence is reasonable, credible, and of solid value.

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[7] Health ⚿392
198Hk392 Most Cited Cases
Substantial evidence supported decision by Building Standards Commission and state building agencies to modify adoption of uniform plumbing code by excluding provisions allowing use of cross-linked polyethylene (PEX) pipes, based on public health concerns, where experienced environmental consultant raised grave concerns about potential health dangers posed by use of PEX, and absence of information sufficient to reach a conclusion concerning the integrity of PEX pipes. West's Ann.Cal.Health & Safety Code § 18930(a)(3, 7).

[8] Administrative Law and Procedure ⚿402
15Ak402 Most Cited Cases
An administrative agency making a quasi-legislative decision is not required to make detailed factual findings supporting its decision.

[9] Health ⚿392
198Hk392 Most Cited Cases
Even assuming that model plumbing code was automatically adopted by Department of Housing and Community Development one year after its publication, pursuant to statute, provision of Building Standards Law was properly interpreted to preclude automatic approval of building standards in such code by Building Standards Commission, and to require Commission's review of such standards. West's Ann.Cal.Health & Safety Code §§ 17922(a), 18931(a).

[10] Constitutional Law ⚿60
92k60 Most Cited Cases
An unconstitutional delegation of legislative authority occurs if a statute authorizes a person or group other than the Legislature to make a fundamental policy decision or fails to provide adequate direction for the implementation of a fundamental policy determined by the Legislature. West's Ann.Cal. Const. Art. 4, § 1.

[11] Health ⚿392
198Hk392 Most Cited Cases
Statutory time limits for adoption of model plumbing code were directory rather than mandatory and jurisdictional, and thus decision by Building Standards Commission and state building agencies to modify adoption of such code by excluding provisions allowing use of cross-linked polyethylene (PEX) pipes, based on public health concerns was not procedurally unfair. West's Ann.Cal.Health & Safety Code § 18928(b).

[12] Environmental Law ⚿577
149Ek577 Most Cited Cases
In enacting the California Environmental Quality Act (CEQA), the Legislature declared its intention that all public agencies responsible for regulating activities affecting the environment give prime consideration to preventing environmental damage when carrying out their duties. West's Ann.Cal.Pub.Res.Code § 21000 et seq.

[13] Environmental Law ⚿573
149Ek573 Most Cited Cases
The California Environmental Quality Act (CEQA) is to be interpreted to afford the fullest possible protection to the environment within the reasonable scope of the statutory language. West's Ann.Cal.Pub.Res.Code § 21000 et seq.

[14] Environmental Law ⚿595(6)
149Ek595(6) Most Cited Cases
Allowing use of cross-linked polyethylene (PEX) pipes in state buildings was "project" which required environmental review under California Environmental Quality Act (CEQA) and CEQA guidelines, and thus substantial evidence supported decision by Building Standards Commission and state building agencies to modify adoption of uniform plumbing code by excluding provisions allowing use of PEX pipes, based on public health concerns, pending such environmental review, where experienced environmental consultant raised grave concerns about potential health dangers posed by use of PEX, and the absence of information sufficient to reach a conclusion concerning the integrity of PEX pipes. West's Ann.Cal.Pub.Res.Code § 21065; 14 CCR § 15378(a).
See 4 Witkin, Summary of Cal. Law (9th ed. 1987) Real Property, § 59B; 9 Miller & Starr, Cal. Real Estate (3d ed. 2001) § 25:186; Cal. Civil Practice

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(Thomson/West 2004) Environmental Litigation, § 8:7; Cal. Jur. 3d, Pollution and Conservation Laws, § 490.

[15] Environmental Law ⚿692
149Ek692 Most Cited Cases
Whether an activity constitutes a project under the California Environmental Quality Act (CEQA) is a question of law that can be decided de novo based on
the undisputed evidence in the record. West's Ann.Cal.Pub.Res.Code § 21000 et seq.

[16] Environmental Law ⚿592
149Ek592 Most Cited Cases
Absent an express statutory or categorical exemption from the requirements of the California Environmental Quality Act (CEQA), courts cannot infer an exemption unless they discern a clear legislative intent to exempt the activity. West's Ann.Cal.Pub.Res.Code § 21000 et seq.
****396 *1397** Bill Lockyer, Attorney General, Andrea Lynn Hoch, Chief Assistant Attorney General, Louis R. Mauro, Senior Assistant Attorney General, Gary Tavetian, Christine Sproul, Ramon M. De La Guardia and Christopher E. Krueger, Deputy Attorneys General, for Defendants and Appellants.

Rockard J. Delgadillo, City Attorney (Los Angeles), Jack Brown, Assistant City Attorney, Dennis J. Herrera, City Attorney (San Francisco), and Kate Herrmann Stacy, Deputy City Attorney, for City of Los Angeles and City and County of San Francisco as Amici Curiae on behalf of Defendants and Appellants.

Adams, Broadwell, Joseph & Cardozo, Daniel L. Cardozo, South San Francisco, Richard T. Drury, San Francisco, and Thomas E. Enslow for Sierra Club, Communities for a Better Environment, Center for Environmental Health, Planning and Conservation League, California Professional Firefighters Association, Consumer Federation of California and California Pipe Trades Council as Amici Curiae on behalf of Defendants and Appellants.

J. Scott Kuhn for Communities for a Better Environment as Amicus Curiae on behalf of Defendants and Appellants.

Brown, Winfield & Canzoneri, Brant H. Dveirin and Jack L. Henningsen, Los Angeles, for Plaintiff and Respondent.

Kronick, Moskovitz, Tiedemann & Girard and Jonathan P. Hobbs, Sacramento, for California Building Officials as Amicus Curiae on behalf of Plaintiff and Respondent.

Hatch & Parent and Lisabeth D. Rothman, Los Angeles, for California Building Industry Association and Building Industry Legal Defense Foundation as Amici Curiae on behalf of Plaintiff and Respondent.

***1398** CROSKEY, J.

The California Building Standards Commission (Commission) and five other state agencies appeal a judgment granting a peremptory writ of mandate in favor of Plastic Pipe and Fittings Association (PPFA). [FN1] The writ of mandate compels the Commission and the Agencies to adopt as part of the California Plumbing Code provisions of the Uniform Plumbing Code allowing the use of cross-linked polyethylene (PEX) pipes, vacate their exceptions to the adoption of those provisions, and vacate the Commission's finding that review is warranted under the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.) with respect to allowing the use of PEX.

FN1. The other state agencies party to this appeal as appellants are the Department of Housing and Community Development, Division of the State Architect-Structural Safety, Office of Statewide Health Planning and Development, Department of Health Services, and Department of Food and Agriculture (collectively Agencies).

The Commission and the Agencies contend (1) the superior court's conclusion that they acted

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arbitrarily and without evidentiary support by refusing to adopt the Uniform Plumbing Code provisions allowing the use of PEX was error; (2) the decision not to allow the use of PEX was not procedurally unfair; (3) the Commission's decision to defer approval of PEX pending CEQA review was proper; and (4) the writ of mandate impermissibly directs the Commission and the Agencies to exercise their discretion in a particular manner. We agree with the first three contentions and do not reach the fourth.

FACTUAL AND PROCEDURAL BACKGROUND

1. *The Adoption and Approval of Building Standards.*

The Commission is a state agency responsible for approving or adopting building ****397** standards adopted or proposed by other agencies, as discussed *post.* Building standards ordinarily are based on model codes with any amendments deemed appropriate. Building standards approved or adopted by the Commission become part of the California Building Standards Code (Code), of which the California Plumbing Code is a part.

The International Association of Plumbing and Mechanical Officials, a private organization, published the 2000 Uniform Plumbing Code, a model code, in October 1999. The model code included provisions allowing the use of PEX pipes and fittings. PEX is a form of plastic.

The Commission and the Agencies initially proposed adopting the model code to apply to buildings regulated by the Agencies, including the provisions ***1399** allowing the use of PEX. [FN2] They each provided an initial statement of reasons for the proposed building standards and a 45-day public comment period commencing in July 2001. During the public comment period, the Commission received a letter from Daniel L. Cardozo on behalf of the California State Pipe Trades Council, a trade group, objecting to allowing the use of PEX. The letter attached a letter from Thomas Reid, an environmental consultant, stating his opinion that the use of PEX pipes potentially could result in contamination of potable water and the environment by chemical leaching of substances from the pipes, and that the pipes potentially could be subject to permeation by substances of low molecular weight contained in soil and groundwater, such as methyl tertiary butyl ether (MTBE) and pesticides. Reid also stated that the pipes potentially could be subject to mechanical failure, and that the pipes may rupture and create openings in the event of a fire and thereby facilitate the spread of fire. He stated that because PEX is not widely used in the United States information on its properties is not readily available.

> FN2. The Department of Housing and Community Development adopts building standards applicable to dwellings and transient lodging facilities (Health & Saf.Code, § 17921, subd. (a)), the Division of the State Architect-Structural Safety adopts building standards applicable to public elementary and secondary schools, community colleges, and "essential services" buildings (Ed.Code, §§ 17310, 81142; Health & Saf.Code, § 16022), the Office of Statewide Health Planning and Development adopts building standards applicable to hospitals and other health care facilities (Health & Saf.Code, § 129850), the Department of Health Services adopts building standards applicable to public swimming pools (*id.,* § 116050), and the Department of Food and Agriculture adopts building standards applicable to dairies and meet inspection facilities.

Reid stated that normal polyethylene softens at high temperatures, and that the material can gain temperature resistance through the cross-linking of polymer chains with chemical bonds. He stated that cross-linked polyethylene (PEX) typically is manufactured using any of three different methods of chemical bonding, and that the different methods may result in different chemical and mechanical characteristics of the finished material. He also stated that PEX is a member of the polyolefin family of polymers, of which polybutylene (PB) is also a member, that antioxidants must be added to

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the pipe resin to protect polyolefins from oxidization and ultraviolet light, and that antioxidants in the pipe resin are consumed when the pipe is exposed to oxidizers such as chlorine and oxygen. He stated that PB pipes suffered from premature mechanical failure due to oxidant degradation despite the use of antioxidant additives, and eventually were taken off the market.

Reid stated his opinion that state agencies should not rely on certification by ****398** NSF International (NSF), a private organization that develops public health and safety standards for products, in determining whether the potential risks of using PEX are acceptable. He explained that NSF expressly disclaims ***1400** any responsibility for the decision whether to use a certified product, does not make its test results available for others to review, and limits its testing protocols based on undisclosed assumptions derived from information provided by manufacturers.

The Commission also received a letter from the California Professional Firefighters stating that PEX may present dangers in the event of a fire by creating toxic smoke and accelerating the spread of fire, and urging the Commission to conduct environmental review under CEQA. The Commission and the Agencies also received comments supportive of allowing the use of PEX.

After receiving public comments and conducting a public hearing, the Agencies modified their proposed building standards by excluding the provisions allowing the use of PEX. The Commission and the Agencies provided further public comment periods on the amended proposals.

The Agencies each provided a final statement of reasons for proposed building standards. The final statements of reasons referred to Reid's comments and stated that neither the agencies nor the Commission had sufficient time to evaluate the potential environmental impact and other potential consequences of allowing the use of PEX or sufficient time to determine whether the use of PEX was "compliant with the laws of the State of California." The Agencies each provided an analysis of the nine criteria under Health and Safety Code section 18930, subdivision (a), pertaining to the building standards as a whole. The Commission provided the analyses on behalf of the Department of Health Services and the Department of Food and Agriculture pursuant to Health and Safety Code section 18928, subdivision (c).

The Commission provided a final statement of reasons in April 2002 stating in pertinent part:

"The public interest requires that when considering building products the approving agencies must always balance the potential benefits against the potential risks. When approving a product new to the California Plumbing Code, such as cross-linked polyethylene tubing (PEX), agencies have an obligation to be reasonably assured that the product does not produce an unreasonable risk to health or safety. When balancing these interests, agencies must resolve close questions in favor of protecting the health and welfare of consumers and of workers installing these products....

"At this time, the CBSC [Commission] feels it is obligated to give both the positive and negative comments and evidence equal credibility. It is unable at ***1401** this time to conclude the negative comments concerning leachable products and permeation are unfounded. The CBSC has limited resources and the need to complete the triennial code adoption cycle has prevented the CBSC from addressing and investigating the issues raised regarding the PEX and the public interest in approving or not approving PEX.

"Although the CBSC has not determined yet whether the claims of Mr. Cardozo are valid, the CBSC will not adopt PEX, at this time, due to insufficient time remaining in its 2001 triennial code adoption cycle to adopt the 2000 UPC and to determine if this change in the model code is compliant with the laws of the State of California. Therefore, the CBSC does not ****399** believe the adoption of PEX would [ ] be in the public interest at this time."

The Commission also provided an analysis of the

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nine criteria under Health and Safety Code section 18930, subdivision (a), stating, in relevant part, "The public interest requires the deletion of authorization for the use of PEX until further exploration of the health and safety issues raised. At this time the CBSC cannot with certainty determine that the use of PEX does no[t] present health and safety issues for consumers and installers." The Commission stated further, "in light of the conflicting claims regarding the use of PEX, it is not appropriate to approve the use of PEX in California until these conflicts have been resolved."

The Agencies adopted and the Commission approved the 2000 Uniform Plumbing Code in May 2002, but they excepted and did not adopt the provisions that would allow the use of PEX pipes in buildings regulated by the Agencies. The Commission found that the proposed approval of the use of PEX may result in a significant environmental impact and ordered the development of a coordinated procedure to proceed under CEQA.

2. *Trial Court Proceedings.*

PPFA filed a petition for writ of mandate (Code Civ. Proc., § 1085) in the superior court in May 2002 against the Commission and the Agencies challenging their failure to approve PEX for the Agencies' uses. California Pipe Trades Council, Sierra Club, Planning and Conservation League, California Professional Firefighters Association, Northern California Mechanical Contractors Association, and Consumer Federation of California moved to intervene in the proceeding in support of the Commission and the Agencies. The superior court denied the motion for intervention on the grounds that the interveners had no immediate interest in the proceeding and that the Commission and the Agencies could adequately represent the interveners' interests. The court also denied a motion by the same organizations for leave to file a brief as amici curiae.

***1402** PPFA argued in the memorandum of points and authorities in support of its petition that the decision to exclude PEX was arbitrary and capricious; that there was no substantial evidence to support the decision; that the decision was fraught with procedural irregularities and undue political influence; that as to the Department of Housing and Community Development the model code was automatically adopted and approved, including the provisions allowing the use of PEX, due to failure by the department and the Commission to act within the statutory time periods; that CEQA does not apply to the adoption and approval of building standards; and that if CEQA did apply it would apply to the entire Code rather than only to the provisions allowing the use of PEX.

The Commission and the Agencies argued in opposition that substantial evidence supported their conclusion that the information available to them was insufficient to overcome their concerns about potential problems with PEX; that there were no procedural irregularities; that the provisions allowing the use of PEX were not adopted and approved automatically as to the Department of Housing and Community Development; and that the decision to conduct review under CEQA was proper.

At the hearing on the merits of the petition, the superior court was impressed by the apparently undisputed representation that 180 local jurisdictions in California already have approved the use of PEX for some purposes, that 49 states have adopted model code provisions allowing ****400** the use of PEX, and that PEX has been used in Europe for 20 to 30 years. The court stated, "I would think that somebody would have been able to come up with something showing that, indeed, there's been a tremendous problem with this product in Europe or tremendous problem with it all over the country or a tremendous problem with it in California; and yet, there's really nothing that I can see here factually that's been pulled together with respect to P.E.X." The court questioned whether allowing the use of PEX in the Code would make any difference at all if PEX already is being used extensively in California. On the other hand, the court suggested that Code approval of PEX might not result in widespread use of PEX if the Code does not make the use of PEX mandatory. The parties disputed the extent to which PEX has been

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used in California and the effect of Code approval on the amount of its use.

The court stated that an agency adopting a model code must justify any exception to a model code provision, and that there must be evidence to support the reasons given for the exception. The court stated that the statements in the Reid letter were conclusory and lacked a "factual foundation." The court stated that Reid did not explain the purported chemical similarities between PEX and PB or explain how those similarities would result in significant environmental impacts. The court also suggested that the ***1403** analyses of the nine criteria under Health and Safety Code section 18930 , subdivision (a), did not state sufficiently why the model code provisions allowing the use of PEX were "inadequate."

The court stated that the Agencies' and the Commission's treatment of PEX appeared to be inconsistent with their treatment of other pipe materials about which they had expressed no concerns, and that they appeared to be splitting the project for purposes of CEQA by applying CEQA with regard to PEX but not with regard to other materials allowed under the Code. The court questioned why the Agencies and the Commission did not apply CEQA almost two years earlier, before the initial public comment period.

The court in a minute order granted the petition "on the grounds raised by Petitioner, except for the ground that PEX was adopted as a matter of law." The court entered a judgment in February 2003 and issued a peremptory writ of mandate ordering the Commission and the Agencies to adopt and approve the 2000 Uniform Plumbing Code provisions allowing the use of PEX, vacate their exceptions to the use of PEX, and vacate the findings that approval of PEX may result in a significant environmental impact. The Commission and the Agencies appeal the judgment.

CONTENTIONS

The Commission and the Agencies contend (1) the superior court's conclusion that they acted arbitrarily and without evidentiary support by refusing to adopt the Uniform Plumbing Code provisions allowing the use of PEX was error; (2) the decision not to allow the use of PEX was not procedurally unfair; (3) the decision to conduct a review under CEQA was proper; and (4) the judgment impermissibly directs the Commission and the Agencies to exercise their discretion in a particular manner.

PPFA contends (1) an agency adopting a model code must make "evidentiary findings" to justify any deviation from the model code, and the Agencies failed to do so; (2) Reid's comments are speculative, factually unsupported, and do not support the decision to exclude PEX; (3) the Commission's approval of PEX for some uses ****401** while excluding it for the Agencies' uses was arbitrary and capricious, and the exclusion of PEX while approving the use of corrugated stainless steel tubing (CSST) was arbitrary and capricious; (4) the rulemaking process was procedurally unfair because the Agencies failed to act within the statutory time period, unreasonably delayed the decision to apply CEQA, and conducted a "sham" hearing to announce a predetermined decision, among other reasons; (5) as to the Department of Housing and Community Development, the model code was automatically adopted and approved as a matter of law, including the provisions allowing use of PEX, ***1404** due to failure by the department and the Commission to act within the statutory time periods; (6) CEQA does not apply because (a) there is no causal link between approval of the use of PEX and a physical change in the environment, (b) the statutory time limits for adoption and approval of building standards do not allow time for environmental review, so the Legislature impliedly exempted the activity from CEQA, and (c) application of CEQA would not achieve CEQA's goal of informing the public about the environmental consequences of approval of use of PEX before the decision is made because PEX already is widely in use; (7) the evidence does not support the conclusion that PEX may have a significant impact on the environment; (8) the Commission and the Agencies improperly delayed approval of PEX by invoking CEQA for the first time at the conclusion of the rulemaking process;

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(9) the Commission and the Agencies improperly split the project by applying CEQA to some uses of PEX but not others and by applying CEQA to PEX but not to other plumbing materials; and (10) the judgment compelling the Commission and the Agencies to allow the use of PEX was proper.

DISCUSSION

1. *Building Standards Law.*

The California Building Standards Law (Health & Saf.Code, § 18901 et seq.) provides for the promulgation of building standards by state agencies. [FN3] State agencies adopt or propose building standards that are then approved or adopted by the Commission. (*Id.*, § 18930, subd. (a).) The adopting agency must submit to the Commission a written analysis of the building standards, "which shall, to the satisfaction of the commission, justify the approval thereof in terms of the following criteria:

> FN3. The Building Standards Law defines building standards, in pertinent part, as "any rule, regulation, order, or other requirement, including any amendment or repeal of that requirement, that specifically regulates, requires, or forbids the method of use, properties, performance, or types of materials used in the construction, alteration, improvement, repair, or rehabilitation of a building, structure, factory-built housing, or other improvement to real property, including fixtures therein, and as determined by the commission." (Health & Saf.Code, § 18909, subd. (a).)

"(1) The proposed building standards do not conflict with, overlap, or duplicate other building standards.

"(2) The proposed building standard is within the parameters established by enabling legislation and is not expressly within the exclusive jurisdiction of another agency.

"(3) The public interest requires the adoption of the building standards.

***1405** "(4) The proposed building standard is not unreasonable, arbitrary, unfair, or capricious, in whole or in part.

"(5) The cost to the public is reasonable, based on the overall benefit to be derived from the building standards.

****402** "(6) The proposed building standard is not unnecessarily ambiguous or vague, in whole or in part.

"(7) The applicable national specifications, published standards, and model codes have been incorporated therein as provided in this part, where appropriate.

"(A) If a national specification, published standard, or model code does not adequately address the goals of the state agency, a statement defining the inadequacy shall accompany the proposed building standard when submitted to the commission.

"(B) If there is no national specification, published standard, or model code that is relevant to the proposed building standard, the state agency shall prepare a statement informing the commission and submit that statement with the proposed building standard.

"(8) The format of the proposed building standard is consistent with that adopted by the commission.

"(9) The proposed building standard, if it promotes fire and panic safety, as determined by the State Fire Marshal, has the written approval of the State Fire Marshal." (Health & Saf.Code, § 18930, subd. (a).)

Health and Safety Code section 18928, subdivision (c), states that if an agency responsible for the adoption of building standards fails to adopt a model code within one year after its publication, the Commission "shall convene a committee to recommend to the commission the adoption, amendment, or repeal, on the agencies' behalf, of

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the most recent editions of the model codes ... and necessary state standards."

The Commission must either approve the building standards adopted by a state agency, return the standards for amendment with recommended changes, or reject the standards. [FN4] (Health & Saf.Code, § 18931, subd. (a).) If the Commission fails to act within 120 days after receiving an agency's ***1406** adopted standards, the standards are deemed approved without further review. (*Ibid.*) Approved standards are codified in the Code. (*Id.*, § § 18931, subd. (b), 18938.) The California Plumbing Code is part of the Code. (Cal.Code Regs., tit. 24, § 101.0 et seq.)

> FN4. The Commission here agreed with the Agencies' decisions. We therefore need not discuss the standard of review applicable to the Commission's review of the Agencies' determinations and analyses (Health & Saf.Code, § 18930, subds. (d)(1) & (e)).

The Commission receives proposed building standards from state agencies for consideration in an annual code adoption cycle, publishes the Code in its entirety every three years, and publishes annual supplements as necessary. (Health & Saf.Code, §§ 18929.1, subd. (a), 18942, subd. (a).)

2. *The Commission's Decision Not to Allow the Use of PEX Was Proper.*

a. *Standard of Review.*

[1][2][3][4] The Commission's approval of building standards under the Building Standards Law is a quasi-legislative act of administrative rulemaking. (*20th Century Ins. Co. v. Garamendi* (1994) 8 Cal.4th 216, 275, 32 Cal.Rptr.2d 807, 878 P.2d 566; see *International Assn. of Plumbing etc. Officials v. California Building Stds. Com.* (1997) 55 Cal.App.4th 245, 254, 64 Cal.Rptr.2d 129.) Judicial review of a quasi-legislative act in an ordinary mandamus proceeding (Code Civ. Proc., § 1085) is limited to determining whether the agency's action was arbitrary, capricious, entirely without evidentiary support, or procedurally unfair. ****403**(*Associated Builders & Contractors, Inc. v. San Francisco Airports Com.* (1999) 21 Cal.4th 352, 361, 87 Cal.Rptr.2d 654, 981 P.2d 499.) This generally means that a court cannot disturb the agency's decision if substantial evidence in the administrative record supports the decision. (*Id.* at pp. 361, 374, 87 Cal.Rptr.2d 654, 981 P.2d 499; *Western States Petroleum Assn. v. Superior Court* (1995) 9 Cal.4th 559, 571-574, 38 Cal.Rptr.2d 139, 888 P.2d 1268.) A court's review is limited to evidence in the administrative record. [FN5] (*Associated Builders, supra,* at p. 374, 87 Cal.Rptr.2d 654, 981 P.2d 499; *Western States, supra,* at pp. 571, 579, 38 Cal.Rptr.2d 139, 888 P.2d 1268.) A court reviewing a quasi-legislative act cannot reweigh the evidence or substitute its own judgment for that of the agency. (*Shapell Industries, Inc. v. Governing Board* (1991) 1 Cal.App.4th 218, 230, 1 Cal.Rptr.2d 818.) This deferential standard of review reflects "deference to the separation of powers between the Legislature and the judiciary, to the legislative delegation of administrative authority to the agency, and to the presumed expertise of the agency within its scope of authority." (*California Hotel & Motel Assn. v. Industrial Welfare Com.* (1979) 25 Cal.3d 200, 212, 157 Cal.Rptr. 840, 599 P.2d 31.) A court independently determines, however, whether the agency acted within the scope of its statutory authority. ***1407** (*Yamaha Corp. of America v. State Bd. of Equalization* (1998) 19 Cal.4th 1, 11, fn. 4, 78 Cal.Rptr.2d 1, 960 P.2d 1031.)

> FN5. Because our review is limited to the administrative record, we reject PPFA's attempt to impeach the decision by the Department of Housing and Community Development by reference to the department's initial statement of reasons dated July 2004 in connection with a code adoption cycle subsequent to the one here at issue.

[5] On appeal, we independently review the agency's decision and apply the same standard of review that governs the superior court. (*Carrancho v. California Air Resources Bd.* (2003) 111

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Cal.App.4th 1255, 1275, 4 Cal.Rptr.3d 536.)

[6] Evidence is substantial if a reasonable trier of fact could conclude that the evidence is reasonable, credible, and of solid value. (*Wilmot v. Commission on Professional Competence* (1998) 64 Cal.App.4th 1130, 1139, 75 Cal.Rptr.2d 656.) The uncorroborated testimony of one witness can constitute substantial evidence, unless the testimony is inherently unreliable. (Evid.Code, § 411; *People v. Scott* (1978) 21 Cal.3d 284, 296, 145 Cal.Rptr. 876, 578 P.2d 123.)

b. *The Evidence Supports the Decision.*

[7] The Agencies and the Commission adopted and approved the 2000 Model Plumbing Code with the exception of certain provisions allowing the use of PEX. The Agencies' decision not to allow the use of PEX was based on their common conclusion that the use of PEX potentially could present an unacceptable danger to public health and safety and that the information in the administrative record was insufficient for them to assuage their concerns. The Commission agreed with the Agencies' conclusion and approved the adopted standards, including the exclusion of PEX, for the same reason.

We conclude that the evidence in the administrative record supports the decision by the Commission and the Agencies. The Reid letter raised grave concerns about the potential dangers posed by the use of PEX and the absence of information sufficient to reach a conclusion concerning the integrity of PEX pipes, including the potential for (1) chemical leaching of substances from the pipes; (2) permeation of ****404** the pipes by toxic substances contained in the surrounding soil and groundwater; (3) mechanical failure of the pipes; and (4) rupturing of the pipes when exposed to high heat, which may create openings that could contribute to the spread of fire. The record shows that Reid has more than 20 years of experience studying public health and mechanical performance issues related to pipe materials, has directed an environmental consulting firm since 1972, holds a bachelor's degree in chemistry, and pursued graduate study in biology for several years. On this record, there is no reasonable question that Reid is qualified to state his opinion on these subjects.

The question is not whether the evidence supports the conclusion that PEX is unsafe and unsound for plumbing uses; the Commission and the ***1408** Agencies made no such finding. Rather, the question is whether the evidence supports the conclusion that the use of PEX potentially may present an unreasonable risk of harm and that the information available to the Commission and the Agencies was insufficient for them to determine whether the use of PEX actually would present an unreasonable risk of harm. We conclude that the Reid letter is substantial evidence both that PEX potentially may present an unreasonable risk of harm and that the information in the administrative record is insufficient to dispel the stated concerns. The Commission and the Agencies were entitled to rely on the Reid letter in the exercise of their discretion under Health and Safety Code section 18930, subdivision (a)(3) and (7), in determining whether allowing the use of PEX is in the "public interest" (*id.*, subd. (a)(3)) and whether incorporation of those model code provisions is "appropriate" (*id.*, subd. (a)(7)).

[8] Contrary to PPFA's argument, the Commission and the Agencies were not required to make "evidentiary findings" in support of their decision. Health and Safety Code section 18930, subdivision (a), states that the adopting agency must provide an analysis of nine criteria and that the analysis must justify the proposed building standards "to the satisfaction of the commission." The Commission must review the standards and the agency's analysis. (*Id.*, § 18930, subds. (d)(1) & (e), § 18931, subd. (a).) Section 18930 recognizes that the agency's analysis may involve "factual determinations" and states that such factual determinations ordinarily are binding on the Commission, except where the building standard is "principally intended to protect the public health and safety." (*Id.*, § 18930, subds. (d)(1), (e).) The statute, however, does not state that the Commission or the adopting agency must make express factual findings to support its decision that a particular building standard is not in the public interest (*id.*, subd. (a)(3)) or that a particular

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model code provision "does not adequately address the goals of the state agency" (*id.*, subd. (a)(7).) Moreover, an administrative agency making a quasi-legislative decision is not required to make detailed factual findings supporting its decision. (*McKinny v. Board of Trustees* (1982) 31 Cal.3d 79, 88, 181 Cal.Rptr. 549, 642 P.2d 460.)

We also reject the arguments that the Commission cannot properly distinguish between the use of PEX in buildings regulated by the Agencies and its use in other buildings for which the Commission approved its use, and that the Agency cannot properly disallow the use of PEX pipes in buildings regulated by the Agencies while allowing the use of CSST pipes in those buildings. The Commission's determination that PEX is appropriate for use in buildings such as hospitals, psychiatric hospitals, skilled nursing facilities, children's nurseries, theaters, dance halls, and jails does not compel the conclusion that it ****405** is appropriate for use in the buildings governed by the Agencies. PPFA has not shown that the evidence compels the conclusion as a ***1409** matter of law that PEX must be appropriate for all buildings if it is appropriate for any or that if CSST is appropriate then PEX must be appropriate too.

c. *The Model Code Provisions Were Not Automatically Adopted and Approved as a Matter of Law as to the Department of Housing and Community Development.*

[9] Health and Safety Code section 17922, subdivision (a), states that the building standards adopted by the Department of Housing and Community Development and submitted to the Commission for approval "shall impose substantially the same requirements as are contained in the most recent editions of the following uniform industry codes as adopted by the organizations specified: [¶] ... [¶] (3) The Uniform Plumbing Code of the International Association of Plumbing and Mechanical Officials." Subdivision (b) states, in pertinent part, "Except as provided in Part 2.5 (commencing with section 18901), in the absence of adoption by regulation, the most recent editions of the uniform codes referred to in this section shall be considered to be adopted one year after the date of publication of the uniform codes."

Health and Safety Code section 18931, subdivision (a), states that the Commission must, "In accordance with Section 18930 and within 120 days from the date of receipt of adopted standards, review the standards of adopting agencies and approve, return for amendment with recommended changes, or reject building standards submitted to the commission for its approval. When building standards are returned for amendment or rejected, the commission shall inform the adopting agency or state agency that proposes the building standards of the specific reasons for the recommended changes or rejection, citing the criteria required under Section 18930. When standards are not acted upon by the commission within 120 days, the standards shall be approved, including codification and publication in the California Building Standards Code, without further review and without return or rejection by the commission."

PPFA maintains that the Department of Housing and Community Development adopted the model code as a matter of law, including the provisions allowing the use of PEX, by failing to adopt building standards within one year after the publication of the model code in October 1999, and that the Commission approved the model code, including the PEX provisions, by failing to act on the adopted standards within 120 days after they were deemed adopted. Under PPFA's construction of the Building Standards Law, the most recent edition of a model code can become California law without any review by either the adopting agency or the Commission. The superior court rejected this argument, and so do we.

[10] ***1410** The legislative power of the state is vested in the Legislature. (Cal. Const., art. IV, § 1.) An unconstitutional delegation of legislative authority occurs if a statute authorizes another person or group to make a fundamental policy decision or fails to provide adequate direction for the implementation of a fundamental policy determined by the Legislature. (*Carson Mobilehome Park Owners' Assn. v. City of Carson*

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(1983) 35 Cal.3d 184, 190, 197 Cal.Rptr. 284, 672 P.2d 1297; *Kugler v. Yocum* (1968) 69 Cal.2d 371, 376-377, 71 Cal.Rptr. 687, 445 P.2d 303.) For the Legislature to grant a private association such as the International Association of Plumbing and ****406** Mechanical Officials the power to make law with no direction from the Legislature and no review by a state agency would be unconstitutional. (*International Association of Plumbing etc. Officials v. California Building Stds Com., supra,* 55 Cal.App.4th at p. 253, 64 Cal.Rptr.2d 129.) We must construe a statute to avoid a constitutional invalidity if a constitutionally sound construction is reasonable. (*City of Los Angeles v. Superior Court* (2002) 29 Cal.4th 1, 10-11, 124 Cal.Rptr.2d 202, 52 P.3d 129.)

Assuming arguendo that the model code was deemed adopted without amendment by the Department of Housing and Community Development under Health and Safety Code section 17922, subdivision (a), we construe section 18931, subdivision (a), to mean that the Commission is deemed to approve adopted building standards through inaction only if the Commission receives the adopted standards from the adopting agency. Section 18931, subdivision (a), states that the Commission must review and act on adopted standards "within 120 days from the date of receipt of adopted standards." We conclude that the Legislature contemplated that automatic approval by the Commission could occur only if the adopting agency affirmatively adopted the building standards and forwarded them to the Commission. If the Commission did not receive adopted standards from the adopting agency, as here, the Commission cannot be deemed to approve the standards through inaction. This ensures that building standards cannot be both deemed adopted by the adopting agency and deemed approved by the Commission with no determination by either the adopting agency or the Commission that the standards are appropriate.

d. *The Decision Was Not Procedurally Unfair.*

[11] PPFA contends the decision was procedurally unfair because (1) the Agencies failed to adopt the model code within one year after its publication as required by Health and Safety Code section 18928, subdivision (b); (2) the Commission and the Agencies improperly delayed the decision to apply CEQA; (3) the Department of Housing and Community Development characterized its decision not to adopt the model code provisions allowing the use of PEX as "secret" and allowed counsel for the California State Pipe Trades ***1411** Council to participate in drafting a public notice; (4) the Governor appointed two new members to the Commission shortly before its hearing in May 2002, one of whom formerly represented a trade group promoting copper pipes, and the Governor received a substantial amount of campaign contributions from the California State Pipe Trades Council; (5) the Commission's hearing in May 2002 was a sham because the Commission "seemed predetermined to exclude PEX" and presented a "pre-printed motion" a copy of which had been given to the California State Pipe Trades Council; (6) the Agencies failed to make independent factual findings and acted under the direction of the Commission; (7) the Commission secretly authorized advance publication of the Code before the May 2002 hearing, so the hearing was a sham and the Commission's decision was predetermined; and (8) the Commission "threaten[ed]" to impose the costs of environmental review on PEX manufacturers without justification.

We reject the contention that the Agencies' failure to adopt the model code within one year after its publication as required by statute rendered the decision procedurally unfair so as to invalidate the Agencies' and the Commission's decision. Statutory time limits ordinarily are considered directory rather than mandatory and jurisdictional unless the Legislature clearly expressed a contrary intent. ****407**(*California Correctional Peace Officers Assn. v. State Personnel Bd.* (1995) 10 Cal.4th 1133, 1145, 43 Cal.Rptr.2d 693, 899 P.2d 79.) The California Building Standards Law does not provide that an agency's adoption of a model code is invalid if it occurs more than one year after the model code was published or that the Commission has no authority to approve building standards that were not timely adopted. Moreover, statutory language

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that appears mandatory may be considered mandatory only in the sense that an administrative agency can be compelled to act if it fails to render a timely a decision, but this does not mean that the agency has no jurisdiction to act after the deadline has passed. (*Id.* at pp. 1146- 1147, 43 Cal.Rptr.2d 693, 899 P.2d 79.) If depriving an agency of the power to act after a deadline has passed would defeat the purpose of the statute, a court should reject such a construction. (*Ibid.*) We conclude that to deprive an agency of the power to adopt a model code more than one year after its publication would deprive the Commission of the agency's considered opinion and application of the agency's expertise, and would defeat the purpose of the statute.

We reject PPFA's second contention concerning procedural unfairness in section 4 *post.* The other contentions concerning alleged undue influence, a sham hearing, and the like are only unsubstantiated allegations and cannot justify the invalidation of the Commission's or the Agencies' decisions.

***1412** 3. *CEQA Applies to Proposed Building Standards Allowing the Use of PEX.*

[12][13] "CEQA is a comprehensive scheme designed to provide long-term protection to the environment. [Citation.] In enacting CEQA, the Legislature declared its intention that all public agencies responsible for regulating activities affecting the environment give prime consideration to preventing environmental damage when carrying out their duties. [Citations.] CEQA is to be interpreted 'to afford the fullest possible protection to the environment within the reasonable scope of the statutory language.' [Citation.]" (*Mountain Lion Foundation v. Fish & Game Com.* (1997) 16 Cal.4th 105, 112, 65 Cal.Rptr.2d 580, 939 P.2d 1280.)

[14][15] CEQA defines a "project" as an activity that may cause a direct or reasonably foreseeable indirect physical change in the environment and that is either directly undertaken by a public agency, undertaken by another person with assistance from a public agency, or involves the issuance by a public agency of a permit or other entitlement. (Pub. Resources Code, § 21065; Guidelines, [FN6] § 15378, subd. (a).) CEQA applies to any discretionary project proposed to be carried out or approved by a public agency, unless the project is exempt. (Pub. Resources Code, § 21080, subd. (a) .) A regulation fitting the description of a discretionary project is a discretionary project under CEQA. (*Wildlife Alive v. Chickering* (1976) 18 Cal.3d 190, 206, 132 Cal.Rptr. 377, 553 P.2d 537 [held that the enactment of regulations by the Fish and Game Commission fixing the dates of a hunting season was a project subject to CEQA]; see Pub. Resources Code, § 21000, subd. (g); Office of Planning and Research discussion ****408** foll. Guidelines, § 15378 ["With some activities carried out by government, the plan, control, or regulation being adopted may need to be regarded as the project even though the plan, etc., is being adopted to control activities to be initiated later by other people"]; [FN7] *Dunn-Edwards Corp. v. Bay Area Air Quality Management Dist.* (1992) 9 Cal.App.4th 644, 657-658, 11 Cal.Rptr.2d 850, disapproved on another ground in *Western States Petroleum Assn. v. Superior Court, supra,* 9 Cal.4th at p. 576, fn. 6, 38 Cal.Rptr.2d 139, 888 P.2d 1268, [held that the enactment of regulations relating to architectural coatings was not categorically exempt under CEQA].) Whether an activity constitutes a project under CEQA is a question of law that can be decided de novo ***1413** based on the undisputed evidence in the record. (*Black Property Owners Assn. v. City of Berkeley* (1994) 22 Cal.App.4th 974, 984, 28 Cal.Rptr.2d 305.)

FN6. All references to Guidelines are to the CEQA Guidelines (Cal.Code Regs., tit. 14, § 15000 et seq.) developed by the Office of Planning and Research and adopted by the California Resources Agency. (Pub. Resources Code, §§ 21083, 21087.) "[C]ourts should afford great weight to the Guidelines except when a provision is clearly unauthorized or erroneous under CEQA." (*Laurel Heights Improvement Assn. v. Regents of University of California* (1988) 47 Cal.3d 376, 391, fn. 2, 253 Cal.Rptr. 426, 764 P.2d 278.)

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> FN7. The discussions of the Guidelines prepared by the Office of Planning and Research are not part of the California Code of Regulations, but are available on the Internet at <http://ceres.ca.gov/ceqa>.

PPFA contends the enactment of regulations allowing the use of PEX is not a project because the causal link between the enactment of regulations and a physical change in the environment is too remote. PPFA argues that PEX is only one of several materials available for plumbing uses and that at this time there is no certainty that PEX will be used in any particular work of construction. A project, however, includes an activity that "may cause ... a reasonably foreseeable indirect physical change in the environment." (Pub. Resources Code, § 21065.) Thus, an activity need not cause an immediate environmental impact to be considered a project. We conclude that the regulations here at issue may have a reasonably foreseeable indirect environmental impact for the reasons expressed by Reid.

[16] PPFA contends the statutory time limits for adoption and approval of building standards do not allow time for environmental review, so the Legislature impliedly exempted the activity from CEQA. The Legislature has expressly exempted certain activities from CEQA (e.g., Pub. Resources Code, § 21080, subd. (b); see Guidelines, § 15260 et seq.) and has authorized the California Resources Agency to enact Guidelines establishing other, categorical exemptions based on the finding that the activities do not have a significant effect on the environment (Pub. Resources Code, § 21084, subd. (a); see Guidelines, § 15300 et seq.). Absent an express statutory or categorical exemption, however, we cannot infer an exemption unless we discern a clear legislative intent to exempt the activity. (*Sierra Club v. State Bd. of Forestry* (1994) 7 Cal.4th 1215, 1230, 32 Cal.Rptr.2d 19, 876 P.2d 505; *Wildlife Alive v. Chickering, supra,* 18 Cal.3d at p. 195, 132 Cal.Rptr. 377, 553 P.2d 537.) The California Supreme Court in *Wildlife Alive* rejected the argument that time restraints imposed by the Fish and Game Code on the enactment of hunting regulations indicated a legislative intent to exempt the activity from CEQA. The court noted that the statutory period of 50 to 70 days to hold public meetings, consider comments, and enact final regulations was sufficient time for environmental review under CEQA. (*Wildlife Alive, supra,* at p. 200, 132 Cal.Rptr. 377, 553 P.2d 537.) Similarly, we conclude that the statutory period of one year after the date of publication of a model code for an adopting agency to adopt or propose adoption of the model code (Health & Saf.Code, § 18928, subd. (b)) is sufficient time for environmental review under CEQA, and that the 120-day ****409** period after receipt of adopted building standards for the Commission to approve building standards (*id.,* § 18931, subd. (a)) is sufficient time for ***1414** environmental review under CEQA. [FN8] PPFA HAS NOT SHOWN AN irreconcilable conflict between ceqa and the adoption and approval of building standards under the Building Standards Law and therefore has not shown a legislative intent to exempt the activity.

> FN8. We need not decide whether the Commission or each adopting agency is the lead agency for purposes of CEQA.

PPFA also contends to apply CEQA in these circumstances would not achieve CEQA's goal of informing the public about the environmental consequences of a decision before the decision is made because PEX already is widely in use. [FN9] The essence of this argument is that the enactment of statewide regulations allowing the use of PEX for buildings regulated by the Agencies would cause no direct or reasonably foreseeable indirect physical change in the environment (Pub. Resources Code, § 21065) because PEX already is widely in use. We reject this argument because on this record we cannot conclude that the enactment of these regulations would cause no direct or reasonably foreseeable indirect physical change in the environment.

> FN9. The parties dispute the extent to which PEX has been used in California.

4. *The Decision to Conduct Review Under CEQA Was Proper.*

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An agency must conduct a preliminary review to determine whether CEQA applies to a proposed activity. (Guidelines, § 15060, subd. (c); *Association for a Cleaner Environment v. Yosemite Community College Dist.* (2004) 116 Cal.App.4th 629, 636, 10 Cal.Rptr.3d 560.) If the agency determines that the activity is a discretionary project that may result in a direct or reasonably foreseeable indirect physical change in the environment and that the activity is not exempt, the agency must either prepare an initial study or proceed directly to the preparation of an EIR. (Guidelines, §§ 15002, subd. (k), 15060, subds. (c) & (d), 15061, 15063, subd. (d); *Association for a Cleaner Environment, supra,* at pp. 639-640, 10 Cal.Rptr.3d 560.)

An initial study is a preliminary analysis to determine whether an EIR or a negative declaration must be prepared and to identify the environmental effects to be analyzed in an EIR. (Guidelines, §§ 15063, 15365.) An agency preparing an initial study must consult with all responsible agencies and trustee agencies responsible for resources affected by the project. (Pub. Resources Code, § 21080.3, subd. (a); Guidelines, § 15063, subd. (g).) An initial study includes in summary form a description of the project and its environmental setting, an identification of environmental effects, a discussion of potential mitigation measures, and an examination of the project's consistency with zoning regulations and other land use controls. (Guidelines, § 15063, subd. (d).)

***1415** An agency's decision whether to prepare an initial study is subject to judicial review under the abuse of discretion standard. (Pub. Resources Code, § 21168.5; *Association for a Cleaner Environment v. Yosemite Community College Dist., supra,* 116 Cal.App.4th at p. 636, 10 Cal.Rptr.3d 560.) Abuse of discretion means the agency did not proceed in a manner required by law or there was no substantial evidence to support its decision. (Pub. Resources Code, § 21168.5.)

PPFA argues that the Commission did not decide to conduct an initial study, but ****410** merely decided that the proposed approval of the use of PEX may result in a significant environmental effect and decided to prepare "a proposed procedure for a coordinated state review of PEX consistent with CEQA." Regardless of whether we construe the Commission's decision as a decision to conduct a preliminary review to determine whether an initial study was warranted or a decision to conduct an initial study, the abuse of discretion standard applies and our conclusion is the same. We conclude that substantial evidence supports the Commission's decision. The Reid letter is substantial evidence that the use of PEX potentially may result in the release of contaminants into the soil, groundwater, and drinking water, mechanical failure, and the spread of fire. The decision by the Commission and the Agencies to consider further the application of CEQA was proper.

Contrary to PPFA's argument, the Commission's and the Agencies' failure to commence CEQA review earlier in the rulemaking process does not compel them to forego environmental review. CEQA contains no automatic approval provision, and its time limits are directory rather than mandatory. (*Eller Media Co. v. City of Los Angeles* (2001) 87 Cal.App.4th 1217, 1221, 105 Cal.Rptr.2d 262.)

Finally, PPFA contends the Commission and the Agencies improperly split the project by deciding to apply CEQA only with respect to the proposed adoption by the Agencies of building standards allowing the use of PEX and not with respect to other agencies' adoption of building standards allowing the use of PEX or with respect to other plumbing materials. This is not a valid argument to forego environmental review. Rather, this is an argument to broaden the scope of the review. PPFA did not timely petition for a writ of mandate challenging the Commission's decision to approve other agencies' adoption of building standards allowing the use of PEX or the Commission's approval of building standards allowing the use of other plumbing materials, and therefore cannot challenge the absence of environmental review of those decisions. (Pub. Resources Code, § 21167, subd. (a).) In any event, the decision to conduct CEQA review does not foreclose the possibility of expanding the scope of any ensuing environmental

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analysis to encompass a larger project, if appropriate.

**1416 DISPOSITION*

The judgment is reversed with directions to the superior court to vacate the peremptory writ of mandate issued on February 13, 2003, and enter a judgment denying the petition for writ of mandate. Appellants are entitled to recover their costs on appeal.

We Concur: KLEIN, P.J., and ALDRICH, J.

124 Cal.App.4th 1390, 22 Cal.Rptr.3d 393, 04 Cal. Daily Op. Serv. 11,090, 2004 Daily Journal D.A.R. 14,920

Briefs and Other Related Documents (Back to top)

• 2004 WL 3245233 (Appellate Petition, Motion and Filing) Petition for Rehearing, of Petitioner and Respondent (Dec. 01, 2004)Original Image of this Document (PDF)

• 2004 WL 2959912 (Appellate Brief) Responsive Brief of Amicus Curiae Sierra Club, Communities for a Better Environment, Center for Environmental Health, Planning and Conservation League, California Professional Firefighters Association, Consumer Federation of California, and Californi a Pipe Trades Council to Amicus Curiae Brief of California Building Industry Association and Building Industry Legal Defense Foundation (Oct. 14, 2004)Original Image of this Document (PDF)

• 2004 WL 2474534 (Appellate Brief) Responsive Brief of Amicus Curiae Sierra Club, Communities for A Better Environment, Center for Environmental Health, Planning and Conservation League, California Professional Firefighters Association, Consumer Federation of California, and Californi a Pipe Trades Council to Respondent Plastic Pipe and Fittings Association's Motion for Production of Additional Evidence; Request for Judicial Notice (Aug. 20, 2004)Original Image of this Document (PDF)

• 2004 WL 2136997 (Appellate Brief) Responsive Brief of Amicus Curiae Sierra Club, Communities for a Better Environment, Center for Environmental Health, Planning and Conservation League, California Professional Firefighters Association, Consumer Federation of California, and Californi a Pipe Trades Council to Amicus Curiae Brief of California Local Building Officials (Jul. 02, 2004)Original Image of this Document (PDF)

• 2004 WL 2385801 (Appellate Brief) Respondent Plastic Pipe and Fittings Association's Response to the Amicus Curiae Brief Filed by the Sierra Club, Communities for A Better Environment, Center for Environmental Health, Planning and Conservation League, California Professional Firefigh ters Association, Consumer Federation of California, and California Pipe Trades Council, in Support of Respondent/Appellant California Building Standards Commission, et Al. (Jun. 08, 2004)Original Image of this Document (PDF)

• 2004 WL 1513845 (Appellate Brief) Respondent's Brief (May. 17, 2004)Original Image of this Document (PDF)

• 2004 WL 1062021 (Appellate Brief) Brief of Amicus Curiae Sierra Club, Communities for a Better Environment, Center for Environmental Health, Planning and Conservation League, California Professional Firefighters Association, Consumer Federation of California, and California Pipe Trad es Council, in Support of Respondent/Appellant California Building Standards Commission, et al. (Mar. 02, 2004)Original Image of this Document (PDF)

• 2004 WL 486076 (Appellate Brief) Application for Leave to File Amicus Curiae Brief and Brief of Amicus Curiae City of Los Angeles City and County of San Francisco in Support of Respondent/Appellant California Building Standards Commission, Et Al. (Feb. 02, 2004)Original Image of this Document (PDF)

• 2004 WL 322559 (Appellate Brief) Appellants' Opening Brief (Jan. 14, 2004)Original Image of this Document with Appendix (PDF)

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124 Cal.App.4th 1390, 22 Cal.Rptr.3d 393, 04 Cal. Daily Op. Serv. 11,090, 2004 Daily Journal D.A.R. 14,920

(Cite as: 124 Cal.App.4th 1390, 22 Cal.Rptr.3d 393)

- B166499 (Docket)
  (Apr. 11, 2003)

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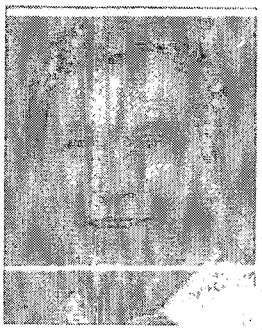
Mr. Reid has directed his firm and participated in much of its technical work since its inception in 1972. Although the firm retains its full-service in environmental assessment, Mr. Reid has made conservation planning his principal professional focus.



Mr. Reid was the first consultant to become involved in habitat conservation planning under the federal Endangered Species Act (ESA), and has been involved in many of the habitat conservation plans (HCP) proposed in the state of California. His scientific expertise and presentation and negotiation skills support the consensus-building process that has resulted in a successful outcome for numerous plans.

TRA prepared the first HCP 1981-82 for the County of San Mateo. The San Bruno Mountain HCP was permitted in 1983. This plan was based on a two-year, large scale, endangered species survey of the 3600 acre San Bruno Mountain, conducted by TRA under Mr. Reid's direction. The San Bruno Mountain HCP resulted in the addition of Section 10(a) to the newly-reauthorized ESA. This addition to the ESA allowed, for the first time, legal take of an endangered species for other than scientific purposes, if take was demonstrated to be mitigated by an approved HCP that demonstrated a net benefit to the endangered species. In addition, under his direction, TRA firm has been responsible for implementing the enhancement program of the San Bruno Mountain HCP since its adoption.

Other conservation plans and planning studies under Mr. Reid's direction include: Coachella Valley Fringe-toed Lizard HCP in Riverside County, the South San Joaquin Valley Ecosystems Protection Program for the California Energy Commission, the Marina Dunes HCP, Metropolitan Bakersfield HCP, the Morro Bay Kangaroo Rat HCP (interim), Kirby Canyon Conservation Plan, the Seascape Uplands (long-toed salamander) HCP, the San Benito County HCP (interim), the Natomas Basin HCP (II).

Mr. Reid served the State of California Department of Fish and Game as the primary facilitator for the Southern California Coastal Sage Scrub NCCP, the state's first Natural Communities Conservation Plan (NCCP). Mr. Reid worked with the scientific review panel and with various federal, state and private participants involved in this process. Aimed at ecosystem conservation, the NCCP program was the first program of its kind. The program encompasses 6000 square miles of coastal sage scrub community in five counties of southern California. Through Mr. Reid's efforts, the participants, including the state and federal governments, have been able to agree on workable process guidelines that govern the long-term protection of the coastal sage scrub ecosystem for the foreseeable future.

In 1996 he assisted the State of California Resources Agency with the conservation planning effort for the Headwaters Forest (Pacific Lumber Company) in Humboldt County, CA. The Headwaters Forest HCP was permitted in 1999. He is currently assisting Placer County with the preparation of a County-wide HCP/NCCP.

Mr. Reid is well versed in the technical aspects of environmental analysis and conservation planning. His skills include aerial photo interpretation, geographic information systems (GIS), mapping, data processing and interpretation, biostatistics, and computer assisted environmental modeling. TRA was responsible for the GIS analysis in the South San Joaquin Valley Ecosystems Protection Program, the Pacific Lumber Headwaters negotiations, and the Placer County Conservation Plan.

Educational Background and Honors

B.S. Chemistry, Yale University, New Haven, CT
Graduate study in Biology, Stanford University, Stanford, CA
National Science Foundation graduate fellowship

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Biographical Sketches

GlobalTox, Inc.

Robert Clark, Ph.D.

Robert Clark is a Principal and founding member of GT Engineering. For over 25 years he h had a broad career in research, industry, and consulting. His specialty is the investigation ar determination of cause for degradation and failure in materials. This has included extensive involving metals, plastics and polymers, glasses and ceramics. He has led international rese involving materials degradation in power plants. For the last 15 years he has had a nationwi consulting practice for insurance firms, manufacturers and industry, legal offices and govern agencies dealing with failure analysis of materials. Dr. Clark has testified in cases across the United States as a Court qualified expert in materials science, mechanical engineering, metallurgy, corrosion and accident reconstruction.

Typical failure analysis projects have involved failures in engineered plastic or polymeric prc such as molded parts, tubing, woven products and cordage (PVC, CPVC, PP, PE, PEX, AB EPDM, nylon etc.); failures in adhesives; failures in ferrous and non-ferrous metals, for exan storage tanks, power grid structures, steam generators, piping systems, marine components turbines, petrochemical plants; failures in glass and ceramics, e.g. corrosion of window light fracture origin in containers.

Dr. Clark holds a bachelors of science degree in Metallurgy, a masters of science degree in Materials Science and Engineering, and Ph.D. in Materials Science and Engineering with a Metallurgy specialization and a minor in Mechanical Engineering, all from the University of California at Berkeley. He previously managed the Corrosion Research and Engineering Se at Battelle Pacific Northwest Laboratories and served as a consultant to the U.S. Nuclear Regulatory Commission.

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CALIFORNIA
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CODE CHANGE SUBMITTALS FOR 2004 ANNUAL CODE ADOPTION CYCLE

SUGGESTED REVISIONS TO THE CALIFORNIA BUILDING STANDARDS CODE TITLE 24

VOLUME III OF IV

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May 2005

ITEM 16-5 AS SUBMITTED

Adopt the following articles for Chapter 6 of the 2003 UPC:

(UPC standards adopted by the Commission are applicable to all occupancies in California.)

CHAPTER 6
WATER SUPPLY AND DISTRIBUTION
MATRIX ADOPTION TABLE

Adopting Agency	BSC	COMMENTS
Repeal entire 2000 UPC Chapter 6 and Adopt entire 2003 UPC Chapter without amendments		
Repeal entire 2000 UPC Chapter 6 and Adopt Entire 2003 UPC Chapter as amended (amended sections listed below)	X	
Adopt Only those sections of the 2003 UPC which are listed below and/or Adopt Only those California promulgated sections listed below		
604.1 exception #2 *CA*	X	
604.11 UPC	†	
604.11.1 UPC	†	
604.11.2 UPC	†	
604.12 UPC	†	
604.13.1 UPC	†	
604.13.2 UPC	†	

This state agency adopts the entire chapter except for those sections indicated by the following symbol: †

ITEM 16-5 – Committee Recommendations

A AA**** **D** FS***

*** The CAC recommended further study for the existing amendments that limit the use of PEX material for occupancies regulated by BSC. **BSC does not concur** with the committee recommendation to further study.

**** A public comment was received and heard during the code advisory meeting from a Mr. Robert Friedlander. Mr. Friedlander recommended approve as amended, with his proposed amendment to remove all BSC amended restrictions for PEX from the new plumbing code. **BSC does not concur** with Mr. Friedlander's recommendation to approve as amended.

Until resolution to the legal actions and appeals processes currently occurs, related to the use of PEX, BSC staff must maintain the existing amendment in chapter 6 of the 2003 UPC.

FURTHER STUDY; APPROVE AS AMENDED

* * *

(END OF ITEM)

minor technical modifications to the existing requirements for clarification and consistency within the code as identified below:

Chapter 1

Section 101.17

The Office of Statewide Health Planning and Development promulgates and enforces regulations for hospitals and skilled nursing facilities (SNFs) in California. Historically, the California Building Code has included different requirements for hospital-based skilled nursing units than it has for freestanding SNFs on a hospital license and for separately licensed SNFs.

Section 72103, Title 22, CCR, defines "skilled nursing facility" as "a health facility or a distinct part of a hospital which provides continuous skilled nursing care and supportive care to patients whose primary need is for availability of skilled nursing care on an extended basis." This definition makes no distinction between skilled nursing services that are provided as a distinct part unit in an acute care hospital, as a distinct part in a freestanding building on the hospital license, or a freestanding separately licensed SNF. Therefore, the regulations that apply to skilled nursing services should be the same, regardless of the type of facility in which the services are provided.

The purpose for this change is to make the regulations for skilled nursing facilities the same, whether the facility is a freestanding separately licensed SNF, a freestanding SNF building on a hospital license, or a distinct part SNF unit in a hospital building.

Chapter 4

The 2000 UPC, Section 402.5 language has been changed in the 2003 UPC and Section 402.7 has been omitted in the 2003 UPC, therefore, the corresponding OSHPD amendments are being repealed.

The Plumbing, Electrical, Mechanical and Energy Code Advisory Committee recommended not adopting Table 4-1, and instead to consider referencing or adopting Uniform Building Code Appendix Table 29. OSHPD does not agree with this recommendation, and requests that the item be APPROVAL AS SUBMITTED.

The Office of Statewide Health Planning and Development amends CPC Table 4-1 for application to health facilities. There would be little, if any difference in the fixture requirements applicable to hospitals, skilled nursing facilities, licensed clinics and correctional treatment centers using either of the tables. For other uses, CBC Appendix Table 29 appears to be less restrictive.

OSHPD has determined that switching to the appendix table in the Building Code would require far more time and study than is available in this code cycle, and therefore would not be possible. The Office is willing to meet with our constituents and interested parties to discuss the possibility and ramifications of proposing the adoption of a different table for determining plumbing fixture counts for submittal in a future code cycle.

Table 4-2 is being amended to add Footnote 22. Some hospitals desire a lavatory located directly in the patient rooms so that nursing staff do not have to walk back to the nurses' station handwashing fixture to wash after performing certain tasks. These patient room lavatory fixtures are "bonus fixtures" not required by code. However, when these fixtures are provided, they must meet the same functional requirements as the required handwashing fixture at the nurse station to prevent nursing staff from spreading infections to patients. Specifically, the faucets for these lavatories cannot have conventional lever or handle controls, but must be the type of controls not requiring direct contact of the hands for operation.

This modification will require lavatories located directly in patient rooms have hands-free type controls and a gooseneck faucet as is currently required for handwashing fixtures. This will ensure that "bonus fixtures" which exceed the minimum number required by code will not increase hospital patient infection rates and compromise patient healthcare.

Chapter 5

Section 508.2 is being amended to eliminate seismic category references of model code to avoid conflict with seismic categories used in Title 24.

Chapter 6

The Plumbing, Electrical, Mechanical and Energy Code Advisory Committee recommended further study on this item. OSHPD does not agree with this recommendation, and requests APPROVAL AS SUBMITTED, based on public safety and environmental concerns with the use of this material.

Studies have demonstrated that PEX material is susceptible to chemical leaching, both from the outside environment and chemicals leaching out of the PEX material itself. The layer of aluminum in the PEX-AL-PEX piping may or may not mitigate some of the chemical leaching from the outside environment, but there is no reason to believe that it will have any effect on the leaching from the material itself. As a result of litigation, one PEX manufacturer has disclosed that the material does have chemical leaching problems including MTBE (methyl tertiary butyl ether, a known human carcinogen) and TBA (tertiary butyl alcohol), which are by-products of the manufacturing process.

The manufacturers association's Installation Handbook for PEX indicates several limitations on the use of the product. It is unknown whether these limitations are still applicable with the use of PEX-AL-PEX. These limitations include applications where the water temperature could exceed 180° F. Current code requirements include 180° F water for rinse water at automatic dishwashing equipment and 160° F water for laundry, maintained over the entire wash and rinse period. In order to supply this water temperature at the fixture, it will be necessary to provide hotter water at the source.

Another limitation is not to allow extended contact with a number of "commonly encountered construction materials." One type of material listed is "fire wall penetration sealing compounds," which are used extensively in hospitals and skilled nursing facilities. The Handbook provides an exception for "water soluble, gypsum-based caulking," but this would be difficult to enforce. Materials may be changed from what is approved on the drawings, and there is an enormous variety of construction materials used on hospital projects. Requiring field staff to know the chemical composition of all the materials, and adverse interactions with chemicals found in other materials is not a reasonable expectation.

PEX-AL-PEX is a new material in the 2003 Uniform Plumbing Code. OSHPD is charged with the promulgation of regulations to protect the health and safety of the occupants of hospitals, skilled nursing facilities, licensed clinics and correctional treatment centers. We must be conservative in the adoption of regulations, considering the vulnerable users of these facilities. Additional research and testing must be performed to demonstrate the safety and reliability of this new material before it can be accepted for use in health facilities.

Chapter 8
The 2003 UPC is consistent with 2003 Uniform Mechanical Code regarding the condensate drain sizing. Therefore, OSHPD amendment Section 815.2.1 is no longer necessary and is being repealed.

Chapter 10
Due to use of new language in 2003 Uniform Plumbing Code, OSHPD is modifying the language used in OSHPD amendment Section1014.1 to be consistent with the model code.

Chapter 13
Due to renumbering of the Sections in Chapter 13, 2003 Uniform Plumbing Code, OSHPD amendment regarding not adopting the Chapter 13 and adoption of NFPA 99, 2002 is being moved to Section 1301.2.

TECHNICAL, THEORETICAL, AND EMPIRICAL STUDY, REPORT, OR SIMILAR DOCUMENTS:

There are no documents to identify.

CONSIDERATION OF REASONALBLE ALTERNATIVES

There are no alternatives to be considered by OSHPD.

REASONABLE ALTERNATIVES THE AGENCY HAS IDENTIFIED THAT WOULD LESSEN ANY ADVERSE IMPACT ON SMALL BUSINESS.

This proposal will not impose an adverse economic impact on small businesses.

FACTS, EVIDENCE, DOCUMENTS, TESTIMONY, OR OTHER EVIDENCE OF NO SIGNIFICANT ADVERSE IMPACT ON BUSINESS.

This proposal will not impose an adverse impact on businesses.

one-third (1/3) of its vertical dimensions. At the lower point, a minimum distance of four (4) inches (102 mm) shall be maintained above the controls with the strapping.

Notation

Authority: Education Code Sections 17310, 81142; Health & Safety Code Section 16022

Reference(s): Education Code Sections 17280 - 17317, and 81130 - 81149; Health & Safety Code Sections 16000 - 16023

ITEM 19-4 – Committee Recommendations

A AA D FS

APPROVED AS RESUBMITTED

* * *

(END OF ITEM)

ITEM 19-5 AS RESUBMITTED

CHAPTER 6 - Water Supply and Distribution

Model Code Adoption/Repeal: Repeal entire 2000 edition UPC Chapter 6 (Water Supply and Distribution), and adopt entire 2003 edition UPC Chapter 6 as amended (amended sections listed below).

604.0 Materials

604.1 Water distribution pipe, building supply water pipe, and fittings shall be of brass, copper, cast iron, CPVC, galvanized malleable iron, galvanized wrought iron, galvanized steel, PEX, or other approved materials. Asbestos-cement, PE, PVC, PEX-AL-PEX, or PE-AL-PE water pipe manufactured to recognized standards may be used for cold water building supply distribution systems outside a building. PEX-AL-PEX water pipe, tubing, and fittings manufactured to recognized standards may be used for hot and cold water distribution systems within a building. PE-AL-PE water pipe and fittings may be used for cold water distribution systems within a building. All materials used in the water supply system, except valves and similar devices, shall be of a like material, except where otherwise approved by the Authority having Jurisdiction.

[For DSA-SS] Exception: Use of PEX piping is not adopted for applications under the authority of the Division of the State Architect-Structural Safety.

604.11 PEX. ***[Not adopted by DSA-SS]*** Cross-linked polyethylene (PEX) tubing shall be marked with the appropriate standard designation(s) listed in Table 14-1 for which the tubing has been approved. PEX tubing shall be installed in compliance with the provisions of this section.

604.11.1 PEX Fittings. ***[Not adopted by DSA-SS]*** Metal insert fittings, metal compression fittings, and cold expansion fittings used with PEX tubing shall be manufactured to and marked in accordance with the standards for the fittings in Table 14-1.

604.11.2 Water Heater Connections. ***[Not adopted by DSA-SS]*** PEX tubing shall not be installed within the first eighteen (18) inches (457mm) of the piping connected to a water heater.

Notation

Authority: Education Code Sections 17310, 81142; Health & Safety Code Section 16022

Reference(s): Education Code Sections 17280 - 17317, and 81130 - 81149; Health & Safety Code Sections 16000 - 16023

606.2.4 PVC Pipe

606.2.4.1 [For DSA-SS] *Joints in PVC pipe shall be made as provided in Section 316.1.6, U.P.C.*

609.11 [For DSA-SS] *Refer to Title 24, Part 2 of the California Building Code for seismic anchorage and bracing requirements and accommodations for building displacements.*

Notation

Authority: Education Code Sections 17310, 81142; Health & Safety Code Section 16022

Potable water supplies to fire protection systems that are not normally under pressure shall be protected from backflow and shall meet the requirements of the appropriate standard(s) referenced in Table 14-1.

603.4.18.2 ***[Not adopted by HCD]*** Where fire protection systems supplied from a potable water system include a fire department (□iamese) connection which is located less than seventeen hundred (1700) feet (518.2 m) from a non-potable water source that could be used by the fire department as a secondary water supply, the potable water supply shall be protected by one of the following:
(1) Reduced pressure backflow preventor
(2) Reduced pressure detector assembly

Note: Non-potable water sources include fire department vehicles carrying water of questionable quality or water that is treated with antifreeze, corrosion inhibitors, or extinguishing agents

603.4.18.3 ***[Not adopted by HCD]*** Where antifreeze, corrosion inhibitors, or other chemicals are added to a fire protection system supplied from a potable water supply, the potable water system shall be protected by one of the following:
(1) Reduced pressure backflow preventor
(2) Reduced pressure detector assembly

603.4.18.4 ***[Not adopted by HCD]*** Whenever a backflow device is installed in the potable water supply to a fire protection system, the hydraulic design of the system shall account for the pressure drop through the backflow device. If such devices are retrofitted for an existing fire protection system, the hydraulics of the sprinkler system design shall be checked to verify that there will be sufficient water pressure available for satisfactory operation of the fire sprinklers.

603.4.18.5 ***[Not adopted by HCD]*** **Residential Sprinkler Systems.** When residential sprinkler systems are installed using the potable water system they shall be installed in accordance with the standards listed in Table 14-1.

ITEM 20-23 – Committee Recommendations

(A) AA D FS

APPROVED AS SUBMITTED

* * *

(END OF ITEM)

ITEM 20-24 AS RESUBMITTED

604.0 Materials

604.1 ~~***[Not adopted by HCD]***~~ Water distribution pipe, building supply water pipe and fittings shall be of brass, copper, cast iron, CPVC, galvanized malleable iron, galvanized wrought iron, galvanized steel, PEX, or other approved materials. Asbestos-cement, PE, PVC, or PEX-AL-PEX, or PE-AL-PE water pipe manufactured to recognized standards may be used for cold water building supply distribution systems outside a building. PEX-AL-PEX water pipe, tubing, and fittings, manufactured to recognized standards may be used for hot and cold water distribution systems within a building. PE-AL-PE water piping and fittings may be used for cold water distribution systems within a building. All materials used in the water supply system, except valves and similar devices shall be of a like material, except where otherwise approved by the Authority Having Jurisdiction ***[For HCD 1 & HCD 2]*** *Enforcing Agency*.

~~***604.1.1 [For HCD 1 & HCD 2]*** *Water distribution pipe, building supply water pipe and fittings shall be of brass, copper, cast iron, galvanized malleable iron, galvanized wrought iron, galvanized steel, or other approved materials. Asbestos-cement, CPVC, PE or PVC, water pipe manufactured to recognized standards may be used for cold water distribution systems outside a building except as provided for CPVC use pursuant to section 604.1.2. All materials used in the water supply system, except valves and similar devices shall be of a like material, except where other wise approved by the Administrative Authority.~~

Section 604.1.12 [For HCD 1] *Local Authority to Approved CPVC Pipe Within Residential Buildings Under Specified Conditions.*

The local responsible building official of any city or county~~, in accordance with the procedures set forth in Chapter 3 (with the exception of section 301.2.7) may authorize by~~ is authorized to issue a permit for the use of CPVC for hot and coldwater distribution systems within the interior of residential buildings provided all of the following conditions are satisfied:

~~***(a) Finding Required.*** *The building official shall first make a determination that there is or will be the premature failure of metallic pipe if installed in such residential buildings due to existing water or soil conditions.~~
(a)~~(b) Permit Conditions. *Any building permit issued pursuant to ~~this~~ section 604.1 shall be conditioned on compliance with the mitigation measures set forth in this subsection.*

(b)~~(c) Approved Materials. *Only CPVC plumbing material listed as an approved material in, and installed in accordance with this code may be used.*

*(c)~~(d)~~ **Installation and Use.** Any installation and use of CPVC plumbing material pursuant to this section shall comply with all applicable requirements of this code and Section 301.0 of Appendix I of this code, Installation Standard for CPVC Solvent Cemented Hot and Cold Water Distributions Systems, IAPMO ~~IS 20-98~~ IS 20-2000.*

*(d)~~(e)~~ **Certification of Compliance.** Prior to issuing a building permit pursuant to this section, the building official shall require as part of the permitting process that the contractor, or the appropriate plumbing subcontractors, provide written certification: (1) that is required in subdivision (e)~~(f)~~; and (2) that he or she will comply with the flushing procedures and worker safety measures set forth in Section 301.0 of Appendix I of this code, Installation Standard for CPVC Solvent Cemented Hot and Cold Water Distribution Systems IAPMO ~~IS 20-98~~ IS 20-2000.*

*(e)~~(f)~~ **Worker Safety.** Any contractor applying for a building permit that includes the use of CPVC plumbing materials authorized pursuant to this section shall include in the permit application a signed written certification stating that:*
(1) They are aware of the health and safety hazards associated with CPVC plumbing installations.
(2) They have included in their Illness and Injury Prevention Plan the hazards associated with CPVC plumbing pipe installations; and
(3) The worker safety training elements of their Injury and Illness Prevention Plan meets the Department of Industrial Relation's guidelines.

*(f)~~(g)~~ **Findings of Compliance.** The building official shall not give final permit approval of any CPVC plumbing materials installed pursuant to ~~this~~ section 604.1 unless he or she finds that the material has been installed in compliance with the requirements of this code and that the installer has complied with the requirements in section 301.0.1, of Appendix I of this code, Installation Standards for CPVC Solvent Cemented Hot and Cold Water Distribution Systems, IAPMO ~~IS 20-98~~ IS 20-2000.*

*(g)~~(h)~~ **Penalties.** Any contractor or subcontractor found to have failed to comply with the ventilation, glove or flushing requirements of section 301.0 of Appendix I of this code, Installation Standards for CPVC Solvent Cemented Hot and Cold Water Distribution Systems, IAPMO ~~IS 20-98~~ IS 20-2000 shall be subject to the penalties in Health and Safety Code, division 13, part 1.5, chapter 6 (section 17995 et seq.). In addition, if during the conduct of any building inspection the building official finds that the ventilation and glove requirements of section 301.0 of Appendix I of this code, Special Requirements for CPVC Installation within Residential Buildings, are being violated, such buildings officials shall cite the contractor or subcontractor for that violation.*

604.11 PEX. Cross-linked polyethylene (PEX) tubing shall be marked with the appropriate standard designation(s) listed in Table 14-1 for which the tubing has been listed or approved. PEX tubing shall be installed in compliance with the provisions of this section.

604.11.1 PEX Fittings. Metal Insert Fittings, metal compression fittings, and cold expansion fittings used with PEX tubing shall be manufactured to and marked in accordance with the standards for the fittings in Table 14-1.

604.11.2 Water Heater Connections. PEX tubing shall not be installed within the first eighteen (18) inches (457mm) or piping connected to a water heater.

604.13 PEX-AL-PEX and PE-AL-PE Crosslinked Polyethylene-Aluminum- Crosslinked Polyethylene (PEX-AL-PEX) and Polyethylene-Aluminum- Polyethylene (PE-AL- PE) composite pipe shall be marked with the appropriate standard designation(s) listed in Table 14-1 for which the piping has been listed or approved. PEX-AL-PEX and PE-AL-PE piping shall be installed in compliance with the provisions of this section.

604.13.1 PEX-AL-PEX and PE-AL-PE Fittings used with PEX-AL-PEX and PE-AL-PE piping shall be manufactured to and marked in accordance with the standard for the fittings in Table 14-1.

604.13.2 Water Heater Connections PEX-AL-PEX or PE-AL-PE tubing shall not be installed within the first eighteen inches (18) (457 mm) of piping connected to a water heater.

606.1.3 *[Not Adopted by HCD]* Mechanically Formed Tee Fittings.
Mechanically extracted collars shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height not less than three (3) times the thickness of the branch tube wall.

The branch tube shall be notched to conform with the inner curve of the run tube and shall have two (2) dimple/depth stops to insure that penetration of the branch tube into the collar is of sufficient depth for brazing and that the branch tube does not obstruct the flow in the main line tube. Dimple/depth stops shall be in line with the run of the tube. The second dimple shall be one quarter (1/4) inch (6.35 mm) above the first and shall serve as a visual point of inspection.

All joints shall be brazed in accordance with Section 316.1.7. Soft soldered joints shall not be allowed.

606.2.1 *[Not Adopted by HCD]* Copper Water Tube. Joints in copper tubing shall be made by the appropriate use of approved fittings properly soldered or brazed together as provided in Section 316.1.3 or Section 316.1.7 or by means of approved flared or compression fittings in Section 606.1.1 or 606.1.3. Solder and soldering flux shall conform to the requirements of Section 316.1.3. ~~*[The following sentence is not adopted by HCD]*~~ Mechanically formed tee fittings shall be made by brazing only and shall conform to the requirements of Section 316.1.7.

***606.2.1.1[For HCD 1 & HCD 2] Copper Water Tube.** Joints in copper tubing shall be made by the appropriate use of approved fittings properly soldered or brazed together as provided in Section 316.1.3 or Section 316.1.7 or by means of approved flared or compression fittings in Section 606.1.1 or 606.1.2. Solder and soldering flux shall conform to the requirements of Section 316.1.3.*

Section: **604.1.1**

The Department proposes to not adopt the above-listed, **California amendment**. The Department is proposing the adoption of UPC Section 604.1 which includes PEX as an approved material. PEX was not proposed for adoption in the 2001 CPC because the Department determined at that time that it did not have sufficient time to evaluate all of the consequences of the use of the material, including environmental factors, due to the time constraints imposed in the previous triennial code adoption process. Since the adoption of the 2001 CPC by the California Building Standards Commission, the Department finalized the review of this product and has determined that there was no basis in the record to exclude this IAMPO approved material. The non-adoption of this amendment will remove a conflict between Section 604.1 and 604.1.1 regarding the use of PEX as an approved material for use in California.

Section: **604.1.2**

The Department proposes to continue the adoption of the above-listed, existing **California amendment** with modifications. The modified text, within the banner, provides consistency in the format of the CPC. Section 604.1.2 is being renumbered as 604.1.1 as a result of the non-adoption of the existing 604.1.1 (see above). Language within this section and subsections (a) through (e) concerning the permitting of CPVC pipe that is duplicative to requirements already in code or statute, such as the requirement to meet the provisions of Chapter 3 and the penalties of Health and Safety Code division 13, part 1.5, chapter 6, have been removed.

Other modifications in the text correct the reference from *"IAPMO IS 20-98" to "IAPMO IS 20-2000."* This change provides a reference to the most recent edition of this standard. These modifications provide clarity for the code user and consistency in format.

Sections: **604.11** **604.11.1** **604.11.2**
604.13 **604.13.1** **604.13.2**

The Department is proposing to adopt the above-listed **model code** sections, without modification.

Sections: **606.2.1** **Model Code**
606.2.1.1 CA

The Department proposes to adopt the above-listed, new **California amendment**, and to not adopt section 606.2.1, the corresponding **model code** section. A banner is added to section 606.2.1 indicating that the section is "not adopted by HCD".

The change in section reference, and text in the proposed amendment, is necessary to provide clarity for the code user. The amendment has no regulatory effect.

FIGURE: **6-1**

The Department proposes to add Figure 6-1 for adoption. The added figure will provide consistency with Title 22 regulations and will provide clarity for the user. The symbol displayed in the figure will provide direction to the user regarding amended sections 601.2.2, 601.2.3, and 604.12.

TABLE 6-4.

The Department proposes to not adopt "Mobile Home, each (minimum)", in **UPC Table** 6-4. The provision is proposed for the non-adoption as it is not a building standard and conflicts with existing regulations contained in the CCR, Title 25, Chapter 2 (Mobilehome Parks) and CCR Title 25, Chapter 3 (Manufactured Housing). This is not a change to the existing amendment.

CHAPTER 7. SANITARY DRAINAGE

The Department proposes the adoption of the 2003 UPC, Chapter 7, with the **California amendments** indicated below, and on the attached matrix table.

Section: **701.1.2.2**

The Department proposes to continue the adoption of the above-listed, existing **California amendment**, with modifications. The modification to the text is consistent with the Department's interpretation of prior code language. The language provides clarity and specificity for the code user, and has no regulatory effect.

Draft EIR
Ignores Public Health Dangers and Environmental Hazards of Plastic Pipe

Comments Submitted by
the California Pipe Trades Council
November 13, 1989

Thomas R. Adams
Ann Broadwell
Daniel L. Cardozo
Chris R. Redburn

Adams & Broadwell

Draft EIR
Ignores Public Health Dangers and Environmental Hazards of Plastic Pipe

Comments Submitted by the California Pipe Trades Council
November 13, 1989

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I. SUMMARY OF COMMENTS

The deficiencies in the Draft Environmental Impact Report ("DEIR") issued by the Department of Housing and Community Development ("HCD") on the proposed expanded use of plastic plumbing pipe are of a magnitude and scope that are startling and unprecedented for a project of this significance. HCD is proposing to approve the use of plastic pipe to carrying drinking water and for drain-waste-vent ("DWV") in all residential, commercial and industrial buildings in California. Plastic pipe is currently prohibited for potable water use inside buildings, and DWV uses are highly restricted because of the fire danger presented by combustible piping.

Despite the fact that the proposed project would subject millions of Californians to toxic and cancer-causing chemicals leaching from plastic plumbing systems, the DEIR dismisses any concern with the use of plastic pipe in a simplistic and superficial report. It ignores the substantial evidence showing that the widespread use of plastic pipe would have serious impacts on drinking water quality, worker health and fire-safety, and devotes almost as much attention to metal pipes, which have been used safely for hundreds of years. Perhaps even more troubling is the DEIR's failure to consider at all a wide range of issues, including the mounting evidence of plastic pipe breaks and leaks, causing millions of dollars in damages and enormous heartache to homeowners across the nation. No objective reader could view this DEIR as a good faith attempt to study the public health and safety dangers of expanded plastic pipe use.

The California Environmental Quality Act ("CEQA") requires the preparation of an environmental impact report ("EIR") in order to fully inform the public and government decision-makers of the potential environmental and public health hazards associated with a proposed project. In this case, however, the DEIR reads like a report intended to advocate the use of plastic pipe, dismissing all evidence of public health and safety effects, often in conclusory fashion or by relying on Plastics Industry reports. This lack of objectivity and balanced analysis misleads the public and government decision-makers and subverts the fundamental policy objectives of CEQA.

This is not the first time a new building material has been proposed for approval based on Industry claims of safety. Asbestos was installed in schools and other buildings throughout the country as a fireproofing and insulation material based on claims by asbestos manufacturers that the material was safe. The tragic history of asbestos should not be repeated here -- the installation of plastic plumbing in California homes, offices and factories should not be allowed until a full and complete study of the potential health and safety effects of that action has been conducted.

In an effort to facilitate a thorough consideration of the potential impacts of plastic pipe use, the California Pipe Trades Council submits these comments on the DEIR. The sweeping deficiencies of the DEIR have required an extraordinary effort to identify both the inadequacies in the analysis presented, as well as a discussion of a number of profoundly important issues that are not considered at all by the DEIR. A separately bound document of appendices containing technical comments and reports as well as reference documents is also presented as comment on the DEIR.

A. The DEIR's Project Description is Too Narrow

The DEIR does not meet the standards for environmental review established by CEQA. It misleads the public and fails to consider significant environmental impacts from the expanded uses of plastic pipe due to an overly narrow definition of the project under consideration. An accurate and complete project description is the cornerstone of an adequate EIR. (*County of Inyo v. City of Los Angeles* (1977) 71 Cal.App.3d 185 [139 Cal.Rptr. 396].)

On the basis of only a few samples of plastic pipe, the DEIR concludes that the entire range of generic pipe known as "CPVC" and "PB" are safe. The DEIR fails to consider:

- the ever-changing manufacturing and formulation processes of pipe, pipe fittings and the solvents, primers and glues used to join the pipe. These processes constantly introduce new chemicals, contaminants and other substances into the pipe and ultimately into the drinking water flowing through it. New

formulations will also expose plumbers to new substances that are toxic or with unknown health effects.

- the mechanical properties of plastic pipe, particularly as they affect the likelihood of mechanical failure. The DEIR implies that PB pipe will be the principal new type of pipe used for hot and cold drinking water applications when in fact PB pipe has suffered so many catastrophic mechanical failures that it has been banned IAPMO for all plumbing systems governed by the UPC. The potential for mechanical failure is a complex problem related to the nature of the pipe material as well as quality control in its manufacture. The implications of mechanical failure in terms of environmental hazard, property damage and economic cost to consumer are critical to an understanding of the full implications of expanded uses of plastic pipe.

- the impact of plastic pipe on non-residential construction. According to recent amendments to state law, the UPC provisions as proposed by HCD will apply to all occupancies. Therefore, the proposed action will permit plastic pipe in all residential, commercial, office and industrial buildings. However, the DEIR did not consider the drinking water, worker health or fire-safety impacts of plastic pipe installations in non-residential buildings.

B. The DEIR Underestimates Impacts on Drinking Water Contamination, Worker Health and Fire Safety

CEQA requires an EIR to contain a balanced, specific and detailed analysis of impacts. (*Whitman v. Board of Supervisors* (1979) 88 Cal.App.3d 397 [151 Cal.Rptr. 866].) In this case, the DEIR presents an incomplete, superficial and biased analysis that significantly understates the magnitude and scope of potential impacts.

1. Plastic Pipe and Joining Materials Will Leach Toxic and Cancer-Causing Chemicals into Drinking Water

The DEIR does not adequately analyze the effect on drinking water quality of plastic pipe because it relies almost exclusively on two narrow studies, one of which is a product of the Vinyl Institute ("Butter"). It ignores a number of earlier studies which provide a more complete context from which to interpret the Cooper and Vinyl Institute studies. A careful review of the Cooper and Butter reports shows that the DEIR did not even fully present those study results, but selected for discussion only those portions which appear to minimize the levels of chloroform in water in contact with CPVC pipe.

The DEIR fails to acknowledge the limitations of the Cooper and Butter studies, or discuss problems with the study protocols. The DEIR also fails to address the lack of consistency between the studies in evaluating the effects of residual chlorine in the water supply, or the fact that the labs did not test a representative sample of available pipe materials. In addition, the Vinyl Institute test of chloroform formation from CPVC pipe cement and showing low levels of chloroform, was performed on unusually cold water. The DEIR failed to report a much higher and consistent level of chloroform in a subsequent test run on 80 degree fahrenheit water containing no residual chlorine. The levels of chloroform leached into drinking water from PVC and CPVC pipe are in violation of Proposition 65, the Safe Drinking Water and Toxic Enforcement Act of 1986.

The DEIR erroneously suggests that private consensual groups like the International Association of Plumbing and Mechanical Officials ("IAPMO"), the National Sanitation Foundation ("NSF") and the American Society for Testing and Materials ("ASTM") will protect the quality of drinking water by regulating plastic pipe. The standards set forth by these organizations do not apply to the chemicals of concern from plastic pipe, solvents and cements. Compliance with these standards is not required and the enforcement of the standards is controlled by the industries the standards are intended to regulate.

The DEIR does not reveal or analyze the potentiating effects of methyl ethyl ketone ("MEK") on the cancer-causing power of chloroform, which is found in drinking water as a result of chlorination. It does not consider exposure by inhalation or through the skin.

The Draft EIR states that flushing newly-installed plastic pipe is adequate mitigation for chemical leaching. However, its proposed flushing procedure is from 1980 and does not take into account any of the information from leaching studies conducted in conjunction with the DEIR itself. Furthermore, a minimally effective flushing regime would require long periods of time and repetitions that are expensive and virtually impossible for plumbers, contractors, builders or building officials to carry out, monitor or inspect. To comply with CEQA, mitigation measures specified in an EIR must be feasible, effective and capable of being monitored for compliance. (Pub. Resources Code § 21081.6.)

The DEIR acknowledges that chemicals can permeate plastic pipe, but dismisses the danger from chemical permeation. However, there are 160,000 underground storage tanks in California containing hazardous materials, 90% store petroleum and at least 30,000 of those are leaking. Each month, 200 new contaminated sites are discovered. Leakage from automobiles alone can penetrate plastic pipe and contaminate drinking water. The DEIR must address the permeation threat posed by plastic pipe.

2. The DEIR Ignores Substantial Impacts from Plastic Pipe on Worker Health

The DEIR does not include the required worst case analysis of the danger to workers who install plastic pipe. It relies exclusively on a Department of Health Services ("DHS") study done for HCD that focused primarily on "average" rather than worst case exposure conditions. However, even this study found exposures to tetrahydrofuran ("THF") greater than those considered safe. The DEIR ignores the conclusion of the DHS study that overexposures will occur for plumbers working under worst case conditions, and downplays the significance of the actual risks workers will experience. The DEIR also fails to consider the effect of the limitations of the DHS sampling data on interpretation of the study results.

The DEIR relies on standards for exposure which are poorly documented and are too high by a factor of 10. The DEIR indicates that the health effects of long-term exposures to THF and MEK have not been well-studied, but ignores the evidence showing that these substances may cause cancer, and may increase the cancer-causing potential of chloroform by a factor of 30. In light

of this evidence, the high levels of THF associated with dermal exposure and enclosed working conditions should have led the DEIR to conclude that there were significant impacts associated with worker installation of plastic pipe.

The DEIR also fails to consider the impacts of increased plastics production on the health of manufacturing workers, particularly for the carcinogens acrylonitrile, butadiene and styrene, or the risk of upset at plastic and pipe manufacturing plants.

