

8.7 Unregulated Constituents

A monitoring plan was established for unregulated constituents for category A+ water production, as required by the State of Nevada category A+ regulations (NAC 445A.27616). Recommended health and performance criteria are summarized in **Table 8.8**. Unregulated constituents were monitored across the APW treatment train during 10 sampling events from April through November 2020. Unregulated constituent results are presented in the following groups: (1) a full suite of unregulated constituents (**Tables 8.9a and 8.9b**), (2) nitrosamines (**Section 8.7.1**), (3) 1,4 Dioxane (**Section 8.7.2**), and (4) PFAS (**Section 8.7.3**).

A full suite of unregulated constituents includes hormones, pharmaceuticals, flame retardants, and recalcitrant organics. The concentrations of unregulated constituents across the APW treatment train were summarized in **Tables 8.9a and 8.9b**. The individual MRL for each is included. The results summarized in **Tables 8.9a and 8.9b** and **Figure 8.5** and **Figure 8.6** show that the unregulated constituents were effectively removed by ozonation, BAC, GAC, and UV treatment steps, and thus demonstrate the advantages of a multi-barrier treatment train.

The concentrations in UV Finished Water and CF Finished Water were below MRLs, except for a few occurrences. Sucralose was detected in levels in four sampling events from 290 to 790 ng/L in the Finished Water. The recommended guidance level for sucralose is 150,000,000 ng/L (see **Table 8.8**). Iohexol was detected in one Finished Water sampling event at 21 ng/L; the MRL is 20 ng/L. The recommended guidance level for Iohexol is 720,000 ng/L. DEET was detected in one Finished Water sample at 15 ng/L; the MRL is 10 ng/L. The recommended guidance level for DEET is 200,000 ng/L. N-nitrosodimethylamine (NDMA) and PFAS results are discussed in Sections 8.7.1 and 8.7.3, respectively.

Table 8.8 Recommended health and performance criteria for unregulated constituents

| CEC Name | Health Criteria (ng/L) | Proposed Method | Purpose |
|---|--|-----------------|------------------------|
| 1,4-Dioxane | 1,000 ¹ | EPA 522 | Health and Performance |
| 17-β estradiol (Estradiol) | -- | EPA 1694M | Performance |
| Atenolol | 4,000 | EPA 1694M | Performance |
| Caffeine | -- | EPA 1694M | Performance |
| Carbamazepine | 10,000 | EPA 1694M | Performance |
| Cotinine | 1,000 | EPA 1694M | Performance |
| N,N-Diethyl-metatoluamide (DEET) | 200,000 | EPA 1694M | Performance |
| Estrone | 320 | EPA 1694M | Performance |
| Ethinyl estradiol (17α-Ethinyl estradiol) | 35 | EPA 1694M | Performance |
| Meprobamate | 200,000 | EPA 1694M | Performance |
| N-Nitrosodimethylamine (NDMA) | 10 ¹ | EPA 521 | Health and Performance |
| N-Nitrosomorpholine (NMOR) | 12 ¹ | EPA 521 | Health and Performance |
| Perfluorooctanoic acid (PFOA) | 70 (combined) ² | EPA 537 | Health and Performance |
| Perfluorooctane sulfonate (PFOS) | 6.5 (PFOS) ³ 5.1 (PFOA) ³ | EPA 537 | Health and Performance |
| Phenytoin (Dilantin) | 6,000 | EPA 1694M | Performance |
| Primidone | 10,000 | EPA 1694M | Performance |
| Sucralose | 150,000,000 | EPA 1694M | Performance |
| Tris (2-chloroethyl) phosphate (TCEP) | 5,000 | EPA 1694M | Performance |
| Triclosan | 2,100,000 | EPA 1694M | Performance |
| Gemfibrozil | 45,000 ¹ | EPA 1694M | Performance |
| Iohexol | 720,000 ¹ | EPA 1694M | Performance |
| Sulfamethoxazole | 35,000 ¹ | EPA 1694M | Performance |

