

Acrylamide and Epichlorohydrin Compliance FACT SHEET

The overuse of chemicals containing acrylamide (A) and epichlorohydrin (E) in drinking water treatment is of concern because these organic chemicals have been classified by the U.S. Environmental Protection Agency (EPA) as probable human carcinogens. Due to their small size, unlinked A&E monomers, also called residual monomers, can escape the filtration process and end up in the finished water for public consumption. Since there are no EPA approved methods for detection of these monomers in finished drinking water, treatment technique requirements were developed pertaining to water treatment chemicals containing A or E.

The treatment technique requirements for A & E became effective on January 1, 1993, under the Phase II Rule. Public water systems (PWSs) using chemicals containing A or E are required to annually certify to the state that the combination (or product) of dose and monomer does not exceed:

0.05% dosed at 1 ppm (mg/l) or equivalent for acrylamide and,
0.01% dosed at 20 ppm (mg/l) or equivalent for epichlorohydrin.

In other words, the acrylamide and epichlorohydrin monomer levels must not exceed 0.0005 ppm (mg/l) and 0.002 ppm (mg/l), respectively, in finished water.

The Drinking Water Program determines compliance by comparing the actual annual average of monthly monomer levels in finished water to the compliance values listed above. The actual annual average of monthly monomer levels is determined based on water production and chemical addition information provided by the affected systems. The monthly monomer levels in finished water are calculated as follows:

Product Measured in Gallons

$[(\text{amount of Product A (gal/month)}) (\% \text{ monomer in Product A}) + (\text{amount of Product B (gal/month)}) (\% \text{ monomer in Product B}) + \dots]$
= Monomer Added (gal/month)

$[(\text{Monomer Added (gal/month)}) / (\text{Water Production (gal/month)})] \times 1,000,000$
= **Monthly Monomer Level in finished Water** (ppm or mg/l)

Product Measured in Pounds

$[(\text{amount of Product A (lbs/month)}) (\% \text{ monomer in Product A}) + (\text{amount of Product B (lbs/month)}) (\% \text{ monomer in Product B}) + \dots]$
= Monomer Added (lbs/month)

$[(\text{Monomer Added (lbs/month)}) / ((\text{Water Production (gal/month)}) (8.345 \text{ lbs/gal}))] \times 1,000,000$
= **Monthly Monomer Level in finished Water** (ppm or mg/l)

The annual average is then determined from these monthly monomer levels. This compliance determination methodology does permit occasional monthly excursions to take into account such factors as reduced chemical effectiveness during low water temperature conditions.

Up until January 1, 1998, monomer percentages for various chemicals containing A or E were determined based on information provided by chemical manufacturers. Effective January 1, 1998, only chemicals meeting American National Standards Institute (ANSI)/National Sanitation Foundation International (NSF) Standard 60 can be used by or within PWSs by Department policy (this policy was communicated to all North Dakota PWSs almost a year in advance of implementation). Effective January 1, 1998, we are accepting only A or E monomer percentages based on the maximum dosage set fourth under Standard 60. This maximum dosage is based on monomer level information provided by the chemical manufacturer to the approved certification organizations, the NSF and the Underwriters Laboratories (UL), and compliance with the treatment technique requirements for A&E. This explains why some chemicals containing A or E may no longer be dosed at levels previously approved by the Drinking Water Program (many chemical manufacturers chose to certify their products at higher monomer percentages when submitting their products for Standard 60 review and approval).

Sample Calculations

System Name: XXXXXXXXXXXX			PWS Number: #####		
MONOMER: ACRYLAMIDE					
MAXIMUM MONOMER CONCENTRATION: 0.0005 mg/l					
PRODUCT:		Product A	Product B		
% MONOMER IN PRODUCT:		0.05	0.05		
<u>MONTH</u>	<u>WATER PRODUCED (gal.)</u>	<u>PRODUCT USED (lbs.)</u>	<u>PRODUCT USED (lbs.)</u>	<u>MONOMER IN FINISHED WATER (mg/l)</u>	<u>COMPLY (Y/N)</u>
JANUARY	53,383,000	201.4	50.2	0.00028	Y
FEBRUARY	52,777,000	304.0	242.0	0.00062	N
MARCH	58,195,000	0.0	456.0	0.00047	Y
APRIL	58,370,000	55.4	345.6	0.00041	Y
MAY	68,339,000	434.4	0.0	0.00038	Y
JUNE	81,922,000	456.7	84.2	0.00040	Y
JULY	107,162,000	0.0	639.4	0.00036	Y
AUGUST	93,764,000	0.0	496.5	0.00032	Y
SEPTEMBER	66,158,000	0.0	299.0	0.00027	Y
OCTOBER	59,163,000	0.0	394.7	0.00040	Y
NOVEMBER	53,535,000	0.0	351.0	0.00039	Y
DECEMBER	57,751,000	0.0	461.0	0.00048	Y
TOTAL	810,519,000	1451.9	3820.0	0.00478	
AVERAGE	67,543,250	121.0	318.0	0.00040	Yes

Equation for Determination of Monthly Monomer Levels (Product Measured in Pounds):

[(amount of Product A (lbs)) (% monomer in Product A) + (amount of Product B (lbs)) (% monomer in Product B) + . . .]
= Monomer Added (lbs/month)

[(Monomer Added (lbs)) / ((Water Production (gal)) (8.345 lbs/gal))] x 1,000,000
= **Monthly Monomer Level in finished Water** (ppm or mg/l)

Calculation of Monomer Level for January:

$(201.4 \text{ lbs.})(0.0005) + (50.2 \text{ lbs.})(0.0005) = 0.1258 \text{ lbs. of Acrylamide Monomers Added}$

$(0.1258 \text{ lbs.}) / [(53,383,000 \text{ gal})(8.345 \text{ lbs/gal})^1] * 1,000,000 = 0.00028 \text{ mg/l (ppm)}$

Calculation of Compliance for the Year:

$(0.00455 \text{ mg/l})^2 / 12 = 0.00038 \text{ mg/l (ppm)} = \text{Annual Average of Monthly Monomer Levels}$

$0.00038 \text{ mg/l} < 0.0005$ Therefore: *Compliance achieved for Acrylamide*

¹ The conversion factor 8.345lbs./gal will drop out of the equation if the products are measured in gallons

² Total of Monthly Monomer Levels for the Year = 0.00455 mg/l (see chart above)