The DEIR selectively reports the results of the worker health studies, leaving out data which indicated that plumber exposure to cements would be excessive, and that animal and human studies of cement mixtures almost universally showed harmful effects. Likewise, the DEIR neglects to mention that these studies concluded that many of the provisions the DEIR itself suggests to protect workers from solvent and cement exposures were unworkable and unenforceable.

3. The DEIR Contains an Inadequate Analysis of Fire-Safety

Unlike metal, plastic burns, promoting fire spread and producing toxic smoke. These critical differences between metal and plastic have significant implications for buildings of all kinds. The DEIR does not adequately analyze these implications. The DEIR uses imprecise terminology where terminology has specific legal meaning, and is thus confusing and ambiguous as to whether the project will deviate from the UPC's restriction of plastic pipe to combustible construction. The DEIR fails to analyze the impacts of using plastic in all fire-rated buildings, including high-rise structures where fires are more likely to result in catastrophic loss of life.

The DEIR does not explain that additional approval by the State Fire Marshall will be required before plastic can be used in non-combustible, fire-rated buildings. It does not reveal that fire-stopping mechanisms in renovation or retrofit jobs have not been tested, and it underestimates the portion of residential construction requiring fire-resistive protections.

The mitigation measures proposed to reduce the fire hazard of plastic pipe suggest that performance standards and construction assemblies can be approved on an ad hoc basis by individual local building officials. Local building officials

do not have the expertise for this type of approval; the mitigation is also contrary to earlier recommendations by SRI that performance standards and construction methods must be regulated through the Uniform Building Code ("UBC") issued by the International Conference of Building Officials ("ICBO"). The current UBC contains no standards or approved construction methods for installation of plastic pipe in fire-resistive construction. No tested assemblies suitable for use with plastic pipe have been accepted by ICBO. The DEIR, as written, misleads the reader into believing that proven fire-resistive assemblies are readily available and have code approval.

C. The Draft EIR Fails to Consider Other Significant Environmental Issues

The Draft EIR is inadequate in its coverage of impacts on air quality, solid waste disposal and ecological effects of expanded plastic plumbing pipe in California. Since PB pipe applications are being disallowed by the International Association of Plumbing and Mechanical Officials ("IAPMO"), CPVC pipe would be the main type of pipe slated for expanded use by the proposed action. Expanded use of ABS DWV will aggravate air quality, water quality and noise impacts.

Air Quality: The solvent cements and primers used in manufacture and installation of CPVC contain organic solvents which contribute to photochemical oxidant formation, and the effects of increased emissions of these substances on air district rules and attainment of air quality standards must be included in an adequate EIR. Similarly, the EIR must address the impacts of the increased use of ozone-depleting substances.

Solid Waste Disposal: Most plastic materials are not biodegradable or degrade very slowly. Plastics already account for 25% of the volume of municipal solid wastes and solid waste disposal capacity is an increasing problem. Since plastic pipe is much and difficult more to recycle than copper pipe, the EIR must address the implications of an increased contribution to plastics in the waste stream.

Ecological Effects: The proposed project could result in the use of nearly 27 million pounds of ABS, 12 million pounds of CPVC and 1.5 million pounds of cement and primer statewide, each year. Yet the DEIR cavalierly dismisses

the potential impacts of such use on surface waters and ecological systems. The carcinogens (e.g., chloroform, styrene, and acrylonitrile) that can leach from these plastic pipe can produce harmful effects at very low concentrations and should not be dismissed as insignificant. Cumulatively, the amount of solvents entering sewage treatment systems may exceed the levels permitted by wastewater treatment authorities.

Noise: The lighter weight and rigid joints of ABS DWV systems transmit more water noise. The expanded use of ABS DWV in multiforming structures could adversely increase interior noise levels.

D. The DEIR Discussion of Economic Effects Is Inaccurate

The DEIR shows negligible cost savings with the use of PB pipe, which may not be relevant since PB pipe will be banned by the UPC because of its record of mechanical failures and will probably not be selected to replace copper should the code changes be approved. The economic analysis of pipe systems presented here shows that initial installation of PVC pipe in a dwelling is about $200 more than copper pipe; CPVC (which must be used for hot water) is about $900 more. Taking into account the 20-year service life of plastic pipe versus the 30+ year life of metal, as well as the costs of flushing, ventilation and inspection, the overall life-cycle cost of a CPVC system is over $3000 more than metal. The DEIR also falsely assumes that any cost savings in the plumbing system would be passed on to the consumer.

E. The DEIR Fails to Assess Significant Impacts, Cumulative Impacts, Irreversible Impacts, and Alternative Projects

The DEIR is required to identify potentially significant environmental impacts resulting from implementation of the proposed project. It fails to do so. The evidence the DEIR should have incorporated strongly indicates that leaching of chemicals into drinking water, worker exposure to solvent cements, increased fire hazards and air quality impacts are significant impacts. Impacts on solid waste disposal, water quality and noise in multi-family residences may be significant; however, the DEIR does not adequately address these issues.

Where significant effects have been identified, CEQA requires that the lead agency impose mitigation measures, or if infeasible, must make findings of

overriding considerations. In the case of plastic pipe, the suggested mitigation measures are infeasible, and with no economic advantage to plastic pipe, there are no possible findings of overriding consideration.

The DEIR does not analyze the cumulative impacts of the project. The DEIR avoids the implications of the use of 16.8 million pounds of plastics per year in new construction in California. The DEIR fails to discuss the cumulative effects of discharge into the environment of water passing through plastic water pipe systems. It does not analyze the incremental effect of adding pollutants to already polluted water and air.

The DEIR explicitly states that it will consider the effects of various chemicals to be additive only, and ignores synergistic and potentiation effects, particularly with regard to cancer promotion. It ignores the potential 30-fold increase in the carcinogenic effects of chloroform caused by simultaneous exposure to MEK. The DEIR does not mention the cumulative effect on public health risk of chloroform leached from CPVC combined with background levels in drinking water of 10 to 90 ppb. It ignores the effect of the project on petroleum supplies, a non-renewable resource.

The alternatives analysis in this DEIR is glaringly deficient. The alternatives are poorly defined, their application to real plumbing systems is unclear, and no real analysis is given of their impacts. In addition, the range of alternatives considered is artificially small. Other alternatives which should have been examined in detail in the EIR include the obvious "no use of PB pipe," and a ban on <u>all</u> plastic pipe (including the existing PVC and ABS applications).

The DEIR contains inadequate consideration of the significant irreversible changes brought about by the proposed action. These include the effects of carcinogens in drinking water, long-term health risks to plastics workers and plumbers, long-term fire safety risks to the public and the property damage and economic effects of mechanical failure of plastic plumbing.

The DEIR does not identify the environmentally superior alternative as required by CEQA. The DEIR states that ". . . the potential for harmful effects from copper leached from metal pipe into drinking water is virtually nonexistent for humans." (DEIR, p. 55.) In view of the fact that there is no health risk associated with metal pipe, (the risk of lead toxicity has been virtually eliminated

by current law) the DEIR should have concluded that the No Project Alternative -- no expanded use of plastic plumbing pipe -- is environmentally superior.

In view of the fact that all types of plastic pipe have been shown to be more expensive than metal pipe once life cycle cost and replacement cost are considered, there is no economic advantage to offset the increased risks associated with the expanded use of plastic pipe. If there is no economic advantage, then exposing the public and workers to any increased risk is completely unjustified.

II. DEIR MISLEADS THE PUBLIC AND FAILS TO ADEQUATELY CONSIDER POTENTIAL IMPACTS DUE TO AN INACCURATE AND OVERLY NARROW PROJECT DEFINITION

The definition of the project under review in an EIR is critically important since it informs the public and government decision-makers of the nature of the proposed activity and determines the scope and content of the analysis that follows. An inaccurate or incomplete project description undermines the public informational objectives of CEQA, and can lead to an underestimation of project impacts and an incorrect identification of alternatives and mitigation measures. In this case, the DEIR's description of the proposed activity is ambiguous, inaccurate and incomplete. This fundamentally flawed project definition misleads the public and official decision-makers regarding the true nature and scope of potential impacts, and results in an inadequate environmental assessment. The DEIR's narrow view of the project also results in a number of potentially significant impacts being excluded entirely from the analysis.

A. An Accurate and Complete Project Definition is the Sine Qua Non of a Legally Sufficient EIR

The significance of the DEIR's inadequate project definition is clear from the case law. The courts have declared that "[a]n accurate, stable and finite project description is the sine qua non of an informative and legally sufficient EIR." (*County of Inyo v. City of Los Angeles* (1977) 71 Cal.App. 3d 185, 193, [139 Cal.Rptr. 396, 401]; see also *City of Santee v. County of San Diego* (October 26, 1989, D007991) _____ Cal.App.3d ____ [89 C.D.O.S. 8002, 8006],

Rural Land Owners Association v. Lodi City Council (1983) 143 Cal.App.3d 1013, 1024-1025 [192 Cal.Rptr. 325,332-333] and *Santiago County Water District v. County of Orange* (1981) 118 Cal.App.3d 818, 829-830 [173 Cal.Rptr. 602, 608].)

The CEQA Guidelines also require that a project definition include: "the whole of the action, which has a potential for resulting in a physical change in the environment, directly or ultimately . . . ." (14 C.C.R. § 15037, subd. (a); See *City of Santee v. County of San Diego, supra*, 89 C.D.O.S. 8005 and *Rural Landowners Association v. Lodi City Council, supra*, 192 Cal.Rptr. 325, 332-333.)

The policy behind the requirement for a clear, accurate and complete project definition was cogently stated in *County of Inyo, supra*, 139 Cal.Rptr. 401: "A curtailed or distorted project description may stultify the objectives of the reporting process. Only through an accurate view of the project may affected outsiders and public decision-makers balance the proposal's benefit against its environmental cost, consider mitigation measures, assess the advantage of terminating the proposal (i.e., the 'no project' alternative) and weigh other alternatives in the balance." (See also *City of Santee v. County of San Diego, supra*, C.D.O.S. 8006.)

The project at issue in *County of Inyo* was a proposed increase in groundwater pumping from the Owens Valley aquifer for export to Los Angeles. (*County of Inyo, supra*, 139 Cal.Rptr. 402-403.) The City's EIR, however, initially described the project to include only the pumping of additional groundwater for use on City-owned lands in Inyo and Mono Counties, although later sections of the report considered the groundwater pumping as part of the City's larger water supply system. (*Id.*, pp. 399-400.).

The court concluded that the ambiguous project definition frustrated the public informational goals of CEQA and undermined the ability of the public and government agencies to present meaningful comments on the Draft EIR. The court found that "[t]he incessant shifts among different project descriptions . . . vitiate the City's EIR process as a vehicle for intelligent public participation." (*County of Inyo, supra*, 139 Cal.Rptr. 405.) The court added that "[a] curtailed, enigmatic or unstable project description draws a red herring across the path of public input." (*Ibid.*)

It important to note that the court invalidated the EIR even though it found that the uncertain project definition had not actually undermined the analysis of potential impacts, since the EIR had considered the broader project in evaluating environmental effects. The court concluded that "[t]he elasticity of the project concept does not vitally affect the 'impact' sections of the report." (*County of Inyo, supra*, 139 Cal.Rptr. 404.) Because the EIR had switched to a more expansive definition for purposes of the impact analysis, "the informative quality of the EIR's environmental forecasts is not affected by the ill-conceived, initial project description" (*ibid.*), but the court invalidated the EIR nonetheless because the statement of the project was incomplete.

An even clearer CEQA violation occurs where an inaccurate project definition affects the substantive environmental analysis. An example of such a violation occurred when the Owens Valley water controversy returned to the court four years later in *County of Inyo v. City of Los Angeles* (1981) 124 Cal.App.3d 1 [177 Cal.Rptr. 479]. In that case, the court found that the EIR had not defined the project to include surface water diversions, even though it was clear from the analysis that the increased export of groundwater would require some reliance on surface water for in-valley uses. (*Id.* at 177 Cal.Rptr. 482-483.) The court held that the exclusion of surface water diversions from the project description not only defeated the informational goals of CEQA, but also resulted in an inaccurate assessment of impacts and project alternatives. (*Id.* at 483 - 444.)

In *Santiago County Water District v. County of Orange, supra*, 118 Cal.App.3d 818 [173 Cal.Rptr. 602], the Court considered a challenge to an EIR on a proposed sand and gravel mining operation. Even though it was not disputed that additional water facilities would be required to serve the proposed mine, the project definition did not include construction of water facilities.

The *Santiago* court concluded that the inaccurate project definition rendered the EIR invalid since not all significant environmental effects had been considered. The court noted that "[t]he construction of additional water delivery facilities is undoubtedly one of the significant environmental effects of the project." (*Id.* at 173 Cal.Rptr. 608.) The court also concluded that the exclusion of the water facilities from the project description misled the public and government decision-makers regarding the full scope of the proposal: "Because of this omission, some important ramifications of the proposed project remained

hidden from view at the time the project was being discussed and approved. This frustrates one of the core goals of CEQA." (*Id.* at 173 Cal.Rptr. 602, 698.)

In *Rural Land Owners Association v. Lodi City Council, supra*, 192 Cal.Rptr. 325, the City considered a general plan amendment necessary to allow development on certain agricultural lands within the City's sphere of influence. However, the EIR described the project to include only the general plan amendment, and excluded the proposed annexation and development of the property as unrelated projects. (*Id.* at 192 Cal.Rptr. 330.)

The court held that the City's restricted project definition defeated CEQA's mandate for public disclosure and full consideration of project impacts. (*Rural Land Owners Association v. Lodi City Council, supra*, 143 Cal.App.3d 332-333 [192 Cal.Rptr. 330].) The court declared that "[r]esponsibility for a project cannot be avoided by limiting the title or description of the project." (*Id.* at 192 Cal.Rptr. 331.)

These cases demonstrate that an erroneous project description will render the EIR legally insufficient. In this case, the DEIR's project definition is clearly inaccurate and incomplete. For example, although the DEIR describes the proposed code change as approval of generic kinds of plastic pipe, the impact analysis considers the leaching dangers from only a narrow subset of the pipe and does not address varying pipe formulations. The DEIR's project description also excludes any consideration of the mechanical properties or failure history of plastic pipe. Most remarkably, the project definition excludes entire classes of occupancies that would be affected by the proposed code change and limits the analysis to residential structures.

The project definition is also ambiguous and misleading. For example, the DEIR defines the project to include authorization of plastic pipe in all fire-rated structures, even though the only code language cited restricts plastic pipe use to combustible construction. These deficiencies in the DEIR project definition will be discussed in more detail in the sections that follow.

B. DEIR Fails to Consider the Impacts Resulting from Variation in Plastic Pipe and Fastenings

The DEIR misrepresents the potential environmental and public health impacts of expanded use of plastic pipe and misleads the public and government decision-makers by reporting the impacts of only a narrow subset of plastic pipe, while at the same time defining the project as approval of plastic pipe as a generic, abstract quantity. Within the nominal designations of CPVC, PVC, PB, and ABS, there is wide latitude in composition which will determine how the pipe will affect the environment. The potential impacts of the pipe are dependent on the way in which the plastic resin is made, the way in which it is formed into pipe and fittings, and the way in which the pipe system is assembled.

1. DEIR Ignores the Substantial Evidence of Changing CPVC Formulations

The DEIR fails to address the impact of the diversity of CPVC chemistry. The 1983 ERD acknowledged the existence of different processes (e.g. use of swelling agents), but quickly dismissed the subject by stating that "B.F. Goodrich is the sole U.S. producer." (ERD, pp. III-7 - III-8.) The DEIR explores the subject no further. The DEIR relies heavily on a leaching test conducted by the University of California Sanitary Engineering and Environmental Health Research Laboratory ("SEEHRL"), reported by Cooper, et. al. 1987, yet the DEIR makes no effort to compare the type of CPVC tested by the Cooper study and the range of pipe that may be used in California upon HCD approval.

Chlorinated Polyvinyl Chloride is a generic name for one type of plastic; there are, however, important differences in the chemical composition of CPVC from different sources. CPVC pipe is extruded from resin made by several different manufacturers (both foreign and domestic) who use different manufacturing processes. The characteristics of resins made by different processes and different manufacturers will vary. Similarly, pipes made from these resins will also be of varying composition.

The current desire to minimize the cost of CPVC production will only increase as the market for plastic pipe expands, draws new manufacturers into the market, and heightens competition. In such a situation, cost competitiveness becomes essential and the willingness to incur added expenses diminishes. In the

absence of regulation, this would favor traditional and cheaper methods of CPVC manufacture over "cleaner," but more expensive, methods.

It is certainly true that B.F. Goodrich has struggled long in the United States to expand uses of CPVC and holds most of the modern domestic patents. Even if B.F. Goodrich were to retain its exclusive U.S. market, B.F. Goodrich itself is pursuing new manufacturing technologies. However, if the market for CPVC pipe expands, other manufacturers, with yet different methods, will become suppliers. By ignoring this economic reality, HCD has prepared an EIR that purports to assess CPVC, but in fact examines only one product of one manufacturer.

a. Patent Information Demonstrates That Varying CPVC Formulations Are Being Developed

In the competitive commodity chemical industry, little published information is available on formulation and manufacture of CPVC resins. Perhaps the best indication of the potential variability among different types of CPVC is information publicly disclosed in patents concerning CPVC manufacture. A 1985 patent survey conducted by B.F. Goodrich revealed that " at least 55 companies worldwide hold some 125 patents related to the production of CPVC."[1]

Such patents describe the processes and ingredients used in manufacture of the CPVC resin which is later extruded into pipe. This patent data can be used to gain a better understanding of the sources and extent of variation in CPVC pipe that could be installed in California. It is clear from this information that a variety of formulations are used in the manufacture of CPVC resin.

A 1983 patent assigned to B.F. Goodrich Co. states that "the major portion of CPVC is produced for use in the piping industry."[2] Another 1983 patent assigned to B.F. Goodrich states that "most commercially used CPVC is

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[1] Parker, RG and Martello, GA, "Chemical Modifications: Chlorinated PVC", Encyclopedia of PVC 2nd edition, Marcel Dekker, New York 1985, Chapter 11, page 620.

[2] U.S. Patent No. 4,377,459 to Parker, BF Goodrich Co., March 22, 1983; Column 8, lines 64-65.

produced by the chlorination of an aqueous suspension of PVC such as is described in U.S. Patent No. 2,996,489 . . . ."[3] U.S. Patent No. 2,996,489, also assigned to B.F. Goodrich, describes a process for the chlorination of PVC to produce CPVC. This process specifies the use of a chlorinated hydrocarbon as a swelling agent, with chloroform being "by far the most effective."[4] The wide-spread use of this method is substantiated in U.S. Patent No. 4,377,459 (issued in 1983) which states that the "most preferred (process for the chlorination of PVC) is a process carried out by suspending PVC in water, which PVC is swollen with a lower halogenated hydrocarbon swelling agent," usually chloroform.[5]

Another chlorinated compound, carbon tetrachloride (CCl_4), is important in the manufacture of CPVC resin. Carbon tetrachloride appears as either an additive or a contaminant in CPVC resin. "Much if not all of the CCl_4 is produced by chlorination of $CHCl_3$, one of the commonly used hydrochloromethylenes which are essential swelling agents. Typically, however, some CCl_4 is added to the chlorination reactor in a relatively small amount. . . ."[6]

The $CHCl_3$ and CCl_4 which are present in the resin are also present in pipe extruded from this resin. Analysis of pipe samples themselves can be used to determine residual concentration of chloroform and carbon tetrachloride in the pipe. Such an analysis of pipe samples is reported in "The Diffusion of Chloroform and Carbon Tetrachloride from Rigid PVC Pipe and Rigid CPVC Pipe into Water," by Donald G. Desrosiers and Paula C. Dunnigan, B.F. Goodrich Chemical Group, September 1982:

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[3] U.S. Patent No. 4,373,093 to Olson and Vielhaber, BF Goodrich Co., February 8, 1983; Column 1, lines 19-21.

[4] U.S. Patent No. 2,996,489, *op. cit., supra*; Column 5, line 65.

[5] U.S. Patent No. 4,377,459, *op. cit., supra*; Column 1, lines 17-21.

[6] U.S. Patent No. 4,147,859 to Davis and Boyer, BF Goodrich Co., April 3, 1979; Column 2, lines 1-6.

> PVC and CPVC resins were compounded, using typical pipe and fitting recipes, and then extruded into pipe specimens. The residual levels of $CHCl_3$ and CCl_4 in these various PVC and CPVC pipes were measured." (Emphasis added.)

The following residual concentrations were reported:

	Residual $CHCl_3$ (ppm)	Residual CCl_4 (ppm)
CPVC Pipe	43	18
CPVC Fittings	5.2	24

If these levels are indeed typical, the level of chloroform and carbon tetrachloride in CPVC pipe and fittings is of particular concern, given the carcinogenic potential of these compounds. In the past little attention was paid to ingredients of CPVC pipe, even though these ingredients are capable of leaching into drinking water. The patent which describes the process used to produce "most commercially used CPVC"[7] states that carbon tetrachloride is "an innocuous material easily removed from the polymer."[8]

Despite this statement, carbon tetrachloride is neither "innocuous" nor "easily removed from the polymer." It is also clear that neither carbon tetrachloride nor chloroform are easy to remove from CPVC resin:

> Since $CHCl_3$ and CCl_4 are swelling agents which, under suitable conditions may be diffused out of CPVC, it would not seem too difficult, given enough time, to rid the CPVC of even traces of the contaminants utilizing a stripping agent such as steam which does not react with either the resin or the contaminants. But it is. It is difficult, time-consuming, and uneconomical, to strip essentially all

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[7] U.S. Patent No. 4,373,093 to Olson and Vielhaber, BF Goodrich Co., February 8, 1983; Column 1, lines 19-21.

[8] U.S. Patent No. 2,996,489, *op. cit., supra*; Column 5, lines 54-55.

> $CHCl_3$ with live steam. It is even more difficult, and for practical purposes, impossible to strip essentially all the CCl_4 out of CPVC with live steam because the concentration of CCl_4 appears to level off at about 10 ppm, based on solid resin . . . .[9]
>
> Another author has observed that
>
> . . . it is only with difficulty and expense that essentially all the swelling agent used in these processes can be removed from the CPVC product.[10]

The difficulty of this process results in the occurrence of chloroform and carbon tetrachloride as contaminants in the end-product, CPVC pipe. Methods designed to "strip" the contaminants from the resin are not completely successful: "despite additional, secondary steam stripping, commercially available CPVC typically contains well over 10 ppm each of $CHCl_3$ and CCl_4." (Emphasis added.)[11]

Patents issued to B.F. Goodrich describe methods for a) removal of carbon tetrachloride and chloroform contaminants from CPVC by methanol stripping[12], and b) production of CPVC which used fluorinated hydrocarbons rather than chloroform.[13] Thus, the capability to produce CPVC resin with lower concentrations of chloroform and carbon tetrachloride exists. The extent to which these methods are used, however, is unclear. These "cleaner" methods involve additional processing of resin and are thus more expensive than conventional methods. This additional expense results in a more costly end-product. CPVC manufacturers are very anxious to limit such additional expenses: ". . . it is essential that the cost of converting it (PVC) to CPVC be

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[9] U.S. Patent No. 4,147,859, *op. cit., supra*; Column 2, lines 40-51.

[10] U.S. Patent No. 4,377,459, *op. cit., supra*; Column 1, lines 34-37.

[11] U.S. Patent 4,147,859, *op. cit., supra*; Column 2, lines 31-34.

[12] U.S. Patent No. 4,147,859, *op. cit., supra*.

[13] U.S. Patent No. 4,350,798 to Parker, BF Goodrich, September 21, 1982.

minimized if the CPVC product is to be an affordable commodity."[14] This economic pressure will be significant since, as discussed below, CPVC is more expensive than its primary competitor, copper.

B.F. Goodrich found that the water-slurry process could be done without swelling agents and Parker and Martello claimed in 1985 that "use of swelling agents has now been discontinued in the United States."[15] But they also stress that diffusion limitation of the chlorinating species in water-slurry produces a polymer with a range of chlorine substitution -- more chlorine at the outside and less in the center of the granule. Because mechanical properties depend critically on chlorine content, a manufacturer using the water-slurry method must use rigorous process control or use a swelling agent. Again, without a specific requirement to the contrary, cost will play the dominant role in determining the manufacturing process used.

The mere availability of methods to manufacture cleaner pipe does not mean that cleaner pipe will be the only product available in California. Disclosure of these methods for reducing the level of contaminants in CPVC pipe entitles the holder of the patent to exclusive use of this method for the lifetime of the patent. Methods of CPVC production patented by B.F. Goodrich would not be available to other manufacturers of pipe. B.F. Goodrich may be understandably reluctant to license its patented process to competitors. In the absence of regulation, these competitors would be free to use cheaper, "dirtier" methods of producing CPVC. These products will in turn increase the economic pressure on B.F. Goodrich.

Thus, economic considerations and patent restrictions will act to limit the volume of CPVC pipe produced by methods which result in lower levels of contaminants. These factors suggest that within a few years after HCD approval most pipe purchased by California consumers will be produced by methods which result in the occurrence of significant residual levels of chloroform and carbon tetrachloride.

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[14] U.S. Patent No. 4,412,898 to Olson and Vielhaber, BF Goodrich Co., November 1, 1983; Column 1, lines 35-37.

[15] Parker and Martello, 1985, *op. cit., supra*, p. 621.

In addition to chloroform and carbon tetrachloride, there are other chlorinated compounds which can be components of CPVC pipe. Some potential contaminants are introduced during the production of PVC, which can later be chlorinated to produce CPVC. U.S. Patent No. 3,534,013 describes a process for manufacturing CPVC which uses as a starting material PVC which has been polymerized "in the presence of at least one specific modifier, i.e., a modifier selected from the group consisting of carbon tetrachloride, 1,1,1-trichloroethane, and 1,2,2-trichloroethane . . . ."[16] The same patent also mentions that trichloroethylene and tetrachloroethylene are "usually utilized as polymerization regulators of PVC." (*Id.*; column 2, lines 59-61.)

The chlorinated ethane compounds are of concern because of their toxicity and of the difficulty of removing them from pipe.[17] Further, these compounds have been demonstrated to leach from pipe into water. The *Diffusion of Organics from CPVC Pipe: Final Report*, James M. Montgomery, Consulting Engineers; September 1982 study conducted by Montgomery Engineers for B.F. Goodrich Co. detected tetrachloroethane, 1,1,2,2-tetrachloroethane and 1,1,2-trichloroethane (as well as carbon tetrachloride and chloroform) in water samples exposed to CPVC pipe. The McKesson Environmental Services study (Butter, 1986) "Effect on Water Quality of Leachable Substances from CPVC Pipe at an Elevated Temperature" found chloroform, carbon tetrachloride and methylene chloride in unchlorinated test water.

U.S. Patent 4,049,517 states that CPVC "is normally prepared by chlorinating VCR (PVC) which has been prepared by an aqueous suspension polymerization process . . . . In aqueous suspension polymerization processes . . . . solvents such as aromatic hydrocarbons, alone or mixtures thereof, such as benzene, toluene and mineral spirits are used as diluents for the catalysts."[18] Benzene is recognized as a carcinogenic chemical. Note that Montgomery Engineers found 0.4 ppb benzene, and McKesson found 0.9 to 1.8 ppb toluene in the CPVC tests.

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[16] U.S. Patent No. 3,534,013 to Wakabayashi, et al., Nippon Carbide, Japan, October 13, 1970; Column 1, lines 36-39.

[17] U.S. Patent No. 2,996,489, *op. cit., supra*; Column 5, lines 57-58.

[18] U.S. Patent No. 4,049,517 to Adachi and Oda, Tokuyama Sekisui, Japan, September 20,1977; Column 3, lines 31-44.

Another hazard is described in U.S. Patent No. 4,052,350: "The main thermal stabilizers which have been conventionally used for stabilizing chlorine-containing resins include inorganic acid salts, organic acid salts, organic tin compounds and the like and, particularly among these conventional stabilizers, lead salts and lead soaps are widely employed due to their excellent thermal resistance effects and low cost. Many of these stabilizers are toxic . . . ."[19] Metal contaminants can also arise unintentionally: ". . . trace contamination of (CPVC by) heavy metals . . . can easily result from hydrochloric acid attack on metal processing equipment."[20]

b. Varying CPVC Formulations Will Result in Dramatically Different Impacts on Drinking Water Quality

Samples of CPVC pipe of varying composition can exhibit striking differences in leaching behavior (i.e., different leachates, or different amounts of the same leachate). These differences are clearly demonstrated in results from the study conducted for B.F. Goodrich Co. by James M. Montgomery, Consulting Engineers.

Judging from B.F. Goodrich research and patent activity, the period from 1982 to 1985 probably saw a significant reduction of swelling agent use. Pipe made at the time of the Montgomery test and the Dunnigan report had higher levels of residual chloroform and other chlorinated organics. Pipe made later had less. Because the variation in manufacturing can explain the different results, the Montgomery data should be incorporated in the EIR.

In the Montgomery study, the leaching behavior of two different samples of CPVC pipe was examined. One pipe was produced by B.F. Goodrich ("BFG pipe") and the other by an unidentified manufacturer ("COM pipe"). For each of the two pipes, pipe assemblies were constructed, cured, and flushed. Each assembly was filled with tap water. The water was allowed to dwell in the assemblies for 14-days and then sampled and analyzed ("14-day samples"). The

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[19] U.S. Patent No. 4,052,350 to Shiohara, Kohara, and Miyoshi, Sekisui Kagaku, Japan, October 4, 1977; Column 1, lines 11-19.

[20] U.S. Patent No. 4,345,040 to Hall, BF Goodrich Co., August 17, 1982; Column 1, lines 65-67.

assemblies were again filled with water which was retained in the pipe for seven days ("+7-day samples"). Analysis of the samples show the extent of variability in leachates between the two samples of CPVC pipe. The COM pipe showed a) generally higher levels of leachates than the BFG pipe, and b) leachates that were not detected from the BFG pipe. Levels of some chlorinated compounds from each of the pipe types are shown below:

Average Concentration
(parts per billion)

	14-day Sample		+7-day Sample	
Leachate	BFG Pipe	COM Pipe	BFG Pipe	COM Pipe
Chloroform	45	52	17	23
Carbon Tetrachloride	7.4	13.5	2.3	9.3
Tetrachloroethane[21]	0.2	14.5	0.1	10.8
1,1,2,2-Tetrachloroethane	0	5.2	0	1.7
1,1,2-Trichloroethane	0	9.7	0	3.0

The levels of carbon tetrachloride are much higher in the samples from the COM pipe than in the samples from the BFG pipe. 1,1,2,2-tetrachloroethane and 1,1,2-trichloroethane were detected in samples from the COM pipe but not from BFG pipe.

These results clearly show the effect the variability in CPVC composition has on leaching from pipe into water. Both BFG pipe and COM pipe are available as "CPVC pipe." However, it is evident that both the number and level of leachates is greater from COM pipe than from BFG pipe. This difference could represent a significant difference in impact on public health. Further, this

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[21] Detected in control samples at 0.2-0.3 parts per billion
Source: Diffusion of Organics from CPVC Pipe: Final Report, James M. Montgomery, Consulting Engineers; September, 1982.

difference means that results of leaching tests on one type of CPVC pipe, as conducted by Cooper. are not necessarily representative of future public exposure.

This is confirmed by tests conducted by Acurex Corporation (Mountain View, CA) for Thomas Reid Associates in March and April of 1984. (See Acurex, appen. D.) Samples of a pipe believed to be manufactured by B.F. Goodrich and another pipe were tested by GC/ECD and GC/MS. Chloroform was found at 21 to 30 ppm, and carbon tetrachloride was found at 8 to 15 ppm.

2. DEIR Ignores the Substantial Evidence of Variation in the Additives Used in PB Formulations

Polybutylene pipe has had a limited commercial history, but aggressive market development efforts by Shell Chemical Co. have led to PB use as water service, water supply, or even domestic plumbing use. There are a variety of ways to polymerize 1-butene, but few make a polymer of sufficient chain length to be used for plastic pipe. The variability of manufacturing seen with CPVC has not emerged for PB.

For PB, the variability that affects potential public health impact comes from the slate of additive compounded with the raw polymer to produce pipe-grade resin. All commercial polyolefins (polyethylene, polypropylene, polybutylene, etc.) are susceptible to oxidative degradation where the carbon-carbon bonds in the polymer chain are broken and the polymer loses strength. The oxidation is a free radical[22] reaction which continues in a chain until the radical is trapped. In this way, an oxidizer can initiate substantial chemical change to the plastic. Because of the sensitivity of polybutylene to oxidative degradation, PB manufacturers have resorted to heavy doses of anti-oxidants.

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[22] A free radical is a molecular fragment with one or more unpaired electrons and is usually highly reactive, often attacking a chemical bond, but producing yet another unpaired electron.

Shell Chemical currently uses Irganox 1010, an antioxidant sold by Ciba-Geigy.[23] Irganox 1010 is one of a family of antioxidants sold to protect polyolefins from oxidation. Such chemicals function by trapping and stabilizing the free radical, intercepting the oxidant or stopping short the chain reaction in the polymer.

In the past few years there have been several prominent failures of the PB pipe. The reports cite mechanical failure and usually refer to the pipe showing a service life far less than the manufacturer claims. Apart from an understandable tendency of the manufacture to overstate durability, there may be several reasons for premature failure of PB pipe systems.

A major source of oxidant in domestic water supply is the residual chlorine. Preliminary lab studies showed extremely high chlorine demand from PB pipe; all of that demand will result in chemical reaction of the material in the PB pipe -- either by reaction with oxygen or by reaction with chlorine. The reaction of either polyolefin or antioxidant with chlorine will produce chlorinated compounds which are liberated into the water. Even the antioxidant oxygen reaction products may undergo further reaction with free chlorine once released from the pipe matrix.

Some indication of the significance of chlorine residual oxidation of PB comes from several recent patents where antioxidant formulations are examined to deal specifically with "chlorine resistant polybutene tube" and "corrosion inhibitors, for polybutene pipes carrying chlorinated water" (Mitsui Petrochemical, 1983 and 1984). It seems that industry is attempting to deal with premature mechanical failure of PB pipe due to unexpectedly high oxidation from residual chlorine in the water supply.

Unfortunately for California, none of these more resistant antioxidants have been subject to the HCD sponsored leaching study, nor were they even addressed in the EIR. Most of the new compounds are complex polyvalent free radical traps that function by reacting with a free radical and by stabilizing the

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[23] This was first disclosed by Shell Chemical, R.F. Schimbor in a letter to Myron Moskovitz, HCD, April 13, 1981. Irganox 1010 is used at 0.25%w in Shell's PB 4127, the grey pipe sold in the US for hot water.

unpaired electron. This class of chemicals can have subtle but significant effects in biological systems.

Even if better antioxidants are developed, it must be recognized that the principal mode of antioxidant function is by sacrificial reaction -- where the antioxidant reacts with the oxygen or chlorine instead of the plastic. Thus there is a significant potential for release of chlorinated antioxidant products into the drinking water.

3. DEIR Ignores the Substantial Evidence Potential Variation in Solvent Cement and Primer Formulation

While the SEEHRL (Cooper, 1987) study gives little information on cement composition, the very high solvent levels observed underscore the need to carefully appraise what the cement leaching potential may be.

a. Existing Cement Composition Varies

The Cooper study revealed nothing on cement composition. The failure to look for n-n-dimethylformamide (DMF) or to characterize contaminants is a deficiency in the Cooper study discussed below.

In the Department of Health Services ("DHS") worker health study, Bellows et al. spent much effort exploring for DMF in solvent cements. Several other solvents were of particular interest to Bellows: methyl ethyl ketone (MEK), tetrahydrofuran (THF), acetone (ACE) and cyclohexanone (CHX) and Bellows measured the amount of those solvents in 20 cement and primer samples, eight of these are specified for use with CPVC-PW. Bellows did not go on to consider the possible effect of future formulations.

The Bellows data are important to the public health assessment in the DEIR. First, they show the wide range of constituents among those cements sampled. Second, they imply the presence of unidentified substances present in the cement. Bellows' appendix E, reproduced here (Bellows, appen. E), lists the solvent analysis. The solvents reported by Bellows add up to less than 100%. For glues, about 5% of the cement is dissolved plastic to thicken the glue and fill voids in the joint. For primers and cleaners, essentially all of the material is

a volatile organic compound. In Bellows' appendix E, the balance unaccounted for in CPVC-PW products is typically more than 10%.

The McKesson study analysis of cement and primer revealed DMF and chlorinated organic contaminants. See discussion below.

The EIR should address the impact of variable cement composition. What are the substances comprising the remainder of the solvent cements? What is the potential public health effect of these substances leached into drinking water?

b. Effect of Recycling on Solvent Contamination

Recent hazardous waste legislation (Tanner) has set into motion a statewide effort to reduce the state's hazardous waste disposal problem. A central provision of the program is to encourage recycling. Solvents are particularly suited to recycling through distillation.

However, solvent recycling will result in bulk solvent on the market that is not as chemically pure as virgin material direct from the primary manufacturer. Contaminants would be introduced into recycled solvent by chemicals introduced by the previous user, mixed in intermediate storage, or from the recycler's own equipment. Since most volatile organics form azeotropes,[24] distillation would not remove small amounts of foreign substances. A solvent sold as MEK could contain chlorinated organics or benzene. (See the analysis of solvent cements conducted by McKesson Environmental Services where chlorinated organics were found as contaminants).

Recycled, chemically impure solvent is suitable for most applications (e.g. degreasing, surface coating). Recycled material would be attractive to a formulator of solvent cements because it would cost less. Recycled solvent

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[24] An azeotrope is liquid mixture of two or more substances that boils with a vapor composition equal to the composition of the liquid. This means that differences in boiling points of pure substances cannot be used to separate them when mixed. For example, a mixture of ethanol and water can be boiled to evaporate the alcohol, but alcohol and water form a 95:5 azeotrope so the composition of the vapor will never be more than 95% alcohol; the 5% water cannot be removed by distillation alone.

typically sells for 30% less than virgin technical grade solvent.[25] Solvent is a major material cost in the manufacture of primers and cements and savings from use of recycled material could significantly improve a manufacturer's profit margin.[26]

Since CPVC is readily soluble in a wide range of chemicals, the presence of small amounts of contaminants would not interfere with the mechanical effect of the cement. Indeed, the formulator would not know what contamination was present and the label could not reflect what was in the can.

c. Effect of Air Quality Regulations on Cement Formulations

The DEIR omits an analysis of the air quality impact of solvent cement use. The solvents are all precursor organic compounds, which react in the atmosphere to create ozone (smog). As discussed in section III.E.1 of this report, the total quantity of solvent emissions from cements and primers would have a significant adverse impact on California air quality.

As the goal of reducing ambient ozone seems less attainable, the state's major airsheds are searching for individually smaller, but cumulatively significant, sources of precursor organic compounds. Both the South Coast Air Quality Management District (SCAQMD) and the Bay Area Air Quality Management District (BAAQMD) have rules on the use of solvents in surface coatings,

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[25] Romic Chemical Corp. (East Palo Alto, CA) indicated typical prices for solvents in 55 gallon drum quantities: Acetone, $0.22/lb.; MEK, $0.29/lb.; THF, $1.05/lb; cyclohexanone, not avail. Tank truck quantities available at lower cost.

Virgin technical solvent available from Ashland Chemical in drums, in quantity: Acetone, $0.39/lb.; MEK $0.38/lb.; THF $1.52/lb.

[26] Cement for use with CPVC typically sells for $29.15/gallon and primer for $20.70/gallon with a 10% discount on large orders (Harrington Plastics, Fremont, California). At 50% THF @ 7.3 lb./gallon and the balance MEK, the savings to the manufacturer from the use of recycled solvent would be about $2.00 per gallon. For higher THF products (e.g. Product # 28 in Bellows' appendix E is 80% THF), the cost incentive may exceed 20% of the wholesale cost of the product.

including the use of solvents in adhesives. Solvent cements and primers used in plastic pipe fall under both districts' rules. The SCAQMD has begun to consider plastic cement solvent use specifically and is entertaining discussions with major cement manufacturers on the impact of the rule. (Pers. comm. with staff of SCAQMD, October 22, 1989.)

All of the common solvents are photochemically reactive. If the use of solvent cements expands with HCD's proposed action, the urban air districts will need to apply the same controls to cements as have been applied to other solvent based systems. In nearly all cases where the material is applied in the field and where environmental controls are impractical, the control takes the form of changing the formulation to less photochemically reactive solvents. Typically these are chlorinated solvents.

Evolving air quality regulations may soon force significant changes in the composition of solvent cements. The EIR should discover what alternative cement formulations are being considered and evaluate the potential for public health impacts from the constituents.

4. Summary

The changing composition of plastic pipe will expose the population to a changing chemical environment. The composition of a pipe determines the substances which may leach from the pipe. The DEIR has examined a few specific examples of pipe formulations in its reliance on the SEEHRL test reported by Cooper and the McKesson test reported by Butter. The DEIR makes no effort to extend the assessment of public risk beyond the narrow range of materials examined in the studies. Changing formulation will affect exposure from PB pipe systems as antioxidants and manufacturing methods change, and from CPVC systems as manufacturing, extrusion and solvent cements change. The differences among samples of CPVC pipe are of special concern. Chlorinated hydrocarbons are among the leachates from CPVC pipe which have the greatest potential for adverse health effects.

The DEIR dismisses the Montgomery results as irrelevant to the present HCD action. Failing to reconcile the different results obtained by Montgomery and Cooper, the DEIR wrongly concludes that the Montgomery tests were erroneous. An important reason that Montgomery and Cooper found different

results is that the two tests were studying different pipe samples. The pipe tested by Montgomery were probably made from resin produced by a swelling agent chlorination process, and the pipe tested by Cooper was not. Recall the differences noted by Montgomery between the BFG and the "COM" pipe -- likewise differences between the pipe tested by Montgomery and Cooper would produce different results.

Unfortunately, the DEIR does not recognize this discrepancy and it fails to adequately portray the potential exposure. There is no code in effect, nor mitigation measure recommended in the DEIR, which would prevent use of CPVC pipe made with carcinogenic compounds.

Unpredictable solvent cement composition has implications in two important area of environmental impact: drinking water and worker health. By failing to adequately characterize the solvent cement portion of the CPVC system, the EIR cannot adequately address these issues. Contaminants in cement will leach readily into drinking water and can introduce chemicals not considered in the DEIR. Contaminants would also pose a greater risk to the worker. It will be difficult for HCD to know what potential worker exposure will be in California without some method of testing the composition of solvent cements.

The DEIR's failure to consider effects from other formulas and manufacturing processes is a major oversight. It is clear that both CPVC and PB pipe systems will be subject to a wide range of variation in manufacture and assembly that could significantly affect public and worker health.

None of the codes pertaining to plastic pipe specifically address the concerns at issue in HCD's consideration of the public health impact of plastic pipe. Reliance on NSF is clearly not sufficient, since NSF test for virtually none of the substances identified as potentially harmful in the DEIR. In order for HCD to resolve the issues raised in the DEIR, HCD must consider health-directed manufacturing standards as a mitigating measure.

The EIR should be revised to show how HCD can assure that pipe formulations or joining systems containing harmful materials will not be used in California.

C. DEIR Fails to Consider Impacts Resulting From the Mechanical Failure of Plastic Pipe

The DEIR completely ignores mounting evidence that plastic pipe simply cannot perform the service for which it is intended on a long-term, reliable basis. In short, it breaks and leaks with unacceptable frequency. The ability of the pipe to carry water and waste reliably for many decades without breaking down is an environmental issue because the leakage of water and wastes into homes, under foundations, and in walls, ceilings and floors robs the people of California of a healthful and pleasing environment (Pub. Resources Code § 21000, subd. (b)), constitutes a health and safety hazard (Pub. Resources Code § 21000, subd. (d)), and deprives Californians of a decent home and satisfying living environment (Pub. Resources Code § 21000, subd. (g).)

The Department's omission of the pipe failure issue from the DEIR makes it impossible to assess all potentially significant impacts caused by the project. A consideration of the entire project must include plastic pipe failure, otherwise important impacts will be "hidden from view" and the goals of CEQA thwarted. (*Santiago County Water District v. County of Orange, supra*, 173 Cal.Rptr. 602, 698.)

1. Scope of the Mechanical Failure Problem

a. Plastic Pipe Failures Are Widespread

Wherever it has been installed, plastic pipe has failed at rates that make its continued use a health and safety hazard. The Council has been able to identify ABS DWV pipe failures in over 10% of housing units surveyed. (Thompson, appen. C, p. 2.) At HCD's September 26, 1989, hearing on the DEIR in Los Angeles, an attorney representing homeowners with ABS failure problems testified that he was personally aware of 5,000 residential units affected by ABS failures. (R.T. September, 26, 1989, hearing, p. 56.)

Among projects surveyed totalling 8,345 housing units, there have been 5,842 separate instances of failure affecting 944 units. (Thompson, appen. C, p. 2.) Failures include fractures at fittings caused by solvents or glues, leaks along the length of the pipe due to poor materials, and weeping of liquid through the

core of foam core ABS pipe. The failures have occurred in 10 counties throughout California where ABS pipe is in widespread use, including major population centers such as Los Angeles, Sacramento and Alameda. (Thompson, appen. C, p. 5.) It is also clear from the evidence that the problems of mechanical failure are not limited to one manufacturer, one extruder or even one kind of pipe.

The failure of PB residential potable water and water service[27] pipe is even more severe. The Council has been able to identify at least 3,496 housing units that have experienced failures in PB pipe systems. (Thompson, appen. C, p. 2.) The Council has also been able to identify 1,186 total PB instances of failure. (Thompson, appen. C, p. 2.) The failures have occurred in six California counties, including San Diego, Santa Clara, San Luis Obispo, Marin, Ventura and Kings counties. In San Diego County, the United States Navy replaced hundreds of PB water pipe with copper in homes constructed on a Naval facility after repeated failures of the PB systems. (See appen. EE.)

PB pipe has been used for residential potable water service primarily in San Diego and Santa Clara counties. In San Diego County, failure information is available on 650 units with PB plumbing systems. Of these, 198 have had failures of their PB systems. (Thompson, appen. C, p. 2.) In Santa Clara County, 3,300 units were surveyed for which failure information was available. (Thompson, appen. C, p. 3.) Five hundred of these units experienced failures in their plumbing systems. (Thompson, appen. C, p. 3.)

Several water distribution agencies using PB pipe to provide water service from water mains in the street to the consumer's water meter were surveyed. All have experienced high failure rates. The North Marin Water District suffered 600 failures out of 6000 installed PB service lines (Thompson, appen. C, p. 4); ten times the number expected with metal pipe. (Thompson, appen. C, p. 2.) The Morgan Hill Water Department has experienced 400 to 500 failures a year. (Thompson, appen. C, p. 4.) In total, Morgan Hill has had more individual failures than it has PB service lines; many of the lines have failed more than once. (Thompson, appen. C, p. 4.) The Camrosa Water District

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[27] Water service pipe refers to pipe running from water mains to the water meters of individual dwelling units or other structures.

installed 3,000 PB service lines, 200 have failed and a quarter of the total have cracks. (Thompson, appen. C, p. 3.)

The magnitude of the problem is illustrated by the flood of litigation by homeowners and contractors against resin manufacturers, pipe extruders, financial institutions and others over plastic pipe failures. A preliminary survey has identified over 75 separate lawsuits, most involving hundreds of homeowners and homes[28]. Many arise in Texas and California, but suits over plastic pipe have been filed in Arizona, Florida, Arkansas, Louisiana, Nevada, and North Carolina.

San Diego has seen a great deal of litigation, including an 80-unit low-cost housing development, Orchard Park (*Kirchoff v. U.S. Brass*, *Danskin v. Citizens Savings & Loan*, *Kringer v. Citizens Savings & Loan*, and *Ball v. Citizens Savings & Loan*), an 80 - 100 unit development (*Anderson v. Shell*), and a 183 unit condominium complex (*Hoffman Const. Co. v. Shell Oil*). The North Marin Water District, Camrosa Water District, and City of Morgan Hill have all sued pipe suppliers and manufacturers over PB failures. (*Camrosa Water District v. Mobil, Witco, et al.*, *Marin County Water District v. PE O'Hare, et al.*, *City of Morgan Hill v. Wesflex & Western Products.*)

Suits have been filed in Bakersfield (*Parkside Partners v. Centaur*), Fresno (*Quailwood Apartments v. Centaur*), Sacramento (*B&A Plumbing v. Centaur*), Kern County (*Gubisan v. Budget Homes*, and *Rancho deLano v. Fresno Distribution*) and San Jose (*Thomasello v. Shell & Celanese*), among others.

b. Plastic Pipe Failures Are Costly

Although many settlements are secret, the information that is available suggests that the cost of repairing failed systems and other forms of recovery in lawsuits is very high. An attorney who handles these cases estimated the exposure of defendants in the range of $30,000 to $40,000 per home. (Pers. Comm. with George Fleming, September 20, 1989.) San Antonio, Texas settled a suit over PB water service failures for $28 million. (Appen. G.) A lawsuit in Bakersfield against Parkside Partners concerning 242 units built with ABS DWV pipe resulted in damages of $2.1 million. (Thompson, appen. C, p. 6.)

[28] The cases are listed by name in appendix F.

Complete replacement of PB systems with copper in San Diego county at Hillside Colony and in San Diego itself cost between $2,500 and $7,500 for each home. (Thompson, appen. C, p. 5.)

Camrosa County Water District and the City of Morgan Hill report higher costs for emergency repairs. Each incident averages $15,000 per line. (Thompson, appen. C, p. 6.)

c. Full Information on Failures is Not Available

What is known at present constitutes only a small portion of actual failures. There is no central clearinghouse for information on this subject, and there are several obstacles to the collection of complete information. Many failures are not reported to anyone but the local plumber who fixes leaks on a regular basis. There is no established process to gather information on individual failures of this kind.

Attorneys who specialized in litigation concerning plastic pipe are not entirely cooperative when asked for information concerning their cases, fearing adverse impacts on their settlement efforts. (Thompson, appen. C, p. 1.) Many of these attorneys have refused to provide any information or participate in surveys of the mechanical failure problem.

Finally, manufacturers, contractors and others who are responsible for the installation of plastic pipe have an interest in suppressing information about failures. These cases injure the reputations of contractors and reduce the value of affected properties. In at least two cases, contractors have threatened homeowners who sought to cooperate with investigations and surveys of failures aimed at establishing the extent of the problem. Both Jodine Downey and Rick Heistand of Simi Valley were told that their plastic pipe problems would not be fixed if they provided information to investigators. (Pers. comm. Dan Ritey, November 8, 1989.)

2. Causes of problem

a. Poor Quality Manufacturing and System Design

The source of the mechanical failure problem is different for the different piping systems. In some cases, the pipe system as specified is inherently flawed, in others, the material is not up to specification. The failed fittings and pipe identified in this survey all carried the appropriate IAPMO, NSF and ASTM stamps of approval.

PB has suffered greatly from mechanical failure because of a faulty pipe/fitting system. Past failures have been largely due to the failure of the fittings used to join the pipe segments. Fittings made from acetal copolymer are subject to attack by residual chlorine in the water.[29] As discussed earlier under PB formulation, problems with acetal fittings also pose a threat to PB pipe itself, and evidence of direct pipe failure is common.[30]

Until 1986, PB fittings were made from an acetal copolymer resin manufactured by the Celanese Corporation under the trade name of "Celcon." Celanese claimed the Celcon system had a service life of 50 years, comparable to that of copper. (Appen. H.) But Celanese, in 1969, was still trying to find a celcon resin that would last as long as 10 years and would not pit, crack, develop surface whiting, cratering, discoloration or leaks. (Appen. I.) Over the next decade, reports of corrosion problems were received from Celanese affiliates from around the world. (Appen. J.)[31]

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[29] Duval, DE. Review of the Celanese Corporation Technical Literature on Resistance of Celcon Acetal Copolymer to Chlorinated Water, LJ Broutman & Assoc. Chicago, IL. July 1, 1988. 13 pp. 43 ref. Duval summarizes information gathered for litigation on acetal fitting failures.

[30] The water service line failures in San Antonio and Marin County were failures of the pipe itself.

[31] Acetal resin manufacturers notified neither their customers nor retail consumers of the full limitations of their product. Shell Chemical Company "killed" stories intended as promotional pieces where plumbing leaks would reflect poorly on the product. (See appen. K.)

Celanese tested its fittings to the same standard as that used for polybutylene pipe, requiring it to withstand 500 PSI in 180 degree water with a confidence level of 85% or better. Nevertheless, Celcon's failure was dramatic. It could only withstand 20-40 PSI with less than 20% confidence. The Celanese solution was to recommend "back up positions be considered both from the technical and marketing points of view." (See appen. L.)

Additional problems arose from the "easy" installation using crimp rings to join the polybutylene pipe and Celcon fittings. "Easy" and "quick" installation required specialized tools that were not perfected after several generations. Worse, tolerance levels for the crimp ring diameter were set at 0.0015th of an inch. A larger diameter would result in leaks. A smaller diameter caused the fitting or the pipe to break. Field realities in plumbing installations preclude the use of such fine tolerances. (See appen. M.)

The Celcon fitting became the subject of so much litigation that Celanese Engineering Resins took action in 1985 to warn its plumbing customers of the "environmental limitations" in using Celcon. (Appen. N.) Celcon was withdrawn from "behind-the-wall" applications, from use in swimming pools, and, as was polybutylene, from use in recirculating hot water systems.

Representatives for the polybutylene pipe industry, as recently as 1989, insist the pipe itself does not fail. However, the North Marin Water District's experience of "prematurely deteriorated, decayed" pipe that had "become brittle due to oxidation in the ground" necessitating replacement after only 10 years of the claimed 50 year service life, is not unusual. (Appen. O.) Thousands of consumers in the United States had systems requiring repair. (Pers. comm. with Richard Rosenthal, attorney for homeowners, November 7, 1989.)

CPVC pipe has not exhibited the range of problems bedeviling PB. The pipe is inherently more resistant to attack by acids and by residual chlorine in the water supply. The chlorinated PVC resin is subject to degradation under heat, which poses a problem to extruders, but the normal exposure in use would not cause a problem to properly manufactured pipe.

Failures in CPVC installations are usually from poor joints. The solvent used to make the joint also softens the pipe at the joint. Applying pressure or

moving the pipe before the joint is fully cured causes permanent weakness and may lead to later breakage and leaks.

Future quality control will be a problem for CPVC. CPVC is a modification to PVC to improve strength and temperature resistance -- PVC is used for DWV and cold water PW, but cannot be used for hot water. Production of CPVC from PVC significantly increases cost of the resin. Cost cutting leading to poorer manufacturing methods, less complete or less homogenous chlorination and changing extrusion additives will increase the susceptibility to failure.

ABS pipe failure comes from chemical attack on the plastic and poor quality manufacturing. ABS is subject to attack by most organic solvents. Household chemicals (e.g drain cleaners, paint thinner) or very hot liquids rapidly attack ABS. The pipe either softens or is subject to surface stress and cracks abruptly from the induced stress.

Poor manufacturing results from an essentially unregulated use of regrind and recycle plastic. Cost competition in the ABS market forces local extruders to cut the average cost of resin by using second hand and off-specification material.

The extrusion process places the plastic under high temperature and mechanical shear. Many of the additives in the formulation are used to stabilize the plastic and aid in extrusion. However, after the plastic is put through several heating and extrusion cycles, there is significant cumulative damage to the polymer chain and mechanical properties are lost. Regrind waste from the extruder is not as good as virgin material.[32]

Further, much of the resin sold as ABS is not true ABS. Ideally, ABS is defined by a fairly specific ratio of the three constituent monomers: acrylonitrile, butadiene, and styrene. In ABS, the monomers are reacted to form a polymer with the various monomers linked together, giving the plastic uniform toughness.

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[32] Throne, JL. "Effect of Recycle on Properties and Profits: Algorithms." Advances in Polymer Technology v. 7 n. 1987, 4 pp. 347-360.

Because acrylonitrile, butadiene, and styrene are also used in other plastics separately, or in pairs, the recycle market offers an extruder a source of the same basic chemicals, but not actually reacted together to form true ABS. ABS pipe manufacturers purchase a resin suitable for extruding into pipe. If the resin contains the correct amount of the acrylonitrile, butadiene, and styrene subunits, it may pass as ABS, but the resin is only a mixture of the subunits, not an integrated chemical substance, and lacks the true mechanical properties ABS is supposed to possess.

Poor grade "ABS" resin is much more susceptible to organic chemical stress cracking because the different plastic particles in the mechanical mixture react differently to the chemical. Indeed even the solvent used for cementing the ABS together can introduce stress cracking at the joint leading to rapid failure.

b. Market Pressures and Recycling

The current market is well developed for ABS for DWV applications in California. The cost competition has already increased the use of recycled material in ABS pipe and this contributes to the problem of mechanical failure.

The problem with ABS will only increase as the pressure for recycling increases. State, federal and even local action to reduce the quantity of plastic in the waste stream will increase the amount of plastic available for recycle. Although a beneficial idea in principle, it is important that the recycled material find its way into the appropriate end product. It is difficult to exclude material that degrades ABS mechanical performance.

The same problem will develop with CPVC and possibly with PB. Already, the extruder can use regrind -- plastic waste from defective product -- to reprocess into pipe. Some filler can be added to the pipe resin to reduce cost.[33] However with more than a few percent of impurities, the material will loose strength. Both PB and CPVC are thermally compatible with other types of plastics -- basically, anything that melts in the same temperature range can be

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[33] Calcium carbonate (chalk)/stearate can be added to CPVC. Shell adds 1.2% talc to pipe grade PB. RF Shimbor, Shell Chemical Co. letter to Myron Moskovitz, HCD. April 13, 1981.

mechanically blended. Much of the current patent literature deals with blends involving PB and other polyolefins, and CPVC and other vinyl or polyethylene polymers. With the proper colorant and a fresh dose of antioxidant or stabilizer, it is possible to use a substantial amount of regrind plastic and recycle to manufacture pipe resin.

The result is that the mechanical properties are degraded, particularly resistance to creep under heat, and that new chemicals are introduced into the pipe matrix. A "CPVC" resin mixture could incorporate PVC from a wide range of sources, and PVC scrap contains lead stabilizers and plasticizers. PB may be blended with other polyolefins containing antioxidants, flame retardants, and UV stabilizers not suitable for use in potable water systems. Both recycle streams will include contaminants other than the basic polymer family, such as residues of inks, coatings, adhesives, and impurities not removed in the recycling process.

The driving force for this is cost. The DEIR claims that CPVC installation costs about 20% less than metal for PW, and that PB cost about 35% less.[34] On the basis of that cost difference, the DEIR predicts that nearly all of the expanded use of plastic in California will be PB. Given IAPMO's recent prohibition on the use of PB, CPVC will most likely be the primary plastic contender.

Immediately upon HCD's action, there will be a vast market opportunity for CPVC manufacturers capable of beating the price of copper and CPVC sold by B.F. Goodrich. An unfavorable price/property balance for CPVC has been a major barrier to the chemical's growth.[35] More expensive than true commodity

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[34] However, the DEIR presents no analysis to support this statement with respect to CPVC. Indeed, the DEIR indicates that CPVC materials costs "are similar to those for copper." (DEIR, p. 12.) Moreover, the DEIR states in its section entitled "Economic Effects" that the use of plastics other than PB for PW use "would increase plumbing costs." (DEIR, p. 87.) As Dr. Dickens' analysis demonstrates, the use of CPVC in place of copper would substantially increase plumbing costs over current levels. (See *post*, section III.G.)

[35] B.F. Goodrich has expended a major effort to open the market for CPVC, persisting when all other domestic firms would not. Much of the published literature extolling the virtues of CPVC is written by B.F. Goodrich employees. The more reserved view is offered by RH

(continued...)

plastics like PVC and polyethylene, and not as stable at high temperatures or as easy to mold as true engineering plastics, CPVC's big market opportunity is potable water applications. If HCD opens up this market, the cost factor will drive quality down and the mechanical failure problem will increase.

c. ASTM, NSF and IAPMO Cannot Protect the Public from Mechanical Failures

The UPC references plumbing material standards established by the ASTM. (UPC, ch. 2, table A, "Plumbing Materials Standards.") However, at present there is no independent governmental agency, private institution, or industry group that establishes or enforces effective standards governing plastic resin and pipe manufacturing and extruding

ASTM is a private organization established for "the development of standards on characteristics and performance of materials, [and] products . . . ." (1989 Annual Book of ASTM Standards section 8, volume 8.04 at iii, hereafter "1989 ASTM Standards," vol. 8.04 at iii") It establishes standards for the composition, size, strength and identity of some plastic plumbing pipe. Standards may be adopted, modified, or withdrawn at any time.

ASTM develops standards by a consensual process among interested parties, including manufacturers and governmental agencies. (1989 ASTM Standards, vol. 8.04 at iv.) Standards are usually written by the manufacturers

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[35](...continued)
Burgess (ICI, Ltd.):

> The softening point of PVC can be increased by chlorination of the product either in a solvent or as a suspension. Normally one grade of chlorinated PVC (CPVC) containing 63% chlorine is produced with a softening point of 120°C compared with 80°C for PVC itself. This grade is difficult to process and expensive so that if a lower softening point is acceptable blends of this product and PVC will be used in the proportions necessary to give the desired softening point. Products of this type have not been very successful commercially but are used for specialty markets such as hot water systems in mobile homes in the USA and for fibre manufacture in France. (R.H. Burgess. Manufacture and processing of PVC, MacMillan, New York, 1982, p. 99; emphasis added.)

of resins and pipe themselves. Each standard is reviewed in a five stage process. Proposed standards must be unanimously approved before they are adopted. (Pers. comm. with Elaine Christian, Assistant to the Director of ASTM, September 12, 1989.) Each participant exercises a full veto over the approval process and can disapprove any proposed standard for any reason.

Compliance with ASTM standards is entirely voluntary for pipe and resin manufacturers. The standards may be less restrictive than is necessary under certain circumstances. (1989 ASTM Standards, vol. 8.04 at iv.) ASTM is solely a standard-developing organization; it has no testing capability.

Virtually every one of ASTM's hundreds of standard specifications for various types and forms of plastic pipe contain a warning that the standard does not address all of the safety problems associated with plastic pipe. The warning reads as follows:

> This standard may involve hazardous materials, operations and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitation prior to use.

ASTM directs users of the standards to develop their own health and safety practices or to follow governmental limitations, of which there none, since ASTM, the NSF and other private groups are the sole source of standards for plastic pipe. (See 1989 ASTM Standards, vol. 8.04.)

IAPMO inspects pipe production at factories listed under its auspices from one to four times per year, although pipe production is carried on year-round. Despite these inspections, widespread failures of ABS and PB pipe have occurred in the past few years. (See, *ante*, section II.C.) This pipe has all been stamped as meeting ASTM and IAPMO standards. The failures of PB pipe have been so catastrophic that IAPMO has removed it from the UPC for potable water applications.

In addition, listing with IAPMO is entirely voluntary. Many installers will not have sufficient information to look for the appropriate stamps, and

competition among producers could lead to the marketing of unlisted pipe that is less expensive than listed products. Pressures to keep prices down, combined with state authorization of expanded uses for plastic pipe, could increase the usage of unlisted (and untested) pipe.

The DEIR discussion is legally inadequate because it fails to investigate even issues raised in the text of the DEIR itself. The DEIR does not discuss the listing and inspection procedures of IAPMO and NSF, nor does it reveal the serious questions that have been raised about the adequacy of these purely private and voluntary procedures.

3. Importance of Considering Mechanical Failures in the EIR Process

Mechanical failure with plastic pipe systems produces direct environmental impacts from the failure itself, causes economic impacts through repair and replacement costs and property damage, and results in indirect impacts by forcing changes in pipe formulations. The DEIR does not address any of these direct impacts, economic impacts, or impacts on future pipe and fitting formulations.

a. Direct Environmental and Public Health and Safety Impacts

Failure of potable water systems is usually sudden because the system is under pressure and the pipe tends to burst when it fails. The break can happen at any place in the system, but is likely to affect the living area of the house.

Loss of property and aggravation are obvious impacts on the homeowner that create harm beyond economic damage. However, water in the living area creates an electrocution hazard. The electrical code requires ground fault circuit interrupters in all "wet areas" (i.e. bathrooms and out-of-doors), but wet floors in other living areas of a residence are not protected. Even when wet floors are the result of an accidental pipe break, a building inspector would declare a residential or commercial structure unsafe where water creates an electrical

hazard. A pipe failure can result in a direct hazard, or a forced evacuation from the damaged building.

Water line breaks under a slab foundation could damage the foundation and threaten the safety of the structure. Water in the soil from the pipe break would become contaminated by contact with the soil. Immersion of a broken potable water line in the ground creates a risk of back-siphon and system contamination when the water pressure drops (e.g. when the main is shut off for repair).

Failure of DWV systems poses the obvious risk of unsanitary conditions from raw sewage and vent gas. Protection of the public health is the motivating purpose for plumbing systems. When ABS-based DWV pipe breaks, the living space of a house is contaminated by sewage. In multifamily dwellings, the sewage could originate in another dwelling, introducing disease.

These significant impacts should be discussed in the EIR. Data are available on the extent of pipe failure. The economic analysis should reflect the cost of premature failure, and the environmental impact analysis should discuss the potential for failures leading to unsanitary and hazardous conditions.

b. Economic Effects

The economic analysis in the DEIR completely fails to consider the economic effect on consumers of mechanical failures of pipe. Particularly toward the end of its service life, plastic pipe is subject to "cracking, splitting, splits, stress fractures, pinholes and shear breaks." (DEIR, p. 88). Such failures can cause disastrous and costly water damage to structures as well as requiring costly replacement of the pipe system inside walls and under floors. Many homeowners' insurance policies exclude damage caused by plumbing failure due to normal wear and tear on the components. Pipe replacement costs are also far higher than initial installation cost because plumbers must work with enclosed structures rather than the open framework of a building under construction.

The failure of the DEIR to fully consider the mechanical failure of plastic pipe produces inaccuracies in its economic analysis. For example, HCD may determine, based on the inability of ABS and PB pipe to carry water and waste reliably, that these types of pipe should not be approved. In that case, the only

remaining piping materials under consideration are PVC and CPVC, both of which are substantially more expensive than metal. An economic analysis based on these assumptions would have to conclude that metal is cheaper than plastic. In contrast, the DEIR concludes that plastic is marginally cheaper than metal.

4. Study of PB Failure History Required to Support Departure from UPC Standards

a. IAPMO Has Voted to Ban PB Pipe Because of its History of Mechanical Failures

In September of 1988, IAPMO voted at its annual conference in Seattle, Washington to withdraw authorization for PB pipe and prohibit all use of the pipe in plumbing systems governed by the UPC. IAPMO's voting membership is limited to its Class A members, which include only government plumbing officials. These plumbing officials voted to ban the use of PB pipe after hearing extensive evidence on the history of PB mechanical failures

After the IAPMO vote in September 1988, the Plastics Industry submitted various code change proposals requesting that IAPMO reverse itself and reinstate approval of PB. These code change proposals were considered by IAPMO at its 1989 annual conference held in September in Sparks, Nevada. The conference delegates were presented with an IAPMO staff report summarizing the PB issue and recommending disapproval of the proposed code changes. The conference again considered the evidence and heard extensive debate on the mechanical deficiencies of PB plumbing pipe. (Reporter's Transcript ("R.T."), IAPMO Annual Conference, Sept 26, 1989, pp. 87-145.) Despite Plastics Industry arguments that mechanical problems with the pipe had been resolved, the plumbing officials responsible for publishing the UPC voted overwhelmingly to reject the code change proposals and reaffirm their decision to ban the use of PB pipe. (R.T., *supra*, p. 131.)

b. HCD Must Show PB Use is Necessary in California and Will Not Jeopardize Public Health and Safety

The State Housing Law requires HCD to adopt building standards which "impose substantially the same requirements as are contained in the most recent editions" of the uniform industry codes. (Health & Saf. Code § 17922.) In

submitting the proposed building standards to the State Building Standards Commission, HCD must also demonstrate that "national specifications, published standards, and model codes have been incorporated," or that such specifications, standards and codes do not "adequately address the goals" of the Department. (Health & Saf. Code § 18930, subd. (a)(7).) The California Building Standards Law also requires that state building standards be "consistent with state and nationally recognized standards for building construction in view of the use and occupancy of each structure to preserve and protect the public health and safety." (Health & Saf. Code § 18941.)

The courts have held that the "protection of public health and safety" was the "paramount policy" underlying the 1970 amendments to the State Housing Law requiring HCD to adopt building standards based on the uniform industry codes. (*Baum Electric Company v. City of Huntington Beach* (1973) 33 Cal.App. 3d 573, 581 [109 Cal.Rptr. 260, 266].) Thus, HCD is permitted to depart from the model codes only "[i]f [it] determines that a material, appliance, installation, device, arrangement or method of construction which is not permitted under the uniform codes is as safe as that permitted under the codes . . . ." (43 Ops.Cal.Atty.Gen. 27, 30 (1964).) HCD must also show that applying the uniform standards in California "would be unreasonable or unnecessary or ill advised." (63 Ops.Cal.Atty.Gen. 566, 578 (1980).)

IAPMO's overwhelming vote at both its 1988 and 1989 annual conferences to prohibit the use of PB makes it virtually certain that the 1991 UPC will not list PB as an authorized material. Given that the IAPMO action was specifically based on the economic loss and damage caused by the mechanical breakdown of the pipe, HCD's proposed blanket approval of PB pipe for potable water use in California must be supported by substantial evidence showing that the protections currently afforded California consumers will not be jeopardized by this action. The DEIR currently contains no discussion of the PB mechanical failure problem.

It is also clear that HCD must examine the PB mechanical failure problem (as well as the failure of ABS pipe) in the context of this EIR, even though the PB ban will not be effective until the 1991 edition of the UPC. CEQA requires that potential environmental impacts be considered at the earliest possible time. (14 C.C.R. § 15004, subd. (b).) It does not permit the lead agency to "piecemeal" a project and consider environmental effects in conjunction with

separate approvals. (*Bozung v. LAFCO* (1975) 13 Cal.3d 263 [118 Cal.Rptr. 249].) Considering the PB issue is particularly critical in the context of this review since the DEIR's environmental analysis assumes that PB will replace copper for potable water use in California. The use of a different plastic material, i.e., CPVC, could lead to dramatically different conclusions.

D. DEIR Fails to Consider Impacts Resulting from Plastic Pipe Installations in Non-Residential Structures

Despite the fact that the proposed code changes would permit plastic pipe use in commercial, office and industrial buildings, the DEIR only considers impacts from residential installations. This critical omission undermines the entire environmental analysis. It is impossible for the DEIR to accurately identify the nature and scope of the potential public health and safety threat from plastic pipe given that whole classes of affected occupancies have been left out of the analysis. The failure to consider impacts from plastic pipe use in non-residential buildings is particularly disturbing given that the DEIR itself acknowledges that impacts resulting from commercial, office and industrial applications could be more significant than in residential applications. (DEIR, appen. C, pp. C-227 - C-228.)

1. The California Building Standards Code Applies to All Occupancies

The DEIR restricts the scope of its analysis on the ground that "[HCD's] regulations do not affect the piping allowed in . . . commercial and industrial applications," since it has jurisdiction only over residential structures. (DEIR, p. 1.) This statement is incorrect; although HCD's enforcement jurisdiction is limited to residential dwellings, once its proposed code changes are approved by the State Buildings Standards Commission and codified in the California Building Standards Code, they apply to all occupancies in the state. The statement also ignores CEQA's well-settled requirement that an EIR must address the environmental effects of the whole project, even if portions of the project are beyond the jurisdiction of the lead agency.

A recent amendment to the California Building Standards Law[36] expressly provides that the building standards contained in the model codes, as referenced in the State Building Standards Code, "shall apply to all occupancies throughout the state . . . ." (Health & Saf. Code § 18941.5, subd. (a).)[37] The legislative history of this provision demonstrates that the express purpose of this amendment was to extend to commercial and industrial buildings state building standards adopted by state agencies with jurisdiction only over residential occupancies.

The amendment to Health and Safety Code section 18941.5 was enacted in the 1988 legislative session by SB 2871. (Sen. Bill No. 2871 (1988 Reg.Sess.) ch. 1302.) The first policy committee report on the bill included the following analysis, which was repeated in all subsequent Committee reports on the bill in both the Senate and the Assembly:

> SB 2871 would require all local agencies to adopt the most recent edition of the model codes as adopted by the state within 180 days from the date of publication by the State Building Standards Commission and expands the application of these model codes from residential only, to all occupancies . . . . [¶] [T]his measure is intended to bring uniformity to the application of building standards contained in the model codes to all types of occupancies, including

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[36] Effective January 1, 1988, the State Building Standards Law was renamed the California Building Standards Law. (Govt. Code § 18910.)

[37] Additionally, it should be noted that the UPC applies to all buildings -- residential, commercial and industrial (UPC § 103, subd. (m).) HCD is required to adopt building standards that are "substantially the same" as the uniform codes. (Health & Saf. Code § 17922, subd. (a).) An amendment restricting applicability of UPC requirements to residential structures would not comply with this requirement.

Even the ERD acknowledged, albeit in a somewhat ambiguous manner, that the proposed HCD amendments would affect non-residential occupancies based on the broader scope of the UPC provisions: "[HCD regulations affect] standards for commercial and other construction only indirectly through association (the UPC, for example, is intended to apply to commercial as well as residential construction)." (ERD, p. I-3, original parenthesis). The DEIR omits this reference and ignores any applicability of the proposed code changes to non-residential structures.

residential, industrial and commercial buildings. Currently, there is confusion among contractors, builders and designers about which edition of the model codes apply to nonresidential buildings." (See Sen. Housing and Urban Affairs Com. Rep. on SB 2871, pp. 1 - 2 (1988 Reg. Sess.).)

The fact that state building standards are adopted based on programmatic authority, e.g., HCD adopts building standards based on its authority over housing, had created confusion and lack of uniformity in enforcement given that building codes are administered based on type of occupancies. The author of SB 2871 explained that his bill was intended to resolve this problem:

> These state programs, e.g., energy, handicap, seismic, etc. are the result of years of legislative initiatives to meet specific needs that were not addressed in 'model' codes. Model codes have always been written, not to address programs, but to aid design of <u>occupancies</u>, i.e., specific types of construction . . . . [¶] State amendments to model codes, therefore, were not addressed to specific occupancies, and as a result a patch-work of programs and occupancies developed, without clear authority and regulations for all occupancies . . . . [¶] An industrial building in Sacramento may not be required to meet any of the states programs, depending on the use of that building . . . . [¶] My Senate Bill 2871, the 'code uniformity' proposal simply says: let us apply the State Code, Title 24, to all occupancies. <u>Therefore, the commercial/industrial occupancies will comply with the state code and its amendments</u>. (Statement of Senator Milton Marks, Sen. Housing and Urban Affairs, April 5, 1988; second emphasis added.)

Thus, it is clear that the proposed code changes will apply to non-residential construction after approval by the State Building Standards Commission and inclusion in the California Building Standards Code. As lead agency, HCD is required to consider the impacts on plastic pipe use in commercial and industrial occupancies even though HCD does not have enforcement jurisdiction over these buildings and even though subsequent approvals are required.

HCD is required to submit the proposed code changes to the State Building Standards Commission for approval. (Health & Saf. Code § 18930.) The Commission may approve, reject or return proposed building standards to the adopting agency for amendment. (Health & Saf. Code § 18931.) In this case, the proposed building standards must also receive written approval of the State Fire Marshall. (Health & Saf. Code § 18930, subd. (a)(9); see discussion, *ante*, section III.D.1.(e).) Except under narrow circumstances, the building standards approved by the Commission must be adopted by local governments. (Health & Saf. Code §§ 17958, 17958.1 and 18941.5.)

In cases where a project must be carried out or approved by more than one agency, CEQA requires that a lead agency be designated to prepare the environmental documents for use by all responsible agencies. (14 C.C.R. § 15050.) The agency to act first must generally be designated the lead agency. (*Citizen Task Force on Sohio v. Board of Harbor Commissioners* (1979) 23 Cal. ed 812 [153 Cal.Rptr. 584].) In this case, HCD was designated the lead agency since, as the adopting agency, it will be the first to act on the code change proposal. All other agencies with subsequent approval power must participate as responsible agencies and must rely on HCD's environmental analysis. (Pub. Resources Code §§ 21980.3, 21080.4, 21104 and 21166.)

CEQA expressly requires that the lead agency consider the potential effects of the whole project, not just that portion of the project within its jurisdiction. (Pub. Resources Code § 21002.1, subd. (d).) The CEQA Guidelines explain that the term "project" means "the whole of the action" under consideration and "which may be subject to several discretionary approvals by governmental agencies. The term 'project' does not mean each separate governmental approval." (14 C.C.R. § 15378, subds. (a) and (c).) The courts have also held that an EIR must consider the environmental effects of the whole project, even if parts of the project are beyond the jurisdiction of the lead agency. (*City of Carmel-By-the-Sea v. Board of Supervisors* (1986) 183 Cal.App.3d 229, 241-247 [227 Cal.Rptr. 899, 907-911], *Bakman v. State Department of Transportation* (1979) 99 Cal.App. 3d 665 [160 Cal.Rptr. 583], *Bozung v. LAFCO* (1975) 13 Cal.3d 263, [118 Cal.Rptr. 249], *EDF v. Coastside County Water District* (1972) 27 Cal.App. 3d 695 [104 Cal.Rptr. 197].)

HCD is clearly required under CEQA to consider the effects of expanded plastic pipe applications in non-residential buildings, even though it is the action

of the State Building Standards Commission that will extend the proposed code changes to these buildings. As discussed below, these effects could be significant. A failure to consider the impacts from non-residential installations would require a separate environmental analysis prior to action by the State Building Standards Commission on the proposed code amendments. This is precisely the kind of "piece-mealing" of a project that CEQA was intended to avoid. (*Bozung v. Local Agency Formation Commission, supra*, 13 Cal.App.3d 283-284 [118 Cal.Rptr. 249].)

2. Environmental Effects in Residential and Non-Residential Structures would be Different

The DEIR itself recognizes that the impacts from plastic pipe installation in non-residential structures would be different and, in some respects, potentially more significant than the impacts identified with respect to residential installations. The DEIR's Technical Appendix on worker health consists of the DHS study of the potential health hazards for workers installing plastic plumbing. The study report acknowledged that its findings were limited to residential installations and specifically indicated that worker exposures in non-residential buildings were likely to be higher:

> This study had several limitations which should be considered when interpreting its results. The most fundamental of these limitations was that the scope of the study was limited to residential installations. Most plumbers do many types of installations during their careers at a mix of residential, commercial, and industrial sites. Commercial and industrial installation, typified by larger pipe sizes and extensive piping systems, are likely to produce higher exposures than occur in residential work. Conclusions about the possible hazards of installing residential plumbing do not directly apply to the hazards faced by these same workers at other sites." (DEIR, appen. C, pp. C-27 - 28, emphasis added.)

The conclusion of the DEIR's own Technical Appendix on worker health that worker exposures are likely to be higher in commercial and industrial installations is particularly significant given that the DHS study found exposure levels with residential installations in excess of established short term limits for some of the solvents at issue. (See discussion, *post*, section III.C.) Under these circumstances, CEQA would clearly require an examination of worker exposure

hazards in non-residential installations before plastic pipe could be authorized for such applications.

It is also likely that the DEIR's analysis of the leaching dangers of plastic pipe would produce different results in the case of non-residential occupancies. The DEIR indicates that, "[i]n determining the possible impacts of chemicals in pipe leaching into potable water, the time that the water remains in the pipe is . . . a critical variable." (DEIR, p. 29.) The second critical variable considered by the DEIR is the nature of water use in a residence, including the amount of water stored in the plumbing system, the amount used for drinking versus other uses, frequency of water replacement in plumbing lines and similar considerations. (*Ibid.*) These two critical determinants of the leaching danger would clearly differ in the case of non-residential occupancies.

The dwell time profile in an office or commercial building would be markedly different from the dwell times found in residential structures. These buildings are generally unoccupied after 5:00 P.M. and on weekends, resulting in significantly longer dwell periods than assumed in the DEIR. These buildings also include some systems, such as drinking fountains, that are used exclusively for drinking, sometimes with great intervals between usages. This again produces different assumptions from those applied in the DEIR.

The use of underground plastic piping to carry drinking water on industrial and commercial sites also raises a serious potential permeation hazard. There is extensive soil contamination throughout the state, and industrial and commercial developments are more likely to be located on contaminated sites than are residential developments. Although the Council disagrees with the DEIR's treatment of the permeation issue with respect to residential installations it is clear that a potentially significant permeation impact must be addressed with respect to industrial and commercial sites.

The DEIR's restricted project definition also distorts the DEIR's analysis of the fire danger. For example, the fuel loads present in residential construction are substantially less than those found in many of the other occupancies found in the UBC. In residential buildings, a ten pound square foot fuel load is much longer than assumed in the DEIR. In other occupancies, this fuel load can be four times that amount, i.e. 40 pounds per square foot or more.

The square footage of all buildings constructed per year in California, aside from residential buildings of not more than three stories in height, is very substantial and is also ignored in the DEIR's assessment of impacts. The effect of height on propagation of fire spread in tall buildings of residential or any other occupancy has been ignored in the DEIR. This stack effect can be considerable, and can spread fire from lower to upper stories of a building via the combustible piping. Finally, hospitals and other institutional buildings use as much or more plumbing as does a residential building. The effect on safety of the use of combustible piping on these institutional buildings has been ignored in the DEIR.

III. DEIR FAILS TO CONSIDER ADEQUATELY THE POTENTIAL IMPACTS OF EVEN THE NARROW PROJECT IT ADDRESSES

A. Drinking Water Contamination

The DEIR does not correctly identify the potential risk from drinking water contamination, even under its narrow project definition. This misrepresentation is compounded by an overstatement of the hazard from lead in drinking water under current law, resulting in a seriously flawed analysis of alternatives and mitigation.

1. DEIR Misrepresents Public Health Impacts by Relying Exclusively on the Cooper and Butter Studies

CEQA requires HCD to examine a reasonable worst case for environmental impact. (*Las Virgenes Homeowners v. Los Angeles* (1986) 177 Cal.App.3d 300 [223 Cal.Rptr. 18].) The two recent state sponsored studies, Cooper for water leaching and Bellows for worker health, add valuable information to the EIR process. For Cooper, a protocol was designed to help fill data gaps in certain areas of knowledge. However, Cooper could not answer questions beyond the specific focus of the study.

The effect of chlorinated water is a major issue not addressed by Cooper. Indeed, the possible significance of the role residual chlorine might play was only brought home by the high solvent levels observed by Cooper. Faced with the deficiency in the HCD testing program, the EIR authors went back to tests

performed by McKesson Environmental Services ("MES") laboratory for the Vinyl Institute (Butter, 1986).

The DEIR makes a significant error in its reliance on Cooper and Butter to the exclusion of a broad analysis. As stated before, the DEIR's complete failure to address the issue of plastic pipe formulation leads it to overlook a significant public health threat. Similarly, a narrow presentation of Cooper and Butter overlooks the limitations inherent in those studies.

Each study is simply a sample of the phenomena under investigation. Changes in any parameter of the tests would change results (the DEIR even notes this in explaining differences between Cooper and Butter). What the DEIR does not do is examine how sensitive the results of either study might be to variations in test conditions such as ambient temperature, number and quality of joints, composition of water, flush/dwell ratios and times, etc. Without an insightful analysis, the DEIR cannot adequately inform the public about how differing conditions in California could affect public health.

In essence, the DEIR reasons that if Cooper or Butter did not see it, it cannot happen. That is obviously wrong, because Cooper and Butter did not study everything. Rather than expend effort in analysis, the DEIR author takes the convenient way out. Instead, the DEIR should examine the few test results, including older tests, to establish a reasonable range of public health impacts. Perhaps the typical level of drinking water contamination would be as described, but under what conditions could levels be twice as great, or more? What would the worst case be? This approach is commonly done in environmental analyses such as air quality assessments and health risk assessments. It should be done here.

2. DEIR Fails to Consider Historical Data

a. Relevant Data on Leaching from Plastic Ignored

The DEIR does a great disservice to the decision making process by discarding data available to the ERD, gathered before 1983. The review of the earlier studies lead SRI to recommend further simulation testing. The recommendation was prompted by the need for certain pieces of information and improved experimental design, not by utter rejection of the earlier data.

Although some of the early studies have drawbacks[38], each one also contains useful information. However, if a past study implies a potentially significant health risk, the EIR must either explain precisely why the result is wrong and could never happen, or explain what measures HCD must take to prevent such conditions in California.

The early studies, such as Montgomery 1980 and 1982, show that high levels of chloroform and other chlorinated organic compounds can result in CPVC systems. The lower levels observed by Cooper can be attributed to any of the following: 1) changed manufacturing methods between 1982 and 1987, 2) different cements used, 3) longer dwell times in Montgomery, and 4) effect of chlorine in water.

The DEIR provides no basis to conclude that the levels seen in Montgomery could not be found in a PW system approved under HCD's proposed action. The DEIR selects only a part of the Butter study, ignoring the follow-up work that reported similar concentrations as found by Montgomery.[39] This is an example of selective reporting which leads to inaccurate conclusions. CEQA requires a balanced, complete inquiry. (14 C.C.R. § 15151.)

CEQA also requires that an EIR consider the significance of impacts under worst case conditions. In this case, the EIR must use the earlier studies as a means of establishing a higher range of potential exposures under worst case conditions. The significance of these exposure levels for public health must be examined.

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[38] For example, some studies used conditions more extreme than normal usage, had little guidance from prior efforts in analytical methodology (e.g solvent interference), or suffered from technical errors (e.g DEHP introduced by water supply connection tubing).

[39] McKesson's follow up study (Part 4) used "protocol water" (not chlorinated) and found chloroform from CPVC at levels up to 27 ppb in preoccupancy water. Such findings easily extrapolate to Montgomery's finding in the two week dwell.

b. DEIR Analysis of Metal Is Based on Studies of Now-Banned Lead-Based Solder

The DEIR's treatment of metal piping contrasts sharply with its treatment of plastic. In the plastic case, all old data are discarded; in the metal case, old studies are used exclusively. The Cooper study did not examine metal pipe. Butter studied copper pipe with 50/50 tin/lead solder. No current study with a defined protocol is available for no-lead solder; that is why the DEIR relies on old data.

Continuing reliance on metal plumbing is the No Action alternative, and is not part of the project. In fact, state law already restricts the amount of lead in solder to 0.2% (p. 58); what is already state law is not mitigation. The analysis in the DEIR on pages 35, 36, 42, 43 and Table 11 reflects conditions contrary to current state law. The discussion should be amended to clearly convey the extent of lead leachate from no-lead copper systems.

The comments here on lead are not meant to belittle the public health significance of lead in potable water. Indeed, the California Pipe Trades Council led the fight to ban lead solder in PW use. When the ERD was prepared, lead-based solder was allowed and the lengthy discussion had more relevance. While it is understandable that an EIR author is loath to discard text, the present treatment of lead in PW produces a significant bias in the document. The DEIR conveys a false impression that No Action--No Plastic means lead-based plumbing systems. That is not true.

With a correct presentation of the status of lead, the DEIR would show significantly less impact from metal pipe. The DEIR's recommended mitigation is current law and requires no further action on the part of HCD.

3. Sanitary Engineering and Environmental Health Research Laboratory Study (Cooper, 1987)

a. Problems with Protocol and Implementation of Study

The University of California Sanitary Engineering and Environmental Health Research Laboratory (SEEHRL) and Acurex, the analytical lab, operated under the HCD defined testing protocol. As seems inevitable, SEEHRL and

Acurex were forced to deviate from the defined protocol during the test. HCD and DHS discussed deviations from protocol but the DEIR does not. It would be valuable to have an organized presentation of the subject to allow the reader to better understand the limitations in the available data. The DEIR appendix A, Podoll's analysis of the Cooper work, should list deviations from the protocol and make it clear which test systems, analytical methods, and dates were affected.

In review of the Cooper study, the Council's consultants noted many problems. Given the magnitude of the challenge, the Council thought that the Cooper study was well done and provided useful information. However, the Council did expect SRI to conduct a thorough review of the Cooper work and base the DEIR discussion on a more sophisticated understanding of what Cooper was actually able to accomplish and what the significance of the Cooper results are to HCD's proposed action.