1. Water Quality Control Policy for Recycled Water (2018). State Water Resources Control Board. Table 7, Sacramento, CA

2. US EPA combined health advisory level

3. California notification level

Table 8.9a Unregulated Constituents – Pre-Injection

| Contaminant | MRL | Units | Sample Event 1 | | | | | | Sample Event 2 | | | | | | Sample Event 3 | | | | | | Sample Event 4 | | | | | |
|---|------|-------|----------------|--------|--------|---------|---------|-------------|----------------|--------|--------|---------|---------|-------------|----------------|--------|--------|---------|---------|-------------|----------------|--------|--------|---------|---------|-------------|
| | | | 4/28/2020 | | | | | | 6/3/2020 | | | | | | 6/16/2020 | | | | | | 6/30/2020 | | | | | |
| | | | CFCGMF INF | O3 INF | O3 EFF | BAC EFF | GAC EFF | UV Finished | CFCGMF INF | O3 INF | O3 EFF | BAC EFF | GAC EFF | UV Finished | CFCGMF INF | O3 INF | O3 EFF | BAC EFF | GAC EFF | UV Finished | CFCGMF INF | O3 INF | O3 EFF | BAC EFF | GAC EFF | UV Finished |
| 1,4-Dioxane ¹ | 0.07 | µg/L | 0.65 | 0.68 | 0.42 | 0.43 | <0.07 | <0.07 | 0.54 | 0.57 | 0.35 | 0.35 | 0.32 | 0.3 | 0.54 | 0.51 | 0.35 | 0.28 | 0.36 | 0.36 | 0.54 | 0.52 | 0.36 | 0.33 | 0.39 | 0.37 |
| 17-β-estradiol (Estradiol) | 10 | ng/L | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| Atenolol | 5 | ng/L | 20 | 20 | <5 | <5 | <5 | <5 | 12 | 36 | <5 | <5 | <5 | <5 | 23 | 23 | <5 | <5 | <5 | <5 | 29 | 42 | 5.2 | <5 | <5 | <5 |
| Caffeine | 10 | ng/L | 11 | 13 | <10 | <10 | <10 | <10 | 13 | 12 | <10 | 21 | <10 | <10 | 19 | 17 | <10 | <10 | <10 | <10 | 28 | <10 | <10 | <10 | <10 | <10 |
| Carbamazepine | 5 | ng/L | 190 | 180 | <5 | <5 | <5 | <5 | 200 | 210 | <5 | <5 | <5 | <5 | 210 | 210 | <5 | <5 | <5 | <5 | 250 | 260 | <5 | <5 | <5 | <5 |
| Cotinine | 10 | ng/L | 43 | 51 | 32 | <10 | <10 | <10 | 30 | 49 | 47 | <10 | <10 | <10 | 69 | 68 | 42 | <10 | <10 | <10 | 68 | 58 | 47 | 13 | <10 | <10 |
| N,N-diethyl-metatoluamide (DEET) | 10 | ng/L | 29 | 34 | 15 | 14 | <10 | <10 | 39 | 53 | 23 | 16 | <10 | <10 | 48 | 65 | 30 | 11 | <10 | <10 | 100 | 200 | 69 | 40 | <10 | <10 |
| Estrone | 10 | ng/L | 38 | 29 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 110 | 59 | <10 | <10 | <10 | <10 | 120 | 83 | <10 | <10 | <10 | <10 |
| Ethinyl estradiol (17α-ethinyl estradiol) | 10 | ng/L | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| Gemfibrozil | 5 | ng/L | 53 | 57 | <5 | <5 | <5 | <5 | 250 | 360 | <5 | <5 | <5 | <5 | 32 | 44 | <5 | <5 | <5 | <5 | 28 | <5 | <5 | <5 | <5 | <5 |
| Iohexol | 20 | ng/L | 7200 | 7400 | 4800 | 2700 | <20 | <20 | 16000 | 11000 | 6800 | 2800 | 160 | <20 | 3600 | 3300 | 2500 | 1700 | 370 | <20 | 5100 | 5600 | 3700 | 1900 | 290 | <20 |
| Meprobamate | 5 | ng/L | 92 | 60 | 51 | <5 | <5 | <5 | 100 | 99 | 50 | 35 | <5 | <5 | 92 | 94 | 57 | 28 | <5 | <5 | 140 | 130 | 110 | 88 | <5 | <5 |
| N-nitrosodimethylamine (NDMA) | 2 | ng/L | <2 | 2.0 | 42 | <2 | <2 | <2 | NM | 2.6 | 51 | <2 | NM | <2 | <2 | <2 | 44 | <2 | <2 | <2 | <2 | <2 | 40 | <2 | <2 | 2.2 |
| N-Nitrosomorpholine (NMOR) | 2 | ng/L | 4.8 | 5.4 | 4.0 | 5.3 | <2 | <2 | NM | 4.8 | 3.8 | 5.1 | NM | <2 | <2 | 3.2 | 2.4 | 4.1 | <2 | <2 | 3.7 | 2.7 | 2.9 | 3.4 | 2.3 | <2 |
| Perfluorooctanoic acid (PFOA) | 2 | ng/L | 10 | 10 | 10 | 8.5 | <2 | <2 | 14 | 14 | 15 | 10 | <2 | <2 | 8.9 | 8.7 | 9.0 | 8.9 | <2 | <2 | 8.6 | <2 | <2 | <2 | <2 | <2 |
| Perfluorooctanesulfonic acid (PFOS) | 2 | ng/L | 2.9 | 2.9 | 3 | <2 | <2 | <2 | 3 | 2.8 | 3.2 | <2 | <2 | <2 | 2.5 | 2.2 | 2.2 | <2 | <2 | <2 | 2.9 | <2 | <2 | <2 | <2 | <2 |
| Phenytoin (Dilantin) | 20 | ng/L | 34 | 35 | <20 | <20 | <20 | <20 | 21 | 22 | <20 | <20 | <20 | <20 | 51 | 50 | <20 | <20 | <20 | <20 | 57 | 62 | <20 | <20 | <20 | <20 |
| Primidone | 5 | ng/L | 250 | 270 | 97 | 35 | <5 | <5 | 270 | 280 | 100 | 21 | <5 | <5 | 250 | 270 | 86 | 21 | <5 | <5 | 290 | 310 | 120 | 49 | <5 | <5 |
| Sucralose | 100 | ng/L | 54000 | 51000 | 33000 | 15000 | <100 | <100 | 55000 | 56000 | 42000 | 13000 | <100 | <100 | 68000 | 74000 | 54000 | 13000 | 870 | 790 | 69000 | 56000 | 52000 | 22000 | 440 | 440 |
| Sulfamethoxazole | 5 | ng/L | 740 | 760 | 28 | <5 | <5 | <5 | 780 | 720 | 31 | <5 | <5 | <5 | 840 | 910 | 18 | <5 | <5 | <5 | 690 | 850 | 14 | <5 | <5 | <5 |
| Tris (2-chloroethyl) phosphate (TCEP) | 10 | ng/L | 76 | 70 | 86 | 30 | <10 | <10 | 120 | 110 | 130 | 29 | <10 | <10 | 75 | 86 | 110 | 16 | <10 | <10 | 120 | 120 | 140 | 64 | <10 | <10 |
| Triclosan | 25 | ng/L | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 |

Notes:

1. 1,4-Dioxane not included in CEC figures. See section 8.7.2 for further discussion.
 BAC = Biological Activated Carbon
 CFCGMF INF = coagulation, flocculation, clarification, granular media filtration influent
 EFF = Effluent
 FW = Finished Water
 GAC = Granular Activated Carbon

INF = Influent
 MRL = method reporting limit
 ng/L = nanograms per liter
 NM = no measurement
 O3 = Ozone
 UV FW = Ultraviolet Finished Water

Table 8.9a Unregulated Constituents – Pre-Injection (Continued)

