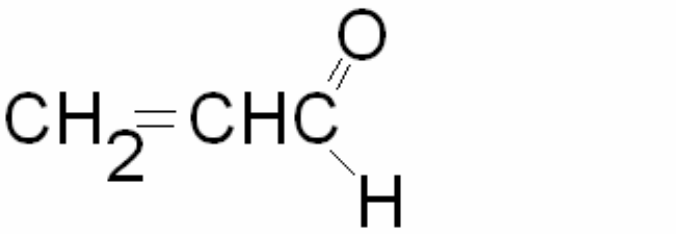
Analyzing canister samples for acrolein

- Acrolein, or propenal is a highly reactive compound, of particular interest to the health-risk community. It is a powerful irritant.



instrumentation

Entech 7100 Preconcentrator

With “real-time integrating canister” for PAMS sampling

Agilent 6890 Gas Chromatograph with FID and

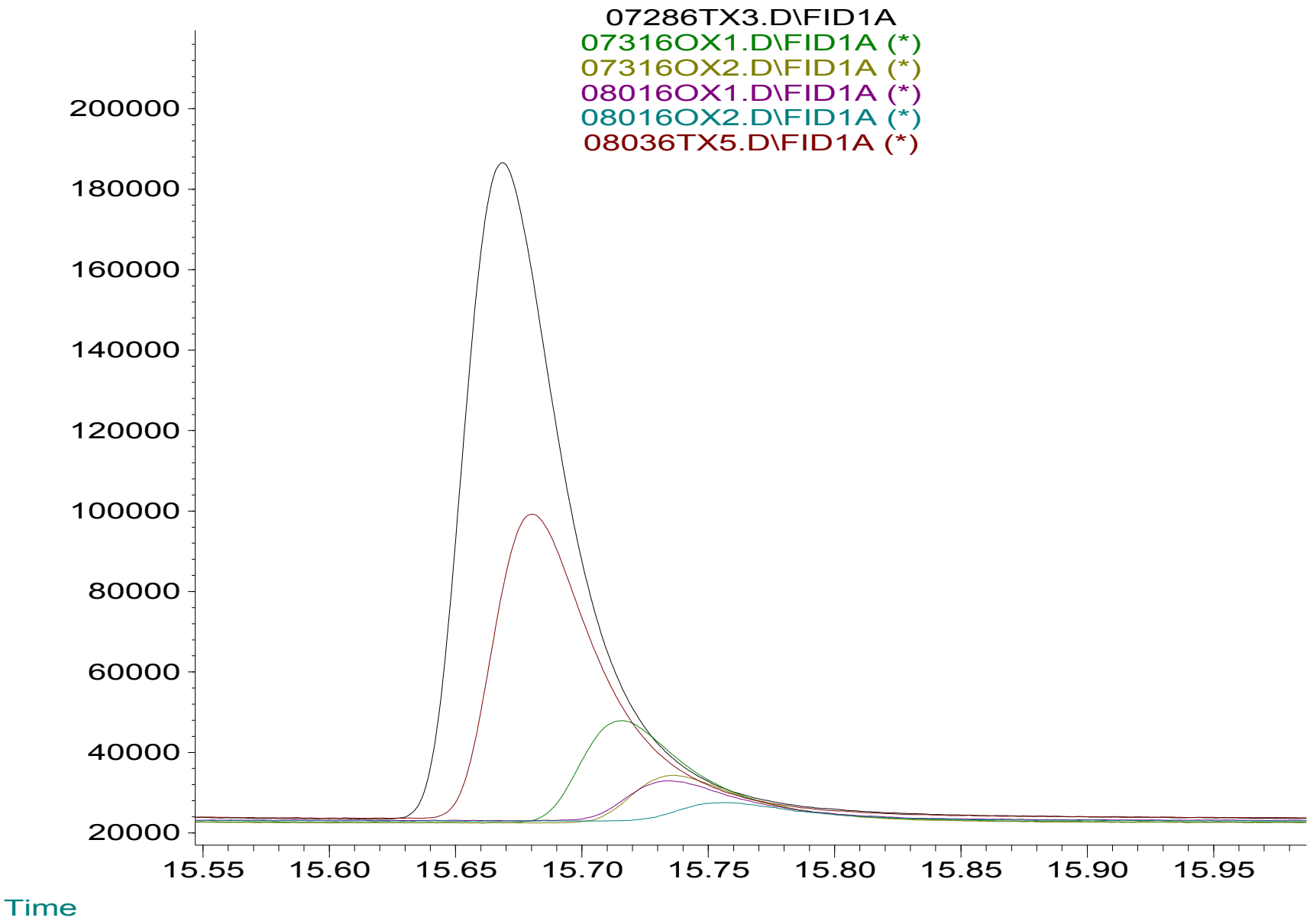
Agilent 5973 Mass Spectrometer.