(1) Impaired Limit of Detection

The Cooper Study revealed large, persistent concentrations of organic solvents in the test water. The same solvents were found in the glues used to assemble the pipe. It had been anticipated that the solvents would pose an analytical problem to the lab -- the difficulty of detecting small quantities of some chemicals in the presence of large quantities of others. It seems that Cooper has done a far better job in dealing with solvent interferences than previous attempts by others, but the interferences persisted nonetheless and forced the testing lab, Acurex Corporation, to deviate from the original testing protocol. Cumulatively, the deviations reduce the resolving power of the test and make the DEIR's unquestioning reliance on the results even less appropriate.

In particular, what were the specific techniques used to reduce the adverse effects of high solvent levels? The report mentions sample dilution. What other methods were used (e.g. diversion of the solvent peak away from the detector)? The lab requested changes in protocol not to improve levels of detection for trace contaminants, but to reduce residual solvent loading on the instrument. How much did the presence of solvent residual reduce levels of detection for trace contaminants?

In all, the EIR should explain to the public what the resolving power of the test/analytical system was and compare the limits of detection (LOD) reported with health risk standards. For example, the LOD for chloroform exceeds the US EPA 10^{-6} cancer risk level. That means that water could contain chloroform at several times the appropriate risk level and the Cooper/Acurex test would not have detected it.

(2) Not All Leachates Identified

Contrary to the intent of the protocol, there was no substantive effort made to identify the Non-Priority Pollutants in either PB or CPVC test waters. This was understood to be a difficult part of the program, but is was equally clear that health concerns from plastic pipe were not limited to the few compounds listed by EPA as priority pollutants.

Acurex endeavored to sharply restrict the breadth of investigation required for non-priority pollutants, asking that HCD/DHS provide identification and standards in advance of the analysis and pay for additional characterization work. HCD staff resisted the change: "First, there is no way of identifying in advance what 'unknown' chemicals will be present in the pipe leachate. A major reason for the study is to allow a laboratory to identify compounds in the leachate. Second, the request for bids provided no time or money for such a secondary study." (Letter from Julie Castelli Nauman, Chief Deputy Director, HCD to Robert Cooper, Project Director, SEEHRL. May 27, 1987, appen. P.)

In the end, very little was done. Acurex reports a few "peaks," denoting chemicals coming off the column for both CPVC and PB, but does not identify them. The ostensible reason is that the peaks disappeared or were sporadic in appearance and would not be significant leachates. The Council is concerned that the analytical procedure may have masked the presence of the unknown substances.

The problem with solvent interference in CPVC systems clearly reduced the lab's ability to detect non-priority pollutant substances. But even with PB, the methods used may not have had optimum resolving power. The protocol specifies, "Identification of additional peaks ... shall be made when the chemical is present at a concentration equal to or greater than 10% of the nearest internal standard (of approximately 50 ug/l)." (HCD Protocol, January 1986. p.

4.) In careful review of the Acurex report, the Council notes extensive discussion of internal standards, but do not see verification that the standards were present at "approximately 50 ug/l," nor does the Council see a discussion of how the non-priority peaks were selected for study.

The likely presence of chemicals in leachate not reported by the lab is illustrated by an accident. When samples were left uncapped, some of the solvent evaporated before they were analyzed. "Two or three of the samples showed unknown peaks due to the concentrating of materials and other effects associated with the loss of solvent. These unknowns were not seen in any other day's samples, suggesting that they were an artifact associated with the day 45 acid analysis. Normally these materials would be well below the detection limit of the instrument." Cooper study, appen. K, p. 23, emphasis added.)

The EIR should present some sense of the magnitude of unidentified substances. What was the quantitative extent of material on the chromatogram that was not identified? Has SRI made an independent review of the Cooper/Acurex data to place confidence on the finding that no compounds other than the few noted in the DEIR could be in leachate from plastic pipe?

(3) Sample Mixup or Analysis Conducted Past Due Date

According to Acurex, several samples were mixed-up. The acid extracts for day 45 were combined inadvertently with the base neutral fractions for samples for day 50. During the re-analysis it was discovered that the acid extract had been left uncapped and the sample volume had changed." (Cooper study, appen. K, pp. 22-23.)

The HCD protocol requires the samples to be analyzed within 14 days. In several cases this was not done by the lab. Although not reported by Acurex, the date on the result summary shows that the samples for solvent cements were analyzed some 40 days late.

(4) Sample and Column Contamination

The ability of the lab to detect and identify small quantities of chemicals depends on freedom from contamination. Reports of occasional appearances of

chlorinated organics and phthalate esters are dismissed as contamination. Samples collected from PB pipe systems were apparently run on equipment impaired by high solvent left from runs on CPVC pipe systems. "Some of these [organic chemicals in PB pipe] appear to be attributed to laboratory contamination or carry-over in the analytical instrument from CPVC samples." (Cooper, appen. K, p. 15.) "An occasional problem was noted of carry over of ketone species (acetone, tetrahydrofuran, 2-butanone, [MEK] and cyclohexanone) into the control an PB samples." (for method 624, Cooper, appen. K p. 20.) " ... an occasional problem of ketone carryover was noted in control and PB samples in spite of efforts to avoid this by use of intermediate blanks and bake out procedures." (Cooper, appen. K, p. 25) "Two recurring laboratory contaminants were noted in the samples. These were the mono-2-ethylhexylester of hexandioic acid and hexadecanoic acid." (Cooper, appen. K, p. 21")

The prospect of solvent carryover is addressed in the HCD protocol. The protocol warns, "The contractor shall take appropriate steps such as disassembling and cleaning the purge and trap apparatus and running blank samples between the analyses of actual test samples to demonstrate that these substances have been reduced to background levels." (HCD, "Test Protocol Plastic Pipe Leaching Study," January 1986.) It is not clear that the contractor was able to so demonstrate.

(5) Inadequate Analysis of Cements

The HCD test protocol states that the joint compounds shall be analyzed. Cooper reports a partial analysis in its appendix J. The analysis is plagued by high levels of dominant solvents such that there is no resolving power for lower level constituents and contaminants. The first analysis effected a limit of detection of 500,000 ppb for priority pollutants -- any hazardous constituent present below this amount would not have been reported. The sample was run later with the major peaks diverted from the detector and the sample could be run without dilution. The limit of detection was improved, but the subsequent analysis was conducted on April 30, 1987, nearly six weeks after the first analysis. The sample was significantly past the required holding time requirement which reduces the recovery of trace contaminants.

In reviewing the HCD file on the Acurex analysis of cements, there is clear dissatisfaction on the part of HCD with the lab's performance, primarily because detection limits are so poor. The delayed analysis did not resolve the concerns raised by HCD or DHS staff.

In the study for the Vinyl Institute, McKesson Environmental Services was able to conduct a more insightful analysis of the solvent cements. (MES, 1986. Table 3, page III-18 to III-20.) Cooper apparently did not attempt to analyze the cements for DMF, a compound found earlier by MES and of public health interest. Cooper detected none of the chlorinated organic compounds found by MES.

Failure to carefully study the solvent cement and primer flaws the Cooper study. First, the analysis was required by the protocol. Second, considering that Cooper found that solvent leached rapidly into the water, it would warrant an effort to find out what was present or to be sure what was not present. A significant defect in project description discussed earlier is the failure to account for formula variability and contamination in solvent products. The point may be demonstrated by a comparison of the Cooper study, which found only low levels of chlorinated organics, with the McKesson elevated temperature study, which found high levels of chlorinated organics. McKesson did find chlorinated compounds in the cements; that may be a significant potential source of public health hazard. The EIR should address the question: Did the Cooper study fail to find chlorinated organics because the cement and primer used were relatively free from contamination?

(6) Duplicates Left Out of Average Values

The lab was routinely sent duplicate samples for backup analyses. The protocol called for analysis of the duplicates when required to resolve inconsistent results and a certain number were selected randomly for analysis as part of the quality control. It seems that the solvent concentrations reported in the main body of the Cooper report and used in the statistical analysis of leaching rates were based on averages that excluded the duplicate data when inclusion of the duplicate would have raised the average. Inclusion of duplicate data would increase the average for THF and slightly reduce the variance in the results.

(7) Reporting of Data Out of Linear Range

The analysis in the DEIR relies on leaching data from the preoccupancy period for its assessment of worker health and for projections of leaching kinetics. However, the solvent levels in the beginning of the simulation period were extremely high, and for some tests, were beyond the instrument's linear range of response. This is noted on Acurex's data sheet, "These values are approximations because they are out of the linear range of the instrumentation." (Cooper, appen. K, various tables, e.g., table 7.4). In the text, Acurex explains that the when a compound was out of linear range, the quantity was estimated by various means and the results reported to one significant figure. (Cooper, appen. K, p. 6.) The EIR should acknowledge the imprecision of the high solvent values and take these into account in statistical analysis of the results.

(8) Inadequate Statistical Analysis

One of the greatest disappointments in the SRI and Cooper work is the short shrift given statistical analysis of the data. Acurex provided a simplistic analysis of the test data. Acurex took widely scattered data -- a few points with a high variance -- and concluded ingenuously that the differences between two duplicate pipe units A/B and C/D were not statistically significant.

Robert Cooper, SEEHRL director, presumably had at his disposal capability to perform an insightful analysis of the data but chose not to do so. "The University [SEEHRL] will not be responsible for the analyses (including statistical) of the data generated by the contract laboratory. These latter functions will be taken care of by the consulting laboratory and others appointed by the State staff." (Memorandum from Robert C. Cooper to Marion B. Lentz, Sponsored Projects Office, Univ. Calif. Berkeley. November 12, 1986. Attachment D to SEEHRL contract with the State.) Hence, Cooper only reported average values for the solvents (Tables 7 to 10, and Figures 4 through 7).

The DEIR appendix A presents one semilogarithmic plot of one solvent for one type of pipe, but offers no further statistical analysis. Even that figure, (Figure 1) would be improved if the y-axis were labeled in actual concentration units instead of natural log units. The casual reader may not realize that "7.0" on the graph's y-axis corresponds to 1100 ppb.

The rate of solvent leaching is important in determining the public health impact of CPVC systems. The DEIR acknowledges, "The greatest uncertainty in plastic pipe leaching is estimation of the concentration-time profile of the CPVC cement solvents. The inherent variability in cement application procedures and the assumption of continued exponential decline of the concentration are the principal causes of these uncertainties." (DEIR, appen. A., p. A-10) Faced with this reality, SRI relies on "extrapolation of test data" to set concentration limits.

One concern is that the extrapolation is based on a simple extension of the semilog plot without an analysis of the variability inherent in the test data and the further variance from other factors (such as the cement application procedures cited by SRI). The DEIR does not disclose the method of the model used in the extrapolation. The graph in Figure 1 looks like an "eyeball" fit. Was curve fitting used? If so, the EIR should report the correlation coefficient and state whether data were lumped. Were analyses conducted for other solvents and for other pipe systems?

The textual discussion of the DEIR, appendix A, Annex A suggests that the curving semilog plot is due to the change in flushing procedure for the protocol, and that the decline in concentration over time changes because the preoccupancy flushing was 19 void volumes and the occupancy flushing was one void volume. In fact, the change in flushing contributes very little to the pattern, perhaps producing the slight upward blip in the graphs at day 16. The ultimate concentration in the pipe reflects the leaching rate and will be most directly influenced by dwell time. Unless the flushing were done over a long period of time, it is doubtful that it would do more than deplete the solvent at the surface of the pipe joint.

A more plausible explanation for the changing rate of decline is that the solvent is sequestered in different parts of the joint, some leaching more quickly, like cement exposed at the inside of the pipe, others more slowly, like cement inside the joint interface. The presence of solvent in slow leaching environment prolongs the potential exposure. (Appendix Q of these comments provides a quantitative presentation of this view.)

If SRI actually uses a curve fitting method, it would be appropriate to determine confidence intervals on the regression. At a minimum, the variable analyses presented by Acurex should be shown along with the mean and standard deviation. In scientific analysis, it is common for experimental data to be presented with error bars reflecting the 95% confidence interval for the data. What the confidence interval shows is the extent to which the average value is affected by the variation in sample analysis. If this is done for the Cooper data, the magnitude of solvent exposure projected from this one test is doubled.

Even that approach does not address the worry expressed in the DEIR over "cement application procedures" or other variables not addressed in the DEIR. The mention of "cement application procedures" may be a reference to the different results from the McKesson (Butter) study, addressed below. In its assessment of the Cooper results, the EIR should attempt to quantify the uncertainty in its estimates.

b. Chlorination Omitted from HCD Protocol

The HCD test protocol used by Cooper specified a high purity water system ("MilleQ" water). The alkalinity (pH) and hardness were controlled, but no residual chlorine was added to the water. The need for high purity water was clearly meant to achieve the lowest possible background level, keeping the standard deviation of the control values low, and thereby allowing the highest possible limit of detection for chemicals leaching from the pipe.[40]

At the time that the protocol was being specified, the primary interest was in the presence of chlorinated hydrocarbons in the CPVC pipe left from the manufacturing process; the potential role of residual chlorine in public water supplies was thought to be less important than chemicals leaching directly from the pipe. Lengthy discussions of the protocol with HCD staff failed to resolve the chlorination issue. The Council's representatives asked HCD to use chlorinated water in a test, but to assure that the water was otherwise pure, to provide a sensitive limit of detection above background levels. The plastics industry argued that the chlorination study added unnecessary cost and if done,

[40] For example, compare the difficulty with Butter in resolving chlorinated organics in a city supply water with a fluctuating background level. (See DEIR, appen. A, table 6, p. A-27.)

should use actual domestic water to show the high levels of trihalomethanes already present.

Recent evidence and the results of the Cooper study now suggest that there may be a significant role of residual chlorine in forming chlorinated hydrocarbons in both PB and CPVC pipe systems. Even the DEIR claims that chloroform would only be present as the product of reaction with residual chlorine. As discussed below, reliance on the earlier McKesson study for CPVC is misplaced, and McKesson did not test PB at all.

c. Cooper Test Not Representative

The Cooper tests on CPVC used four simulation systems, two from each of two brands of pipe and each brand with a different cement. As described, *ante*, section II.B., there is much potential variation in both pipe and cement. However, the Cooper study did not look behind the labels to determine how representative the materials were. The pipe resin in both samples was probably made by B.F. Goodrich. The solvent and primer came under different labels, but these are apparently only different "house brands" for material made by the same company.[41]

Given the concerns already raised over the potential for contamination as a result of manufacturing, the failure of Cooper or HCD to learn more of the history of the pipe and cements used in the test is a significant flaw in the scientific analysis used to justify the conclusion in the DEIR.

d. Selective Interpretation of Results

Some of the results of Cooper are removed before inclusion in the DEIR. Cooper[42] and Podoll of SRI analyzing Cooper[43] reported low levels of

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[41] The CPVC pipe came from Genova and from R & G Sloan, both use B.F. Goodrich resin. The cement and primer were labeled "Master Plumber" and "Ace Hardware", both made by PCI Industries. SEEHRL 1987, pp 2,3.

[42] Cooper, 1987, p. 15 and appen. K, Acurex Final Report, August 31, 1987. David R. Taylor.

chloroform and trichloroethane or trichloroethene in water from the CPVC systems. Neither is mentioned in the DEIR list of leachates from Cooper, and the DEIR is so bold as to say "Chloroform was not found [in the Cooper test]." (DEIR, p. 40.)

4. McKesson Environmental Services Study (Butter, 1986)

The DEIR attempts to bypass the lack of information on chlorine effects by relying on the McKesson Environmental Services (MES) study done for the Vinyl Institute (Butter, 1986). This is inappropriate. The information should be presented in the DEIR, but the EIR authors seem not to have made an independent appraisal of the data as required by CEQA. Further, the Butter study is the only information used in the DEIR to address an important public health issue.

a. Inappropriate to Rely on Vinyl Institute Sponsored Study

The study was sponsored by the Vinyl Institute, with Alan J. Olsen of B.F. Goodrich as a principal administrator. B.F. Goodrich is the principal domestic manufacturer of CPVC pipe and is a real party in interest in the HCD action, if not the formal "applicant." CEQA requires the lead agency to exercise independent judgment in using information, particularly when provided by the applicant. Certainly HCD recognized the need for testing conducted for the state independent of the parties to the action (Plastics Industry and Pipe Trades). HCD expended a significant effort soliciting and directing the efforts of a testing laboratory. It is essential that the public have the same confidence in the EIR.

b. Problems with Protocol

The EIR should carefully assess the deficiencies in the Butter study. As described below, the deficiencies severely limit the advisability of HCD's reliance on the Butter study for assessment of the chlorination issue. Given the significance of the issue, HCD failure to add chlorination to the Cooper study renders the conclusions in the DEIR invalid.

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[43](...continued)

[43] Dr. Thomas Podoll, "Water Quality Review Update" Technical Studies, appen. A, p. A-25.

(1) MES "Chlorinated" Water Not Reported

The most significant problem with the study as prepared by McKesson is the selection of chlorinated water for the CPVC test. The Vinyl Institute originally asked MES to study copper pipe in parallel with the tests of plastic overseen by HCD. (Butter, 1986, p. I-1.) MES proceeded with tests on copper (using 50-50 tin-lead solder) and used three different test waters:

- Domestic Water. Raw water from the Sacramento Municipal System, trucked from Sacramento to MES in Dublin and chlorinated on-site at MES. The raw water is naturally low in hardness (24 mg/l as $CaCO_3$).

- HCD Protocol Water. Local (Dublin) water passed through reverse osmosis and the MilleQ ion exchange system then hardness (100 mg/l as $CaCO_3$) and pH (8) adjusted. No chlorine.

- Softened Water. Protocol water of specified hardness was passed through a conventional water softener and chlorinated to 1.0 ppm residual chlorine.

(Butter, 1986, p. II-11.)

The rigorous attention to test waters for copper pipe was presumably directed at an effort to see the levels of metal scavenged by soft waters with a reduced pH (acid) from residual chlorine.

When the first HCD plastic pipe leaching test was aborted due to laboratory error[44], the Vinyl Institute asked MES to undertake a study of CPVC. The waters selected for study were:

- Domestic Water. Dublin municipal (chlorinated) water. Not modified by lab; connected directly, with a pressure controlling valve.

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[44] Versar Laboratories, selected by HCD to perform the leaching test, was terminated in 1986.

° HCD Protocol Water. As for metal system, above.

(Butter, 1986, p. III-25.)

Contrary to the test of copper pipe, MES added no chlorine to any of the CPVC test waters. For the "domestic water," MES claims that "[t]he chlorine level was checked each day water was used." (Butter, 1986, p. III-25.) However, these chlorine levels are not reported. The level of residual chlorine actually introduced into the system is a critical experimental variable, yet it is unknown. The DEIR cannot rely on an alleged test of CPVC with chlorinated water if it is not known how much chlorine was present.

The water called "Dublin municipal" by MES is supplied by the Dublin San Ramon Services District (DSRSD). The water is obtained by DSRSD from Alameda County Flood Control and Water Conservation District, Zone 7. Zone 7 chlorinates raw water from the California Aqueduct or from Del Valle Reservoir, but the chlorine levels have fallen by the time DSRSD receives the water for distribution, and the DSRSD usually supplements chlorination to 0.5 ppm. The high chlorine demand from surface water supplies causes DSRSD to perform further chlorination at reservoirs because the residual chlorine level falls during distribution. (Pers. comm. with John Mauck, Water Supervisor, DSRSD, November 1, 1989.)

Although MES did not report residual chlorine levels, it is likely that residual chlorine introduced into the CPVC pipe assembly was well below 0.5 ppm, less than half of the level MES was asked to maintain for the chlorinated soft protocol water used in the test on copper pipe. MES used a different chlorinator for the Sacramento municipal water in the metal tests. MES did not report the level of chlorine desired, but the chlorinator malfunctioned during the test sending total chlorine as high as 3.0 ppm. (Butter, 1986, p. II-17, and part II, figure 4.) It seems certain that MES did not use chlorine levels that high on the CPVC pipe.

The different treatment of plastic and metal show a bias in experimental design. Aside from calling into question the reliability of the study, the differences are significant for the DEIR's conclusions. It appears that the low levels of chloroform reported by Butter may be due in part to the low levels of

residual chlorine in the test water. Yet the DEIR adopts the Butter value for preoccupancy chloroform without taking into account the problem of representativeness of the residual chlorine level. If residual chlorine had been greater, would not the reaction with solvent be more rapid, leading to higher chloroform concentrations in the water?

(2) High Background Levels of Halogenated Organics Obscure Test Results

The municipal water from DSRSD has high background levels of halogenated organics which obscure the test results. The high chlorine demand from the surface water supplied by DSRSD which depletes residual chlorine is also responsible for producing halogenated organics in the water. Total trihalomethanes (THM) often reach 100 ppb, particularly in early winter. (Pers. Comm. with John Mauck, DSRSD, November 1, 1989.) Surely this condition would have been well known to MES staff.

Unfortunately, the high and fluctuating levels of THM confound the analysis of leaching and secondary THM formation in the pipe system. With background levels ranging from 6 to 53 ppb chloroform over the course of the study (Butter, 1986, table 14-1, p. III-64), the lab's ability to resolve the contribution from the plastic pipe system is severely reduced.

Butter acknowledged this limitation (with emphasis added):

> Trihalomethane concentrations found in the discharge from the municipal water tube assemblies during the usage period correlate well with concentrations in the municipal input water, and a contribution from the pipe assemblies cannot be established. (Butter, 1986, p. III-1.)

> The concentration of the three [THM] vary within the precision of the analyses and any contribution from the CPVC pipe cannot be discerned. (Butter, 1986, p. III-57.)

> . . . the effect of the piping system on the concentration of trihalomethanes in a chlorinated water supply is not significant in relation to the

concentration in the inlet water based on the expected precision of the method at that concentration. (Butter, 1986, p. III-82.)

In these statements, Butter is warning the reader that the background levels were so high that MES really couldn't be sure if they found anything. In deciding to rely on the MES study, SRI should conduct an analysis of the effect of high background levels on the limit of detection. The HCD protocol makes reference to the "Guidelines for Data Acquisition and Data Quality Evaluation in Environmental Chemistry"[45] which show how a high standard deviation in the field blank or control sharply increases the limit of detection and reduces test resolving power. yd

Even pipe contributions smaller than background can have a significant public health impact. First, any addition to the cancer risk is an adverse impact. Second, the concerted efforts of government and water distributors to reduce THM in drinking water is offset by increases from a new source. Third, THM can be reduced system-wide, but the chloroform in a plastic PW system is added just before use and is no longer susceptible to system-wide treatment.

The obscuring effect of using a high THM municipal water demonstrates further bias in experimental design. When the Vinyl Institute studied copper, special soft municipal water was trucked in from Sacramento, and a special soft, chlorinated pure water was prepared from HCD Protocol water. Experimental conditions were ideal for leaching and detecting metals from copper. However, when the Vinyl Institute studied CPVC, different municipal water was used, and no chlorinated high purity water was used. Experimental conditions were adverse for leaching and detecting chloroform from CPVC.

(3) CPVC Test Run with Very Cold Water

According to the DEIR hypothesis, chloroform appeared in Butter because solvents, particularly MEK, leached from the joints and reacted with the residual chlorine in the municipal water. The DEIR failed to mention that the MES test

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[45] ACS Committee on Environmental Improvement, "Guidelines for Data Acquisition and Data Quality Evaluation in Environmental Chemistry", Anal. Chem. 52:14 pp. 2242-2249. Dec. 1980.

was run with unusually cold water which resulted in a smaller than normal amount of leaching and reaction.

MES began the CPVC study in early winter. The "mini assemblies" and the full scale simulation were housed in an unheated building. During the winter months, the temperature of the MES experimental setup was typically 45°F. Thus the entire CPVC leaching study done by MES was conducted in a virtual icebox -- significantly reducing chemical mobility and reactivity, and leading to a dramatic underestimate of the potential for chloroform in CPVC piping.

The chloroform concentration depends on the rate of formation. The key factors determining the rate of formation are diffusion and dissolution (solvent leaching) and reaction with chlorine. The rates of all of these physical chemical phenomenon are temperature dependant. Actual rate dependance varies according to the reaction, but reactions typically are accelerated exponentially by increasing temperature.[46] The chemistry governing this phenomenon is not exotic, yet the DEIR never attempts to consider the effect of temperature on the applicability of the McKesson results.

Surely hot water in a PW system will increase reaction rates, and the effect of longer dwell at higher temperature should be addressed by the EIR. Circulating hot water systems will keep the solvent-chlorine system at an elevated temperature, 120°F or more. However, even in a conventional hot water supply

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[46] The rate relationship is defined by the Arrhenius equation and requires knowledge of the activation energy.

$$k = k'e^{-E_{act}/RT}$$

Where k is the new rate, k' is the rate constant, E_{act} is the activation energy (cal/mole), R is the gas constant, T is absolute temperature, and e is the base of natural logarithms.

Although E_{act} for the dark, aqueous chlorination reaction is not known, the typical value of E_{act} is 13,000 cal/mole and leads to an approximate doubling of reaction rate with a 10° rise in temperature (Linus Pauling, General Chemistry, 2nd. ed., WH Freeman, San Francisco 1958. Page 409). The temperature difference from 45°F to 80°F is equivalent to 20°C. At typical E_{act}, one would predict a fourfold increase in solvent chlorination rate. Were pipe to be maintained at 120°F, the reaction would be 18 times greater than at 45°F.

system, current energy conservation requirements call for insulation that can keep water warm above ambient for an hour.

Cold water supply will usually be warmer than the 45°F average for MES pipe leaching study. Pipes in interior walls will be warmed by building heat in winter, and pipes in crawl spaces or in exterior walls will be warmed by sun and exterior air temperatures during summer. It would be common in the warm season to have standing water in the cold supply reach 80°F or more.

c. Errors in Interpretation

Despite the significant limitations, there is useful information in Butter that could contribute to the DEIR's analysis. Unfortunately, the DEIR omits reference to results from Butter that demonstrate a higher leaching potential than do the results from Cooper.

d. MES Elevated Temperature Test Not Reported

MES acknowledged the problem with running the CPVC simulation in the cold. In response, MES tested a "mini" assembly of CPVC. The report, part IV of Butter, is included here as appendix R. The mini assembly is a ten foot length of pipe with five fittings and 12 joints in all. Unlike the simulation test assemblies which were built by a master journeyman plumber (Butter, 1986, p. III-6.), the mini assembly was built by laboratory staff. MES used only the unchlorinated HCD protocol water for the reexamination and the straight "chlorinated" municipal water was not used. (Butter, 1986. Page IV-15.) The assembly was flushed and filled the same as in the full simulation, but kept at 80 °F during the test.

The results displayed in Part IV of Butter show much more rapid leaching. Day 1-2 showed chloroform at 27 ppb and THF at 160,000 ppb. Chloroform appeared in every sample out to day 43. On day 50, the last day of the mini test, THF was found at 6800 ppb and MEK at 190 ppb. (Butter, 1986, part IV, table 2, pp. IV-13,14.)

Butter explained these results as follows:

> Higher levels of extractables were found in water from assemblies at 80°F than was found in water from assemblies at ambient temperatures. This is not surprising in view of the 35°F differential between the two studies. That difference translates to 6-7 x increased reaction rates. Thus the data generated presents the worst possible case for CPVC at the elevated temperatures. (Butter, 1986, p. IV-1.)

Butter also mentioned the following considerations that tempered the interpretation: 1) the ratio of joints-to-length was greater than in the HCD protocol, 2) the cementing of the joints was less perfect, exposing substantially more cement area, and 3) sampling of a limited internal volume could lead to a non-homogeneous sample.

Although the additional joints and sloppy work would increase leaching, such conditions could easily occur in actual construction. The last ten feet of pipe reaching the water tap has the largest number of fittings per foot of pipe, and, overuse of glue is common in unskilled labor. After all, the mini assembly was built by McKesson Environmental Services technicians, not by people completely unfamiliar with the plastic pipe materials.[47]

Note the high and consistent presence of chloroform in unchlorinated water. The DEIR attempts to explain all chloroform as the product of solvent reaction with residual chlorine. In the mini test system, with no residual chlorine, the chloroform observed must have come from some other source. The EIR must reconsider its hypothesis for chloroform formation. The EIR should consider the levels MES observed in the elevated temperature as relevant to the establishment of a worst case condition.

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[47] The "and a lick to stick" approach is common in unskilled labor assembling plastic pipe. Plastic joints can be imperfect for several reasons. In particular, failure to cut square and debur pipe leads to incomplete insertion and a poor joint. Solvent cements are not meant to fill voids and only work well in an "interference" fitting. However, when a plastic joint leaks, it cannot be remade, as with metal, it must be entirely cut out. Depending on the stage of assembly, this can be an extreme nuisance. Hence, the inexperienced plastic worker will often use a great excess of glue in an attempt to avoid the inconvenience of failures.

e. MES Cement Analysis Not Reported

The McKesson study presents an analysis of the solvent cements and primers used in the test system. The detail of the analysis is not published, but it seems from the results that MES was able to achieve a level of resolution Acurex could not achieve. It would make sense for the EIR to publish information from Butter to make up for the deficiency in the results from Cooper.

The solvent cement data are reproduced here as appendix S. The analysis gives the major constituents in rough percentages and shows the minor constituents or contaminants found. Among the minor constituents area N-N-dimethylformamide (DMF), and chlorinated organics.

The DMF was found leached into the water in the pipe. DMF is a health concern, and its presence in cements was brought out by the worker health studies. (Bellows, 1989.) Since the SEEHRL study did not analyze for DMF, the EIR should refer to the MES study.

The chlorinated organics imply contamination of the solvent, as would be expected from use of recycled material. None of the manufacturing processes for the oxygenated solvents (THF is an ether, MEK, ACE, CHX are ketones) would involve methylene chloride, trichloroethane, or freon, yet those chemicals were found in the cement. MES was having serious problems with limit of detection and dirty blanks for methylene chloride, but levels of methylene chloride were observed above control values in the test water. In the Appendix to the DEIR, Podall noted that "Methylene chloride, a minor constituent of the cement, was detected on day 1 at about 10 ppb and fell to about 2 ppb by day 75." (DEIR, appen. A, p. A-25). But the main body of the DEIR doesn't list methylene chloride as a potential leachate from cement in table 9, page 40, and does not include an analysis of the potential health effects of methylene chloride, a carcinogen and neurotoxin. The EIR should alert the public to the possibility of chlorinated compounds being introduced directly into the water from contaminants in the cement.

5. Effect of Chlorination

a. Other Studies Should Not Be Dismissed

The following laboratory test results are dismissed by the DEIR:

1. United States Testing Company, Inc. "Extraction of Polybutylene Pipe with Chlorinated Water." (December 8, 1986.)

2. James Montgomery Consulting Engineers, Inc. "Diffusion of Organics from Polybutylene Pipe." (September 9, 1987.)

Both studies used a chlorinated test water to extract organic material from polybutylene pipe samples. In each case, the PB pipe showed a high affinity for the residual chlorine and correspondingly high levels of chloroform were observed.

The tests were not intended as simulations of actual domestic usage. The extraction took place in a glass jar with short lengths of PB pipe immersed in hot water. The tests used long extraction periods for the PB and provided continual replacement of chlorine as it was consumed by reaction with the PB pipe. However, the conditions are relevant to appraisal of domestic health hazard and the results are significant. PB is meant to be used with hot water and the contact times used in the Montgomery Engineers study for chlorination 2, 4, and 6 hours are not unrealistically long.

If conditions are extrapolated to shorter extraction times and chlorine is not replenished, the tests still imply adequate contact time for nearly complete reaction of organics in the PB to form chlorinated organics in drinking water. Furthermore, the slower leaching under normal usage conditions will act to prolong the period of exposure.

The results of chlorinated test water in PB systems has implications to the CPVC system as well. Based on lab studies in glass, the chlorination of organics is slow under normal drinking water pH. The presence of the pipe, however, may provide conditions to accelerate the reaction. The presence of very high, persistent solvent levels in the CPVC system suggests that there may be a far greater potential for residual chlorine in the domestic water supply to form

chloroform by reaction with solvents. Typical residual chlorine levels are 500 to 1000 ppb chlorine. Even partial reaction with solvents would deplete the chlorine rapidly and has the potential to produce chloroform levels well above 100 ppb.

b. DEIR Fails to Consider Effect of Residual Chlorine on Chloroform Production

The problem of reaction with residual chlorine will be significant. While formation of trihalomethanes from chlorine in drinking water is recognized as a public health problem, the far greater threat of water-borne infection prevents reducing or abandoning chlorine as the preferred method of water treatment. In recent years, giardia has emerged as a formidable water-borne infection in the U.S. and EPA requirements for water supply to meet bacterial count standards will unfortunately require higher doses of chlorine in some water systems. Most affected are systems with long pipe runs from plant to consumer, such as Los Angeles, where the need to maintain bacteriostatic residuals at the periphery of the system will result in higher levels of residual in the central area.

Pipe affinity for chlorine will reduce chlorine residual in the potable water system, reducing public health protection and possibly increasing the incidence of pipe borne pathogens. The DEIR ignores the significant problem of bacterial or other pathogenic colonies established in plumbing. The initial smooth surface of plastic pipe erodes in use and offers a substrate for microorganism growth.

6. The DEIR Fails to Consider that Producers and Installers of Plastic Pipe Will Violate Proposition 65

Proposition 65, also known as the Safe Drinking Water and Toxic Enforcement Act of 1986 (Health & Saf. Code § 25249.5 et seq.) prohibits any "person in the course of doing business" from knowingly discharging or releasing a chemical known to the state to cause cancer or reproductive toxicity into water. (Health & Saf. Code § 25249.5.) Chloroform, a chemical found to leach into drinking water from plastic pipe (particularly CPVC and PVC) in the DEIR, is a chemical known to the state to cause cancer. (22 C.C.R. § 12000, subds. (b) and (c).) Chloroform was placed on the list of carcinogenic chemicals on

October 1, 1987, more than twenty months ago. The discharge of chloroform into water from plastic pipe is, therefore, a violation of Proposition 65.

Chloroform leaches from plastic pipe during the first two days after installation at the level of 27 ppb, which is equivalent to 27 micrograms per liter of water. (Butter, 1986, part IV, table 2, pp. IV-13, 14.) Assuming, as do the DEIR and the Proposition 65 regulations, that an average person ingests 2 liters of water per day, the exposure would be 54 micrograms per day. (DEIR, p. 46; 22 C.C.R. § 12721, subd. (d)(2)(A).) This exceeds by six times the exposure limit of 9 micrograms per day established by Proposition 65 and attendant regulations. (Health & Saf. Code § 25249.10, subd. (c), 22 C.C.R. § 12711, subd. (a)(2).) It exceeds by more than four times the exposure level established by the state for drinking water of 6 ppb. (22 C.C.R. §12711, subd. (a)(3); CDHS, Applied Action Levels for Chlorine, 1988.)

Since the chloroform leached from plastic pipe exceeds legal levels, it is considered a significant amount of contamination and is barred by Proposition 65. (Health & Saf. Code § 25249.9, subds. (b)(1) and (2).) Resin and pipe manufacturers and plastic pipe installers would be enjoined from making and installing the pipe and could be liable for civil penalties of $2500 per day for each violation. (Health & Saf. Code § 25249.7, subds. (a) and (b).)

Chloroform leaches from plastic pipe directly and indirectly. As the result of manufacturing processes, it may be present in the pipe itself and dissolve directly into the water. (See, *ante*, section III.A.6.b.) In addition, it is created from the interaction of MEK from pipe solvents with residual chlorine already in the water for disinfection. (DEIR, p. 40.) Either of these sources would constitute a "discharge or release into water" because it is a "direct or indirect transfer" of chloroform to consumers by a manufacturer or installer. (22 C.C.R. § 12202, subd. (e)(4); Health & Saf. Code § 15149.11, subd. (a).) Since the chloroform leaches into potable water systems, it is contaminating drinking water. (Health & Saf. Code § 25249.5.)

The DEIR completely ignores Proposition 65 and the effect of its provisions on the proposed expanded uses of plastic pipe. This omission is important because Proposition 65 could make many of the expanded uses illegal

due to leaching of chloroform and other chemicals in excess of established limits.[48]

7. ASTM, NSF and IAPMO Cannot Protect the Public from the Health Dangers of Plastic Pipe

The DEIR is misleading in suggesting that private agencies will assure the safety of plastic pipe. The DEIR ignores questions raised in the ERD about whether "voluntary standards organizations, such as the National Sanitation Foundation, [can] catch the majority of errors in manufacturing pipe and related materials." (ERD, p. II-22.)

NSF only tests for some metals and for vinyl chloride monomer. NSF does not test for chemicals of concern from the plastic pipe or from CPVC pipe cements. NSF does not address the range of chemical public health hazards addressed in the DEIR. It does not test for Substances such as tetrahydrofuran (THF), methylethylketone (MEK), cyclohexanone, acetone, chloroform or degradation products from the antioxidants. NSF cannot even determine the full range of substances it could test for because NSF is not informed by the plastics industry of the proprietary formulation of plastic pipe.

The NSF sampling procedure and NSF seal does not protect the public from harmful substances in pipe. NSF tests only a small sample of pipe that has already been distributed in the market place. If the NSF test reveals an excessive level of chemicals (ie. vinyl chloride) a warning is issued to the manufacturer to meet the standard, but the "defective" pipe is not removed from the market. Only repeated exceedance of maximum permissible levels result in an NSF seal being withdrawn.

If the use of PVC, CPVC, and ABS pipe were more widespread, a great proportion of the pipe sold would not carry the NSF seal anyway because the non-NSF-approved pipe is cheaper, and would be installed by many contractors for this reason.

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[48] The DEIR also fails to consider that IARC considers exposure to carcinogens at any level unsafe.

Other testing organizations such as ASTM, referred to in the UPC do not test for chemicals leached into drinking water. Most importantly, ASTM does not issue standards related to the issues of water quality, worker safety, or smoke toxicity.

Many ASTM standards for plastic pipe reference additional standards developed and adopted by the NSF. Compliance with NSF standards is not required by the ASTM standards. Every ASTM standard references NSF Standard 14 in a note to the materials section of the standard. The note reads, in pertinent part,

> [name of subject pipe] intended for use in the transport of potable water should be evaluated and certified as safe for this purpose by a testing agency acceptable to the local health authority. The evaluation should be in accordance with requirements for chemical extraction, taste, and odor, that are no less restrictive than those included in National Sanitation Foundation Standard 14. . . . (Emphasis supplied.) (See, for instance, ASTM Standards F441 - 88 and F442 - 88.)

NSF standard 14 requires monitoring of pipe for chemical extraction parameters once a year for 11 substances, not including MEK, THF, acetone, chloroform, DMF, or cyclohexanone. It does not require monitoring for additional substances and establishes no levels at which such substances would be considered dangerous. (1989 NSF standard 14 § 7.0, p. 7.) The standard leaves quality assurance testing to the manufacturer itself. (1989 NSF standard 14 § 9.0, p. 10.) The conditions of extraction for standard 14 are less rigorous than may be experienced in actual use. Before the pipe is extracted, cut lengths are put through the wash cycle of a laboratory dishwasher with detergent in deionized water. It would be difficult for HCD to require a flushing protocol as effective in precleaning pipe.

NSF has also developed another standard related to drinking water, standard 61, entitled "Drinking Water System Components - Health Effects." This standard requires that pipe be tested according to prescribed protocols for indirect additives to drinking water from the pipe. However, those companies choosing to list their plastic plumbing pipe and fittings under standard 14 do not

have to comply with the requirements, of standard 61 and will not be required to do so until the end of 1990. (Pers. comm. with Jim Pascal, National Sanitation Foundation, October 17, 1989.) Standard 61 has never been used to test the safety of plastic pipe for use in potable water applications. The only products listed by NSF as meeting standard 61 requirements are sand and gravel used as process media for water treatment. (NSF, NSF Listings, Drinking Water Additives - Health Effects, May 31, 1989, pp. 11, 12.)

Even if NSF Standard 61 were ever to be applied to plastic pipe, it could not assure the safety of the pipe.[49] Standard 61 is intended for voluntary use only. (1988 NSF Standard 61, p. v.) NSF disclaims responsibility for use of the standard by others and states that "[p]rovisions for safety have not been included in this standard because governmental agencies or other national standards-setting organizations provide safety requirements." (1988 NSF Standard 61, p. vii.)

Finally, Standard 61 is fatally flawed because it leaves to the manufacturers and agencies the task of determining just how much contaminant may leak into drinking water from plastic pipe and joining materials without endangering the health and safety of consumers. In effect, even if Standard 61 applied to the plastic pipe proposed for use in drinking water systems, it contains no standards on the most crucial issue of all -- at what level these pollutants are dangerous.

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[49] Appendix A of standard 62 describes Toxicological Review and Evaluation Procedures of indirect additives to water from plastic pipe and joining and sealing materials (among other sources). More or less extensive testing strategies are outlined depending on the potential human exposure level. (Standard 61, p. A-4 - A-7.) Significantly, Standard 61 does not specify precisely what levels of indirect additives are unacceptable in drinking water. Methods to be used by the manufacturers or agencies to determine the maximum level of exposure that is safe for humans are contained in Standard 61, but the levels of allowable exposure themselves, the core of any effective system of regulation, are not specified. Plastic pipe is not even required to comply with the maximum exposure levels already established by the Environmental Protection Agency for a very few pollutants. (NSF standard 61, p. A-7 and appen. F. Appendix F lists EPA exposure limits, but that appendix is explicitly not made a part of the standard.)

The DEIR is also in error when it claims that the UPC requires NSF listing. Nothing in the UPC requires NSF listing for plastic pipe or joining materials. Indeed, the only standards such pipe must meet are established by IAPMO and ASTM.

a. Safety Standards Are Not Enforced

Manufacturers wishing to place the NSF stamp on their products must obtain an listing with the Foundation. The companies pay for such listings. Listed pipe is tested three times a year. If it fails the appropriate tests, it is subject to violation procedures, which, in extreme cases, could include a recall.

The NSF sampling procedure and NSF seal does not protect the public from harmful substances in pipe. NSF tests only a small sample of pipe that has already been distributed in the market place.

There is evidence that NSF has refused to delist substandard products because of the financial support form listed products. The Foundation was sued by a pipe manufacturer in 1985 after it failed to halt sales of much cheaper ABS pipe by a competitor. The pipe was made from scrap plastic, rather than the materials required by NSF and ASTM standards.

Although NSF delisted the competitor, it failed to publicize that fact and, indeed, misrepresented the status of the manufacturer to inquiring customers. In addition, NSF failed to stop the continued manufacture, sale and installation of the substandard pipe although it carried the NSF stamp of approval. (Supply House Times, October 1985, appen. T, pp. 19, 20.)

In 1987, NSF itself admitted that it could not assure compliance with its standards in a timely manner and could not recover unsafe pipe after it was sold or installed. In February 1987, NSF learned that thousands of pounds of PVC pipe produced by a North Carolina manufacturer during several months in late 1986 and early 1987 contained amounts of residual vinyl chloride monomer (RVCM) in excess of NSF standards. NSF did not learn of the violation until almost two months after the pipe was manufactured and did not issue a recall of the pipe until two months after that, on March 24, 1987.

This situation is particularly serious since pipe with RVCM leaches dangerously high levels of vinyl chloride, a known cancer-causing agent, into the water that flows through it. The delay by NSF in discovering the violation and its slow response was compounded by the fact the NSF could recover only 10% to 20% of the dangerous pipe. (Pers. comm. with Tom Gable, NSF, on June 18, 1987.) As a result, between 80% and 90% of the dangerous PVC potable water and drain-waste-vent pipe was sold and installed in the homes of unsuspecting consumers, who to this day are probably being exposed unacceptably high doses of vinyl chloride. (See June 2, 1987, letter, from Judith Kuhn; May 12, 1987, letter, Kuhn to Gable; May 29, 1987, letter Gable to Kuhn; March 24, 1987, recall notice from NSF, appen. V.)

No private group with such a record can be trusted to protect the health and welfare of Californians. Nevertheless, the DEIR proposes to place full responsibility for the safety of plastic pipe sold in California on the shoulders of NSF. This plan is unacceptable and in derogation of the duty of HCD to protect the safety of our citizens.

8. Analysis of the Potential Impacts of Permeation

The DEIR dramatically understates the significance of the permeation hazard of plastic pipe.[50] The analysis understates the risk by: (1) Failing to accurately assess the permeation potential of CPVC; (2) Ignoring the acknowledged permeation risk of PB; and (3) Failing to assess the extent of contaminated soils in the state.

a. DEIR Fails to Correctly Assess the Permeation Risk of CPVC Water Pipe

The DEIR identifies two factors affecting permeation: (1) " . . . whether the pipe is rigid or flexible;" and (2) "the activity (or availability) of the chemical surrounding the pipe." (DEIR, p. 38.) While the general concept of "rigidity" conveys a sense of the denseness of the matrix, it does not accurately convey the

[50] Permeation refers to the phenomenon where substances outside of pipe are able to penetrate the pipe and appear in the water inside.

resistance to diffusion by different chemical species. After all, unglazed terra cotta is rigid but permeable to liquids.

The 1985 Berens report dominates the DEIR's analysis of CPVC pipe. In that study, a theoretical estimation is made for relatively low levels of chemical diffusing through a rigid matrix. However, there is no factor for chemical or solvent-solute interaction between the diffusing chemical and the pipe matrix.

The DEIR only notes that the resistance of CPVC to permeation would be reduced if solvent concentrations were sufficiently high to soften the pipe. However, that position does not adequately reflect the peculiar solubility of CPVC in chlorinated organics. Even small amounts of C_1 or C_2 chlorinated organics are absorbed into CPVC and alter the polymer matrix. That is why such compounds are used as "swelling agents" in the manufacture of CPVC pipe.

The DEIR dismisses the potential for low molecular weight halogenated organic permeation to CPVC. The EIR must examine the susceptibility of CPVC pipe to chloroform, trichloroethene, and methylene bromide.

b. DEIR Ignores the Acknowledged Permeation Risk of PB

The DEIR finds that PB is more susceptible to permeation, because it is a "rubbery plastic." For this reason, the DEIR concludes that:

> [T]here is a clear risk of using plastic pipe service lines, particularly those made of PB, in the vicinity of underground gasoline storage tanks, dump sites, and other areas where high organic chemical contamination of the soil is possible. (DEIR, p. 39; emphasis added.)

The Council concurs that permeability of PB is such that there would be significant cumulative exposure in contaminated soils.[51] Permeation in polyolefins has been extensively studied in assessments of polyolefin suitability for packaging

[51] The DEIR discussion of chemical sorption on soil raises an important complicating factor, although this issue is not resolved in the DEIR.

and gas piping; the role of monomer type, polymer density, and crystallinity produce effects more relevant to permeation than rubberiness. In any event, it is clear that PB is permeable to aromatics such as benzene (a carcinogen).

Although the DEIR finds a "clear risk" of permeation from PB use in contaminated soils, it does not propose any mitigation to address the hazard. HCD must consider measures to regulate plastic pipe use in contaminated soils. In order to develop such regulations, the EIR should list chemicals that pose permeation threats -- chemicals that are capable of permeating PB, and that are in industrial or domestic use and hence may be in the pipe environment.

For each chemical listed, the EIR should determine the external matrix concentration which would produce specified interior levels with a lengthy dwell. The potential for soil sorption effects should be noted, but the inert matrix values should be reported. In view of the permeation hazard of CPVC overlooked by the DEIR, the list should include chemicals capable of permeating CPVC as well.

Such a table would allow HCD to make a more reasoned assessment of the extent of potential permeation. At a minimum, this information would show that PB is unsuited in soils contaminated by gasoline, and that CPVC is unsuited in soils heavily contaminated by halogenated organics. It would also show that either pipe could be permeated by methyl bromide, the fumigant used in residential pest control.

This information would enable HCD to consider appropriate mitigation measures to address the permeation hazard as required by CEQA. For example, should existing DHS regulations governing the use of plastic pipe in public water distribution systems where there may be a danger of contaminated soils be extended to plastic pie from the meter to the residence? (See 22 C.C.R. § 64622.) If plastic pipe is restricted from areas contaminated by gasoline or other chemicals, how would HCD ensure that the area not become contaminated after the pipe is installed? Should plastic pipe be prohibited from use in areas of high contamination risk? Should plastic pipe be prohibited from use on commercial sites? Industrial sites? Former commercial agricultural lands? The EIR must also consider prohibiting underground use of plastic pipe as an environmental superior alternative.

c. DEIR Fails to Assess the Extent of Contaminated Soils in the State

The DEIR understates the risk of permeation by ignoring the extensive soil contamination in California. The State Water Resources Control Board has identified 160,000 underground tanks in California storing hazardous materials. (Golden State Report, "Tanks a Lot," October 1989, p. 20.) Ninety percent of these tanks are storing petroleum, and at least 30,000 are leaking. (*Ibid.*) Another 200 new contaminated sites are identified each month. (*Ibid.*; emphasis added.) These leaking storage tanks can be found beneath every type of commercial, industrial and residential building, including private homes. (*Ibid.*)

Leaking fuel can travel long distances floating on the ground water or as vapor through permeable backfill in utility trenches. Furthermore, storage tanks are not the only source of potential contamination. Leakage from vehicles, illegally dumped waste, or spillage from industrial processes can introduce contamination where it could not be predicted.

The DEIR also dramatically understates the permeation risk by failing to consider plastic pipe use on commercial and industrial sites. These sites are much more likely to face soil contamination problems and may also have much longer service lines from the meter to the structure. The DEIR should examine the extent of soil contamination on such sites, and HCD must consider prohibiting the use of underground plastic pipe in non-residential applications.

With respect to residential applications, the DEIR fails to consider the permeation hazard posed by residential development on former agricultural lands. Many commonly used agricultural chemicals are present in the soil and could present permeation dangers if underground plastic pipe is used. In view of the extent of agricultural land conversion in California and the heavy use of chemicals by commercial growers, this is a potentially significant hazard not addressed by the DEIR.

Proposed development projects between July 1987 and April 1989 in the ten Central Valley counties alone would convert 87,000 acres of former cropland to residential and other urban uses. (American Farmland Trust, "Risks, Challenges and Opportunities -- Agricultural, Resources and Growth in a Changing Central Valley," 1989, p. 18.) It is estimated that 500,000 acres of

farmland in the Central Valley may be converted to residential subdivisions, offices and factories in the next ten year period. (*Ibid.*) The State Department of Conservation reports that agricultural land conversion in the Central Valley may be even greater, possibly 100,000 acres per year. (Pers. comm. with Kim Trott, Department of Conservation, November 3, 1989.)

9. The DEIR Understates the Health Risks Associated with the Chemicals that Leach into Drinking Water from Plastic Pipe Cements[52]

Organic chemicals such as MEK, THF, and DMF, as well as the principal trihalomethane - chloroform, leach from plastic pipe and the primers, solvents and cements used to join the pipe into the drinking water flowing through it. Chloroform alone is a known human carcinogen and what is known about the other substances raises serious questions about the safety of chronic human exposure to them singly or in concert.

a. Problems with DEIR Selection of Standards Governing Acceptable Levels

The DEIR attempts to establish standards by which to judge the potential health impacts of chemicals leaching from plastic pipe. Unfortunately, in the absence of adequate toxicological data, the DEIR asserts without foundation that risk is unlikely. Consistently, the technical discussion in the DEIR is followed by a conclusion not supported by the technical facts.

In the discussion of carcinogenesis, the DEIR states "in the absence of information to the contrary, all such effects (ie. of various chemicals together) have been treated (where quantifiable) as if they were additive. This methodology ignores synergistic effects, potentiation effects, and the now known effects of certain chemicals as cancer promoters, turning on promotor genes which cause other genes to produce uncontrolled cell growth.

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[52] This discussion is based on the report by Dr. Martyn Smith and Ms. Catherine Wright attached as appendix A. Please see that report for a more detailed discussion of these issues and for specific references to the scientific literature.

In the discussion of maximum contaminant levels (MCL's) on p. 49, the DEIR states that MCL's have been developed for 26 compounds and that 83 more compounds will have such levels designated by the end of 1989. The DEIR does not mention whether any additional compounds of concern in the plastic pipe EIR are among the 83 compounds to be newly designated.

b. Drinking Water Consumers Will Be Exposed to Dangerous Chemicals Through Skin Absorption and Inhalation

Ignoring its own technical appendix, the DEIR assumes that potable water consumers will be exposed to toxic chemicals only from drinking the contaminated water. This is clearly incorrect. (Smith, appen. A, pp. 5, 6.)

A recent study shows that the drinking of water may not even be the primary route of consumer exposure. The dose of dangerous chemicals from skin absorption of chemicals may equal more than half of the dose received from drinking. (Smith, appen. A, p. 6.)

Consumers also inhale toxic chemicals that evaporate from contaminated water. The enclosure of the bathroom can trap dangerous chemicals in the air at high levels during a shower. (Smith, appen. A., p. 6.) Inhalation of these chemicals exposes children to the same amount of chemical as is contained in 1.1 liters of the water, women the amount in 3.7 liters, and men the amount in 2.5 liters of the water. (Smith, appen. A, p. 6.)

Because the DEIR assumes exposure to only 2 liters of water a day from drinking, it does not consider additional exposure to contaminants from skin absorption and inhalation. The Department cannot assess the true health risk posed by the contaminants added to drinking water by plastic pipe unless it acknowledges and measures all routes of exposure.

c. The DEIR Fails to Consider the Combined Effect of Chemicals Leaching from Plastic Pipe

Despite the significant evidence to the contrary, the DEIR assumes that the danger posed by the combination of chemicals from plastic pipe will be simple sum of the danger posed by each individually. The DEIR ignores the evidence that the carcinogenic effects of these leachates is multiplied when they are found together.

Most notably, the worker health study reveals that MEK potentiates the cancer causing effects of chloroform. Dr. Martyn Smith estimates that this potentiation can be as much as 30 times, increasing the cancer risk to humans far beyond acceptable levels. (Smith, appen. A, p. 16.) In addition, the worker health study mentions peripheral neuropathy caused by the combined exposure of MEK and THF. MEK and acetone, plastic pipe leachates, cause polyneuropathy when found together. (Smith, appen. A, p. 12.)

Nor are small doses of carcinogenic material necessarily safe. In combination with equally small doses of other carcinogens, they can cause cancer even at low levels. The synergistic effects of the leachates are described in more detail in section III.B.7. of these comments and in the comments of Dr. Smith. (See appen. A., pp. 15, 16.)

Before exposing Californians to a chemical that could worsen a contaminated environment by increasing the damage done by chemicals already in their bodies, the Department must carefully and fully consider the environmental effects of such action. It has instead attempted to ignore this significant environmental impact, in violation of CEQA.

d. The DEIR Ignores the Evidence that MEK and THF Cause Chronic Health Effects

Relying on a lack of chronic toxicity data on MEK and THF, the DEIR concludes that they pose no health risks. This reasoning is seriously flawed. Indeed, what is known about these substances suggests that they are dangerous and potentially carcinogenic.

Subchronic toxicity studies of THF showed serious effects requiring further study of the chronic effects of this substance. (Smith, appen. A, pp. 7, 8.) THF damages chromosomes, and may be a cause of cancer. THF has caused toxic hepatitis in plumbers. (Smith, appen. A, p. 8.) The DEIR has no basis for its assumption that THF is safe.

As discussed, MEK potentiates the carcinogenic effects of other common contaminants. It causes irritation and central nervous system depression. Chronic irritation is associated with skin cancer. Subchronic toxicity studies of MEK show that it causes liver damage. It, like THF, causes chromosome aberrations. (Smith, appen. A, p. 8.) It would be highly irresponsible to introduce MEK into the drinking water thousands of California homeowners without more information concerning its potential health effects.

e. The DEIR Does Not Assess the Health Impacts of Irganox 1010

Irganox 1010 is an antioxidant used in large quantities in plastic pipe. Several structurally similar antioxidants are rodent carcinogens. The toxicity of these substances must be addressed in the DEIR. (Smith, appen. A, pp. 6, 7.) Tests for FDA approval of Irganox 1010 are not strictly relevant. The chemicals present in the water will be the breakdown products of Irganox 1010 and the products of its reaction with chlorine. Note that the DEIR makes reference to no test of PB with chlorinated water -- none was done.

f. The DEIR Fails to Use the More Conservative Standard in Assessing the Health Impacts of MEK

The discussion of MEK is also suspect because SRI chose to use a more lenient Health Advisory ("HA") standard of 1800 ppb rather than the more conservative EPA standard of 170 ppb, claiming that the SRI standard is based on a more recent study. From the two studies cited, there is no clear reason why one standard is preferable other than SRI's claim that the later (higher standard) study had "good laboratory practices." (DEIR, p. 51.) However, neither study examined oral MEK intake and neither gives a good basis for the DEIR's conclusion of no risk.

Since the EPA itself has not relaxed the standard, why should the "SRI" standard be used to evaluate risk? In particular, the SRI standard seems to have been chosen so that levels measured in the pipe the at than 60 days occupancy are below the standard, where they would be considerably above the EPA standard. HCD is required to assess potential health effects under the most health-protective regulatory standard.

10. The DEIR's Suggested Mitigation would not be Effective and Fails to Comply with CEQA

a. Proposed Flushing Would Not Provide Effective Protection

Flushing is suggested as an approach to the problem of ridding the pipe system of contamination, but the flushing recommended by the DEIR as mitigation would not address the full spectrum of the threat.

The 1989 DEIR suggests the same flushing procedure first proposed in 1980, before any environmental analysis had been conducted. The hypothesis then was that any leaching would be short term and that a short term (e.g. 2 week) flushing regime would suffice. However, when the Cooper study was completed, the persistence of solvents was generally acknowledged by the study team as a bit of a surprise. (Pers. comm., presentation in meeting at DHS, December 17, 1987.) Despite this persistence, despite the potential interaction with residual chlorine (not studied), despite MEK potentiation of THM (not studied), and despite the probable levels of contaminants from other formulations and assembly methods (not studied), the DEIR merely repeats the same short term flushing protocol as mitigation.

The simulation study had a "pre-occupancy" phase which was intended to allow initial leaching to reduce contaminant levels without having to "count" the results in the public health analysis, although the DEIR does report the pre-occupancy data, as it should. The pre-occupancy period was not designed to test a flushing protocol. To the extent it may bear upon a flushing protocol, the fact that high solvent levels remained after the pre-occupancy phase demonstrates the ineffectiveness of such protocol. The DEIR establishes no maximum acceptable level for contaminants remaining after flushing, nor does it

present evidence that a greater volume or a greater elapsed time would be required.

b. Proposed Mitigation would not be Feasible or Enforceable

The DEIR presents flushing as mitigation without proposing that any language be added to the UPC or the State Plumbing Code to implement the recommendation. A state informational bulletin would not suffice, since the requirement is not incorporated into the code used as a reference by installers. It is also hard to imagine how criteria for adequate flushing could be developed, given the immense technical difficulties in testing water for minute amounts of organic chemicals. Without testing, it would also be impossible to ensure that the flushing procedure was being implement properly or was effective.

Even if the requirement were codified and a realistic protocol were developed, it would not ensure implementation. Contractors and builders will resist the expensive and time-consuming procedure suggested. Flushing requires repetitive actions to be carried out after the plumber has finished his work. It would be difficult to assign responsibility for flushing to someone other than the plumbing subcontractor, yet requiring the plumbing subcontractor to perform flushing would force him to return daily to the job site.

Building Codes specify materials and methods of construction that are practical to enforce through inspection. Plumbing is inspected before the sheet rock goes up and markings, straps, joints, etc. are in plain view. Even the use of non-lead solder can be observed by the color of the solder outside of the joint. By contrast, how is a building inspector to know whether the entire plumbing system has been flushed?

CEQA requires that a mitigation program adopted as condition of the project be accompanied by a reporting or monitoring program to ensure compliance during implementation. (Pub. Resources Code § 21081.6.) The proposed flushing mitigation would not comply with this requirement.

B. Worker Health

1. DEIR Analysis of Worker Health Risks Fails to Comply with CEQA

To fulfill the requirements of CEQA, the DEIR must identify a reasonable "worst case" exposure level and determine if that exposure level would create a significant effect. The CEQA Guidelines require that "[t]he EIR . . . focus on the significant effects on the environment. The significant effects should be discussed with emphasis in proportion to their severity and probability of occurrence." (14 C.C.R. § 15143.)

If the worst case analysis produces a significant effect, the DEIR must then propose mitigation measures to reduce the impacts to insignificance. Conversely, if no impacts are found to result from the worst case analysis, no significant impacts exist and no mitigation is required. However, if the proposed mitigation measures cannot fully mitigate the impacts, the DEIR must clearly state the severity of the resultant risks.

The DEIR's worker health analysis is based upon data collected in the DHS worker health study completed earlier this year and on the 1983 ERD. However, the DEIR departs significantly from both reports in its overall tone, and omits many significant points. In constructing its analysis of the impacts resulting from plastic pipe installation, the DEIR has focused on average impacts and ignored significant impacts resulting from a reasonable worst case analysis. This approach leads the DEIR to faulty conclusions not supported by the referenced technical documents.

The DHS report was professionally well presented, acknowledging that limitations existed during the study which must be considered when evaluating the study results. The previous SRI study addressed some of the technical problems in proposing mitigation measures. Both the DHS study and the ERD recognize that overexposures will occur under worst case installation conditions.

The DEIR, however, fails to acknowledge the limitations of the DHS data which focused on average exposure levels. Furthermore, after arriving at a substantially weaker conclusion by not examining worst case conditions, the DEIR does not establish a basis for mitigation measures. Without a strong

rationale, the resulting mitigation measures are technically inadequate and far too general to reduce the hazards associated with the installation of plastic plumbing pipe.

To be useful in the public review process, the DEIR must adequately portray the risks involved with installation of CPVC, PB, and ABS pipe. The DEIR should weigh the inadequacies of existing data on exposure levels and health effects. A closer examination of this data will show that the potential impacts associated with installation of plastic plumbing pipe are underestimated significantly in the current DEIR.

A legally sufficient analysis must address the following topics:

- Are the risks associated with the worst case exposure conditions significant?
- How do the limitations of the DHS sampling data affect the resultant overexposure probability estimations?
- How do the limitations of the DHS sampling data affect the regression analysis?
- What is the significance to worker health of the high levels of dermal absorption found in the DHS study?
- How feasible, effective and enforceable are the mitigating measures which the DEIR suggests; do the measures decrease the hazards of plastic pipe installation?

2. The DEIR Fails to Consider the Risks Associated with Worst Case Exposures

Conditions which contribute to high exposure levels and occur under many circumstances are identified in the DHS report and mentioned in the DEIR. The DEIR, however, does not indicate the severity of the risks present during these worst case exposure conditions. The DEIR must both clearly identify these conditions and the consequent risks to present a complete picture of the

hazards involved. This section will discuss what factors lead to worst case conditions, how they are particularly applicable to CPVC-pw installations, and how their significant risks should be explained in the DEIR.

Typical CPVC-PW installation (the focus of the DEIR) includes many factors which lead to worst case conditions more often than in other types of pipe installations. These factors are listed below.

- Installation is simple and fast, therefore enabling many joints to be cemented in a short time.

- Installation involves the use of primers and cleaners as well as cement, therefore causing higher solvent exposures to workers.

- Installation is typically completed later in construction, therefore it is being conducted in more enclosed areas.

- Installation for remodeling jobs occurs more frequently, further increasing the amount of work conducted in enclosed areas.

- Installation is often concurrent with DWV installation using PVC or ABS pipe, exposing many workers to solvents from both pipes.

Similar conditions are also discussed in the ERD (p. IV. C-10) and included in the DEIR (p. 61) under Chemical Exposures in Plumbing for New Construction;

> At times, however, plumbers must work in enclosed spaces. For buildings with basements, plumbers may not begin work until the subflooring has been installed the first floor; in such cases, they have to work close to the underside of the flooring (in industrial construction, or in large commercial buildings of poured concrete, they always have to work close to the flooring, regardless of the story). Second, even in partially framed buildings, the plumbers work from time to time in small spaces where air exchange is minimal. In addition, plumbing requires close attention to detail--particularly in making good joints. Thus, plumbers installing plastic or copper pipe

will sometimes work with their eyes (and thus their noses) close to the pipe to verify the soundness of joints; that posture increases the potential for inhaling vapors from pipe solvents.

Additional conditions which lead to high airborne and dermal exposures for prefabricaton work are discussed in the ERD:

> On a site where plastic is used, the journeyman or advanced apprentice usually doing the actual installation would have relatively intimate and constant contact with the cement throughout the day. This exposure would result not only from the vapor exposure as he cemented the joints, but also from the residual cement on his hands (or gloves) and clothing. A large job with the aforementioned time and cost pressures would accentuate this behavior, and it would not be uncommon for a plumber to end the day with his coveralls coated with the cement. (ERD, p. IV.C-10.)

The DEIR also observes that "[t]he exposures of the workers doing the prefabrication (on site or in the shop) may be substantial." (DEIR, p. 61.)

Because of the variety of work conditions described in the ERD which can lead to high exposure levels, the Council had recommended that testing exposures under such conditions should be a central objective of the DHS study. The DHS study protocol recognized that sites where large amounts of solvents are present in air with limited dispersion and high volatilization capability would produce higher exposures. These conditions exist when:

- Many joints are being cemented in a short period.
- Heavy skin contact occurs through bad application practices.
- Spills occur.
- Several workers are present in a limited space.
- Work is conducted in enclosed (little air movement) areas.

- At high temperatures.

Despite this recognition, the protocol did not focus the study effort on data gathering under these conditions. The Council criticized the study protocol on the ground that the proposed testing would not produce information on exposure levels experienced by workers encountering worst case conditions. (See letter to Julie Nauman, August 30, 1988. appen. V.)

As was predicted, the sampling information produced by the DHS study was extremely limited in worst case data. Due to the common CPVC work practices discussed above, one would expect to encounter combinations of worst case conditions more frequently at CPVC potable water sites than at other sites tested. Unfortunately, only two of the sites monitored (sites 14 and 17) contained more than one of the worst case conditions (enclosed area/heavy skin contact/high temperature). No site was observed where all of the contributing conditions occurred at the same time. The study also failed to examine exposures at commercial and industrial sites, despite acknowledging that exposures at such sites would be higher.

Although the DHS study states that the researchers were unable to locate worst case sites, DHS failed to test a number of sites with multiple worst case conditions that were specifically identified and available. (See letter from Sally Mitchell, November 6, 1989, appen. W.) The failure to test these sites prevented presentation of a truly random survey.

Given the limited sampling data, the DHS report could only estimate the risks to typical workers during an <u>average</u> work day (for the conditions monitored in the study). The severity of the risks present during worst case conditions were not discussed quantitatively. However, as the DHS study itself recognizes, <u>overexposure will occur for plumbers working in worst case conditions</u>:

> The workers with the highest exposures <u>did</u> experience overexposures; for them, overexposure was a reality, not a probabilistic event. Other workers with similar working conditions are likely to have similar exposures . . . ." (See Memorandum from Linda Rudolph, Chief Occupational Health Surveillance and Evaluation Program, DHS to Julie Nauman, responding to comments on draft Worker Health

Study, p. 4.) "[W]orkers who spend extended periods in highly-enclosed areas may experience frequent overexposures. Two workers did, in fact, have repeated overexposures while working for several hours in a crawl space. Because the amount of work in highly-enclosed areas may be over-represented or under-represented in this study (sites with enclosed areas were specifically sought for monitoring, but few were located), the calculated exceedance probabilities may not apply to the industry as a whole. (DEIR, appen. C, p. C-30.)

In its analysis of chemical exposures, the DEIR acknowledges that the probability (a 25% chance) of exceeding exposure limits in enclosed spaces is high:

> [S]hort-term exposures have been found to approach or exceed the short-term limits (STELs) for tetrahydrofuran (THF) and methyl ethyl ketone (MEK), especially during work in enclosed areas. The estimated probabilities of such a short-term exceedance of the STELs for THF and MEK were 0.04 or less except in enclosed spaces where the probability was as high as **0.25**. (DEIR, p. 67, emphasis added.)

Despite this recognition, the DEIR ignores the significance of the risks presented by exposures in enclosed spaces. The quoted 0.25 probability refers to the probability of overexposure during any random 15 minute period. A short-term probability of 0.25 equals a 99.99 probability for an exceedance of the short-term exposure limit at least once during an 8-hour day.[53] Therefore, as stated in the DHS study, workers with the highest exposures will experience overexposures. However, by disregarding the worst case risks, the DEIR does not adequately portray the severity of the hazards involved with installation of plastic pipe.

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[53] An 8-hour day contains (32) 15-minute periods. Each 15 minute period has a 25% chance for over exposure and conversely a 1-0.25 = 0.75 or 75% chance of going through 32 periods with no over exposure is $0.75^{32} = 0.0001$. Hence, the chance of one or more over exposures in (32) 15-minute periods is 0.9999.

3. The DEIR Fails to Determine How the Limited DHS Sampling Data Affects the Overexposure Probability Estimators

A caveat appears throughout the DHS study regarding the effect of the limited sampling survey on the report findings. The DEIR, however, does not mention the limitations on the data anywhere in its analysis of this issue. The DEIR should not quote the statistics reported by the DHS study without also repeating the limitations on that data described in the DHS report. Since no sites contributed data influenced by all of the worst case conditions and very few study sites contained combinations of the conditions, the data reported in the DEIR may underestimate overexposure probabilities. This caveat should be explicitly and clearly stated to inform the reader of possible unobserved and unaccounted-for exposures, and the implications of the possible underestimation should be fully analyzed in the EIR.

One key finding of the DHS report is the calculated probabilities for overexposure. These probabilities reflect the percentage of time when exposures exceed exposure limits. Any high exposures monitored and their associated frequencies highly influence the resulting probabilities. Implicit in the calculated probabilities (for the average worker) is the assumption that the distribution of working conditions over the study period is identical to that of a hypothetical worker day.

The probabilities presented in the DHS study apply only to the working conditions monitored and cannot be reliably extrapolated to other conditions. If the distribution of time spent over a working day is different (i.e. all time is spent in highly enclosed areas), the probabilities based on the study-wide distribution will underestimate the frequency of overexposure for the 8-hour working day. This could easily occur if, as noted in the DHS study, one worker may drill holes all day while another lays pipe and cements joints continuously. (DEIR, appen. C, p. C-15.) Thus, if more worse case sites would have been included within the sampling survey, more frequent overexposures might have occurred and subsequently higher probabilities might have resulted.

As discussed, the DHS sampling survey was limited in "worst case" sites. The study surveyed only residential installations and only two of the sites monitored contained more than one of the worst case conditions. No site was observed where all of the contributing conditions occurred at the same time and

no non-residential sites were included. These limitations were emphasized in the DHS study report:

> Commercial and industrial installation, typified by larger pipe sizes and extensive piping systems, are likely to produce higher exposures than occur in residential work. Conclusions about the possible hazards of installing residential plumbing do not directly apply to the hazards faced by these same workers at other sites. . . . Certain combination of working conditions could, in principle, sometimes occur together to produce "worst case" exposures higher than those found in this study. For example, the data presented above suggest that those might occur at a site with: no air movement, several workers in the same work space, many joints glued for a given period, heavy skin contact with primers and cements, and perhaps high ambient temperatures and a few spills of the products. Two of the sites monitored (sites 14 and 17) had several of these factors, but not all of them. Sites with all the factors listed above could have higher exposures. (DEIR, appen. C, pp. C-27 - 28.)

The main text of the DEIR does not discuss these limitations. The DEIR references the exceedance probabilities in the DHS study without discussing the implications of the under-represented sites. These implications should be clearly stated.

4. The DEIR Fails to Consider How the Limited DHS Sampling Data Affects the Regression Analysis

A regression analysis determines which individual factors in a study are significantly related to the study focus (high exposure levels). The resultant correlations presumably indicate how working conditions affect exposure and thus show which work conditions should be avoided or controlled by effective mitigation measures. In addition, this analysis indicates which combinations of conditions could lead to the highest, and therefore more significant, exposures. These results are important because they implicate possible, realistic exposure levels not directly observed within the limited the scope of the DHS study. The DEIR has not correctly interpreted the results of DHS's regression analysis.

The study's regression analysis compares high exposure levels over all sites monitored to:

(1) Composition of bulk products.

(2) Number of joints cemented per period.

(3) Air flow rate.

(4) Temperature

The DHS regression analysis found that significant associations existed between THF exposures and factors 3 and 4 for CPVC-potable water installation. Negative associations were found for both factors. Factors 1 and 3 were significantly associated with THF exposures for all installation types together. A negative association was again found correlating air flow rate and exposure levels. A positive rate was shown between the composition of the bulk products and exposure levels.

The association between factors 1 and 3 seem plausible, however, the negative association for temperature (increasing temperature was associated with decreasing exposure) for CPVC installations is counter-intuitive. One would expect an increase in temperature to cause higher exposures due to the volatility of the solvents (a more plausible physical relationship).

For the regression to be statistically correct, all combinations of conditions must be monitored. However, the study sampling was limited; not all combinations of significant variables were monitored. For example, no high temperature conditions were sampled in the enclosed areas. This limitation was explained in the DHS report:

> The observed association between job factors and exposure levels cannot reliably be used to predict exposure levels expected under conditions not monitored in this study, particularly because several of the job factors were interrelated, decreasing the reliability of the resulting statistics. For example the highest exposures, which dominated the exposure distribution, were collected in just two crawl spaces. Both had ventilation, and both were partially

underground and quite cool. Thus, if the overall exposure model controlled imperfectly for air flow rate (which is unlikely), then a misleading apparent (negative) association could appear between temperature and exposure level." (DEIR, appen. C, p. C-29.)

Before any study can determine precise associations, adequate data for each condition must be accumulated. Since no high temperature conditions were sampled in enclosed areas, the regression analysis was based on inadequate data. Although these limitations on the sampling survey were addressed in the DHS report, they are not reported in the DEIR.

The limited data on high temperature sites is of particular importance in California where high ambient temperatures often exist. Even though no significant association was found for temperature in this data set, a significant association may exist under different sampling conditions. This point was acknowledged in the DHS study:

> These data do not preclude the possibility that high ambient temperatures produce somewhat elevated exposures; rather they indicate that in this data set the temperature effect (if any) is minor compared to the effects of ventilation and bulk composition. (DEIR, appen. C, p. C-29.)

Thus, high temperature may lead to additional overexposures. This association should be analyzed in the EIR.

5. The DEIR Fails to Consider the Significance of Dermal Absorption

In the DHS study, end-of-shift urine samples were taken to determine the effects of high dermal exposure on workers. The urine levels found during the study ranged from below the detection limit up to 6700 ug/l with a mean of 452 ug/l. Since no Biological Exposure Limit has been established, the authors converted the values to estimated air exposure levels. These were based on correlations between urine levels for light and heavy dermal absorption and measured air exposures. The resulting estimated airborne

exposures ranged from 165 ppm to 850 ppm (well over the 8-hr TLV of 200 ppm).

While this procedure incorporates considerable uncertainty, the DEIR does not consider the potential health impacts of these high exposure levels. The DEIR simply observes without further discussion:

> [T]he total biological uptake, as measured in urine analysis, was substantially above the urinary concentrations that airborne exposure alone would have produced; uptake through the skin appears to have been responsible for the excess. The actual high values are not reported. These values cannot be lightly dismissed, however, because they so far exceed the established full-shift exposure limit for THF (up to 3.7 fold). (DEIR, pp. 67 - 68, emphasis added.)

The high air exposure levels (more than 4 times the TLV) are sufficiently high enough to warrant concern. The lack of toxicity data at these levels should not preclude the EIR from issuing a stronger statement of the potential detrimental health effects associated with dermal absorption of solvents.

In light of the uncertainties regarding chronic health effects, the high levels of THF associated with dermal exposure, the overexposures occurring in enclosed areas and the limitations of the DHS study regarding a worst case analysis, it is clear that the study and the DEIR underestimate the risks associated with the installation of plastic plumbing pipe. The large increase in total biological uptake due to high dermal exposures are not even mentioned in the Worker Safety and Health summary on pages 70 - 72 of the DEIR.

6. DEIR Fails to Consider Significant Evidence of Potential Health Effects to Workers Installing Plastic Pipe[54]

a. Chronic Exposure to MEK and THF May Cause Significant Health Effects

What is known about MEK and THF suggests that the chronic exposure suffered by those who install plastic pipe daily for many years may cause cancer. As is summarized above in the discussion of water quality, a study this year showed that repeated exposure of rats and mice to THF caused narcosis, degeneration of the adrenal cortex, and changes in the uterus of female mice. (Smith, appen. A, pp. 7 - 8.) THF has also been shown to be toxic to rat livers. (Smith, appen. A, p. 7.) Although the DEIR itself cites evidence that THF causes structural and numerical chromosome aberrations, potentially causing cancer, this information is ignored, and the DEIR concludes that there is no evidence of possible health effects. (DEIR, p. 56.) On the basis of this information, the National Toxicology Program is pursuing THF chronic toxicity/carcinogenicity studies to determine the magnitude of cancer risk from THF. (Smith, appen. A, p. 7.)

Finally, the literature reveals two case histories of plumbers who suffered toxic hepatitis from exposure to plastic pipe glue containing THF. (Smith, appen. A, p. 8.) The available evidence clearly suggests chronic health effects from THF. This information is of particular concern since the worker health study found higher installer exposure to THF than any other substance.

Similarly, the DEIR concludes that exposure to MEK poses no occupational danger to plumbers. Yet the evidence that does exist suggests otherwise. As is discussed above, MEK causes irritation, central nervous system depression, chromosomal aberrations and liver damage. (Smith, appen. A, p. 8.) MEK may also potentiate the carcinogenic effects of other solvents and chloroform. (See discussion below.) MEK can cause quite

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[54] This discussion is based on the report of Dr. Martyn Smith and Ms. Catherine Wright, attached as appendix A. Please see the report for a more detailed discussion of these issues and for specific references to the scientific literature.

severe effects with unknown long-term implications. (Gibson statement, appen. X.)

This information creates doubts about the quality and safety of water from plastic pipe, and even greater concern to installers, who may drink large amounts of water soon after installation, and who absorb and inhale the solvent cements chemicals.

b. Installers Will Be Exposed to Potentially Dangerous Combinations of Solvents and Other Contaminants

These comments have already pointed out the danger in assuming, as does the DEIR, that the interactive effect of solvent cements and other contaminants is only additive. (See *ante*, section III.A.) Studies show that the solvents in combination may cause illness where each individually would not, and that the leachates are more dangerous when considered with other contaminants in the water and the general environment. (Smith, appen. A, pp. 12 - 17.)

The DEIR states that "no chronic effects have been attributed to" MEK and THF. (DEIR, p. 56.) Yet the worker health study acknowledges "a few case reports of chronic MEK exposure, in combination with chronic exposure to other solvents such as THF or toluene, causing peripheral neuropathy." (DEIR, appen. C, p. C-69.)

The DEIR fails to discuss evidence of polyneuropathy in shoe factory workers exposed to MEK, acetone and toluene, two of which are plastic pipe leachates. (Smith, appen. A, p. 13.) It fails to note peripheral neuropathy caused by combined exposure to MEK and THF discussed in the worker health study. (Smith, appen. A, p. 13.)

Not only does the DEIR ignore the effects of the leachates acting together, it ignores the effect of the leachates in combination with contaminants already in the water and the environment. Most notably, the DEIR does not confront the fact that MEK makes chloroform, a carcinogen, even more dangerous, perhaps by as much as 30-fold. (Smith, appen. A, pp. 14 - 17.)

The DEIR finds that chloroform leaches into water from plastic pipe at the rate of 6 ppb. Chloroform is also found in drinking water at background levels of between 10 and 90 ppb and it leaches from plastic pipe. This level of chloroform alone creates a cancer risk of one in a hundred thousand. Increasing this risk 30 times establishes a risk level that is unacceptable under current public health standards. (Smith, appen. A, p. 16.) MEK makes other common substances such as acetone, ethanol and rubbing alcohol, more carcinogenic. (Smith, appen. A, p. 16.)

Finally, what is now known about cancer suggests that adding even a small amount of a carcinogen to the environment may cause cancer in humans already exposed to a number of other carcinogens at low doses. (Smith, appen. A, pp. 15 - 16.) "A 'non-carcinogenic' dose of a known carcinogen (in animal experiments) does still bear a risk that will become manifest if other carcinogens are applied to the same organ." (Smith, appen. A, p. 16.) The failure to discuss this risk is a failure to analyze the cumulative impacts of the project.

c. Short-Term Exposures Are Significant

The DEIR attempts to dismiss short-term over-exposures to solvent chemicals. These exposures are important, however, because they can have long-term, chronic effects on pipe installers.

For instance, a short term exposure of 15 minutes or less may actually expose bodily tissues to toxic solvents for 5 hours while they are distributed throughout the body. (Smith, appen. A, p. 10.) It cannot be assumed that exposure ends when the source outside the body is removed.

In addition, the irritation of eyes, nose and throat reported in the studies and by the plumbers surveyed in the worker health study can cause serious health problems[55]. Chronic irritation experienced during a career of

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[55] Plumbers at a San Francisco apartment building of over 200 units also reported significant evidence of plumber irritation such as dizziness and headache. (Mitchell letter, November 6, 1989, appen. W.)

exposure to these chemicals may indicate carcinogenic effects. (Smith, appen. A, p. 11.)

Overexposure to toxics is a significant environmental effect of the proposed project and must be discussed as such in the DEIR. Failure to do so violates CEQA.

d. Leachates May Be Dangerous at Much Lower Levels than was Previously Assumed

The DEIR relies in some instances on the assurance that exposures to MEK, THF, chloroform and other chemicals is below the threshold limit values (TLV's) established by the American Conference of Governmental Industrial Hygienists. (Smith, appen. A, pp. 11-12.) However, MEK produces irritation at half the TLV level, and a substantial percentage of the plumbers in the worker health study reported irritation as well.

This information is consistent with the recent work of Dr. S.A. Roach, who has completed a comprehensive examination of the studies supporting TLV levels. His results are sobering; in four out of five studies, 100% of those exposed to TLV levels or below were adversely affected. Dr. Roach recommends that average exposures should be kept to below one-tenth of the TLV's. (See Roach letter to Nauman, October 24, 1989, appen. Y.)

HCD's proposed building standards must protect the health and safety of Californians. The standards may not expose workers to toxic chemicals that may cause illness. Since the evidence suggests that TLVs are not sufficiently health protective, the EIR must examine exposure dangers below TLV levels.

e. The DEIR Ignores Increased Toxic Exposures of Workers in Plastic Manufacture

Although it concedes that the proposed project will result in millions of additional tons of plastic consumption, the DEIR makes no mention of the effect of more production on manufacturing workers. Acrylonitrile, butadiene and styrene are rodent carcinogens and vinyl chloride is a human carcinogen. (Smith, appen. A, p. 19.) Solvent cement and primer

manufacture will expose plant workers to solvent hazards as described for plumbing workers.

There is no analysis of the risk of upset at plastics plants, although a recent explosion at the Phillips Petroleum plastics plant in Texas killed over 20 workers. (San Francisco Chronicle, October 24, 1989 at A3, appen. Z.)

The DEIR must assess all significant impacts, including the effect on workers in plastics manufacture, pipe manufacture and solvent cement manufacture.

7. The DEIR Suppresses Critical Portions of the Fowler Report on Worker Health

Although the technical report prepared by Douglas Fowler forms the organizational and textual basis for the DEIR's discussion of worker health issues, portions of the Fowler report that do not support the conclusions of the DEIR are missing from the draft.

The discussion of new construction in the DEIR is almost word for word from the Fowler report (DEIR, p. 61), but the last three sentences of the report's discussion are missing from the DEIR. The sentences read as follows:

> On those sites where plastic is used, plumbers may have relatively intimate and constant contact with the cement throughout the day. This exposure results not only from the vapor exposure as they cement the joints, but also from the residual cement on their hands (or gloves) and clothing. Plumbers may end the day with their coveralls coated with cement. (Fowler Report, p. C-5.)

While the information in the very last sentence is repeated in the DEIR and the report, the information concerning close contact and exposure from inhalation and skin contact is missing. The removal of these lines from the DEIR is critical since they suggest that plumber exposure to cements will be very high.

The DEIR discussion entitled "Installing Copper" does not contain a sentence found in the report which states that "Since the recent banning of lead solder in potable water systems, lead exposure has been dramatically reduced." (Fowler Report, p. C-6.) This fact about the installation of copper plumbing systems that is highlighted in the report and later mischaracterized in the DEIR as "mitigation."

The report introduces the worker health study by citing portions of the ERD which establish the need for such a study and then noting that "the survey [worker health study] included at least limited attempts to provide all of the information sought in our 1983 ERD." (Fowler Report, p. C-8; emphasis supplied.) The Fowler report thus acknowledges the limitations on the worker health study that are never addressed in the DEIR.

The DEIR also omits large portions of the discussion in the Fowler report entitled "Toxicity of Cement Mixtures in Humans and Animals." The Fowler report noted that a detailed review of animal studies found that "[s]cores for the adhesives indicated slight or slight to moderate damage, respectively." (Fowler Report, p. 7.) The DEIR includes only a two sentence paragraph concluding that cements present no significant health hazard. (DEIR, p. 69.)

The most notable omissions from the DEIR are contained in the Fowler report in the section on mitigation measures entitled "Potential for Exposure Reduction." (Fowler Report, pp. C-18 - C-21.) While the DEIR includes the mitigation measures themselves almost word for word, important limitations on the measures which cast doubt on their feasibility are discussed in detail in the Fowler report, but are omitted from the DEIR. (DEIR, pp. 72 - 74.)

For instance, on the issue of ventilation, the report states:

> Field observations and conversations with knowledgeable construction personnel indicate that provision of portable local exhaust ventilation systems is frequently thought necessary by plumbers, but that (especially in the commercial or large tract residential work) they frequently either do not ask for this protection or are refused by representatives of some general

> contractors. The reasons for such reluctance to make this request, or for the refusals, are the pressures of time and cost on these closely scheduled jobs and the skepticism of the plumbers regarding the practicality of these controls. (Fowler Report, p. C-19.)

Given the unwillingness of the plumbers to ask for, and the contractors to provide, ventilation, the feasibility and practicality of the ventilation mitigation is in doubt. Such a mitigation measure would not comply with CEQA standards. Yet this information is omitted from the DEIR, denying the public and policy makers of information necessary to make an intelligent decision regarding the proposed project.

The DEIR also fails to disclose information contained in the Fowler report that throws doubt on the feasibility of the mitigation requiring the use of gloves during installation of plastic pipe. The Fowler report states as follows:

> It is not clear that plumbers would readily use such gloves, even if they were available. Plumbing requires that a reasonable sense of touch be maintained for the installation of piping, especially in finished work, where some of the work may be done "blind" inside cabinets and the like. (Fowler Report, p. C-19.)

The interference gloves present to good plumbing practice make their use highly unlikely. This proposed mitigation does not meet CEQA standards.

Project alternatives are a form of mitigation. (*Citizens for Quality Growth v. City of Mount Shasta* (1988) 198 Cal.App.3d 433, 443-445, [243 Cal.Rptr. 727, 732-734.]) The DEIR suggests an alternative that would require all plastic pipe be joined with threaded, rather than glued, fittings. (DEIR, p. 103.) Yet text contained in the Fowler report but removed from the DEIR shows that this project alternative is not a reasonable one.

> Threaded fittings -- already available for connections to galvanized steel piping -- would also be a possible ultimate solution. However, given observed work practices, it is probable that the

excessive time required to make threaded connections in the field would eliminate an advantage of the plastic pipe over competing systems and would not be acceptable to contractors. (Fowler Report, p. C-19.)

Without this information, the reader cannot assess the viability of one of the project alternatives discussed in the DEIR.

8. The Mitigation Measures Suggested by the DEIR Will Not Be Feasible, Effective or Enforceable

The consideration of appropriate mitigation measures is an essential part of the CEQA process:

> CEQA establishes a duty for public agencies to avoid or minimize environmental damage where feasible. . . . A public agency should not approve a project as proposed if there are feasible alternatives or mitigation measures available that would substantially lessen any significant effects that the project would have on the environment. In deciding whether changes in a project are feasible, an agency may consider specific economic, environmental, legal, social, and technological factors. (14 C.C.R. § 15021.)