| Contaminant | MRL | Units | Sample Event 5 | | | | | | Sample Event 6 | | | | | |
|---|------|-------|----------------|--------|--------|---------|---------|-------------|----------------|--------|--------|---------|---------|-------------|
| | | | 7/21/2020 | | | | | | 8/25/2020 | | | | | |
| | | | CFCGMF INF | O3 INF | O3 EFF | BAC EFF | GAC EFF | UV Finished | CFCGMF INF | O3 INF | O3 EFF | BAC EFF | GAC EFF | UV Finished |
| 1,4-Dioxane ¹ | 0.07 | µg/L | 0.56 | 0.58 | 0.37 | 0.37 | 0.34 | 0.32 | 0.49 | NM | NM | NM | NM | 0.28 |
| 17-β-estradiol (Estradiol) | 10 | ng/L | <10 | <10 | <10 | <10 | <10 | <10 | NM | NM | NM | NM | NM | NM |
| Atenolol | 5 | ng/L | <5 | <5 | <5 | <5 | <5 | <5 | NM | NM | NM | NM | NM | NM |
| Caffeine | 10 | ng/L | <10 | <10 | <10 | <10 | <10 | <10 | NM | NM | NM | NM | NM | NM |
| Carbamazepine | 5 | ng/L | 280 | 290 | <5 | <5 | <5 | <5 | NM | NM | NM | NM | NM | NM |
| Cotinine | 10 | ng/L | <10 | <10 | 29 | <10 | <10 | <10 | NM | NM | NM | NM | NM | NM |
| N,N-diethyl-metatoluamide (DEET) | 10 | ng/L | <10 | <10 | <10 | 12 | <10 | <10 | NM | NM | NM | NM | NM | NM |
| Estrone | 10 | ng/L | 82 | 48 | <10 | <10 | <10 | <10 | NM | NM | NM | NM | NM | NM |
| Ethinyl estradiol (17α-ethinyl estradiol) | 10 | ng/L | <10 | <10 | <10 | <10 | <10 | <10 | NM | NM | NM | NM | NM | NM |
| Gemfibrozil | 5 | ng/L | 16 | 21 | <5 | <5 | <5 | <5 | NM | NM | NM | NM | NM | NM |
| Iohexol | 20 | ng/L | 4900 | 4700 | 2900 | 2400 | 480 | <20 | NM | NM | NM | NM | NM | NM |
| Meprobamate | 5 | ng/L | 100 | 86 | 49 | 30 | <5 | <5 | NM | NM | NM | NM | NM | NM |
| N-nitrosodimethylamine (NDMA) | 2 | ng/L | <2 | <2 | 53 | 3.3 | <2 | <2 | <2 | <2 | 32 | <2 | <2 | <2 |
| N-Nitrosomorpholine (NMOR) | 2 | ng/L | 6.6 | 6 | 5.6 | 5.3 | <2 | <2 | 6.7 | 7.2 | 5.2 | 5.8 | <2 | <2 |
| Perfluorooctanoic acid (PFOA) | 2 | ng/L | 8.9 | 8.7 | 8.2 | 10 | <2 | <2 | 15 | NM | NM | NM | NM | 2.2 |
| Perfluorooctanesulfonic acid (PFOS) | 2 | ng/L | 2.9 | 3.6 | 3.1 | <2 | <2 | <2 | 2.8 | NM | NM | NM | NM | <2 |
| Phenytoin (Dilantin) | 20 | ng/L | <20 | <20 | <20 | <20 | <20 | <20 | NM | NM | NM | NM | NM | NM |
| Primidone | 5 | ng/L | 260 | 270 | 100 | 18 | <5 | <5 | NM | NM | NM | NM | NM | NM |
| Sucralose | 100 | ng/L | 66000 | 64000 | 52000 | 11000 | 370 | 290 | NM | NM | NM | NM | NM | NM |
| Sulfamethoxazole | 5 | ng/L | 470 | 590 | <5 | <5 | <5 | <5 | NM | NM | NM | NM | NM | NM |
| Tris (2-chloroethyl) phosphate (TCEP) | 10 | ng/L | 180 | 170 | 120 | 21 | <10 | <10 | NM | NM | NM | NM | NM | NM |
| Triclosan | 25 | ng/L | <25 | <25 | <25 | <25 | <25 | <25 | NM | NM | NM | NM | NM | NM |

Notes:

1. 1,4-Dioxane not included in CEC figures. See section 8.7.2 for further discussion.
 BAC = Biological Activated Carbon
 CFCGMF INF = coagulation, flocculation, clarification, granular media filtration influent
 EFF = Effluent
 FW = Finished Water
 GAC = Granular Activated Carbon

INF = Influent
 MRL = method reporting limit
 ng/L = nanograms per liter
 NM = no measurement
 O3 = Ozone
 UV = Ultraviolet

Table 8.9b Unregulated Constituents – During Injection

| Contaminant | MRL | Units | DURING INJECTION | | | | | | | |
|---|------|-------|------------------|-------------|----------------|-------------|----------------|-------------|-----------------|-------------|
| | | | Sample Event 7 | | Sample Event 8 | | Sample Event 9 | | Sample Event 10 | |
| | | | 9/23/2020 | | 9/29/2020 | | 10/13/2020 | | 10/28/2020 | |
| | | | CFCGMF INF | CF Finished | CFCGMF INF | CF Finished | CFCGMF INF | CF Finished | CFCGMF INF | CF Finished |
| 1,4-Dioxane ¹ | 0.07 | µg/L | 0.49 | 0.22 | 0.48 | 0.13 | 0.6 | 0.13 | 0.54 | 0.26 |
| 17-β-estradiol (Estradiol) | 10 | ng/L | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| Atenolol | 5 | ng/L | <5 | <5 | <5 | <5 | <5 | <5 | 56 | <5 |
| Caffeine | 10 | ng/L | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| Carbamazepine | 5 | ng/L | 240 | <5 | 170 | <5 | 200 | <5 | 210 | <5 |
| Cotinine | 10 | ng/L | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| N,N-diethyl-metatoluamide (DEET) | 10 | ng/L | <10 | <10 | <10 | 15 | <10 | <10 | <10 | <10 |
| Estrone | 10 | ng/L | <10 | <10 | <10 | <10 | 52 | <10 | <10 | <10 |
| Ethinyl estradiol (17α-ethinyl estradiol) | 10 | ng/L | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| Gemfibrozil | 5 | ng/L | <5 | <5 | <5 | <5 | 13 | <5 | <5 | <5 |
| Iohexol | 20 | ng/L | 5500 | <20 | 5100 | <20 | 8000 | <20 | 5300 | 21 |
| Meprobamate | 5 | ng/L | 310 | <5 | 200 | <5 | 140 | <5 | 150 | <5 |
| N-nitrosodimethylamine (NDMA) | 2 | ng/L | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 |
| N-Nitrosomorpholine (NMOR) | 2 | ng/L | 6.4 | <2 | 3.3 | <2 | 6 | <2 | 4.4 | <2 |
| Perfluorooctanoic acid (PFOA) | 2 | ng/L | 12 | <2 | 29 | <2 | 13 | <2 | 17 | <2 |
| Perfluorooctanesulfonic acid (PFOS) | 2 | ng/L | 3 | <2 | 2.7 | <2 | 2.5 | <2 | 2.6 | <2 |
| Phenytoin (Dilantin) | 20 | ng/L | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 |
| Primidone | 5 | ng/L | 250 | <5 | 280 | <5 | 220 | <5 | 290 | <5 |
| Sucralose | 100 | ng/L | 110000 | 350 | 45000 | <100 | 73000 | <100 | 65000 | <100 |
| Sulfamethoxazole | 5 | ng/L | 1000 | <5 | 680 | <5 | 780 | <5 | 700 | <5 |
| Tris (2-chloroethyl) phosphate (TCEP) | 10 | ng/L | 200 | <10 | 300 | <10 | 220 | <10 | 180 | <10 |
| Triclosan | 25 | ng/L | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 |

