Investigation of factors affecting the accumulation of vinyl chloride in polyvinyl chloride piping used in drinking water distribution systems

Points of interest:

1. The objective of this study was to compare VC accumulation from new PVC pipe from different US manufactures and to understand the effects of aging, biofilm coverage, and chlorine residual on VC levels.
2. Vinyl Chloride (VC) is a known human carcinogen and is regulated by the EPA.
    a. Maximum contaminant level (MCL) of 2 parts per billion (ppb)
    b. Maximum contaminant level goal (MCLG) of 0.0
3. New schedule 40 PVC reactor
    a. VC accumulation above detection limit at 29th hour
    b. After 101 hours VC levels ranged from .0093-.024 ppb
4. New cPVC reactor
    a. SDR11 cPVC VC levels were 0.007 ppb after 4 hours
    b. Schedule 80 cPVC VC levels were above detection limit after 4 hours
    c. At 101 hours VC levels for all formulations and manufactures was between 0.011 and 0.025 ppb.
5. Aging was found to have no significant effect on the accumulation of VC in Sch. 40 PVC and SDR11 cPVC.
    a. 15 year old Sch. 80 PVC showed levels significantly higher than any other pipe with levels over 0.2 ppb after 168 hours.
6. Biofilms were found to have an effect on the accumulation of VC.
    a. The removal of biofilms from aged pipe slightly increased the accumulation of VC for Sch. 40 PVC and Sch. 80 cPVC.
    b. SDR11 cPVC showed higher concentrations when the biofilm was left intact.
7. Chlorine may also contribute to the accumulation of VC via disinfectant byproduct reactions.
    a. cPVC accumulated more VC in chlorinated reactors compared to dechlorinated reactors over time.
    b. Copper pipe reactors, which eliminates VC leaching, had detectable VC levels in chlorinated reactors and not in the dechlorinated reactors.
8. Recommendations
    a. Additional research needs to be conducted on effects of biofilms.
    b. Further research is needed to understand relationship between VC accumulation and DBP reactions.

DIPRA Comments:

1. Confirms that VC leaches from PVC and cPVC pipes.
2. While not above the MCL the VC levels detected were above EPA's MCLG of 0.0