The DEIR describes several possible mitigation measures but does not indicate whether any of the mitigation measures are required to protect worker health. In addition, many of the mitigation recommendations included in the DHS study have been dropped without explanation. Finally, there is little or no discussion of whether the measures would be feasible or enforceable. This discussion does not provide HCD with any basis to determine what mitigation measures must be required in conjunction with its action on the project. The question of whether HCD can feasibly reduce exposure below hazardous levels remains unanswered.

The DHS study's recommendations focused on preventing the overexposures associated with worst case conditions.

> To prevent such overexposures, the following recommendations should be implemented consistently throughout the construction industry. (DEIR, appen. C, p. 35.)

Although the DEIR incorporates some of these recommendations, no clear rationale for the measures suggested is established since the DEIR never fully acknowledges or investigates the risks associated with worst case conditions.

The first DHS recommendation urged contractors to avoid work in enclosed areas. This recommendation was left out of the DEIR with no explanation. Although the recommendation would appear prudent, given that air flow rate was the strongest and most prevalent factor affecting exposure levels, this measure is not practical. Work in enclosed spaces is unavoidable in the construction industry. The DHS study itself acknowledged that "CPVC-pw installation is usually done later in the overall construction process . . . so the buildings tend to be more enclosed." Installing CPVC-pw pipe earlier in construction would increase the chance of pipe damage.

A recommendation to avoid work in enclosed spaces does not represent feasible or effective mitigation. A worker refusing to work in an enclosed space because of exposure to plastic pipe glues could be immediately fired. A worker may legally refuse to work only where an unsafe condition presents "an imminent risk of death or serious bodily injury." (*Whirlpool Corp. v. Marshall* (1980) 100 S.Ct. 883, 888-890.)

The DEIR included a weakened version of the DHS's recommendation for ventilation. This mitigation measure is much too general to provide the specific guidance needed to reduce the hazards present under worst case conditions. Under what circumstances would ventilation be mandatory? What technical specifications for ventilation would be required? What agency would establish these requirements and specifications? Would Cal/OSHA have sufficient funding to increase its regulatory responsibility.

The DEIR's reliance on Cal/OSHA inspections to ensure compliance with the suggested mitigation demonstrates a lack of familiarity with occupational health and safety regulation. Cal/OSHA's "Policy & Procedure Manual" establishes the following "Inspection Priorities": (1) Imminent hazards and/or fatality; (2) Serious injury; (3) Scheduled health inspections.

(Cal/OSHA "Policy & Procedure Manual," appen. AA, p. 1.) In addition, Cal/OSHA's Deputy Chief for Field Services, Hamilton Fairburn, indicated that Cal/OSHA devotes 90% of its inspection efforts to complaints and accidents, with only a small portion of time directed to scheduled inspections. (Pers. comm with Hamilton Fairburn, Deputy Chief of Field Services, Cal/OSHA, October 20, 1989.) He also observed that it is especially difficult to conduct scheduled inspections in the construction industry because of the number of projects around the state, and because of the short time period a particular contractor is on-site. Mr. Fairburn observed tat there are so many construction contractors in the state that with Cal/OSHA's current level of staffing, it would take "30 years" to inspect each of them just once.

The third DHS recommendation urged contractors to "establish and enforce work practices that minimize skin contact," prohibit "cleaning hands with primers, and wiping excess cement from joints," and provide and require the wearing of protective gloves for those who cannot follow these practices. (DEIR, appen. C, p. C-35.) The DEIR suggests limiting applicator and dauber sizes and making protective gloves "available" on work sites. (DEIR, pp. 73, 74.)

Making contractors responsible for establishing protective measures would provide no assurance that workers would be protected. The powerful economic interest of contractors to avoid protective measures which add costs and time to the job make it unlikely that such measures would be implemented. HCD cannot rely on industry self-enforcement to protect workers. Nevertheless, the DEIR does not recommend any changes to Health & Safety Code provisions, Cal/OSHA regulations or enforcement responsibility. It simply suggests that "reminding employers of their responsibility will be sufficient." (DEIR, p. 74.) The ERD acknowledged that no gloves exist which offer protection from all of the hazards associated with plastic pipe installation:

> In the case of requiring the use of gloves, it is not clear that there is any one glove material that might be relied upon for protection against the variety of solvents found in the cements in common use. Table IV-43 shows results of a recent laboratory investigation of the permeability of some of the solvents of interest though common glove materials. From that table, it can

> be concluded that the material that are most protective against DMF (neoprene and natural rubber) are poorly protective against THF and MEK. Similarly, the material most suitable for MEK and THF is polyvinyl alcohol (PVA), which is not suitable for DMF. Further PVA tends to disintegrate in water, making it useless for construction work. (ERD, p. IV.C-49.)

This statement is consistent with data issued by glove manufacturers which demonstrate that no glove currently available would provide protection from THF. (See appen. BB.) This is particularly disturbing here, given that high exposures to THF were one of the key findings of the DHS study.

The feasibility of this measure is also questionable, given the burden the neoprene gloves would pose for a workers' manual dexterity and comfort. This point is also examined in the ERD:

> Finally, it is not clear that plumbers would actually use such impermeable gloves, even if they were available. Plumbing requires a reasonable sense of touch for the installation of piping, especially in finishing work, where some of the work may be done "blind" inside cabinets and the like. (ERD, p. IV.C-49.)

The limitation on dauber size is also not a practical suggestion. The installation of larger pipe, particularly in commercial and office buildings requires the use of large daubers. The DEIR neither discusses the practicality of the suggestions nor recommends any action to implement the proposal.

The four measures recommended by the DHS study required contractors to provide emergency portable eyewash stations to protect employees from the hazards of splashes of plastic pipe primers and cements or of hot flux. The serious eye damage from these chemicals could be reduced with immediate flushing at the stations. No mention of this hazard or the mitigation measure was included in the DEIR.

Several other mitigation measures suggested by the DEIR involve education and training of to inform plumbers of risks and equipment and techniques to help reduce exposures and increase safety in the use of plastic

plumbing pipe. These are good ideas in theory, however, implementation of education and training programs involves time, effort, and money for plumbing contractors, plastic pipe and supply distributors, primer and cement manufacturers, and HCD. How will the education program be setup and coordinated between all of these groups? Who will fund the program? Are all plumbers currently required to pass the state licensing exam? Are plumbing contractors required? Should HCD propose changes in the sate licensing examination to the Contractors Examination Board? What will motivate contractors to provide health and safety training for their employees? Will such training be required? Who will enforce the training requirement? None of these issues are discussed, and no actions to implement the proposal are recommended.

The DEIR also overlooks the short careers of many workers. The DHS study stated that "[w]orkers' experience in the pipe trades ranged from 3 months to 41 years. . . . workers installing CPVC-fire had the least experience (mean 1.7 years). Only eight (10%) reported receiving specific health and safety training, which usually focused on worker safety . . . . Only two workers (3%) said they had been informed about the potential hazards of the substances in plastic pipe primers and cements." (DEIR, appen. C, p. C-14.) With a transient work force, how can contractors be expected to educate their employees on a consistent basis? This issue is not addressed.

In light of current conditions, it is unlikely that the industry will adopt additional measures to protect worker safety from a new hazard. As observed in the DHS report, the construction industry is presently unable to protect the safety of its worker against the obvious dangers associated with ladder and chainsaw use; how can it be expected to guard against the more subtle dangers of chemical exposure? The DEIR does not present sufficient information for HCD to make required findings regarding appropriate mitigation measures.

C. The Discussion of Fire Safety is Inadequate and Fails to Comply with CEQA

1. The Description of the Proposed Code Change and the Code Change Process is Ambiguous, Incomplete and Inaccurate

a. The DEIR's Consideration of Plastic Pipe Use in Fire-Rated Buildings Conflicts with the Proposed Code Language Contained in Table 1

The DEIR's description of the proposed code changes is ambiguous and inconsistent. The DEIR describes the project as adoption of UPC provisions governing the use of plastic pipe, as codified in the 1982 edition of the Code. (DEIR, p. 1.) The specific UPC sections proposed for adoption are set forth in Table 1, and expressly limit the use of plastic pipe DWV uses to "structures where combustible construction is allowed." (DEIR, pp. 5 - 7.)

The DEIR, however, adds the following footnote to the combustible construction limitation: "HCD is proposing to allow ABS, PVC and CPVC DWV piping in fire-resistive construction." (DEIR, p. 5, fn. 2.) On the previous page, the DEIR states that HCD is proposing to allow the use of ABS and PVC DWV pipe "in fire-resistive construction in fire-rated buildings." (DEIR, p. 4.) No further explanation is offered.[56]

The DEIR's casual use of terminology is the source of the confusion. "Combustible," "fire-resistive" and "fire-rated" are terms of art used in UBC provisions establishing building standards and requirements for fire-safety. The UBC establishes fire-resistive requirements for both combustible and noncombustible construction. (See UBC, Table 17-A, included in appen. DD.) Since the UPC language proposed for adoption would permit the use of plastic pipe in fire-resistive construction in combustible buildings, DEIR

[56] Additional uncertainty is created by the fact that the DEIR text mentions only PVC and ABS as being proposed for DWV use in fire-rated structures even though Table 2 includes CPVC as a proposed DWV use in fire-rated structures.

footnote 2 can only mean that HCD is proposing to allow the use of plastic plumbing systems in fire-resistive construction in noncombustible buildings.[57]

The UPC has never authorized the use of plastic pipe in noncombustible, fire-rated structures. Prior to 1982, the UPC restricted the use of PVC and ABS DWV pipe "to residential construction, not more than two (2) stories in height." (UPC, §§ 401, subd. (a) and 503, subd. (a)(1) (1979 ed.).) With the issuance of the 1982 edition of the Code, this language was revised to limit plastic pipe to "combustible construction." (UPC § 401, subd. (a)(2) and § 503 subd. (a)(2) (1982 ed.).) This language has remained the same in all subsequent editions of the UPC and is the language proposed for adoption by HCD.

The ambiguity in the DEIR's description of the proposed code change raises a number of significant issues which must be addressed in the Final EIR. First, the legal effect of the proposed code adoption is unclear given the conflict between the expanded use of plastic pipe apparently proposed by HCD, and the expanded use authorized by the actual code language reflected in Table 1. Although the DEIR indicates that HCD is proposing the use of plastic pipe in fire-rated, noncombustible buildings, no code language to implement that proposal has been set forth as a part of this project. Indeed, the only code language circulated for public review would expressly prohibit the use of plastic pipe in noncombustible fire-resistive construction.[58]

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[57] Under the UBC, combustible construction refers to Type III, Type IV and Type V structures, which are buildings of 3 stories or less with a combustible structural framework allowed. (See UBC, table 17-A, appen. DD.) An additional story is allowed if the building is fully sprinklered. (UBC § 507.) Noncombustible or fire-rated buildings are Type I and Type II structures, which are multi-story and high rise buildings with a noncombustible structural framework. (UBC, table 17-A.) Type I buildings can be of unlimited height and area; Type II buildings, if fire-rated, can be up to 12 stories in height and can have in excess of 240,000 square feet per floor. (UBC, table nos. 5-C and 5-D.)

[58] Although the DEIR contains no code language to implement a proposal to permit plastic pipe in noncombustible construction, further mystery is created by the DEIR's Figure 2, which describes "Decisions Leading To Expanded Use of Plastic Plumbing Pipe." (DEIR, p. 10.) This Figure includes a box entitled "Amendments

(continued...)

The lack of clarity in the description of the proposed project regarding plastic pipe use in fire-rated construction also violates CEQA's mandate for full disclosure and meaningful public participation. The DEIR's ambiguous footnote and incorrect use of terminology, particularly in an area as complex and arcane as this, is certain to mislead and confuse both the general public and government decision-makers regarding the nature and scope of the changes proposed with respect to fire-safety requirements. CEQA has been characterized as an "environmental full disclosure" statute, intended to apprise the public and agency decision-makers of all environmental effects associated with a proposed project. (14 C.C.R. § 15151.) This is important not only to ensure accountability, but also to enable meaningful participation by interested parties in the environmental review process. (Pub. Resources Code § 21003, subd. (b).) The uncertain project description also violates the requirement of the California Building Standards Law that HCD demonstrate that the proposed building standards are "not unnecessarily ambiguous or vague, in whole or in part." (Health & Saf. Code § 18930, subd. (a)(6).)

In this case, the State Building Standards Commission and the State Fire Marshall have direct approval authority and other public officials (e.g., uniform code bodies, local building officials) have a direct interest in the

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[58](...continued)
Permitting Additional Uses Not in UPC." The Key to the Figure describes this action as "Already Completed."

This reference to amendments permitting uses beyond the UPC which are "already completed" is completely inexplicable. Could it somehow be a reference to amendments to implement the expanded use of plastic pipe in fire-rated construction? If so, what does it mean to say these amendments are "already completed"?

Since the lack of explanation for this reference precluded any meaningful comment, the Council asked HCD's CEQA Project Coordinator, Mike McMillan, for an explanation from either the Department or SRI regarding the significance of this statement in Figure 2. Mr. McMillan was also at a loss to explain what was meant by this reference and indicated that he would request an explanation from SRI. Despite repeated requests from the Council, no explanation was forthcoming.

proposed code changes. Since the conflict between the HCD proposal and the code language set forth in the DEIR is never reconciled, these public decision-makers may not be aware of the magnitude of the proposed change. The failure to set forth code language to implement the proposed use of plastic pipe in noncombustible construction also denies both the public and government decision-makers of their right to comment on the proposed project. (Pub. Resources Code § 21003, subd. (b).)

The DEIR's discussion of the potential fire hazard fails to distinguish between plastic pipe use in fire-resistive construction in combustible buildings and the unprecedented expansion of plastic pipe use to all noncombustible, fire-rated structures.[59] Under the UBC, multi-story and high rise fire-rated buildings must meet much more extensive and stringent requirements to ensure fire safety. (See UBC, table 17-A, appen. DD, and chs. 18, 19 and 43.)[60] In addition to a non-combustible structural framework, these buildings must have a non-combustible load-bearing internal construction that resists the spread of fire, gases and smoke from floor to floor and between adjacent offices or residential units.

This internal fire protection is provided by a combination of highly technical floor, ceiling, wall and chase partitions. (UBC, Table No. 17-A.) These fire-resistive assemblies must contain a fire in one location for a minimum of one or two hours depending on whether the containment is from one story to another or within a story. It is the intent of the UBC to achieve this degree of containment in order to afford the occupants of multi-story and high-rise buildings adequate time to escape and to create a manageable and more easily controlled fire.

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[59] Expanded plastic pipe use in fire-resistive construction in combustible structures also presents a significant fire danger. The discussion in the following sections on the inadequacy of the DEIR's analysis of the fire hazard and proposed mitigation measures applies to the proposed use of plastic pipe in both combustible and noncombustible construction.

[60] Multi-story buildings are structures two stories or more, but less than 75 feet to the floor of the upper most occupied story; high rise buildings are structures over 75 feet (UBC, § 1807.)

Plastic pipe is not currently allowed anywhere in the UBC's extensive provisions regulating construction techniques and materials in fire-rated buildings and fire-resistive assemblies. The use of combustible plumbing systems that traverse and penetrate the protective floors and partitions within a fire-rated building can severely affect the integrity of the fire-resistive assemblies and can undermine the safety afforded by such assemblies. Unlike noncombustible metal pipes, plastic plumbing systems have been shown to act as a fuse, linking the entire building into one common fire disaster. It is for this reason that the UBC does not currently permit the use of plastic plumbing systems in fire-resistive construction.

The DEIR also fails to consider HCD's limited discretion to adopt less restrictive standards than are established in the UPC. (See, *ante*, section II.D.3.b.) It is precisely because of concerns about fire-safety that IAPMO decided to restrict plastic DWV uses to wood-frame, combustible construction. This intention was recently reaffirmed at IAPMO's 60th Annual Education and Business Conference on Uniform Plumbing Code Changes held in Sparks, Nevada on September 26, 1989. Because the term "combustible construction" is not specifically defined in the UPC, the limitation on the use of plastic pipe had led to some confusion in enforcement. In order to address the problem, the President of IAPMO appointed an Ad-Hoc Committee on Combustible Construction. (Pers. comm. with Ed Wachter, Executive Director, IAPMO.)

The Ad-Hoc Committee voted unanimously to recommend that IAPMO add the following definition to the UPC: "Combustible Construction -- For the purpose of this code, combustible construction is a structure in which any member of its structural framework will ignite and burn at a temperature of 1392° F. or less." (Proposed Code Revisions, Item 2, IAPMO Annual Conference, Sept. 26, 1989.) This definition includes only wood-frame buildings of three stories or less and confirms IAPMO's intent to limit the use of plastic DWV pipe to these structures.[61]

The Plastic Pipe and Fittings Association (PPFA) and other Plastics Industry representatives opposed adoption of the definition at the conference

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[61] The 1392° F threshold is the UBC point at which non-combustible is defined under UBC Standard 4-1. (UBC, § 415.)

and argued that IAPMO ought to remove its restriction on the use of plastic pipe in noncombustible, fire-resistive construction. (R.T., IAPMO Annual Conference, pp. 4-9.) The full IAPMO voting membership, which includes only government plumbing officials, rejected the Plastics Industry arguments and voted overwhelmingly to adopt the definition of combustible construction and retain the UPC prohibition on the use of plastic pipe in noncombustible, fire-rated structures. (R.T., IAPMO Annual Conference, p. 14.)

A proposal to allow the installation of combustible DWV piping in all multi-story and high-rise buildings is unprecedented and raises profound issues of public safety. As discussed in section II.D.3.b. with regard to the proposed authorization of PB, HCD has limited discretion to adopt less restrictive standards than the UPC. HCD must show that the uniform standards would be "unreasonable, unnecessary or ill-advised" if applied in California, and that performance tests or other evidence demonstrate that the public health and safety would be equally protected under the proposed standards. In this case, the DEIR does not identify any unique conditions indicating that the UPC restrictions would be unreasonable in California. As will be discussed, the DEIR also fails to support its conclusion that the use of combustible piping will not compromise public safety with any performance tests or comparable evidence.

b. DEIR Understates the Amount of Fire-Rated Residential Construction Affected by the Proposed Code Change

The DEIR misstates the scope of fire-rated residential construction subject to the proposed code change. The DEIR states that "[t]he only residential buildings that are fire-rated, however, are structures having three or more stories and structures of any height whose occupants might not be able to rescue themselves in the event of a fire (e.g., schools, hospitals, and nursing homes). Therefore, fire-rated buildings account for only a very small portion of total new residential construction." (DEIR, p. 12.) This statement is incorrect and reveals that the authors of the DEIR do not understand UBC standards establishing fire-resistive requirements.

The 1988 UBC requires one-hour fire-resistive construction for all dwelling unit separations (walls or floors) regardless of the required fire

rating of the rest of the building. (UBC, § 1202, subd. (b).) The section 1202 provisions requiring one-hour fire-resistive walls and floors apply to all buildings with two or more dwelling units. Any plumbing system installed in the walls or floors of these dwellings are subject to the same mitigation requirements as for a full, one-hour fire-rated building.

The DEIR also indicates an anticipated 90,000 multi-family dwelling units out of a 250,000 total dwelling units estimated for 1988. Thus, almost 40% of the total estimated dwelling units constructed in 1988 would be multi-family units and would not represent a "very small portion of total residential construction" as suggested by the DEIR. Under the 1988 UBC, all of these units will contain fire resistive construction. In those cases where plastic pipe is installed in such buildings, the mitigation measures necessary to protect public health and safety will be required.

c. The DEIR Fails to Consider the Use of Plastic Pipe in Non-Residential Construction

As discussed in section III.D.1.c., the proposed code changes would apply to all occupancies, including commercial, office and industrial buildings. The DEIR, however, addresses only residential buildings and does not address the public safety impacts of this significant expansion of combustible piping into all fire-rated structures.

The square footage of all buildings constructed per year in California, aside from residential buildings of not more than three stories in height, is very substantial and is ignored in the impact assessment made by the DEIR. In addition, hospitals and other institutional buildings generally contain more plumbing than a residential building. The effect on safety of the use of combustible piping on these institutional buildings has been ignored in the DEIR.

The proposed expanded use of plastic pipe would increase the fire hazard to the public because the fuel loads present in residential construction are substantially less than those found in many of the other occupancies governed by the UBC. In residential buildings, a ten pound per square foot fuel load is assumed. In other occupancies, this fuel load can be four times that amount, i.e. 40 pounds per square foot or more. The effect

of the height on propagation of fire spread in tall buildings of residential or any other occupancy has also been ignored in the DEIR. This stack effect can be considerable, and can spread fire from lower to upper stories of a building via the combustible piping.

d. DEIR Fails to Consider Fire-Safety Impacts from Plastic Pipe Use in Remodeling and Renovation

After describing current plumbing material use, the DEIR states: "Remodeling and renovation may pose exceptions to these guidelines." (DEIR, p. 11.) The only additional discussion of this point occurs on page 13, where the DEIR assumes that "[r]enovations are likely to use the original plumbing materials in replacing part or all of the plumbing systems." The potential fire-safety impacts associated with plastic pipe use in renovation work are not addressed.

There has been virtually no testing of fire-safety mitigation systems that can be used as a retrofit in existing buildings where combustible piping is proposed to replace metallic piping systems. Fire tests conducted on conventional combustible framed buildings, with standard cutouts in the plates for plumbing installation, demonstrate that combustible piping reduce the one-hour fire resistance of the wall by half, to an average 30 minute fire endurance. (See ERD, pp. IV.D-15.)

The special mitigation requirements for plastic pipe use in renovation work are also ignored by the DEIR. The traditional methods for replacing existing plumbing systems in a renovation cannot be used with plastic pipe. It is impossible with such work to ensure that the mitigation procedures are properly followed, particularly at the floor line or plate line in combustible construction.

In order to maintain fire safety with such in such circumstances combustible piping should not be allowed in walls and floors to replace existing metallic piping without special mitigation. This mitigation must include submission of complete details of the method of installation for approval by the building and fire officials as both capable of achieving the required fire-rating and proper installation, and capable of inspection. Because of the complex nature of the retrofitting or replacement of existing

piping, any such work would also require special inspection under the provisions of UBC section 306.

The DEIR also underestimates the potential scope of plastic pipe use in renovation work. For example, in cases where an existing plumbing system has failed or otherwise requires replacement, that system is rarely, if ever, replaced with a steel system. It is very likely that the proposed code changes would result in the use of plastic plumbing systems in such cases.

e. The DEIR Fails to Consider the Requirement for State Fire Marshal Approval

The DEIR fails to consider the approval authority of the State Fire Marshall in conjunction with the proposed code changes. The function of the Office of the State Fire Marshall is to promote and develop methods for protecting life and property against fire and panic. (Health & Saf. Code § 13100.1.) Toward that end, the State Fire Marshall is required to prepare and adopt building standards to promote fire-safety in construction with regard to various categories of structures. (See Health & Saf. Code §§ 13108 [state-owned buildings and institutions], § 13143 [jails, hospitals, nurseries, schools, theaters and auditoriums], § 13143.6 [semi-custodial care facilities] and § 1321.1 [high-rise structures].)

In 1981, the Legislature amended the State Housing Law to substitute the State Fire Marshall for HCD as the entity responsible for developing building standards governing fire-safety in the occupancies subject to the State Housing Law (hotels, motels, lodging houses, apartment houses, swellings, buildings, and accessory structures). State Fire Marshall authority over building standards governing fire-resistive construction in these occupancies is now found in two sections of the State Housing Law. (See Health & Saf. Code § 17920.7 and § 17921, subd. (b).) This transfer of authority was based on the increased concern of the Legislature with the entire area of residential fire safety.

The California Building Standards Law also expressly requires that any building standards submitted to the State Building Standards Commission by any adopting agency that involve fire and panic safety must have the "written approval of the State Fire Marshall." (Health & Saf. Code § 18930, subd.

(a)(9).) Despite this explicit requirement, the DEIR does not mention the approval authority of the State Fire Marshall and the Figure 2 list of decisions required before the expanded use of plastic pipe does not list the State Fire Marshall as an "actor" in the process. (DEIR, p. 10.)

The submission of building standards permitting the use of combustible piping within, and penetrating through, fire-resistive construction would clearly affect fire-safety and require the written approval of the State Fire Marshall pursuant to Health and Safety Code section 18930. The elaborate performance standards and construction methods suggested by the DEIR as necessary to mitigate the fire hazard are evidence of the fire-safety implications of the proposed building standards. The State Fire Marshall is the only state official with the expertise and authority to evaluate such fire-safety mitigation.

The DEIR also blatantly misrepresents the consistent position of the State Fire Marshall through out this proceeding. The DEIR claims that the State Fire Marshall's 1980 and 1987 reports found that the use of plastic pipe would have "negligible" effects on fire spread, intensity, and toxicity. (DEIR, appen. D, p. D-8.). This statement is the exact opposite of what the State Fire Marshall concluded.

The State Fire Marshall's 1980 report concluded that use of combustible piping in fire-rated construction presented potentially significant hazards and should not be allowed without additional study. The report concluded that "additional in-depth fire testing is necessary to: (a) ensure that plastic pipe will not contribute to unusual fire spread; and (b) that the toxicity generated by the combustion of plastic pipe will not extend beyond the area of initial exposure in quantities sufficient to prove hazardous." (State Fire Marshall, "Fire Hazards of Plastic Pipe," May 1, 1980, p. 1.) The DEIR's mischaracterization of the State Fire Marshall's position is remarkable given that the 1980 State Fire Marshall Report was one of the key bases for HCD's decision to prepare an EIR on the plastic pipe proposal.

The DEIR also misrepresents the 1987 State Fire Marshall report. First, this report was limited to a consideration of the smoke toxicity danger to fire-fighters from two kinds of plastic pipe used in fire sprinkler systems;

it did not consider issues of fire spread or intensity. (State Fire Marshall, "The Potential Toxic Hazards Relating to the Use of Plastic Pipe for Automatic Fire Sprinkler Systems," April, 1987, p. 1.) Second, the report found that laboratory tests showed that burning plastic pipe presented a significant hazard (*Id.*, pp. 32-37), however, the report concluded that the hazard could be managed in real world applications, provided a number of specific mitigation measures were required. (*Id.*, pp. 42-44.)

The State Fire Marshall's 1987 report on plastic sprinkler systems reinforces the arguments that follow regarding the inadequacies of the DEIR's mitigation recommendations. The State Fire Marshall's report strongly emphasizes that the smoke toxicity hazard from plastic sprinkler pipe can only be avoided through careful implementation of appropriate mitigation measures. The report concluded that approved and listed installation systems were essential. (State Fire Marshall Report, supra, p. 43.) The report also stated that careful adherence to the specifications of the approved systems was required, and noted that the listed systems strictly limit the type of occupancies and the types of construction where plastic pipe may be used. (*Ibid.*) The report also indicated that installation of the sprinkler systems required "approval of local building and fire departments to insure proper and safe installation." (*Ibid.*)

The State Fire Marshall's 1987 report reveals the inadequacies of the DEIR's fire-safety mitigation proposal:

> A common theme running through all of the research, testing and investigation done relative to the use of plastic for sprinkler pipe is the necessity for protection. All of the mitigating factors related to its use can only be considered effective if the pipe is installed behind appropriate barriers. Because the research findings [regarding the dangers of plastic pipe] are unequivocal in their conclusions, the use of PB and CPVC is totally unacceptable in any configuration in which the pipe is exposed." (State Fire Marshall Report, *supra*, p. 43; emphasis added.)

HCD must condition its adoption on State Fire Marshall approval of the proposed building standards as they affect the use of plastic pipe in fire-resistive construction.

2. The Proposed Mitigation Fails to Comply with CEQA and Would not Protect the Public from the Fire-Safety Hazards of Plastic Pipe

The DEIR expressly finds that the installation of plastic plumbing systems under the proposed code changes would create a significant fire danger. The DEIR Technical Appendix on fire safety finds that "[p]lastic plumbing systems are more of a fire hazard than their metal counterparts particularly at penetrations through fire-rated barriers." (DEIR, appen. D, p. D-7.) The DEIR text concludes: "[I]n fire-rated walls, plastic plumbing pipe cannot be installed in the same manner as metal pipe without lowering the fire rating." (DEIR, p. 77.)

In order to mitigate the fire hazard created by plastic plumbing systems, the DEIR suggests two mitigation measures. The first mitigation proposal provides:

> HCD could issue a special Information Bulletin to ensure that local jurisdictions are aware of the ramifications of using plastic plumbing pipe. This bulletin could inform building inspectors that fire ratings can be maintained by the proper use of fire-stopping materials and techniques that comply with existing fire codes and performance standards. (DEIR, p. 80.)

The second mitigation proposal provides:

> [I]n a special Information Bulletin on plastic plumbing pipe, HCD could emphasize that additional care is required in the inspection of buildings with plastic plumbing pipe to ensure that code requirements are met through proper installation. (DEIR, p. 81.)

The DEIR's suggested mitigation measures are in direct conflict with the findings of the ERD, which expressly rejected these measures as ineffective. These mitigation measures are also proposed without reference to the development of fire-safety standards and requirements in the UBC and violate CEQA's requirement that proposed mitigation be capable of implementation and enforcement.

a. The Mitigation Measures Proposed by the DEIR Must be Approved and Certified by ICBO and Codified in the UBC

It is important to emphasize that there has been general agreement by all parties as to the mitigation measures required to address the fire danger created by the use of combustible plumbing systems. All participants to this proceeding have agreed that, prior to the expanded use of plastic pipe, it was necessary to have both performance standards and construction methods which demonstrated that plastic systems would not compromise the protection afforded by fire-resistive assemblies. It had also been generally agreed that such performance standards and construction methods must be approved and certified by the ICBO.

The DEIR departs from these accepted principles by suggesting, for the first time, that performance standards and construction assemblies can be approved on an ad-hoc basis by individual local building officials. The DEIR proposal reveals a profound misunderstanding of the building standard development process in general and the combustible piping standards and requirements in particular.

Local building officials do not have either the technical expertise or the resources to evaluate performance standards and construction methods for the use of combustible piping in or through fire-resistive assemblies. This is a highly complex area that has been under study by technical subcommittees of the ICBO for several years. The lengthy review of these issues by ICBO demonstrates that the DEIR's recommendation to allow certification of standards and assemblies by local building officials is both impractical and premature. The absence of ICBO approved standards and construction assemblies would not only lead to inconsistent requirements around the state, it would provide no guarantee that nationally recognized standards would be applied. The fire dangers presented by plastic pipe demand such guarantees.

The DEIR's mitigation recommendations are in direct conflict with the conclusions of the ERD, which contained a much more detailed examination of the fire safety issue and which is incorporated by reference in the DEIR. The ERD clearly stated that performance standards and construction

methods necessary to make plastic pipe safe in fire-resistive construction cannot be left to local approval. The ERD observed:

> Traditionally, technically complex or controversial changes in building materials or methods of construction have not been left to the individual building official to grapple with because the individual official typically does not have the resources or training to resolve the issue. Moreover, it has long been recognized that such a fragmented approach to issues concerning human safety and protection of property is not in the interest of society. (ERD, p. IV.D-3.)

The ERD went on to observe that adequate protection of the public health and safety could only be assured through the established review procedures of the existing code bodies:

> It is one of the fundamental purposes of, for example, the International Conference of Building Officials (ICBO) to investigate the merits of new construction or material proposals and to develop and adopt into code the appropriate UBC provisions to specify safe construction methods and installation conditions. Changes to the Uniform Building Code, produced by ICBO, are processed each year. The changes to the code are carefully reviewed in public hearings by professional experts in the field of building construction and fire and life safety. (ERD, p. IV.D-3.)

The ERD expressly concluded that "[f]ollowing such a review procedure in the case of proposed expanded use of plastic pipe is essential for the following reasons:"

> "(1) Special and as yet undeveloped or unproven construction measures involving additional cost and care are needed to satisfy code performance standards (primarily for fire-resistive construction).

"(2) Significant amounts of combustible material are at issue, notably in the case of ABS DWS piping, and there is a potential health hazard from smoke generation, particularly from PVC and CPVC.

"(3) Code enforcement is likely to be a significant problem with plastic pipes, and the resources for enforcement must be carefully weighed in developing code provisions.

"(4) The Uniform Building Code (1982 Edition) is deficient in specific provisions, standards or recommendations for installation of plastic pipe in fire-resistive construction.[62] The Uniform Plumbing Code (1982 Edition) does not address the issue at all."

Each of the reasons cited by the ERD for making ICBO adoption of standards and construction methods a prerequisite to HCD approval of expanded plastic pipe use remains true today. However, the ERD's careful analysis is completely ignored by the DEIR.

b. The UBC Contains None of the Mitigation Measures Recommended by the DEIR

The current UBC (1988 edition) is as deficient in specific provisions, standards or recommendations for installation of plastic pipe in fire-resistive construction as was the 1982 edition of the UBC considered in the ERD. The proposed amendments to the State Plumbing Code as described by the DEIR would allow the use of plastic in fire-resistive construction without any of the approved standards or construction methods the DEIR claims are required to ensure the safety of plastic pipe use in fire-resistive construction.

Unlike the ERD, which emphasized the need to coordinate approval of the expanded use of plastic pipe with the approval and certification of

[62] "The UBC (1982) defines 'fire-resistive construction' as follows: 'Fire-resistive construction is construction to resist the spread of fire, details of which are specified in this code.'" (ERD, p. IV. D-4; original emphasis.) With this footnote, the ERD further emphasized the need to rely on the UBC, which is the only source for detailed standards governing fire-resistive construction.

fire-safety mitigation measures in the UBC review process, the DEIR proposes mitigation as if the UBC did not exist. None of the mitigation measures recommended by the DEIR has been incorporated into the UBC in the period since publication of the ERD. The DEIR also disregards the fact that ICBO is currently engaged in a review of some of the measures discussed in the DEIR.

At its 66th Annual Code Development Conference in September 1988, ICBO approved for the first time a number of performance standards for the penetration of fire-resistive assemblies by combustible piping. However, these standards do not cover the special installation and inspection procedures which the ERD indicated were critical to maintaining the integrity of the fire-resistive assemblies. Furthermore, these performance standards are subject to the ICBO annual code change cycle and may be revised or withdrawn completely before final approval. Even if not altered, these changes would not be codified until the 1991 edition of the UBC, which after state and local adoption would not be effective until sometime in 1992.

More importantly, the critical installation methods necessary to ensure fire-safety have not yet received even preliminary acceptance from ICBO. The PPFA manual cited in the DEIR is a Plastics Industry document that has been submitted to the National Evaluation Service for review. The assemblies described in that document have not received any acceptance or certification from ICBO.

It is not at all clear that the devices described in the PPFA manual will receive ICBO acceptance. Indeed, the 1985 manual referenced in the DEIR contains numerous assemblies that do not restrict the annular space of the penetration to 1/8 inch, which the Fire & Life Safety Committee of ICBO considered essential to maintain the fire-rating with plastic systems. (Design Guide to the 1988 Uniform Building Code, 1988 supplement, pp. 35-37.) The installation methods proposed by the Plastics Industry are a long way from acceptance by ICBO.[63]

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[63] The Council is advised that there have been subsequent editions of the PPFA manual, although these documents are not available for public review. If the Final EIR references any later editions of the PPFA manual or any other material to support its

(continued...)

If plastic pipe were authorized by the State Plumbing Code, no approved assemblies currently exist that could be practically installed. Although Underwriters Laboratories lists a few assemblies using plastic pipe, even the Plastics Industry acknowledges that these systems "are not practical from a pricing standpoint." (HCD Task Force Meeting, Tape #5, Comments of Joe Zicherman, representing Society of the Plastics Industry.) It is precisely for this reason that the Plastics Industry is attempting to obtain acceptance of the less expensive assemblies described in the PPFA manual. However, at this point no such assemblies have received even preliminary acceptance from ICBO.

Thus, the three steps described in the ERD as essential to the safe use of plastic pipe in fire-resistive construction (UBC standards, UBC approved construction methods and ICBO Evaluation Reports for accepted assemblies) remain absent but are assumed to exist by the DEIR. This is a glaring error in the fire-safety analysis that could have serious ramifications should the proposed code changes be approved. Even if some of the required mitigation measures should be developed in the future, the DEIR overlooks the fact that many local jurisdictions may attempt to approve plastic pipe through local amendments upon certification of the Final EIR. At that point, none of the mitigation measures required to protect the public from the fire dangers of plastic pipe would be in place.

c. The Mitigation Measures Proposed by the DEIR Require Application of the UBC Special Inspection Process

Even if combustible piping installation methods are accepted by ICBO and the related standards and code provisions are incorporated in the 1991 UBC, the DEIR itself acknowledges that plastic pipe use in fire-resistive construction raises special enforcement issues. In discussing its proposed mitigation measures, the DEIR observes:

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[63](...continued)
view that approved construction methods are available, CEQA requires that such material be made available for public review and comment. (14 C.C.R. § 15150, subd. (b).)

> The effectiveness of most fire stop systems is sensitive to workmanship; consequently, additional care is required in installation and inspection to ensure the prescribed protection is achieved. Furthermore, economic pressures and competition generally drive performance to the minimum allowable level, requiring vigilance to ensure that the acceptable level of fire safety is maintained.
>
> Therefore, in a special Information Bulletin on plastic plumbing pipe, HCD could emphasize that additional care is required in the inspection of buildings with plastic plumbing pipe to ensure that code requirements are met through proper installation. (DEIR, p. 80.)

The ERD emphasized the need for extreme care in inspecting the installation of fire-resistive assemblies containing plastic pipe to ensure that the combustible piping would not compromise fire safety. The ERD observed that because "considerable care and attention are required to fire-stop the penetration for plastic plumbing systems sufficiently to maintain the fire rating," it is important to consider "the question of nullifying the protective countermeasures by sloppy workmanship or intentional circumvention of the code." (ERD, pp. IV.D-8 and D-26.). The ERD went on to explain:

> "'Resistance to fire propagation is no better than the most poorly constructed seal or sleeve. A forgotten cementing job around the outside of a conduit penetrating a wall, or an inadequate fire stop between floors in a pipe chase can negate the value of good design. Note that good fire stops and seals are more important in plastic systems than metal. With poor seals, heat and flame will be forced to flow around the pipe due to the positive pressure on the fire side.
>
> "'This could quickly melt or burn the plastic conduit or pipe, exposing a much larger opening for flame penetration and transport of smoke and toxic gas. Even with steel pipe in rated construction, fire penetration has occurred. The chance for fire penetration, and the hazard resulting from such a failure, is greater for plastic pipe.

"'In view of the more stringent design and inspection requirements that are needed to achieve an equivalent level of fire safety, the difference in cost of plastic, compared to metal, systems may be less than some believe.'" (ERD, pp. IV.D-26-D-27, quoting from Smith, E.E., 1973, "Fire Hazards of Plastic Pipe, Conduit, and Insulated Wire.")

These concerns remain valid today. Indeed, in light of the evidence showing that plastic pipe will not offer a savings in cost over metal pipe (see, *post*, section III.G.), there be even greater economic pressure to cut corners and avoid the cost of special mitigation measures required with plastic pipe use than estimated by the DEIR. Yet, the DEIR simply suggests that HCD could issue an Information Bulletin informing building officials that additional care is required with the installation of plastic pipe.

An Information Bulletin would not constitute sufficient mitigation given the need for extreme diligence required in the installation of plastic systems emphasized in both the DEIR and the ERD. The recommendation also demonstrates a lack of familiarity with the building inspection process. For example, a Building Inspector typically examines construction after framing and after close-up. Where the mitigation measures are installed after framing, but before close-up, the Building Inspector would not be in a position to examine the fire-resistive assemblies that would be installed behind sheetrock at the time of the final inspection.

Under such circumstances, departure from the unusual inspection process is required. A Building Inspector must arrange to be present to examine the fire-resistive mitigation assemblies present behind the covering of the framing before that covering is installed. The Building Inspector must also examine the installation after cover-up to ensure that the mitigation methods required at the penetrations of the surface covering are installed properly.

The UBC has in place a "special inspection" process intended for use in cases where unusual inspection needs are present. Section 306 lists types of construction work requiring special inspection and includes a catch-all for any work involving unusual hazards or conditions. In this case, the DEIR itself demonstrates the critical importance of proper installation. It is also clear that inspection of the installation of fire-resistive mitigation devices

during the phases of construction would require substantial time as well as departure from the customary inspection routine. Under these circumstances, it is clear that protection of the public health and safety demands that plastic pipe installation in fire-resistive construction be added to the types of construction requiring special inspection under UBC section 306, and that HCD make invocation of the special inspection process a condition of approval.

d. The Mitigation Measures Proposed by the DEIR Must be Referenced in the State Plumbing Code

Even assuming the UBC is someday amended to include both performance standards and accepted construction methods for the use of plastic pipe in fire-resistive construction, another point overlooked by the DEIR is the lack of coordination between the UPC and the UBC. The proposed project is to amend the State Plumbing Code by adopting the 1982 amendments to the UPC. The UPC does not regulate fire-resistive construction. Even the Plastics Industry in its oral comments on the DEIR in Los Angeles noted that "[t]here's a discrepancy between the Plumbing Code and the Building Code in this area." (R.T., September 26, 1989, hearing, Los Angeles, p. 45.)

The problem is that even if the 1991 or later editions of the UBC specified performance standards and specific installation methods, the UPC and the State Plumbing Code would not require that such standards and installation requirements be satisfied. The DEIR does not recommend that any such standards or methods be specified in the State Plumbing Code or reference the appropriate standards in the UBC. As a result, plastic pipe will be authorized for use without any fire protection mitigation measures being legally required.

The failure to coordinate the provisions of the UPC with UBC requirements also creates a serious enforcement problem. This issue was discussed at the recent IAPMO conference in conjunction with consideration of a proposed amendment to the UPC requiring that plumbing installed within or penetrating fire-resistive construction be tested against nationally

recognized standards and be listed by approving agencies as suitable for the purpose. (R.T., IAPMO Annual Conference, pp. 29-30.)[64]

Several speakers observed that the proposed amendment would create enforcement problems since the technical expertise and responsibility for inspecting the construction of fire-resistive assemblies rests with the Building Inspector, not the Plumbing Inspector. One plumbing official described the practical difficulty in implementing such a provision:

> When I go out and do -- and I do the plumbing inspections in my jurisdiction most of the time --when I go out and do a top-out inspection, I may never see the rest of that building again. I think most of you in code enforcement would agree with that, that sometimes, as inspectors, that is the last time we see it.[65] [¶] Now, this code change would then give us the responsibility of making sure that penetration has been done properly. I see this as being unenforceable from a plumbing inspector's position. It's actually a building inspector that is going to have to go back and make sure that the penetration assembly itself -- not the pipe -- as a plumbing inspector, I am going to check the pipe. I am going to make sure it's right, but that actual assembly is going to be checked by somebody else. (R.T., IAPMO Annual Conference, pp. 27-28.)

The same enforcement problem would be created by an amendment to the State Plumbing Code allowing the use of plastic pipe in fire-resistive construction. Plumbing Inspectors do not have the expertise, responsibility or practical ability in the course of the usual plumbing inspection routine to ensure proper installation and penetration of fire-resistive assemblies. The required fire-safety mitigation would be entirely unenforceable and ineffective

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[64] The proposed amendment was rejected. (R.T., IAPMO Annual Conference, p. 40.)

[65] "Top-out" refers to the stage of plumbing installation after framing of the building and initial "rough-in" plumbing work and includes drilling, layout and all plumbing installations above the first floor. This stage is followed by the finishing work which includes plumbing of all fixtures and final installations after sheetrocking and cover-up.

unless HCD includes language in the proposed code change requiring special inspection by the appropriately qualified officials.

3. Summary of Fire-Safety Analysis

The DEIR's description of the proposed code changes and code change process with respect to fire-safety is ambiguous, inconsistent and misleading. The DEIR indicates that plastic pipe use is proposed in noncombustible fire-rated construction, even though the only code language proposed would prohibit plastic pipe use in such structures. The DEIR also fails to identify the approval authority of the State Fire Marshall with respect to the proposed standards. The DEIR's analysis of the fire-safety impacts is also incomplete, failing to consider non-residential installations and renovation work.

With respect to mitigation measures, the DEIR's recommendations would not be feasible, effective or enforceable. In order to implement the mitigation measures suggested by the DEIR, the following actions must take place:

(1) ICBO final adoption of standards and performance requirements governing the use of plastic pipe in fire-resistive construction.

(2) Codification of standards and performance requirements governing the use of plastic pipe in fire-resistive construction in the UBC.

(3) State Fire Marshall adoption of standards and performance requirements governing the use of plastic pipe in fire-resistive construction consistent with the provisions of the UBC.

(4) State Building Standards Commission approval of code changes submitted by the State Fire Marshall and codification of such changes in the California Building Standards Code.

(5) ICBO approval and listing of installation methods for the use of plastic pipe in fire-resistive construction.

(6) State Fire Marshall approval and listing of installation methods for the use of plastic pipe in fire-resistive construction or acceptance of ICBO approved assemblies.

(7) Amendments to UPC and State Plumbing Code referencing the appropriate UBC and California Building Standards Code requirements regarding the use of plastic pipe in fire-resistive construction.

D. The Discussion of Smoke Toxicity Is Inadequate and Fails to Comply With CEQA

The DEIR dismisses the danger from smoke produced by burning plastic pipe as an insignificant hazard. It ignores the fact that smoke from burning plastic releases numerous highly toxic and carcinogenic substances into the air. For instance, burning PVC releases dioxins and furans. When these substances are inhaled by occupants and fire fighters, they can cause severe injury. (Smith, appen. A, p. 17.)

The DEIR does not address or analyze the long term health-effects of exposure to hydrogen chloride, which is produced when PVC burns. Hydrogen chloride burns the respiratory tract, causing long term respiratory damage. Carcinogens inhaled or absorbed from burning pipe will also produce long-term health risks. An adequate DEIR must discuss these issues. (Smith, appen. A, p. 18.)

The DEIR does not address or analyze the very real possibility that, under current construction methods, an individual in a room adjacent to a burning room could be exposed solely to smoke from plastic pipe. The fire test conducted by the Warnock Hersey International laboratory proved smoke from plastic pipe can pour from a burning room through openings in the wall created by burning pipe into an adjacent room that is not itself burning. Injury and death from plastic conduit smoke alone was very great in the

Beverly Hills Supper Club fire. The smoke caused injuries long before the building itself went up in flames. (Wallace, 1981, p.208.) In some parts of buildings, such as basements and utility shafts the pipe is not hidden behind a wall of any kind, but is fully exposed. Under these conditions the only smoke exposure is the highly toxic plastic pipe smoke.

The DEIR completely fails to mention the Warnock Hersey test although it is discussed in the ERD. (ERD, p. IV.D-15.) The test considered the installation of plastic pipe under typical construction practices. Although the DEIR suggests special construction methods for plastic pipe, as is explained above, none of these methods are currently approved and available. The possibility of injury or death from inhalation of only plastic pipe smoke remains a risk. It should be analyzed in the DEIR.

The DEIR claims that since HCD has jurisdiction over only a small portion of the flammable substances in modern buildings, limits on plastic pipe would have no effect. If every agency adopted such a policy there would be no regulation of admittedly dangerous substances such as smoke from plastic plumbing pipe. Indeed, CEQA requires that the agency lessen the adverse environmental impacts over which it has control. (*Citizens for Quality Growth v. City of Mount Shasta* (1988) 198 Cal.App.3d 433 [243 Cal.Rptr. 868].)

E. Other Potential Impacts not Considered

1. DEIR Fails to Consider Potential Impacts on Air Quality

The Initial Study identified air quality as an area of potentially significant impacts. The DEIR, however, discusses this issue only in the context of the general impact of increased pipe manufacturing in the state and dismisses any possible impact by stating that the plastic manufacturing plants would have to comply with emissions controls. (DEIR p. 96.) This rather limited discussion fails to comply with CEQA and ignores evidence of a potentially significant effect of the project.

a. Cement Solvents are a Significant Source of Reactive Organic Gas Air Pollutant Emissions

The DEIR failure to adequately characterize the project leads to a failure to consider air quality impacts. Generally, the DEIR gives little consideration to the solvent cement and primer component of the CPVC piping system, yet these materials contain organic solvents which are precursors to the formation of photochemical oxidant or ozone (smog). The DEIR is misled by its economic analysis to assume that essentially all potable water piping will be PB rather than the more costly CPVC. However, because of poor reliability in PB systems, the use of PB will be prohibited in the 1991 UPC. Thus, CPVC may become the only "plastic pipe" available for California. Even if PB were to remain available, the EIR should at least examine the sole use of CPVC as a worst case air pollution impact from plastic pipe.

Increased plastic pipe use will increase solvent use. CPVC-pw pipe will require solvent cement and primer rich in THF, typically 70%, with MEK, Cyclohexanone, Acetone, and other volatile solvents making up the remainder. ABS for DWV uses similar solvents, but without the more costly THF. (Bellows, et. al. 1989, appen. E.) All of these volatile organics are photochemically reactive. In urban air basins, the organic vapors from solvent use in the field and from cement manufacture will contribute to ambient ozone levels.

Using the ERD's fitting data for a typical single family house and published cement and primer use data, the amount of primer and cement is 0.17 gallons for PW, and 0.80 gallons for DWV. (ERD, 1983, tables II-2 and II-3; Chasis, DA, Plastic Piping Systems, 2nd ed. Industrial Press New York 1988. Table 3-4.) Considering the solvent composition and the presence of non-volatile material in cements, the weight of reactive organic is 2.4 lb. per dwelling for PW and 10.3 lb.per dwelling for DWV.

The DEIR estimated use changes reflect dominance of PB over CPVC.[66] The amount of plastic can be estimated from the DEIR's

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[66] "PB and, to a limited extent CPVC, would replace copper for water supply." (DEIR, p. 13.)

assumptions for the amount of new construction and the amount of fire-rated construction, and the amount of plastic pipe use in each category. In all, the DEIR estimated new construction at 259,000 single family equivalents. Assuming expanded plastic PW in 90% of these and expanded plastic DWV in fire-rated units, total annual solvent use would be 549,000 pounds for PW and 921,700 pounds for DWV.

This increased solvent use would have a significant adverse impact on air quality. Obviously, not all of the solvents are emitted directly to the air, but cumulative emissions from manufacture, open containers at the job site, curing joints, and vapor evolution from water containing leached solvents, would ultimately bring most of the material into the air.

This volume of solvent is a 0.22% increase in South Coast stationary source emissions for reactive organic gasses. This increase is significant. The current stationary source inventory for reactive organic gasses in the South Coast air basin is 590.54 tons/day (1985). Assuming that a third of new construction took place in the South Coast basin, and correcting for the work week and summer construction season, the expanded use of plastic pipe amounts to an increase of 1.27 tons per day of reactive organic gasses. For an industrial project, such emissions would require New Source Review and application of stringent controls.

The South Coast Air Quality Management District and the Bay Area Air Quality Management District have rules limiting solvent use. SCAQMD rule 1168 (adopted April 7, 1989) sets a current limit of 650 g/l (5.4 lb./gal) of solvent in cement for plastic pipe, to fall to 250 g/l (2.4 lb./gal.) by January 1, 1991. The BAAQMD plans to extend its rule 8-4 to plastic cements in the next year. Current products on the market as analyzed by HCD in the DEIR do not comply with this rule. The EIR should evaluate the potential air quality impact of increased solvent use and explain the effect of the proposed HCD action on air district rules and effect on attainment of air quality standards.

b. Manufacturing Process

A wide range of chemicals can be used in the manufacture of CPVC pipe. Some of these are chlorinated or fluorinated compounds that are

considered ozone depleting substances.[67] Solvent cement manufacturers faced with new rules on limits to precursor organics (see below) may switch to compounds which are not considered precursors,[68] but which are ozone depleting substances. The DEIR must perform a full evaluation of the potential impact. Merely concluding that pipe would be manufactured out-of-state is not an adequate assessment for a truly global pollutant.

The ERD noted that most pipe resin is made out-of-state and that a few extruders are in state. The DEIR gives only a vague discussion of pollution from manufacturing. While the amount of plastic used in California may be a small percent of the amount used nationwide, there will be significant increases in pipe extrusion and solvent cement manufacture in the state. At the minimum, the EIR should estimate the magnitude of increases in the state and investigate the kind and approximate magnitude of environmental pollution associated with expanded manufacturing.

Several of the manufacturers are having a difficult time meeting the increasingly strict emissions controls. Reliance on "pollution control permits" (DEIR, p. 96) is not sufficient mitigation for HCD action.

2. DEIR Fails to Consider Potential Impacts on Solid Waste Disposal

In 1987 the public discarded about 22 billion pounds of plastic material and by the year 2000 that amount is expected to reach 38 billion pounds, accounting for 10% by weight and nearly 25% by volume of municipal solid wastes. (Chemical & Engineering News, January 30, 1989.) Disposal of plastics presents a significant problem. Most plastic materials are not biodegradable or degrade very slowly in the dark, anaerobic environment of

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[67] For example, U.S. Patent 4,373,093, issued to Olson, et. al. (B.F. Goodrich) cites the use of chlorofluorocarbons in the manufacture of CPVC.

[68] BAAQMD Rule 8-1-208: Organic Compound, Non-Precursor: Methylene chloride, 1,1,1 trichloroethane, 1,1,2 trichlorotrifluoroethane (CFC-113), trichlorofluoromethane (CFC-11), dichlorodifluoromethane (CFC-12), dichlorotetrafluoroethane (CFC-114) and chloropentafluoroethane (CFC-115).

a landfill, take up valuable space and can leach toxic chemicals when disposed of in landfills.

Plastic pipe would enter the waste stream from renovation of buildings with new plumbing systems, from demolition and from disposal of scrap material left over from construction projects. If plastic pipe became widely used, it could compose a substantial amount of the plastic material disposed of at landfills.

Recycling plastics for reuse could present a solution to the disposal problem but development of the framework necessary for recycling including, collection, sorting, reclamation and reuse, is still being developed and is not a commonly available technology. Some of the most basic problems still being solved include the development of efficient collection systems, the difficulty in removing debris and impurities from used plastic as heat degrades the integrity of plastic, the difficulty in sorting different types of plastics prior to recycling and the contamination of recyclable plastic with biodegradable plastic which makes the end product weaker and unmarketable. Valid markets for the end product must be developed.

By contrast, copper pipe is readily recycled. The material is easily extracted from demolition debris and a well established market for copper scrap already exists. Reprocessing copper eliminates most foreign material so the recycled metal is indistinguishable from virgin material in making new pipe.

Wide spread use of plastic pipe could aggravate existing solid waste disposal problems or create new problems. The EIR should address issues relating to the disposal of used pipe with particular emphasis on the impacts of landfilling plastic pipe and the feasibility of wide spread recycling. The eventual disposal of large quantities of plastic pipe has potentially significant impacts on solid waste programs throughout the state which must be addressed in this EIR.

The recycling issue is critical to HCD consideration. There is no facile mitigation available to push the issue beyond concern. On one hand, increased use of plastics such as the pipe resins that are formulated to resist biodegradation will have an adverse impact on the environment. On the

other hand, increased pressures to recycle plastics will exacerbate the problem of chemical and mechanical quality control of the pipe itself, and increased potential for chemical leaching and mechanical failure will have an adverse impact on the environment.

3. DEIR Fails to Consider Ecological Effects

Since the DEIR dismisses the public health impact of chemical leached into drinking water, it is not surprising that the DEIR also brushes off any environmental effect from leaching. The discussion is not adequate. (DEIR, p. 95.) The annual volume of pipe and solvent is immense: nearly 27 million pounds of ABS, 12 million pounds of CPVC, and 1.5 million pounds of cement and primer. The cumulative quantity of leachate may well be significant, particularly when concentrated in a few urban areas.

The quantity of chloroform initially leaching in water will exceed the state Proposition 65 threshold for discharge into drinking water. ABS leaches styrene and acrylonitrile, both carcinogens, and both of concern at very low levels. High levels of the cement solvents are found in potable water pipe and would be present in the DWV system at even greater levels.[69] The water from the potable water and DWV piping would be discharged into the municipal sewer. The solvents in the cements are the same as are used in industry. Most wastewater treatment agencies have restrictions on the discharge of solvents into the sewer. For example, without an industrial discharge permit, a business in Los Angeles would be prohibited from discharging wastewater if it contained the levels of solvent reported by Cooper for CPVC.

The EIR should evaluate reliance on flushing as a public health measure in the light of the possible restrictions on wastewater discharge. The solvents are obviously present in the pipe, flushing merely makes them someone else's problem. The EIR should address what restrictions would be

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[69] More cement and primer is used for the DWV system because of the larger diameter pipes. In the typical single family home described in the ERD, DWV uses 4.7 times the solvent product as does the PW system. The solvent in the DWV would enter the sewer or leave as vapor through the vent. The concentration of solvents in waste water leaving the house would be several times higher than the levels observed by Cooper or Butter in the potable water studies.

placed on a home builder or plumbing contractor working on a large housing project that was required to flush the piping systems of many units during a building inspection. Note that Butter found total solvents in day 1-2 at 181,430 ppb; the cumulative quantities of solvents would be significant.

4. DEIR Fails to Analyze Potential for Noise Impacts

The DEIR discussion of noise (p. 96) shows no effort to analyze the potential for noise from plastic piping systems. Accounts are termed "anecdotal" and apparently, "no empirical data . . . could be found." A review of titles in the bibliography does not suggest any references that discuss noise inside structures or from pipe systems. The DEIR does not even attempt to identify which system -- potable water or DWV -- is the subject of the anecdotes, although the reader may infer from the comment about fire-rated buildings that it is the DWV system.

The EIR could at least relate some anecdotes. If it did, the reader would learn that most of the concern surrounds the significant reduction in sound attenuation from the light-weight, rigid plastic pipe system. As the DEIR shows in table 3 (p. 14), the weight of a cast iron DWV system is 1,775 pounds, compared with 300 pounds for ABS. Mass is well known as the most effective sound attenuation factor; the plastic system with roughly one-sixth the mass absorbs less acoustical energy than iron. Similarly, sound travels well through rigid material. In no-hub cast iron, the neoprene rubber sleeve connector has an internal rubber ring that fits between the sections of iron pipe -- metal does not touch metal -- so that the transmission of acoustical energy along the pipe system is broken at every joint. In ABS, the pipe system is solvent welded into one continuous piece. The plastic system transmits acoustical energy better than the iron system.

The DEIR gives no estimates or measurements of sound levels from either potable water or DWV systems. Nonetheless, the DEIR concludes without any analysis at all that "noise levels would not reach significant levels." Without determining the noise level and without stating a standard of significance, how can the DEIR come to this conclusion?

The standard that should be applied is noise limits for the inside of residences. Extensive noise study from the early 1960's onward has led to

the current community noise standards in common use today. For example, the USEPA reported that "[interior sound] levels of 40 dB(A) have been known to awaken approximately 25% of the sleeping population, while levels of 45 dB(A) appear to keep approximately 20% of the population from falling asleep immediately. These considerations have led to the adoption of 40 dB(A) as a criterion level for sleep interference effects." (Bolt, Beranek and Newman, Noise From Construction Equipment and Operations, Building Equipment, and Home Appliances. USEPA NTID300.1, December 31, 1971, p. 67.)

Noise measurements should be easy to take for the DWV system. A 1971 EPA study reported flush toilet noise and discussed piping systems. Flush toilet noise peaked at 77 dB(A) in some models with others as low as 62 dB(A). (Bolt, Beranek and Newman, 1971. *op. cit., supra*, pp. 50 - 53.) How much of this energy is transmitted through pipe mounting into an adjacent unit in a multifamily building? How much acoustic energy could be generated by a surge of wastewater falling in a plastic DWV system?

Noise in a multifamily building is a significant source of stress and impairs the quality of the environment. It may be necessary for the EIR to pose the more explicit question drawn from anecdote: Will a light sleeper be awakened by a neighbor flushing a toilet? Will sound levels in plastic DWV reach 40 dB(A) in the sleeping areas of multifamily residences? If so, then the impact would be significant, and the EIR should consider mitigation such as requiring acoustic insulation around DWV when it passes along a sleeping area.

F. The DEIR Analysis of the Effect of the Proposed Project on Housing Costs Is Internally Inconsistent, Inaccurate and Incomplete[70]

The treatment of economic impacts in the DEIR is inadequate to inform the public and policy makers of the economic ramifications of the

[70] This section is based on a study prepared by Dr. William T Dickens, included as appendix B. Please see that study for a detailed discussion of the economic issues and appropriate citations.

propose project. Although the DEIR describes the alleged savings associated with the use of PB pipe, PB pipe has been banned by IAPMO and would most likely not be the material replacing copper in California. Moreover, the DEIR fails to calculate the costs of the types of pipe that would serve as the attentive material, CPVC and PVC. The DEIR also notes several additional costs of plastic pipe, but does not take them into account in its comparative cost calculations. The analysis also contains numerous inconsistencies and inaccuracies.

1. PVC and CPVC Are Significantly More Costly than Copper

Those forms of plastic most likely to be used in residential construction will be more expensive than copper. An analysis based on a plumbing system described in the ERD (Tables II-2 and II-3) using standard estimating procedures (Means, 1988) shows that the cost of materials and installation of a PVC potable water system would be $228.55 more than a copper system[71]. A CPVC potable water system would cost $904.87 more than a copper system. (See Dickens, appen. B, p. 2, table 1.) There is simply no economic advantage to plastic pipe.

2. The DEIR Ignores Several Additional Costs of Plastic

a. Plastic Costs More Than Metal to Replace

The DEIR assumes for its analysis that plastic systems last 20 years and metal 30 years. (DEIR, p. 88.) However, this differential is not taken into account in the DEIR's analysis of the comparative cost of plastic and metal. In addition, the facts do not support a service life for metal of only 30 years. Copper pipe can last from 30 to 200 years, and cast iron even longer. (Dickens, appen. B, p. 2.) The population weighted mean life of copper is 64 years for water from five water districts covering 60% of California's population. (Dickens, appen. B, p. 3.)

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[71] Although PVC is not proposed for potable water systems, the economic analysis in the DEIR contains ambiguous language suggesting that the DEIR considered the cost of a PVC system. (DEIR, p. 87.) In the interest of completeness a PVC system economic analysis is included here.

Assuming a service life of plastic at 20 years and a service life of metal at a conservative 50 years, the present value of the cost of replacing a plastic system is at least $1,558.00 more than the present value of the cost of replacing a metal system. Assuming a lower discount rate, metal is $3,083.00 cheaper to replace, at present value, than plastic. (Dickens, appen. B, p. 4, table 2.) This is a cost to be borne by the homeowner, not the builder.

b. Plastic Is More Expensive to Repair Than Metal

Due to differing service lives, plastic is, by conservative estimate, $167.51 more expensive to repair than copper at present value. (Dickens, appen. B, p. 5, table 3.)

c. The DEIR Does Not Take the Cost of Flushing into Account to Determine the True Costs of Plastic

Labor will be required to flush the plastic pipe system as recommended in the DEIR. However, the DEIR does not take this cost into account in its economic analysis. If labor for only two trips to the project site for flushing is included, an additional cost per building of $192.00 will be added to the total cost of the plastic plumbing pipe system. (Dickens, appen. B, pp. 6,7.)

d. The Cost of Ventilation Must Be Included in the Analysis

The DEIR does not estimate the cost of the ventilation it recommends. A survey of existing ventilation methods suggests that a system sufficient to satisfy the DEIR's recommendation would add as much as $100.00 to the cost of installing a plastic system. (Dickens, appen. B, p. 7.)

e. The Cost of Special Inspections and Fire-Stopping Mechanisms Must Be Accounted For

In order to control fire in buildings plumbed with plastic systems, special fire-stopping mechanisms must be placed in fire walls where plastic pipe penetrates. Special inspections will be required while construction proceeds since the evidence of installation of such mechanisms will not be visible after construction is complete. These inspections will cost a minimum

of $150.00 for each unit in a multi-story building. (Dickens, appen. B, p. 7.) This is a conservative estimate of the increased cost for fire safety mitigation, since it does not include the cost of the fire-stopping systems themselves or the increase costs of the special installation methods required for such systems.

f. Including All Costs and Mitigations, Plastic Pipe Will Cost Between $2,400 and $3,000 More Than Metal Pipe

The following table provides a conservative summary of the total savings associated with the use of metal over plastic plumbing pipe.

Increased Costs of PVC and CPVC over Metal

	PVC	CPVC
Installation Labor & Materials	$ 228.55	$ 904.87
Replacement (Present value)	1558.00	1558.00
Repair (Present value)	167.51	167.51
Flushing	192.00	192.00
Ventilation	100.00	100.00
Special Inspection	150.00	150.00
Total Increased Cost	$2396.06	$3072.38

Using less conservative assumptions, the increased cost of plastic could amount to almost $4,000.00 in present value. (Dickens, appen. B, p. 10.)

3. Other Economic Assumptions in the DEIR Are Incorrect

The economic analysis of the DEIR is flawed in a number of other ways, as well. For instance, the DEIR assumes that any savings in plumbing costs will be reflected in housing prices. This assumption cannot be supported.

Since the amount of housing is limited, the price of a house is not determined by its cost, but by the demand for housing. (Dickens, appen. B, p. 8.) In other words, housing prices depend on what people will pay and not on what it costs to build. The same is true for rents. (*Ibid.*)

The DEIR suggests that corrosion control costs could be saved if plastic were installed. California does not have particularly corrosive water, and corrosion treatment is done by the water department, not the homeowner[72]. In any case, corrosion control for metal pipe could not be suspended since water distribution systems, metal systems in homes, and the couplings for some plastic systems continue to consist of metal pipe. (Dickens, appen. B, p. 9.) There will be no savings resulting from decreased corrosion control.

There is no support cited in the DEIR for the proposition that fewer variances for plastic would be required if the proposed project were implemented, and a survey of local jurisdictions has uncovered none. Indeed, requests for variances to use plastic pipe appear to be rare or nonexistent. (Dickens, appen. B, p. 9.)

4. The Economic Analysis in the DEIR Is Inconsistent and Incapable of Confirmation

The DEIR does not provide any factual support for its estimate of plumbing costs of $580 for materials and $580 for labor. The estimate represents a decrease in materials costs and an increase in labor costs from the estimates cited in the ERD, but the DEIR does not explain the variation. (See ERD, p. IV.F-1 - 9.) The tables cited in support of the

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[72] The DEIR is in error when it ascribes savings to a municipal water system to individual homeowners. (Dickens, appen. B, p. 9.)

estimate (ERD Tables II-2 and II-3) contain no information concerning the cost of a PVC potable water supply system although the estimates appear to include such a system.

Neither the DEIR nor the ERD (which is incorporated by reference) explain why a mark-up of 15% for overhead and profit is included or the source of the percentage chosen. The DEIR assumes reduced material costs of $95 and reduced labor costs of $58 with the use of PB potable water pipe. Since PB pipe is not likely to be used for potable water service, given IAPMO's recent ban, these figures are of little relevance. In any case, they vary inexplicably with the amounts cited in the ERD; the alleged material savings is greater in the ERD and the labor savings less. The source for these figures is not cited or explained.

The DEIR is confusing and inconsistent on the issue of whether or not plastic pipe would be cheaper than copper. On one hand it states that, except for PB (now banned), the use of other plastics would "increase plumbing costs." (DEIR, p. 87.) Later the document states that the substitution of one plastic for another would not affect replacement costs for a plumbing system. This cannot be true if all plastic systems except PB systems would be more costly.

The DEIR states that the replacement cost of a plastic system will be cheaper than the replacement cost of a metal and plastic system. (DEIR, p. 88.) This conclusion is also not consistent with the earlier conclusion that, except for PB systems, the use of plastic will increase plumbing costs.

The DEIR and ERD are contradictory on the expected service life of plastic and copper plumbing systems. At one point a 20 year service life for plastic systems and a 30 year service life for copper is referenced. (DEIR, p. 88.) On the very same page, it is assumed that both plastic and copper have a 20 year service life. The DEIR cites no source for these assumptions and, as discussed, they are wrong.

Much of the material in the economic analysis of both the DEIR and the ERD is unsupported in the text itself, and no analysis or confirmation can be performed on the assertions made. For instance, the DEIR places dollar figures on the cost savings for replacement of a plastic plumbing

system in single family and multifamily units. (DEIR, p. 88; ERD, p. IV.F-3.) These figures are not the same in both documents and the DEIR does not explain the variation. Neither document cites to a single source to justify the alleged savings figures.

Similarly, the DEIR does not document the basis for alleged cost savings cited for multiple-family dwelling units, for corrosion treatment, or for life-cycle cost savings. (DEIR, pp. 87 - 89.)

The failure of the DEIR to support many of the factual assumptions made during its economic analysis deprives the public of its ability to assess the environmental impacts of the proposed project. "A conclusory statement 'unsupported by empirical or experimental data, scientific authorities, or explanatory information of any kind' not only fails to crystallize issues [citation omitted] but 'affords no basis for a comparison of the problems involved with the proposed project and the difficulties involved in the alternatives.'" (*People v. County of Kern* (1974) 39 Cal.App.3d 830, 841-842 [115 Cal.Rptr. 67, 75, quoting *Sylva v. Lynn* 482 F.2d 1282, 1285 (1st Cir. 1973)].)

The conclusory statements in the DEIR concerning the costs of metal and plastic piping systems, the costs of corrosion control, the savings of some systems over others, the service lives of various systems, and other, unsupported factual material do not meet the requirements of CEQA.

IV. OTHER CEQA VIOLATIONS

A. DEIR Fails to Identify Significant Effects

1. CEQA Requires that an EIR Identify Potential Impacts that are Considered Significant

The DEIR fails to indicate whether any of the impacts it discusses are considered potentially significant, even though the analysis with respect to several issues would seem to compel such a conclusion. The DEIR may be under the mistaken impression that if it concludes that no significant effects would occur after the implementation of mitigation measures or changes and

modifications in the project, then it need not identify significant impacts. This view is contrary to the plain language of CEQA and the Guidelines.

The fundamental purpose of an EIR is to identify the significant effects of a proposed project. It is this determination that imposes an obligation on the lead agency to require mitigation measures or changes in the project to mitigate or avoid the identified effects. The identification of significant effects also creates an obligation under CEQA to make certain mandatory findings, including findings that appropriate mitigation measures or changes have been required to lessen the significant effects.

CEQA expressly provides that "[t]he purpose of an environmental impact report is to identify the significant effects of a project on the environment, to identify alternatives to the project, and to indicate the manner in which those significant effects can be mitigated or avoided." (Pub. Resources Code § 21002.1, subd. (a).) The California Resources Agency "Discussion" following CEQA Guidelines section 15064 emphasizes this point:

> The determination of significance is one of the key decisions in the CEQA process. This decision leads to the preparation of either a Negative Declaration or an EIR which involves the additional requirements to investigate the significant effects, to propose mitigation measures and alternatives, to respond to public comments, and to make findings on the feasibility of changing the project to reduce or avoid significant effects. ("Discussion" following 14 C.C.R. § 15064.)

CEQA Guideline section 15064 explains the legal obligations of the lead agency and responsible agencies when the EIR identifies one or more significant effects:

> Determining whether a project may have a significant effect plays a critical role in the CEQA process . . . [¶] When a final EIR identifies one or more significant effects, the lead agency and each responsible agency shall make a finding under Section 15091 for each significant effect and may need to make a statement of overriding considerations under Section 15093 for the project. (14 C.C.R. § 15064.)

Under section 15091, a public agency is prohibited from approving a project when the EIR identifies one or more significant effects unless the agency makes findings based on substantial evidence that changes or alterations to avoid or substantially lessen the identified effects have been required, that such changes are within the jurisdiction of another agency, or that specific factors make mitigation measures or alternatives infeasible. (14 C.C.R. § 15091.) Where a public agency proposes to approve a project with significant effects that have been identified in the EIR but not substantially mitigated, it must adopt findings of overriding considerations supporting its decision. (14 C.C.R. § 15093.)

The failure to clearly identify significant effects also violates the informational objectives of CEQA. CEQA states that "[t]he purpose of an [EIR] is to provide public agencies and the public in general with detailed information about the effect which a proposed project is likely to have on the environment; to list ways in which the significant effects of such a project might be minimized; and to indicate alternatives to such a project." (Pub. Resources Code § 21061; see also § 21002.1.) It also defeats CEQA's policy of meaningful public input on appropriate mitigation measures or other changes and modifications in the project to avoid the identified effects.

2. DEIR does not Identify any Impacts as Significant, Despite an Analysis that Would Clearly Compel Such a Conclusion

The DEIR does not identify a single significant effect of the expanded use of plastic pipe, despite the obvious finding of its own analysis that significant impacts would occur without appropriate mitigation. The failure to identify significant effects violates the CEQA provisions discussed above and conceals from the public and government decision-makers information essential to evaluate the proposed project.

Probably the most glaring example of this deficiency in the DEIR occurs in its discussion of fire-safety. As discussed in section III.D.1., the DEIR finds unequivocally that the expanded plastic pipe use proposed by HCD would create a fire hazard, endangering the public health and safety. The DEIR concludes that "in fire-rated walls, plastic plumbing pipe cannot

be installed in the same manner as metal pipe without lowering the fire rating." (DEIR, p. 77.)

The DEIR's conclusions on fire-safety clearly constitute a finding of significant effect. An unambiguous statement of this finding is required by CEQA in order to alert the lead agency and responsible agencies of the importance of effective mitigation or changes in the project to lessen or avoid the significant effect. It also puts the public decision-makers on notice of the requirement to adopt appropriate findings as required by the CEQA Guidelines before acting on the project.

The DEIR's failure to state its finding that plastic pipe use would create a significant fire danger without the suggested special mitigation measures also misleads the public and undermines informed participation. A reader may be misled to believe that the special methods for plastic pipe installation in fire-resistive construction are a part of this project, rather than separate measures the imposition of which is critical to the protection of the public health and safety. The disclosure of this fact is especially important here since, as demonstrated in section III.D.1.e., these mitigation measures are not within HCD's jurisdiction to approve or require.

In a similar fashion, the DEIR's analysis of worker health indicates that without the elaborate worker protection methods suggested, a significant health impact on workers installing plastic pipe would result. As discussed in section III.C.8., the DHS worker health study found exposures in excess of established exposure levels. CEQA itself indicates that a finding of significant effect is required if a project "will cause substantial adverse effects on human beings, either directly or indirectly." (Pub. Resources Code § 21083.) The CEQA Guidelines also indicate that the creation of "a potential public health hazard" should also be considered a significant effect." (14 C.C.R. appen. G, subd. (v).)

With respect to drinking water contamination, the DEIR finds that a worker drinking preoccupancy water would be exposed to a cancer risk of 1 in 1 million. (DEIR, p. 52, fn. 6.) As the DEIR states, this is the level typically considered by regulators to represent a significant risk level. (DEIR, p. 57.) Nevertheless, the DEIR does not indicate any findings of significant impacts with respect to drinking water quality.

B. The DEIR Does Not Identify Feasible Mitigation Measures

As is described in detail above, HCD must develop feasible mitigation measures to decrease or avoid all of the significant impacts it identifies. In order to approve the project, it must make findings based on substantial evidence that mitigations have been required. (14 C.C.R. § 15091.)

In adopting mitigation measures, the Department is also required to adopt a reporting and monitoring program that will insure that the mitigation measures are actually implemented. (Pub. Resources Code § 81081.6.) The monitoring program must be supported by substantial evidence on the record. (14 C.C.R. § 15091, subd. (b).) The DEIR contains no evidence upon which to base the necessary findings for the monitoring and enforcement of mitigation measures.

As has been discussed throughout these comments, the DEIR does not contain feasible or enforceable mitigation measures. For example, flushing to reduce leaching of dangerous chemicals will not be reliably accomplished, and the flushing protocol does not reflect recent information concerning leaching. No amendments to the plumbing code or other actions are proposed to implement and enforce the proposal are set forth. The same is true with worker health. (See, *ante*, section III.C.10) and fire-safety (see, *ante*, section III.D.2.)

The mitigation discussion of the DEIR does not comply with CEQA, and provides no basis for a monitoring or implementation program.

C. The DEIR Discussion of Cumulative and Long-Term Effects Fails to Comply with CEQA

1. The Overall Impact of Expanded Uses of Plastic Pipe Must Be Considered With the Effects of Other Activities

The DEIR must contain a discussion of the cumulative impacts of the proposed project considered with other related activities. (14 C.C.R. § 15130.) "'Cumulative impacts' refers to two or more individual effects

which, when considered together, are considerable or which compound or increase other environmental impacts." (14 C.C.R. § 15355.)

"[I]t is vitally important that an EIR avoid minimizing the cumulative impacts. Rather, it must reflect a conscientious effort to provide public agencies and the general public with adequate and relevant detailed information about them." (*San Franciscans for Reasonable Growth v. San Francisco* (1984) 151 Cal.App.3d 61, 80 [198 Cal.Rptr. 634].) As in the rest of the EIR, conclusory statements do not constitute an adequate cumulative impact analysis. (*Whitman v. Board of Supervisors* (1979) 88 Cal.App.3d 397 [151 Cal.Rptr. 866].)

Cumulative impacts arise from two sources: the sum total of the many individual effects attributable to the project itself (14 C.C.R. § 15355 subd. (a)), and the impact of the project when considered in the context of other developments. (14 C.C.R. § 15355, subd. (b).) A project's environmental impact may not itself be significant, but it may become significant in light of the cumulative impacts of other past, present or foreseeable projects.

The cumulative and long-term impact analysis in the DEIR does not meet this standard. The discussion in the DEIR of the cumulative and long-term effects of increased use of plastic pipe consists of one page in a 350 page document. It repeats and misstates material from other parts of the report, but adds virtually nothing to the substance of the text. It denies the existence of cumulative impacts that do exist and misrepresents the facts concerning those impacts.

2. The DEIR Does Not Accurately Assess the Aggregate Effects of Expanded Uses of Plastic Pipe

In its assessment of cumulative impacts, the DEIR fails to acknowledge the full impact of the project when it states that the interactions among the leachates from plastic pipe, fittings and solvents would have only additive effects. (DEIR, p. 99.) This statement is false. The DEIR itself indicates only that additive effects were assumed for the purposes of analysis, not that other synergistic effects among leachates do not exist. (DEIR, p. 47.)

The comments of Dr. Martyn Smith, attached as appendix A, show that the assumption of only additive effects is incorrect, and that certain combinations of leachates have been proven to have potentiating effects on human cancer. For instance, a 1984 study suggests that MEK potentiates the carcinogenic properties of chloroform 30-fold. (Smith, appen. A, p. 16.) This is a significant health effect caused by the cumulative impacts of MEK and chloroform in plastic pipe leachates and chlorinated drinking water.

The DEIR underestimates the effect of MEK in water by as many as 30 times. An EIR that significantly underestimates cumulative impacts is in violation of CEQA and must be redrafted. (*San Franciscans for Reasonable Growth v. San Francisco* (1984) 151 Cal.App.3d 61 [198 Cal.Rptr. 634] (underestimation of square footage of other building projects by two or three times requires new cumulative impact analysis).)

In addition, the DEIR's position is contrary to evidence showing interactive effects of MEK and THF, both of which are found in solvent cements used to join CPVC pipe.[73] The worker health study and other scientific evidence document peripheral neuropathy and polyneuropathy in humans caused by exposure to both of these solvents. (See, *ante*, section III.C.8.a.) The DEIR does not acknowledge or explain the cumulative effects on human health of the solvents used in plastic plumbing systems.

3. The DEIR Fails to Discuss the Project in a Wider Environmental Context

In reviewing the cumulative impacts of the project and factors outside the project, the agency must look both at the environmental context in which the project will be implemented and other related projects that may magnify the total environmental damage. (Whitman v. Board of Supervisors (1979) 88 Cal.App.3d 397, 408 [151 Cal.Rptr. 502, 515]; Citizens to Preserve Ojai v. Board of Supervisors (1985) 176 Cal.App.3d 421, 431 [222 Cal.App.3d 247].) The DEIR does neither.

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[73] With the banning of PB, the greatly increased use of CPVC is likely.

a. The DEIR Does Not Discuss the Cumulative Impact of the Project on an Already Polluted Environment

While the DEIR notes that the chloroform leached from pre-occupancy water in the Cooper study reaches the AAL, it does not discuss this exposure in conjunction with the fact that most drinking water contains chloroform at background levels between 10 and 90 ppb.[74] (See *ante*, section III.C.8.a.) The DEIR also fails to consider the possibility that MEK could increase the cancer-causing effects of chloroform already in water to very dangerous levels.

Cancer can be caused by a combination of known carcinogens, even if individually they are present at low levels. The total exposure of workers and drinking water consumers to the carcinogens in plastic pipe and joining compounds as well as other common household exposures could increase the risk of cancer beyond the risk encountered through exposure to any one of the substances. (See, *ante*, section III.C.8.a.) The cumulative exposure to the toxic chemicals associated with plastic pipe when considered in light of other past, present and foreseeable exposures is undoubtedly significant. The Department must complete an analysis of these cumulative impacts in order to assure that the DEIR complies with standards required by CEQA.

The DEIR also states that water quality in California is poor. (DEIR, p. 44.) The DEIR also finds that carcinogenic and potentially carcinogenic leachates will enter the water from plastic pipe, but does not state that the cumulative impact of these chemicals on polluted water will make pure water an even more distant goal.[75]

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[74] The sole mention of this issue in the DEIR is a speculative one. (" . . . if other sources of these chemicals contaminate the water supply . . . .") (DEIR, p. 99.) Since it is clear that consumers will be exposed to other sources of chloroform, this fact must be discussed. It is not sufficient to speculate where specific and useful information is available.

[75] Of course, consistent with the tone of the entire DEIR, it uses serious environmental problems as an excuse to add to dismiss the incremental degradation as minor. For instance, the DEIR concludes that, although plastic pipe emits toxic smoke when burned, the smoke would be only a small portion of the total smoke in a fire. (DEIR, p. 81.) Noting that water quality in California is

(continued...)

In its discussion of fire safety, the DEIR notes that the smoke from fires in houses and other occupancies is highly toxic. (DEIR, p. 86.) It concedes that plastic pipe will add to the amount of already toxic smoke, but does not state, as it should, that the additional smoke from plastic pipe will aggravate an already significant and dangerous environmental impact.

The DEIR must acknowledge these cumulative impacts and assess whether or not they can be mitigated or whether the benefits are greater than the environmental costs. (14 C.C.R. § 15043.)

b. The DEIR Does Not Consider the Proposed Project With Other Projects

There is no indication in the DEIR that HCD has made or caused to be made any systematic survey of other projects that could magnify the already severe impacts of the proposed project. For instance, an increased use of plastics as a building material, alluded to in the discussion, might adversely affect the health of construction workers by exposing them to ever-greater amounts of plastic and joining materials from wall coverings, electrical conduits and other sources. This cumulative effect is not mentioned or analyzed in the DEIR.

There has apparently been no search of building code changes in the past ten years to determine if other plastic building materials are being or have been approved during that period.
Without such an analysis, it will be impossible to assess whether the incremental increase in plastics caused by use of plastic pipe is part of a much larger trend with even more significant environmental effects.

The DEIR ignores the cumulative effect of increased manufacturing and fabrication of plastic pipe and its resins on air and water quality and

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[75](...continued)
poor, the DEIR reasons that the slight additional decrease in water quality caused by plastic pipe will not effect the situation. (DEIR, p. 44.) This logic will, in the long run, "overwhelm the natural environment." (*Las Virgenes Homeowners Federation, Inc. v. County of Los Angeles* (1986) 177 Cal.App.3d 300, 306 [223 Cal.Rptr. 18, 23].)

worker health. Greater production will certainly increase factory emissions into water and air. Hazardous wastes from manufacture will increase. The DEIR must investigate and quantify air, water and soil pollution by the plastics industry and present a discussion of the subject so that the public and the Department will have a complete assessment of the impacts of this project and the cumulative impacts of this project and other related projects.

Because the DEIR ignores impacts on manufacturing, it contains no discussion of the cumulative impacts on employees of the plastics industry resulting from increased production of resins, pipe, fittings and solvents.

4. The DEIR Misstates the Long-term Effects of Exposure to Plastic Pipe

Since the Department is proposing an amendment to state policy and regulation concerning the uses of plastic pipe in California, the DEIR must include a discussion of the long-term effects of the project under scrutiny. (14 C.C.R. § 15126, subd. (e) and § 15127.)

As these comments have shown, the DEIR is wrong in its bald statement that ". . . although toxicological data are not complete, repeated exposure would probably not accumulate to serious, long-term health risks." (DEIR, p. 99.) Based on information contained in the appendices and other sources, the true state of knowledge at this time is that THF and MEK may well have chronic health effects on humans. There is a lack of information, but what is known suggests that these substances have long-term carcinogenic effects. Recent studies suggest that THF is toxic to the liver, that MEK and THF produce chromosomal aberrations which may cause cancer, and that the irritative effects of MEK may have long-term effects. (See, *ante*, section III.C.8.a.)

In light of this information, the DEIR should conclude that long-term exposure to these substances could accumulate to serious, chronic health effects. Because of such potentially serious long-term effects, the DEIR must consider whether the use of plastic pipe is justified despite the lack of economic or other benefits. (14 C.C.R. § 15093, subd. (b); *Towards*

Responsibility in Planning v. City Council (1988) 200 Cal.App.3d 671 [246 Cal.Rptr. 317].)

D. The Identification of Alternatives in the DEIR Does Not Aid Informed Decision-Making

1. Under CEQA, the Discussion of Alternative Projects is the Linchpin of the EIR

The DEIR admits, but subsequently ignores that the proposed expanded uses of plastic pipe have substantial environmental impacts. These include a significant degradation of already degraded water quality, worker overexposure to dangerous solvents and chloroform, and increased flammability of building materials. In light of the significant environmental impact of the project, a full discussion of project alternatives as required by CEQA is the "linchpin" of the DEIR. (*Monroe County Conservation Council, Inc. v. Volpe* (2d Cir. 1972) 472 F.2d 693, 697-698.)

An EIR must contain a "detailed statement" setting forth the "alternatives to the proposed project." (Pub. Resources Code § 21100, subd. (d).) The discussion of alternatives must be sufficiently detailed to "foster informed decision-making and informed public participation." (14 C.C.R. § 15126, subd. (d)(5).) "Conclusory comments in support of environmental conclusions are generally inappropriate." (*Laurel Heights Improvement Association v. Regents* (1988) 47 Cal.3d 376 [253 Cal.Rptr. 426, 438].)

Where, as here, the agency approving the project is the same as the agency proposing the project, the discussion and analysis of alternatives in the EIR must be specific enough to explain the reasoning process of the agency to the public. (*Laurel Heights Improvement Association v. Regents, supra*, 253 Cal.Rptr. at 440; *Citizens for Quality Growth v. Mount Shasta* (1988) 198 Cal.App.3d 436, 441 [243 Cal.Rptr. 727, 730].)

2. The DEIR Merely Identifies, but Does Not Discuss, Alternative Projects

The DEIR does not take the consideration of alternatives seriously. As a result, it does not comply with CEQA standards for consideration of alternatives to the proposed plumbing code amendments.

The perfunctory nature of the alternatives analysis in the DEIR is obvious from the extremely brief treatment of so important an aspect of the environmental review. Three general alternatives are identified, the second with several overlapping sub-alternatives. The entire treatment is little more than two pages in a DEIR (with appendices) of over 350 pages. (DEIR, pp. 103 -105; *Laurel Heights Improvement Association v. Regents* (1988) 47 Cal.3d 376 [253 Cal.Rptr. 426, 438]. EIR alternatives analysis of one and one-half pages in 250 page document violates CEQA.)

3. No Project Alternative

The first alternative identified in the DEIR is the "no project" alternative. It contains no more discussion than did this alternative in *Laurel Heights*, stating the "obvious conclusion" that the impacts identified in the DEIR would not occur. (*Laurel Heights Improvement Association v. Regents, supra*, 253 Cal.Rptr. at 438.) There is no discussion or analysis of this alternative. For instance, the fire safety implications of the no project alternative are not even mentioned. The economic effects are neither mentioned nor discussed. The DEIR does not mention or discuss widespread mechanical failures of plastic pipe. Indeed, the DEIR does not even outline in any detail exactly what the no project alternative would entail for uses of metal and plastic pipe.

a. Modified Projects

The second set of alternatives is five modifications on the proposed project which narrow its scope. The fifth modification is merely a combination of the third and fourth. None of these alternatives is discussed in more than a single paragraph. The DEIR fails to analyze how the mechanical failures of plastic pipe affect these modifications.