Notes:

1. 1,4-Dioxane not included in CEC figures. See section 8.7.2 for further discussion.
 CFCGMF INF = RSWRF SE (RSWRF FE 10/28/20)
 CF = Cartridge Filter

MRL = method reporting limit
 ng/L = nanograms per liter
 NM = no measurement

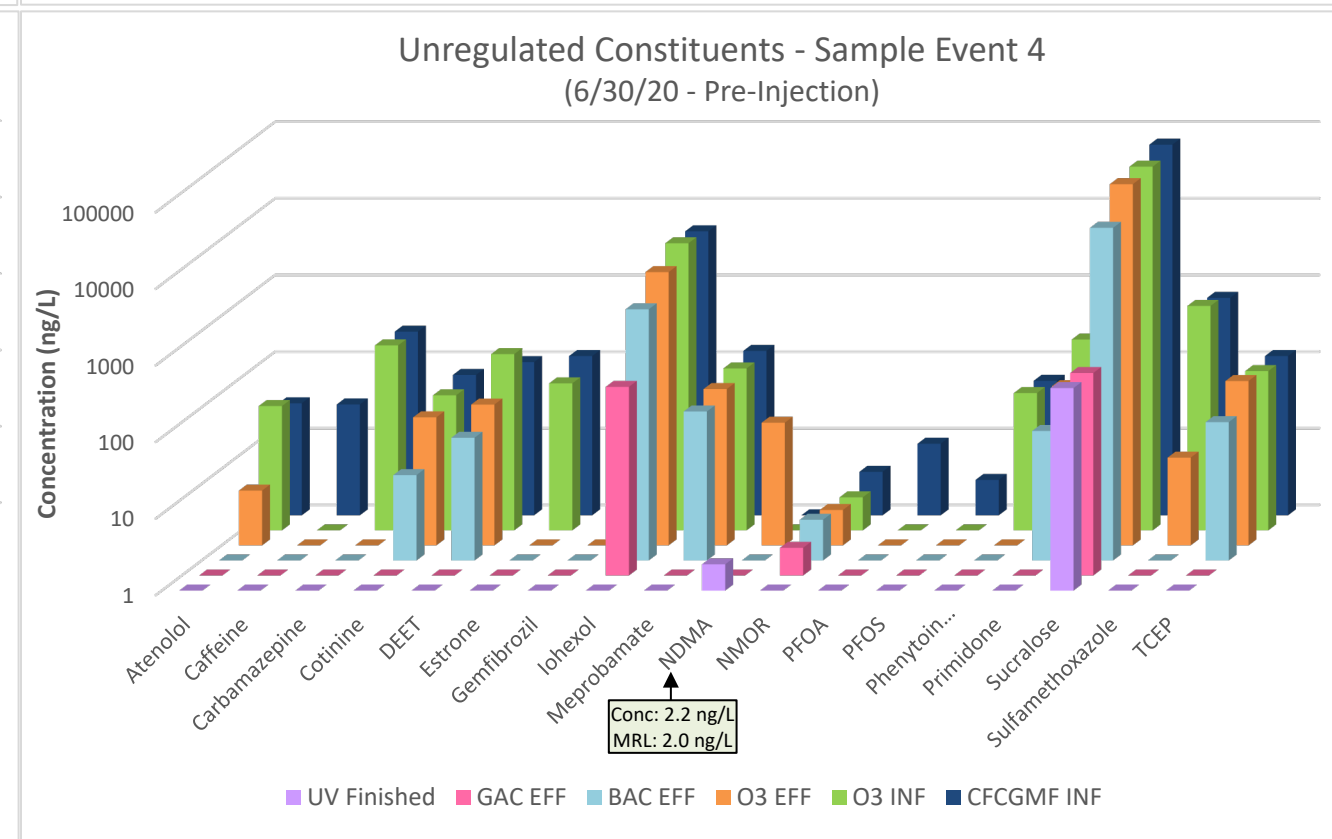
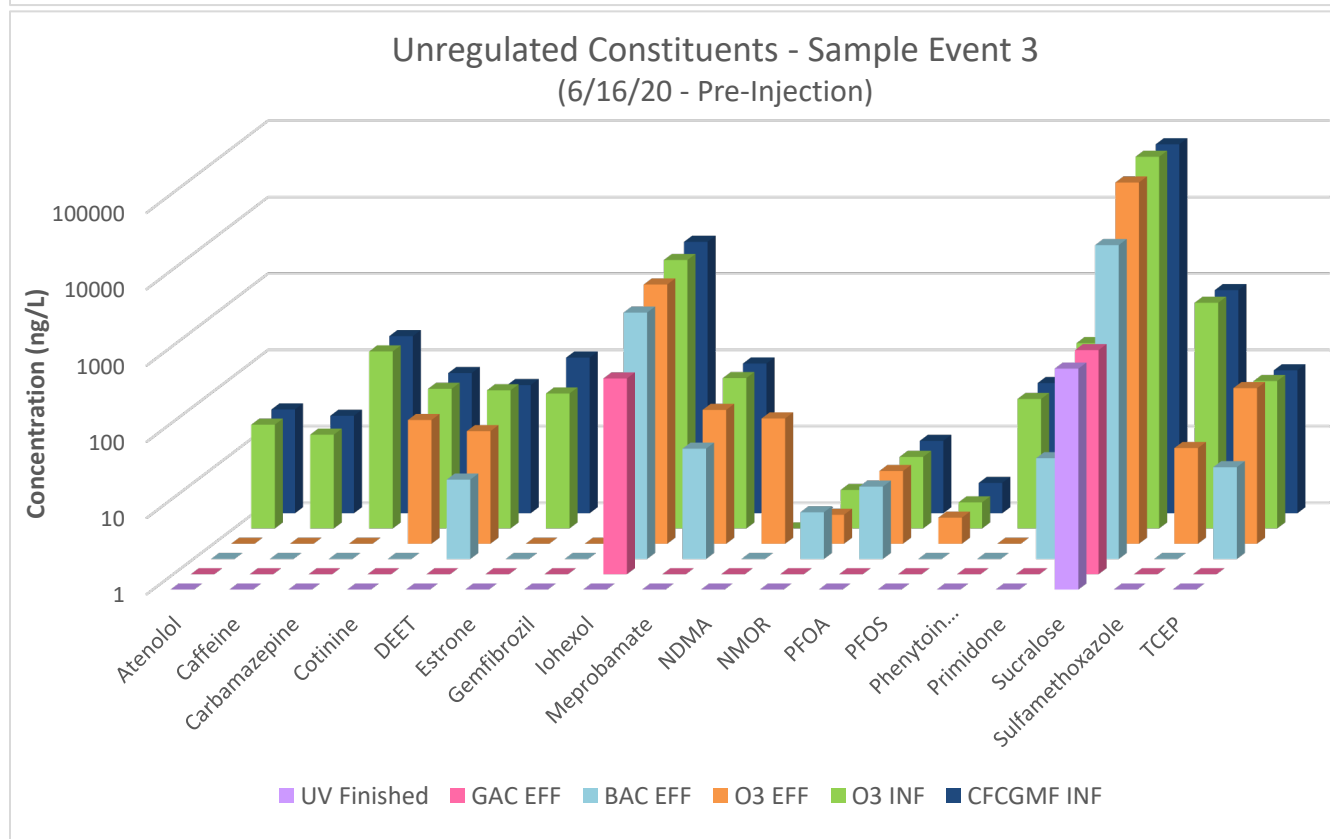
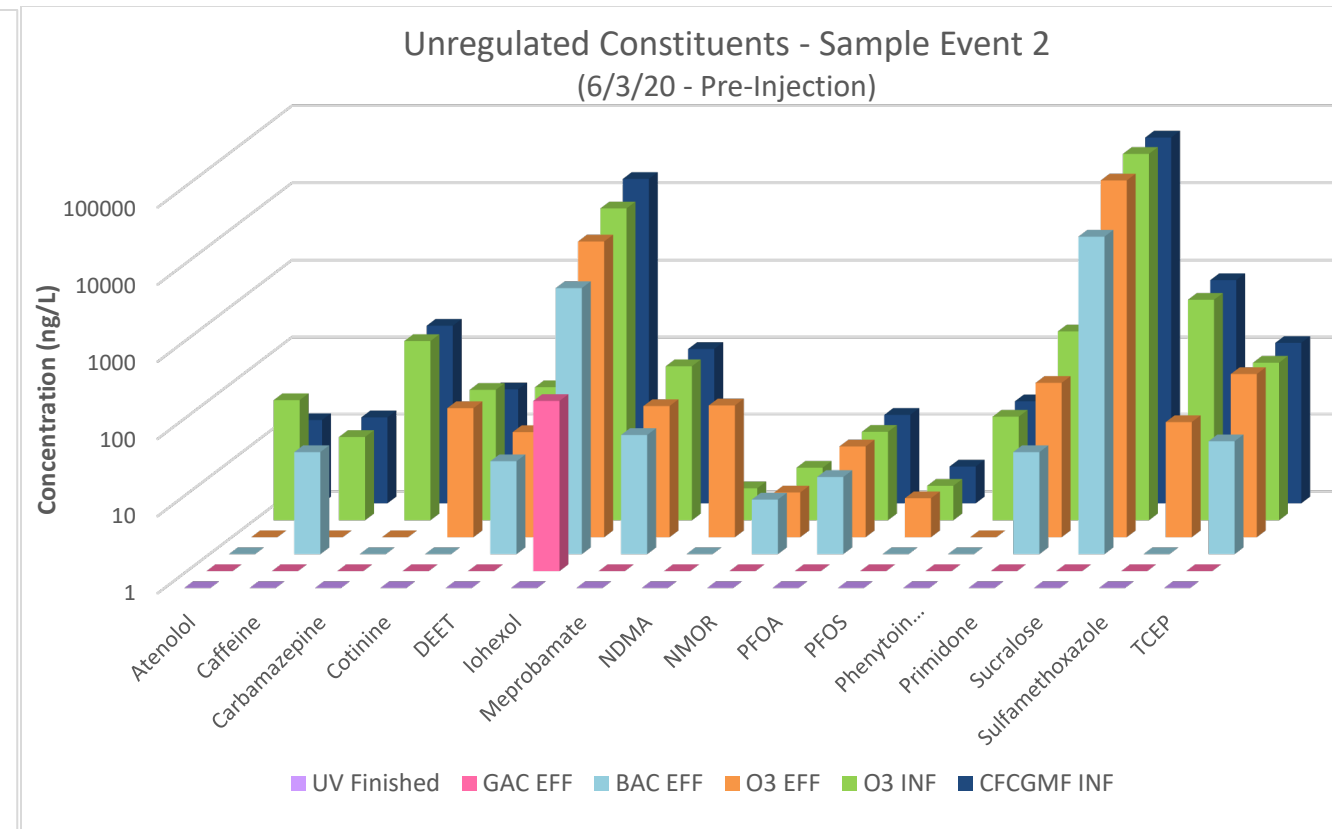
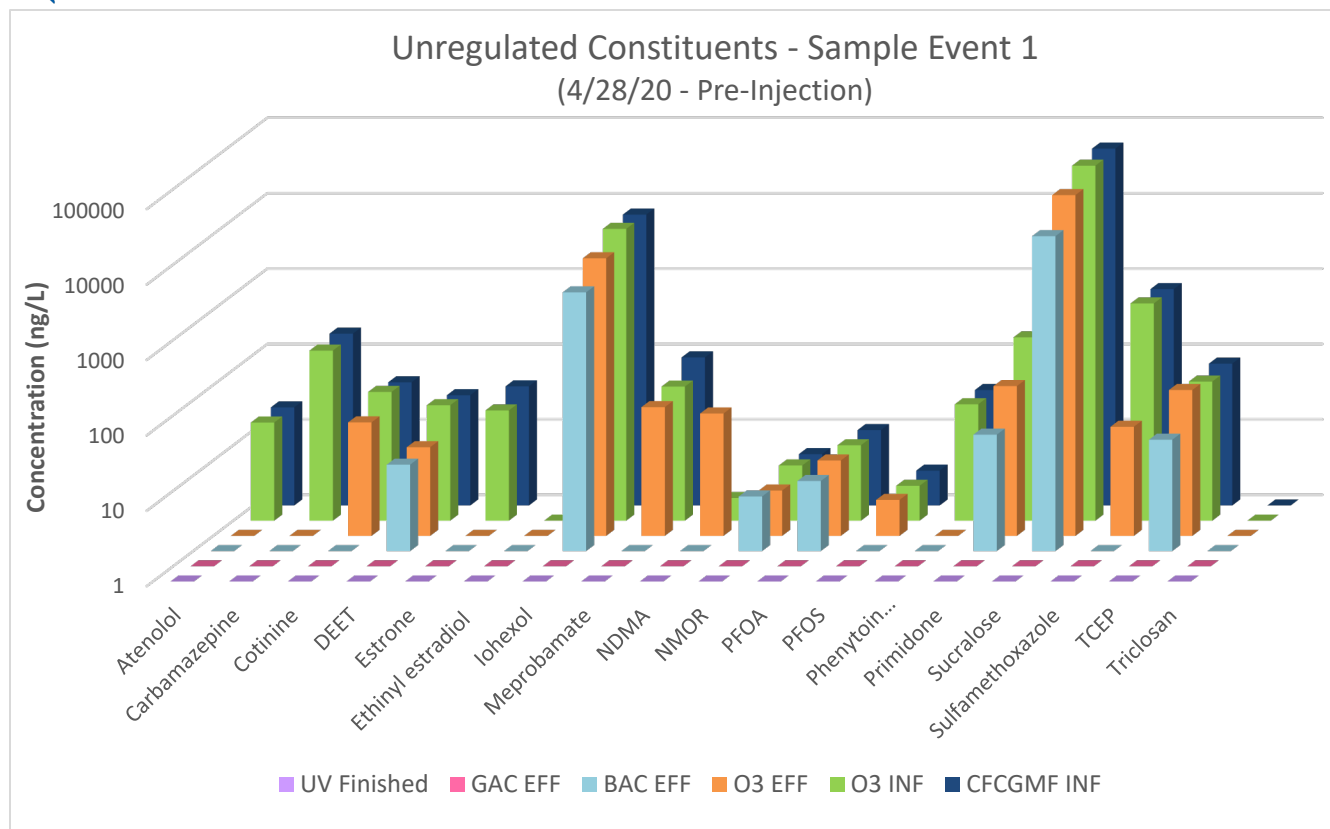


