The BFGoodrich Company
Chemical Group
6100 Oak Tree Boulevard
Cleveland, Ohio 44131
216-447-6000

Tab N

December 10, 1984

TO: Vinyl Institute Technical Committee

FROM: Alan J. Olson, The BFGodrich Company, Chemical Group

RE: Metal Pipe Leachate Studies

BACKGROUND

The California Department of Housing and Community Development (DHCD) is the lead agency for a current Environmental Impact Report (EIR) on the expanded use of plastic pipe inside the house. Last August, as part of the EIR, DHCD published a test protocol to study leachates from plastic plumbing, specifically from polybutylene (PB) and chlorinated polyvinyl chlorine (CPVC) tubing. The actual PB and CPVC leachate testing is to begin shortly at Versar Laboratories, Springfield, Virginia. The testing does not include any comparative testing on metal pipe or joining materials. This report recommends the independent testing of metal piping -- specifically copper tubing with lead/tin solder -- so that a relative comparison can be made between organic leachates from plastic pipe and inorganic metal leachates from metal pipe.

DISCUSSION

A s t of screening tests was performed at the BFGoodrich Technical Center at Avon Lake, Ohio, to determine the order of magnitude level of l ad leached from a copper tubing system joined with 50/50 lead/tin solder. The DHCD protocol test water (pH8, 100 ppm $CaCO_3$ hardness -- fairly hard) and flushing regimen were used. Short pieces of copper tubing were joined with couplings using lead/tin solder -- a scaled-down version of the DHCD protocol which specifies 90-feet of tubing with 30 fittings. The overall length at Avon Lake was 18-inches, with 2 fittings. Testing at Avon Lake was done at room temperature (the protocol temperature) and at 60°C. The "pre-occupancy" flushing regimen was followed for the first 21 days (instead of 14 as in the protocol) and the "occupancy" flushing regimen was followed for the next 55 days. (The protocol specifies a period of 75 days total.)

TEN 42,154.55

RESULTS

Data from the 18-inch long pieces with four joints were adjusted to r fl ct the joint/volume ratio in the protocol's 90-foot long assemblies with 60 joints. The data revealed:

1. Throughout the entire 76-day test period, the lead levels exceeded the USEPA drinking water standard by at least two to three times. Excursions to nearly 80 times the limit were encountered. This is an amazing result, considering that hard alkaline water was used.

2. The 60°C systems showed higher lead than the room temperature systems at approximately 23°C.

3. On two test days, analyses were also made for cadmium, zinc, copper and tin. The first three metals were below the USEPA drinking water standard. There is no USEPA standard for tin, but its levels exceeded the National Sanitation Foundation's standard of .05 ppm.

FUTURE RESEARCH OPTIONS

1. A quick screening test, similar to the above one, could be performed by BFG on galvanized pipe, looking for cadmium, zinc and other heavy metals.

2. Since antimony/tin solder has been used to replace lead/tin solder in several areas, a trace metal analysis could be performed at BFG. Researchers at the University of Massachusetts have suggested that arsenic and other toxic metals are constituents.

3. The University of California at Berkeley has provided and identified "aggressive" (i.e. corrosive) public drinking water in California -- the Sacramento City Water System. The City will ship samples of its water in five-gallon plastic containers. Berkeley also provided two recipes to formulate the water in the lab.

4. At least two California labs, the Environmental Research Group and McKesson, are eager to conduct metal pipe leachate studies according to the DHCD test protocol, under contract with Industry. They could begin leachate testing by the end of January, 1985. This means metal pipe leachate results would be available within a month of the Versar plastic pipe results. The data would c rtainly be submitted to the EIR record, and would be considered in the final EIR analysis.

Such a test would entail testing one type of CPVC with the protocol pH8 water (as a tie point with the Versar tests); and copper tubing with lead/tin solder tested with the protocol pH8 water, the protocol pH8 water passed through a water softener,* and with simulated (or actual) Sacramento City water.

The testing for the part appears to be less than $200,000.

*Hard water limits plumbosolvency by forming $CaCO_3$ deposits on the solder joints. Since a water softener exchanges Na for Ca ions, lead levels may remain very high in this system. There seems to be no references to this type of experiment in the literature.

5. The National Sanitation Foundation requires plastic piping materials to undergo rigorous ingredient qualification and product certification, including an extraction test. No metal piping components undergo such testing. Based on the results from 1 and 2, NSF-type testing could be performed by a California-based lab on metal piping and joining materials to highlight the inherent problems with certain metal piping constituents.

   The testing for this part would be less than $20,000.

6. An extensive literature search has shown widespread problems with lead solder, but little data exist on other piping materials, such as trace metals in antimony/tin solder.

RECOMMENDATIONS

1. Continue the literature search with the aim of submitting an annotated bibliography to the EIR record.

2. Publish the BFG metal pipe leachate results in the AWWA Journal.

3. Contract with one of the California labs to run the DHCD test protocol on metal pipe as outlined above in Item 4 under "Future Research Options."

4. Screen the trace metals of antimony/tin solder, and run an NSF-type extraction test on it and other metal piping components at a California-based lab.

Alan J. Olson TEN 2768

Alan J. Olson

cc: D. Goodman (Tenneco)
[redacted]
G. R. Snider, Jr. (BFGoodrich)

AJO/jb/VS0417M

TOV 42,15457