The first modification is too unclear to allow for intelligent public comment as required by CEQA. It would "permit the use of only PB for hot and cold water supply, inside and outside all buildings." (DEIR, p. 103.) It is not clear whether this is an awkward way of saying that all proposed CPVC uses would be abandoned, or that CPVC use would still be proposed for drain-waste-vent applications. If the latter is implied, then the short discussion of this alternative is partially irrelevant since plumbers would continue to be exposed to dangerous solvent cements.

If this is a "no CPVC" alternative, it should be stated as such and subjected to the level of discussion and analysis required by CEQA. For instance, in *Laurel Heights*, the court disapproved an alternative site analysis that merely identified where the sites were and stated that they were too small. There was no discussion of how large the alternative sites were, the possibility of expanding existing sites, or purchasing or leasing other sites away from residential neighborhoods.

A discussion of a "no CPVC" alternative in the required detail would, at a very minimum, demand some analysis of its impact on water quality and fire safety. The DEIR erroneously concludes that all other impacts would be the same as the proposed project, although the body of the document states that CPVC is more expensive than PB and copper, so this alternative would allow the use of less expensive plumbing materials.

In light of the removal of PB pipe from the UPC by IAPMO, the DEIR inexplicably fails to propose, discuss and analyze a "no PB" alternative. Since the Department and the State Building Standards Commission are prohibited from approving building standards that are not as safe as those found in the UPC (see, *ante*, section II.3.b.), the implementation of this alternative is clearly within the reasonable range of alternatives which must be analyzed. Yet it is not mentioned in the draft.

Any discussion of the "no PB" alternative must include an analysis of the public health, worker health, fire safety and economic implications of such a project. These must be weighed against the environmental impacts of the proposed project itself and the other suggested alternatives.

Another alternative identified but not discussed or analyzed in the DEIR suggests that plastic installations be limited to threaded and not glued fittings. There is no assessment of the feasibility of this alternative - can these types of plastic pipe be joined in threaded fittings? The DEIR does not discuss the implications for fire safety of this alternative. There is no analysis of the economic impact of using threaded instead of glued joints. There is simply no information provided about this alternative that allows the public to assess it in any meaningful way.

The DEIR also suggests that PB and CPVC pipe be used only outside buildings. The DEIR does not mention the impact of such a project on water quality. It does not address the economic feasibility of the alternative.

The fourth modification is unclear. It could refer to a project that limits DWV outside and in fire-rated construction to CPVC pipe, or one which limits CPVC pipe use to DWV outside and in fire-rated construction. Until the meaning of the alternative is clarified, the public cannot comment on it with any precision. In any case, the alternative is only identified, but is not discussed or analyzed. It does not address the water quality impacts of such a project, or its economic feasibility.

The last modification is a combination of the preceding two and suffers from the same analytic flaws. There is no discussion or analysis of water quality or worker health issues, nor any effort to weigh the environmental advantage of the alternative against the other alternatives.

b. No Plastic Alternative

The DEIR proposes a final alternative which would ban all plastic pipe in California. This alternative is not subject to sufficient discussion to allow a reasonable assessment of its environmental advantages. For instance, the DEIR states that a "no plastic" alternative would decrease permeation of pipe and that leachates would change. However, the leachates referred to are not listed nor are their toxic properties compared. It is impossible from this discussion to determine whether or not plastic or metal leachates are to be preferred.

The truncated discussion of the alternative states that the positive or negative impacts on industry would probably be greater than the proposed project, but the positive or negative impacts are not listed. Without such information, it is impossible to assess this alternative. The DEIR presents no discussion of the economic impact of the "no plastic" alternative.

4. The DEIR Does Not Identify "No Project" as the Environmentally Superior Alternative

The entire alternatives discussion completely ignores the purpose of the requirement that alternatives be presented in the first place. There is no discussion of the "comparative merits of the alternatives" as required by CEQA. (14 C.C.R. § 15126, subd. (d).) The alternatives discussion in the DEIR does not identify the environmentally superior alternative, does not explain why the alternatives were rejected in favor of the proposed project, and does not identify a superior alternative from among all but the "no action" alternative. All of these analyses are required by CEQA and are missing here. (14 C.C.R. § 15126, subds. (d)(1) and (2).)

On the basis of the comments presented in this document, there can be no doubt that the "no project" alternative is the environmentally superior project. Although the entire spectrum of negative environmental impacts of plastic pipe, from manufacture to sale to installation, cannot be repeated here, without expanded uses of plastic plumbing pipe, the mechanical failure, water quality, worker health, and fire safety problems associated with this product would disappear. Cast iron, galvanized steel and copper pipe pose no danger to water quality. (DEIR, p. 55.) They are environmentally superior to plastics, and even the DEIR concludes they are no more expensive.

The limited discussion of project alternatives in the DEIR is completely inadequate to meet the minimal standards for such discussion in CEQA. "To facilitate CEQA's informational role, the EIR must contain facts and analysis, not just the agency's bare conclusions or opinions." (*Laurel Heights Improvement Association v. Regents* (1988) 47 Cal.3d 376 [253 Cal.Rptr. 426, 439], citing, among others, *Concerned Citizens of Costa Mesa, Inc. v. 32nd Dist. Agricultural Assn.* (1986) 42 Cal.3d 929, 935 [231 Cal.Rptr. 748].) The alternatives posed in the DEIR must be completely analyzed and explained

and circulated for public review after the ambiguities and uncertainties have been clarified.

E. The DEIR Fails to Consider All Significant Irreversible Environmental Changes Resulting from Expanded Uses of Plastic Pipe

CEQA requires the EIR to include a detailed statement concerning "[a]ny significant irreversible environmental changes which would be involved in the proposed project should it be implemented." (Pub. Resources Code § 21100, subd. (e).) The DEIR barely acknowledges this requirement with a scant half page discussion of the irreversible changes the proposed project would cause. The DEIR discussion contradicts the ERD section on the same topic and no explanation is offered.

The expanded uses of plastic will have at least four major irreversible impacts. The project will discharge carcinogens and other dangerous chemicals into drinking water of unknown types in unknown quantities. It will expose plumbers to daily doses of known carcinogens and other chemicals that may be cancer-causing. It will introduce into fire-rated and non fire-rated construction a new flammable material to replace a material that is not flammable. Finally it will replace a strong, stable, long-lasting pipe material with weaker, more fragile plastic in construction where replacement is virtually impossible without destructive renovations of considerable cost and inconvenience to building owners.

The DEIR dismisses the irreversible changes in drinking water quality in a few lines. It does not recognize the real implication of the facts buried in the document, appendices and supporting studies which raise serious questions concerning the leaching of chemicals, some known, most not, into already polluted drinking water. As these comments have shown, an inadequate project description has led the Department to ignore large areas of impact. New materials and new manufacturing processes have changed the formulation of pipe and the contaminants found with pipe just during the period the DEIR has been in production.

If DMF is phased out, what will replace it? What will be the irreversible effects on water quality and ultimately the health of Californians

from these new chemicals? Is there any way to know what new materials are being used or what new manufacturing processes installed before the pollutants they produce are consumed by the general population? None of these issues are discussed in this section of the DEIR.

Those impacts that are addressed are underestimated. For instance, the DEIR must discuss the irreversible environmental changes resulting from the introduction of THF and MEK into drinking water over tens and hundreds of years.

The DEIR discussion of the irreversible impacts of plastic pipe on worker health is also completely inadequate. The Department's own study shows that plastic pipe solvents will expose plumbers to unsafe levels of THF. These comments highlight the fact that the established levels of safety themselves are inadequate, and that present information concerning the known chemicals suggests chronic health effects. What are the irreversible changes inherent in exposing California's plumbers to greater amounts of carcinogens? The DEIR must discuss this question in detail.

In striking contrast to the non-discussion of irreversible impacts on worker health contained in the DEIR, the ERD discusses the fact that increased deaths from cancer are certainly an irreversible long-term impact from the use of plastic pipe and its primers, solvents and glues. (ERD, p. V-12.) There is no explanation of the very different conclusions on this point found in the DEIR and ERD.

The reader is left confused and uncertain about the true irreversible effects of the proposed project. The DEIR says there are no impacts at all. The ERD indicates that more deaths will result. At the very least, this inconsistency must be explained. To comply with the spirit and letter of CEQA, however, the DEIR must honestly and openly discuss each and every irreversible impact, including increased deaths from cancer.

Although the ERD suggests increased mortality from the smoke toxicity of plastic pipe, the DEIR dismisses the irreversible impacts of flammable plastic pipe. (ERD, p. V-12; DEIR, p. 101.) Certainly the exchange of an inflammable for a flammable material will be irreversible. If the project is implemented a portion of building construction not now vulnerable to fire

will burn. Homes and buildings plumbed with plastic will then be more flammable as a whole. This effect of the project is irreversible.

Neither the ERD or DEIR discuss the irreversible impact of installing failure-prone plastic instead of metals that last much longer. Tens of thousands of homes will contain plumbing systems that break and leak far sooner and more frequently than metal. It will not be possible to replace all of these systems for economic, logistic and practical reasons. The wide usage of plastic pipe would, alone, make removal or use of other materials unlikely. (14 C.C.R. § 15126, subd. (f).) In some cases, where plumbing is placed in concrete slabs, replacement is simply not possible. The installation of plastic in these locations is irreversible. Yet this fact is neither mentioned nor discussed in the DEIR.

The advantages of a serious assessment of the irreversible effects of increased uses of plastic are revealed in the history of the plumbing code change now under review and other building materials that have, after the fact, been found to be dangerous.

Had the code changes now proposed gone into effect as planned in 1981, thousands of California homes would have been plumbed with polybutylene pipe. PB piping systems used in limited areas of California and widely in Texas has and continues to fail, ruining homes, reducing property values, and costing thousands of dollars for partial or complete replacements. The delay caused by careful environmental review has saved California from being used as a vast testing ground for unsound materials. The irreversible damage done elsewhere has been avoided. More damage and the costs of repair can also be avoided if the DEIR contains a hard and honest look at plastic pipe and the changes it will cause.

The cost of reversing a mistake is much higher than avoiding one in the first place. Hundreds of millions of dollars have been spent removing asbestos from homes, offices, schools and other buildings because its impact on human health was not adequately assessed before it became a ubiquitous building material. The impact on human health is irreversible. The cost of removal is unavoidable, although much asbestos will probably never be removed. Its ill-considered use will plague us for hundreds of years.

In light of recent experience with PB pipe and asbestos, the Department must complete an assessment of the irreversible environmental impact of installing even greater amounts of plastic pipe in homes and buildings.

One of the basic irreversible changes the DEIR should consider is the use of nonrenewable resources. (14 C.C.R. § 15126, subd. (f).) Plastic is a petroleum by-product. Petroleum is a non-renewable resource. Unlike metals, plastic is not recyclable. The DEIR does not mention these facts or assess whether the current use of petroleum for this purpose is justified, as required by CEQA. The DEIR must study how much petroleum will be used in the coming years, what alternative uses might be, how long known resources will last, and the relative advantages and disadvantages of present versus postponed use of this resource.

In its present state, the DEIR treatment of significant irreversible changes in the environment resulting from increased uses of plastic pipe does not comply with CEQA.

V. CONCLUSION

The analysis presented in these comments clearly demonstrates that the proposed code changes would cause significant adverse effects on public health and safety. The DEIR substantially underestimates potential impacts due to a number of omissions and deficiencies in the analysis of drinking water contamination, worker health and fire-safety. Moreover, the DEIR fails to consider at all a broad range of potentially significant impacts due to an inaccurate and overly narrow project definition.

The economic analysis presented by Dr. Dickens also proves that the code changes would substantially increase plumbing costs. The DEIR completely misinterprets the economic impact of the proposal by failing to take into account a number of significant additional costs associated with the use of plastic pipe. The DEIR also dramatically understates the true cost of switching to plastic plumbing by assuming the use of PB instead of copper. As discussed, PB has been banned by IAPMO and will most likely not be the material substituted for copper. As demonstrated in Dr. Dickens'

analysis, the use of any other plastic material would significantly increase plumbing costs over the cost of metal pipe.

Under these circumstances, HCD would be unable to justify the proposed code changes under the standard required by the California Building Standards Law. Health and Safety Code section 18930 requires HCD to demonstrate, inter alia, that "[t]he public interest requires the adoption of the building standards" and that "[t]he cost to the public is reasonable based on the overall benefit to be derived from the building standards." (Health & Saf. Code § 18930, subds. (a)(3) and (5).) In view of the significant adverse impacts and increase costs associated with the expanded use of plastic pipe, it is clear that HCD will not be able to meet this standard and will be required to withdraw the proposed code changes.

STATE OF CALIFORNIA
DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
Division of Codes and Standards

INITIAL STUDY

I. BACKGROUND

1. Department of Housing and Community Development

This project is a response on the part of the Department of Housing and Community Development to the mandate of the Legislature as expressed in the State Housing Law, Sections 17910 - 17995 of the Health and Safety Code, specifically in Sections 17921 and 17922.

Section 17921 directs the Department to adopt, amend, and enforce rules and regulations for the protection of the public health, safety and general welfare of the occupant, and the public governing the erection, construction, and maintenance of all dwellings and structures in the state. The Department's mandate in Section 17921 to adopt rules and regulations for the protection of the public health, safety and general welfare provides the authority for the Department to act in areas not addressed or incompletely addressed by the Uniform Codes. Section 17922 directs that the rules and regulations adopted, amended or repealed from time to time be substantially the same requirements as are contained in the widely used Uniform Codes (such as the Uniform Building Code and the Uniform Plumbing Code). The Legislature has further directed that the Department is to consider local conditions and any amendments to the Uniform Codes.

Pursuant to Section 17958 the Law requires that the governing body of every city or county must adopt ordinances or regulations, within one year, imposing the same requirements as the State's, thus in effect the State regulations are also local regulations when this occurs. Section 17958.5 provides that a city or county may modify or change the requirements published in the State Building Standards Code based on finding of need due to local climatic, geographical, or topographical conditions, subject to certain actions and limitations required of these local entities.

2. Description of Proposed Project

The Department of Housing and Community Development proposes to approve the expanded use of plastic (non-metal) piping systems in the specific applications and conditions listed in the use matrix that follows. The uses are in basic conformance with the proposed 1982 Uniform Plumbing Code (UPC) as published by the International Association of Plumbing and Mechanical Officials (IAPMO). The matrix lists both those plastic pipe applications approved under the 1979 UPC and expanded uses proposed under the 1982 UPC. A copy of the relevent sections of the new code are attached to the end of this Initial Study.

3. Initial Study Authors

This Initial Study was prepared by the Department of Housing and Community Development, Division of Codes and Standards. The Plastic Plumbing Pipe Task Force, representing industry, labor, and interested state agencies participated in the study preparation. Coordination between the Task Force and the Department was provided by Michael C. McMillan, Department EIR Coordinator.

Plastic Pipe Use Matrix

(Yes with an underline - Applications already approved.)
(Yes without an underline - Proposed expanded uses.)

Application	Type of Pipe				
	ABS	PB	PE	PVC	CPVC[2]
Inside a Building					
Not Fire-Rated Construction[1]					
Cold water supply	No	Yes	No	No	Yes
Hot water supply	No	Yes	No	No	Yes
Drain, waste, vent	Yes	No	No	Yes	Yes
Fire-Rated Construction[1] (Exposed locations)					
Cold water supply	No	No	No	No	No
Hot water supply	No	No	No	No	No
Drain, waste, vent	No	No	No	No	No
Fire-Rated Construction[1] (Within fire-resistive construction)					
Cold water supply	No	Yes	No	No	Yes
Hot water supply	No	Yes	No	No	Yes
Drain, waste, vent	Yes	No	No	Yes	Yes
Outside a Building					
Cold water supply	No	Yes	Yes	Yes	Yes
Hot water supply	No	Yes	No	No	Yes
Drain, waste, vent	Yes	No	No	Yes	Yes
Solvents/Glues Used in Installation	Yes	No	No	Yes	Ye

1. Fire-rated refers to material or construction which will withstand a standard fire exposure as determined by recognized testing methods. The amount of time the material resists the spread of fire is indicated by the degree of its fire rating. The higher the fire-rating, the longer the material will resist the spread of fire. Examples of fire-rated materials include concrete, steel, and one-inch thick gypsum board.

   Not fire-rated refers to materials or construction which have no appreciable resistance to the spread of fire. Since these materials or construction methods have little fire resistance, they are not given a fire rating. Examples of not fire-rated materials and construction is that found in a typical wood-frame single family dwelling.

2. CPVC is available for use only under the "other approved materials" local option.

II. ENVIRONMENTAL IMPACTS

(Explanations of all "yes" and "maybe" answers are provided in Section III).

	Yes	Maybe	No
1. **Earth.** Will the proposal result in:			
a. Unstable earth conditions or in changes in geologic substructures?	___	X	___
b. Disruptions, displacements, compaction or overcovering of the soil?	___	___	X
c. Change in topography or ground surface relief features?	___	___	X
d. The destruction, covering or modification of any unique geologic or physical features?	___	___	X
e. Any increase in wind or water erosion of soils, either on or off the site?	___	___	X
f. Changes in deposition or erosion of beach sands, or changes in siltation, deposition or erosion which may modify the channel of a river or stream or the bed of the ocean or any bay, inlet or lake?	___	___	X

	Yes	Maybe	No
g. Exposure of people or property to geologic hazards such as earthquakes, landslides, mudslides, ground failure, or similar hazards?	___	___	X
2. Air. Will the proposal result in:			
a. Substantial air emissions or deterioration of ambient air quality?	___	X	___
b. The creation of objectionable odors?	___	___	X
c. Alteration of air movement, moisture, or temperature, or any change in climate, either locally or regionally?	___	___	X
3. Water. Will the proposal result in:			
a. Changes in currents, or the course of direction of water movements, in either marine or fresh waters?	___	___	X
b. Changes in absorption rates, drainage patterns, or the rate and amount of surface runoff?	___	___	X
c. Alterations to the course or flow of flood waters?	___	___	X
d. Change in the amount of surface water in any water body?	___	___	X
e. Discharge into surface waters, or in any alteration of surface water quality, including but not limited to temperature, dissolved oxygen or turbidity?	___	X	___
f. Alteration of the direction or rate of flow of ground waters?	___	___	X
g. Change in the quantity of ground waters, either through direct additions or withdrawals, or through interception of an aquifer by cuts or excavations?	___	___	X
h. Substantial reduction in the amount of water otherwise available for public water supplies?	___	___	X
i. Exposure of people or property to water related hazards such as flooding or tidal waves?	___	___	X

	Yes	Maybe	No
4. **Plant Life.** Will the proposal result in:			
a. Change in the diversity of species, or number of any species of plants (including trees, shrubs, grass, crops, and aquatic plants)?	___	___	X
b. Reduction of the numbers of any unique, rare or endangered species of plants?	___	___	X
c. Introduction of new species of plants into an area, or in a barrier to the normal replenishment of existing species?	___	___	X
d. Reduction in acreage of any agricultural crop?	___	___	X
5. **Animal Life.** Will the proposal result in:			
a. Change in the diversity of species, or numbers of any species of animals (birds, land animals including reptiles, fish and shellfish, benthic organisms or insects)?	___	___	X
b. Reduction of the numbers of any unique, rare or endangered species of animals?	___	___	X
c. Introduction of new species of animals into an area, or result in a barrier to the migration or movement of animals?	___	___	X
d. Deterioration to existing fish or wildlife habitat?	___	X	___
6. **Noise.** Will the proposal result in:			
a. Increases in existing noise levels?	___	X	___
b. Exposure of people to severe noise levels?	___	___	X
7. **Light and Glare.** Will the proposal produce new light or glare?	___	___	X
8. **Land Use.** Will the proposal result in a substantial alteration of the present or planned land use of an area?	___	___	X
9. **Natural Resources.** Will the proposal result in:			
a. Increase in the rate of use of any natural resources?	___	X	___

	Yes	Maybe	No
b. Substantial depletion of any nonrenewable natural resource?	___	___	X
10. Risk of Upset. Will the proposal involve:			
a. A risk of an explosion or the release of hazardous substances (including, but not limited to, oil, pesticides, chemicals or radiation) in the event of an accident or upset conditions?	___	X	___
b. Possible interference with an emergency response plan or an emergency evacuation plan?	___	X	___
11. Population. Will the proposal alter the location, distribution, density, or growth rate of the human population of an area?	___	X	___
12. Housing. Will the proposal affect existing housing, or create a demand for additional housing?	___	X	___
13. Transportation/Circulation. Will the proposal result in:			
a. Generation of substantial additional vehicular movement?	___	___	X
b. Effects on existing parking facilities, or demand for new parking?	___	___	X
c. Substantial impact upon existing transportation systems?	___	___	X
d. Alterations to present patterns of circulation or movement of people and/or goods?	___	___	X
e. Alterations to waterborne, rail or air traffic?	___	___	X
f. Increase in traffic hazards to motor vehicles, bicyclists or pedestrians?	___	___	X
14. Public Services. Will the proposal have an effect upon, or result in a need for new or altered governmental services in any of the following areas:			
a. Fire protection?	___	X	___
b. Police protection?	___	___	X
c. Schools?	___	___	X

	Yes	Maybe	No
d. Parks or other recreational facilities?			X
e. Maintenance of public facilities, including roads?			X
f. Other governmental services?			X
15. Energy. Will the proposal result in:			
a. Use of substantial amounts of fuel or energy?			X
b. Substantial increase in demand upon existing sources of energy, or require the development of new sources of energy?		X	
16. Utilities. Will the proposal result in a need for new systems, or substantial alterations to the following utilities:			
a. Power or natural gas?			X
b. Communications systems?			X
c. Water?			X
d. Sewer or septic tanks?			X
e. Storm water drainage?			X
f. Solid waste and disposal?			X
17. Human Health. Will the proposal result in:			
a. Creation of any health hazard or potential health hazard (excluding mental health)?		X	
b. Exposure of people to potential health hazards?		X	
18. Aesthetics. Will the proposal result in the obstruction of any scenic vista or view open to the public, or will the proposal result in the creation of an aesthetically offensive site open to public view?			X
19. Recreation. Will the proposal result in an impact upon the quality or quantity of existing recreational opportunities?			X
20. Cultural Resources.			
a. Will the proposal result in the alteration of or the destruction of a prehistoric or historic archaeological site?			X

	Yes	Maybe	No
b. Will the proposal result in adverse physical or aesthetic effects to a prehistoric or historic building, structure, or object?	___	___	X
c. Does the proposal have the potential to cause a physical change which would affect unique ethnic cultural values?	___	___	X
d. Will the proposal restrict existing religious or sacred uses within the potential impact area?	___	___	X
21. Mandatory Findings of Significance.			
a. Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	___	X	___
b. Does the project have the potential to achieve short-term, to the disadvantage of long-term, environmental goals? (A short-term impact on the environment is one which occurs in a relatively brief, definitive period of time while long-term impacts will endure well into the future.)	___	X	___
c. Does the project have impacts which are individually limited, but cumulatively considerable? (A project may impact on two or more separate resources where the impact on each resource is relatively small, but where the effect of the total of those impacts on the environment is significant.)	___	X	___
d. Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	___	X	___

III. DISCUSSION OF ENVIRONMENTAL EVALUATION

1.a. Earth. Approval of the expanded use of plastic plumbing pipe may result in unstable earth conditions. If plastic pipe carrying liquid under pressure, when installed under slab foundations, fails (leaks) more frequently than metal pipe, the soil beneath the foundations may become saturated. This saturation may lead to unstable earth conditions in situations such as hillside homes, structures on expansive soils, or structures near areas of previous landslides or soil creep.

2.a. Air. Should the expanded use of plastic plumbing pipe be approved in California, a significant demand may be produced for additional pipe. This demand may lead to increased production or a general increase in activity at major chemical plants. Increased production may produce an increase in air emissions with a potential decrease in ambient air quality.

Major chemical and petrochemical plants in California are operated under permits issued by Air Quality Management Districts. An increase in production or refinery operations within the limits of existing air quality permits is not considered a significant impact. To increase production above limits set in existing permits would require a new permit or permit modification by the Air District. At that time, the impact and potential mitigation measures for air quality would be assessed by the Air District. Expanded use of plastic plumbing pipe is not expected to result in substantial new air emissions or a deterioration of ambient air quality.

3.e. Water. Should the expanded use of plastic plumbing pipe be approved in California, toxic substances may be released in small quantities from the pipe and pipe solvents into the liquid within the pipe in quantities more or less than from metal pipes and solders. There is considerable controversy in the scientific and technical community over what substances may leach from plastic plumbing materials and in what quantities. A similar controversy exists for metal pipes. The potential impact, if any, of plastic pipe leachates from an expanded use of plastic pipe on surface water quality is not known. Expanded use of plastic plumbing pipe may result in an alteration of surface water quality.

5.d. Animal Life. Approval of the expanded use of plastic plumbing pipe may lead to a deterioration of existing aquatic habitat. As discussed under item 3.e., the potential impact of plastic pipe leachates on surface water in relation to the existing impact from metal pipe leachate is not known. If the impact was adverse, it may in turn affect aquatic organisms and their habitat. The magnitude of the potential impact on aquatic habitats should be assessed.

6.a. Noise. Submitted into the record of the plastic pipe project is a letter from Hilliard and Bricken, Consulting Acoustic and Energy Engineers, Santa Ana, California, stating, "There is strong evidence that there is a real advantage of using cast iron (rather than plastic riser drain pipe) to decrease the rushing noise of water." In homes where plastic pipe is in use, however, no significant impact has been reported from increased noise levels of water flowing through the pipes. Expanded use of plastic plumbing pipe is not expected to produce a significant adverse increase in existing noise levels.

9.a. Natural Resources. Approval of the expanded use of plastic plumbing pipe may result in a change in the rate of use of petroleum, a natural resource. Approval may result in a decrease in the rate of use of copper (in copper pipe) and iron and zinc (in galvanized pipe). The magnitude of the petroleum increase, and whether it would be a significant impact, is not known.

10.a. and b. Risk of Upset. In the event of a fire in a building containing plastic plumbing pipe, toxic fumes may be released from the burning pipe. Different types of plastic would produce different fumes on combustion. If toxic fumes or smoke were produced, they may interfere with emergency evacuation. Additional information may be needed before it can be determined if plastic pipe would contribute to unusual fire spread or that the toxicity generated by the combustion of plastic pipe would not extend beyond the area of initial exposure in quantities sufficient to prove hazardous from through-penetrations in fire-rated construction or within fire-rated construction.

11. Population. Approval of the expanded use of plastic plumbing pipe may alter the location, distribution, density, or growth rate of an area. Should the potential reduced cost of plastic pipe have a significant effect on the cost of housing, the cost reduction may alter population distributions. The availability of new lower cost housing may attract populations from other areas.

12. Housing. Approval of the expanded use of plastic plumbing pipe in California may affect existing housing and create a demand for additional housing. If plastic plumbing pipe is found to be both less expensive to purchase and to install, the cost of constructing new homes may be reduced.

14.a. Public Services. As discussed previously in Items 10.a. and b., the use of plastic plumbing pipe in multi-story buildings may produce toxic fumes or smoke in quantities that may prove hazardous. Should plastic plumbing pipe be shown to create a hazardous situation during a fire, approval of the expanded use of plastic plumbing pipe may result in a need for altered governmental services, namely fire protection.

15.b. Energy. Expanded use of plastic plumbing pipe may or may not require a net increase in energy consumption over the manufacture, shipping, and installation of conventional pipe materials. The relative energy use between pipe materials needs to be assessed.

17.a. and b. Human Health. The most significant source of potential adverse impact which may occur if plastic pipe is approved for expanded plumbing use is in the area of human health. There may be a potential health hazard from chemicals leached into drinking water from the pipe and solvents used in joining the pipe. Each type of pipe may have different types of leachate. The quantities of such leachates, including singularly, in combination, and/or in aggregate, their relevant acute or chronic adverse effects on human health, and the relative contribution exposure to plastic pipe pollutants would have on an occupant of housing using plastic pipe needs to be assessed, as is feasible. The similar impact should be assessed relative to the effect from approved metal pipes (such as lead pipe and lead-soldered copper pipe and associated fluxes).

The manufacturing and installation of some types of plastic pipe may expose plant workers or pipe-trades craftsmen to potential dermal and inhalation health hazards from solvent vapors, solvent skin contact, and airborne particulates. The health and safety impact may be greater or less than that associated with metal pipe installation. The potential for significant adverse impacts of both metal and plastic pipe on worker safety should be assessed and compared.

21.a. Quality of the Environment. Approval of the expanded use of plastic plumbing pipe may degrade the quality of the environment. As described under Items 3.e. and 5.d., the expanded use of plastic pipe may cause a change in surface water quality and may cause a deterioration of existing aquatic habitat.

21.b. Short-Term vs. Long-Term Goals. Approval of the expanded use of plastic plumbing pipe may achieve short-term goals (e.g., lower cost, reduced energy use, easier installation) to the disadvantage of long-term goals (e.g., potential for continuous exposure to chemicals in water supply).

21.c. Cumulative Impact. The cumulative impact of expanded use cannot be assessed until the magnitude of the individual impacts is determined.

21.d. Effects on Humans. Expanded approval of plastic plumbing pipe may produce an adverse effect directly or indirectly on human beings.

Additional Potential Impacts.

Fiscal. Approval of the expanded use of plastic plumbing pipe may reduce the cost of plumbing materials for construction. The magnitude of cost difference between metal and non-metal materials as a percentage of total construction cost should be assessed. Potential differences in labor costs for installation of the two materials should be assessed.

IV. DETERMINATION

On the basis of this initial evaluation, I find approval of the expanded use of plastic plumbing pipe MAY have a significant effect on the environment. An ENVIRONMENTAL IMPACT REPORT is required to assess the magnitude of any potential adverse effects, discuss alternatives to the project as proposed, and determine feasible mitigation measures to reduce identified impacts.

Date:

By: I. Donald Terner, Director
Department of Housing and Community Development

(800) 392-7591
P.O. Box 869006
Plano, Texas 75086-9006

consumer plumbing recovery center

home
notice
guidelines
terms
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FAQs
claim form
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appeals

General FAQs

- *What is the Consumer Plumbing Recovery Center (CPRC)?*
- *What is the COX vs. Shell Oil et al. Settlement?*
- *How was the public notified about this program?*
- *Could you explain the Cox Settlement?*
- *What needs to be provided to CPRC to provide adequate verification of the Installation Date of the PB Plumbing System?*
- *What will I recover under the Settlement if I am eligible?*
- *What is a Polybutylene Plumbing System as defined by the Class?*
- *How do I know if I have Polybutylene inside my house?*
- *What is a leak and how do I know if I have one inside my house?*
- *How is a leak verified?*
- *I have had a leak in my home. How do I receive recovery?*
- *How long does it take to receive the Claim Eligibility Form in the mail?*
- *The leak(s) at my property is minor. Should the leak(s) be reported to the CPRC?*
- *What do I do if I have a current leak in my yard line?*
- *We currently have a leak(s) at our property. Will CPRC send a plumbing company to perform the repairs to the leak(s)?*
- *I have already replumbed my home at my own expense. Can I still file a claim?*
- *I have polybutylene plumbing, but I have not had any leaks, am I entitled to anything?*
- *I have not had any leaks. Do I need to register my name and address with the CPRC in case I do have a leak in the future?*
- *Do I have to currently own the property to make claim for repairs that were made during my ownership?*
- *I'm in the process of purchasing a house with PB, and the current owner had a leak last year. Can I file a claim on the previous owners leak once I own the home?*

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What is the Consumer Plumbing Recovery Center (CPRC)?

The Consumer Plumbing Recovery Center (CPRC) is a third party administrator. It is a claim handling facility established as a not-for-profit corporation approved by the court to administer the terms of *COX vs. Shell, et al.* national class action Settlement.

CPRC is required to disburse benefits in strict accordance with the Settlement Agreement reached among the parties. The primary function of the Company is to maintain and properly administer the approximately $1 billion fund created by the Settlement. The CPRC handles claims and manages the Settlement Fund for and under the continuing supervision of the Court.

back

What is the COX vs. Shell Oil et al. Settlement?
The Settlement is a national class action settlement involving certain polybutylene plumbing systems and polybutylene yard service lines installed between January 1, 1978 through July 31, 1995. The Settlement provides for the disbursement of a billion dollar fund to claimants who qualify under the terms of the Settlement Agreement.

back

How was the public notified about this program?
Several Legal Notices in the media announced the class action to the American public. It is important to understand that "notice", as it applies to class action litigation, does not mean notice to each and every individual Class Member, but rather, to the community. Since this is a national class action, the community is the entire United States. As with many legal notices, Cox depended on national and local media to reach members of the Class. This involved advertising in newspapers, magazines, television, radio, and even the Internet. Additionally, there has been extensive free publicity in the form of news articles in and public service announcements by the media. Notices have appeared in trade journals and other periodicals such as newsletters published by homeowner associations. In addition to the above, there have been many media articles on polybutylene and ***Cox vs. Shell Oil***. This has included such TV programs as *Good Morning America* and *CBS This Morning*. Articles have appeared in the *Wall Street Journal*, *The Washington Post*, and others. Reporters from many newspapers, TV stations, and magazines, some large, some from small cities, have interviewed CPRC personnel. The Court concluded the Cox notice program was "...one of the most comprehensive class action campaigns ever undertaken."

back

Could you explain the Cox Settlement?
Claimants may be eligible for a replumb (replacement of the plumbing system) or yard service line replacement at no charge and/or certain Leak Expense reimbursement if they

- Presently own or have previously owned a home plumbed with a polybutylene plumbing system or a polybutylene yard service line which was installed between January 1, 1978 through July 31, 1995 **and**
- Their home has experienced a Qualifying Leak.

back

What needs to be provided to CPRC to provide adequate verification of the Installation Date of the PB Plumbing System?
If actual original installation documentation cannot be provided, CPRC requires a form of verification to be provided. The original Certificate of Occupancies, Building Permits, and information from the original water authority showing the original activation date would be forms of documentation that can be provided to CPRC. Please note that the above documentation will be required for each individual building in a multi building property.

back

What will I recover under the Settlement if I am eligible?
The Settlement offers to eligible claimants the ACV (actual cash value) for damages to tangible property from leaks, reimbursement of out of pocket expenses from leaks, and in some cases replacement of the PB Plumbing System

or Yard Service line.
The Settlement does not cover water bills, lost time from work, tenant related expenses, bodily injury or pain and suffering.

back

What is a Polybutylene Plumbing System as defined by the Class?
That portion of any potable water distribution system with an Installation Date between January 1, 1978 and July 31, 1995, which is within a structure and is composed of Polybutylene Pipe with acetal or metal insert fittings (or any combination thereof). PB Plumbing System does not include PB Yard Service Line.

back

How do I know if I have Polybutylene inside my house?
Examine the plumbing system anywhere there is accessible plumbing in the home such as under kitchen and bathroom sinks, at the water heater, in a crawlspace or attic. Please refer to the photos section of our website for photos of polybutylene plumbing systems.

back

What is a leak and how do I know if I have one inside my house?
A leak is a verifiable failure in a component of a PB Plumbing System that leads to unwanted discharge of water. A leak inside a home could manifest itself by visible water damage in walls, floors or ceilings. An increase in water usage may also indicate an unseen leak.

back

How is a leak verified?
Adequate verification of a claimed leak will need to be provided. Plumbing repair receipts, work orders, photographs of the leak and/or repair and the actual failed part of the PB Plumbing System are adequate forms of verification of a leak in the PB Plumbing system.

back

I have had a leak in my home. How do I receive recovery?
Complete a Claim Eligibility Form online or manually complete a printed copy and mail it to CPRC
Or request a Claim Eligibility Form from the CPRC by calling 1-800-392-7591 or by writing to CPRC at PO Box 869006, Plano, TX 75086-9006. When received by the CPRC, the form will be reviewed to determine if the home is eligible for recovery under the Cox Settlement.

back

How long does it take to receive the Claim Eligibility Form in the mail?
The claim forms are mailed once a week on Thursday using bulk rate postage. Allow approximately 21 days to receive the form. **For the Notice campaign: The claim forms are mailed every day using first class postage. Allow approximately 7-10 days to receive the form.**

back

The leak(s) at my property is minor. Should the leak(s) be reported to the CPRC?
Any plumbing leak(s) in a PB plumbing system, regardless of severity, should be reported to the CPRC for evaluation.

back

What do I do if I have a current leak in my yard line?
Call the CPRC at 1-800-876-4698 to file a claim. The claim will then be reviewed for qualification. In most cases the CPRC has a contracted plumber in your area that can be sent out to replace the yard service line. This service is typically done at no cost to the homeowner.
If it is an extreme emergency and our office is closed, please call a plumber and have a temporary repair made to the line until CPRC can be reached. Save any receipts for possible reimbursement.

back

We currently have a leak(s) at our property. Will CPRC send a plumbing company to perform the repairs to the leak(s)?
CPRC will not send a plumbing company to perform repair work. You will need to repair the leaks and retain all pertinent verification that such a leak was experienced in the PB Plumbing System.

back

I have already replumbed my home at my own expense. Can I still file a claim?
Yes, you may be entitled to a full or partial reimbursement on your out of pocket expense.

back

I have polybutylene plumbing, but I have not had any leaks, am I entitled to anything?
No, per the terms of the Settlement, the home must incur a leak to be eligible for recovery.

back

I have not had any leaks. Do I need to register my name and address with the CPRC in case I do have a leak in the future?
No, it is not necessary to contact the CPRC unless the structure has a polybutylene leak inside the structure or yard service line.

back

Do I have to currently own the property to make claim for repairs that were made during my ownership?
As long as you are an eligible Class Member, you do not currently have to own and/or occupy the property to claim for expenses incurred during the ownership period.

back

I'm in the process of purchasing a house with PB, and the current owner

had a leak last year. Can I file a claim on the previous owners leak once I own the home?

No, For a Class Member to receive relief as an Eligible Claimant, the Qualifying Leak(s) or Qualifying Yard Service Leak(s) must occur in the Unit during the Claimant's ownership of that Unit.

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SUPERIOR COURT OF CALIFORNIA

COUNTY OF SAN FRANCISCO

RICHARD CUFFE; GREG BAKER; RON MORGAN; SAM GILL; CALIFORNIA PIPE TRADES COUNCIL; CALIFORNIA FIREFIGHTERS ASSOCIATION; PLANNING AND CONSERVATION LEAGUE; SIERRA CLUB; CALIFORNIA LEGISLATIVE CONFERENCE OF THE PLUMBING, HEATING AND PIPING INDUSTRY; and MECHANICAL CONTRACTORS ASSOCIATION OF NORTHERN CALIFORNIA, Petitioners, vs. CALIFORNIA BUILDING STANDARDS COMMISSION and CALIFORNIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT, Respondents. B. F. GOODRICH COMPANY, INC., Real Party in Interest.	Case No. 977657 PEREMPTORY WRIT OF MANDATE [CCP §§ 1087, 1104] Date: Time: Dept: 8 Room: Judge William Cahill

or the date that the information bulletin described in paragraph 1(c) of the Judgment Granting Peremptory Writ of Mandate is sent, whichever is later, showing what you have done to comply with this Writ and shall include a copy of the information bulletin prepared pursuant to paragraph 3.

[Seal]

ALAN CARLSON
Clerk

By: _____
Deputy Clerk

LET THE FOREGOING WRIT ISSUE.

Dated: 3/13/97 1997

Honorable William Cahill
Judge of the Superior Court

CAHILL

SUPERIOR COURT CITY & COUNTY SAN FRANCISCO CAL.

ENDORSED
FILED
San Francisco County Superior Court
JAN 21 1997
ALAN CARLSON, Clerk
BY: GAIL HERRLESS
Deputy Clerk

CALIFORNIA SUPERIOR COURT

CITY AND COUNTY OF SAN FRANCISCO

DEPARTMENT NUMBER EIGHT

RICHARD CUFFE; GREG BAKER; RON MORGAN; SAM GILL; CALIFORNIA PIPE TRADES COUNCIL; CALIFORNIA FIREFIGHTERS ASSOCIATION; PLANNING AND CONSERVATION LEAGUE; SIERRA CLUB; CALIFORNIA LEGISLATIVE CONFERENCE OF THE PLUMBING HEATING AND PIPING INDUSTRY; and MECHANICAL CONTRACTORS ASSOCIATION OF NORTHERN CALIFORNIA, Petitioners, vs. CALIFORNIA BUILDING STANDARDS COMMISSION and CALIFORNIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT, Respondents.	NO. 977657 **ORDER GRANTING WRIT OF MANDATE**

This matter came before the court on October 10, 1996. The Honorable William Cahill, presiding, orders this matter submitted. After further consideration of all papers and arguments, the court orders as follows:

(Guidelines sec. 15061(b)(3)). The record presented to this court on CPVC's effect on the environment does not permit this court to find that there is no possibility that CPVC pipe would not affect the environment significantly. There is a dispute between the parties regarding the extent of the possibility of chemical leaching and solvents polluting drinking water carried in the pipe. In addition there is a dispute regarding potential chemical exposure to workers installing the pipe. Apparently there is some validity to petitioners' position because for 14 years respondents agreed with them.

Whether or not there should be a ban in California on CPVC pipe for residential use is not something which this or any court should be involved with. The decisions in this area are solely for the legislature and the executive branch, but these branches of government have passed and enacted into law the California Environmental Quality Act, and it is the duty of this court to insure that CEQA is complied with when required by law. This is one of those instances.

As such, the Respondent agencies were required to initiate the CEQA process, beginning with an initial study, and ending with either the production of a final Environmental Impact Report, or a Negative Declaration. Neither was produced in this case, rendering the process in violation of CEQA. Thus, petitioners' writ of mandate is GRANTED.

DATED: 1/21/97

William Cahill
San Francisco Superior Court

CrossLinked PolyEthylene

Connecting or repairing PEX pipe? You can buy QEST compression fittings for it.
These repair connectors/fittings are very easy to use and very dependable.
All that you need is an adjustable wrench and channel lock type pliers; or two of the same.

Note: at this time, we (still) do not sell PEX pipe or fittings.

There are many reasons for this: some of which may not seem "rational." Also, some people have viewed our attitude as "paranoid" and we understand this.

Our Founder has seen and experienced what happened with polybutylene, (Shell Oil, the resin manufacturer pulled out of the U.S. market mainly due to litigation) and we simply wish to wait and see with PEX whether it will stand the test of time with potable water usage.

One of the main things that bothers us the lack of universality of the pipe and fittings. The continual "improvements" that keep coming along with PEX.

We understand that PEX has been used in Europe in hydronic - closed systems - conditions for over 30 years but not with chlorine and open systems.

We have recently read where some brands of the PEX piping cannot pass (very) high concentrations (4 parts per million or more) of chlorine. We understand that most potable water never sees over 2 ppm. Our concern is that of time and chlorine; and we simply wish

to stay on the cautious side.

"Better safe than sorry" is our Founder's attitude.

Questions we have asked ourselves about PEX piping:

Are all PEX pipe manufacturers offering the same quality of PEX pipe?

Is all PEX piping the same?

Are all methods of connecting PEX pipe and are all fittings for PEX equal?

Then there is this for us to consider:

there is the PE-Xa (Engel Process PEX with manufacturers Wirsbo and Rehau).

There is the PE-Xb process PEX produced by the silane-method (offered by Vanguard also known as PEX-B).

There is evenPE-Xc (irradiation-method of PEX also known as PEX-C).

There also is available the sandwiched PEX/Aluminum/PEX pipe.

PEX is cross-linked polyethylene and it is not ordinary polyethylene pipe.

PE stands for polyethylene and X for cross-linking.

The material's chemical abbreviation is PE-X.

There is PEX specifically made for potable (drinking) water.

There is PEX made for under floor piping and there is PEX specifically made for radiation type heating.

We realize that not all PEX pipe is the same and that makes it very difficult for us to "know" what is "best."

Wirsbo, the quality-oriented manufacturer of AquaPEX (r) - wrote (Product Catalog, dated March 1, 1998)
*"**Do not use or store** AquaPEX (r) where it will be exposed to direct sunlight for more than **30 days**."*

In Wirsbo's Installation Handbook (May, 1996) it states that if one is unsure of exposure time to sunlight or uv rays, one should *"...submit sample of tubing prior to installation."*

Cold weather installations?
"In temperatures below 50 degrees, do not hold the tubing in the expanded position for over two seconds."

Cold water durability?
In their warranty, dated May 1,1995:
".....It is expressly understood, that failure as a result of freezing of water within the pipes, or failure as a result of over exposure to direct sunlight, as defined in the current Wirsbo-AquaPEX Installation Handbook, does not constitute a defect in materials or workmanship, and shall not be covered by this warranty....."

US Brass, in Bulletin no: QT-131 (dated October 17, 1996) wrote to their customers:
*"Field tests have confirmed that QestPEX (tm) material should not be stored in direct or **indirect** sunlight. Failure to adhere to these instructions, as stated in our instructions manual, will void the Qest warranty."*

In Reeves Journal, May 1996, page 23, James Hinte, technical engineer for Vanguard plastics (a major, quality-oriented, PEX piping manufacturer) wrote:
".....Cross-linking is a delicate operation-either too much or too little of it can compromise the quality of the finished product....."
*Because of the variety of materials used in the PEX manufacturing processes, long term performance is **not** guaranteed in each case. Users should be careful to consider only pipes which have been tested and shown to meet the requirements of hot water pressure applications."*

Since we want our customers to have total satisfaction with everything that they ("you" hopefully) buy from us, we are still, after a number of years, in the process of trying to make up our minds whether to sell PEX or not.

We hope that you will share ANY information, both positive and negative about PEX with us.

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Attorneys for Plaintiff

MICHAEL K. JEANES
Clerk of the Superior Court

By YOLANDA SETTLES, Deputy
Date 03/27/2001 Time 11:37 AM

Description	Qty	Amount
CASE# CV2001-005145		
CIVIL NEW COMPLAINT	001	150.00
TOTAL AMOUNT		150.00

Receipt# 00003962166

SUPERIOR COURT OF THE STATE OF ARIZONA

IN AND FOR THE COUNTY OF MARICOPA

JOYCE DEFREN, a single woman,

Plaintiff,

v.

TRIMARK HOMES, INC., an Arizona corporation, and TRIMARK BENNETT ESTATES, L.L.C., an Arizona limited liability company,

Defendants.

Case No. CV2001-005145

COMPLAINT

(Contract)

Attorneys and Counselors
14646 North Kierland Boulevard, Suite 255
Scottsdale, AZ 85254-3457
Telephone (480) 991-9077

Plaintiff, JOYCE DEFREN, by and through undersigned counsel, for her Complaint against Defendants, alleges as follows:

ALLEGATIONS COMMON TO ALL CAUSES OF ACTION

1. Plaintiff is a resident of the State of Arizona and, at all times relevant to this complaint, has resided in Maricopa County.

2. Defendant Trimark Homes, Inc., is, and at all times material to this complaint was, a corporation organized under the laws of the State of Arizona.

3. Defendant Trimark Bennett Estates, L.L.C., is, and at all times material to this complaint was, a limited liability company organized under the laws of the State of Arizona.

4. On information and belief, Defendants Trimark Homes, Inc. and Trimark Bennett Estates, L.L.C., (hereinafter collectively "Trimark") are, and at all times material to this complaint were, engaged in the business of constructing and selling single-family homes in Maricopa County, Arizona.

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5. All events complained of herein occurred in Maricopa County.

6. This Court has jurisdiction over this action pursuant to A.R.S. § 12-123, and venue properly lies in this Court pursuant to A.R.S. § 12-401.

7. On or about August 31, 1999, Plaintiff entered into a "Purchase Contract" for the construction of a home by Trimark at lot 12 of the Sonoran Hills subdivision in Scottsdale (hereinafter the "Residence"). A true and correct copy of the "Purchase Contract" is attached hereto as Exhibit 1 and incorporated herein by reference.

8. The Residence was constructed by Trimark and escrow closed on January 22, 2001, with Plaintiff taking possession of and title to the home that day.

9. Immediately after moving into the Residence, Plaintiff detected the presence of a chemical odor emanating from all of the home's interior faucets whenever those faucets were used. That chemical odor was also detected when the rear hose faucet was used.

10. Analytical results of the water collected from Plaintiff's faucets indicate the water is contaminated with unsafe concentrations of benzene, methylindane, brominated indanol, epoxide and other deleterious chemicals.

11. Plaintiff and her teenage daughter have been diagnosed with chemical poisoning and have been directed by their joint physician to vacate the house.

12. The presence of the aforementioned chemicals have rendered the water in Plaintiff's home unfit for consumption, cooking and bathing.

13. All attempts by Defendants to identify the source of the chemicals and to rid the home of the same have been unsuccessful.

14. The inability of the home's plumbing system to deliver potable water, free of deleterious chemicals, has rendered the Residence defective and uninhabitable.

COUNT I

[Breach of Contract]

15. Plaintiff incorporates and re-alleges each and every allegation contained in paragraphs 1 through 14 as if fully set forth herein.

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16. Defendants have breached the "Purchase Contract" by delivering a home to Plaintiff that is defective and uninhabitable.

17. Further, Defendants failed to satisfy its obligation to construct Plaintiff's home to a standard of quality equal to the quality of its model homes and/or standards of the home building industry as regulated by the Registrar of Contractors as provided in paragraph 13(c) of the Purchase Contract.

18. By virtue of this breach, Plaintiff is entitled to recover from Defendants damages in an amount to be proven at trial.

19. Since this matter arises out of contract, Plaintiff is entitled to her costs and attorneys' fees pursuant to A.R.S. § 12-341.01, or otherwise.

20. Further, pursuant to Rule 55(b)(1), Arizona Rules of Civil Procedure, in the event judgment by default is rendered in Plaintiffs' favor, Plaintiff seek reasonable attorneys' fees in the amount of not less than $2,500.00.

WHEREFORE, Plaintiff prays for judgment against Defendants as follows:

A. For compensatory, incidental and consequential damages in an amount to be proven at trial, with interest on the foregoing amounts until paid in full;

B. For her costs and reasonable attorneys' fees incurred herein, with interest on the foregoing amounts until paid in full; and

C. For such further relief as the Court may deem just and proper under the circumstances.

COUNT II

[Breach of Express Warranty]

21. Plaintiff incorporates and re-alleges each and every allegation contained in paragraphs 1 through 20 as if fully set forth herein.

22. In connection with Defendants' construction and sale of the subject house to Plaintiff, Defendants warranted in paragraph 13(c) of the Purchase Contract that the house would

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be constructed to a quality of construction equal to the quality of its model homes and/or standards of the home building industry as regulated by the Registrar of Contractors.

23. Defendants have breached its express warranty as the construction quality of Plaintiff's home is not equal to the quality of its model homes and/or standards of the home building industry as regulated by the Registrar of Contractors.

24. The house constructed for and sold to Plaintiff is defective, uninhabitable and in violation of the Defendants' express warranty.

25. By virtue of this warranty breach, Plaintiff is entitled to recover from Defendants damages in an amount to be proven at trial.

26. Since this matter arises out of contract, Plaintiff is entitled to her costs and attorneys' fees pursuant to A.R.S. § 12-341.01 or otherwise.

27. Further, pursuant to Rule 55(b)(1), Arizona Rules of Civil Procedure, in the event judgment by default is rendered in Plaintiff's favor, Plaintiff seeks reasonable attorneys' fees in the amount of not less than $2,500.00.

WHEREFORE, Plaintiff prays for judgment against Defendants as follows:

A. For compensatory, incidental and consequential damages in an amount to be proven at trial, with interest on the foregoing amounts until paid in full;

B. For her costs and reasonable attorneys' fees incurred herein, with interest on the foregoing amounts until paid in full; and

C. For such further relief as the Court may deem just and proper under the circumstances.

COUNT III

[Breach of the Implied Covenant of Good Faith and Fair Dealing]

28. Plaintiff incorporates and re-alleges each and every allegation contained in paragraphs 1 through 27 as if fully set forth herein.

29. Under Arizona law, there is an implied covenant of good faith and fair dealing by each and every party to a contract.

30. Defendants have breached the implied covenant of good faith and fair dealing by delivering to Plaintiff a home that defective and uninhabitable.

31. By virtue of this breach, Plaintiff is entitled to recover from Defendants, and each of them, damages in an amount to be proven at trial.

32. Since this matter arises out of contract, Plaintiff is entitled to her costs and attorneys' fees pursuant to A.R.S. § 12-341.01 or otherwise.

33. Further, pursuant to Rule 55(b)(1), Arizona Rules of Civil Procedure, in the event judgment by default is rendered in Plaintiff's favor, Plaintiff seeks reasonable attorneys' fees in the amount of not less than $2,500.00.

WHEREFORE, Plaintiff prays for judgment against Defendants as follows:

A. For compensatory, incidental and consequential damages in an amount to be proven at trial, with interest on the foregoing amounts until paid in full;

B. For her costs and reasonable attorneys' fees incurred herein, with interest on the foregoing amounts until paid in full; and

C. For such further relief as the Court may deem just and proper under the circumstances.

COUNT IV

[Breach of Implied Warranties]

34. Plaintiff incorporates and re-alleges each and every allegation contained in paragraphs 1 through 33 as if fully set forth herein.

35. Under Arizona law, a home builder/seller impliedly warrants that its homes are fit for habitation and are constructed in a workmanlike manner.

36. The homes constructed and sold by Defendants are impliedly warranted to be habitable and constructed in a workmanlike manner.

37. Because the house Defendants constructed and sold to Plaintiff is defective and uninhabitable, Defendants have breached its implied warranties of habitability and workmanlike construction.

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38. By virtue of this breach, Plaintiff is entitled to recover from Defendants, and each of them, damages in an amount to be proven at trial.

39. Since this matter arises out of contract, Plaintiff is entitled to her costs and attorneys' fees pursuant to A.R.S. § 12-341.01 or otherwise.

40. Further, pursuant to Rule 55(b)(1), Arizona Rules of Civil Procedure, in the event judgment by default is rendered in Plaintiff's favor, Plaintiff seeks reasonable attorneys' fees in the amount of not less than $2,500.00.

WHEREFORE, Plaintiff prays for judgment against Defendants as follows:

A. For compensatory, incidental and consequential damages in an amount to be proven at trial, with interest on the foregoing amounts until paid in full;

B. For her costs and reasonable attorneys' fees incurred herein, with interest on the foregoing amounts until paid in full; and

C. For such further relief as the Court may deem just and proper under the circumstances.

COUNT V

[Consumer Fraud]

41. Plaintiff incorporates and re-alleges each and every allegation contained in paragraphs 1 through 40 as if fully set forth herein.

42. A.R.S. § 44-1522 proscribes the use of false, fraudulent, misleading, or deceptive practices in advertising and selling merchandise.

43. In connection with Defendants' sale of its home to Plaintiff, Defendants impliedly and expressly promised and represented to Plaintiff that it would construct and deliver to her a home that was non-defective and habitable.

44. Defendants made the aforementioned promises and representations with the intention that Plaintiff rely on the same, Plaintiff did rely on those promises and representations, and as a consequence Plaintiff has suffered damages by virtue of receiving a home that is defective and uninhabitable from Defendants.

45. By virtue of Defendants' unlawful practices, Plaintiffs are entitled to recover from Defendants damages in an amount to be proven at trial.

46. Further, since Defendants have acted in a wanton and reckless fashion, demonstrating ill will, spite and reckless indifference to Plaintiff's interests and health and safety, Plaintiff is entitled to punitive damages from Defendants.

47. Further, pursuant to Rule 55(b)(1), Arizona Rules of Civil Procedure, in the event judgment by default is rendered in Plaintiffs' favor, Plaintiffs seek reasonable attorneys' fees in the amount of not less than $2,500.00.

WHEREFORE, Plaintiffs pray for judgment against Defendants as follows:

A. For compensatory, incidental and consequential damages in an amount to be proven at trial, with interest on the foregoing amounts until paid in full;

B. For punitive damages in an amount sufficient to deter Defendants and others contemplating a similar course of conduct from engaging in such deceptive practices, with interest on the foregoing amounts until paid in full;

C. For their costs and reasonable attorneys' fees incurred herein, with interest on the foregoing amounts until paid in full; and

D. For such further relief as the Court may deem just and proper under the circumstances.

COUNT VII

[Rescission]

48. Plaintiff incorporates and re-alleges each and every allegation contained in paragraphs 1through 47 as if fully set forth herein.

49. Under Arizona law, where there is a substantial failure of consideration, the party denied the benefit of the consideration it bargained for is entitled to rescind the contract.

50. The house Plaintiff purchased from Defendants is defective and is uninhabitable, denying her the consideration for which she bargained.

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51. Based on the foregoing, Plaintiff is entitled to rescind her contract with Defendants.

52. In addition to having the purchase price of the house restored to her, Plaintiff is entitled to recover incidental and consequential damages in an amount to be proven at trial from Defendants.

53. Since this matter arises out of contract, Plaintiff is entitled to her costs and attorneys' fees pursuant to A.R.S. § 12-341.01 or otherwise.

54. Further, pursuant to Rule 55(b)(1), Arizona Rules of Civil Procedure, in the event judgment by default is rendered in Plaintiff's favor, Plaintiff seeks reasonable attorneys' fees in the amount of not less than $2,500.00.

WHEREFORE, Plaintiff prays for judgment against Defendants as follows:

A. Restoration to Plaintiff of the full purchase price of the defective house, with interest on the foregoing amount until paid in full;

B. For incidental and consequential damages in an amount to be proven at trial, with interest on the foregoing amounts until paid in full;

C. For her costs and reasonable attorneys' fees incurred herein, with interest on the foregoing amounts until paid in full; and

D. For such further relief as the Court may deem just and proper under the circumstances.

RESPECTFULLY SUBMITTED this 26 day of March 2001.

PESKIND HYMSON & GOLDSTEIN, P.C.

By _____

E.J. Peskind, Esq.
Stephen L. Wetherell, Esq.
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VERIFICATION

STATE OF ARIZONA)
) ss.
County of Maricopa)

Joyce DeFren, being first duly sworn upon her oath, deposes and states as follows:

1. I am the plaintiff in this action and am authorized to make this Affidavit.

2. I have read the foregoing Complaint and know the contents thereof, and verify that the allegations and information contained therein are true to the best of my knowledge, information and belief.

By Joyce DeFren
Joyce DeFren

SUBSCRIBED AND SWORN to before me this 26th day of March, 2001 by Joyce DeFren.

[illegible] My Comm. Expires May 7, 2004

Notary Public

EXHIBIT "1"

SONORAN HILLS
Parcel A

PURCHASE CONTRACT, RECEIPT AND ESCROW INSTRUCTIONS

SELLER: Trimark Bennett L.L.C.
Address: 1733 N. Greenfield #101
Mesa, AZ 85202
Telephone: (602) 854-3818
BUYER: Joyce DeFeen or nominee
as _____ joint tenancy; _____ community property; _____
tenants in common; _____ sole and separate property; _____
community property with right of survivorship; _____
Address: 9796 E Cochise Dr
Scottsdale, AZ 85258
Telephone: 602 451-0957
ESCROW AGENT: Security Title Agency
Escrow Officer: Lisa Ludwig Escrow No.: _____

PROPERTY: Lot 12, SONORAN HILLS, PARCEL B, a subdivision according to the plat recorded in Book 433 of Maps, page 40 records of Maricopa County, Arizona, together with a single family home (the "Home") to be constructed on such lot. The Home shall be Seller's model 2000 Elevation A, Garage _____. The Lot and the Home shall hereafter be collectively referred to as the "Property".

OWNERS ASSOCIATION: Upon recordation of the deed from Seller to Buyer for the Lot, Buyer automatically will become a member of Sonoran Foothills Master Community Home Owners Association (the "Association") and shall be subject to the terms of the Declaration of Covenants, Conditions and Restrictions for Sonoran Hills, recorded as Instrument No. 2001764501, records of Maricopa County, Arizona, as the same has been or may be amended from time to time (the "Declaration") and the Articles of Incorporation, By-Laws, Rules and Regulations of the Association. The current periodic assessment levied by the Association for lots within the subdivision is $ 35 per month.

1. AGREEMENT. Seller agrees to sell and Buyer agrees to buy the Property on the terms and conditions set forth in this Agreement.

2. OPENING DATE. The Opening Date shall be the date of deposit of a fully executed copy of this Agreement and the initial earnest money deposit, as identified in 4a below, with Escrow Agent. Escrow Agent shall notify Buyer and Seller in writing of the Opening Date.

3. CLOSING DATE. The Closing Date shall be within ten (10) calendar days after substantial completion of the Home and issuance of a Certificate of Occupancy by the City of Scottsdale stating that construction of the Home has been substantially completed in accordance with the Plans and Specifications on file at the Seller's office. The Certificate of Occupancy shall be conclusive evidence that construction has been substantially completed and that Seller has substantially fulfilled its commitments under this Agreement as to construction of the Home and other improvements (except as to "punch-list" items). The Final Home Delivery / Punch List, prepared by the Contractor, shall be binding on Buyer and Seller for all purposes. At closing, if the Final Home Delivery / Punch List still has items to be completed, an amount equal to 150% of the dollar amount identified as the cost to complete the "Punch-List" items shall be impounded by Escrow Agent until Escrow Agent receives a Supplemental Certificate from the Contractor stating that the "Punch-List" items have been fully completed and at such time the impounded funds shall be released to Seller. If the "Punch-List" items have not been completed within thirty (30) days after the Closing Date, the impounded funds shall be delivered to Buyer and shall be applied to the actual costs of completing the "Punch-List" items, with any excess remaining being delivered to Seller.

BASE PRICE: $ 372,900
LOT PREMIUM: $ 0
UPGRADES/OPTIONS: $ to Be determined
TOTAL SALES PRICE: $ 372,900
payable as follows:

(a) See addendum
earnest money payment to be paid in cash or by personal check or cashier's check at the time Buyer executes this Agreement. The earnest money shall be deposited in escrow.

(b) See addendum
as an additional earnest money payment to be paid in cash or by cashier's check upon completion and inspection by the City of Scottsdale of the concrete house foundation (Foundation Inspection).

(c) to Be determined
as additional earnest money payment to be paid in cash or by cashier's check for all upgrades and options selected by Buyer as shown on the Schedule "A" portion of this contract. This amount is to be paid at time of 4b payment mentioned above.

(d) See addendum
as additional earnest money payment to be paid in cash or by cashier's check upon completion and inspection, by the City of Scottsdale, of the rough house framing (Framing Inspection).

(e) to Be determined
as a Loan amount according to the provisions of Paragraph 9.

(f) to Be determined
as an additional payment to be made in cash or by cashier's check on or before the close of escrow, such payment to be deposited in escrow.

(g) All payments shall be by personal check or by cash, or by cashier's check payable to Escrow Agent, or by wire-transferred funds.

(h) Upon loan approval and the removal of all Buyer and Seller contingencies as identified in Section 23, the initial earnest money deposit and additional earnest money payments described in 4a, 4b, 4c, and 4d above shall become non-refundable and be released to Seller.

(i) BUYER IS ADVISED AND UNDERSTANDS THAT THE EARNEST MONEY DEPOSIT, DOWN PAYMENTS AS SHOWN IN 4(a), 4(b), 4(c), AND 4(d) ABOVE AND OTHER ADVANCED MONIES WILL BE RELEASED TO SELLER IN ACCORDANCE WITH 4(h) ABOVE. SUCH MONIES WILL BE PAID TO SELLER AND MAY BE USED BY SELLER. THIS MEANS BUYER ASSUMES THE RISK OF LOSING SUCH MONIES IF SELLER IS UNABLE OR UNWILLING TO PERFORM UNDER THE TERMS OF THIS CONTRACT.

JD Initial _____ Initial

5. PRELIMINARY TITLE REPORT.

(a) Promptly following the Opening Date, Escrow Agent shall deliver a current Preliminary Title Report (the "Report") on the Property to Buyer and Seller and shall be accompanied by legible copies of all documents referred to in the Report.

(b) Buyer shall have ten (10) days (the "Review Period") following receipt of the Report in which to review and to give Seller and Escrow Agent written notice of any title exception which is unacceptable to Buyer, in Buyer's reasonable judgment. If Buyer gives notice of dissatisfaction as to any exception to title as shown in the Report, Seller shall have until the close of escrow to eliminate the disapproved exceptions from the Report; provided that Seller may notify Buyer in writing of its decision not to eliminate the disapproved exceptions and within ten (10) days following Buyer's receipt of Seller's notice, Buyer shall either

(i) waive the disapproved exceptions by written notice to Seller and purchase the Property as provided in this Agreement, or

(ii) this Agreement shall be deemed canceled and of no further force and effect at 5:00 p.m. of such tenth (10th) day. If Seller does not eliminate those exceptions on or before the close of escrow (or notify Buyer of its decision not to do so as herein provided), it being understood and agree, however, that Seller shall have no duty whatsoever to eliminate or secure a title endorsement against any such exception. Buyer's sole and exclusive remedy shall be to cancel this Agreement by giving written notice of Cancellation to Seller and Escrow Agent on or before the close of escrow.

(c) Buyer's failure to disapprove any exceptions or to specify its objections to the contents of the Report during the Review Period shall be deemed an acceptance of title as described in the Report and a waiver of Buyer's right to cancel this Agreement according to this Paragraph.

(d) Upon any cancellation in accordance with this Paragraph, the amounts paid into Escrow by Buyer and/or Buyer's lender and all documents deposited in escrow by Buyer and Seller shall be returned to such parties and this Agreement shall terminate.

6. CONVEYANCE. At the close of escrow, Seller shall convey title to the Property to Buyer by a special warranty deed, subject to current taxes and assessments, reservations in patents, all easements, rights of way, encumbrances, liens, covenants, conditions, restrictions, obligations and liabilities as may appear of record and all matters which an accurate survey of the Property or a physical inspection of the Property would disclose.

7. TITLE INSURANCE. At the close of escrow, Seller shall provide Buyer with a standard coverage owner's policy of title insurance in the full amount of the sales price, effective at the close of escrow, insuring Buyer that fee simple title to the Property in vested in Buyer, subject only to the usual printed exceptions contained in such title insurance policies, to the matters approved by Buyer as provided in Paragraph 5 of this Agreement.

to Buyer's Deed of Trust as described in Paragr 9. if applicable, and to any other matters approved in writing by Buyer.

8. CLOSING COSTS.

(a) Upon the close of escrow, Buyer and Seller each agree to pay one-half (1/2) of the escrow charges.

(b) Seller agrees to pay the entire cost of the standard coverage owner's policy of title insurance.

(c) Real estate taxes, homeowner's association assessments, either existing or imposed, improvement liens and other special assessments shall be prorated in the escrow as of the close of escrow based on the latest available information. Any other closing costs shall be paid by Buyer and Seller according to the usual and customary practice.

(d) Seller agrees that all closing costs and any commissions payable by Seller shall be deducted from Seller's proceeds at the close of escrow. On or before the close of escrow, Buyer agrees to deposit with Escrow Agent cash in an amount sufficient to pay all closing costs payable by Buyer.

9. FINANCING. If any part of the purchase price for the Property is to be paid from the proceeds of a loan, within five (5) days following execution of this Contract by Buyer, Buyer shall make application for and use its best efforts to obtain a loan from a lender (to be approved in writing by Seller). Within three (3) business days of being requested to do so, Buyer shall furnish all information and truthfully and diligently make, execute and complete all documents which any lender may request for the prompt processing and timely funding of any loan applied for. Buyer shall notify Seller within three (3) days from the date that any loan applied for by Buyer is accepted, rejected or modified. If Buyer is approved for a loan in an amount less than that applied for, the difference shall be deposited by Buyer with Seller within five (5) business days after notification of the lender's approval for such lesser amount. If (i) Buyer is rejected for a loan by any lender to whom the Buyer has made a loan application or (ii) Buyer's loan application has not been approved within thirty (30) days from the date of Seller's acceptance of this Contract, or (iii) loan approval is subject to conditions that are unacceptable to Seller, in its sole discretion, Seller may cancel this Contract, and if Buyer has fully complied in good faith with its obligation under this Paragraph and has done nothing to delay or hinder loan approval, Buyer may cancel this Contract. In the event of such cancellation, Seller shall refund to Buyer all sums received from Buyer pursuant to this contract except for $500.00 plus the costs of all extras which have been purchased or ordered by Seller and all architectural and engineering fees and costs incurred by Seller in revising Seller's standard plans and initial site plan layout to accommodate changes requested by Buyer, which amounts Seller shall be entitled to retain as reimbursement and compensation for administering this Contract, installing or purchasing extras, customizing a residence for Buyer, canceling escrow and taking the Property off the market. Notwithstanding the foregoing, if Buyer requests in writing that Seller commence construction of the Residence prior to Buyer's qualification for financing, and if Buyer provides evidence satisfactory to Seller, in Seller's sole discretion, that Buyer possesses sufficient and available funds to pay the amounts due under this Contract, and if Seller so agrees, this financing contingency shall be deemed waived. Buyer shall be responsible for and shall pay all points, appraisal, credit reports or other fees, interest and other costs in connection with any loan applied for, whether or not this transaction is completed. The interest rate and fees for any loan applied for by Buyer are matters of concern solely between Buyer and Lender and shall not in any way affect the rights or obligations of the parties hereto. Seller has not agreed to provide a loan to Buyer nor has Seller guaranteed the availability of a loan or any particular loan terms. Seller shall not be responsible for the representations, actions, or omissions made by any lender.

10. MECHANICS' AND MATERIALMEN'S LIENS. Seller shall pay all construction costs to construct the Home in accordance with the Plans and Specifications and shall indemnify and hold Buyer and Escrow Agent harmless from any and all claims of liens for materials or labor supplied to the Property other than claims and liens of contractors, other than Seller, who have contracted directly with Buyer to provide labor or materials to the Property and other than claims and liens relating to materials and labor supplied to the Property following the Closing Date by persons, other than Seller.

11. POSSESSION. Seller agrees that it will deliver possession of the Property to Buyer on the Closing Date. Prior to the Closing Date, Buyer may, from time to time and only with reasonable notice to Seller, enter upon the Property with its representatives and agents to examine the Property and the Home, provided such activities do not interfere with the activities of Seller on the Property. This may only occur Monday through Friday with Seller's Representative. Buyer agrees to indemnify and hold Seller harmless from any injury, liability, costs, or expense to person or property arising out of Buyer's exercise of the rights granted pursuant to this Paragraph and this indemnity shall survive the Closing Date. This hold harmless clause shall govern irrespective of Seller's negligence. Buyer understands and acknowledges that Buyer hereby waives any and all claims against Seller for injury, liability, costs, or expense to person or property arising from inspections during construction.

12. ESCROW.

(a) An escrow for this transaction shall be established with Escrow Agent and Escrow Agent is hereby employed to handle the escrow. This Agreement shall constitute escrow instructions and a copy shall be deposited with Escrow Agent for this purpose. Should Escrow Agent require the execution of its standard form printed escrow instructions, Buyer and Seller agree to execute same; however, such instruction shall be construed as applying only to Escrow Agent's employment, and if there are conflicts between the terms of this Agreement and the ter the printed escrow instruction, the terms of this agreement shall control.

(b) Buyer and Seller further agree that:

(i) They will indemnify and save harmless Escrow Agent from all reasonable costs, damages, attorneys' fees and expense, which it may incur or sustain in connection with these instructions, except as caused by the negligence or fault of Escrow Agent or a breach by Escrow Agent of its duties under this Agreement or law.

(ii) They authorize Escrow Agent in the event of any conflicting demands made upon it concerning these instructions, or this escrow at this election, to hold any money and documents deposited hereunder until it receives mutual instructions by all parties or until a civil action shall have been finally concluded in a court of competent jurisdiction determining the rights of all parties. In the alternative, Escrow Agent may, at its discretion, at any time commence a civil action to interplead any conflicting demands to a court of competent jurisdiction to determine its rights of the parties to this escrow. In accordance with subparagraph (b) (i) above, the parties will pay to Escrow Agent its expenses and attorneys' fees sustained in connection with the civil action and any appeal to determine its rights and the rights of the parties to this escrow.

(c) If the escrow fails to close because of Seller's default, Seller shall be liable for all escrow cancellation charges. If the escrow fails to close because of Buyer's default or because Buyer is unable to obtain a loan as provided in Paragraph 9 above, Buyer shall be liable for all escrow cancellation charges. If the escrow fails to close for any other reason, Seller and Buyer shall each be liable for one half (1/2) of all escrow cancellation charges.

13. CONSTRUCTION OF HOME. Seller will cause the Contractor to construct the Home on the Property in accordance with the terms and conditions of this Agreement.

(a) Starting and Completion Dates. Construction of Home shall, unless otherwise agreed in writing, begin upon the last to occur of the following:

(i) Seller's receipt of a building permit;

(ii) if Buyer has applied for a loan, upon Buyer's receipt of the Loan and delivery of evidence of the Loan to Seller.

(iii) Buyer's approval of the title matters disclosed in the Report as provided in Paragraph 5 above. Subject to the provisions of subparagraph (g) below, Seller shall proceed with due diligence to substantially complete the Home no later than To Be determined

(b) Plans and Specification.

The Contractor shall have the right to make changes in the nature of the work to be performed under the Plans and Specifications which he determines to be necessary and appropriate to complete the Home substantially in accordance with the Plans and Specifications. Such discretionary changes may include adjustments in measurements, materials and structural changes provided any changes of materials or methods do not materially and substantially alter the quality, grade, structural soundness or aesthetics of the Home.

(c) Quality of Construction. Seller is only obligated to construct a home for the Buyer which equals the quality of construction on display at the model homes and/or to the standards of the home building industry as regulated by the State Registrar of Contractors.

(d) Insulation Quality. Insulation will be installed in the Residence as follows where construction allows:

(i) walls separating refrigerated areas from non-refrigerated areas; Type: wall constructed with 2 x 4 framing will have fiberglass batts; thickness 3 inches; R-Value: 13. Wall constructed with 2 x 6 framing will have fiberglass batts; thickness 6 inches; R-Value: 19;

(ii) ceiling (except over garage or unrefrigerated storage areas); Type: cellulose or fiberglass batts; thickness: 10-12 inches; R-Value: 30.

All thickness and R-values are approximate and R-values do not include the R-value of other wall or ceiling materials. Notwithstanding the foregoing, insulation may be of lesser thickness and R-value than indicated in certain areas where the design of the Residence does not permit greater thickness. Examples of locations where thickness and R-values may vary include locations where studs are placed in walls, at corners and windows and where roof trusses attach to outside walls. The R-values are based on the representation of the manufacturer and/or installer of the insulation and Seller does not warrant or represent that these R-values are correct. Seller has the right to make substitutions as to the type, thickness and R-value of insulation installed in the Residence without obtaining the consent of Buyer, as long as there are no substantial changes in the R-value of the insulation installed in a substantial portion of the Residence.

(e) Responsibility of Buyer.

(i) Communication with Seller. Buyer will issue all communications concerning the work to be performed under this Agreement directly to Seller. Buyer shall not impede or endeavor to supervise the construction work to be performed under or arising out of this Agreement. Buyer agrees not to effect any changes in the work of any of Seller's agents, employees or subcontractors, including Contractor. All changes desired by Buyer shall be made by agreement with Seller and in accordance with the provisions for change orders provided in subparagraph (f) below.

(ii) Selection items. Buyer agrees to make timely selections of all colors, tile, counter tops, cabinets, plumbing fixtures, hardware, carpeting, floor covering, lighting and other electrical fixtures, and all other materials, fixtures or other items of whatever nature which Buyer shall be entitled to select, approve or have an "allowance" for. In the event Buyer fails to select or approve such Selection Items within twenty-one (21) calendar days of the escrow opening date, Seller shall be free to make selections of such items for and on behalf of Buyer. If Seller makes such selections after this twenty-one (21) day period has expired, Seller's selections shall be final and accepted by Buyer and Buyer shall be without

recourse against Seller for such selections. I event Buyer elects to change his designation of any Selection Items (or any that were selected for him by Seller) subsequent to their purchase or installation, it is agreed and understood such changes will be made at Buyer's expense in accordance with the change order provisions of subparagraph (f). Seller may require Buyer to pay the estimated amount of such additional cost before commencing installation of any changed Selection Items.

(f) Seller Responsibilities.

(i) Supervision. Seller, in constructing the Home and related improvements, is not the agent of Buyer. Seller shall be responsible for all construction under this Agreement, including the techniques, sequences, procedures, method and means and for coordination of all work.

(ii) Compliance with Laws. Seller shall comply in all material respects with all laws and ordinances, and the rules, regulations, or orders of all public authorities (the "Requirements") relating to construction of the Home. If any of the Plans and Specifications are at variance with such Requirements, Seller shall notify Buyer promptly on discovery of such variance and enter into such change orders as may be necessary to comply with the applicable Requirement. Buyer shall pay any additional costs attributable to such change orders.

(g) Insurance

(i) Seller's Liability Insurance. Seller shall acquire and keep in force at its own expense during the entire period of construction of the Home such liability insurance and will protect it from claims under workmens' compensation and other employee benefit laws, for bodily injury and death, and for property damage, that may arise out of work performed under this agreement, whether directly or indirectly by Seller, Contractor or by a subcontractor. Such insurance shall include contractual liability insurance applicable to Seller's obligations under this Agreement. Seller shall provide proof of such insurance to Buyer upon written request.

(ii) Property Damage Insurance. Seller shall maintain at its expense during construction of the home, property damage insurance on the property to its full insurable value, against fire, vandalism and other perils ordinarily included in extended coverage. Seller shall provide proof of such insurance to Buyer upon written request.

(h) Work Changes.

(i) The parties agree that once they have started construction, Seller shall have no obligation to make changes in the work to be performed. The parties may nevertheless mutually agree to changes in the nature of additions, deletions or other modifications in the work to be performed pursuant to the Plans and Specifications.

(ii) All change orders shall be in writing and signed by both parties specifying the changes to be made and shall include conforming changes in the purchase price and the time for completion of construction. Work shall be changed and the purchase price and completion time shall be modified only if set out in written change order. Seller may require Buyer to pay any amounts by which the purchase price will be increased prior to commencing work pursuant to a change order.

(i) Extension of Time. If Seller is delayed at any time during the work to be performed under this Agreement such as changes ordered in the work, labor disputes, unusual delays in transportation, unavoidable casualties, unavailability of materials, labor, adverse weather conditions or other causes beyond his control, then the time for completion of construction shall be extended for such a reasonable time as is justified by the delays beyond the control of Seller.

(j) Disputes. All claims and disputes relating to construction of the home shall be subject to arbitration at the option of either Buyer or Seller in accordance with the arbitration rules of the American Arbitration Association for the construction industry. Any party electing to arbitrate a dispute shall file a written notice of demand for arbitration with the other party and with the American Arbitration Association.

. SELLER'S WARRANTIES

(a) Seller warrants to Buyer, that the home will be free from structural defects for a period of two years, and all non-structural components will be free from defects for a period of one year from the date of delivery of the deed to the Property and Home. Seller warrants that the Home has been situated on the Property and has been constructed in substantial compliance with the local building codes and the Plans and Specifications. The home shall include all the improvements and appurtenances set forth in the Plans and Specifications for the home. The structural warranty shall apply to any defect which may arise due to negligence on the part of Seller, Contractor or any of its agents, or from defective materials used in the construction of the home. THE WARRANTIES SHALL NOT APPLY TO ANY DEFECTS CAUSED BY, OR ARISING FROM, CLIMATIC CONDITIONS WHICH MAY AFFECT NORMAL CHARACTERISTICS OF CERTAIN BUILDING MATERIALS, EXPANSION, CONTRACTION, MOISTURE, HUMIDITY OR ANY CHANGE OR ALTERATION RESULTING FROM NEGLIGENCE, IMPROPER MAINTENANCE OR ABNORMAL USE OF THE HOME. NO OTHER WARRANTIES, EXPRESS OR IMPLIED, ARE GIVEN, INCLUDING, BUT NOT LIMITED TO, A WARRANTY OF FITNESS FOR HABITATION, QUALITY OR CONDITION, EXCEPT AS EXPRESSLY SET FORTH ABOVE.

(b) SELLER HEREBY LIMITS AND DISCLAIMS ANY WARRANTY ON TANGIBLE PERSONAL (SUCH AS AIR CONDITIONERS, FURNACES, WATER HEATERS, REFRIGERATORS, PLUMBING FIXTURES AND OTHER APPLIANCES THAT ARE CONSIDERED CONSUMER PRODUCTS IF IT MAY BE INCLUDED IN THE SALE. SELLER DOES NOT WARRANTY THESE TYPES OF PERSONAL PROPERTY FOR ANY OR FITNESS FOR USE, WORKMANSHIP, QUALITY OR ANY OTHER PURPOSE. THIS LIMITED WARRANTY AND DISCLAIMER DOES NOT AFFECT THE WARRANTIES, IF ANY, MADE BY THE MANUFACTURERS OF SUCH PERSONAL PROPERTY. SELLER WILL ASSIGN ANY ASSIGNABLE MANUFACTURER'S WARRANTIES TO BUYER ON THE CLOSING DATE.

(c) Seller reserves the right to make repairs or correct any defects for which it is responsible according to the terms stipulated in this Paragraph, at the time and in the manner deemed most advisable by Seller. Seller shall have no duty to make any corrections or repairs pursuant to this Paragraph until after Seller has received written notice from Buyer that such corrections or repairs need to be made. So long as Seller promptly undertakes any corrections and repairs required hereunder, the parties agree that the full extent of Seller's Liability under the warranties contained in this Paragraph shall be the cost to correct the defect and to restore the Home to comply with the Plans and Specifications (except as then required by governmental laws or regulations).

BUYER UNDERSTANDS AND ACCEPTS ALL WARRANTIES AND RECOGNIZES THE EXTENT AND LIMITATIONS OF SELLER'S LIABILITIES AS EXPRESSED IN THIS PARAGRAPH.

15. NO ASSIGNMENT: BINDING EFFECT. Buyer may not assign or otherwise transfer its rights under this Agreement without prior written consent of Seller, which consent may be given or withheld at Seller's sole discretion. Except as limited by the preceding sentence, this Agreement is binding upon and shall insure to the benefit of the parties and respective successors and assigns.

16. ATTORNEY'S FEES. If any action is brought by either party in respect to its rights under this Agreement, the prevailing party shall be entitled to reasonable attorney's fees and court costs as determined by the court or arbitrator.

17. ADDITIONAL REPRESENTATIONS. Such indication shall be binding on Buyer. Buyer shall write in below any representations or promises which are not set out in this Contract, but which have been made by Seller or its purported agents or employees, and upon which Buyer is relying in making this purchase, and if there are none, Buyer shall so indicate.

18. CONSTRUCTION. This Agreement shall be construed according to Arizona law. Time is of the essence in this Agreement.

19. NOTICE. Notices shall be in writing and shall be given by personal delivery or by deposit in the United States mail, certified mail, return receipt requested, postdate prepaid, addressed to Seller and Buyer at the addresses set forth in this Agreement or at such other address as a party may designate in writing. The date notice is given shall be the date on which the notice is delivered, if notice is given by personal delivery, or the date of deposit in the mail, if the notice is sent through the United States mail. Notice shall be deemed to have been received on the date on which the notice is delivered, if notice is given by personal deliver, or three (3) days following such deposit in the mail, if notice is sent through the United States mail. A copy of any notice given to a party shall also be given to Escrow Agent.

20. SELLER'S REMEDIES. If Buyer fails to deposit the remainder of the sales price in the time and manner set forth in this Agreement or to perform when due and other act required by this Agreement, Seller may terminate this Agreement and the escrow, such termination to be effective immediately upon Seller giving written notice of termination to Buyer and Escrow Agent. Upon such termination, Seller shall be entitled to, and Escrow Agent shall deliver to Seller, all earnest money previously deposited in escrow as consideration for acceptance of this Agreement and for taking the Property off the market and not as a penalty. The taking and acceptance of the earnest money by Seller under this provision shall not in any way limit, impair or defeat the right of Seller to specifically enforce this Agreement or to seek and recover further damages, if any, on account of such failure; however, if Seller seeks and obtains specific performance or damages, any amount received by Seller under this Paragraph shall be applied towards the purchase price or damages, as applicable.

21. BUYER'S REMEDIES. Buyer may, on the fourteenth (14th) day following the date Buyer gives written notice to the Seller, and in addition to whatever other remedies are available to Buyer at law or in equity, including the right to have specific performance of this Agreement and the escrow, terminate this Agreement and the escrow, when Seller has materially defaulted in performance of any of the provisions herein, or failed to carry out the construction in accordance with the Plans and Specifications.

22. FURTHER DOCUMENTATION. Each party agrees in good faith to execute such further or additional documents as may be necessary or appropriate to fully carry out the intent and purpose of this Agreement.

23. TIME PERIODS. The time for performance of any obligation or taking any action under this Agreement shall be deemed to expire at 5:00 p.m. (MST) on the last day of the applicable time period provided for herein. If the time for the performance of any obligation under this Agreement expires on a Saturday, Sunday or legal holiday, the time for performance shall be extended to the next succeeding day which is not a Saturday, Sunday or legal holiday.

24. NO ORAL CHANGES OR REPRESENTATIONS.

(a) Seller wishes to avoid any misunderstanding concerning the purchase of the Property and it is the policy of Seller not to enter into any oral agreement with the buyer or to ask the Buyer to rely on any oral representations concerning the Property or the subdivision in which the

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property is located. The entire agreement bet... Buyer and Seller must be expressed in writing in this Contract, Schedule "A", or Addendum.

Continued on attached addendum.

(b) TO INDUCE SELLER TO ACCEPT THIS CONTRACT, BUYER ACKNOWLEDGES THAT THERE ARE NO UNDERSTANDINGS, REPRESENTATIONS OR PROMISES OF ANY KIND THAT HAVE BEEN MADE TO INDUCE THE EXECUTION OF THIS CONTRACT AND THAT THIS CONTRACT SETS FORTH IN FULL THE ENTIRE AGREEMENT BETWEEN THE PARTIES. BUYER FURTHER ACKNOWLEDGES THAT IT HAS NOT RELIED ON ANY ORAL AGREEMENT, STATEMENT, REPRESENTATION OR OTHER PROMISE THAT IS NOT EXPRESSED IN WRITING IN THIS CONTRACT. No salesman or broker has any authority to modify their terms hereof nor any authority to make any representation or agreement not contained in this Contract and no person on behalf of Seller is authorized to make any future oral agreement upon which Buyer may rely to cancel, change or modify any portion of this Contract. This Contract supersedes any and all prior understandings and agreements. This Contract may be amended or modified only by an agreement in writing signed by Buyer and Seller or Seller's authorized agent.

25. ENTRY ON PROPERTY. Seller's field construction personnel and contractors have no authority to make promises or waivers which are binding upon seller. Buyer agrees not to interfere with the work of such personnel and contractors. Buyer understands that construction sites within the subdivision can be dangerous and Seller discourages Buyer from visiting any such construction sites, including the Property. Buyer shall be responsible for all injury and damage to persons or property suffered by Buyer or Buyer's family members or guests who visit construction sites within the subdivision and Buyer shall indemnify, defend and hold Seller and its contractors harmless for, from and against any such injuries and damages and all costs and expenses related thereto, including attorneys' fees, or respective of Contractor's own negligence.

26. ENVIRONMENTAL NOTICE. SELLER MAKES NO WARRANTIES, EXPRESS OR IMPLIED, ABOUT THE EXISTING OR FUTURE SOIL OR ENVIRONMENTAL CONDITIONS ON OR ADJACENT TO THE LOT OR THE SUBDIVISION, INCLUDING POSSIBLE PRESENT OR FUTURE POLLUTION OF THE AIR, WATER OR SOIL FROM ANY SOURCES, INCLUDING BUT NOT LIMITED TO RADON GAS OR UNDERGROUND MIGRATION OR SEEPAGE OF HAZARDOUS SUBSTANCES OR OTHER POLLUTANTS. SELLER EXPRESSLY DISCLAIMS ANY LIABILITY FOR ANY TYPE OF DAMAGE, WHETHER DIRECT, INDIRECT OR CONSEQUENTIAL, WHICH THE LOT OR ITS INHABITANTS MAY SUFFER BECAUSE OF ANY EXISTING OR FUTURE ENVIRONMENTAL OR OTHER CONDITIONS (SUCH AS BUT NOT LIMITED TO POWER LINES OR RADON) AFFECTING SUCH INHABITANTS, THE LOT OR REAL PROPERTIES IN OR ADJACENT TO THE SUBDIVISION.