Figure 8.5 Unregulated Constituents across the APW Treatment Train Pre-Injection

Note: Non-detect values displayed as <1 ng/L in all plots

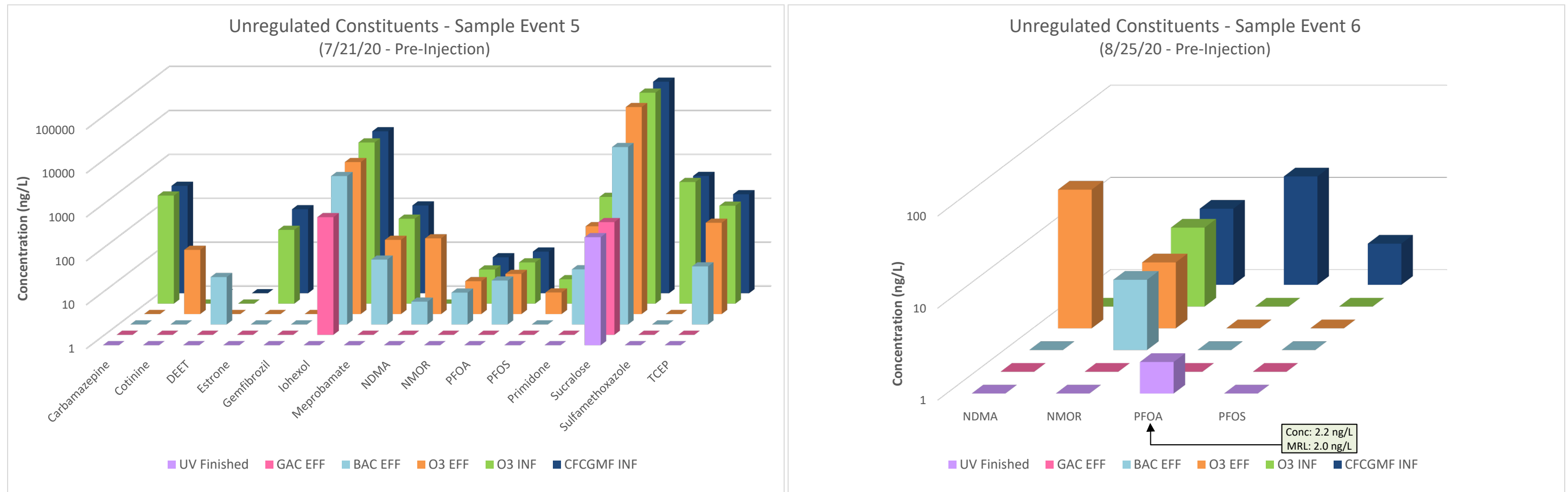


Figure 8.5 Unregulated Constituents across the APW Treatment Train Pre-Injection (Continued)