27. BROKERAGE DISCLOSURE. Seller hereby discloses that one or more of its principals may be licensed as a real estate broker/salesperson under the laws of the State of Arizona. Buyer acknowledges that the real estate sales agents marketing lots and residences for Seller at the Subdivision are acting solely as the agents of Seller. Seller does not utilize sub-agents; therefore, if Buyer has been shown the Lot by a real estate agent other than one of Seller's project agents, such real estate agent is the agent of Buyer and solely represents Buyer. Seller shall not pay any real estate broker or agent a real estate commission or any other compensation unless there is a written agreement signed by Seller and the real estate broker or agent detailing the amount of compensation to be paid, the conditions of payment and confirming that the real estate agent or broker is acting solely on behalf of Buyer and not as a sub-agent of Seller.

28. MISCELLANEOUS.

(a) If this Contract is signed by more than one Buyer, each Buyer shall be jointly and severally liable hereunder. The numbers and gender used herein shall be deemed to apply to such number and gender as the context requires.

(b) This Contract shall inure to the benefit of and shall be binding upon the parties, their heirs, personal representatives, successors and assigns, provided, however, whether this contract nor any rights hereunder may be assigned or transferred by Buyer prior to the Closing without the prior written consent of Seller, and any such prohibited assignment shall be void.

(c) Except as otherwise provided herein, no waiver in connection with this contract shall be effective unless it is in writing signed by the party against who enforcement of the waiver is sought. The waiver of a breach of any position of this Contract shall not constitute a waiver of the same or a different breach in the future.

(d) Time is of the essence with respect to the performance of all terms, conditions and provisions of this Contract.

(e) This Contract shall not be binding upon Seller until accepted by Seller and executed by Seller's authorized representative. Buyer's earnest money deposit is accepted subject to prior sale, and this Contract may be canceled by Seller in the event of prior sale.

(f) If prior to the Closing all or a substantial portion of the Residence shall be destroyed or materially damaged by fire or other casualty, either Buyer or Seller may cancel this Contract, in which event Buyer shall be entitled to a full refund of all amounts paid hereunder, unless Seller agrees to repair and complete construction no later than one hundred twenty (120) ... s after the date of fire or other casualty or twelve (12) months after commencement of construction, whichever is later, in which event this Contract shall remain in full force and effect.

(g) This Contract shall be governed and enforced under the laws of the State of Arizona.

(h) Within five (5) days after request therefore, Buyer and Seller shall execute and deliver any additional documents and provide any additional information required or reasonably requested by the other party, any lender or escrow agent in order to evidence or give effect to the provisions of this Contract, both prior to and following the Closing. If the parties cannot agree upon the terms and conditions of any documents to be executed which are not specifically agreed upon in this Contract, then Escrow Agent's standard form of that particular document shall be used.

29. ACKNOWLEDGMENTS AND RIGHTS OF BUYER.

(a) Buyer understands and accepts that (i) the as-built location of utility lines, utility improvements (such as but not limited to junction boxes, transformers or pedestals) and sewer taps, may vary from locations shown on plot or site layout plans, (ii) there may be minor encroachment by fences on either side of actual lot lines; (iii) future construction on or grading or excavation of the Property by buyer must comply with applicable drainage plans, and if not correctly engineered, could disrupt drainage and cause ponding or flooding; (iv) the character and uses of property surrounding and in the vicinity of the subdivision may change; (v) there may be deviations in the Residence from Seller's standard plans or model or spec homes located within the subdivision and from illustrations and designs shown in promotional materials; (vi) floor plans, maps, landscaping and elevation renderings included within information and promotional brochures may not have been drawn to scale and any square footage or dimensions shown in such materials are only approximations; (vii) some exterior and interior items shown in Seller's model and spec homes are upgrades over Seller's standard features and, unless included in Seller's Included Features list or Extras on Schedule A attached hereto, such upgraded items are not included in the purchase price; (viii) Seller reserves the right to make changes in the design of the subdivision and in the plans, specifications, materials, size and location of all subdivision improvements, including the homes to be built within the subdivision; (xi) Seller is not responsible for and does not warrant against concrete that cracks if over-watering by the Buyer near the concrete has created a condition of settlement; (x) Seller is not responsible for and does not warrant against cracks in ceramic tile installed over or near concrete floor expansion joints; and (xi) there may be minor variations from the Plans as to the location of the walls of the Residence. Seller disclaims and shall have no liability or responsibility in connection with the foregoing and Buyer hereby releases Seller from any and all responsibility, obligation or liability for the occurrence of any of the foregoing items.

(b)Buyer hereby acknowledges, certifies and affirms that prior to the execution hereof, Buyer has received (and has read and understood the provisions contained in the state of Arizona Department of Real Estate Public Report and copies of the Declaration and the Articles of Incorporation, Bylaws, Rules and Regulations of the Association.

THE BUYER MUST BE GIVEN A COPY OF THE PUBLIC REPORT OF THE ARIZONA DEPARTMENT OF REAL ESTATE PRIOR TO SIGNING THIS DOCUMENT.

OFFER

Buyer acknowledges having made a personal, on-site inspection of the property prior to signing this Agreement and offers and agrees to buy the Property upon the terms and conditions set forth in this Agreement.

Date: _____, 19 _____

"Buyer"

"Buyer"

ACCEPTANCE

Seller accepts Buyer's offer as stated in section 4 of the Contract above and agrees to sell the Property to Buyer and to construct a home on the property upon the terms and conditions set forth in this agreement.

Date: _____, 19 _____

"Seller"

ACCEPTANCE BY ESCROW AGENT

Escrow Agent accepts employment as Escrow Agent for this transaction according to the terms and conditions set forth in this Agreement.

Date _____, 19 _____

"Escrow Agent"

Broker hereby acknowledges receipt, subject to collection, of Buyer's First Earnest Money Deposit (4a) in the amount of $ _____ paid in cash _____, by personal check _____ or other (specify) _____.

Date _____, 19 _____

BROKER AND SALES PERSON APPROVAL

"Broker" "Salesperson"

SECURITY TITLE AGENCY

ESCROW CLOSING INSTRUCTIONS AND APPROVAL OF SETTLEMENT STATEMENT

Date: January 17, 2001 Escrow No: 43-43-02892-FC

The undersigned hereby employ Security Title Agency to act as Escrow Agent in closing the subject escrow. They instruct the Escrow Agent and agree as follows:

. Deposit of Documents & Funds. They will deliver to Escrow Agent all documents, pay to Escrow Agent all sums and do all things necessary to enable Escrow Agent to comply herewith and to record or deliver said documents; and they will pay to Escrow Agent all charges payable by them respectively.
. Payments by Escrow Agent. They instruct Escrow Agent to pay from any funds held by it for their respective credit all amounts necessary to procure documents and to pay on their behalf all charges and obligations payable by them respectively, in accordance with these instructions and the Settlement Statement, including dormant account maintenance fees under the Arizona Uniform Unclaimed Property Act.
. Recording & Disbursement. When these instructions have been complied with and the insurer is willing to issue the requested title insurance policy and when Escrow Agent's fees and charges have been paid, Escrow Agent shall file, record or deliver all documents and shall disburse all funds in accordance with these instructions and the Settlement Statement.
. Deposit & Clearance of Funds by Escrow Agent. They direct that all money be paid in United States dollars to Escrow Agent which upon receipt thereof shall deposit such funds in a non-interest bearing general escrow account in one or more financial institutions doing business in Arizona whose deposits are federally-insured. Disbursement of any funds may be made by checks of Escrow Agent. Escrow Agent shall be under no obligation to disburse any funds represented by check or draft, and no check or draft shall be deemed payment to Escrow Agent, until Escrow Agent is advised by the financial institution in which deposited that such check or draft has been honored, unless Escrow Agent specifically agrees in writing to accept liability for the sufficiency thereof. Escrow Agent is not liable for any loss or impairment of funds while those funds are in the course of collection or while those funds are on deposit in a financial institution if such loss or impairment results from the failure, insolvency or suspension of such financial institution. Escrow Agent may require cash, cashier's check, certified check or money order or may present a check for proper clearance prior to any disbursements. The failure of Escrow Agent to present a check for clearance prior to the close of escrow is not a waiver of Escrow Agent's right to be reimbursed for a dishonored item.
. Prorations & Adjustments. All prorations and adjustments unless otherwise indicated on the Settlement Statement are on the basis of a 30-day month. Real estate taxes are prorated on the basis of the current year if the taxes for the current year are available on the business day next preceding the close of escrow through the real estate tax reporting service used by Escrow Agent or if the parties have delivered to the Escrow Agent on or before the next business day preceding the close of escrow a copy of the current tax bill issued by the county treasurer. Escrow Agent is not liable in the event a subsequent tax bill is different from that used as a basis for tax proration. Furthermore, Escrow Agent is not liable, nor is it responsible, for making an adjustment in the escrow settlement, if the taxing authority after the close of escrow determines that additional taxes are due.
Insurance Other Than Title. If instructed, Escrow Agent is authorized to execute on their behalf form assignments of, or to order changes in, any insurance called for other than title insurance and to forward the policies to the insurer's agent with a request that the insurer consent to such transfer, attach a loss payable clause or other endorsement or make such other additions or corrections as may be required and that said agent thereafter return such policies to the parties entitled to them. The parties are responsible to determine that the premiums have been paid, that the insurance is in force or has been renewed, transferred, assigned or properly endorsed, that an existing policy has been cancelled or terminated or that the type and amount of any insurance coverage is appropriate or sufficient. Escrow Agent may rely on the insurance information furnished by the parties, is not liable for any inaccuracy thereof and is not obligated to inquire further.
Indemnity. They will pay all costs, damages, attorneys' fees, expenses and liabilities which Escrow Agent may incur or sustain in connection with these instructions, the escrow or any court action or dispute resolution procedure arising therefrom, including any legal action to enforce collection of its fees and charges, except as caused by the bad faith, willful misconduct or gross negligence of Escrow Agent.
Escrow Agent's Lien. They grant to Escrow Agent a lien upon all documents and money deposited and the right to reimburse itself for costs, damages, attorneys' fees, expenses and liabilities incurred or sustained in connection with these instructions or the escrow.
Affidavit of Real Property Value. The Escrow Agent is instructed to execute and file on their behalf the affidavit required by Section 11-1133 and 28-1137(B), Arizona Revised Statutes, using the sales price as the total consideration if at the time of filing the affidavit has not been executed by the parties..
. Professional Advice. The parties acknowledge that Escrow Agent has not given, and will not be requested or expected to give, financial, tax or legal advice, to give advice as to the type or form of instrument to be used in connection with this escrow, to review any documents deposited to determine the legality or sufficiency, to explain the meaning or legal consequences of any such document, to make any inquiry of any nature concerning the financial condition of the parties, the risks associated with the transaction, the value or condition of the real or personal property, to assist in the negotiating or structuring of the sale, to verify square footage or to determine possessory rights. As an accommodation Escrow Agent makes available to the parties certain standard forms of instruments that are commonly used in Arizona but does not, and will not, recommend or select a particular form and will not complete, fill in or alter any form unless specifically instructed to do so by the parties, their attorneys, representatives or agents who will designate the specific information to be inserted on the form or the specific source where such information can be found.
Excluded Matters. There are some matters which Escrow Agent will not investigate or determine and for which it assumes no liability, unless specifically instructed in writing to the contrary. Included are unrecorded liens, including mechanics' liens; proposed improvement district liens or assessments; homeowners association liens; personal property taxes or transfer of personal property; utility charges or deposits; boundary lines, location or condition of improvements; square footage; possessory rights, including delivery of possession; compliance with limitations on the use of property, such as, building and zoning ordinances or restrictions; taxes or assessments which are not shown as existing liens by the records of any taxing authority that levies taxes or assessments on real property as of the closing of this escrow or which were not disclosed to Escrow Agent; reservations or exceptions in patents; transfers or filings of water rights; treatment of wood infestation; premiums and assignability or effectiveness of fire, property, flood or casualty insurance policies; usury in any loan involved in the escrow; the availability of or charges for water, power and waste collection; compliance with or violation of any environmental law; the legal or tax consequences of vesting; and the sufficiency, or correctness as to form or manner of execution, of any document deposited by the parties, their agents or the lender or as to the identity, authority or right of any person executing the same.

UNDERSIGNED CERTIFY AS FOLLOWS:

1. THEY HAVE READ AND UNDERSTAND THESE INSTRUCTIONS AND ALL INSTRUMENTS BEARING THEIR SIGNATURES OR BESTOWING A BENEFIT IN THEM, INCLUDING ANY PROMISSORY NOTE IN THEIR FAVOR. THEY HAVE BEEN ADVISED OF THEIR RIGHT TO SEEK INDEPENDENT ADVICE BEFORE SIGNING THESE INSTRUCTIONS AND WERE GIVEN THE OPPORTUNITY TO ASK QUESTIONS OF THE ESCROW OFFICER ABOUT THESE INSTRUCTIONS AND THE SETTLEMENT STATEMENT.
2. THEY HAVE REVIEWED AND APPROVED THE SETTLEMENT STATEMENT DATED JANUARY _____, 2001 . TO THE BEST OF THEIR KNOWLEDGE AND BELIEF IT IS A TRUE AND ACCURATE STATEMENT OF ALL AUTHORIZED RECEIPTS AND DISBURSEMENTS MADE ON THEIR ACCOUNT OR BY THEM IN THIS TRANSACTION.
3. THEY UNDERSTAND THAT THEIR SIGNATURES ON THESE INSTRUCTIONS, ANY INSTRUMENTS AND THE SETTLEMENT STATEMENT SIGNIFY THEIR APPROVAL OF THE CONTENTS.
4. THEY UNDERSTAND THAT THE ESCROW AGENT IS RELYING UPON THIS CERTIFICATE IN CLOSING THE SUBJECT ESCROW. THEY AGREE THAT THE ESCROW AGENT WILL CONTINUE TO ACT PURSUANT TO THESE ESCROW INSTRUCTIONS UNLESS AND UNTIL SERVED WITH A WRITTEN NOTICE OF CANCELLATION THEREOF.

MARK BENNETT ESTATES, L.L.C., a Limited Liability Company

BY: _____
BRIAN K. HARDY, PRESIDENT

Joyce D. DeFren
JOYCE D. DEFREN

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MICHAEL K. JEANES, CLERK
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2002 APR 25 PM 12:59

SUPERIOR COURT OF ARIZONA

MARICOPA COUNTY

JOYCE DEFREN, a single woman,

Plaintiff,

vs.

TRIMARK HOMES, INC., an Arizona corporation; TRIMARK BENNETT ESTATES, L.L.C., an Arizona limited liability company,

Defendants.

TRIMARK HOMES, INC., an Arizona corporation; TRIMARK BENNETT ESTATES, L.L.C., an Arizona limited liability company,
Plaintiff,

Third-party Plaintiff,

vs.

GILBERT PLUMBING COMPANY, INC.,

Third-Party Defendant.

GILBERT PLUMBING COMPANY, INC.,

Third-Party Plaintiff,

vs.

UPONOR WIRSBO,

Third-Party Defendant.

Case No.: CV2001-005145

GILBERT PLUMBING COMPANY'S THIRD PARTY COMPLAINT

(Product Liability and Common Law Indemnity)

GENERAL ALLEGATIONS

COMES NOW the Third-Party Defendant/Third-Party Plaintiff Gilbert Plumbing Company, Inc. ("Gilbert Plumbing") and for its Third-Party Complaint against Uponor Wirsbo ("Wirsbo") alleges as follows:

1. Wirsbo is a Minnesota Corporation. Wirsbo's business includes manufacturing and then selling Aquapex® pipe to plumbing subcontractors including Gilbert Plumbing in Maricopa County, Arizona.

2. Gilbert Plumbing hereby incorporates by reference the Plaintiff's Complaint and the Third-Party Complaint of Defendant/Third-Party Plaintiff Trimark Homes, Inc. and Trimark Bennett Estates, L.L.C. and the answers filed thereto. (Copies are attached hereto as Exhibits 1-4.)

3. Plaintiff has alleged various counts against Defendant contractors Trimark Homes, Inc. and Trimark Bennett Estates, L.L.C. (hereinafter "Trimark" and "Bennett") who built, developed and sold the Plaintiff's residence to Plaintiff alleging that the pipes installed in and the water supplied to the Plaintiff's home have chemical contaminants that have allegedly rendered the home uninhabitable.

4. On or about August 15, 1998, Trimark entered into a subcontract agreement with Gilbert Plumbing whereby Gilbert Plumbing, operating and doing business in Maricopa County, Arizona, subcontracted to install the plumbing for the homes Trimark was building at Arroyo Canyon, including Plaintiff's house. These homes were built, developed and sold by Trimark and Bennett. The subcontract agreement ("the plumbing subcontract") between Trimark and Gilbert Plumbing is hereby incorporated by reference and is attached hereto as Exhibit 5.

5. Pursuant to the plumbing subcontract, Trimark provided homeowners with a choice between copper pipe and Aquapex® pipe manufactured by Wirsbo.

6. Wirsbo Aquapex® pipe was selected by Plaintiff Joyce Defren for installation in her Trimark home.

7. Pursuant to the start orders received from Trimark, Gilbert Plumbing

installed Wirsbo Aquapex® piping in Joyce Defren's home.

8. Wirsbo provided each homeowner with a twenty-five (25) year Limited Warranty for its Aquapex® piping when installed by a Wirsbo trained installer.

9. The employees of Gilbert Plumbing that installed the Aquapex® tubing at the Defren's residence were Wirsbo trained installers.

10. Through its warranty and relationship with its plumbing subcontractor customers, who install Wirsbo Aquapex® piping pursuant to Wirsbo installation guidelines, Wirsbo agrees to defend and indemnify plumbing subcontractors for claims and damages arising out of defects or problems with Wirsbo Aquapex® piping.

11. In its plumbing subcontract with Trimark, Gilbert Plumbing agreed to indemnify Trimark only from claims, damages, or losses resulting from Gilbert Plumbing's performance of its installation work.

12. Under the plumbing subcontract, Gilbert Plumbing expressly declined to guarantee or warranty the Wirsbo Aquapex® piping that was installed in the Defren home.

13. To investigate Plaintiff Defren's claim regarding water odor, Trimark retained Michael Fox, Ph.D., who has conducted numerous tests on certain water samples related to Plaintiff Defren's home between 2001 and 2002. Dr. Fox has concluded that the water at the Defren home allegedly contains benzene-4, MtBE, and t-butanol.

14. Dr. Fox has concluded that the cause for these chemicals being present in the water at the Defren home is the result of Wirsbo's Aquapex® pipe being defective in terms of its manufacture and design.

15. Based on Dr. Fox's conclusion, Trimark has improperly brought suit against Gilbert Plumbing seeking indemnification for the claimed defects in Wirsbo's Aquapex® pipe.

16. Since defects in Wirsbo's Aquapex® pipe is the basis behind Trimark's third-party action against Gilbert Plumbing, Gilbert Plumbing hereby brings its Third Party action against Wirsbo seeking defense and indemnification.

COUNT ONE

(Breach of Express and Implied Warranties)

17. Gilbert Plumbing incorporates paragraphs 1-16 above as if fully set forth herein.

18. If there are defects in the Aquapex® pipe which exist, as alleged in Plaintiff's Complaint and/or Trimark's Third Party Complaint, the defects would constitute breach of the express and implied warranties contained in the Wirsbo Limited Materials Warranty provided in the Aquapex® Professional Plumbing Installation Handbook. Wirsbo's Aquapex® pipe warranty is for a period of twenty-five (25) years.

19. Gilbert Plumbing has repeatedly tendered its request for defense and indemnification to Wirsbo for the third-party claims brought against it by Trimark, which has been denied by Wirsbo. As such, Gilbert Plumbing is entitled to full indemnification in the event an adverse judgment is entered against it and reimbursement of all attorneys' fees, costs and expenses incurred from its defense of this action.

20. In the event that Wirsbo's alleged breaches of express and implied warranties result in an adverse judgment against Gilbert Plumbing, Gilbert Plumbing will be entitled to full reimbursement for all past and future costs, expenses, and attorneys' fees.

COUNT TWO

(Contractual Indemnity)

21. Gilbert Plumbing incorporates paragraphs 1-20 as if fully set forth herein.

22. Pursuant to the express and implied terms of the Warranty regarding the Wirsbo piping that is provided as part of the Aquapex® purchase contract, Wirsbo has a contractual duty to defend, hold harmless and indemnify Gilbert Plumbing for any and all damages arising from the alleged failure and defects of the Wirsbo piping.

23. To the extent that Gilbert Plumbing is found liable for damages claimed by Trimark or Bennett relating to the alleged failure and defects associated with the Wirsbo Aquapex® piping, Wirsbo has a duty to indemnify Gilbert Plumbing from any

adverse judgment entered against them and reimburse Gilbert Plumbing for all of its attorneys' fees, costs and expenses.

COUNT THREE

(Common Law Indemnity)

24. Gilbert Plumbing incorporates paragraphs 1-23 as if fully set forth herein.

25. Plaintiff in the original Complaint and Trimark in its Third-Party Complaint against Gilbert Plumbing have alleged defects in the Aquapex® piping installed during the construction of the Defren residence.

26. If such alleged defects are proven to exist, Gilbert Plumbing did not create or cause the defects alleged by Trimark.

27. To the extent alleged defects in the Aquapex® piping system are proven to exist, said defects are the result of the failure of the Wirsbo Aquapex® piping and not the result of the installation of Aquapex® piping by Gilbert Plumbing.

28. As such, Wirsbo would therefore be liable to indemnify Gilbert Plumbing for judgment entered against Gilbert Plumbing and in favor of Trimark in this lawsuit which pertained to the quality or integrity of Wirsbo's Aquapex® piping systems.

WHEREFORE, Gilbert Plumbing seeks judgment against Wirsbo as follows:

A. For indemnification for any judgment against entered Gilbert Plumbing ;

B. For compensatory damages to be proven at time of trial that will include but not be limited to attorneys' fees, costs and expenses incurred in defending this action;

C. For attorneys' fees pursuant to A.R.S. § 12-341.01; and

///

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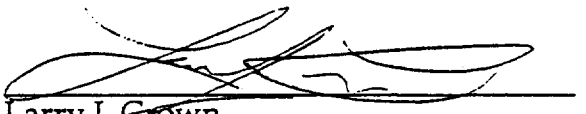
///

///

D. For such other and further relief as the Court deems just and proper.

DATED this 24 day of April, 2002.

JENNINGS, HAUG & CUNNINGHAM, LLP

By 

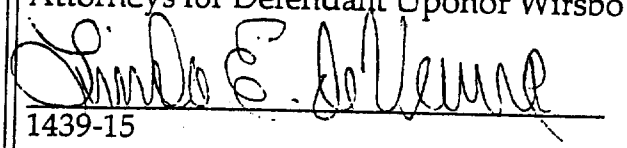
Larry J. Crown
Melinda C. Bechtel
Attorneys for Third-Party Defendant
Gilbert Plumbing Company, Inc.

A copy of the foregoing was hand-delivered to Judge O'Melia this 25th day of April, 2002, and copies were mailed to:

W. Michael Flood, Esq.
Jennings, Strouss & Salmon, P.L.C.
One Renaissance Square
Two North Central Avenue
Phoenix, AZ 85004-2393
Attorneys for Third-Party Plaintiffs Trimark Homes, Inc. and Trimark Bennett Estates, Inc.

Rick Bistro, Esq.
Burch & Cracchiolo, P.A.
702 E. Osborn Road, Suite 200
Phoenix, AZ 85014
Attorneys for Plaintiff Defren

Terence Bishop, Esq.
Larkin, Hoffman, Daly & Lindgren
7900 Xerxes Avenue South, Suite 1600
Bloomington, MN 55431
Attorneys for Defendant Uponor Wirsbo



1439-15

EXHIBIT "1"

COPY

E.J. Peskind, Esq., SBN 003096
Stephen L. Wetherell, Esq., SBN 015353
PESKIND HYMSON & GOLDSTEIN, P.C.
14646 North Kierland Boulevard, Suite 255
Scottsdale, Arizona 85254
(480) 991-9077

Attorneys for Plaintiff

MAR 2 7 2001

MICHAEL K. JEANES, CLERK
Y. SMITTLES
DEPUTY CLERK

SUPERIOR COURT OF THE STATE OF ARIZONA

IN AND FOR THE COUNTY OF MARICOPA

CV2001-005145

JOYCE DEFREN, a single woman,

Plaintiff,

v.

TRIMARK HOMES, INC., an Arizona corporation, and TRIMARK BENNETT ESTATES, L.L.C., an Arizona limited liability company,

Defendants.

Case No. CV2001-_____

COMPLAINT

(Contract)

Plaintiff JOYCE DEFREN, by and through undersigned counsel, for her Complaint against Defendants, alleges as follows:

ALLEGATIONS COMMON TO ALL CAUSES OF ACTION

1. Plaintiff is a resident of the State of Arizona and, at all times relevant to this complaint, has resided in Maricopa County.

2. Defendant Trimark Homes, Inc., is, and at all times material to this complaint was, a corporation organized under the laws of the State of Arizona.

3. Defendant Trimark Bennett Estates, L.L.C., is, and at all times material to this complaint was, a limited liability company organized under the laws of the State of Arizona.

4. On information and belief, Defendants Trimark Homes, Inc. and Trimark Bennett Estates, L.L.C., (hereinafter collectively "Trimark") are, and at all times material to this complaint were, engaged in the business of constructing and selling single-family homes in Maricopa County, Arizona.

5. All events complained of herein occurred in Maricopa County.

6. This Court has jurisdiction over this action pursuant to A.R.S. § 12-123, and venue properly lies in this Court pursuant to A.R.S. § 12-401.

7. On or about August 31, 1999, Plaintiff entered into a "Purchase Contract" for the construction of a home by Trimark at lot 12 of the Sonoran Hills subdivision in Scottsdale (hereinafter the 'Residence'). A true and correct copy of the "Purchase Contract" is attached hereto as Exhibit 1 and incorporated herein by reference.

8. The Residence was constructed by Trimark and escrow closed on January 22, 2001, with Plaintiff taking possession of and title to the home that day.

9. Immediately after moving into the Residence, Plaintiff detected the presence of a chemical odor emanating from all of the home's interior faucets whenever those faucets were used. That chemical odor was also detected when the rear hose faucet was used.

10. Analytical results of the water collected from Plaintiff's faucets indicate the water is contaminated with unsafe concentrations of benzene, methylindane, brominated indanol, epoxide and other deleterious chemicals.

11. Plaintiff and her teenage daughter have been diagnosed with chemical poisoning and have been directed by their joint physician to vacate the house.

12. The presence of the aforementioned chemicals have rendered the water in Plaintiff's home unfit for consumption, cooking and bathing.

13. All attempts by Defendants to identify the source of the chemicals and to rid the home of the same have been unsuccessful.

14. The inability of the home's plumbing system to deliver potable water, free of deleterious chemicals, has rendered the Residence defective and uninhabitable.

COUNT I

[Breach of Contract]

15. Plaintiff incorporates and re-alleges each and every allegation contained in paragraphs 1 through 14 as if fully set forth herein.

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Attorneys and [illegible]
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16. Defendants have breached the "Purchase Contract" by delivering a home to Plaintiff that is defective and uninhabitable.

17. Further, Defendants failed to satisfy its obligation to construct Plaintiff's home to a standard of quality equal to the quality of its model homes and/or standards of the home building industry as regulated by the Registrar of Contractors as provided in paragraph 13(c) of the Purchase Contract.

18. By virtue of this breach, Plaintiff is entitled to recover from Defendants damages in an amount to be proven at trial.

19. Since this matter arises out of contract, Plaintiff is entitled to her costs and attorneys' fees pursuant to A.R.S. § 12-341.01, or otherwise.

20. Further, pursuant to Rule 55(b)(1), Arizona Rules of Civil Procedure, in the event judgment by default is rendered in Plaintiffs' favor, Plaintiff seek reasonable attorneys' fees in the amount of not less than $2,500.00.

WHEREFORE, Plaintiff prays for judgment against Defendants as follows:

A. For compensatory, incidental and consequential damages in an amount to be proven at trial, with interest on the foregoing amounts until paid in full;

B. For her costs and reasonable attorneys' fees incurred herein, with interest on the foregoing amounts until paid in full; and

C. For such further relief as the Court may deem just and proper under the circumstances.

COUNT II

[Breach of Express Warranty]

21. Plaintiff incorporates and re-alleges each and every allegation contained in paragraphs 1 through 20 as if fully set forth herein.

22. In connection with Defendants' construction and sale of the subject house to Plaintiff, Defendants warranted in paragraph 13(c) of the Purchase Contract that the house would

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be constructed to a quality of construction equal to the quality of its model homes and/or standards of the home building industry as regulated by the Registrar of Contractors.

23. Defendants have breached its express warranty as the construction quality of Plaintiff's home is not equal to the quality of its model homes and/or standards of the home building industry as regulated by the Registrar of Contractors.

24. The house constructed for and sold to Plaintiff is defective, uninhabitable and in violation of the Defendants' express warranty.

25. By virtue of this warranty breach, Plaintiff is entitled to recover from Defendants damages in an amount to be proven at trial.

26. Since this matter arises out of contract, Plaintiff is entitled to her costs and attorneys' fees pursuant to A.R.S. § 12-341.01 or otherwise.

27. Further, pursuant to Rule 55(b)(1), Arizona Rules of Civil Procedure, in the event judgment by default is rendered in Plaintiff's favor, Plaintiff seeks reasonable attorneys' fees in the amount of not less than $2,500.00.

WHEREFORE, Plaintiff prays for judgment against Defendants as follows:

A. For compensatory, incidental and consequential damages in an amount to be proven at trial, with interest on the foregoing amounts until paid in full;

B. For her costs and reasonable attorneys' fees incurred herein, with interest on the foregoing amounts until paid in full; and

C. For such further relief as the Court may deem just and proper under the circumstances.

COUNT III

[Breach of the Implied Covenant of Good Faith and Fair Dealing]

28. Plaintiff incorporates and re-alleges each and every allegation contained in paragraphs 1 through 27 as if fully set forth herein.

29. Under Arizona law, there is an implied covenant of good faith and fair dealing by each and every party to a contract.

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30. Defendants have breached the implied covenant of good faith and fair dealing by delivering to Plaintiff a home that defective and uninhabitable.

31. By virtue of this breach, Plaintiff is entitled to recover from Defendants, and each of them, damages in an amount to be proven at trial.

32. Since this matter arises out of contract, Plaintiff is entitled to her costs and attorneys' fees pursuant to A.R.S. § 12-341.01 or otherwise.

33. Further, pursuant to Rule 55(b)(1), Arizona Rules of Civil Procedure, in the event judgment by default is rendered in Plaintiff's favor, Plaintiff seeks reasonable attorneys' fees in the amount of not less than $2,500.00.

WHEREFORE, Plaintiff prays for judgment against Defendants as follows:

A. For compensatory, incidental and consequential damages in an amount to be proven at trial, with interest on the foregoing amounts until paid in full;

B. For her costs and reasonable attorneys' fees incurred herein, with interest on the foregoing amounts until paid in full; and

C. For such further relief as the Court may deem just and proper under the circumstances.

COUNT IV

[Breach of Implied Warranties]

34. Plaintiff incorporates and re-alleges each and every allegation contained in paragraphs 1 through 33 as if fully set forth herein.

35. Under Arizona law, a home builder/seller impliedly warrants that its homes are fit for habitation and are constructed in a workmanlike manner.

36. The homes constructed and sold by Defendants are impliedly warranted to be habitable and constructed in a workmanlike manner.

37. Because the house Defendants constructed and sold to Plaintiff is defective and uninhabitable, Defendants have breached its implied warranties of habitability and workmanlike construction.

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38. By virtue of this breach, Plaintiff is entitled to recover from Defendants, and each of them, damages in an amount to be proven at trial.

39. Since this matter arises out of contract, Plaintiff is entitled to her costs and attorneys' fees pursuant to A.R.S. § 12-341.01 or otherwise.

40. Further, pursuant to Rule 55(b)(1), Arizona Rules of Civil Procedure, in the event judgment by default is rendered in Plaintiff's favor, Plaintiff seeks reasonable attorneys' fees in the amount of not less than $2,500.00.

WHEREFORE, Plaintiff prays for judgment against Defendants as follows:

A. For compensatory, incidental and consequential damages in an amount to be proven at trial, with interest on the foregoing amounts until paid in full;

B. For her costs and reasonable attorneys' fees incurred herein, with interest on the foregoing amounts until paid in full; and

C. For such further relief as the Court may deem just and proper under the circumstances.

COUNT V

[Consumer Fraud]

41. Plaintiff incorporates and re-alleges each and every allegation contained in paragraphs 1 through 40 as if fully set forth herein.

42. A.R.S. § 44-1522 proscribes the use of false, fraudulent, misleading, or deceptive practices in advertising and selling merchandise.

43. In connection with Defendants' sale of its home to Plaintiff, Defendants impliedly and expressly promised and represented to Plaintiff that it would construct and deliver to her a home that was non-defective and habitable.

44. Defendants made the aforementioned promises and representations with the intention that Plaintiff rely on the same, Plaintiff did rely on those promises and representations, and as a consequence Plaintiff has suffered damages by virtue of receiving a home that is defective and uninhabitable from Defendants.

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Attorneys and C[illegible]s
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Telephone (480) 991-9077

45. By virtue of Defendants' unlawful practices, Plaintiffs are entitled to recover from Defendants damages in an amount to be proven at trial.

46. Further, since Defendants have acted in a wanton and reckless fashion, demonstrating ill will, spite and reckless indifference to Plaintiff's interests and health and safety, Plaintiff is entitled to punitive damages from Defendants.

47. Further, pursuant to Rule 55(b)(1), Arizona Rules of Civil Procedure, in the event judgment by default is rendered in Plaintiffs' favor, Plaintiffs seek reasonable attorneys' fees in the amount of not less than $2,500.00.

WHEREFORE, Plaintiffs pray for judgment against Defendants as follows:

A. For compensatory, incidental and consequential damages in an amount to be proven at trial, with interest on the foregoing amounts until paid in full;

B. For punitive damages in an amount sufficient to deter Defendants and others contemplating a similar course of conduct from engaging in such deceptive practices, with interest on the foregoing amounts until paid in full;

C. For their costs and reasonable attorneys' fees incurred herein, with interest on the foregoing amounts until paid in full; and

D. For such further relief as the Court may deem just and proper under the circumstances.

COUNT VII

[Rescission]

48. Plaintiff incorporates and re-alleges each and every allegation contained in paragraphs 1 through 47 as if fully set forth herein.

49. Under Arizona law, where there is a substantial failure of consideration, the party denied the benefit of the consideration it bargained for is entitled to rescind the contract.

50. The house Plaintiff purchased from Defendants is defective and is uninhabitable, denying her the consideration for which she bargained.

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51. Based on the foregoing, Plaintiff is entitled to rescind her contract with Defendants.

52. In addition to having the purchase price of the house restored to her, Plaintiff is entitled to recover incidental and consequential damages in an amount to be proven at trial from Defendants.

53. Since this matter arises out of contract, Plaintiff is entitled to her costs and attorneys' fees pursuant to A.R.S. § 12-341.01 or otherwise.

54. Further, pursuant to Rule 55(b)(1), Arizona Rules of Civil Procedure, in the event judgment by default is rendered in Plaintiff's favor, Plaintiff seeks reasonable attorneys' fees in the amount of not less than $2,500.00.

WHEREFORE, Plaintiff prays for judgment against Defendants as follows:

A. Restoration to Plaintiff of the full purchase price of the defective house, with interest on the foregoing amount until paid in full;

B. For incidental and consequential damages in an amount to be proven at trial, with interest on the foregoing amounts until paid in full;

C. For her costs and reasonable attorneys' fees incurred herein, with interest on the foregoing amounts until paid in full; and

D. For such further relief as the Court may deem just and proper under the circumstances.

RESPECTFULLY SUBMITTED this 26 day of March 2001.

PESKIND HYMSON & GOLDSTEIN, P.C.

By

E.J. Peskind, Esq.
Stephen L. Wetherell, Esq.
Peskind Hymson & Goldstein, P.C.
14646 N. Kierland Blvd., Suite 255
Scottsdale, AZ 85254
Attorneys for Plaintiffs

Attorneys and Co-Directors
14646 North Kierland Blvd., Suite 255
Scottsdale, AZ 85254-3457
Telephone (480) 991-9077

161799v1

VERIFICATION

STATE OF ARIZONA)
) ss.
County of Maricopa)

Joyce DeFren, being first duly sworn upon her oath, deposes and states as follows:

1. I am the plaintiff in this action and am authorized to make this Affidavit.
2. I have read the foregoing Complaint and know the contents thereof, and verify that the allegations and information contained therein are true to the best of my knowledge, information and belief.

By Joyce DeFren
Joyce DeFren

SUBSCRIBED AND SWORN to before me this 26th day of March, 2001 by Joyce DeFren.

[illegible]
My Comm. Expires [illegible]

Notary Public

Attorneys and Counsellors
14646 North Kierland Blvd, Suite 255
Scottsdale, AZ 85254-3457
Telephone (480) 991-9077

161799 v1

EXHIBIT "1"

SONORAN HILLS
Parcel A
PURCHASE CONTRACT, RECEIPT AND ESCROW INSTRUCTIONS

SELLER: Timmerk Bennett & Jc

Address: 1733 N. Greenfield #101
Mesa, AZ 85202

Telephone: (602) 854-3818

BUYER: Joyce DeFeo or nominee

as ____ joint tenancy; ____ community property; ____ tenants in common; ____ sole and separate property; ____ community property with right of survivorship; ____

Address: 9796 E Cochise Dr
Scottsdale, AZ 85258

Telephone 602 451-0950

ESCROW AGENT: Security Title Agency

Escrow Officer: Lisa Ludwig Escrow No.: ____

PROPERTY: Lot 12, SONORAN HILLS, PARCEL B, a subdivision according to the plat recorded in Book 439 of Maps, page 10 records of Maricopa County, Arizona, together with a single family home ("Home") to be constructed on such lot. The Home shall be Seller's 2809 Elevation A, Garage ____. The Home shall hereafter be collectively referred to as the "Property".

OWNERS ASSOCIATION: Upon recordation of the deed from Seller to Buyer for the Lot, Buyer automatically will become a member of Sonoran Hills Master Community Home Owners Association (the "Association") and shall be subject to the terms of the Declaration of Covenants, Conditions and Restrictions for Sonoran Hills, recorded as Instrument No. 96-0764501, records of Maricopa County, Arizona, as the same has been and may be amended from time to time (the "Declaration") and the Articles of Incorporation, By-Laws, Rules and Regulations of the Association. The current periodic assessment levied by the Association for lots within the subdivision is $ 35 per month.

1. AGREEMENT. Seller agrees to sell and Buyer agrees to buy the Property on the terms and conditions set forth in this Agreement.

2. OPENING DATE. The Opening Date shall be the date of deposit of one fully executed copy of this Agreement and the initial earnest money deposit, as identified in 4a below, with Escrow Agent. Escrow Agent shall notify Buyer and Seller in writing of the Opening Date.

3. CLOSING DATE. The Closing Date shall be within ten (10) calendar days after substantial completion of the Home and issuance of a Certificate of Occupancy by the City of Scottsdale stating that construction of the Home has been substantially completed in accordance with the Plans and Specifications on file at the Seller's office. The Certificate of Occupancy shall be conclusive evidence that construction has been substantially completed and that Seller has substantially fulfilled all commitments under this Agreement as to construction of the Home and other improvements (except as to "punch-list" items). The Final Home Delivery Punch List, prepared by the Contractor, shall be binding on Buyer and Seller for all purposes. At closing, if the Final Home Delivery Punch List still has items to be completed, an amount equal to 150% of the dollar amount identified as the cost to complete the "Punch-List" items shall be impounded by Escrow Agent until Escrow Agent receives a Supplemental Certificate from the Contractor stating that the "Punch-List" items have been fully completed and at such time the impounded funds shall be released to Seller. If the "Punch-List" items have not been completed within thirty (30) days after the Closing Date, the impounded funds shall be delivered to Buyer and shall be applied to the actual costs completing the "Punch-List" items.

4. PURCHASE PRICE. The purchase price for the Property is $ 225,000.00 payable as follows:

(a) $ 5,000.00 as earnest money deposit to be paid in cash or by cashier's check upon execution of this Agreement by Buyer and Seller.

(b) $ 5,000.00 as an additional earnest money payment to be paid in cash or by cashier's check upon completion and inspection by the City of Scottsdale of the concrete house foundation (Foundation Inspection).

(c) to Be determined as additional earnest money payment to be paid in cash or by cashier's check for all upgrades and options selected by Buyer as shown on the Schedule "A" portion of this contract. This amount is to be paid at time of (b) payment mentioned above.

(d) See addendum as additional earnest money payment to be paid in cash or by cashier's check upon completion and inspection, by the City of Scottsdale, of the rough house framing (Framing Inspection).

(e) to Be determined as a Loan amount according to the provisions of Paragraph 9.

(f) to Be determined as an additional payment to be made in cash or by cashier's check on or before the close of escrow, such payment to be deposited in escrow.

(g) All payments shall be by personal check or by cash, or by cashier's check payable to Escrow Agent, or by wire-transferred funds.

(h) Upon loan approval and the removal of all Buyer and Seller contingencies as identified in Section 23, the initial earnest money deposit and additional earnest money payments described in 4a, 4b, 4c, and 4d above shall become non-refundable and be released to Seller.

(i) BUYER IS ADVISED AND UNDERSTANDS THAT THE EARNEST MONEY DEPOSIT, DOWN PAYMENTS AS SHOWN IN 4(a), 4(b), 4(c), AND 4(d) ABOVE AND OTHER ADVANCED MONIES WILL BE RELEASED TO SELLER IN ACCORDANCE WITH 4(h) ABOVE. SUCH MONIES WILL BE PAID TO SELLER AND MAY BE USED BY SELLER. THIS MEANS BUYER ASSUMES THE RISK OF LOSING SUCH MONIES IF SELLER IS UNABLE OR UNWILLING TO PERFORM UNDER THE TERMS OF THIS CONTRACT.

Initial ____ Initial ____

5. PRELIMINARY TITLE REPORT.

(a) Promptly following the Opening Date, Escrow Agent shall deliver a current Preliminary Title Report (the "Report") on the Property to Buyer and Seller and shall be accompanied by legible copies of all documents referred to in the Report.

(b) Buyer shall have ten (10) days (the "Review Period") following receipt of the Report in which to review and to give Seller and Escrow Agent written notice of any title exception which is unacceptable to Buyer, in Buyer's reasonable judgment. If Buyer gives notice of disapproval as to any exception to title as shown in the Report, Seller shall have until the close of escrow to eliminate the disapproved exceptions from the Report, provided that Seller may notify Buyer in writing of its decision not to eliminate the disapproved exceptions and within ten (10) days following Buyer's receipt of Seller's notice, Buyer shall either

(i) waive the disapproved exceptions by written notice to Seller and purchase the Property as provided in this Agreement, or

(ii) this Agreement shall be deemed canceled and of no further force and effect at 5:00 p.m. of such tenth (10th) day. If Seller does not eliminate these exceptions on or before the close of escrow (or notify Buyer of its decision not to do so as herein provided), it being understood and agree, however, that Seller shall have no duty whatsoever to eliminate or secure a title endorsement against any such exception. Buyer's sole and exclusive remedy shall be to cancel this Agreement by giving written notice of Cancellation to Seller and Escrow Agent on or before the close of escrow.

(c) Buyer's failure to disapprove any exceptions or to specify its objections to the contents of the Report during the Review Period shall be deemed an acceptance of title as described in the Report and a waiver of Buyer's right to cancel this Agreement according to this Paragraph.

(d) Upon any cancellation in accordance with this Paragraph

...eting the "Punch-List" items, with any excess remaining being ...ller.

BASE PRICE: $ 372,900

LOT PREMIUM: $ -0-

UPGRADES/OPTIONS: $ to Be determined

TOTAL SALES PRICE: $ 372,900
payable as follows:

(a) See addendum
an earnest money payment to be paid in cash or by personal check or ...thers check at the time Buyer executes this Agreement. The earnest ...ney payment shall be deposited in escrow.

(b) See addendum

...by Buyer and Seller any cancellation in accordance with this Paragraph, the amounts paid into Escrow by Buyer and/or Buyer's lender and all documents deposited in escrow by Buyer and Seller shall be returned to such parties and this Agreement shall terminate. (2)

5. CONVEYANCE. At the close of escrow, Seller shall convey title to the Property to Buyer by a special warranty deed, subject to current taxes and assessments, reservations in patents, all easements, rights of way, encumbrances, liens, covenants, conditions, restrictions, obligations and liabilities as may appear of record and all matters which an accurate survey of the Property or a physical inspection of the Property would disclose.

7. TITLE INSURANCE. At the close of escrow, Seller shall provide Buyer with a standard coverage owner's policy of title insurance in the full amount of the sales price, effective at the close of escrow, insuring Buyer that fee simple title to the Property is vested in Buyer, subject only to the usual printed exceptions contained in such title insurance policies, to the matters approved by Buyer as provided in Paragraph 6 of this Agreement.

's Deed of Trust as described in Paragraph 8, if applicable, and other matters approved in writing by Buyer.

8. CLOSING COSTS.

(a) Upon the close of escrow, Buyer and Seller each agree to pay one-half (1/2) of the escrow charges.

(b) Seller agrees to pay the entire cost of the standard coverage owner's policy of title insurance.

(c) Real estate taxes, homeowner's association assessments, either existing or imposed, improvement liens and other special assessments shall be prorated in the escrow as of the close of escrow based on the latest available information. Any other closing costs shall be paid by Buyer and Seller according to the usual and customary practice.

(d) Seller agrees that all closing costs and any commissions payable by Seller shall be deducted from Seller's proceeds at the close of escrow. On or before the close of escrow, Buyer agrees to deposit with Escrow Agent cash in an amount sufficient to pay all closing costs payable by Buyer.

9. FINANCING. If any part of the purchase price for the Property is to be paid from the proceeds of a loan, within five (5) days following execution of this Contract by Buyer, Buyer shall make application for and use its best efforts to obtain a loan from a lender (to be approved in writing by Seller). Within three (3) business days of being requested to do so, Buyer shall furnish all information and truthfully and diligently make, execute and complete all documents which any lender may request for the prompt processing and timely funding of any loan applied for. Buyer shall notify Seller within three (3) days from the date that any loan applied for by Buyer is accepted, rejected or modified. If Buyer is approved for a loan in an amount less than that applied for, the difference shall be deposited by Buyer with Seller within five (5) business days after notification of the lender's approval for such lesser amount. If (i) Buyer is rejected for a loan by any lender to whom the Buyer has made a loan application or (ii) Buyer's loan application has not been approved within thirty (30) days from the date of Seller's acceptance of this Contract, or (iii) loan approval is subject to conditions that are unacceptable to Seller, in its sole discretion, Seller may cancel this Contract, and if Buyer has fully ed in good faith with its obligation under this Paragraph and has nothing to delay or hinder loan approval, Buyer may cancel this Contract. In the event of such cancellation, Seller shall refund to Buyer all sums received from Buyer pursuant to this contract except for $500.00 plus the costs of all extras which have been purchased or ordered by Seller and all architectural and engineering fees and costs incurred by Seller in revising Seller's standard plans and initial site plan layout to accommodate changes requested by Buyer, which amounts Seller shall be entitled to retain as reimbursement and compensation for administering this Contract, installing or purchasing extras, customizing a residence for Buyer, canceling escrow and taking the Property off the market. Notwithstanding the foregoing, if Buyer requests in writing that Seller commence construction of the Residence prior to Buyer's qualification for financing, and if Buyer provides evidence satisfactory to Seller, in Seller's sole discretion, that Buyer possesses sufficient and available funds to pay the amounts due under this Contract, and if Seller so agrees, this financing contingency shall be deemed waived. Buyer shall be responsible for and shall pay all points, appraisal, credit reports or other fees, interest and other costs in connection with any loan applied for, whether or not this transaction is completed. The interest rate and fees for any loan applied for by Buyer are matters of concern solely between Buyer and Lender and shall not in any way affect the rights or obligations of the parties hereto. Seller has not agreed to provide a loan to Buyer nor has Seller guaranteed the availability of a loan or any particular loan terms. Seller shall not be responsible for the representations, actions, or omissions made by any lender.

10. MECHANICS' AND MATERIALMEN'S LIENS. Seller shall pay all construction costs to construct the Home in accordance with the Plans and Specifications and shall indemnify and hold Buyer and Escrow Agent harmless from any and all claims of liens for materials or labor supplied to the Property other than claims and liens of contractors, other than Seller, who have contracted directly with Buyer to provide labor or materials to the Property and other than claims and liens relating to materials and labor supplied to the Property following the Closing Date by persons, other than

11. POSSESSION. Seller agrees that it will deliver possession of the property to Buyer on the Closing Date. Prior to the Closing Date, Buyer may, from time to time and only with reasonable notice to Seller, enter on the Property with its representatives and agents to examine the property and the Home, provided such activities do not interfere with the

Agreement and the terms of the printed escrow instruction, the terms of this agreement shall control.

(b) Buyer and Seller further agree that:

(i) They will indemnify and save harmless Escrow Agent from all reasonable costs, damages, attorneys' fees and expenses which it may incur or sustain in connection with these instructions, except as caused by the negligence or fault of Escrow Agent or a breach by Escrow Agent of its duties under this Agreement or law.

(ii) They authorize Escrow Agent in the event of any conflicting demands made upon it concerning these instructions, or this escrow at this election, to hold any money and documents deposited hereunder until it receives mutual instructions by all parties or until a civil action shall have been finally concluded in a court of competent jurisdiction determining the rights of all parties. In the alternative, Escrow Agent may, at its discretion, at any time commence a civil action to interpleed any conflicting demands to a court of competent jurisdiction to determine its rights of the parties to this escrow. In accordance with subparagraph (b) (i) above, the parties will pay to Escrow Agent its expenses and attorneys' fees sustained in connection with the civil action and any appeal to determine its rights and the rights of the parties to this escrow.

(c) If the escrow fails to close because of Seller's default, Seller shall be liable for all escrow cancellation charges. If the escrow fails to close because of Buyer's default or because Buyer is unable to obtain a loan as provided in Paragraph 9 above, Buyer shall be liable for all escrow cancellation charges. If the escrow fails to close for any other reason, Seller and Buyer shall each be liable for one half (1/2) of all escrow cancellation charges.

12. CONSTRUCTION OF HOME. Seller will cause the Contractor to construct the Home on the Property in accordance with the terms and conditions of this Agreement.

(a) Starting and Completion Dates. Construction of Home shall, unless otherwise agreed in writing, begin upon the last to occur of the following:

(i) Seller's receipt of a building permit;

(ii) If Buyer has applied for a loan, upon Buyer's receipt of the Loan and delivery of evidence of the Loan to Seller.

(iii) Buyer's approval of the title matters disclosed in the Report as provided in Paragraph 5 above. Subject to the provisions of subparagraph (g) below, Seller shall proceed with due diligence to substantially complete the Home no later than To Be determined

(b) Plans and Specification.

The Contractor shall have the right to make changes in the nature of the work to be performed under the Plans and Specifications which he determines to be necessary and appropriate to complete the Home substantially in accordance with the Plans and Specifications. Such discretionary changes may include adjustments in measurements, materials and structural changes provided any changes of materials or methods do not materially and substantially alter the quality, grade, structural soundness or aesthetics of the Home.

(c) Quality of Construction. Seller is only obligated to construct a home for the Buyer which equals the quality of construction on display at the model homes and/or to the standards of the home building industry as regulated by the State Registrar of Contractors.

(d) Insulation Quality. Insulation will be installed in the Residence as follows where construction allows:

(i) walls separating refrigerated areas from non-refrigerated areas; Type: wall constructed with 2 x 4 framing will have fiberglass batts; thickness 3 inches; R-Value: 13. Wall constructed with 2 x 6 framing will have fiberglass batts; thickness 6 inches; R-Value: 19;

(ii) ceiling (except over garage or unrefrigerated storage areas); Type: cellulose or fiberglass batts; thickness: 10-12 inches; R-Value: 30.

All thickness and R-values are approximate and R-values do not include the R-value of other wall or ceiling materials. Notwithstanding the foregoing, insulation may be of lesser thickness and R-value than indicated in certain areas where the design of the Residence does not permit greater thickness. Examples of locations where thickness and R-values may vary include locations where studs are placed in walls, at corners and windows and where roof trusses attach to outside walls. The R-values are based on the representation of the manufacturer and/or installer of the insulation and Seller does not warrant or represent that these R-values are correct. Seller has the right to make substitutions as to the type, thickness and R-value of insulation installed in the Residence without obtaining the consent of Buyer, as long as there are no substantial changes in the R-value of the insulation installed in a substantial portion of the Residence.

(e) Responsibility of Buyer.

[illegible] of Seller on the Property. This may only occur Monday through with Seller's Representative. Buyer agrees to indemnify and hold [illegible] harmless from any injury, liability, costs, or expense to person or property arising out of Buyer's exercise of the rights granted pursuant to this Paragraph and this indemnity shall survive the Closing Date. This hold harmless clause shall govern irrespective of Seller's negligence. Buyer understands and acknowledges that Buyer hereby waives any and all claims against Seller for injury, liability, costs, or expense to person or property arising from inspections during construction.

12. ESCROW.

(a) An escrow for this transaction shall be established with Escrow Agent and Escrow Agent is hereby employed to handle the escrow. This Agreement shall constitute escrow instructions and a copy shall be deposited with Escrow Agent for this purpose. Should Escrow Agent require the execution of its standard form printed escrow instructions, Buyer and Seller agree to execute same; however, such instruction shall be construed as applying only to Escrow Agent's employment, and if there are conflicts between the terms of this

(e) Responsibility of Buyer.

(i) Communication with Seller. Buyer will issue all communications concerning the work to be performed under this Agreement directly to Seller. Buyer shall not impede or endeavor to supervise the construction work to be performed under or arising out of this Agreement. Buyer agrees not to effect any changes in the work of any of Seller's agents, employees or subcontractors, including Contractor. All changes desired by Buyer shall be made by agreement with Seller and in accordance with the provisions for change orders provided in subparagraph (f) below. (2)

(ii) Selection Items. Buyer agrees to make timely selections of all colors, tile, counter tops, cabinets, plumbing fixtures, hardware, carpeting, floor covering, lighting and other electrical fixtures, and all other materials, fixtures or other items of whatever nature which Buyer shall be entitled to select, approve or have an "allowance" for. In the event Buyer fails to select or approve such Selection Items within twenty-one (21) calendar days of the escrow opening date, Seller shall be free to make selections of such items for and on behalf of Buyer. If Seller makes such selections after this twenty-one (21) day period has expired, Seller's selections shall be final and accepted by Buyer and Buyer shall be without

urse against Seller for such selections. In the event Buyer elects to change his designation of any Selection items (or any that were selected for him by Seller) subsequent to their purchase or installation, it is agreed and understood such changes will be made at Buyer's expense in accordance with the change order provisions of subparagraph (f). Seller may require Buyer to pay the estimated amount of such additional cost before commencing installation of any changed Selection items.

(f) Seller Responsibilities.

(i) Supervision. Seller, in constructing the Home and related improvements, is not the agent of Buyer. Seller shall be responsible for all construction under this Agreement, including the techniques, sequences, procedures, method and means and for coordination of all work.

(ii) Compliance with Laws. Seller shall comply in all material respects with all laws and ordinances, and the rules, regulations, or orders of all public authorities (the "Requirements") relating to construction of the Home. If any of the Plans and Specifications are at variance with such Requirements, Seller shall notify Buyer promptly on discovery of such variance and enter into such change orders as may be necessary to comply with the applicable Requirement. Buyer shall pay any additional costs attributable to such change orders.

(g) Insurance

(i) Seller's Liability Insurance. Seller shall acquire and keep in force at its own expense during the entire period of construction of the Home such liability insurance and will protect it from claims under workmens' compensation and other employee benefit laws, for bodily injury and death, and for property damage, that may arise out of work performed under this agreement, whether directly or indirectly by Seller, Contractor or by a subcontractor. Such insurance shall include contractual liability insurance applicable to Seller's obligations under this Agreement. Seller shall provide proof of such insurance to Buyer upon written request.

(ii) Property Damage Insurance. Seller shall maintain at its expense during construction of the home, property damage insurance on the property to its full insurable value, against fire, vandalism and other perils ordinarily included in extended coverage. Seller shall provide proof of such insurance to Buyer upon written request.

(h) Work Changes.

(i) The parties agree that once they have started construction, Seller shall have no obligation to make changes in the work to be performed. The parties may nevertheless mutually agree to changes in the nature of additions, deletions or other modifications in the work to be performed pursuant to the Plans and Specifications.

(ii) All change orders shall be in writing and signed by both parties specifying the changes to be made and shall include conforming changes in the purchase price and the time for completion of construction. Work shall be changed and the purchase price and completion time shall be modified only if set out in written change order. Seller may require Buyer to pay any amounts by which the purchase price will be increased prior to commencing work pursuant to a change order.

(i) Extension of Time. If Seller is delayed at any time during the work to be performed under this Agreement such as changes ordered in the work, labor disputes, unusual delays in transportation, unavoidable casualties, unavailability of materials, labor, adverse weather conditions or other causes beyond his control, then the time for completion of construction shall be extended for such a reasonable time as is justified by the delays beyond the control of Seller.

(j) Disputes. All claims and disputes relating to construction of the home shall be subject to arbitration at the option of either Buyer or Seller in accordance with the arbitration rules of the American Arbitration Association for the construction industry. Any party electing to arbitrate a dispute shall file a written notice of demand for arbitration with the other party and with the American Arbitration Association.

14. SELLER'S WARRANTIES

(a) Seller warrants to Buyer, that the home will be free from structural defects for a period of two years, and all non-structural components will be free from defects for a period of one year from the date of delivery of the deed to the Property and Home. Seller warrants that the Home has been situated on the Property and has been constructed in substantial compliance with the local building codes and the Plans and Specifications. The home shall include all the improvements and fenances set forth in the Plans and Specifications for the home. The ural warranty shall apply to any defect which may arise due to egligence on the part of Seller, Contractor or any of its agents, or from efective materials used in the construction of the home. THE VARRANTIES SHALL NOT APPLY TO ANY DEFECTS CAUSED BY, R ARISING FROM, CLIMATIC CONDITIONS WHICH MAY AFFECT IORMAL CHARACTERISTICS OF CERTAIN BUILDING MATERIALS

WILL ASSIGN ANY ASSIGNABLE MANUFACTURER'S WARRANTIES TO BUYER ON THE CLOSING DATE.

(b) Seller reserves the right to make repairs or correct any defects for which it is responsible according to the terms stipulated in this Paragraph at the time and in the manner deemed most advisable by Seller. Seller shall have no duty to make any corrections or repairs pursuant to this Paragraph until after Seller has received written notice from Buyer that such corrections or repairs need to be made. So long as Seller promptly undertakes any corrections and repairs required hereunder, the parties agree that the full extent of Seller's liability under the warranties contained in this Paragraph shall be the cost to correct the defect and to restore the Home to comply with the Plans and Specifications (except as then required by governmental laws or regulations).

BUYER UNDERSTANDS AND ACCEPTS ALL WARRANTIES AND RECOGNIZES THE EXTENT AND LIMITATIONS OF SELLER'S LIABILITIES AS EXPRESSED IN THIS PARAGRAPH.

15. NO ASSIGNMENT: BINDING EFFECT. Buyer may not assign or otherwise transfer its rights under this Agreement without prior written consent of Seller, which consent may be given or withheld at Seller's sole discretion. Except as limited by the preceding sentence, this Agreement is binding upon and shall insure to the benefit of the parties and respective successors and assigns.

16. ATTORNEY'S FEES. If any action is brought by either party in respect to its rights under this Agreement, the prevailing party shall be entitled to reasonable attorney's fees and court costs as determined by the court or arbitrator.

17. ADDITIONAL REPRESENTATIONS. Such indication shall be binding on Buyer. Buyer shall write in below any representations or promises which are not set out in this Contract, but which have been made by Seller or its purported agents or employees, and upon which Buyer is relying in making this purchase, and if there are none, Buyer shall so indicate.

18. CONSTRUCTION. This Agreement shall be construed according to Arizona law. Time is of the essence in this Agreement.

19. NOTICE. Notices shall be in writing and shall be given by personal delivery or by deposit in the United States mail, certified mail, return receipt requested, postage prepaid, addressed to Seller and Buyer at the addresses set forth in this Agreement or at such other address as a party may designate in writing. The date notice is given shall be the date on which the notice is delivered, if notice is given by personal delivery, or the date of deposit in the mail, if the notice is sent through the United States mail. Notice shall be deemed to have been received on the date on which the notice is delivered, if notice is given by personal deliver, or three (3) days following such deposit in the mail, if notice is sent through the United States mail. A copy of any notice given to a party shall also be given to Escrow Agent.

20. SELLER'S REMEDIES. If Buyer fails to deposit the remainder of the sales price in the time and manner set forth in this Agreement or to perform when due and other act required by this Agreement, Seller may terminate this Agreement and the escrow, such termination to be effective immediately upon Seller giving written notice of termination to Buyer and Escrow Agent. Upon such termination, Seller shall be entitled to, and Escrow Agent shall deliver to Seller, all earnest money previously deposited in escrow as consideration for acceptance of this Agreement and for taking the Property off the market and not as a penalty. The taking and acceptance of the earnest money by Seller under this provision shall not in any way limit, impair or defeat the right of Seller to specifically enforce this Agreement or to seek and recover further damages, if any, on account of such failure; however, if Seller seeks and obtains specific performance or damages, any amount received by Seller under this Paragraph shall be applied towards the purchase price or damages, as applicable.

21. BUYER'S REMEDIES. Buyer may, on the fourteenth (14th) day following the date Buyer gives written notice to the Seller, and in addition to whatever other remedies are available to Buyer at law or in equity, including the right to have specific performance of this Agreement and the escrow, terminate this Agreement and the escrow, when Seller has materially defaulted in performance of any of the provisions herein, or failed to carry out the construction in accordance with the Plans and

EXHIBIT "2"

COPY
MAY 14 2001
MICHAEL K. JEANES, CLERK
E. ANZALDUA
DEPUTY CLERK

W. Michael Flood - 001764
JENNINGS, STROUSS & SALMON, P.L.C.
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Telephone: (602) 262-5911

Attorneys for Defendant Trimark Homes, Inc.

IN THE SUPERIOR COURT OF THE STATE OF ARIZONA

IN AND FOR THE COUNTY OF MARICOPA

JOYCE DEFREN, a single woman,

Plaintiff,

vs.

TRIMARK HOMES, INC., an Arizona corporation; TRIMARK BENNETT ESTATES, L.L.C., an Arizona limited liability company,

Defendants.

No. CV2001-009145

ANSWER

(Assigned to The Honorable Michael J. O'Melia)

COME NOW the Defendants TRIMARK HOMES, INC. and TRIMARK BENNETT ESTATES, L.L.C., and for their Answer to Plaintiff's Complaint, admit, deny and allege as follows:

I.

Defendants admit the allegations set forth in Paragraphs 1, 2, 3, 4, 5, and 6 of Plaintiff's Complaint.

II.

Answering Paragraphs 7 and 8 of Plaintiff's Complaint, Defendants admit that on or about the dates alleged the Plaintiff entered into a Purchase Contract and closed escrow with respect to the subject residence. Defendant's copy of Exhibit 1 is not clear or complete and Defendant hereby incorporates by reference a true copy of said Purchase Contract.

III.

Answering Paragraphs 8 through 14, Defendant admits upon information and belief that Plaintiff detected odors coming from the plumbing system of Plaintiff's residence that is believed to be of a chemical source, but Defendants are without sufficient knowledge or information sufficient to form a belief as to the truth of the remaining allegations set forth therein and therefore deny said allegations.

IV.

Defendants deny each and every allegation set forth in Plaintiff's Complaint not herein expressly admitted.

V.

Answering Count I of Plaintiff's Complaint, Defendants deny Paragraphs 15, 16, 17, 18, 19 and 20.

VI.

Answering Count II of Plaintiff's Complaint, Defendants admit that warranties regarding the construction and sale of the residence are as set forth in the Purchase Contract incorporated herein by reference, and Defendants deny the remaining allegations set forth in Paragraphs 21, 22, 23, 24, 25, 26, and 27.

VII.

Answering Count III of Plaintiff's Complaint, Defendants admit Paragraph 29, but deny the allegations set forth in Paragraphs 28, 30, 31, 32 and 33.

VIII.

Answering Count IV of Plaintiff's Complaint, Defendants deny the allegations set forth in Paragraphs 34, 35, 36, 37, 38, 39 and 40.

IX.

Answering Count V of Plaintiff's Complaint, Defendants incorporate by reference A.R.S. § 44-1522, but deny its application to the construction and sale of Plaintiff's residence, except for what has previously been admitted, deny the allegations set forth in Paragraphs 41, 42, 43, 44, 45, 46, and 47.

X.

Answering Count VI of Plaintiff's Complaint, Defendants incorporate by reference A.R.S. § 44-1522, but deny its application to the construction and sale of Plaintiff's residence, except for what has previously been admitted, deny the allegations set forth in Paragraphs 41, 42, 43, 44, 45, 46, and 47.

XI.

Answering Count VII of Plaintiff's Complaint, Defendants deny the allegations set forth in Paragraphs 48, 49, 50. 51, 52, 53 and 54.

XII.

Answering Defendant does not waive any affirmative defenses that may become evident in the course of further investigation and discovery and expressly reserves the right to raise such other affirmative defenses upon further allegations and/or facts which may render other defenses applicable, including those set forth in A.R.S. § 12-683 and Rule 8(c), which are hereby incorporated by reference as though fully set forth herein.

WHEREFORE, having fully answered Plaintiff's Complaint, Defendants pray that Plaintiff take nothing thereby, that Plaintiff's Complaint be dismissed and that Defendants have judgment in their favor together with their costs and attorneys fees, and for such other relief as the Court may deem just in the premises.

Dated this 14th day of May, 2001.

JENNINGS, STROUSS & SALMON, P.L.C.

By W. Michael Flood

W. Michael Flood
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Two North Central Ave.
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Attorneys for Defendant Trimark Homes, Inc.

Copy of the foregoing mailed on this 14th day of May, 2001, to:

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14646 N. Kierland Blvd., Suite 255
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Attorneys for Plaintiff

By W. Michael Flood

EXHIBIT "3"

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Telephone: (602) 262-5911

Attorneys for Defendant Trimark Homes, Inc.

COPY
MAY 14 2001
MICHAEL K. JEANES, CLERK
T. ANZALDUA
DEPUTY CLERK

IN THE SUPERIOR COURT OF THE STATE OF ARIZONA

IN AND FOR THE COUNTY OF MARICOPA

JOYCE DEFREN, a single woman,

Plaintiff,

vs.

TRIMARK HOMES, INC., an Arizona corporation; TRIMARK BENNETT ESTATES, L.L.C., an Arizona limited liability company,

Defendants

TRIMARK HOMES, INC., an Arizona corporation; TRIMARK BENNETT ESTATES, L.L.C., an Arizona limited liability company,

Third Party Plaintiffs

vs.

GILBERT PLUMBING COMPANY, INC.,

Third Party Defendant

No. CV2001-009145

THIRD PARTY COMPLAINT

(CONTRACT--- EXPRESS AND COMMON LAW INDEMNITY and REFORMATION)

(Assigned to The Honorable Michael J. O'Melia)

COME NOW the Defendants/Third Party Plaintiffs TRIMARK HOMES, INC. and TRIMARK BENNETT ESTATES, L.L.C., and for their Third Party Complaint against Gilbert Plumbing Company, Inc., allege as follows:

I.

Third Party Plaintiffs hereby incorporate by reference the Plaintiff's Complaint and Defendants' Answer thereto.

II.

Plaintiff has alleged various counts against Defendant contractor TRIMARK HOMES , INC. and TRIMARK BENNETT ESTATES, L.L.C., (hereinafter "TRIMARK BENNETT") who formerly owned and sold the Plaintiff's residence to Plaintiff alleging that the plumbing system for the Plaintiff's home has chemical contaminants that have rendered it uninhabitable.

III.

On or about August 15, 1998, TRIMARK HOMES entered into a Subcontract with Third Party Defendant GILBERT PLUMBING COMPANY, whereby GILBERT PLUMBING COMPANY ("Subcontractor"), a duly licensed plumbing subcontractor operating and doing business in Maricopa County, Arizona, subcontracted to furnish all labor, materials, supplies and services for the plumbing systems for the residences at Arroyo Canyon, including Plaintiff's residence, being constructed by TRIMARK HOMES ("Contractor") and developed and sold by TRIMARK BENNETT ("Owner"). The Contract Agreement is hereby fully incorporated by reference.

IV.

Under said Contract Agreement Third Party Defendant GILBERT PLUMBING agreed to fully indemnify and hold harmless the contractor, TRIMARK HOMES, and owner, TRIMARK BENNETT from any claims, damages, losses , expenses and attorneys fees arising out of or resulting from GILBERT PLUMBING's performance of the work caused by Gilbert Plumbing or by anyone under contract to or agreement with GILBERT PLUMBING.

V.

In addition to its express indemnity, Third Party Defendant Gilbert Plumbing is subject to an implied indemnity to the Third Party Plaintiffs for any liability incurred as the result of Plaintiff's Complaint arising from GILBERT PLUMBING's work and/or materials, to wit, Plaintiff's claim for bodily injuries and property damage arising from the plumbing system supplied and installed by GILBERT PLUMBING.

VI.

In its Contract Agreement with Third Party Plaintiff TRIMARK HOMES, Gilbert Plumbing further agreed to provide General Liability Insurance protection with the Contractor, TRIMARK HOMES, to be named as additional insured, against claims for damages for the plumbing system work supplied and performed by GILBERT PLUMBING under the agreement.

VII.

Third Party Defendant unilaterally undertook to alter the written terms of the Contract Agreement after it was signed by TRIMARK HOMES without discussion or consent of TRIMARK HOMES, however, it was clearly the intent of TRIMARK HOMES that GILBERT PLUMBING's general liability policy was to be provided to cover TRIMARK HOMES as additional insured and that it would be primary to any other coverage and would fully cover the indemnity and hold harmless obligations of GILBERT PLUMBING owed to TRIMARK HOMES as the Contractor and TRIMARK BENNETT as the Owner.

VIII.

The Contract Agreement entered into between TRIMARK HOMES and GILBERT PLUMBING was initially executed by TRIMARK HOMES and delivered to GILBERT PLUMBING. GILBERT PLUMBING purported to delete portions of the indemnity and insurance provisions of the Contract Agreement without discussion or concurrence of TRIMARK HOMES WHO neither initialed or concurred with any purported changes to these provisions. The general liability policy to be purchased by GILBERT PLUMBING, and which was provided by them indicating by Certificate that TRIMARK HOMES was an additional insured, was understood to provide primary coverage and protection for the Contractor, TRIMARK HOMES, and the Owner, TRIMARK BENNTT, as well as for GILBERT PLUMBING for claims arising from the performance of the work and materials provided by GILBERT PLUMBING pursuant to their Contract.

WHEREFORE, Third Party Plaintiffs pray as follows:

1. In the event that Plaintiff obtains judgment against them on Plaintiff's Complaint entitling Plaintiff to damages, attorneys fees and/or other relief against TRIMARK HOMES and/or TRIMARK BENNETT, that GILBERT PLUMBING be held to fully indemnify them and that the Third Party Defendants recover their costs and attorneys fees in connection with the defense of said claims;

2. That the Court declare that the indemnity and insurance provisions of the Contract Agreement entered into between TRIMARK HOMES and GILBERT PLUMBING be reformed as originally contemplated and in accordance with the intent of the parties at the time TRIMARK HOMES executed the contract [unaltered by any efforts by Gilbert Plumbing to unilaterally initial or endorse changes to the Agreement without discussion or its concurrence] such that the general liability policy purchased by GILBERT PLUMBING provided primary coverage and protection for the Contractor, TRIMARK HOMES, and the Owner, TRIMARK BENNTT, as well as for GILBERT PLUMBING for claims arising from the performance of the work and materials provided by GILBERT PLUMBING pursuant to their Contract, and that said Contract be reformed so as to express this intent.

3. Third party Plaintiffs further pray for full indemnification as entitled under the unaltered provisions of the agreement, for their costs and attorneys fees in connection with the pursuit of this Third party Complaint, and for such other relief as may be deemed just.

Dated this 14th day of May, 2001.

JENNINGS, STROUSS & SALMON, P.L.C.

By W. Michael Flood

W. Michael Flood
One Renaissance Square
Two North Central Ave.
Phoenix, AZ 85004-2393
Attorneys for Third Party Plaintiffs Trimark Homes, Inc. and Trimark Bennett Estates, Inc.

Copy of the foregoing mailed on this 14th day of May, 2001, to:

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Stephen L. Wetherell, Esq.
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Scottsdale, AZ 85254
Attorneys for Plaintiff

By W. Michael Flood

EXHIBIT "4"

7/18/01

RICHARD ... CLERK
RECEIVED, DOC
DOCUMENT DEPOSITORY
2001 JUL 18 PM 3:53
FILED
BY E. LEE, DEP

William W. Drury, Jr., #005238
Charles A. Struble, #009860
RENAUD, COOK & DRURY, P.A.
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40 North Central, Suite 1600
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(602) 307-9900
Attorneys for Defendant Gilbert Plumbing Company, Inc.

IN THE SUPERIOR COURT OF THE STATE OF ARIZONA

IN AND FOR THE COUNTY OF MARICOPA

JOYCE DEFREN, a single woman,

Plaintiff,

v.

TRIMARK HOMES, INC., an Arizona Corporation; TRIMARK BENNETT ESTATES, L.L.C., an Arizona limited liability company,

Defendants/Third Party Plaintiffs,

v.

GILBERT PLUMBING COMPANY, INC., an Arizona Corporation,

Third Party Defendant.

No. CV2001-005145

AMENDED ANSWER OF GILBERT PLUMBING COMPANY, INC. TO THIRD-PARTY COMPLAINT

(Assigned to the Honorable Michael J. O'Melia)

Third-party defendant Gilbert Plumbing Company, Inc. ("Gilbert Plumbing"), for its answer to the third-party complaint, hereby admits, denies and alleges as follows:

1. Denies the allegations contained in paragraph 1 of the Third-Party's complaint except that third-party defendant admits that it did plumbing work at plaintiff's home.

2. Alleges that plaintiff's complaint speaks for itself and third-party defendant denies the allegations contained in plaintiff's complaint not admitted above.

3. Admits that Gilbert Plumbing entered into a subcontract with third-party plaintiff Trimark Homes and specifically denies that the contract agreement is as stated by third-party plaintiff.

LAW OFFICES RENAUD, COOK & DRURY, P.A. 40 NORTH CENTRAL AVE SUITE 1600 PHOENIX, AZ 85004 TELEPHONE 307-9900 FACSIMILE 307-9123

4. Denies that Gilbert Plumbing agreed to fully indemnify and hold harmless the contractor unless the claim arose from the negligence of Gilbert Plumbing or persons under contract or agreement with Gilbert Plumbing.

5. Denies the allegations contained in ¶5 of the third-party complaint.

6. Admits the contract speaks for itself and denies the remaining allegations contained in ¶6 of the third-party complaint.

7. Denies the allegations contained in ¶7 of the third-party complaint.

8. Denies the allegations contained in ¶8 of the third-party complaint.

9. Denies each and every allegation of the third-party complaint not expressly admitted herein.

10. Denies that third-party plaintiff is entitled to indemnity from Gilbert Plumbing.

11. Allege that damages to Plaintiffs' home, if any, was due to the fault of non-parties for which Gilbert Plumbing is not responsible.

12. Alleges that inasmuch as this matter arises out of contract that Gilbert Plumbing is entitled under A.R.S. §12-341.01 to recover its attorneys' fees and costs incurred herein.

13. As additional affirmative defenses to the third-party complaint, it is alleged that facts may come to light to support any and all of the lawful affirmative defenses. Therefore, third-party defendant hereby alleges the possible defenses of waiver, estoppel, setoff, non-joinder of indispensable, necessary and proper parties, release, laches, assumption of risk, lack of mutuality, statute of frauds, lack of jurisdiction over the subject matter, lack of jurisdiction over the person, res judicata, abatement, insufficiency of process, the doctrine of avoidable consequences, accord and satisfaction, improper venue, sudden emergency, unavoidable accident, statute of limitations and/or any other lawful affirmative defense available by law, including, but not limited to, any other affirmative defense set forth in Rules 6 and 8, Arizona Rules of Civil Procedure.

WHEREFORE, having fully answered the third-party complaint, third-party defendant asks that same be dismissed, that third-party plaintiffs take nothing thereby, that third-party defendant be awarded its attorneys' fees and costs incurred herein, and for such other and further relief as the Court may deem just and proper.

LAW OFFICES
RENAUD, COOK
& DRURY, P.A.
40 NORTH CENTRAL AVE
SUITE 1900
PHOENIX, AZ 85004

DATED this 16th day of July, 2001.

RENAUD, COOK & DRURY, P.A.

By: _____
William W. Drury, Esq.
Charles A. Struble
Two Renaissance Square
40 North Central, Suite 1600
Phoenix, AZ 85004-4449
Attorneys for Defendant Gilbert Plumbing Company, Inc.

COPY of the foregoing mailed this 16th day of July, 2001, to:

E. J. Peskind, Esq.
Stephen L. Wetherell, Esq.
PESKIND HYMSON & GOLDSTEIN, P.C.
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Attorneys for Plaintiff Defren

Michael Flood, Esq.
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One Renaissance Square
Two North Center Avenue
Phoenix, Arizona 85004
Attorney for Trimark Homes, Inc. and Trimark Bennett Estates, LLC

_____

LAW OFFICES
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SUITE 1600
PHOENIX, AZ 85004
TELEPHONE 307-4000
FACSIMILE 307-4102

EXHIBIT "5"

COPY

ONTRACT AGREEMENT

Billing Reference

Project No. 200

Cost Code: 3014

Amount: See Exhibit C

Construction Lender: _____

PROJECT NAME Arroyo Canyon

PROJECT ADDRESS 7865 E. Vista Bonita Drive, Scottsdale, Arizona 85255 (Hayden & Pinn Peak)

PROJECT PHONE NO. 991-6022 CONTRACT FOR Plumbing

AMOUNT See Exhibit C

THIS CONTRACT, made and entered into this 15th day of September, 1997 by and between

NAME Gilbert Plumbing Co.

ADDRESS 254 S. Mesa Dr., Mesa, Arizona 85210

hereinafter known as Subcontractor, and Trimark Homes, Inc. hereinafter known as Contractor.

Office Address 7500 E. McDonald Dr., #300-A
Scottsdale, AZ 85250

SECTION 1: DESCRIPTION OF WORK.

Subcontractor agrees to furnish all labor, materials, installation, supplies, equipment, services, machinery, tools, and other facilities of every kind and description required for th prompt and efficient execution of the work described herein, and to perform the work necessary to complete the following generally described duties:

See Exhibit A

All as more particularly described on the SCOPE OF WORK attached here to as Exhibit "A" and by this reference incorporated herein, for the said job, in strict accordance with th above mentioned contract documents, applicable codes and ordinances, and to the full satisfaction and acceptance of the Contractor for the total consideration set forth and including a cartage and applicable taxes of any nature whatsoever, in accordance with the PAYMENT SCHEDULE provisions of this agreement.

SECTION 2: PAYMENT SCHEDULE

Subcontractor shall not be paid until he has complied with all of the provisions of this SECTION. Subcontractor shall submit all invoices for work and materials furnished duplicate, to Contractor for approval. All invoices shall be accompanied by Lien Releases, Labor Releases, Notarized Material Releases, (Exhibit "B"); and Subcontractor's Declaratio to Procure Payment executed by the Subcontractor, his laborers and all supplies who furnished materials to said job, to the date of the invoice(s). Any payment made hereunder, prior t total completion and acceptance of Subcontractor's work shall not be construed as evidence of acceptance of any part of Subcontractor's work nor a waiver of any claim by Contract arising out of faulty workmanship or materials or from failure of the Subcontractor to comply strictly with the contract documents. The acceptance by the Subcontractor of final payme shall be and shall operate as a release to the Contractor of all claims and all liability to the Subcontractor for all things done or furnished in connection with this work and for every a and neglect of the Contractor and others relating to this work. No payment, however, final or otherwise, shall operate to release the Subcontractor or his sureties from any obligatio under this contract or the Performance and Payment Bond, if any.

Contractor agrees to pay Subcontractor as stated below. Contractor's payment obligations are conditioned upon receipt of appropriate lien waivers, affidavits, warranties an guaranties pertaining to any and all work performed by Subcontractor, and its suppliers and/or materialmen. Contractor may deduct and/or withhold payments from Subcontractor t protect against any claims or liens. Subcontractor agrees to pay for all labor, materials, equipment, tools, appliances and everything used in, or in connection with the performance of thi agreement, when due, and to protect Contractor from all claims and liens on account thereof, and to furnish satisfactory evidence to Contractor that Subcontractor has satisfied all of th requirements noted above.

See Exhibit C attached hereto:

Subcontractor shall comply with the payment and invoicing requirement set forth on attached Exhibit D. Contractor may withhold payment of money otherwise due t Subcontractor pursuant to this or any other Contract Agreement for any of the following reasons: (a) The omission of any work required by the Contract Documents or defective wor that has not been remedied; (b) Mechanic's liens or stop notices filed or reasonable evidence indicating the probable filing of such liens or notices, including any pre-lien notice, in whic case Contractor may withhold one hundred twenty-five percent (125%) thereof; (c) Failure of Subcontractor to make payments properly to subcontractors, materialmen, laborers, or othe

_____
Subcontractor's Name

_____
Contractor's Initials

[signature] 1-28-98
Subcontractor's Initials/date

[illegible] initialing this page, Subcontractor acknowledges and certifies that subcontractor has read and understands the contents of this page and agrees to be bound thereby.

rsons entitled to file a mechanic's lien claim or stop notice; (d) The existence of reasonable doubt by Contractor that the Contract can be completed for the balance of the contract pric unpaid, unless the Subcontractor deposits with Contractor sufficient funds to satisfy such deficiency, as provided herein; (e) Failure of Subcontractor to accomplish the work un this Contract or any reasonable indication that the work will not be completed within the time of performance provided herein; (f) Any damage to another contractor or to a subcontract performing work on the project; and (g) Any payment dispute or controversy between two (2) or more contractors or subcontractors.

Whenever the grounds giving rise to the above withholding have been removed, Contractor shall pay to Subcontractor the amount withheld because of such grounds less a expenses incurred by Contractor or damages sustained by Contractor as a result of the withholding, the cause of the withholding, or the removal of the cause of the withholding. A payment made by Contractor directly to any laborers, subcontractor or materialmen shall be deemed payment to Subcontractor and credited against the contract price due Subcontractor. The right to withhold pursuant to this Section shall be in addition to all other rights and remedies Contractor may have in this Contract.

SECTION 3: INDEPENDENT INVESTIGATION

Subcontractor has satisfied himself, by his own investigation and research, regarding all the conditions affecting the work to be done and materials to be furnished including requirements, statutes and ordinances of all governmental entities, and as to the meaning and intention of the plans and specifications and the general conditions, thereof, referred herein, and basing his conclusion to execute this Contract on such investigations, independent of any estimate or other information prepared or furnished by Contractor [illegible] furnish certain completed work, in accordance with the Plans and Specifications herein described, as part of said job. ~~No [illegible]~~ no verbal agreement or conversation with any representative or Contractor either before or after the execution of this Contract, shall affect or modify any of the terms or obligatio contained herein. All provisions of the above mentioned contract documents, specifications, and drawings which are applicable to this Contract or which in any way affect the wo herein described, shall have the same effect as if written in full in this Contract, except insofar as such provisions may be specifically changed by this Contract.

SECTION 4: PERFORMANCE

Subcontractor shall be liable to Contractor for damage due to delay in completion of work if such delay is caused by Subcontractor. Contractor may deduct the total of su damage from any sums owing Subcontractor. If such delay damages exceed any sums owed to Subcontractor by Contractor under this contract, Subcontractor shall be liable Contractor for such amounts. Contractor's remedies for damage due to delay caused by Subcontractor, in whole or in part, shall be direct and in whatever amount permitted in law equity attributable to Subcontractor, or under this contract.

Upon the breach of this Contract in whole or in part or upon any assignment thereof voluntarily or by operation of law or upon the commission of any act of bankruptcy Subcontractor or upon Subcontractor's failure or refusal to do any of the work to be done hereunder to the satisfaction of Contractor, Contractor may at its option personally, by agen or other Subcontractors perform and complete said work for the account and all the expense of Subcontractor and withhold from the price to be paid hereunder sufficient fun therefore. If such costs of completion exceed amounts due to Subcontractor or the contract price under this contract, Subcontractor shall be liable to Contractor for such amounts.

The Subcontractor agrees to clean up and remove from premises, from time to time, all waste material and debris of every description which may accumulate in the building about the premises as a result of his work. The work must be left in a clean acceptable manner. Should the Subcontractor refuse or neglect to clean up or remove waste materials a debris upon being directed to do so by the Contractor, the Contractor may remove same or cause it to be removed by others and the Subcontractor shall suffer a deduction from contract price for the expense incurred.

SECTION 5: LABOR

Should Subcontractor become involved in any labor dispute for any reason, which dispute results in hand billing, picketing, parading, blocking, or walking within 100 yards of t construction site. Contractor may terminate this Contract upon 24 hours written notice to Subcontractor. Subcontractor agrees to hold harmless and pay Contractor for any damages legal expenses incurred by Contractor, by reason of any such labor dispute. Subcontractor is aware that such damages or costs may include costs relating to the shutdown of the proje delaying the project, lost wages, property damages, and expenses incurred by Contractor's attorneys in attempting to remove, isolate or control such labor dispute. In addition, shou Contractor elect to operate a secondary or reserve gate by reason of any such labor dispute, Subcontractor agrees to pay for all expenses incurred in the operation and administration such gate including guard services.

Failure to comply with the terms of this Section 5 shall, upon 24 hours written notice, constitute grounds for termination of this Contract Agreement in addition to any and other rights Contractor may have under the terms hereof or by law.

Subcontractor agrees not to delay or permit the delay of the progress of the work on account of any labor union difficulties, and to hold the Contractor harmless from any lo damage or delay occasioned by any difficulties between Subcontractor and any labor union. In the event a union threatens to strike, picket or otherwise delay the work, Contract shall, in addition to its other rights and remedies, have the option of canceling this contract forthwith, and having the work continue and/or completed at Subcontractor's expens Subcontractor will comply with all terms and conditions of any master labor agreement covering the work to be done under this project, and will prevent the occurrence of any strik slowdown or other labor difficulty or dispute arising out of the presence of Subcontractor on the job or the activities of Subcontractor. If Subcontractor is a union signatory:

a. It is agreed by the parties hereto that a substantial and material consideration for the acceptance of the bid of the Subcontractor and the contracting of the work herein defined guarantee and warranty herein made by the Subcontractor that a valid collective bargaining agreement is, and for the duration of this agreement will, remain in full force and effe ween the Subcontractor and the appropriate Building and Construction Trades Union or Unions, AFL-CIO, or with the International Brotherhood of Teamsters, Chauffeur arehousemen and Helpers of America, or an affiliate thereof.

b. It is agreed that all work performed by the Subcontractor shall be rendered in accordance with each and all of the terms and provisions of the aforesaid collective bargainir agreements including, but not limited to, hourly rates of pay and payments to trust funds as required by said collective bargaining agreements.

c. The Subcontractor warrants and represents that he is presently and for the duration of this agreement will remain, current in payments to the appropriate health and welfa pension, vacation and apprenticeship fund, or funds, as required of him by his collective bargaining agreement with the appropriate Building and Construction Trades Union or Unior AFL-CIO, or with the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America, or an affiliate thereof.

d. In the event the Subcontractor is delinquent in the payment or payments to the appropriate health and welfare, pension, vacation, and apprenticeship fund or funds, regardless the job in connection with the delinquency occurred, the Contractor shall have the right to first deduct the full amount of such delinquency from payments to be made to t Subcontractor pursuant to this agreement. The Contractor shall have the further right to pay the amounts so deducted directly over to the appropriate fund or funds and the Subcontract hereby expressly designates and authorizes Contractor to act as his agent for this purpose.

e. If the Subcontractor breaches any of the provisions herein it is agreed that Contractor shall immediately have an option to cancel this contract in its entirety. The foregoing rig to cancel shall not be construed to deny to Contractor any other right or remedy, which it may have under this contract, in law or equity.

f. All of the provisions herein shall apply to any Subcontractor performing work as herein defined, under any change of name, or association or joint venture (including any persc who may have been a principal financially associated with the Subcontractor, who is delinquent in fringe benefit payments to the aforesaid named funds).

SECTION 6: TAXES

Subcontractor acknowledges that he is familiar with and agrees to pay any and all city, county state, or federal taxes, including, without limitation, all sales, transaction privileges and/ use taxes, in connection with the work and materials to be furnished hereunder, which is his responsibility to pay under the state and federal laws.

SECTION 7: EXTRAS

It is understood and agreed that all labor and/or materials furnished by the Subcontractor shall be deemed to be included within the contract price stated herein, even though said lab and/or materials are not specifically required or demanded in this Contract, or the plans or specifications, and the same shall, nevertheless, be deemed to be included within the scope labor and/or materials properly and necessarily required for the performance hereof, except only one condition and none other, to wit: that any labor and/or materials furnished hereund that is authorized by Contractor in writing, together with a definite statement in said authorization that said labor and/or materials shall be deemed to be an "extra," and shall be paid f in addition to the contract price at a sum specified in said authorization. Any such extra work authorization must be in writing and signed by Subcontractor and Contractor. Contract may at any time during the progress of said project, order in writing, deviations, additions, deductions or omissions, and the same shall not void this Contract, but the value thereof agreed upon in such written authorization shall be added to or deducted from the contract price hereof. Any modifications in the work to be done by Subcontractor that are change requiring the substitution of certain work and/or materials for other work and/or materials originally required by this agreement, or by the plans and specifications incorporated into th agreement, shall not entitle the Subcontractor to additional compensation unless the change order is in writing and specifically authorizes an "extra" in a stated amount.

It is expressly agreed and understood by and between the Contractor and the Subcontractor that no extra charges will be paid without written authorization; that the contract pric includes performing all work specified according to specifications and acceptable to Contractor, FHA, and job superintendent as herein provided, and that said work must comply with a city, county, state and federal building codes and requirements. Under no circumstances shall Subcontractor negotiate directly with Contractor's buyers for any change, addition o deletion from the work for such buyer without the express written consent from Contractor.

SECTION 8: DEVIATIONS

Subcontractor shall make no changes and shall be responsible for any deviation from the plans and/or specifications that he may make and may be required to cause any work t conform strictly to the plans and/or specifications unless a written authorization from Contractor addressed to Subcontractor shall be given setting forth specifically in detail what change shall be made. It shall be deemed that the costs of the changes, unless otherwise specifically agreed upon in writing, shall not exceed a credit for the work not required to be done.

SECTION 9: SAFETY

Subcontractor shall be responsible for the compliance with all safety rules and regulations, including specifically, but not by way of limitation, the Occupational Safety and Health Ac of 1970, and any amendments thereof, during the conduct of Subcontractor's performance on and in connection with the project. Subcontractor shall indemnify Contractor for any and all

____
Subcontractor's Name

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actor's Initials

[illegible] 1-28-98
Subcontractor's Initials/date

* By initialing this page, Subcontractor acknowledges and certifies that subcontractor has read and understands the contents of this page and agrees to be bound thereby.

expenses incurred by Contractor for fines, penalties, and corrective measures that result from acts of commission or omission by Subcontractor, his agents, employees and assigns, re to comply with such safety rules and regulations, irrespective of Contractor's own negligence or actions.

Subcontractor and/or his employees will comply with all safety rules and regulations as required by the Contractor and the Occupational Safety and Health Act of 1970. It is t responsibility of each Subcontractor to inform their employees of these safety requirements. The Contractor's safety rules and regulations will be issued to each Subcontractor for iter that may not be covered by OSHA Act of 1970. Each subcontractor is to have first aid equipment and trained personnel to perform first aid treatment for their employees as required l the OSHA Act. Subcontractor and/or their employees who are in violation of any of these safety rules and regulations may be subject to fines that will be imposed per the OSHA A· Subcontractor and/or their employees who are in violation of the safety rules and regulations will be notified in writing of these violations, and it is the responsibility of ea Subcontractor to correct these violations immediately. Subcontractor and/or their employees who are in repeated violation and/or refuse to comply with these safety rules and regulatio will be removed from the project.

Subcontractor agrees to comply with all safety orders and regulations imposed by the OSHA or the Division of or any other appropriate regulatory agency of the State of Arizor Subcontractor agrees to abide by the provisions of Occupational Safety and Health or The Industrial Commission any union agreements which are binding upon Contractor and whi· affect the performance of Subcontractor's work hereunder. At Contractor's option, Subcontractor shall furnish to Contractor, at Subcontractor's expense, a completion, labor, material, a faithful performance bond in favor of Contractor. Said bond shall provide that no changes or additions to the plans, specifications, or clarification instructions, of this contract sh· exonerate or discharge the surety under such bond.

Subcontract warrants that it is familiar with all and not in violation of any laws, ordinances, rules and regulations required by any public or private authority pertaining to the work the performance of this contract agreement. Subcontractor shall employ for the performance of its work responsibilities hereunder only capable and competent workers and trade persor Subcontractor shall require its employees to abide by reasonable job site rules, and will not employ such workers or trade persons whose employment on the project is reasonab objected to by Contractor. Reasonable rules may include, but not limited to, rules regarding safety, alcohol and drugs. During the performance of its work, Subcontractor shall (conform to all safety regulations and requirements prescribed by all Federal, State, County and City authorities, and any other governmental authority having jurisdiction over the Proje and (b) take all additional precautions as Contractor or Owner may reasonably require for safety and accident prevention purposes. Subcontractor shall provide his employees with su appliances, utilities, facilities, tools and equipment and shall further provide such employees with a safe place to work. Subcontractor shall perform the work in a safe manner with hi regard for safety and take all standard precautions to prevent accidents and to preserve life and health and all personnel performing or in any way coming in contact with the performan· of the work under this contract. Subcontractor will report immediately in writing to Contractor any injury to any of Subcontractor's employees at the Project site and will give Contract· a copy of any accident report given to any third party.

Should Subcontractor, Subcontractor's employees, subcontractors or their employees fail to comply, within twenty four (24) hours from the time Contractor issues Subcontractor written notice of noncompliance or within the time of an abatement period specified by any government agency, whichever period is shorter, Contractor may give notice of default Subcontractor for failure to perform in accordance with the terms of this Agreement. Failure of Subcontractor to remedy such default within twenty four (24) hours after such noti· shall give Contractor the option of:

a. Without terminating this Agreement or the obligation of Subcontractor, Contractor may perform such portion of the work or may furnish any material, equipment, or other ite required, as Contractor, in its sole discretion, may deem necessary to avoid noncompliance with any applicable safety or health laws. The cost of such work or materials, equipment · other items shall be deducted from the contract price, and, in the event the cost of such work or materials or other items of any nature exceeds the balance due Subcontractor, sur excess shall be immediately due and owing from Subcontractor to Contractor.

b. Without terminating this Contract, Contractor may eject Subcontractor from the job site, and Contractor shall have the further option of: (i) completing the work or ar portion thereof itself, or (ii) having the work, in whole or in part, completed by others. The foregoing right to eject Subcontractor shall not be construed to deny Contractor any oth right or remedy which it may have under this Contract, in law or equity.

SECTION 10: PROTECTION AGAINST INJURY

Subcontractor does agree to protect his own work ~~and to be responsible therefore under all circumstances and for the condition thereof until final acceptance of the entire projec~~ to protect adjacent property from injury arising out of his work, and to make good and be liable for any such damage or injury.

SECTION 11: INDEMNITY AND INSURANCE

~~A. To the fullest extent permitted by law, Subcontractor shall indemnify and hold harmless Contractor from any and all claims, damages, losses, expenses, demands, judgments,~~ liability, including costs of defense and attorney's fees, arising directly or indirectly out of any obligation of Subcontractor under this contract agreement or work performed b Subcontractor or for Subcontractor. This indemnification shall extend to claims resulting from performance of this contract agreement and shall apply to the extent the claim, demand loss, etc. is caused in whole or in part by any negligent act or omission of Subcontractor or any of Subcontractor's agents, employees, subcontractors, suppliers and/or materialmen ~~This indemnity shall be effective regardless of whether the claim, demand, loss, etc. is caused in some part by Contractor and/or Contractor's own negligence.~~ Subcontractor sha secure and maintain, during the entire progress of the work, full and unlimited Workmen's Compensation and Employers' Liability Insurance, Comprehensive General Liabilit· ·lic Liability and Property Damage insurance including without limitation automobile and products liability coverage in amounts and with a carrier or carriers satisfactory t tractor; to furnish Contractor with certificates of said insurance before commencing work hereunder which certificates shall provide that the policy shall not be canceled or reduce coverage until thirty (30) days after written notice shall be given to Contractor of such cancellation or reduction in coverage; to insure his interest from loss to the premises resultin from fire, settlement, earth, flood, storm and wind, earthquake, theft, embezzlement, riot or any other cause whatsoever and Contractor shall not, under any circumstances, be liable · accountable to Subcontractor for such loss.

B. Subcontractor shall, at Subcontractor's sole expense, obtain and maintain in force at all times from the date of this agreement until the work under this agreement is ful completed, the following policies:

1. Comprehensive General Liability Insurance: Coverage shall be on an "Occurrence" basis and shall insure Subcontractor for work performed under this agreement again claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees and for damages, other than to the work itself, because · injury to or destruction of tangible property, including loss of use resulting therefrom and shall include the following coverages:
   a. Operations and Premises: includes coverage from Explosion, Collapse or Underground Operations.
   b Blanket Contractual Liability Coverage ~~to comply with the indemnity provisions contained in this Agreement~~. Coverage to apply to both written and verbal agreements.
   c. Protective Liability to cover Subcontractors Liability arising out of work performed by its subcontractors.
   d. Products and Completed Operations. Subcontractor agrees to furnish evidence of such insurance coverage for twenty four (24) months following date of acceptance b Contractor.
   e. Broad Form Property Damage extended to apply to Completed Operations.
   f. Broad Form Comprehensive General Liability Endorsement or its equivalent.
   g. Personal Injury Coverage with exclusions (a) contractual and (c) employee deleted.
   h. Contractor shall be named as additional insureds.
   i. ~~Endorsement providing that such insurance is primary insurance and that any other insurance maintained by Subcontractor is excess and noncontributing with insurance required hereunder.~~
   j. Limits of Liability shall not be less than: $1,000,000 Bodily Injury and Property Damage (Combined Single Limit).
2. Automobile Liability Insurance: Coverage shall insure all Owned, Hired and Non-Owned Automobiles with Minimum Limits of $1,000,000 Bodily Injury and Propert Damage (Combined Single Limit).
3. Workers' Compensation Insurance: Coverage shall insure the Subcontractor's employees as required under the Worker's Compensation and Occupational Disease Laws o other statute of the State where the work is performed and Employer's Liability with a $1,000,000 Limit each accident, $1,000,000 by disease-Policy Limit, and $1,000,00· Disease - Each Employee. Coverage shall include the following:
   a. Voluntary Compensation Endorsement
   b. All States Endorsement
   c. Waiver of Subrogation as respects Contractor and Subcontractor.
4. Property: Subcontractor is responsible for providing insurance via an installation floater policy covering all materials and supplies at Subcontractors premises, in transit or a the job site until such materials and supplies are installed as a permanent part of the project. Such insurance shall contain a waiver of subrogation as respects Contractor an Subcontractor.
5. Certificate of Insurance: Subcontractor shall furnish Contractor with a Certificate of Insurance or policy of insurance and such other written evidence Contractor may requir to confirm the existence of the insurance required hereunder prior to the commencement of the work, but in no event later than five (5) days following the full execution o this Agreement. All insurance policies shall be issued by insurance companies and in amounts satisfactory to Contractor. No such policy shall be canceled or subject t reduction of coverage or other modification except after thirty (30) days written notice to Contractor, Subcontractor shall, at least (30) days prior to the expiration of suc policies, furnish Contractor with renewal Certificates of Insurance, or copies of policies, or "binders". The Subcontractor shall not violate or permit to be violated, any required insurance policy.

See Addendum "A"

Subcontractor's Name

1-28-98

Subcontractor's Initials/date

...ractor's Initials

** By initialing this page, Subcontractor acknowledges and certifies that subcontractor has read and understands the contents of this page and agrees to be bound thereby.

6. Owned or Leased Property: Owned or leased property or construction type tools, equipment and machinery used for construction shall be insured by the Subcontractor. If t Subcontractor chooses not to insure any construction equipment or other property brought onto the site, then Subcontractor agrees to hold Contractor, its agents, office directors or employees, harmless from any and all claims arising from the possession or use of such equipment and shall execute a specific indemnity agreement as may required by Contractor.

7. Subcontractor hereby agrees that Contractor shall be named as an additional insured on all such insurance policies, except worker's compensation policies.

SECTION 12: SUBCONTRACTOR'S PERMITS, LICENSES

Subcontractor agrees to obtain at his expense all permits and licenses to comply with all laws, ordinances, rules, regulations, order and requirements of the city, county, state a federal governments and of any Board or Commission or other duly qualified body having jurisdiction which shall or might affect or apply to the work, and to maintain Subcontracto License as required by the State in which the work is being performed.

Subcontractor hereby represents and warrants that it possesses any and all construction and/or contractor licenses, permits, plan approvals and/or inspections regarding the performan of the work under this agreement as necessary and/or required by law; and, that all such licenses are current and in good standing. Subcontractor agrees to be responsible for assuring th performance of the work under this contract complies with any and all governmental codes, rules, requirements, and/or regulations. Subcontractor represents and warrants that it is compliance with all applicable federal, state and local laws regarding permits and licenses that may be required to perform the scope of work under this agreement.

SECTION 13: RE-INSPECTIONS

Subcontractor shall be charged for re-inspections resulting from unacceptable materials or workmanship.

SECTION 14: PREVENTION OF LIENS

Subcontractor agrees to pay when due, all claims for labor and/or materials and/or Subcontracts applied on or furnished hereunder, and to prevent the filing of any lien of mechanics materialmen, or attachments, garnishments, or suits involving the title of the property upon which the improvements are erected. Subcontractor agrees within five (5) days after writt demand is addressed to him at the address herein contained, by United States mail, to cause the effect of any such suit or lien to be removed from the premises, and in the event t Subcontractor shall fail to do so, Contractor is authorized to withhold funds pursuant to Section 2 or use whatever means it may deem best to cause said lien, attachment, or suit, togeth with its effect upon the title, to be removed, discharged, compromised, or dismissed, and the costs thereof, together with reasonable attorney's fees, plus 15% of such cost shall becor immediately due Contractor from Subcontractor. Subcontractor may litigate any lien or suit above described provided he cause any such lien or claim to be removed from the premis above mentioned, and shall execute and deliver to Contractor such lien waivers, releases, affidavits, contracts, bills, records, accounts, etc., as Contractor may deem necessary for t protection in such events.

In the event Contractor is served with any Writ of Attachment, Writ of Execution, Notice of Levy (Federal or State), or any other legal processes for any debt or alleged debt Subcontractor at any time during the period of this Contract prior to completion, Contractor shall automatically be entitled to keep and retain any funds or tonics then due Subcontract for work and materials furnished and/or previously billed and approved but unpaid to Subcontractor. It is understood and agreed that the purpose of the preceding sentence is to guarant that the Contractor shall have sufficient funds with which to complete Subcontractor's duties under this contract if the suit or levy out of which the above legal process arises, attaches the work, the property or any funds or property of Contractor. The occurrence of any such suit or levy shall be deemed a partial breach of this contract and Contractor shall gi Subcontractor three (3) days written notice to remove said levy, and Subcontractor's failure to do so shall entitle Contractor to the same rights as Subcontractor's failure to remove a li or suit from the premises.

If, after completion of this Contract and final payment of the contract price, any lien or claim shall appear, or still exist, the Subcontractor shall completely indemnify the Contract against any and all loss or damage which may be suffered by reason thereof, in accordance with section 11 set forth above.

Subcontractor shall promptly pay and discharge all just and valid bills, charges, cost, claims and demands for material, labor or otherwise, arising out of the work, and all labor Uni obligations. Insurance and taxes, including sales tax, social security, unemployment, withholding and other payroll taxes as required by law, and if requested by Contractor, shall subm all data, documents, records and information necessary to substantiate such payment. If the Subcontractor shall fail to do any of the aforesaid items upon receipt of one (1) day writt notice or verbal notice from Contractor, Contractor reserves the right to pay directly for material and labor supplied to job site as he deems appropriate and the cost and expense there shall be paid by Subcontractor. Should any liens or claims of lien mechanics, materialmen or otherwise be filed by anyone against the property in connection with the work of th Subcontractor, the Subcontractor shall, within one (1) day notice from Contractor pay and discharge the same and cause the same to be released. Should the Subcontractor fail to do s the Contractor may do so, and the cost and expense thereof, including any bond or indemnity deposits, shall be paid by Subcontractor.

SECTION 15: ASSIGNMENT AND SUBCONTRACTING NH 1-28-98

~~Subcontractor shall not assign or subcontract any portion of this Contract without first obtaining permission in writing from Contractor, and then only subject to provisions to th Contract.~~

Subcontractor hereby agrees that Contractor may assign this Contract including, but not limited to, any guarantees or warranties of workmanship or materials. No consent to a assignment or transfer and no subcontract shall under any circumstances operate to relieve Subcontractor of any of his obligations under this Contract; and for all purposes hereunder, a ...gnees, Subcontractors and other transferees shall be deemed to be agents of the Subcontractor. If Contractor permits assignment, Subcontractor shall remain liable to Contractor und ...ntract agreement and the obligation of Subcontractor shall also become the obligation of Assignee.

...bcontractor agrees not to assign any money due or to become due him hereunder. In the event Subcontractor makes an assignment for the benefit of creditors, files a petition in bankruptcy, has a petition in bankruptcy filed against him, suffers or permits an attachment, levy or execution to remain against any materials or monies due the Subcontractor: Contractor shall be entitled to cancel this Contract forthwith in addition to any other remedies Contractor may have by this Contract or by law provided.

~~If the Subcontractor is a corporation, any individual who signs this Contract on behalf of Subcontractor is jointly and severally responsible with Subcontractor on this Contract.~~

SECTION 16: ATTORNEY FEES

Subcontractor shall be responsible to Contractor for any and all attorney's fees and costs relating to any action brought to interpret or enforce the performance of this Contract, or any of the terms, covenants or conditions thereof, and in any action brought against Subcontractor by third parties in which Contractor is joined as a party, whether the same proceed t judgment or not. This provision shall also apply to any suit of any bond furnished hereunder.

SECTION 17: SURETY BOND

If the Contractor requires for any reason whatsoever, Subcontractor agrees that he will, within ten (10) days from the date of this Contract, provide the Contractor with payment and performance bonds, at Contractor's expense, provided such expense does not exceed one percent (1%) of the total contract price, conditioned upon the faithful performance of this Contract in all its particulars and/or a labor and material bond, duly executed with a Surety company acceptable to the Contractor, as surety, and in form and content acceptable to the Contractor. If a bond is required and Subcontractor fails or refuses to provide such a bond within ten (10) days after request, such refusal is sufficient grounds for termination of this agreement.

SECTION 18: FAILURE OR DEFINITION AND GENERAL PRINCIPLES

a. The term "Contract Documents" shall refer to and consist of this Contract Agreement, all plans and specifications, any amendments, change orders or addenda thereto executed i accordance with Section 7 and Section 22 of this Contract Agreement, and all drawings, all of which are hereby incorporated herein by this reference. The Contract Documents are intended to supplement each other as if such work was described in all. The intention of the Contract Documents is to include all labor, materials, equipment, appliances and other items necessary for the proper execution and completion of the work.

b. The term Subcontractor refers to the firm or individual, or series of individuals, or corporation, who is obligated to perform the obligations set forth in any phase of the Contract so endorsed by him or his power of attorney.

SECTION 19: SUPERVISION

a. Subcontractor, or his representatives, shall exercise full time general supervision on all phases of his operation to insure correct performance of the Contract Documents. Contractor, or his representative, shall have access to any and all parts of the Subcontractor's storage facilities, construction grounds, etc., and may at any time inspect, sample, test, or require tests to be taken on any materials furnished or ordered to be used in the construction of the work described in the Contract Documents.

b. Subcontractor shall be responsible to and answer directly to the Contractor or his representative, for his acts or omissions, and for the acts and omissions of his employees and of all persons directly or indirectly employed or retained by him in connection with the work outlined as his responsibility under the Contract Documents.

c. Subcontractor shall at all times respect the judgment and authority of the Contractor's representative acting in the capacity of Job Superintendent. Subcontractor shall report any and all criticism, material shortage, labor trouble, or other conditions or circumstances which in any way affect the performance of his duties or the completion of the job.

~~d. Subcontractor agrees that the Contractor shall have full and free access, during working hours, to all books of account and records of the Subcontractor relating to the work under his Contract, including the right to make copies, excerpts or transcripts from such books of account and records and related and supporting documents and statements.~~

SECTION 20: PLANS AND SPECIFICATIONS

a. The Contract Documents are intended to collaborate so that any work exhibited or called for in any of them, whether exhibited in any other or not, is to be executed in the true intent and meaning thereof, the same as if set forth in all of the Contract Documents. However, should any law, ordinance or regulation of the State, County, Federal Housing Administration, Veteran's Administration, or municipality, prescribe additional requirements, or should any of the work called for be in violation of the requirements of such authorities, then the requirements of such law or regulations shall prevail and shall be required to be completed by the Subcontractor as a part of the work called for in the Contract Documents, and no compensation shall be allowed therefore.

Subcontractor's Name

...ctor's Initials

1-28-98
Subcontractor's Initials/date

[1] By initialing this page, Subcontractor acknowledges and certifies that subcontractor has read and understands the contents of this page and agrees to be bound thereby.

b. It is the intent of the parties that all work described herein shall equal or exceed the Federal Housing Administration and/or Registrar of Contractors, construction requirements, local building codes, zoning ordinances, and restrictive covenants; that all erection, application, or installation shall be in accordance with the manufacturer's directions or the best standard practice, and performed in a good and workmanlike manner.

c. Figured dimensions given on the plans shall, in all cases, be considered as correct in lieu of measurements by scale. It is intended that all figures and dimensions should agree. However, it shall be the responsibility of the Subcontractor to check all figures and measurements prior to commencing work, and any discrepancies apparent to him must be reported to the Contractor immediately for adjustment. Failure to comply in this respect, and any additional costs resulting from noncompliance, shall be borne by the Subcontractor.

SECTION 21: QUALITY, MATERIALS AND WORKMANSHIP

Whenever any manufactured article, implement, or series of articles or implements is mentioned in the specifications by name, trade name or manufacturer's name, it is intended to establish a standard of merit and quality. The intent of this definition is to require quality materials and workmanship, however, substitutes of equal merit may be used by the Subcontractor, but only upon the written consent of the Contractor, or his authorized representative. Under no circumstances, shall a substitute material be used which will not conform to requirements set forth in the Contract Documents.

→ Gilbert Plumbing Bid sheets (8) dated 1/27/98 for Arroyo Canyon ... State Gilbert Plumbing's Warranty are part of this contract.

SECTION 22: CHANGES FROM PLANS AND SPECIFICATIONS

Should any changes to the Plans and Specifications be required after the signing of the Contract Documents, it shall be the responsibility of the Subcontractor to advise the Contractor, in writing, of the effects upon his portion of the Contract. The Subcontractor shall perform no additional work nor shall he decrease his obligation to the Contract without the written consent and compensation adjustment from the Contractor. [initials]

SECTION 23: GUARANTEES AND WORKMANSHIP

a. Subcontractor warrants its work against all deficiencies and defects in materials and/or workmanship and agrees to satisfy same without cost to Owner or Contractor for a period of two (2) years from the date of Substantial Completion or per the Contract Documents, whichever is longer. Subcontractor agrees to guarantee his work against all defects of materials or workmanship, as called for in the plans, specifications and addenda, or if no guarantee is called for, then for a period of 2 years from the date of occupancy of the subject matter covered by this agreement. Upon Contractor's notification, Subcontractor shall proceed within 24 hours at his own expense, to replace any defective material and/or perform any labor necessary to correct any defect whether in his work, or affected by his work and upon failure of Subcontractor to do so within 24 hours, Contractor may, at Subcontractor's expense, furnish such materials and/or labor as are necessary to bring the work up to the required standard. Subcontractor shall continue to be liable for all implied warranties and all latent defaults beyond the expiration of any warranty.

b. It shall be the responsibility of the Subcontractor during the course of construction to contact the Contractor or his representative daily to receive any and all notices of discrepancies. The Subcontractor shall immediately arrange for the correction of any and all discrepancies outlined to him by the Contractor and shall notify the Contractor upon completion of the work performed necessary to eliminate the discrepancies. Should the Subcontractor fail to comply with the Contractor's discrepancy notice within seven (7) days after notification, payments may be withheld pursuant to Section 2 until such time as the discrepancies are eliminated.

c. It shall be the responsibility of Subcontractor, after the completion of Construction and during the guarantee and any under implied warranty period, to correct any and all discrepancies and defects in workmanship and/or materials performed or supplied by Subcontractor on the work of construction, within seven (7) days after notification of such discrepancies and defects by Contractor. Subcontractor shall notify Contractor immediately upon completion of the work performed or materials supplied necessary to eliminate the discrepancies and defects.

SECTION 24: EQUAL OPPORTUNITY CLAUSE

Subcontractor agrees not to discriminate against any employee or applicant for employment because of race, color, age, religion, sex, national origin or on the basis of any other high classification, and to comply with all laws and regulations regarding discrimination. It is understood that contracts will be awarded and labor will be employed on the project herein described without discrimination as to whether employees of any Subcontractor or those employed by the Contractor of the project are members or nonmembers of any labor organization, and the Subcontractor accepts this contract with that understanding.

SECTION 25: PROCEDURE

If, as a result of fire, earthquake, flood, storm, wind, Act of God, war, strikes, picketing, boycott, lockouts, or other causes beyond the control of Contractor, Contractor shall consider it inadvisable to proceed with the work hereunder, the Subcontractor shall, upon receiving written notice thereof from Contractor, immediately discontinue any further work hereunder until such time as Contractor may deem it advisable to resume said work. Subcontractor will resume the work hereunder promptly upon receiving notice from Contractor to d so, and Subcontractor shall not be entitled to any damages or compensation on account of any cessation of work as a result of any of the causes aforesaid.

SECTION 26: WORK COMMENCEMENT AND PROGRESS

Time is of the essence in performing this contract agreement. Subcontractor shall provide Contractor with any requested scheduling information of Subcontractor's Work. The Schedule of Work, including that of this Subcontract shall be prepared by Contractor and may be revised as the Work progresses. Subcontractor recognizes that changes may be made in the Schedule of Work and agrees to comply with such changes without additional compensation. Subcontractor shall reasonably coordinate its work with all other contractors, ...ntractors, and suppliers on the Project so as not to delay or damage their performance, work, or the Project.

...ubcontractor agrees to commence the work within three (3) days after notice by Contractor to do so, to keep sufficient competent workmen, supplies of materials, tools and ...ment on the job to prosecute the work diligently to completion, and Subcontractor agrees not to hinder or delay the other trades in the performance of their work. Contractor shall b... ...ne judge as to the sufficiency of the workmen, supplies of materials, tools, and equipment furnished by Subcontractor. Subcontractor agrees to designate at least one workman as foreman and instructions, changes, or notices of any type given to said workman by Contractor, or his representatives, shall have the same effect as though given directly to Subcontractor. If the material herein called for is not delivered promptly, thereby causing or threatening to cause delay in the progress of the work, the Contractor shall have the right to investigate the cause of said delay and expedite deliveries, and all expenses thus incurred by the Contractor shall be charged to and paid by the said Subcontractor.

Subcontractor agrees to instruct all of his workmen, including his foreman, who come on the job to sign the daily register provided by Contractor or, if no such register is available, to leave a written memo at the job office, or with Contractor's job superintendent, setting forth his name and his employer. Subcontractor agrees that the labor releases which he is required to furnish as a condition of payment under this contract shall include releases from all workmen employed by him on the work.

If in the judgment of Contractor the work of Subcontractor is not proceeding adequately or that Subcontractor has breached any other provision of this Contract, Contractor may after giving 24 hours notice either verbally or by telegram, or letter to Subcontractor of such breach, proceed to have the work done in the manner most expedient to Contractor an... charge to Subcontractor the cost (including any incidental expenses) and damages to the entire job and/or to Contractor including, but not limited to, interest charges, and leg... responsibility, if any, to other Subcontractors or to Contractor. Contractor shall be entitled to take possession of and use any materials, tools, equipment, plans, permits, and diagrams o... the job site or intended for the work and use the same for the performance of the work. Subcontractor waives any claim, demand, or cause of action, against Contractor for the loss, us... misuse, abuse, or conversion of the tools, materials, equipment, plans, permits, or diagrams, taken or used by Contractor in accordance with this section.

If any of the work performed by Subcontractor hereunder (i) fails to pass the inspection of the building inspector or such governmental authority as shall be assigned to make suc... inspection; or (ii) fails to pass the inspection of the inspector for any lending institution which holds the first trust deed; or (iii) is not of a standard and quality reasonably acceptable t... Contractor, then in such event, Subcontractor agrees to make such corrections as are necessary to comply with such inspections within 24 hours after he has been notified of the particula... defect requiring such correction. Such 24 hour notice may be made verbally, directly to Subcontractor or his authorized foreman or supervisor, or may be made in writing to the office c... Subcontractor.

SECTION 27: MISCELLANEOUS

a. Subcontractor further agrees to hold the Contractor and all supervisors harmless from any expense of any nature arising out of any and all claims (including, but not limited to, claims that may be presented by virtue of any [illegible] under the Subcontractor), for union welfare, pension, vacation, apprenticeship, owner-operator, health and welfare and related type payment obligations connected with the job herein referred to, whether or not well founded. [initials]

b. The Contractor may terminate the Contract of the Subcontractor or his Subcontractors (and the Subcontractor shall so provide in contracts with his Subcontractors), in the even... that the Subcontractor, or his Subcontractors, are listed by the administrative office of the appropriate health and welfare, pension, vacation, or apprenticeship funds as being delinquen... in payment, or payments, to said fund or funds, regardless of the job in connection with which the alleged delinquency occurred. If said Contract (and/or Subcontract(s)) is terminate... pursuant to this provision, Subcontractor shall be obligated to pay the entire cost of completion of work called for by said contract(s) whether Contractor has said work completed on ... time and material basis or lets a new Contract for completion of the work. If Contractor elects *not* to terminate, pursuant to this provision: Subcontractor appoints Contractor (an... Subcontractor shall similarly bind his Subcontractors to do so) Subcontractor's agent to use Contractor's judgment and discretion to pay such amounts as Contractor believes due an... owing, pursuant to then existing collective bargaining agreements to the appropriate administrative office, out of funds Contractor would otherwise be required to pay Subcontractor... Contractor's determination as to amount(s) to be paid, if any, shall be final.

c. Contractor has been notified that Subcontractor is an open shop Subcontractor. Subcontractor and Contractor is aware that he may be working in conjunction with nonunio... trades. Subcontractor represents and warrants that his working in conjunction with non-union trades will not violate or constitute a breach of any union contract to which he may be ... party or give rise to any right of Subcontractor to withdraw union members from the job site. Should there be picketing of the work, it shall be the obligation of Subcontractor to continu... the proper performance of his work. If the Contractor establishes a reserve gate for the Subcontractor's purposes during any picketing, the Subcontractor agrees to comply with th... instructions given for the entry and exit of Subcontractor, Subcontractor's employees and suppliers. Subcontractor must continue proper performance of his work whether or not a vali... reserve gate system is in effect during picketing. Contractor has no obligation to maintain a valid reserve gate system.

____
Subcontractor's Name

____
...ractor's Initials

____
Subcontractor's Initials/date

** By initialing this page, Subcontractor acknowledges and certifies that subcontractor has read and understands the contents of this page and agrees to be bound thereby.

d. Subcontractor will not work overtime nor be compensated for such overtime unless requested by and agreed to by Contractor. Provided the Subcontractor is not in default in any [illegible] hereof, and in order to expedite the final completion of the project or general or special work thereon, if the Contractor requests the Subcontractor to work overtime, and that the Subcontractor shall work said overtime, and it is understood that the Contractor is to pay only the actual extra cost over the rate for regular time of said overtime. T[illegible]ips covering said Overtime must be checked and approved by the Contractors authorized agent at the project on a daily basis. No commission is to be charged by or allowed to the Subcontractor for, or on account of said overtime. If, however, the Subcontractor is behind in the work herein contemplated, or in the opinion of the Contractor delays the progress of work necessary to complete the project, then, if requested by the Contractor, the Subcontractor shall use such overtime as may be necessary to keep abreast with the general progress the work, and the cost and expense incurred by the use of said overtime shall be borne entirely by the Subcontractor.

e. Any notice which Contractor desires to or is required to give Subcontractor maybe delivered to Subcontractor personally or may be mailed to Subcontractor at the address Subcontractor, or at such other address as may be designated in writing by Subcontractor to Contractor; and such notice shall be deemed served upon being deposited in the United St[illegible] mails so addressed and postage thereon prepaid; but the time for performance by Subcontractor of any act based on such notice or the time for the exercise by Contractor of any r[illegible] based on such notice shall be extended for twelve hours in the event such notice is served by mail.

f. Nothing herein contained shall be deemed to constitute Subcontractor an agent, representative or employee of Contractor, and Subcontractor is and shall be an independ[illegible] Subcontractor.

g. This contract is subject to the [illegible] of necessary construction loans by Contractor.

h. The terms of this contract voids and nullifies any and all other agreements between the parties hereto, pertaining to above mentioned job.

i. This contract shall be binding upon and shall inure to the benefit of all the parties hereto, their beneficiaries, successors, and assigns.

j. If the work under this contract has not commenced within 180 days from the date of this contract, then this contract shall be without further legal force and effect and this contr[illegible] shall be void in all respects.

In the event Contractor advances or pays any sum to cure any default by Subcontractor under the contract documents, such advance or sum shall bear interest at the lesser of 18% or t[illegible] highest lawful rate from the date such sum is advanced or paid by Contractor until repaid by obligation to make any such advance or payment.

SECTION 28: NO STOPPAGE OF WORK

In the event of a dispute between Contractor and Subcontractor, including a payment dispute, Subcontractor shall not delay or stop work, but will continue and complete the work under this contract agreement, unless terminated or ordered to stop by Contractor in accordance with this contract agreement.

"CONTRACTOR"

Approved and accepted on

_____ 19__

By:

TRIMARK HOMES, INC.
a. Arizona Corporation

By. _____

Title: President

"SUBCONTRACTOR"

Approved and accepted on

January 28 1998

By: [signature]

Title: President

Address: 254 S. Mesa Dr.

Mesa, Arizona 85210

Telephone: 834-1188

License No. 34226

EXHIBIT "B"

Project Name: Arroyo Canyon
Project Job Number: 200
Trade: Plumbing

This Exhibit "B" is part of the Subcontract Contract between the Subcontractor and the Contractor executed concurrently, and the conditions and specifications of either are an integral part of the other.

GENERAL REQUIREMENTS

1. Signature of the Subcontract Contract confirms that this Subcontract Contract, Exhibit A, B, C, and D together with the approved plans dated _____ and specifications and manufacturer's installation literature, represent the total agreement between Subcontractor and Contractor.

2. Subcontractor shall perform all work in accordance with this contract and the Contractor's schedule.

3. Unacceptable work of Subcontractor which does not meet the minimum Standards of the Arizona Home Building industry, or that as displayed in the model complex, shall be promptly removed, replaced or repaired as directed by the Contractor at Subcontractor's expense. Subcontractor's standard pick up work shall be completed in accordance with the Contractor's schedule.

4. ~~Subcontractor shall unconditionally guarantee all work, material and labor, for a period of two (2) years from the date of each unit's certificate of occupancy~~. 2 JAS

5. Subcontractor shall have a qualified staff on the job site for each and every day his men are performing their scope of this contract.

6. Contract prices as described in Exhibit "C" and/or "C-2" attached hereto and made a part hereof are firm through project completion unless otherwise stated on the Exhibit "C" and/or "C-2". _____ (Initial by Subcontractor)

~~7. Subcontractor will provide to Contractor upon their completion of work, all documents, forms or literature which refer to their work and material warranties~~. JAS

8. All work includes, but is not limited to, all services and assumption of responsibilities that are normally and usually provided by subcontractors in the subject trade(s), group(s), and associated work in the Arizona Home Building Construction Industry.

9. Compliance. Signature of this Subcontract Contract confirms that Subcontractor is in compliance with federal, state and local law, including, but not limited, Immigration Reform & Control Act of 1986, to use only employees authorized to work in the United States.

10. Compliance. Signature of this Subcontract Contract confirms that Subcontractor is in compliance with federal, state and local law concerning regulation of hazardous waste and/or materials and/or chemicals used or discovered on the job site.

11. Subcontractor agrees to comply with all the terms and conditions of the Federal Occupational Safety and Health Act in the course of the performance of his duties pursuant to this contract agreement and indemnifies and holds the Contractor harmless as to any other charges or fines resulting from any violation by the Subcontractor.

Subcontractor's Initials	Date	Contractor's Initials	Date
JAS	1-28-98		

Exhibit "A"

We hereby submit specifications and estimates for: White fixtures, chrome trim
Plan 1000 - Arroyo Canyon

1 - 33 x 22 kitchen sink drain w/MOEN 7385W faucet and 3910W soap dispenser (sink by other) Dishwasher & Disposal installation (includes Whirlaway 921PC disposal)
Icemaker line to valve on wall in box

2 - K2906-8 lave w/MOEN 5993/H205P Faucets

1 - Lav drains w/MOEN 5993/H205P Faucets(bowls by others)

2 - Lav drains w/MOEN 5973/H205P Faucets (bowls by others)

3 - K3422EB Elongated white water closets (Crane 1.6 gal. flush)

1 - K715/716 cast iron tub w/MOEN 3113/H105P (chrome drain-no trip lever hole)

1 - Tub drain and valve w/MOEN 4999/T979/H205P (chrome drain-no trip lever hole)

1 - Shower drain w/MOEN 3103/H105P Faucet

1 - Fiberglass drop-in laundry sink w/MOEN 7231

1 - Automatic washer drain & valve with box
Soft water loop on hot water only

1 - 75 gal. gas water heater (venting supplied & installed by others)

6 - Gas outlets (water heater, 2 furnaces, dryer, cook top, BBQ)

4 - Hose bibs

1 - Pressure reducing valve

1 - Fire sprinkler Tee
1 - J-3 Jetta master tub 1 - gas to standard fireplace

1st shading included

OPTION:

White cast iron wet bar w/MOEN 7790P/14705----------$400.00

We hereby submit specifications and estimates for: White fixtures, chrome trim
Plan 2000 - Arroyo Canyon

1 - 33 x 22 kitchen sink drain w/MOEN 7365W faucet and 3910W soap dispenser (sink by other) Dishwasher & Disposal installation (includes Whirlaway 921PC disposal)
Icemaker line to valve on wall in box

2 - K2906-8 lave w/MOEN 5993/H205P Faucets

1 - Lav drains w/MOEN 5993/H205P Faucets(bowls by others)

2 - Lav drains w/MOEN 5973/H205P Faucets (bowls by others)

3 - K3422EB Elongated white water closets (Crane 1.6 gal. flush)

1 - K715/716 cast iron tub w/MOEN 3113/H105P (chrome drain-no trip lever hole)

1 - Tub drain and valve w/MOEN 4999/T979/H205P (chrome drain-no trip lever hole)

1 - Shower drain w/MOEN 3103/H105P Faucet

1 - Fiberglass drop-in laundry sink w/MOEN 7231

1 - Automatic washer drain & valve with box
Soft water loop on hot water only

1 - 75 gal. gas water heater (venting supplied & installed by others)

6 - Gas outlets (water heater, 2 furnaces, dryer, cook top, BBQ)

4 - Hose bibs

1 - Pressure reducing valve

1 - Fire sprinkler Tee
1- J-3 Jetta master tub 1- gas to standard fireplace

1st shading included

OPTION:

White cast iron wet bar w/MOEN 7790P/14705----------$400.00

We hereby submit specifications and estimates for: White fixtures, chrome trim
Plan 6000 - Arroyo Canyon

1 - 33 x 22 kitchen sink drain w/MOEN 7385W faucet and 3910W soap dispenser (sink by other) Dishwasher & Disposal installation (includes Whirlaway 921PC disposal)
Icemaker line to valve on wall in box

2 - w/MOEN 5993/H205P Faucets (bowls by others)

1 - Lav drains w/MOEN 5993/H205P Faucets(bowls by others)

4 - Lav drains w/MOEN 5973/H205P Faucets (bowls by others)

5 - K3422EB Elongated white water closets (Crane 1.6 gal. flush)

2 - K715/716 cast iron tub w/MOEN 3113/H105P (chrome drain-no trip lever hole)

2 - Tub drain and valve w/MOEN 4999/T979/H205P (chrome drain-no trip lever hole)

1 - Shower drain w/MOEN 3103/H105P Faucet

1 - Fiberglass drop-in laundry sink w/MOEN 7231

1 - Automatic washer drain & valve with box
Soft water loop on hot water only

1 - 75 gal. gas water heater (venting supplied & installed by others)

7 - Gas outlets (water heater, 3 furnaces, dryer, island cook top, BBQ)

4 - Hose bibs

1 - Pressure reducing valve

1 - Fire sprinkler Tee

1 - J-3 Jetta master tub

1 - gas to standard fireplace

1st shading included

OPTION:

White cast iron wet bar w/moen 7790p/14705----------$400.00

2nd water heater 50 gal. gas water heater----------$350.00

We hereby submit specifications and estimates for: White fixtures, chrome trim
Plan 5000 - Arroyo Canyon

1 - 33 x 22 kitchen sink drain w/MOEN 7385W faucet and 3910W soap dispenser (sink by other) Dishwasher & Disposal installation (includes Whirlaway 921PC disposal)
Icemaker line to valve on wall in box

2 - w/MOEN 5993/H205P Faucets (bowls by others)

1 - Lav drains w/MOEN 5993/H205P Faucets(bowls by others)

3 - Lav drains w/MOEN 5973/H205P Faucets (bowls by others)

5 - K3422EB Elongated white water closets (Crane 1.6 gal. flush)

3 - K715/716 cast iron tub w/MOEN 3113/H105P (chrome drain-no trip lever hole)

3 - Tub drain and valve w/MOEN 4999/T979/H205P (chrome drain-no trip lever hole)

1 - Shower drain w/MOEN 3103/H105P Faucet

1 - Fiberglass drop-in laundry sink w/MOEN 7231

1 - Automatic washer drain & valve with box
Soft water loop on hot water only

1 - 75 gal. gas water heater (venting supplied & installed by others)

6 - Gas outlets (water heater, 2 furnaces, dryer, island cook top, BBQ)

4 - Hose bibs

1 - Pressure reducing valve

1 - Fire sprinkler Tee

1 - J-3 Jetta Master tub 1- gas to standard fireplace

1st shading included

OPTION:

White cast iron wet bar w/MOEN 7790P/14705----------$400.00

2nd water heater - 50 gal. gas water heater----------$350.00

We hereby submit specifications and estimates for: White fixtures, chrome trim
Plan 4000 - Arroyo Canyon

1 - 33 x 22 kitchen sink drain w/MOEN 7385W faucet and 3910W soap dispenser (sink by other) Dishwasher & Disposal installation (includes Whirlaway 921PC disposal)
Icemaker line to valve on wall in box

2 - K2906-8 lave w/MOEN 5993/H205P Faucets

1 - Lav drains w/MOEN 5993/H205P Faucets(bowls by others)

2 - Lav drains w/MOEN 5973/H205P Faucets (bowls by others)

4 - K3422EB Elongated white water closets (Crane 1.6 gal. flush)

2 - K715/716 cast iron tub w/MOEN 3113/H105P (chrome drain-no trip lever hole)

2 - Tub drain and valve w/MOEN 4999/T979/H205P (chrome drain-no trip lever hole)

1 - Shower drain w/MOEN 3103/H105P Faucet

1 - Fiberglass drop-in laundry sink w/MOEN 7231

1 - Automatic washer drain & valve with box
Soft water loop on hot water only

1 - 75 gal. gas water heater (venting supplied & installed by others)

7 - Gas outlets (water heater, 3 furnaces, dryer, island cook top, BBQ)

4 - Hose bibs

1 - Pressure reducing valve

1 - Fire sprinkler Tee
1 - J-3 Jetta master tub 1 - gas to standard fireplace

1st shading included

OPTION:

White cast iron wet bar w/MOEN 7790P/14705----------$400.00

2nd. 50 gal. gas water heater----------$350.00

We hereby submit specifications and estimates for: White fixtures, chrome trim
Plan 3000 - Arroyo Canyon

1 - 33 x 22 kitchen sink drain w/MOEN 7385W faucet and 3910W soap dispenser (sink by other) Dishwasher & Disposal installation (includes Whirlaway 921PC disposal)
Icemaker line to valve on wall in box

2 - K2906-8 lave w/MOEN 5993/H205P Faucets

1 - Lav drains w/MOEN 5993/H205P Faucets(bowls by others)

2 - Lav drains w/MOEN 5973/H205P Faucets (bowls by others)

4 - K3422EB Elongated white water closets (Crane 1.6 gal. flush)

1 - K715/716 cast iron tub w/MOEN 3113/H105P (chrome drain-no trip lever hole)

1 - Tub drain and valve w/MOEN 4999/T979/H205P (chrome drain-no trip lever hole)

1 - Shower drain w/MOEN 3103/H105P Faucet

1 - Fiberglass drop-in laundry sink w/MOEN 7231

1 - Automatic washer drain & valve with box
Soft water loop on hot water only

1 - 75 gal. gas water heater (venting supplied & installed by others)

6 - Gas outlets (water heater, 2 furnaces, dryer, cook top, BBQ)

4 - Hose bibs

1 - Pressure reducing valve

1 - Fire sprinkler Tee

1-J-3 Jetta mastan tub

1- gas to standard fireplace

1st shading included

OPTION:

White cast iron wet bar w/MOEN 7790P/14705----------$400.00

12. Subcontractor must provide his STATE CONTRACTOR'S LICENSE NUMBER AND CERTIFICATE OF INSURANCE NAMING CONTRACTOR AS ADDITIONAL INSURED, PRIOR to commencement of his work on the project. Subcontractor understands and accepts that no payments will be made without this said information on file with Contractor. _____ (initial by subcontractor)

13. Authorized Extra Work Procedures:

A. In the event Subcontractor is required to perform services and/or provide material over and above provisions made in this Subcontract Contract and expects to be compensated for same, Subcontractor must first obtain written approval from the Contractor in the form of a Purchase Order.

B. Authorized extra work Purchase Orders must be billed within ninety (90) days of completion of extra work. If not billed within this time limit, Contractor will not pay Subcontractor for extra work and Subcontractor will waive any request for payment of said extra work.

14. Should Subcontractor be asked to perform any work by Contractor's representative(s) that Subcontractor deems unethical or not within Arizona Home Building Industry Standards and/or UBC Building Codes, Subcontractor must notify Contractor's President (Brian Hardy) in writing prior to commencement of work.

15. Invoices. Subcontractor shall state project name, project job number, project address and lot number on all invoices. All purchase order work shall be invoiced on separate documented billing from that of contract billing. Failure to comply may result in the return of the invoice(s) unpaid.

16. Alcoholic beverages and controlled substances are prohibited on all project job sites.

17. Loud music on the job site is prohibited.

18. Subcontractor shall maintain job site in a clean fashion on a daily basis. All materials shall be stockpiled in the location designated by the Contractor. Stocking is prohibited on the Natural Open Space(s), sidewalk and/or street.

19. Subcontractor is responsible for removal of any waste material and/or debris, related to their trade, from the house and/or grounds into a trash bin, or trash pile location, provided by contractor, on a daily basis.

20. Should Subcontractor refuse or neglect to comply with item(s) 18 and/or 19 of Exhibit "B", Contractor shall, after notice of first violation, at his discretion and Subcontractor's expense have waste material and/or debris removed.

21. No vehicles shall be permitted on any portion of the Natural Open Space Area, existing curb, gutter, sidewalk or driveways. Failure to adhere to this policy shall result in a fine of $250.00 per incident.

22. Should Subcontractor fail Municipal and/or Building Department Code Inspection(s) (RED TAGGED), it shall be corrected expeditiously. Should additional inspection(s) continue to fail for the same reason as the initial inspection, Subcontractor will be fined $50.00 per day of construction delay and all reinspection fee(s) until inspection(s) is approved (GREEN TAGGED).

Subcontractor's Initials	Date	Contractor's Initials	Date
[signature]	1-28-05		

Exhibit C
TRIMARK HOMES, INC.
Payment Schedule

Project Name Arroyo Canyon

Project Number 200

Trade Cost Code 3014

This Exhibit "C" is part of the Contract Agreement between the Subcontractor and the Contractor executed herein for the Arroyo Canyon Project. The conditions and specifications of the Exhibit are an integral part of that said contract.

Definition of Percentage Completion

100 % = Upon Completion

____ % = _____

Payment Terms

PLAN	COST	
1 - (1000)	~~$9,433.00~~	9,658.00
2 - (2000)	~~$9,734.00~~	9959.00
3 - (3000)	~~$10,922.00~~	11,147.08
4 - (4000)	~~$11,464.00~~	11,669.00
5 - (3500)	~~$13,942.00~~	13,267.00
6 - (4500)	~~$13,118.00~~	13,341.00

See exhibit "A" for all standard items

All Project Bills Will be submitted to contractor by the 5th day of each month.

Payment for Project Bills submitted by the 5th of the month will be paid after 3:00 p.m. on the 20th of the same month. A 30 day notice is required for any price increases.

Contractor:
Trimark Homes, Inc.
an Arizona Corporation

By: _____

Title: President

Subcontractor:
Gilbert Plumbing, Inc.
254 S. Mesa Dr.
Mesa, AZ 85210

By: [signature]

Title: [illegible]

GILBERT PLUMBING CO.
254 SOUTH MESA DRIVE • MESA, ARIZONA 85210
PH. 834-1188 • FAX 969-2083 • LIC. 34226
Dependable Contracting for 30 years

1/26/98

Trimark
Contract Addendum "A"

INDEMNIFICATION:

To the fullest extent permitted by law, the Subcontractor shall indemnify and hold harmless the Contractor, Owner, Architect and/or their agents/employees from and against any claims, damages, losses, expenses, attorneys fees, and delays arising out of or resulting from Subcontractor performance of the work, provided that such claim, damage, loss, expense, attorney's fees or delay is attributable to bodily injury, sickness, disease or death, or injury to or destruction of tangible property, is caused by Subcontractor or by anyone under contract to or agreement with the Subcontractor or any directly or indirectly employed by the Subcontractor.

By: _____
Ward A. Gilbert
Gilbert Plumbing Company

By: _____
Authorized Agent
Trimark

Exhibit "D"

Invoicing and Payment Requirements

I. Contract Billings - Billing and Payment Dates

Invoices are to be submitted on the 5th of each month. Invoices received on or before the 5th will be paid on the 20th of the same month.

Invoices may be mailed or hand delivered by 5:00 P.M. on the due date to the address listed below. Invoices delayed by the postal service will be paid based on the date received in our office.

Invoices should be addressed as follows:

TRIMARK HOMES, INC.
7500 E. McDonald Dr.
Suite 300-A
Scottsdale, AZ 85250

Invoices mailed or delivered to an address other than indicated above will not be the responsibility of the Contractor.

Payment will be mailed to your business address on the date outlined above. If you wish to pick up your check, the Accounts Payable Department must be notified prior to payment date and the checks will not be issued until after 3:00 P.M. on the payment date. When a scheduled payment date falls on a weekend or a holiday, the agreed payment day will be the next business day.

II. Change Orders - Billing and Payment Dates

Invoices are to be submitted on the 5th of each month. Invoices received on or before the 5th will be paid on the 20th of the same month. Change Order Invoice Billing must be invoiced seperately from that of Contract Billing.

All other conditions of the contract invoice instructions apply to change order invoices.
*Contractor not responsible to pay for work which is invoiced 120 days after the completion of said work.

III. Billing Procedures

A. Contract Invoices

All contract invoices should reflect the following information on the invoice(s):

1. Project name Arroyo Canyon
2. Project number 200
3. Contract cost code (see paysheet of contract) 3014
4. Draw number as indicated on Exhibit C of your contract

All work being referenced on a particular invoice must be completed by the date the invoice is received in our office or the entire invoice will be denied payment and returned to your office. _____ (Sub Initial) *Contractor not responsible to pay for work which is invoiced 120 days after the completion of said work.

B. Change Order Billing

All change order invoices should reflect the following information on the invoice(s):

1. Project name Arroyo Canyon
2. Project number 200
3. Change order number 3014

All work referenced on a particular invoice **must be completed by the date the invoice is received in our office or the entire** invoice will be denied payment and returned to your office. _____ (Sub Initial) * Contractor not responsible to pay for work which is invoiced 120 days after the completion of said work.

IV. General Information

A. No payment will be made to any subcontractor unless Certificates of Insurance are on file in our office. The insurance requirements are outlined in your contract.

B. All extra services or materials over and above Contract provisions must first have written approval and a change order number from the contractor or payment will be denied.

C. All labor and materials releases must accompanyy all invoices to avoid a delay in processing for payment. *Contractor not responsible to pay for work which is invoiced 120 days after completion of said work.

Any information contained in these invoice instructions that is unclear or unacceptable to the subcontractor should be clarified prior to the execution of this contract. It is th subcontractor's responsibility to notify the Contractor of invoice or payment problems. Any subcontractor that uses the reason of late payment and invoice problems as a reason fo non-performance of work must show written proof of notification to the Contractor by Certified Mail no less that 10 calendar days prior to the subcontractor's action of non-performance. At any time that non-performance occurs by a subcontractor without the above procedure followed then said subcontractor will be in "breach of contract".
_____ (Sub Initial)

Trimark Homes, Inc.

by: _____
Contractor's Signature

_____
Subcontractor's Signature

FENNEMORE CRAIG
Douglas C. Northup (No. 013987)
Thomas D. Ulreich-Power (No. 019345)
3003 North Central Avenue, Suite 2600
Phoenix, Arizona 85012-2913
Telephone: (602) 916-5000
dnorthup@fclaw.com
tulreich@fclaw.com

Terrence Bishop
Larkin, Hoffman, Daly & Lindgren
7900 Xerxes Avenue South
Suite 1600
Bloomington, MN 55431
tbishop@lhdl.com

Admitted Pro Hac Vice

Attorneys for Third-Party Defendant
Uponor Wirsbo

RECEIVED
AUG 0 9 2002

SUPERIOR COURT OF ARIZONA

MARICOPA COUNTY

JOYCE DEFREN, a single woman,

Plaintiff,

v.

TRIMARK HOMES, INC., an Arizona corporation; and TRIMARK BENNETT ESTATES, L.L.C., an Arizona limited liability company,

Defendants.

No. CV2001-005145

UPONOR WIRSBO'S INITIAL RULE 26.1 DISCLOSURE STATEMENT

TRIMARK HOMES, INC., an Arizona corporation; and TRIMARK BENNETT ESTATES, L.L.C., an Arizona limited liability company,

Third-Party Plaintiffs,

v.

GILBERT PLUMBING COMPANY, INC.,

Third-Party Defendant.

(Assigned to the Honorable Michael J. O'Melia)

GILBERT PLUMBING COMPANY, INC.,

Third-Party Plaintiff,

v.

UPONOR WIRSBO,

Third-Party Defendant.

Third Party Defendant Uponor Wirsbo ("Wirsbo") hereby submits its Initial Rule 26.1 Disclosure Statement. Wirsbo reserves the right to supplement this Disclosure Statement as discovery reveals additional information to the parties.

I. FACTUAL BASIS.

Plaintiff filed the instant Complaint in March, 2001 claiming bodily injury and property damage against Trimark Homes, Inc. and Trimark Bennett Estates, LLC. ("Trimark"). Plaintiff alleged that her injuries were caused by contaminated water at her residence at 7870 East Vista Bonita Drive, Scottsdale, Arizona. Trimark was the general contractor for plaintiff's residence. Neither Gilbert Plumbing Company, Inc. ("Gilbert"), the company who installed the plaintiff's plumbing system, nor Wirsbo, the manufacturer of the AQUAPEX tubing utilized for the plumbing system, were named as defendants.

On May 14, 2001, Trimark filed a third-party complaint against Gilbert reasserting plaintiff's contract counts, in addition to common law indemnity and reformation. Gilbert, in turn, filed a third-party complaint against Wirsbo seeking defense and indemnification for alleged defects in the manufacturer and/or design of Wirsbo's AQUAPEX tubing. Trimark subsequently filed a third-party complaint against Wirsbo seeking defense and indemnification for plaintiff's asserted claims.

The AQUAPEX tubing utilized in the plumbing system at the plaintiff's residence is manufactured through the Engel Method, which changes high-density polyethylene to cross-linked polyethylene (PEX). The Engel Method PEX (often referred to as PEX A)

is cross-linked during the manufacturing process using heat and high pressure. The result is an extremely uniform product with high temperature, pressure and chemical resistance. AQUAPEX tubing has been used in plumbing systems around the world for over 30 years – longer than any other flexible plumbing systems on the market. AQUAPEX is listed to ANSI NSF International Standard 14 (formerly the National Sanitation Foundation) that defines requirements for ingredients, materials, products, quality assurance and marketing. AQUAPEX is also listed to ANSI NSF International Standard 61 that defines requirements for toxicity. There have been no allegations that the tubing installed at the plaintiff's residence is defective.

II. LEGAL THEORIES FOR DEFENSES.

Wirsbo's AQUAPEX tubing is constructed from cross-linked polyethylene. The permeable characteristics of cross-linked polyethylene tubing prohibit installation in soil or ground water contaminated with solvents, fuels, organic compounds or other detrimental materials. Where such conditions are suspected, chemical analysis of the soil or ground water should be performed before installation.

Extensive testing of the water from plaintiff's residence has revealed the presence of MtBe, t-butanol, and benzene-4. The first two are by-products of the manufacturing process of AQUAPEX tubing and were at levels well within the acceptable range for the National Sanitation Foundation guidelines. However, benzene is not a by-product of the process of manufacturing AQUAPEX tubing. Trimark's own expert, Dr. Michael Fox, has concluded that the source of the benzene-4 is the termicitide applied by a subcontractor of Trimark. The termicitide application process takes place after Gilbert completes its underground installation work. Thus, Wirsbo's AQUAPEX tubing is in place prior to the termicitide's application to the surrounding area. Trimark's subcontractor provided all work associated with the termicitide's application to plaintiff's property. To the extent that there is any contamination of the water, which may have

affected the plaintiff, the source of that contamination is the termicitide applied by a subcontractor of Trimark. It is Trimark who must ultimately bear the responsibility for any such contamination.

Alternatively, the presence of benzene-4 may have resulted from Gilbert Plumbing's improperly installing AQUAPEX tubing by failing to bury it at a sufficient depth to prevent the termicitide from permeating into the piping.

Wirsbo is not involved in any way with the application of termicitide or the installation of AQUAPEX tubing. Plaintiff's injuries and damages, if any, are not the result of any action or inaction of Wirsbo, but rather are the fault of third persons or entities, including nonparties to this litigation, who are not under Wirsbo's control. Accordingly, the trier of fact must allocate fault against all such individuals or entities, whether parties or nonparties to this litigation, pursuant to A.R.S. §§ 12-2505 and 12-2506.

Wirsbo also alleges that Plaintiff has failed to mitigate her claimed damages.

III. NAMES, ADDRESSES, AND TELEPHONE NUMBERS OF WITNESSES.

1. **Ward Gilbert**
c/o Jennings Haug & Cunningham, LLP
2800 North Central, Suite 1800
Phoenix, Arizona 85004-1049
(602) 234-7800

Ward Gilbert is an officer of Gilbert Plumbing. Mr. Gilbert is responsible for bidding and purchasing. Mr. Gilbert will testify to the facts set forth in Section I of this Disclosure Statement, Gilbert Plumbing's contract with Trimark, Gilbert Plumbing's work on plaintiff's home, the installation of Wirsbo AQUAPEX piping, and any other facts or circumstances surrounding the construction of plaintiff's home.

2. **Steve Gilbert**
c/o Jennings Haug & Cunningham, LLP
2800 North Central, Suite 1800
Phoenix, Arizona 85004-1049
(602) 234-7800

Steve Gilbert is an officer of Gilbert Plumbing. Mr. Gilbert is responsible for fieldwork. Mr. Gilbert will testify to the facts set forth in Section I of this Disclosure Statement, Gilbert Plumbing's contract with Trimark, Gilbert Plumbing's work on plaintiff's home, the installation of Wirsbo AQUAPEX piping, and any other facts or circumstances surrounding the construction of plaintiff's home.

3. **Sandra Dean**
c/o Jennings Haug & Cunningham, LLP
2800 North Central, Suite 1800
Phoenix, Arizona 85004-1049
(602) 234-7800

Sandra Dean is an officer of Gilbert Plumbing. Ms. Dean is responsible for office management. Ms. Dean will testify to the facts set forth in Section I of this Disclosure Statement, Gilbert Plumbing's contract with Trimark, Gilbert Plumbing's work on plaintiff's home, the installation of Wirsbo AQUAPEX piping, and any other facts or circumstances surrounding the construction of plaintiff's home.

4. **Employees of Gilbert Plumbing**
c/o Jennings Haug & Cunningham, LLP
2800 North Central, Suite 1800
Phoenix, Arizona 85004-1049
(602) 234-7800

Discovery is just beginning in this matter and it is unknown at this time which Gilbert Plumbing employees performed installation work at plaintiff's residence. As the identities of these employees are discovered, their names will be disclosed. It is anticipated that these unknown employees will testify to the facts set forth in Section I of this Disclosure Statement, Gilbert Plumbing's contract with Trimark, Gilbert Plumbing's work on plaintiff's home, the installation of Wirsbo AQUAPEX piping, subsequent testing and investigations done in response to alleged water odor emanating from plaintiff's residence, and any other facts or circumstances surrounding the construction of plaintiff's home.

5. **Trimark Employees**
c/o W. Michael Flood, Esq.
Jennings, Strouss & Salmon, P.L.C.
One Renaissance Square
Two North Central Avenue
Phoenix, AZ 85004-2393

Discovery is just beginning in this matter and it is unknown which Trimark employees performed construction work on plaintiff's residence. The documents list several employees who had contact with plaintiff's residence including Dennis, Jeff, and Tyler Prock. It is anticipated that these employees will testify regarding any facts or circumstances surrounding the construction of plaintiff's residence.

6. **Joyce Defren**
c/o Rick Bistro, Esq.
Burch & Cracchiolo, P.A.
702 E. Osborn Road, Suite 200
Phoenix, AZ 85014

Ms. Defren is the original plaintiff in this case. Ms. Defren will testify to the allegations set forth in her Complaint and all other facts and circumstances relevant to the instant litigation.

7. **Daughter of Joyce Defren**
c/o Rick Bistro, Esq.
Burch & Cracchiolo, P.A.
702 E. Osborn Road, Suite 200
Phoenix, AZ 85014

Wirsbo believes Ms. Defren's daughter lived with her at the residence. It is anticipated that Ms. Defren's daughter will testify to the facts and circumstances surrounding the allegations made in her mother's Complaint.

8. **Rory McLeod**
c/o Doug Northrup
Fennemore Craig
3003 N. Central Avenue, Ste. 2600
Phoenix, AZ 85012

Terrence Bishop
Larkin, Hoffman, Daly & Lindgren
7900 Xerxes Avenue South

Suite 1600
Bloomington, MN 55431

Mr. McLeod is Director of Finance for Wirsbo. Mr. McCloud will testify to the manufacture and design of AQUAPEX piping, Wirsbo's twenty-five year warranty, and any other relevant facts and circumstances relevant to this litigation.

9. **Joe Pauley**
c/o Doug Northrup
Fennemore Craig
3003 N. Central Avenue, Ste. 2600
Phoenix, AZ 85012

Terrence Bishop
Larkin, Hoffman, Daly & Lindgren
7900 Xerxes Avenue South
Suite 1600
Bloomington, MN 55431

Mr. Pauley is the President of Wirsbo. Mr. Pauley will testify to the manufacture and design of Wirsbo AQUAPEX piping, installation requirements, Wirsbo's twenty-five year warranty, and any other facts and circumstances relevant to the instant litigation.

10. **Scott Ehlert**
c/o Doug Northrup
Fennemore Craig
3003 N. Central Avenue, Ste. 2600
Phoenix, AZ 85012

Terrence Bishop
Larkin, Hoffman, Daly & Lindgren
7900 Xerxes Avenue South
Suite 1600
Bloomington, MN 55431

Mr. Ehlert is the marketing manager for Wirsbo. Mr. Ehlert will testify to the correspondence dated June 14, 2001, to Gilbert Plumbing concerning AQUAPEX plumbing systems. Mr. Ehlert will further testify to the manufacture and design of AQUAPEX piping, installation requirements, Wirsbo's twenty-five year warranty, and any other facts relevant to the instant litigation.

11. **Steve Redford**
c/o Doug Northrup
Fennemore Craig
3003 N. Central Avenue, Ste. 2600
Phoenix, AZ 85012

Terrence Bishop
Larkin, Hoffman, Daly & Lindgren
7900 Xerxes Avenue South
Suite 1600
Bloomington, MN 55431

Steve Redford is the Director of Engineering for Wirsbo. Mr. Redford will testify to the manufacture and design of AQUAPEX tubing, installation requirements, Wirsbo's twenty-five year warranty, and any other facts relevant to the instant litigation.

12. **Michael Fox, Ph.D.**
c/o W. Michael Flood, Esq.
Jennings, Strouss & Salmon, P.L.C.
One Renaissance Square
Two North Central Avenue
Phoenix, AZ 85004-2393

Dr. Fox has been retained by Trimark and completed numerous tests on the water at plaintiff's residence. It is anticipated Dr. Fox will testify to the results of his testing, his belief as to the source of the chemicals present in the water, and any other facts relevant to the instant litigation.

13. **Employees of Aquatic Consulting and Testing**
c/o Jennings Haug & Cunningham, LLP
2800 North Central Avenue, Suite 1800
Phoenix, Arizona 85004-1049
(602) 2347800

Gilbert Plumbing used the services of Aquatic Consulting and Testing, Inc. located at 1525 West University Drive, Suite 106, P.O. Box 1510, Tempe, Arizona 85281. It is anticipated the employees who performed testing on the water located at plaintiff's residence will testify to the type of testing done on the water and the results of the testing.

14. Employees of Spectrum Labs
c/o Doug Northrup
Fennemore Craig
3003 North Central Avenue, Suite 2600
Phoenix, Arizona 85012

Terrence Bishop
Larkin, Hoffman, Daly & Lindgren
7900 Xerxes Avenue South
Bloomington, Minnesota 55431

Wirsbo used the services of Spectrum Labs located at 301 West County Road E2, St. Paul, Minnesota 55112. It is anticipated that the employees who performed tests on any water collected will testify regarding the type of testing done and the results of such tests.

15. Representatives from all developers, contractors, sub-contractors, and other parties involved in the construction of plaintiff's home.

16. All witnesses listed by the other parties to the litigation including witnesses later removed from the witness list.

17. Relevant building inspectors that examined plaintiff's residence during the construction of her home.

18. Custodial or other foundational witnesses necessary for the introduction of listed documents or exhibits.

Wirsbo reserves the right to supplement this portion of the Disclosure Statement as discovery continues to reveal relevant witnesses.

IV. ALL PERSONS WHO WIRSBO BELIEVES MAY HAVE KNOWLEDGE RELEVANT TO THE EVENTS, TRANSACTIONS, OR OCCURRENCES THAT GIVE RISE TO THE ACTION, AND THE NATURE OF THE KNOWLEDGE OR INFORMATION SUCH INDIVIDUAL IS BELIEVED TO POSSESS.

See Section III of this Disclosure Statement.

V. NAMES AND ADDRESSES OF ALL PERSONS WHO HAVE GIVEN

STATEMENTS WHETHER WRITTEN, RECORDED, SIGNED, OR UNSIGNED, AND THE CUSTODIAN OF THE COPIES OF THOSE STATEMENTS.

Wirsbo is unaware of any statements at this time but reserves the right to supplement this Section of the Disclosure Statement as additional information becomes available.

VI. NAME AND ADDRESS OF EACH PERSON WHO WIRSBO EXPECTS TO CALL AS AN EXPERT WITNESS AT TRIAL, THE SUBJECT MATTER ON WHICH THE EXPERT IS EXPECTED TO TESTIFY, THE SUBSTANCE OF THE FACTS AND OPINIONS TO WHICH THE EXPERT IS EXPECTED TO TESTIFY, A SUMMARY OF THE GROUNDS FOR EACH OPINION, THE QUALIFICATIONS OF THE WITNESS, AND THE NAME AND ADDRESS OF THE CUSTODIAN OF ANY REPORTS PREPARED BY THE EXPERT.

Discovery is just beginning and Wirsbo has not had an opportunity to decide whether it intends to use an expert witness in this litigation. Wirsbo reserves the right to retain the services of an expert as the factual and legal issues develop in the instant litigation.

VII. COMPUTATION OF DAMAGES.

Damage experts are unknown at this time but will be disclosed, if at all, in accordance with the schedule agreed upon at the comprehensive pretrial conference.

VIII. THE EXISTENCE, LOCATION, CUSTODIAN, AND GENERAL DESCRIPTION OF ANY TANGIBLE EVIDENCE OR RELEVANT DOCUMENTS AND INSURANCE AGREEMENTS WIRSBO INTENDS TO USE AT TRIAL.

Wirsbo has not made any determination regarding the specific documents or other tangible materials that it may introduce as trial exhibits. At present, Wirsbo anticipates using any and all of the documents listed in Section IX and the parties' Disclosure Statements.

Wirsbo is not aware of any relevant insurance agreements to this litigation.

IX. DOCUMENTS RELEVANT TO THE SUBJECT MATTER OF THE ACTION OR REASONABLY CALCULATED TO LEAD TO THE DISCOVERY OF ADMISSIBLE EVIDENCE.

1. Spectrum Labs test results dated 02/15/01. Bates Number WIRS0001-0011.

2. Uponor Wirsbo - AQUAPEX installation handbook dated 05/2001. Bates Number WIRS0012-0041.

3. Uponor Wirsbo - AQUAPEX twenty-five year warranty. Bates Number WIRS0042-0043.

4. Orange Coast Laboratory Report. Bates Number WIRS0044-0078.

5. NSF Documents and Correspondences. Bates Number WIRS0079-0325.

6. Any and all exhibits listed in and/or attached to documents exchanged by the parties.

7. Any and all expert witness reports to be issued and any and all exhibits listed in and/or attached thereto.

8. Any and all curriculum vitae pertaining to any expert witnesses.

9. Any and all documents reviewed and relied upon by any and all expert witnesses in rendering their opinions.

10. The file materials of any and all expert witnesses.

11. Without waiving objections, any and all depositions that may be taken in this matter.

12. Any and all exhibits listed in depositions and/or attached thereto.

13. Any and all exhibits which may be discovered after filing this disclosure statement.

As discovery proceeds, Wirsbo will supplement this section of the Disclosure Statement as additional information becomes available.

DATED this 30th day of July, 2002.

FENNEMORE CRAIG

By _____
Douglas C. Northup
Thomas D. Ulreich-Power
Terrence Bishop
Attorneys for Third-Party Defendant
Uponor Wirsbo

COPY OF THE FOREGOING
mailed this 30th day of July, 2002,
to:

Eric J. Bistrow
Burch & Cracchiolo
702 E. Osborn Road, Suite 200
Phoenix, Arizona 85014
Attorneys for Plaintiff

W. Michael Flood
Jennings, Strouss & Salmon
201 East Washington Street, 11th Floor
Phoenix, Arizona 85004-2385
Attorneys for Trimark Homes, Inc. and
Trimark Bennett Estates, L.L.C.

Larry J. Crown
Melinda C. Bechtel
Jennings, Haug & Cunningham
2800 North Central Avenue, Suite 1800
Phoenix, Arizona 85004-1049
Attorneys for Gilbert Plumbing Company, Inc.

Michelle Harding

COPY OF THE FOREGOING
mailed this 8th day of August, 2002,
to:

Scott F. Frerichs
Mann, Berens & Wisner
2929 North Central Avenue, Suite 1600
Phoenix, Arizona 85012-2760
Attorneys for Joyce Defren

Nicole Harding

VERIFICATION STATEMENT

The undersigned, on behalf of Uponor Wirsbo, declares under penalty of perjury that he/she has read Uponor Wirsbo's Initial Disclosure Statement and knows the contents thereof, that the same is true to his/her knowledge, except as to such matters as are therein stated upon information and belief, and as to said last-mentioned matters, he/she believes them to be true.

By: Rory MacLeod

Names: Rory MacLeod

Title: Director of Finance

Tracking ID: PM01163
Project #: 010
Region: 01

NSF International

July 3, 2000

Ann Arbor, MI • Sacramento, CA • Washington, D.C. • Brussels, Belgium

QUALIFICATION TESTING
WIRSBO AQUAPEX 1/2"

Send To 50820
WIRSBO COMPANY
5925 148TH STREET WEST
APPLE VALLEY MN 55124
Attn: MR. RICH HOULE

Customer 50820
WIRSBO COMPANY
5925 148TH STREET WEST
APPLE VALLEY MN 55124
Attn: MR. RICH HOULE

Plant 50828
WIRSBO OF CANADA
79 MCILLVEEN DRIVE
P.O. BOX 2059
SAINT JOHN, NEW BRUNSWICK E2L 3T5
CANADA
Attn: MR. DAVID JACKMAN

The enclosed report details the results of the testing performed by NSF on your product(s). Your program representative will contact you if there are any remaining issues concerning the evaluation/certification of this product.

Please contact your representative if you have any questions. We thank you for having your product(s) tested by NSF.

CC : 010
John Goins
01 - Domestic

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Tracking ID:	PM01163
Project #:	010
Region:	01
NSF Field Representative:	John Goins
Lab Number:	S004174649
Description:	Wirsbo Aqua PEX 1/2"
Sampled:	MAR 27, 2000
Received:	APR 05, 2000
Normalization Time:	16
Normalization Factor - Additional (NFx):	1
Class Function:	PIPE/PIP
Tracking ID:	PM01163
Listing Status:	A1
NSF Standard:	14
Normalization Amount (Field):	488.2
Normalization Volume (Field):	1
Normalization Factor - NF2:	1

Parameter	Result	Control	Units	Entered

Lab Number:	S004174650
Description:	Wirsbo Aqua PEX 1/2", Sample exposed at 23C and pH 8
Sampled:	MAR 27, 2000
Received:	APR 05, 2000

$Normalization Information:

A_f = 488.2	A_i = 149	A_e = 149
V_f = 1	V_i = 0.310	V_e = 0.310
T_f = 16	T_i = 16.00	T_e = 16.00
NF_1 = 1.0157181208	NF_2 = 1	NF_e = 1.0157181208
NF_x = 1		

Parameter	Result	Control	Normalized Result	Units	Entered
Additives sample preparation information					
Date exposure completed	11-MAY-00	11-MAY-00			12-MAY-00
Surface area exposed (AI)	149	Unavail		In2	12-MAY-00
Final volume of solution (VI)	0.310	2.97		liters	12-MAY-00
Length of exposure (TI)	16.00	16.00		hours	12-MAY-00
Number of units exposed in-product (AI)	2	Unavail		units	12-MAY-00
External Note: 1 unit = 1 pipe 50 inches long		Unavail			12-MAY-00
Volatiles: Unregulated VOC's					
Dichlorodifluoromethane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00

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Parameter	Result	Control	Normalized Result	Units	Entered
Chloromethane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Vinyl Chloride	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Bromomethane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Chloroethane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Trichlorofluoromethane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Trichlorotrifluoroethane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
1,1-Dichloroethylene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Methylene Chloride	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
trans-1,2-Dichloroethylene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
1,1-Dichloroethane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
2,2-Dichloropropane	1.7	ND(0.5)	1.7§	ug/L	17-MAY-00
cis-1,2-Dichloroethylene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Chloroform	6.1	ND(0.5)	6.2§	ug/L	17-MAY-00
Bromochloromethane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
1,1,1-Trichloroethane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
1,1-Dichloropropene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Carbon Tetrachloride	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
1,2-Dichloroethane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Trichloroethylene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
1,2-Dichloropropane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Bromodichloromethane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Dibromomethane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
2-Chloroethylvinyl Ether	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
cis-1,3-Dichloropropene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
trans-1,3-Dichloropropene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00

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Parameter	Result	Control	Normalized Result	Units	Entered
1,1,2-Trichloroethane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
1,3-Dichloropropane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Tetrachloroethylene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Chlorodibromomethane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Chlorobenzene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
1,1,1,2-Tetrachloroethane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Bromoform	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
1,1,2,2-Tetrachloroethane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
1,2,3-Trichloropropane	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
1,3-Dichlorobenzene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
1,4-Dichlorobenzene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
1,2-Dichlorobenzene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Carbon Disulfide	ND(1)	ND(1)	ND(1.0)	ug/L	17-MAY-00
Methyl-tert-Butyl Ether	17	ND(0.5)	17	ug/L	17-MAY-00
Methyl Isobutyl Ketone	ND(5)	ND(5)	ND(5.1)	ug/L	17-MAY-00
Methyl Ethyl Ketone	ND(5)	ND(5)	ND(5.1)	ug/L	17-MAY-00
Toluene	1.2	ND(0.5)	1.2§	ug/L	17-MAY-00
Ethyl Benzene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
m+p-Xylenes	ND(1.0)	ND(1.0)	ND(1.0)	ug/L	17-MAY-00
o-Xylene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Styrene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Isopropylbenzene (Cumene)	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
n-Propylbenzene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Bromobenzene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
2-Chlorotoluene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00

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Parameter	Result	Control	Normalized Result	Units	Entered
4-Chlorotoluene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
1,3,5-Trimethylbenzene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
tert-Butylbenzene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
1,2,4-Trimethylbenzene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
sec-Butylbenzene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
p-Isopropyltoluene (Cymene)	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
1,2,3-Trimethylbenzene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
n-Butylbenzene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
1,2,4-Trichlorobenzene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Hexachlorobutadiene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
1,2,3-Trichlorobenzene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Naphthalene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Benzene	ND(0.5)	ND(0.5)	ND(0.51)	ug/L	17-MAY-00
Total Trihalomethanes	6.1	ND(0.5)	6.2§	ug/L	17-MAY-00

Lab Number: S004174651
Description: Wirsbo Aqua PEX 1/2", Sample exposed at 82C and pH 8
Sampled: MAR 27, 2000
Received: APR 05, 2000

$Normalization Information:

A_f = 488.2
V_f = 1
T_f = 18
NF_1 = 0.9580836941
NF_2 = 1

A_l = 672
V_l = 1.36
T_l = 16.50
NF_2 = 1

A_c = 672
V_c = 1.36
T_c = 16.50
NF_c = 0.9580836941

Parameter	Result	Control	Normalized Result	Units	Entered
Additives sample preparation information					
Date exposure completed	11-MAY-00	11-MAY-00			12-MAY-00
Surface area exposed (Al)	672	Unavail		in2	12-MAY-00

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Parameter	Result	Control	Normalized Result	Units	Entered
Final volume of solution (Vf)	1.36	1.98		liters	12-MAY-00
Length of exposure (Tf)	16.50	16.50		hours	12-MAY-00
Number of units exposed in-product (Af)	9	Unavail		units	12-MAY-00
External Note: 1 unit = 1 pipe 50 inches long		Unavail			12-MAY-00
2-Methyl-2-propanol	7200	ND(200)	6900	ug/L	21-JUN-00
Semivolatile Compounds, Base/Neutral/Acid 625					
N-Nitrosodimethylamine	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
N-Nitrosomethylethylamine	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
N-Nitrosodiethylamine	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Cyclohexanone	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Phenol	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Aniline	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
2-Chlorophenol	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
2-Ethyl-1-hexanol	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Benzenemethanol (Benzylalcohol)	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
2-Methylphenol (o-Cresol)	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
4-Methylphenol (p-Cresol)	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
N-Nitrosopyrrolidine	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
N-Nitrosodi-n-propylamine	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
1-Phenylethanone (Acetophenone)	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
N-Nitrosomorpholine	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
2-Phenyl-2-propanol	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
N-Nitrosopiperidine	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Isophorone	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
2,4-Dimethylphenol	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00

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Parameter	Result	Control	Normalized Result	Units	Entered
Naphthalene	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Benzothiazole	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
N-Nitrosodi-n-butylamine	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
p-tert-Butylphenol	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
2-Methylnaphthalene	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
a,a-Dimethyl-p-isopropylbenzenemethanol	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Dimethylphthalate	ND(40)	ND(40)	ND(38)	ug/L	28-JUN-00
aaa'a'Tetramethyl-1,3-benzenedimethanol	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Acenaphthylene	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
aaa'a'Tetramethyl-1,4-benzenedimethanol	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Acenaphthene	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Diethylphthalate	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Fluorene	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
N-Nitrosodiphenylamine	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Phenanthrene	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Anthracene	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Di-n-butylphthalate	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Fluoranthene	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Pyrene	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Butylbenzylphthalate	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Benzo(a)anthracene	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
bis(2-Ethylhexyl)phthalate	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
bis(2-Ethylhexyl)adipate	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Chrysene	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Di-n-octylphthalate	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00

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Parameter	Result	Control	Normalized Result	Units	Entered
Benzo(b)fluoranthene	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Benzo(k)fluoranthene	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Benzo(a)pyrene	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Dibenzo(a,h)anthracene	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Indeno(1,2,3-cd)pyrene	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Benzo(g,h,i)perylene	ND(4)	ND(4)	ND(3.8)	ug/L	28-JUN-00
Semivolatile Compounds, Base/Neutral/Acid 625 Scan					
Scan Control Complete	Complete	Complete			28-JUN-00
Methyl hexanone CAS# 110-12-3	8	Unavail	8	ug/L	28-JUN-00
		Unavail			28-JUN-00

(1) External note:
Compounds with AS: are Authentic Standard compounds. Those without AS: are Tentatively Identified Compounds (TICs). CAS numbers for TICs are provided for toxicological evaluation

Status: **Pass**

Reviewer: M Sanders Date: 7/3/00

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All work performed at NSF International, 789 Dixboro Ann Arbor, MI 48105

References to Testing Procedures:

Parameter/Test Description	NSF Reference
Additives sample preparation information	- E8ADINFO
Methyl-2-propanol, 2-, (t-butylalcohol), GC/FID	- O80018NSF
Semivolatile Compounds, Base/Neutral/Acid 625	- O28066625
Semivolatile Compounds, Base/Neutral/Acid 625 Scan	- O28071625
Volatiles: Unregulated VOC's	- O32077502

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Cross-Linked Polyethylene Tubing & Water Contamination

CHEMAXX HOME

Areas of Expertise

Michael Fox, PhD.

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Cross-Linked Polyethylene Tubing and Water Contamination

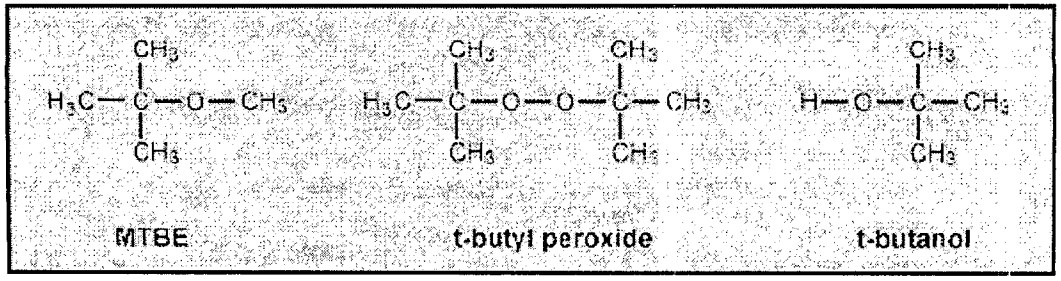
During 2001, families that had just purchased newly constructed custom homes valued at about a half million dollars or more noticed that their drinking water smelled and tasted strange. The odor was reminiscent of gasoline. Chemaxx was brought in to investigate the source of the chemicals. First, it was determined that the incoming water from the city was clean. Therefore, the chemical contamination was originating from somewhere in the home itself.

In the course the investigation it was discovered that t-butanol and MTBE were showing up in the water. The levels of t-butanol spanned a broad range, but in homes where the water had been stagnant for a period of time the concentrations were as high as 10,000 ppb and greater. For comparison, the State of California has an enforceable Maximum Contaminant Level (MCL) on MTBE of 13 ppb, and a non-enforceable Action Level on t-butanol of 12 ppb.

It was noted that t-butanol and MTBE were fingerprints for gasoline. Therefore, a number of scenarios were investigated, including ground water contamination, accidental contamination during construction or sabotage.

It turned out that the homes had been plumbed with cross-linked polyethylene tubing, commonly and generically referred to as PEX. After considerable investigation that included several dead-end scenarios, it was determined that the source of these two chemicals was the tubing itself.

One method of cross-linking polyethylene tubing is via the catalyst t-butyl peroxide. The t-butanol and MTBE are breakdown products of the t-butyl peroxide. The t-butanol was significantly more predominant than the MTBE. A methyl group is obviously picked up from the tubing somehow in order to form the MTBE.



Since the chemicals enter the water via a diffusion process, the concentrations were a function of how long the water was in contact with the tubing. Long periods of stagnation favored high levels of the chemicals while frequent and regular use of the water lines favored lower concentrations. With time, the chemicals are eventually washed out of the tubing. Research was also conducted to determine exactly how long they persist.

After a two-year timeout period due to an exclusive consulting contract with a PEX manufacturer, Chemaxx is re-starting its PEX research as of December 2004, which will focus on chemicals that might leach from recently manufactured PEX tubing, the potential diffusion of aromatic termiticide solvents through PEX tubing and the possible long-term deterioration of PEX by chlorine in the drinking water.

Note: There are different ways to cross-link polyethylene and not all types of cross-linked polyethylene tubing contain t-butyl peroxide. Such tubing would not be expected to contribute MTBE or t-butanol to the drinking water. Also, the data above pertained to PEX tubing manufactured during 2001 or earlier. It is Chemaxx's understanding that some producers of PEX may have altered their manufacturing processes, and what was found in 2001 may not apply today. However, if t-butanol and/or MTBE are showing up in the drinking water of newly constructed homes with PEX tubing, there is a possibility that it is coming from the PEX tubing. In fact, preliminary experiments conducted on PEX tubing purchased on November 23, 2004 produced results reminiscent of the 2001 experience.

Recommendation: If you plan to move into a new home plumbed with PEX tubing, or have recently done so, and if you are concerned about the

possibility of chemicals entering the drinking water, you might want to flush all the lines daily for 1-2 minutes for the first 3-6 months and perhaps once a week for the next 6-12 months. Another helpful approach is to install a reverse osmosis water purification system for drinking water and ice makers.

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Methyl Tertiary Butyl Ether
MTBE
Fact Sheet

I. *Overview*

A. MTBE is a fuel oxygenate added to boost octane and make gasoline burn more efficiently, and therefore "cleaner".

B. Oxygenates (primarily MTBE and ethanol) reduce carbon monoxide emissions and volatile organic chemical emissions. At certain levels, MTBE reduces benzene emissions (a known carcinogen).