Note: Non-detect values displayed as <1 ng/L in all plots

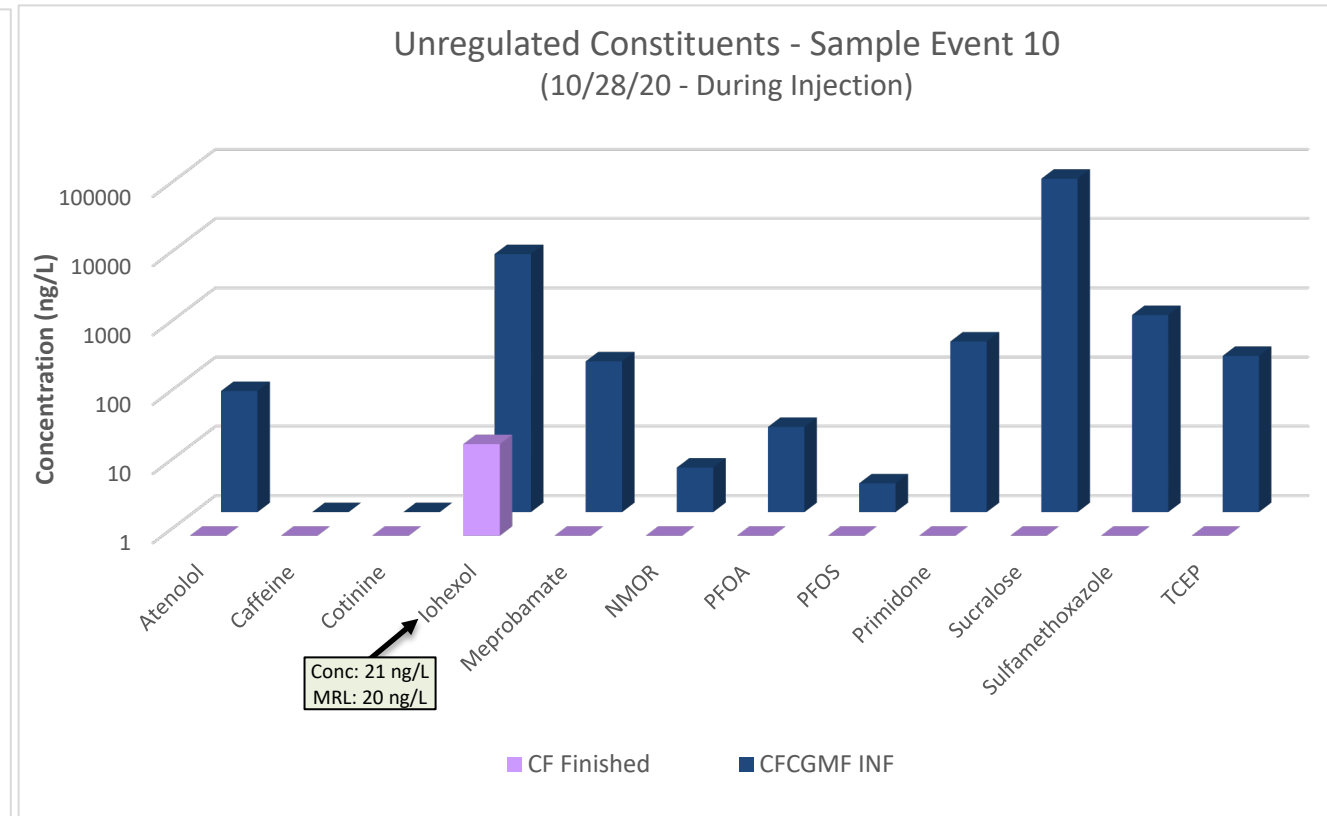
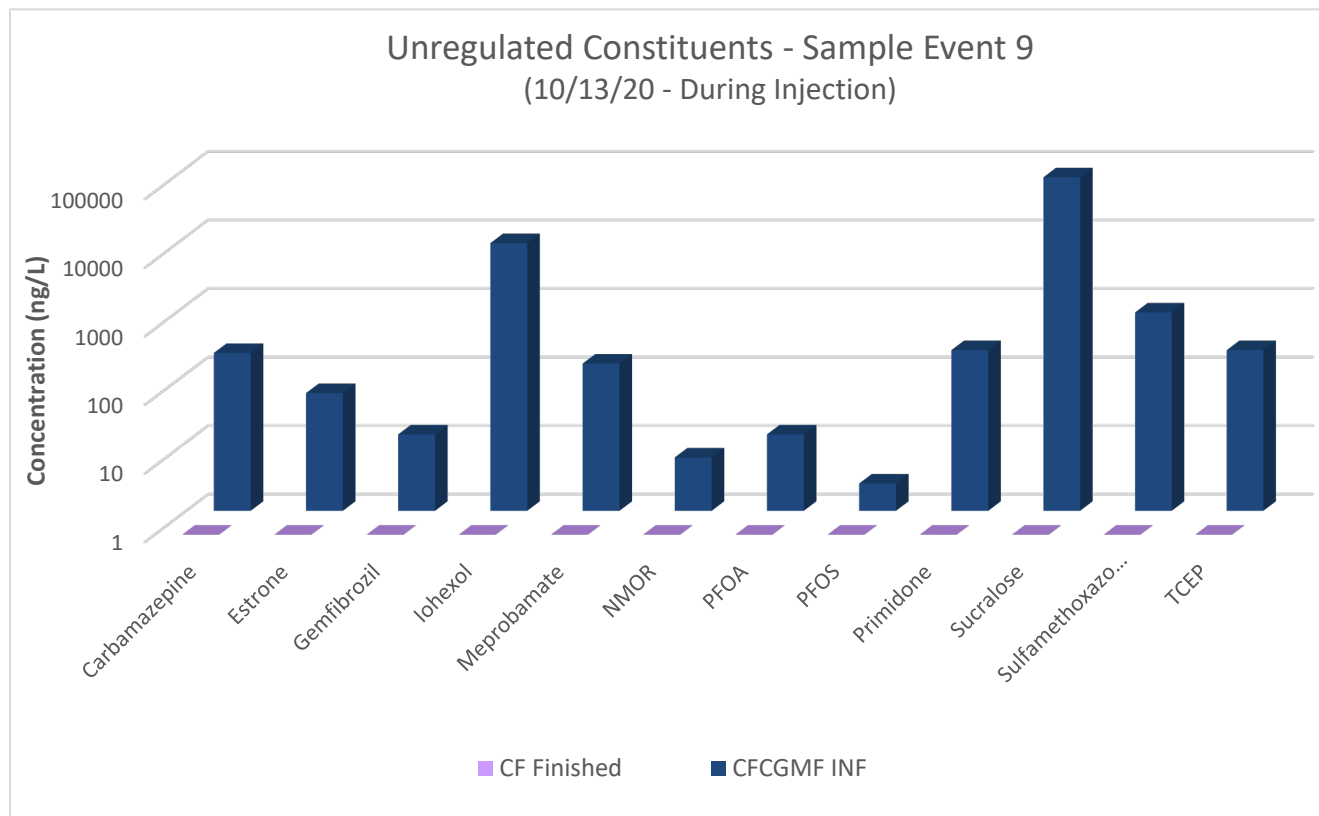
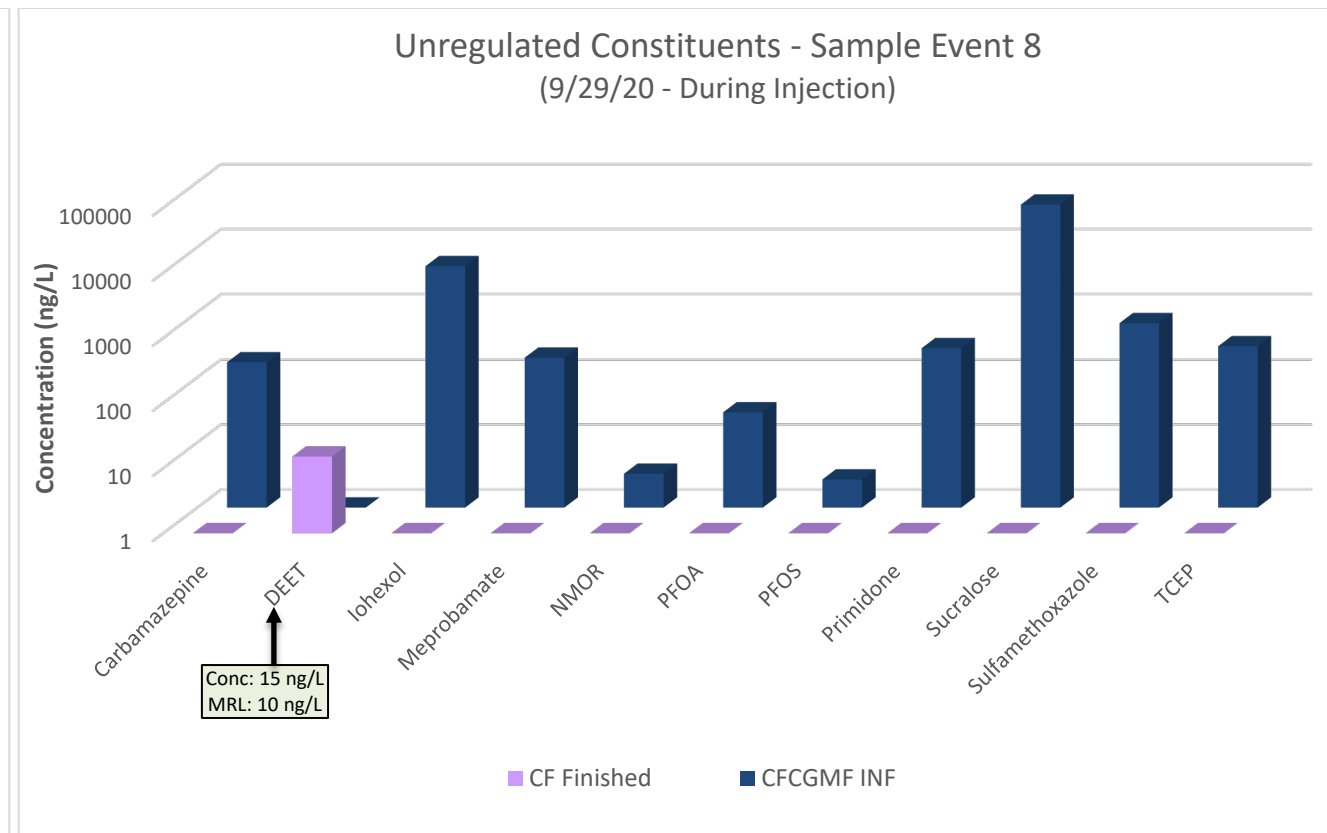