C. Federal Clean Air Act - requires gasoline to have a year-round average of 2% by weight of oxygen in ozone non-attainment areas categorized as "extreme" and "severe" (e.g., Sacramento, eastern Los Angeles, Riverside, San Bernardino counties). The CAA also requires an oxygenated fuel that contains 2.7% oxygen by weight in areas categorized as non-attainment for carbon monoxide (only a concern in Los Angeles).

D. California Cleaner Burning Gasoline regulations - refiners can choose to follow a formula specified by regulation for blending gasoline, which includes an oxygen standard, or a model that would include an option for zero oxygen to achieve air pollution benefits.

E. Neither the federal Clean Air Act nor California regulations specify *which* oxygenate is required in reformulated gasoline. Refiners chose MTBE over other oxygenates because of its availability and blending properties.

F. Approximately 70% of the reformulated gasoline sold in California uses MTBE at an average of 11 % by volume.

II. *The Problem*

A. MTBE is a synthetic molecule that dissolves in water and therefore seeps into groundwater from leaking fuel tanks faster, farther and more easily than other constituents of gasoline like benzene.

B. Underground storage tanks were ordered replaced or upgraded by December 22, 1998, but no storage tank is considered leak-proof.

III. *MTBE Contamination*

A. Lawrence Livermore National Laboratory data shows that MTBE has been detected at over 4,600 leaking underground fuel tank sites - but only half the sites have been inspected.

B. Over 60% of the reservoirs in the state have detected MTBE. Lake Perris (Metropolitan Water District of So. Cal), Anderson Reservoir (Santa Clara Valley Water District), San Pablo Reservoir (East Bay MUD), Lake Berryessa (Solano Co. Water Dist.), Canyon Lake (Elsinore Valley Muni Water District).

C. MTBE has been detected in public drinking water supplies in South Lake Tahoe, Santa Monica, Riverside, Anaheim, Los Angeles, San Francisco, Santa Clara, and San Diego (partial list).

D. Santa Monica lost 75% of its drinking water wells due to MTBE contamination; South Lake Tahoe Public Utility District has lost over one third of its drinking water wells.

E. Drinking water wells in Santa Clara Valley Water District and Sacramento have been shut down due to MTBE contamination.

F. In Glenville (Bakersfield area) MTBE levels have been detected in a private well as high as 190,000 parts per billion (ppb).

IV. *Health Hazards of MTBE*

A. The Office of Environmental Health Hazard Assessment set a public

health goal for MTBE of 13 ppb (advisory, not enforceable) based on its potential to be a human carcinogen.

B. U.S. Environmental Protection Agency: "MTBE is an animal carcinogen and has human carcinogenic hazard potential."

C. University of California study: "MTBE is an animal carcinogen with the potential to cause cancer in humans."

D. White House National Science and Technology Council report: "There is sufficient evidence that MTBE is an animal carcinogen and that the weight of evidence supports regarding MTBE as having a carcinogenic hazard potential for humans."

E. National Toxicology Program (NTP) voted 6 to 5 against listing MTBE as a chemical likely to cause cancer in humans.

F. Science Advisory Board of the Safe Drinking Water and Toxic Enforcement (Prop 65) in December was split on whether to list MTBE as a chemical clearly shown to cause cancer.

G. Centers for Disease Control study (in Alaska) and anecdotal reports of acute effects of MTBE exposure include: headache, nausea or vomiting, burning sensation in the nose or mouth, cough, dizziness, eye irritation and disorientation.

H. CA Dept of Health secondary drinking water standard for taste and odor is 5 ppb. In higher concentrations MTBE smells like turpentine and tastes like paint thinner.

V. *Alternatives to MTBE*

A. The two most viable alternatives to MTBE are ethanol and no oxygenates. No oxygenates would require a change in the federal Clean Air Act or a waiver from the oxygen requirement in the CAA.

B. Most of the terminals in California are currently not able to dispense ethanol. Some conversion over a minimum two to three year period would be required.

VI. *Economic Impact of Removing MTBE*
All estimated costs are from the California Energy Commission unless otherwise noted.

A. *Immediate ban*

1. Economic impact would be catastrophic resulting in the loss of 15 - 40% of CA's fuel supply, according to CA Energy Commission. (40 million gallons of gasoline is consumed per day in California.)
2. Gas prices could double.
3. Cost to the General Fund unknown.

B. *Intermediate Phaseout: 3 years*

1. Fuel supplies would be adequate, terminals would be able to be retooled, but refineries would not have time to make major modifications.
2. Gas prices would increase by approx. $.07 per gallon with ethanol and up to $.09 per gallon if no oxygenates were used.
3. Cost to the General Fund approximately $20 million per year in lost revenues (Dept of Finance).

C. *Long Term Phaseout: 6 years*

1. Fuel supplies would be adequate
2. Refineries would retool for alternatives to MTBE at a cost of approximately $2 - $3 billion.
3. Gas prices could increase by approximately $.03 per gallon with ethanol and up to $.04 if no oxygenates were used.
4. Cost to the General Fund approximately $20 million per year in lost revenues (Dept of Finance).

D. *Clean-Up Costs*

1. UC report estimates $340 million - $1.5 billion in annual clean up costs.

2. Cost for drinking water well replacement is estimated at $1 million to $1.5 million per well (State Water Resources Control Board).

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California Department of Health Services

MTBE: Drinking Water Regulations and Monitoring Results

Last Update: November 3, 2003

Methyl tertiary butyl ether (MTBE), a gasoline additive, is a **regulated drinking water contaminant** in California. It has:

- a primary maximum contaminant level (MCL) of 13 micrograms per liter (µg/L), effective May 2000, that addresses **health concerns** — its **public health goal** is also 13 µg/L
- a secondary MCL of 5 µg/L, effective January 1999, that addresses concerns about **taste and odor**
- a **detection limit for purposes of reporting** (DLR) of 3 µg/L. The DLR is the level at which DHS is confident about the quantity being reported. Results at or above the DLR are required to be reported to DHS; some laboratories may report results at lower concentrations.

As of November 3, 2003, monitoring results from **sources reporting more than one MTBE detection** at any concentration since 1990 has shown

- Detections greater than 13 µg/L: 27 sources (19 systems). The greatest number occurred in the counties of Los Angeles (5 sources) and San Diego (3)
- Detections greater than 5 µg/L: 51 sources (26 systems). The greatest number occurred in the counties of Los Angeles (13 sources), San Diego (6), Kern (6), Monterey (3) and San Francisco (3)
- Detections equal to or greater than 3 µg/L: 75 sources (50 systems). The greatest number occurred in the counties of Los Angeles (17 sources), San Diego (8), Kern (7), El Dorado (5), Monterey (3), Orange (3), and San Francisco (3)

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All PHGs developed as of April 23, 2004

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List of All Public Health
Action Levels for Chem Drinking Water
Public Health Goals
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Chemical (follow links below to download a copy of the PHG document)	California PHG (ppb)
1,1-Dichloroethane	3
1,1 Dichloroethylene	10
1,2 Dibromo-3-chloropropane	0.0017
1,2 Dichloroethane	0.4
1,2 Dichloropropane	0.5
1,1,2,2-Tetrachloroethane	0.1
1,2,4 Trichlorobenzene	5
1,2 Dichlorobenzene	600
1,3 Dichloropropene (Telone II®)	0.2
1,4 Dichlorobenzene	6
2,4 Dichlorophenoxyacetic acid	70
Arsenic	4 ppt
Alachlor	4
Aluminum	600
Antimony	20
Asbestos	$7x10^6$ fibers/L
Atrazine	0.15
Barium	2,000
Bentazon	200
Benzene	0.15
Benzo[a]pyrene	0.004
Beryllium	1
Cadmium	0.07
Carbofuran	1.7
Carbon Tetrachloride	0.1
Chlordane	0.03

Chlorobenzene	200
Chromium (total)	withdrawn
Copper	170
Cyanide	150
Dalapon	790
Dichloromethane	4
Diethylhexyl adipate	0.2 ppm
Diethylhexylphthalate (DEHP)	12
Dinoseb	14
Diquat	15
Endothall	580
Endrin	1.8
Ethylbenzene	300
Ethylene dibromide	0.01
Fluoride	1,000
Glyphosate	1,000
Gross Alpha Particle Activity	N/A
Gross Beta Particle Activity	N/A
Heptachlor	0.008
Heptachlor epoxide	0.006
Hexachlorobenzene	0.03
Hexachlorocyclyopentadiene	50
Lead	2
Lindane	0.032
Mercury, inorganic	1.2
Methoxychlor	30
Methyl tertiary butyl ether (MTBE)	13
Nickel	12
Nitrate	10,000 as N
Nitrate and Nitrite	10,000 as N
Nitrite	1,000 as N
Oxamyl	50
Pentachlorophenol	0.4
Perchlorate	6
Picloram	500
Silvex	25
Simazine	4
Tetrachloroethylene	0.06
Thallium	0.1
Thiobencarb	70
Toluene	150
Toxaphene	0.03
Trichloroethylene	0.8

Trichlorofluoromethane (Freon 11)	700
Trichlorotrifluoroethane (Freon 113)	4,000
Uranium	0.5
Vinyl Chloride	0.05
Xylene	1,800

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Proceedings, 20 th NoDig conference, Copenhagen May 28-31 2002.

Potential water quality deterioration of drinking water caused by leakage of organic compounds from materials in contact with the water

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ABSTRACT

Organic materials have been used in drinking water pipes and storage tanks for several years. During the last decade plastic materials are used for bottles and containers for water. Leaching of organic matter from the materials to the drinking water is proven. Water in contact with plastic pipes, surface coatings or other materials can be affected by migration of components that make the water quality unacceptable with respect to aesthetic effects or health.

Leaching of - volatile organic compounds may cause unwanted taste and odour in - water, and possible health risk. Organic compounds such as xylene, styrene, phenols and ethyl benzene have been identified. Compounds leaching from epoxy and polyethylene appear to give unwanted taste and smell to the water.

Microbiological growth in the drinking water distribution system may cause deterioration of the water quality, due to increased turbidity, heterotrophic bacteria, and even pathogens. Leakage of biodegradable organic matter from materials used in the distribution system may promote microbiological growth. There are variations in microbiological growth between various materials. In particular, the change from copper to synthetic materials for in-house installations may be a reason for increased microbiological growth.

KEYWORDS

Water quality, leakage, pipe material, coatings, biofilm, taste and odour, ATP

INTRODUCTION

Organic materials have been used in drinking water pipes and storage tanks for several years. During the last decade plastic materials have also been used for bottled water.

The possibility for organic compounds to leak from the pipe material, lining or paint into the water has been in focus for some time. The main concerns are related to compounds causing unwanted taste and odour in the water, and the possibility for the compounds to promote microbiological growth.

This paper will focus on recent Norwegian research and experiences, performed by Aquateam and the Norwegian Food Control Authority

RELEVANT PIPE MATERIALS

Plastic materials used for service pipes may be made from PVC (polyvinyl chloride), HDPE (high density polyethylene) or GRP (glass fibre reinforced polyester). In-house plastic plumbing materials will consist of PVC or PEX (cross-bound PE).

Epoxy lining can be used on concrete and on stainless steel in pipes and basins.

Additionally, lubricants may be used for fitting pipes together, as well as in the production of, for instance, stainless steel pipes.

TASTE AND ODOUR

Several complaints on drinking water quality in Norway or on offshore installations are related to volatile organic matter (VOC) leaching from epoxy lining or paint. Typical VOCs from epoxy are alkyl benzenes and alkoxy compounds -. In particular leaching of hydrocarbons from in-situ epoxy coated storage tanks offshore and on ships seems to be a problem, with a solvent (xylene/ethylbenzene) content of up to 60-70 µg/l being measured. C3- and C4 cyclohexanes and other alicyclic hydrocarbons have also been identified as taste and odour compounds leaching from surface coatings. In a treated water basin for municipal water supply, organosulphide compounds were identified as the source for taste and odour, and the most likely source of the sulphides produced was microbiological activity due to degradation of organic compounds leaching from the epoxy lining (Skjevrak, 1999; Skjevrak, 2000).

Organic compounds leaching from PE bottles and tanks have been the source of taste and odour in water and even a week colour has been experienced because of this migration. Analysis of the water has identified low concentrations of several VOCs, such as ketones (Skjevrak, 1999).

Migration of VOC from water pipes manufactured of HDPE, PVC and PEX has been investigated using static contact with water for three successive test periods each of 72 hours duration according to EN-1420-1 (Skjevrak, 2000; Skjevrak, 2002a and b). The leaching of organic compounds from HDPE pipes showed a considerable variation both in type and amount. Five out of seven tested brands of HDPE pipes showed unacceptable TON values (TON > 3) of test water. Degradation products from phenol-based antioxidants were major migrants from HDPE pipes. VOCs leaching from PEX pipes gave an intense odour of test water. Several of the migrated VOCs were not identified. Oxygenates predominated within the identified VOC with methyl tert-butyl ether (MTBE) as a major component Migration tests of PVC pipes revealed few volatile migrants in low concentrations, and TON assessments did not show significant odour in any of the tests. VOCs leaching from lubricants used for joining of pipes included components such as C6-C11 aliphatic aldehydes, ketones, siloxanes and phenol based anti oxidants. Migration of VOC from HDPE into natural biofilm established in HDPE pipes at turbulent flow conditions is also looked into (Skjevrak, 2002c).

MICROBIOLOGICAL REGROWTH

Microbiological growth in the drinking water distribution system causes deterioration of the water quality, due to increased turbidity through increased number of bacteria, taste and odour. The focus on microbiological growth in pipelines has mainly been on the biofilm establishment on pipe walls. The biofilm increases the possibilities for survival of pathogens.
The control of the biofilm development is therefore of great importance and will depend on several factors:

- Temperature
- Water treatment
- Residual chlorine
- Biodegradable organic material (BOM)
- The distribution system
  - Pipe materials
  - Velocities
  - Retention times
  - Corrosion

Plasticised PVC is used for containers for waters, and often waters that are sold as superior to tap water. An experiment was performed in order to study the effect of the containers on the microbiological water quality. Pieces of the plastic material were and nutrient salts added to distilled water. Frequent measurements on the heterotrophic growth, measured as the growth of *Pseudomonas fluorescence (P17)*, were performed over a period of 180 days. The results are shown in Figure 1.

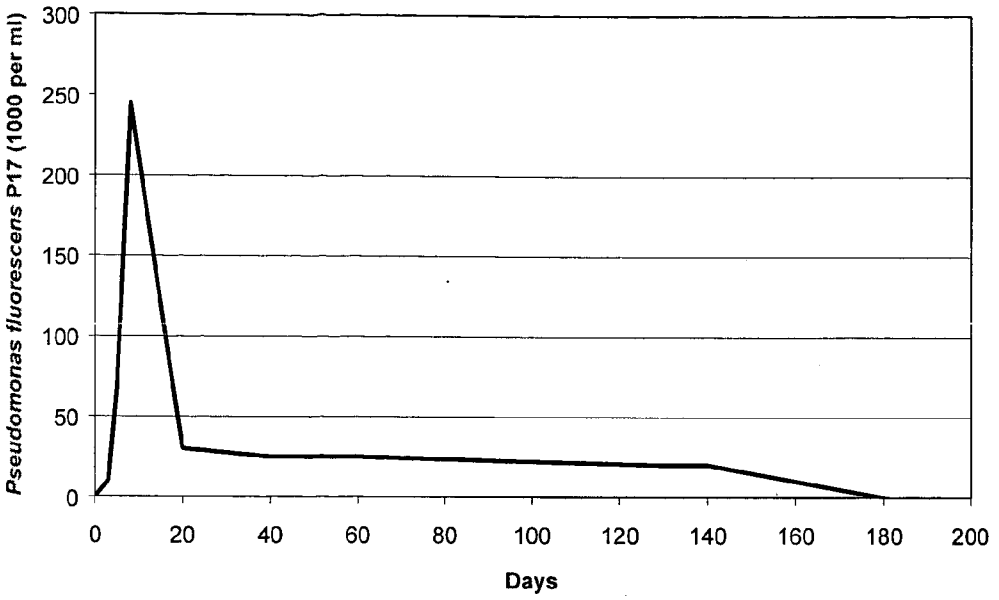

Figure 1: The growth of Pseudomonas fluorescence (P17) in ultrapure water exposed to plasticised PVC (Charnock 2000)

During the test the growth of *Pseudomonas fluorescence* (P17) increased during the first 10 days of exposure to a high number. After 10 days, the growth decreased rapidly at the first 20 days, and slower after 20 days of exposure. After 180 days of exposure, no growth was determined, showing that the leaching was a temporary event. Based on this result the leaching will be limited to the first days of the service time.

The effect of the leaching of BOM from the pipe will depend on the water's retention time, the pipe's diameter, and often the general growth condition. The latter is in particular temperature, but also limiting nutrients and inhibitors will influence the growth. Results from recent Norwegian measurements on various plumbing materials exposed to tap water in Oslo are shown in Figure 2. The methods used were a modification of the biofilm formation potential (BFP) determination described by van der Kooij and Veenendaal (1993). The measurements have been performed on coupons cut from commercial pipes of stainless steel, PE, PVC and copper with a diameter of 10-15 mm. Coupons made of glass were used as a reference The coupons were placed inside plexi glass pipes with an inner diameter of 20 mm. Each two weeks three coupons of each material were sampled, the biofilm was removed in an ultrasonic bath, and was analysed for ATP. The water supplied was from the tap in Oslo, with no adjustment of the water quality. Due to Norwegian chlorination practise the residual free chlorine at the tap was marginal. The water was exchanged twice a day, and the water temperature was maintained similar to room temperature, which was approximately 20 °C. Therefore any growth occurring was assumed to simulate growth found in in-house installations.

The regrowth potential in the drinking water in Oslo, measured as assimilable organic carbon (AOC) with *Pseudomonas* P17 and *Spirillium* NOX, is approximately 25 µg AOC/l. This is high enough to give heterotrophic growth, according to van der Kooij (1992), but is lower than the average AOC-value in Norwegian drinking waters (Hem and Charnock, 1999).

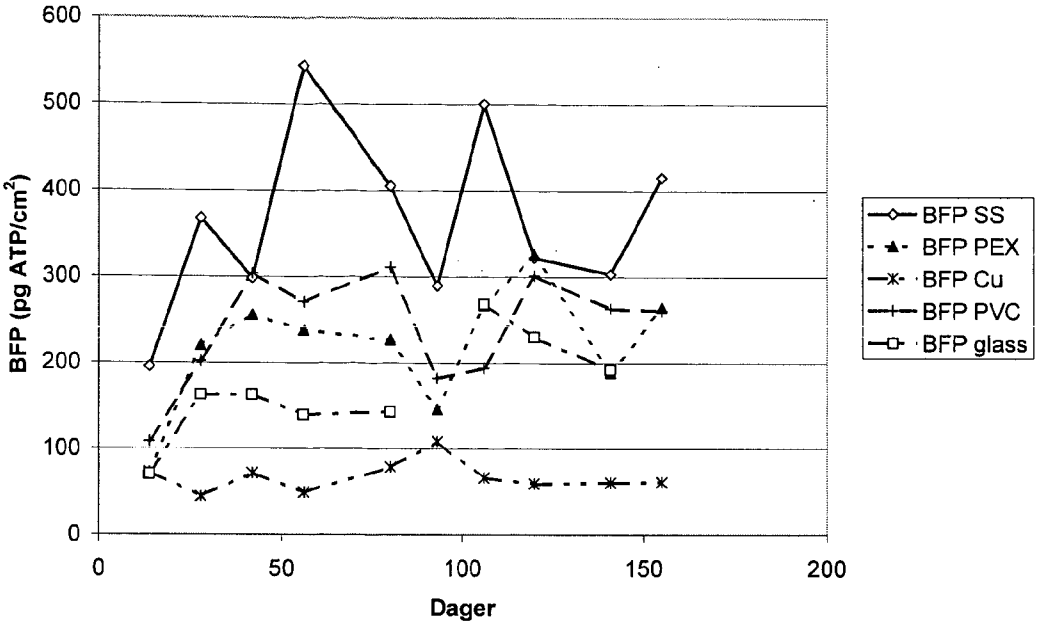

Figure 2: BFP measured as ATP on various plumbing materials exposed to tap water in Oslo.

The microbiological growth on the coupons was particularly high the first month after start-up of the experiment, and after approximately two months the biomass was close to stable, meaning that the growth seems to balance with the biofilm detachment. This observation differs from what is seen in an ongoing BFP measurement on glass coupons exposed to constantly streaming water in a drinking water with approximately similar AOC. In the latter measurement the biomass increased during 150 days of exposure. The difference is probably due to the tapping regime, with the water temperature as a possible factor influencing the results.

The results in Figure 2 show that the inhibitory effect of copper is considerable, when the growth on this material is compared to the growth on other materials, glass included. The effect of changing from the toxic plumbing material copper to any non-toxic material may result in increased biofilm growth. The plastic materials, PVC and PEX, have a higher biofilm growth on their surfaces than the glass reference at the beginning of the test. This may be explained with organic material leaching from the pipes and being available for the microorganisms. The growth on stainless steel was also high in the beginning of the test, probably due to remaining lubricants from pipe production. The difference between growth on the various materials, copper not included, was reduced considerably with time. The difference between the reference and the plastic materials do not give reason to conclude that the BOM from the pipe material is more important than the BOM from NOM, at least not with the water quality in question.

LEGAL ASPECTS

According to the EU council directive, the drinking water shall have a taste and odour acceptable to consumers, and there shall not be any abnormal change in the taste (EU, 1998). This means that when organic compounds from materials in contact with the water leach VOCs in an amount that gives unacceptable taste and odour to the water, this is in conflict with the EU council directive. For some of the incidents reported with organics leaching from epoxy lining, the water is not in accordance with the EU directive. VOCs from PEX pipes in in-house installations may also be present to an extent that is in conflict with the directive. However, it remains to be proven that the pipes are the main source for unacceptable VOC addition to the water. One reason for the latter is the limited use of PEX pipes in-house, but the uses of such pipes are increasing rapidly.

Very few organic compounds are specified in the EU directive. The VOCs relevant with regard to leakage from pipe materials named in the directive are probably benzene (<1.0 µg/l) and vinyl chloride (<0.5 µg/l), epichlorohydrin (<0.10 g/l) and acrylamide (0.10 g/l), but of course none toxic organic compound should be

present in the drinking water. If one assumes that the benzene limits apply to all BTEXs, the xylene and ethylbenzene measured in some epoxy lined water storage tanks exceeds the acceptable limit.

Neither the BOM nor the BFP is specified in the directive. The direct effect of microbiological growth will be an increased HPC, which is specified for water in bottles and containers (HPC<100/ml, 22 °C, HPC<20/ml, 37 °C). These limits may be exceeded, at least in new bottles and containers made from plasticised PVC, as seen from Figure 2. A more severe effect would be the possible survival of pathogens, but fortunately there are no reported events where the presence of pathogens is proven to be due to biofilm growth promoted by the leakage of organic compound from pipes and storage tanks. Whether a change in the main plumbing material from the biocide copper to the growth promoting PEX remains to be seen.

CONCLUSIONS

A variety of VOCs are known to leach from pipes and linings. These VOCs can give taste and odour to the drinking water, and can cause the water to fail the acceptable limits. Unacceptable odour of drinking water due to migration of volatile components from PEX-pipes has been registered. -

Different linings and pipe materials in a water supply distribution system can cause BOM leaching into the water phase. This may promote exceeding biofilm growth. When the treated water has a BOM so low that no growth will occur, the biofilm on organic pipe materials show this effect. There is, however, so far no evidence for the organics leaching from main pipes or basins to be a considerable problem with regard to microbiological regrowth.

When looking at in-house installations, the picture will be quite different from the main pipes with regard to leakage of VOCs from the pipe material giving the water taste and odour, and also with regard to growth due to these VOCs. The most important effect of a change in plumbing material from copper to PVC or PEX with regard to growth is, however, that copper is toxic to the microorganisms and therefore the growth on this material is inhibited.

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WATER RESEARCH

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Volatile organic components migrating from plastic pipes (HDPE, PEX and PVC) into drinking water

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Abstract

High-density polyethylene pipes (HDPE), crossbonded polyethylene pipes (PEX) and polyvinyl chloride (PVC) pipes for drinking water were tested with respect to migration of volatile organic components (VOC) to water. The odour of water in contact with plastic pipes was assessed according to the quantitative threshold odour number (TON) concept. A major migrating component from HDPE pipes was 2,4-di-tert-butyl-phenol (2,4-DTBP) which is a known degradation product from antioxidants such as Irgafos 168®. In addition, a range of esters, aldehydes, ketones, aromatic hydrocarbons and terpenoids were identified as migration products from HDPE pipes. Water in contact with HDPE pipes was assessed with respect to TON, and values $\geqslant 4$ were determined for five out of seven brands of HDPE pipes. The total amount of VOC released to water during three successive test periods were fairly constant for the HDPE pipes. Corresponding migration tests carried out for PEX pipes showed that VOC migrated in significant amounts into the test water, and TON $\geqslant 5$ of the test water were observed in all tests. Several of the migrated VOC were not identified. Oxygenates predominated the identified VOC in the test water from PEX pipes. Migration tests of PVC pipes revealed few volatile migrants in the test samples and no significant odour of the test water.
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Keywords: Plastic pipes; Drinking water; VOC; Migration

1. Introduction

Pipes made of high-density polyethylene (HDPE) and polyvinyl chloride (PVC) have found wide-spread use in the drinking water distribution net. However, the quality of water passing through polyethylene pipes can be affected by migration of components from the plastic material such as additives and degradation products thereof as well as oxidation byproducts of the polymer. Leaching of phenolic compounds related to antioxidants such as BHT and various carbonyl compounds from polyethylene used in HDPE pipes and PE granulate is documented in the literature [1–4]. For PVC pipes, migration of various chlorinated compounds and organotin compounds have been reported [4–7]. Details on VOC migration from crossbonded polyethylene (PEX) pipes, used as a substitute for copper tubings for in-house installations, are not found.

Testing of organoleptic properties of drinking water in contact with plastic pipes was according to the CEN method for organoleptic assessment of water in piping systems.[1] This method prescribes static contact between water and plastic pipe for three successive periods each of 72 h duration. According to a Danish proposal for testing of plastic pipes for drinking water [8] based on the test conditions in the CEN method, no significant taste and odour of water should be observed in the third and final test. In addition, visual changes in the test

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[1] EN 1420-1: Influence of organic materials on water intended for human consumption. Determination of odour and flavour assessment of water in piping systems. Part 1: Test method. CEN/TC164/WG3, 1999.

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water should not be observed and the total amount of carbon (TOC) should decline from the first to the third test to a value less than 0.3 mg/l. Literature data describing the individual migrating species under these test conditions are however sparse. On background of the methods and proposals for testing of plastic pipes the present work focus on the identification and quantification of migrating VOC. The odour intensity of water kept in contact with plastic pipes is assessed as well as the relationship between VOC and odour. The total content of organic compounds is also measured. Organic components migrating from plastic pipes may serve as nutrients for micro-organisms, and thus promote microbial growth in pipelines [9–12]. The present work contributes to the knowledge on types and amounts of migrants available for microbial utilization in plastic pipes for drinking water.

2. Materials and methods

2.1. Principle

The quality of water in contact with plastic pipes during three successive test periods is described in terms of threshold odour number (TON), migration of volatile organic components (VOC) and bulk concentrations of organic carbon. Preparation of the test water samples is based on CEN method EN-1420-1 for testing of organoleptic properties of drinking water in contact with plastic pipes.

2.2. Plastic pipes used for testing

Seven brands of HDPE pipes (pressure and dimension classification: PN 10, PE50) were investigated and three 1 m test pieces of each brand were applied for migration testing. The dimension of HDPE pipes was $63 \times 5.8\,mm^2$ with an inner diameter (i.d.) corresponding to 51.4 mm. The ratio between area and volume of the tested pipes was $774.7\,cm^2/1000\,ml$ which corresponds to 0.8:1. Two different brands of PEX pipes were tested. One test piece of 13 m length was tested for each of the brands. The dimension of the tested PEX pipes was $15 \times 2.5\,mm^2$ with i.d. = 12 mm. The surface area to volume ratio of PEX pipes hence corresponds to $4000\,cm^2/1000\,ml = 4:1$. With respect to PVC pipes, two different brands were tested. Three test pieces each of 30 cm length were tested of each brand. The dimension of tested PVC pipes (PN 10), $110 \times 5.3\,mm^2$ and i.d. = 99.4 mm, thus corresponds to an area to volume ratio of $402\,cm^2/1000\,ml = 0.4:1$.

2.3. Migration tests

Ultrapure Milli-Q water used for migration tests (referred to as Milli-Q water) was obtained by prepurification of tap water using an Elgastat Option 4 equipped with reverse osmosis unit, UV-photo-oxidation and filter unit. Prepurified water was fed to a Milli-Q Gradient equipped with Millipore Q-Gard and Quantum filter units for additional polishing with respect to organic species. Pipe test pieces were flushed and kept in contact with Milli-Q water at stagnant conditions for 24 h according to the procedure described in EN-1420-1 prior to migration tests. After rinse and prewash, test pieces were filled with Milli-Q water, sealed with Al-stoppers and left at room temperature for 72 h. The water in the test pieces, referred to as the test water in the following text, was collected after 72 h and analysed with respect to VOC, TON, TOC and chemical oxygen demand (COD_{Mn}). The test pieces were refilled with Milli-Q water and left for an additional period of 72 h before sampling and analysis of the test water as described above. In total three successive tests each of 72 h duration were performed. An extended migration test of 41 days duration was carried out for HDPE pipe no. 1, and the test water analysed with respect to selected VOC. Migration tests were carried out in triplicate for each of the three successive tests for HDPE pipe no. 5 in order to evaluate the repeatability of VOC quantifications.

Reference samples were prepared by storing Milli-Q water in glass bottles with glass stoppers in parallel with the migration tests carried out for plastic pipes and analysed in correspondence with the test water samples.

2.4. VOC analysis

All glass equipment in contact with the test water samples or reference water samples for VOC determinations was heated to 450°C for 2 h prior to use in order to remove organic contaminants. VOC were concentrated from 1000 ml portions of the test water and reference samples by a purge and trap method based on the open-loop stripping principle [13,14]. Prior to purging two internal standards (1-chloro-octane and 1-chloro-decane, each 50 ng/l) were added to test and reference samples. Ultrapure N_2 (hydrogas 6.0, flow 100 ml/min) was used for purging and VOC were trapped on a Tenax GR adsorbent (60–80 mesh, Alltech). The Tenax adsorbent was kept in stainless-steel tubes supplied with the Perkin Elmer ATD-400 instrument. The water samples were kept at 40°C in a waterbath for 1 h during the purge and trap sequence while the Tenax tubes were kept at 55°C. VOC adsorbed on Tenax tubes were thermally desorbed using Perkin Elmer ATD-400 equipped with a Peltier cryofocusing Tenax GR trap and directly introduced to the column (Chrompack CP Sil 13 CB, 25 m, 0.25 mm i.d., 1.2 μm film thickness) of a HP 6890 GC connected to HP 5973 MSD using 70 eV EI ionization. Identification of VOC mass spectra was based on the Wiley database of mass spectra and

confirmed with pure reference compounds in most cases. Calibration curves for quantification of VOC were established correspondingly by analyses of dilution series of reference compounds in Milli-Q water.

2.5. Threshold odour number (TON)

The organoleptic properties of water were assessed according to EN 1622 [15] which is based on a quantitative dilution method. Five dilutions of the test water samples were performed, and TON was assessed at a scale from 0 to $\geqslant 5$. Milli-Q water (TON = 0) was used as reference. TON values higher than three were assigned to water samples with significant odour in accordance with Norwegian drinking water regulations. The uncertainty in TON assessment is estimated to ± 1 by repetitive determinations.

2.6. Bulk parameters for organic content

Chemical oxygen demand (COD_{Mn}) was determined according to a Norwegian standard method [16], and the limit of detection is 1 mg/l O. TOC was determined according to ISO-8245 [17]. The limit of detection was 0.4 mg/l C.

3. Results

3.1. VOC in the test water from HDPE pipes

Table 1 shows VOC identified in the test water samples from HDPE pipe migration experiments. The identified VOC in HDPE pipe test samples were grouped in six compound classes (Table 1). These compound classes comprised of components related to antioxidants, esters, aldehydes, ketones, terpenoids and aromatic hydrocarbons. The same components were quantified in the three successive tests and represent major parts of identified VOC for all HDPE pipes (Table 2). VOC detected but not identified in the test water samples were present in minor amounts.

Control of VOC background level in water used for testing and the applied analytical apparatus is crucial for successful low-level VOC determination. Concentration levels of background VOC in reference water samples showed that the amounts of total VOC (TVOC) in reference samples varied between 80 to 280 ng/l for the same classes of VOC as those determined in the test water (Table 2). These concentrations were low compared to the lowest concentration of TVOC observed in the test water samples (1.3 μg/l, pipe no. 6).

The TVOC in the test water samples varied among the HDPE pipe brands (Fig. 1). The lowest yields of TVOC were observed in the test water from HDPE pipe no. 4 and 6, whereas TVOC yields in the test water from pipe

Table 1
Classification of detected VOC in migration tests with HDPE pipes

Component class	Class no.	Identified VOC	Abbreviation
Components related to antioxidants	1	2,6-Di-tert-butyl-benzoquinone	2,6-DTBQ
		2,4-Di-tert-butyl phenol	2,4-DTBP
		4-Methyl-2,6-di-tert-butyl-phenol	BHT
Esters	2	Butyl acetate	
		Ethyl hexanoate	
		Hexyl acetate	
		Propyl hexanoate	
		Butyl hexanoate	
		Ethyl octanoate	
		Hexamethyl butanoate	
		Isobornyl acetate	
		Hexyl hexanoate	
		Ethyl decadienoate	
		2,2,4-Trimethyl-1,3-pentanediol-diisobutyrate	2,2,4-TPD
Aldehydes	3	Nonanal	
		Decanal	
Ketones	4	2-Decanone	
		2-Undecanone	
		2-Dodecanone	
Terpenoids	5	Alpha pinene	
		Delta carene	
		Limonene	
		Alpha terpinolene	
		Alpha farnesene	
Aromatic Hydrocarbons	6	Benzene	
		Toluene	
		Ethyl benzene	
		m- and *p*-xylene	
		o-Xylene	
		Styrene	
		Isopropyl benzene	
		n-Propyl benzene	
		Ethyl methyl benzene	
		1,3,5-Trimethyl benzene	
		1,2,4-Trimethyl benzene	
		p-Isopropyl toluene	
		Naphthalene	

Table 2
Quantitative results for VOC in test water from seven HDPE pipe brands. Migration tests were carried out by three successive tests each of 72 h duration

Pipe brand no.	Test no.	VOC *i* test water (ng/l)							Testwater TON	VOC in reference water (ng/l)							Reference water TON
		Component class no.								Component class no.							
		1	2	3	4	5	6	Total VOC		1	2	3	4	5	6	Total VOC	
1	1	2220	540	840	210	40	1100	4950	⩾5	0	0	70	0	0	30	100	0
	2	1490	430	880	270	50	1200	4320	⩾5	0	0	90	0	0	20	110	0
	3	1760	390	780	300	40	1080	4350	⩾5	0	0	50	0	0	20	80	0
2	1	780	350	730	60	40	600	2560	4	0	0	70	0	0	30	100	0
	2	450	190	460	50	40	540	1730	4	0	0	100	0	0	20	120	0
	3	400	200	700	60	40	400	1800	4	0	0	50	0	0	30	80	0
3	1	780	20	60	120	20	1270	2270	4	10	0	70	0	0	100	190	0
	2	1130	10	70	120	10	1390	2730	⩾5	10	0	100	0	0	120	240	0
	3	750	20	40	90	10	1310	2220	⩾5	20	0	60	10	0	40	140	0
4	1	330	110	260	120	50	930	1800	1	10	0	110	20	10	70	220	0
	2	390	140	460	120	40	940	2090	2	10	0	60	10	0	40	120	0
	3	300	110	340	160	30	810	1750	2	10	0	100	10	0	30	160	0
5	1	5180	710	950	300	60	1150	8350	⩾5	10	0	50	0	0	20	90	0
	2	5010	610	600	250	70	840	7380	4	20	0	70	10	0	130	230	0
	3	4320	530	690	230	60	660	6490	⩾5	10	0	50	0	0	180	250	0
%RSD[a]		10	10	4	12	7	3	7									
6	1	780	30	70	50	30	410	1370	1	10	0	60	10	0	30	120	0
	2	680	100	130	70	20	320	1320	1	10	0	80	10	0	10	100	0
	3	990	90	120	70	30	290	1590	0	10	0	70	10	0	10	100	0
7	1	1670	280	500	80	80	450	3060	⩾5	10	0	60	0	0	30	100	0
	2	1990	170	150	60	50	390	2810	4	10	0	80	10	0	180	280	0
	3	2530	140	110	60	50	220	3110	⩾5	10	0	70	20	0	30	130	0

Class 1 = components related to antioxidants, class 2 = esters, class 3 = aldehydes, class 4 = ketones, class 5 = terpenoids, class 6 = aromatic hydrocarbons.

[a] %RSD is based on triplicate runs of each test for HDPE pipe no. 5.

no. 2 and 3 were slightly higher. The highest amounts of TVOC were observed in test samples from pipe no.1, 5 and 7 (Table 2).

3.1.1. *Classes of identified VOC*

Components related to antioxidants (class 1, Table 1) predominated most of the test water samples from HDPE pipes, and include 2,4-di-tert-butyl phenol (2,4-DTBP), 2,6-di-tert-butyl benzoquinone (2,6-DTBQ) and in some of the test samples, trace amounts of BHT. 2,4-DTBP is known as a degradation product of, e.g. Irgafos 168® (tris(2,4-di-tert-butyl-phenol)phosphite)[18]. 2,4-DTBP was a major component within the class 1 components in the test water samples from all tested HDPE pipes except pipe nos. 2 and 4 (Table 3). The relative contribution of 2,4-DTBP to the amount of TVOC in successive tests varied from 1% to 4% (pipe no. 4) and 53% to 79% (pipe no. 7). High relative contribution from 2,4-DTBP to TVOC was also found in test samples from pipe no. 5. The highest concentrations of 2,4-DTBP (5 μg/l) was observed in test no. 1 from pipe no. 5.

2,6-DTBQ, a degradation product of the antioxidants Irganox 1010® and Irganox 1076® [19], was present in lower yields than 2,4-DTBP in most test water samples except in test waters from HDPE pipe brands no. 2 and 4. The yield of 2,6-DTBQ varied between 60 and 600 ng/l (data not shown) in the test water samples from the seven HDPE brands. BHT is widely used as an antioxidant in plastics and is frequently encountered as a background contaminant. The amount of BHT in the test samples corresponded to the background (reference) level or slightly above the background level in some of the test samples, and is thus regarded as insignificant in this context.

A number of ester compounds were identified in the test water from HDPE pipes (class 2, Table 1). Butyl hexanoate was a major individual component with maximum concentration around 300 ng/l. Another abundant ester component, 2,2,4-trimethyl-1, 3-pentanediol diisobutyrate (2,2,4-TPD) is known as a plasticizer in surface coatings, moldings and for PVC plastisols and organosols [18]. 2,2,4-TPD has been reported as a plasticizer in HDPE pipes [1]. HDPE pipes investigated in the present work are however unplasticized. 2,2,4-TPD is an abundant background component in our reference water samples, and is therefore also present in the test water samples. Potential migration of 2,2,4-TPD from HDPE pipes was thus considered less likely, and its presence in the test water was ascribed to the high background level. Hence, this component was not included in the total amount of esters (Table 2).

The aldehydes nonanal and decanal (class 3, Table 1) were encountered in amounts well above the reference level in most test water samples except in the test water samples from HDPE pipes no. 3 and 6. The maximum concentrations of these aldehydes in the test water samples were close to 1 μg/l. Aldehydes are known to be thermal degradation products generated during pipe production [2,3]. The background level of nonanal and decanal is mainly due to degradation of the Tenax adsorbent. Ketones (class 4) in the test waters were comprised of 2-decanone, 2-undecanone and 2-dodecanone which probably are high-temperature byproducts as described for aldehydes. Terpenoids (class 5) were also detected in amounts less than 100 ng/l (Table 2).The origin of terpenoids is not known.

Aromatic hydrocarbons (class 6, Table 1) in the test water samples were comprised of benzene, toluene, ethylbenzene, xylenes, styrene and various C3- and C4-alkylated benzenes in addition to naphthalene. The background level of aromatic hydrocarbons is mainly due to toluene in ambient air. The concentration of aromatic hydrocarbons in the test water varied within the range 200–1300 ng/l (Table 2). The amount of benzene varied between blank level or slightly above blank level up to concentrations of 500 ng/l in the test water from pipe no. 4, and 1 μg/l in pipe no. 3.

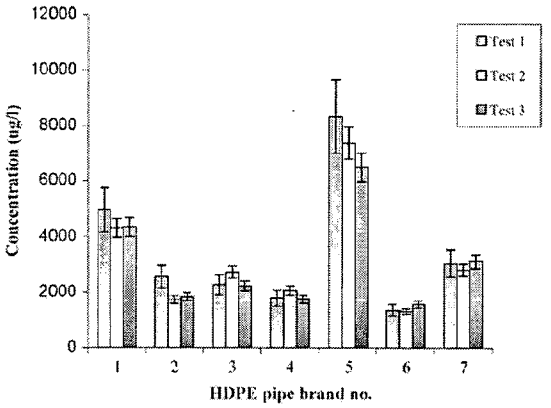

Fig. 1. Concentration of TVOC in the test water samples from HDPE pipes. The analytical uncertainty between successive tests is indicated.

3.1.2. VOC concentration in successive tests

Migration tests were carried out in triplicate for each of the successive tests for HDPE pipe no. 5. The analytical deviations based on the repeated migration tests for the various classes of components varied between 3% mRSD and 12% RSD for HDPE pipe no. 5 (Table 2). The difference observed between tests of HDPE pipe no. 5 was investigated by Students *t*-test, and the analytical uncertainty at 95% confidence level corresponds to 2.3 times the standard deviation. At 95% confidence level no significant difference was found between tests 1 and 2 with respect to the amount of TVOC. The difference between tests 1 and 3 with respect to TVOC was however significant. Analytical uncertainties for HDPE pipe no. 5 were considered representative for all HDPE pipes and are indicated in Fig. 1. The analytical deviation for 2,4-DTBP corresponded to 10% RSD (data not shown), and the concentration

Table 3
Migration of 2,4-di-tert-butyl phenol from HDPE pipes to water during three successive tests

Pipe brand no.	Concentration in test water (ng/l)				Concentration in reference water (ng/l)		
	Test 1	Test 2	Test 3	Total	Test 1	Test 2	Test 3
1	1950	1320	1570	4840	0	0	0
2	140	60	40	240	0	0	0
3	630	940	580	2150	10	0	0
4	60	40	20	120	0	0	0
5	5000	4800	4200	14000	10	10	10
6	700	610	910	2220	0	0	0
7	1600	1920	2470	5990	10	10	10

of 2,4-DTBP in the three successive tests for pipe no. 5 (Table 3) was not significantly different.

Inspection of the VOC data in Table 2 reveals that VOC concentrations of individual classes of components as well as TVOC were rather similar in the three successive tests carried out for each HDPE pipe brand (Fig. 1). In most cases, the observed differences between the successive tests were accounted for by analytical uncertainties as indicated in Fig. 1. Significant reduction in TVOC concentration in test 1 compared to test 3 is observed for HDPE pipes nos. 2 and 5 only. The concentration of 2,4-DTBP (Table 3) was significantly reduced from the first through the third test in the test water from pipe nos. 1 and 4. The concentration of 2,4-DTBP in the test water from the other pipes was similar for all tests or significantly higher in the second or third test compared to the first test. Analyses of VOC in water from the 24 h prewash period showed that the concentrations of VOC were slightly higher or similar to those in the following 72 h tests (data not shown).

Since the VOC concentrations in the successive tests were similar, an extended test of 41 days duration was carried out for one of the HDPE pipes (no. 1) in order to investigate the concentration trends for selected VOC beyond the 10 days specified in the standard method. The concentration of major components related to antioxidants (class 1) decreased just slightly during this extended test period, and after 41 days the concentration approached half the value observed at the first 72 h test. A similar concentration trend was observed for major ester components (hexanoates), although a slightly enhanced decline in concentration with time was observed for these components compared to class 1 components. The results shows that migration of these components persisted beyond the 41 days test period (data not shown).

3.2. VOC in the test water from PEX pipes

The predominating VOC in the test water from PEX pipes was methyl-tert-butyl ether (MTBE). In test water from PEX pipe no. 1 the MTBE concentration was reduced from 47.6 μg/l in the first test to 33.5 μg/l in the third test (Table 4). In test water from PEX pipe no. 2 the concentrations were considerably lower: 5.8 μg/l in the first test and 5.0 μg/l in the third test (Table 4). Repeated tests were not run for PEX pipes and the contribution of analytical deviations to the observed differences in VOC concentrations between successive tests is not known. Several unidentified compounds, presumably various oxygenates, were encountered in the test water samples along with the identified VOC. Unidentified VOC were not quantified and their contribution to the total amount of organic migrants is not known. Some of the unidentified components appeared in the test waters for both PEX brands, whereas others were specific for individual brands.

3.3. VOC in the test water from PVC pipes

VOC detected in the test water from PVC pipes (data not shown) were comprised of hexanal, octanal, nonanal and decanal. Only trace amounts of hexanal and octanal were found in the test water from the three successive tests for both PVC pipes, whereas nonanal and decanal were present in concentrations from 280 ng/l or less (pipe no. 1) and 170 ng/l or less (pipe no. 2). Analyses of wash water from the 24 h prewash carried out prior to migration experiments revealed that concentration of nonanal and decanal were four to eight times higher than observed in the test water from the first 72 h migration test.

Table 4
Results from migration experiments carried out with PEX pipes for three successive 72-h test periods

Parameter	VOC (ng/l) in test water from PEX pipe no. 1			VOC (ng/l) in test water from PEX pipe no. 2		
	Test 1	Test 2	Test 3	Test 1	Test 2	Test 3
Methyl tert-butyl ether	47600	37300	33500	5800	5100	5000
Tert-butanol	540	580	510	1130	300	1180
4-Butoxy phenol	nd	nd	nd	2550	550	2250
5-Methyl-2-hexanone	870	770	660	nd	nd	nd
Ionol	+	+	+	nd	nd	nd
Mesityl oxide	nd	nd	nd	400	50	250
Tert-butyl isobutyl ether	nd	nd	nd	100	50	100
Unidentified VOCs	+ +	+ +	+ +	+ +	+ +	+ +
COD_{Mn} (mg/l)	<1	<1	1	2	1,5	1,3
TOC (mg/l)	1,6	1,4	1,3	2,1	2,5	2,5
TON	⩾5	⩾5	⩾5	⩾5	⩾5	⩾5

In cases where quantitative data not were established. Relative amounts of VOC are indicated with + or + +.
nd: Not detected.

3.4. Threshold odour number (TON)

The test water samples from five out of seven different brands of HDPE pipes gave TON $\geqslant 4$ (Table 2). The two HDPE pipes nos. 4 and 6 imparted no or insignificant odour (TON $\leqslant 2$) to water, whereas the test waters from pipes nos. 1, 2,3,5 and 7 showed high TON values. The TON values were not reduced from the first to the third test.

TON values $\geqslant 5$ were assigned to all test samples of both PEX pipes (Table 4).

Significant odour was not observed from PVC test samples where TON mainly was assessed to a value of zero and not higher than two in any of the tests (data not shown).

3.5. Bulk parameters for organic carbon content

Measured values for TOC and COD_{Mn} were lower than the detection limits for the respective methods for all reference and test samples from HDPE pipes.

Migation of organic components was significant for the two tested PEX pipes. COD_{Mn} values of the two first tests of PEX pipe no. 1 (Table 4) were less than the detection limit whereas the COD_{Mn} for the third test was equal to 1 mg/l O. TOC values were reduced from 1.6 mg/l in the first test to 1.3 mg/l in the third test for PEX pipe no. 1. For PEX pipe no. 2 COD_{Mn} was reduced from 2 mg/l O in the first test to 1.5 mg/l O and 1.3 mg/l O in the second and third test, respectively. TOC values increased from 2.1 mg/l in the first test to 2.5 mg/l in the two following tests (Table 4). These data do not indicate positive correlations between COD_{Mn} and TOC values in the test waters from PEX pipes.

TOC and COD_{Mn} results for PVC pipes were lower than the detection limits for all test samples (data not shown).

4. Discussion

The presented data show that water quality can be affected by migration of organic components to a varying extent when plastic pipes are in static contact with water. The tests were carried out on unused pipes, prior to potential impacts of use and ageing.

4.1. HDPE pipes

The composition of VOC in the test waters from HDPE pipes is dominated by components related to antioxidants (class 1) where 2,4-DTBP and 2,6-DTBQ are major individual components. Various carbonyl compounds and aromatic hydrocarbons are present as well. The concentration of benzene in water from one of the tested HDPE pipes corresponds to the limit of benzene (1 μg/l) given in EU's drinking water directive [20]. In the test water from the remaining HDPE pipes the concentration of this compound is well below 1 μg/l. Leaching of phenolic antioxidants such as BHT and alkylbenzenes have been associated with odour of water passing through HDPE pipes [1]. Off-flavours from HDPE pellets are ascribed to the presence of carbonyl compounds such as aldehydes, ketones and esters [2,3,21,22]. Some alkylated benzoquinones are known to cause off-flavours to water [19]. Terpenoids were present in very low concentrations and are less likely to affect TON in the present case, even if these compounds are well-known odourants. Literature data thus confirm that VOC identified in the test waters from HDPE pipes (Table 1) have an odour potential, and the results show that TON values $\geqslant 4$ were measured in all tests with five out of seven brands of HDPE pipe. This means that test samples for five HDPE pipes show unacceptable odour deviations and do not comply with Danish test proposals [8].

Individual VOC can vary considerably with respect to their odour threshold values, which means that individual components contribute to a varying extent to the odour of the sample. In the present work, the test water samples with the lowest amounts of TVOC also showed the lowest TON values and hence, insignificant odour of test samples. Test samples with high concentrations of TVOC showed significant odour and gave high TON values. These results indicate a proportionality between TON and TVOC concentrations. However, test samples from the two HDPE pipes no. 2 and 3 with rather low TVOC yields did not support this trend. This suggests that high concentrations of TVOC were associated with high TON, whereas low concentrations of TVOC not necessarily implies low TON values. In cases where high TON values were noted despite relatively low yields of TVOC it is possible that components contributing to odour are not detected by the applied method, or that additional components with particularly low odour threshold values are present. For most of the test samples it is however concluded that the concentration of TVOC and TON values were positively correlated.

A slight although significant reduction in concentration of TVOC from the first to third test was observed only for two of the seven HDPE pipes. For the remaining pipes the differences between the concentrations of TVOC throughout the successive tests were accounted for by analytical uncertainty. This means that the VOC migration yields were not, or very slightly, reduced from the first to the third test. This is not in agreement with requirements for total organic content in the Danish test proposal [8]. Minor or insignificant differences in concentrations of TVOC in the three tests were in accordance with the stable TON values throughout the test period. This indicate that in cases where high TON values and high concentrations of

TVOC are observed in the first 72 h tests, significant release of VOC and unacceptable odour may be expected also beyond the specified 10 days test period.

The stable concentration levels observed throughout the three successive 72 h tests are confirmed by the test results from the 41 days test period, which showed that VOC concentration decreased slowly in the tests carried out beyond the first 10 days. With respect to class 1 components, which represents degradation products from antioxidants, persistent migration should be expected as the HDPE polymer is protected against degradation during the lifetime of the pipe by degradation of antioxidants.

Measured values of TOC and COD_{Mn} in the test water from HDPE pipes were less than the respective detection limits in all samples, including those with significant odour. Hence, these bulk parameters are not sufficient for evaluating the migration from HDPE pipes with respect to specific components which affect water quality.

4.2. PEX pipes

Formation of oxygenated byproducts from cross-bonding processes based on organic peroxide reactions during PEX pipe production is likely to contribute to VOC in the test water samples. This is in agreement with the abundant oxygenated components identified in the present work. The major individual component identified, MTBE, is known to cause taste and odour episodes and should, according to recommendations issued by US EPA, not exceed 20–40 μg/l [23,24]. MTBE is thus assumed to be one of the major contributors to the high values for TON ($\geqslant 5$) found in all the test water samples from PEX pipe no. 1. Unidentified VOC probably contribute to high TON values as well.

The total amount of VOC migrating from PEX pipes is not known since unidentified VOC were not quantified. High migration levels were however confirmed by organic bulk parameters. Unlike HDPE pipes, PEX pipes generally produced measurable COD_{Mn} and TOC values in the test water. However, the organic content determined by TOC were not in agreement with those determined by COD_{Mn}. The deviation between these two bulk parameters is not unexpected since the sample work-up procedure differs and the COD_{Mn} method is developed for easily oxidized substances. According to the Danish test proposal [8], the TOC content was too high in the final test of both PEX pipes. The presence of odour potent components as well as the considerable proportion of unknown components suggests that the organic bulk parameters are not sufficient for evaluation of migration from PEX pipes. The high content of organic compounds in PEX test water could be due to either the high area to volume ratio for PEX tubes (area:volume ratio 4:1) or the quality of the PEX material itself. High migration levels of organic compounds from PEX pipes used at in-door temperatures may promote bacterial regrowth, and needs further investigation.

4.3. PVC pipes

Particularly high relative concentrations of nonanal and decanal in wash water samples compared to the subsequent migration tests were observed for PVC pipes. These observations were different to the situation for HDPE pipes where the VOC concentration in samples taken from the 24 h wash water was slightly higher or comparable to those of the following test samples. The relatively high concentration of aldehydes in wash water from PVC pipes suggests that major parts of VOC from PVC pipes originate from a surface layer which is readily removed by the initial rinse and wash procedure. Organic bulk parameters and TON values confirm low migration from PVC pipes.

5. Conclusions

- Volatile organic components (VOC) migrating from high-density polyethylene pipes (HDPE) pipes into water were comprised of compounds related to antioxidants in addition to esters, aldehydes, ketones, aromatic hydrocarbons and terpenoids. 2,4-di-tert-butyl phenol was a major individual component.
- The test water from five out of seven brands of HDPE pipes showed threshold odour number (TON) $\geqslant 4$, and thus significant odour. The total amounts of VOC (TVOC) were proportional to TON in the test water from most of the HDPE pipes.
- Values for COD_{Mn} and TOC from HDPE pipe test waters were lower than the detection limits and these parameters are thus not suited for determination of migration with respect to specific components which can affect water quality.
- Several VOC were observed in the test water from PEX pipes, but relatively few were identified. The identified VOC were mainly constituted by oxygenates with MTBE as the major individual VOC.
- MTBE was found in concentrations above the recommended US EPA taste and odour values for MTBE in drinking water in one PEX pipe, and is probably a significant contributor to the high TON values of test water from PEX pipes.
- COD_{Mn} and TOC indicated in most cases leaching of organic material from PEX pipes to water. The high concentrations of organics in test water could be due to the quality of the PEX material as well as high area to volume ratio in these pipes.
- Test water from PVC pipes contained few VOC in low concentrations and TON was mainly zero.

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Material Safety Data Sheet
tert-Butanol, 99.5%

ACC# 95670

Section 1 - Chemical Product and Company Identification

MSDS Name: tert-Butanol, 99.5%
Catalog Numbers: AC107710000, AC107710010, AC107710025, NC9164479, NC9994579, XXAC10771-40KG, XXAC10771-80KG
Synonyms: Tert-Butyl Hydroxide; 1,1-Dimethylethanol; 2-Methyl-2-Propanol; Trimethylcarbinol.
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
75-65-0	tert-Butyl alcohol	99.5	200-889-7

Hazard Symbols: XN F
Risk Phrases: 11 20

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: after melting, clear colorless liquid. Flash Point: 11 deg C. **Warning! Flammable liquid and vapor.** May cause central nervous system depression. May be absorbed through intact skin. Causes eye, skin, and respiratory tract irritation.
Target Organs: Kidneys, central nervous system, liver, respiratory system, eyes, skin.

Potential Health Effects
Eye: Causes eye irritation. May cause chemical conjunctivitis and corneal damage.
Skin: Causes skin irritation. May be absorbed through the skin in harmful amounts. Prolonged and/or repeated contact may cause defatting of the skin and dermatitis. May cause cyanosis of the extremities.
Ingestion: May cause gastrointestinal irritation with nausea, vomiting and diarrhea. May cause liver and kidney damage. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. Heavy exposure may cause irritation of the eyes, nose and throat; head ache; nausea; fatigue; and dizziness.
Inhalation: Inhalation of high concentrations may cause central nervous system effects characterized by nausea, headache, dizziness, unconsciousness and coma. Causes respiratory tract irritation. May cause liver and kidney damage. May cause lung damage. Aspiration may lead to pulmonary edema. Vapors may cause dizziness or suffocation. May cause blood changes. May cause burning sensation in the chest.
Chronic: Repeated eye exposure may cause visual abnormalities including blurred vision and

photosensitivity.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid. Do NOT allow victim to rub eyes or keep eyes closed.
Skin: Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse.
Ingestion: Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Get medical aid immediately.
Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid. Do NOT use mouth-to-mouth resuscitation.
Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors may form an explosive mixture with air. Vapors can travel to a source of ignition and flash back. Will burn if involved in a fire. Flammable Liquid. Can release vapors that form explosive mixtures at temperatures above the flashpoint. Use water spray to keep fire-exposed containers cool. Water may be ineffective. Material is lighter than water and a fire may be spread by the use of water. Containers may explode in the heat of a fire. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas.
Extinguishing Media: For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam. For large fires, use water spray, fog, or alcohol-resistant foam. Use water spray to cool fire-exposed containers. Water may be ineffective. Do NOT use straight streams of water.
Flash Point: 11 deg C (51.80 deg F)
Autoignition Temperature: 470 deg C (878.00 deg F)
Explosion Limits, Lower:2.40 vol %
Upper: 8.00 vol %
NFPA Rating: (estimated) Health: 1; Flammability: 3; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Remove all sources of ignition. Absorb spill using an absorbent, non-combustible material such as earth, sand, or vermiculite. Do not use combustible materials such as sawdust. Use a spark-proof tool. A vapor suppressing foam may be used to reduce vapors.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well-ventilated area. Ground and bond containers when transferring material. Use spark-proof tools and explosion proof equipment. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep away from heat, sparks and flame. Do not get on skin or in eyes. Do not ingest or

inhale. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.
Storage: Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a cool, dry, well-ventilated area away from incompatible substances. Flammables-area.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local explosion-proof ventilation to keep airborne levels to acceptable levels.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
tert-Butyl alcohol	100 ppm TWA	100 ppm TWA; 300 mg/m3 TWA 1600 ppm IDLH	100 ppm TWA; 300 mg/m3 TWA

OSHA Vacated PELs: tert-Butyl alcohol: 100 ppm TWA; 300 mg/m3 TWA
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: after melting, clear colorless
Odor: camphor
pH: Not available.
Vapor Pressure: 36 mbar @ 20 C
Vapor Density: 2.6
Evaporation Rate:1.05 (Butyl Acetate=1)
Viscosity: 3.35 mPas 30 deg C
Boiling Point: 83 deg C @ 760mm Hg
Freezing/Melting Point:25 - 25.5 deg C
Decomposition Temperature: Not available.
Solubility: Soluble.
Specific Gravity/Density:.7860g/cm3
Molecular Formula:C4H10O
Molecular Weight:74.12

Section 10 - Stability and Reactivity

Chemical Stability: Stable at room temperature in closed containers under normal storage and handling conditions.
Conditions to Avoid: High temperatures, incompatible materials, ignition sources, excess heat.
Incompatibilities with Other Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:
CAS# 75-65-0: EO1925000
LD50/LC50:
CAS# 75-65-0:
Dermal, guinea pig: LD50 = >10 mL/kg;
Draize test, rabbit, eye: 100 uL/24H Severe;
Draize test, rabbit, skin: 500 uL/24H Mild;
Inhalation, rat: LC50 = >10000 ppm/4H;
Oral, rabbit: LD50 = 3559 mg/kg;
Oral, rabbit: LD50 = 3600 mg/kg;
Oral, rat: LD50 = 2743 mg/kg;
Oral, rat: LD50 = 3500 mg/kg;
Skin, rabbit: LD50 = >2 gm/kg;
Carcinogenicity:
CAS# 75-65-0: Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
Epidemiology: No information found.
Teratogenicity: No information found.
Reproductive Effects: No information found.
Neurotoxicity: No information found.
Mutagenicity: No information found.
Other Studies: See actual entry in RTECS for complete information.

Section 12 - Ecological Information

No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: None listed.

Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
Shipping Name:	BUTANOLS				BUTANOLS
Hazard Class:	3				3
UN Number:	UN1120				UN1120
Packing Group:	II				III
Additional Info:					FLASHPOINT 11 C

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 75-65-0 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
SARA

CERCLA Hazardous Substances and corresponding RQs
None of the chemicals in this material have an RQ.
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 75-65-0: acute, flammable.
Section 313
This material contains tert-Butyl alcohol (CAS# 75-65-0, 99 5%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
This material does not contain any hazardous air pollutants. This material does not contain any Class 1 Ozone depletors. This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA. None of the chemicals in this product are listed as Priority Pollutants under the CWA. None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 75-65-0 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.
California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives
Hazard Symbols:
XN F
Risk Phrases:
R 11 Highly flammable.
R 20 Harmful by inhalation.

Safety Phrases:
S 16 Keep away from sources of ignition - No smoking.
S 9 Keep container in a well-ventilated place.

WGK (Water Danger/Protection)
CAS# 75-65-0: No information available.
Canada - DSL/NDSL
CAS# 75-65-0 is listed on Canada's DSL List.
Canada - WHMIS

· This product does not have a WHMIS classification.

Canadian Ingredient Disclosure List

CAS# 75-65-0 is listed on the Canadian Ingredient Disclosure List.

Exposure Limits

CAS# 75-65-0: OEL-AUSTRALIA:TWA 100 ppm (300 mg/m3);STEL 150 ppm (450 mg/m3) OEL-AUSTRIA:TWA 100 ppm (300 mg/m3) OEL-BELGIUM:TWA 100 ppm (303 mg/m3);STEL 150 ppm (455 mg/m3) OEL-DENMARK:TWA 50 ppm (150 mg/m3);Skin OEL-FRANCE:TWA 100 ppm (300 mg/m3) OEL-GERMANY:TWA 100 ppm (300 mg/m3) OEL-THE NETHERLANDS:TWA 100 ppm (300 mg/m3) OEL-THE PHILIPPINES:TWA 100 ppm (300 mg/m3) OEL-SWEDEN:TWA 50 ppm (150 mg/m3);STEL 75 ppm (25 mg/m3);Skin OEL-SWITZERLAND:TWA 100 ppm (300 mg/m3);STEL 200 ppm (600 mg/m3) OEL-TURKEY:TWA 100 ppm (300 mg/m3) OEL-UNITED KINGDOM:TWA 100 ppm (300 mg/m3);STEL 150 ppm OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

Section 16 - Additional Information

MSDS Creation Date: 9/02/1997
Revision #5 Date: 3/18/2003

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

OEHHA
Office of Environmental Health Hazard Assessment
Water - Public Health Goals (PHGs)

Memorandum

To: Winston H. Hickox, Secretary for Environmental Protection

From: Joan E. Denton, Ph.D., Director

Date: March 9, 1999

Subject: Adoption of a Public Health Goal for Methyl Tertiary Butyl Ether in California drinking water

In accordance to Health and Safety Code, Section 116365 (California Safe Drinking Water Act of 1996, SB 1307, Calderon/Sher), the Office of Environmental Health Hazard Assessment (OEHHA) hereby adopts a Public Health Goal (PHG) of 13 ppb (parts per billion, or micrograms per liter) for methyl tertiary butyl ether (MTBE) in drinking water based exclusively on public health considerations.

OEHHA has completed a technical support document which provides the basis for the adoption of the PHG for MTBE. This document has undergone peer review, a public workshop, and two public review and comment periods in fulfillment of the requirements of Health and Safety Code, Section 57003 (SB 1082). The final document incorporates changes in response to comments and will be available on our web site.

The technical support document provides information on health effects that may result from MTBE exposure and estimates the level of the contaminant in drinking water that would pose no significant health risk to individuals consuming the water on a daily basis over a lifetime. PHGs represent non-mandatory goals based solely on public health considerations, and are developed based on the best available data in the scientific literature. The document provides technical assistance to the Department of Health Services (DHS) for establishing a primary drinking water standard (Maximum Contaminant Level, or MCL) which also considers economic factors and technical feasibility. It also provides relevant information useful to federal, state, and local public health officials.

Neither the U.S. Environmental Protection Agency (U.S. EPA) nor California DHS has established an MCL for MTBE. California has recently adopted a Secondary MCL of 5 ppb based on taste and odor effective January 7, 1999. The Drinking Water Advisory Level recommended by U.S. EPA in 1997 is 20 to 40 ppb.

OEHHA appreciates this opportunity for developing the PHG for MTBE in fulfillment of our mission in environmental and public health protection.

Download the technical support document for MTBE in drinking water.

Download the response to public comments for the draft technical support document for MTBE in drinking water.

You will need the FREE program Adobe Acrobat Reader to view or print these files.

For technical assistance or comments, please contact our Web Mistress

Last Updated March 12, 1999

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DHS DRINKING WATER ACTION LEVELS

Action levels are health-based advisory levels for unregulated contaminants in drinking water. They are used by the California Department of Health Services (DHS) to provide guidance to drinking water systems.

Detections of contaminants above action levels prompt certain notification requirements and recommendations.

For more about the derivation and application of action levels, as well as contaminant-specific information, see the Drinking Water Program's website:

http://www.dhs.ca.gov/ps/ddwem/AL/actionlevels.htm

DHS DRINKING WATER ACTION LEVELS	
Contaminant	**Action Level (milligrams per liter)**
Contaminants of Current Interest	
Boron	1
Chlorate	0.8
Dichlorodifluoromethane	1
1,4-Dioxane	0.003
Formaldehyde	0.1
N-Nitrosodimethylamine (NDMA)	0.00001
Perchlorate	0.004
Tertiary butyl alcohol	0.012
1,2,3-Trichloropropane	0.000005
Vanadium	0.05
Historic or Rarely Detected Contaminants	
Aldicarb	0.007
Aldrin	0.000002
Baygon	0.03
a-Benzene Hexachloride	0.000015
b-Benzene Hexachloride	0.000025
n-Butylbenzene	0.07
sec-Butylbenzene	0.26
tert-Butylbenzene	0.26
Captan	0.0015
Carbaryl	0.7
Carbon disulfide	0.16
Chloropicrin	0.056
2-Chlorotoluene	0.14
4-Chlorotoluene	0.14
Chlorpropham (CIPC)	1.2
Diazinon	0.006
1,3-Dichlorobenzene	0.6
Dieldrin	0.000002
Dimethoate	0.001

DHS DRINKING WATER ACTION LEVELS, Continued	
Contaminant	**Action Level (milligrams per liter)**
2,4-Dimethylphenol	0.1
Diphenamide	0.2
Ethion	0.004
Ethylene glycol	14
Isopropylbenzene	0.77
Malathion	0.16
N-Methyl dithiocarbamate (Metam sodium)	0.02
Methyl isobutyl ketone (MIBK)	0.12
Methylisothiocyanate	0.05
Methyl parathion	0.002
Naphthalene	0.17
Parathion	0.04
Pentachloronitrobenzene	0.02
Phenol	4.2
n-Propylbenzene	0.26
2,3,5,6-Tetrachloroterephthalate	3.5
1,2,4-Trimethylbenzene	0.33
1,3,5-Trimethylbenzene	0.33
Trithion	0.007

For more information, please visit the DHS Drinking Water Program's website:

http://www.dhs.ca.gov/ps/ddwem/AL/actionlevels.htm

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

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

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

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

A. MECHANICAL FAILURES USING THE PRODUCT PEX

1. PEX is not a similar plastic as PB as suggested by Thomas Reid.

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

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

PB's water pipe fittings were subject to failure due to chlorine in the drinking water. The literature indicates that this is not a problem for PEX or its fittings. PEX piping and fittings are not subject to attack by chlorine and has piping and fittings have been certified by NSF International to resist attack by chlorine used as oxidizers in the water supply.

Since the adoption of the 2001 California Plumbing Code millions of feet of PEX water pipe have been installed in residential homes in California through the alternative material approval process, in manufacture homes as an approved product, as an approved pipe material in the 2001 California Mechanical Code for hydronic heating, and in private buildings such as schools, and office buildings for potable water supply systems. The Department has found nothing in the record indicating that any of this installed PEX piping has been attacked by chlorine in the water supply causing mechanical failures. There is also nothing in the record indicating any mass mechanical failures of this installed pipe.

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

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

4. Law suit concerning PEX failure in 19 units of a 57 unit Condominium in Seattle.

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

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

the complaint HCD obtained, only 19 of the 57 units experience water damage do to the PEX mechanical failures.

The Departments literature search showed that copper tubing was once widely used for radiant floor heating, but the materials tendency to expand and contract caused premature failure and is no longer used.[2] Nearly all floor-heating systems installed in North America (over two billion feet of PEX) are made from PEX and PEX-AL-PEX.

The literature search does not support the existence of wide spread mechanical failures of PEX radiant heating pipe. Instead, the literature search found no reports of wide spread failures of the billions of feet of PEX installed in North America, including California, since 1977. Because the PEX piping failed in only 19 units of the 57 unit condominium complex at Blueberry Place it appears that failure was due to handling and installation of the PEX because there is noting in the record to support an inherent structural problem with the product itself.

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

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

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

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

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

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

environmental effects between the use of CPVC and the currently approved copper pipe material.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

After reviewing the ASTM Standard 876-00 and the emails from ASTM it has been concluded that this statement has been misinterpreted by the Pipe Trades Council concerning this safety standard. The caveat enumerated in section 1.4 of the PEX ASTM standard 876 states "The following safety hazards caveat pertains only to the test methods portion Section 7 of this specification." This hazards caveat is only for the hazards associated with the person performing the testing methods of the standard used to certify the PEX material. It is not a safety hazard caveat concerning the PEX material itself as suggested by the Pipe Trades Council.

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

(a) Thomas Reid and Associates stated that there is a lawsuit in Scottsdale, Arizona suggesting that PEX pipe has leached MTBE contamination into the water and poisoned the family in concentrations of 15, 17, and 22 PPB—which is 3-4 times the 5 ppb taste and odor threshold and near or above the 20 ppb action level. Thomas Reid and Associates also stated that WIRSBO Manufacturing has disclosed that PEX does have chemical leaching problems. They have also stated that "Tests by NSF confirmed this problem" and found MTBE in the water flushed through the PEX plumbing.

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

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

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

plastic pipe leaching contaminates into the sampling water rendering the samples useless.

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

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

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

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

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

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

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

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

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

This letter supports a potential problem in City of Scottsdale where there may have been either excessive or illegal applications of termiticide in some homes which brings into question the validly of the Pipe Trades Council suggestion that the permeability of PEX was the source of the alleged problem of this house.

The record shows that the manufactures of copper or galvanize pipe recommend in their installation standards not to place this pipe in contaminated soils such as soils contaminated with termiticide. This is because placing copper or galvanized pipe in termiticide contaminated soils could cause drinking water contamination where there are mechanical fittings and pin hole leaks in the pipes[8]. PEX pipe installation standards also recommend avoiding placing this pipe in contaminated soils.

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

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

(c) The California Structural Pest Control Board, created in 1935, highest priority is to protect and benefit the public by regulating the structural pest control industry[9]. The Structural Pest Control Board is a national leader in creating an environment where the public is fully protected and well informed in the control of household pests (including but not limited to rodents, vermin and insects) and wood-destroying pests and organisms or such other pests which may invade households or structures, including railroad cars, ships, docks, trucks, airplanes, or the contents thereof.

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

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

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

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

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

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

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

Bill Staack

From: Purkiss, Dave [Purkiss@nsf.org]
Sent: Monday, September 15, 2003 5:45 AM
To: Bill Staack
Cc: Jost, Mark; Kashefi, Nasrin; Brown, Jeremy; Mclellan, Clif
Subject: Questions on PEX

Dear Mr. Staack:
I am writing in reply to your email to Mark Jost of NSF on September 08, regarding MTBE and PEX products. My understanding is that Wirsbo will be in direct communication with you regarding the information in the first paragraph of your email.
Regarding the information in the second paragraph of your email, I can confirm that the taste and odor threshold of MTBE is 5.0 ppb, and the EPA's action level for taste and odor for MTBE is 20 ppb. It is important to understand that the EPA's action level is based on taste and odor and is not a health effects level. NSF's current health effects level for MTBE is 50 ppb. The levels of MTBE that leach from PEX products Certified by NSF to NSF/ANSI Standard 61 are below this level. Please contact me at your convenience with any questions.
Sincerely,

Dave Purkiss
General Manager
Water Distribution Systems
NSF International
Phone:734-827-6855
Fax: 734-827-7719

-----Original Message-----
From: Bill Staack [mailto:BStaack@hcd.ca.gov]
Sent: Monday, September 08, 2003 4:16 PM
To: Jost, Mark
Cc: Dave Walls; Ron Bergeson; Kevin Reinertson; Doug Hensel
Subject: PX contaminated with MTBE and TBA
I am looking for confirmation of some statements made by a Mr. Thomas Reid, President of Thomas Reid Associates a Palo Alto environmental engineering and consulting firm. Mr. Reid said that "As a result of litigation in Arizona involving the poisoning of a family by contaminated drinking water, Wirsbo, a major PEX manufacturer has disclosed that PEX does have chemical leaching problems including problems with the leaching of MTBE (methyl tertiary butyl ether) and TBA (tertiary butyl alcohol) which are by-products of the manufacturing process." Mr, Reid further stated that "Tests by NSF International confirm this problem and have found MTBE in potable water flushed through PEX piping in concentration of 15, 17, and 22 parts per billion, 3 to 4 times the 5 parts per billion taste and odor threshold for MBTE and near or above the action level of 20 parts per billion. Could you please provide my agency with any information concerning these statements. Bill Staack, Esq., P.E. Legal Affairs Division Department of Housing and Community Development
(916) 323-7288
e-mail: BStaack@hcd.ca.gov
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MTBE Monitoring Results

Last Update: June 9, 2005

The gasoline additive methyl tertiary butyl ether (MTBE) is a regulated drinking water contaminant in California, with:

- a primary MCL of 13 µg/L (2000) that addresses health concerns -- its public health goal is also 13 µg/L
- a secondary MCL of 5 µg/L (1999) that addresses taste and odor concerns
- a detection limit for purposes of reporting (DLR) of 3 µg/L. The DLR is the level at which DHS is confident about the quantity being reported. Results at or above the DLR are required to be reported to DHS; some laboratories may report results at lower concentrations.

Following detections of MTBE in some drinking water sources in the early and mid-1990s, DHS adopted a 1997 regulation that included MTBE as an unregulated chemical for which monitoring was required by certain public water systems. Subsequently, required monitoring has been associated with compliance with MTBE's MCLs.

As of May 2, 2005, the DHS database includes MTBE analytical results reported for ~13,300 sources, where "sources" may include both raw and treated drinking water wells and surface water sources, distribution systems, blending reservoirs, and other sampled entities. Nearly all of the results are non-detects.

DHS' database contains 109 sources with two or more reported MTBE detections at any concentration. These occurred in 31 counties, as shown in Table 1. Also shown are the number of sources with a detection greater than MTBE's primary MCL, secondary MCL, and DLR.

[Also, see information about the Drinking Water Treatment and Research Fund (DWTRF). The DWTRF addresses oxygenates including MTBE in drinking water.]

Table 1. Peak concentrations of MTBE detected in drinking water (number of sources with detects)[1]

County	>13 µg/L	>5 µg/L	≥3 µg/L	all detects
Los Angeles	6	16	19	23

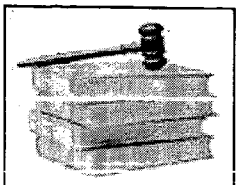
San Diego	5	8	10	11
Kern	5	6	7	7
Monterey	3	5	5	5
San Francisco	2	3	3	4
Riverside	2	2	2	2
Sacramento	2	2	2	2
El Dorado	1	1	5	11
Orange	1	1	3	3
Yuba	1	1	2	2
Madera	1	1	1	1
San Benito	1	1	1	1
Siskiyou	1	1	1	1
Lake	.	1	2	5
Alameda	.	1	2	4
Merced	.	1	2	3
San Mateo	.	1	2	3
San Luis Obispo	.	1	2	2
Tulare	.	1	2	2
Fresno	.	1	1	1
Mono	.	1	1	1
San Bernardino	.	1	1	1
Shasta	.	1	1	3
Solano	.	.	1	2
Ventura	.	.	1	2
Calaveras	.	.	1	1
Lassen	.	.	1	1
Mendocino	.	.	1	1
Sonoma	.	.	1	1
Santa Clara	.	.	.	2
Nevada	.	.	.	1
TOTAL	**31**	**58**	**83**	**109**

[1]Numbers of sources should should be considered draft, since they may change

with subsequent updates. Data are from sources with two or more reported MTBE detections at any concentration.

Go to Drinking Water Treatment and Research Fund (DWTRF)
(The DWTRF addresses oxygenates such as MTBE in drinking water)

Return to DDWEM



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CURRENT CASES
PRACTICE AREAS
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CLASS NOTICES
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LEGAL LINKS
EMPLOYMENT
DISCLAIMER
PRIVACY
SITE MAP

ThermalEase and UltraPEX Cross-Lined Polyethylene (PEX) Tubing Complaints

Lieff Cabraser Heimann & Bernstein, LLP, is a national plaintiffs' law firm that represents homeowners, building owners and consumers in a wide range of cases involving allegedly defective home and building products.

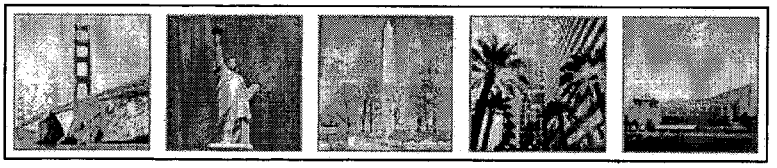
On behalf of homeowners, we have filed a lawsuit based on complaints involving the manufacture, sale and advertising of UltraPEX pipes or tubing. UltraPEX is a brand name for pipes or tubing incorporated in hydronic heating systems and used for hot and cold water plumbing. UltraPEX pipes consist of cross-linked, non-barrier plastic (polyethylene) pipes or tubing. The ThermalEase Company is a distributor of UltraPEX pipes.

While radiant heating has been used for decades in Europe, newer hydronic heating systems have become increasingly sold in the United States and Canada. Many of these systems use UltraPEX tubing to transport hot water from the hot water heater to fan coils which blow hot air into individual rooms. It has been alleged that UltraPEX pipes prematurely degrade and crack, releasing hot water and causing property damage when used in hot water applications, including hydronic heating systems.

If you own a house or other structure in which UltraPEX tubing has been installed since 1995 to transport hot water and have experienced any tubing failure, please click here to contact a Lieff Cabraser attorney at no cost or obligation. Before contacting us, however, please attempt to identify the brand name of the piping used in your system and the date of its installation. This information is generally printed on the tubing and, if incorporated in a hydronic heating system, can usually be observed at or near the manifold in the garage. We thank you for sharing your experiences with us.

Notice

This website is sponsored by Lieff Cabraser Heimann & Bernstein, LLP, a national plaintiffs' law firm, and is not affiliated in any way with the makers of ThermalEase and UltraPEX Cross-Lined Polyethylene (PEX) Tubing.



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INVESTIGATION OF PLASTIC PIPE PERMEATION BY ORGANIC CHEMICALS

BY

Ramon G. Lee, P.E.
Director, Research & Technology
American Water Works Service Company

Kentucky-Tennessee
AWWA Section Meeting
Lexington, Kentucky

November 5, 1985

In the past several years there has been an increasing awareness of the potential for plastic pipe to be permeated by organic chemicals. Numerous incidents have been reported in the literature and at industry meetings. This awareness has no doubt resulted from improved analytical capability and availability. Several years ago the response to taste and odor complaints may have been limited to more traditional tests for bacteria and inorganic chemicals. Today, a complaint which might suggest the presence of an organic chemical will probably be tested for volatile organic chemicals or other more sophisticated analysis.

CASE HISTORIES

The East Bay Municipal Utilities District in Oakland, California reported in 1979 that at least four instances of apparent petroleum distillate penetration of PB water service lines had been encountered by their field personnel (1). Later laboratory testing confirmed this supposition to their satisfaction. A case in Maryland was reported in which concentrations up to 5,500 ug/L of toluene were found in a water sample collected from service line consisting of both PE and PB (2). The soil surrounding the service line was contaminated with gasoline as a result of a leaking underground storage tank that had been abandoned.

Similar incidents were reported by the Alabama Department of Environmental Management (3). One incident, typical of most reported cases, started with a complaint of an unusual odor which resulted in the collection of a sample for organics analysis. The

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Similar incidents were reported by the Alabama Department of Environmental Management (3). One incident, typical of most reported cases, started with a complaint of an unusual odor which resulted in the collection of a sample for organics analysis. The

organics detected could not be traced to the water source, so service pipe permeation was suspected. During replacement of the PB service pipe the soil excavation released a strong fuel odor. Further investigation revealed that this site was the fuel storage yard during construction of the subdivision and the soil was still saturated with diesel fuel. A second incident reported in Alabama occurred as a gasoline truck accident spilled fuel which then saturated the soil and permeated PB service pipe. In this instance the spilled gasoline travelled under the road bed to permeate another service line 60 feet away.

In the past several years there have been occasions within the American System where permeation of potable water system service line materials by petroleum products has occurred. Both occasions were similar in that the water company became alerted by a customer complaint of odor in the drinking water. One instance occurred at a private residence in Chattanooga, Tennessee where the customer service line was 3/4 inch PE. The investigation was initially confounded because the problem was temporarily corrected by flushing the customer's plumbing. The customer's service line was replaced with copper after it became known that gasoline had leaked from the customer's car in the vicinity of the line. The presence of gasoline could be observed in the ditch during the line replacement. A section of the PE line was taken to the water company laboratory where it was filled with plant tap water and sealed. After two weeks exposure, the water was found to contain toluene (3100 ug/L), benzene (520 ug/L) and ethylbenzene (440

ug/L), all of which were absent in the plant tap water, but are constituents of gasoline.

A similar instance occurred in Darien, Connecticut where a customer complaint of gasoline odor resulted in sample analysis which showed benzene (>100 ug/L) and toluene (>50 ug/L) in the tap water. As in the other case, the odors were absent after flushing and when the homeowners' plumbing was in daily use. Samples collected after the system had not been in use for 2 days contained approximately 16 ug/L benzene and a gasoline odor. The customers' 1 1/4 inch PE service line was replaced with copper after it was determined that an abandoned underground gasoline storage tank on the customers' property had developed a leak and saturated the ground surrounding the line.

The introduction of organic contamination through pipeline permeation may not only cause complaints, but can render the water unfit for consumption (4). Seven employees of a Columbus, Ohio business reported symptoms of light headedness, weakness, abdominal cramps, and diarrhea. The suspected cause was gasoline permeation through a 1 1/2" PE water service line. A gasoline station had occupied the site prior to the present business.

PROJECT DESCRIPTION

The American Water Works System is made up of over 100 separate water supply systems serving approximately 5 million consumers in 20 states. Individual systems range in size from fewer than 1000 to more than 125,000 customers. With this diversity in size of operations and geographical locations, there

are a variety of pipe and service line materials in use. Plastic pipe, predominately polyethylene (PE) and polybutylene (PB), is used for service lines in many locations. Additionally, PVC pipe is used in many locations for distribution mains. Because of concerns over the permeation of service line by organic chemicals, we decided to conduct our own research investigation.

The objective of the study was to determine the extent and nature of permeation of several different organic compounds through the types of service line material in use in the American System. Service lines were examined, rather than mains, because the greater surface area to water content ratio in the smaller diameter service line will make the impact of any permeation more severe. Perhaps more significant, the daily static water conditions experienced in residential service line would magnify the impact of any permeation. Additionally, plastic pipe materials are more widely used for service lines than for distribution mains.

The conditions of exposure were designed to simulate worst case field conditions. Because of concerns over the effects of industrial environments on plumbing materials two exposure tanks were used. One involved exposure of the five different pipe materials to a vapor environment. The second was performed separately but concurrently with exposure of the five different pipe sections to a moist soil environment to which sufficient contaminant was added so the pipe was above the satu-

rated soil, yet still within the moist capillary zone. Three organic compounds (gasoline, trichloroethylene and chlordane) were investigated separately in each study. The contaminated environment (and the pipes) was contained in enclosed glass tanks, with the pipes extending through the end walls of the tanks (see Figure

Each phase of the project (gasoline, chlordane and trichloroethylene) lasted for a minimum 10 week exposure with water samples analyzed at 4 intervals during the exposure period. The pipe systems were all unjointed 3/4 inch lines filled with tap water. After each exposure interval the pipe contents were removed for analyses, and fresh tap water was again placed in each pipe for the next exposure interval. Plastic pipe materials were also used for controls by placing PB, PE and CPVC pipe sections outside the contaminated environment. These were sampled in an identical manner to the exposed pipes.

RESULTS

The results, summarized in Table I were as follows:

1. Iron and copper pipes were not permeated by any of the organic contaminants (TCE, chlordane, and gasoline) in either the soil or the vapor environments.

2. PE pipe was permeated by TCE within 1 week in both the soil and vapor exposures. Gasoline permeation occurred within 1 day in the vapor and 3 weeks in the soil exposure. The chlordane did not permeate the PE pipe.

3. PB pipe was permeated by TCE and gasoline within 1 day and not by chlordane within 10 weeks. Results were the same in both the soil and vapor environments.

4. CPVC pipe was permeated by TCE within 1 day in the soil environment and not until 14 weeks in the vapor environment. Gasoline permeation occurred within 6 weeks in the soil environment and not at all in the 14 week vapor exposure. The chlordane did not permeate the CPVC pipe.

5. In both the TCE and gasoline exposures, the CPVC was softened by the chemical exposure. After removal from that environment, the pipe returned to its original stiffness.

CONCLUSIONS

As a result of this study, we have confirmed that plastic pipe is susceptible to permeation from certain organic chemicals, particularly solvents. Permeation of service line material, because of the small surface area to water volume ratio when compared to larger distribution piping, is most likely to create a problem. This is aggravated by the fact that water in the service lines will remain static for longer periods of time, thus allowing concentrations to rise.

AWWSC has developed guidelines concerning the use of plastic materials for service line applications within the System. Some

limitations are desirable in areas where the potential for soil contamination is high, e.g. a gasoline storage area. However, since water company responsibility for customer service lines is limited, further restrictions concerning the use of plastic pipe may require some broader regulatory or plumbing code controls to be effective.

TABLE I

SERVICE LINE PERMEATION RESULTS

TIME TO PERMEATE (1)

PIPE		TRICHLOROETHYLENE		CHLORDANE		GASOLINE (2)	
MATERIAL	CONTROLS	SOIL	VAPOR	SOIL	VAPOR	SOIL	VAPOR
Copper	---	dnp (3)	dnp	dnp	dnp	dnp	dnp
Iron	---	dnp	dnp	dnp	dnp	dnp	dnp
PB	dnp	1 day	1 day	dnp	dnp	1 day	1 day
PE	dnp	1 week	1 week	dnp	dnp	3 weeks	1 day
CPVC	dnp	1 day	14 weeks	dnp	dnp	6 weeks	dnp

(1) Sampling interval during which organic contaminant was present at a concentration of 1 mg/l or higher.

(2) Permeation defined as 1 mg/l benzene, toluene, xylene or ethylbenzene.

(3) dnp: did not penetrate during exposure period; trichloroethylene - 14 weeks, chlordane - 10 weeks, gasoline - 14 weeks.

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4. McGill, R., "Solvent Migration Through Plastic Service Lines". Presented at the Twentieth Annual Workshop, Columbus, OH, March, 1982.