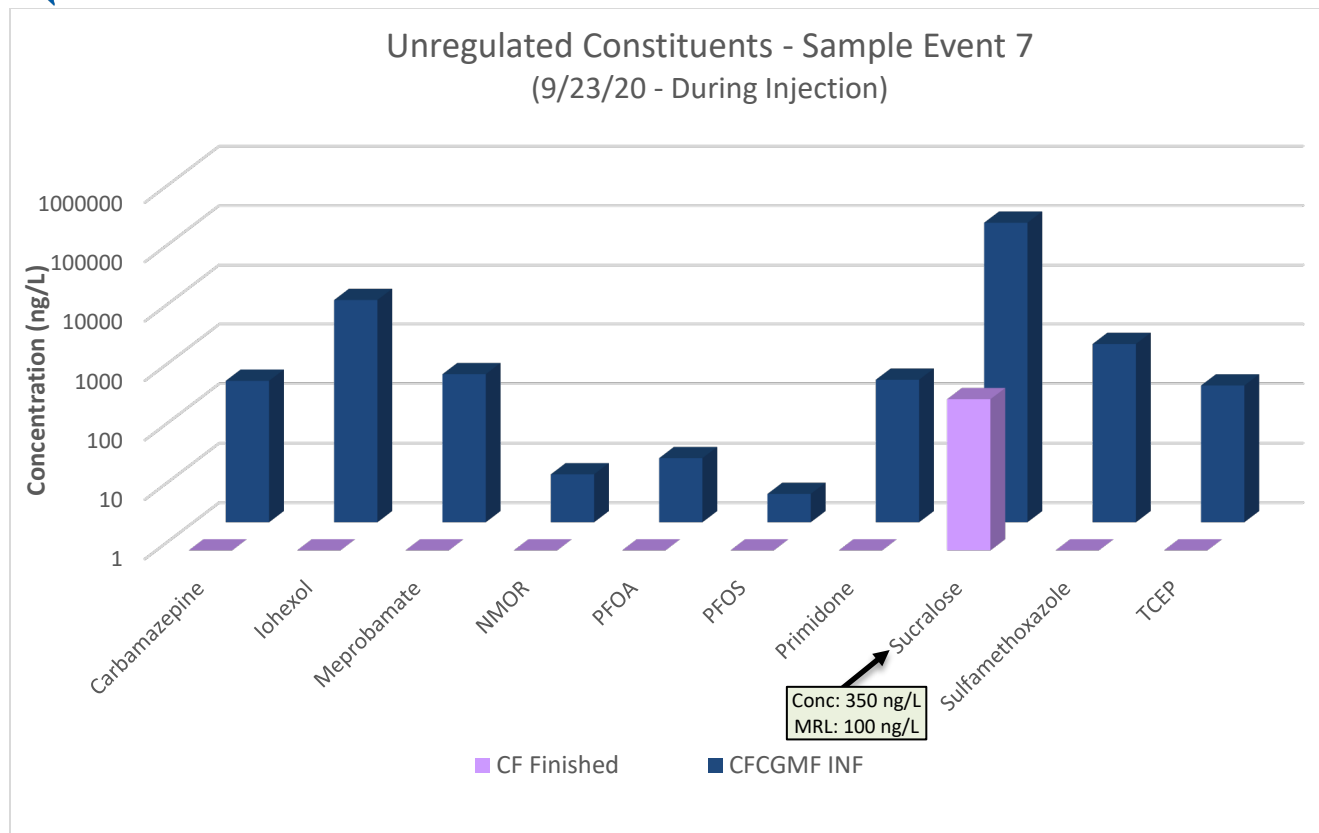


Figure 8.6 Unregulated Constituents across the APW Treatment Train During Injection

Note: Non-detect values displayed as <1 ng/L in all plots