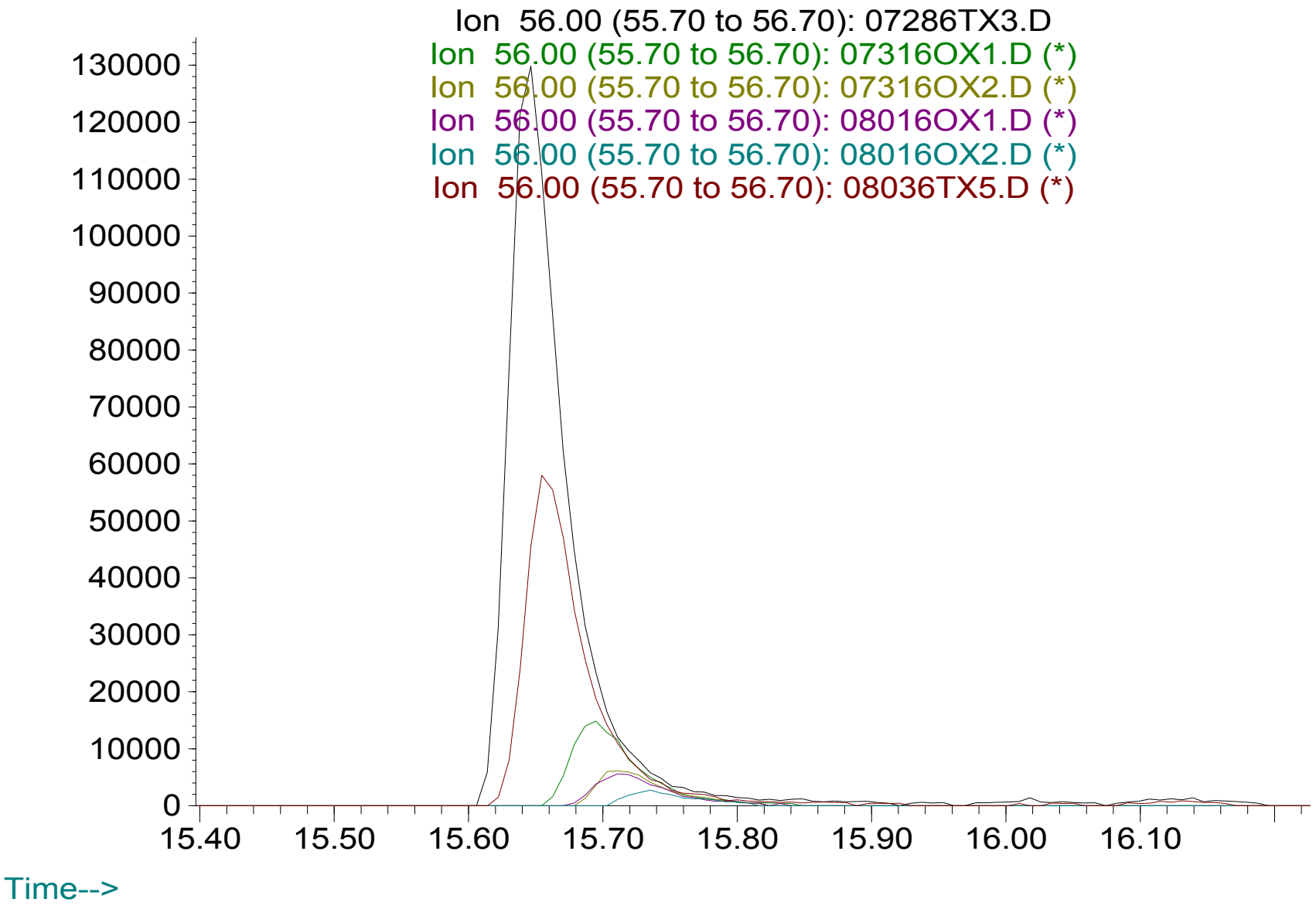
Downstream of the column a splitter leads to the MS and FID detectors, giving each a roughly similar carrier gas flow.

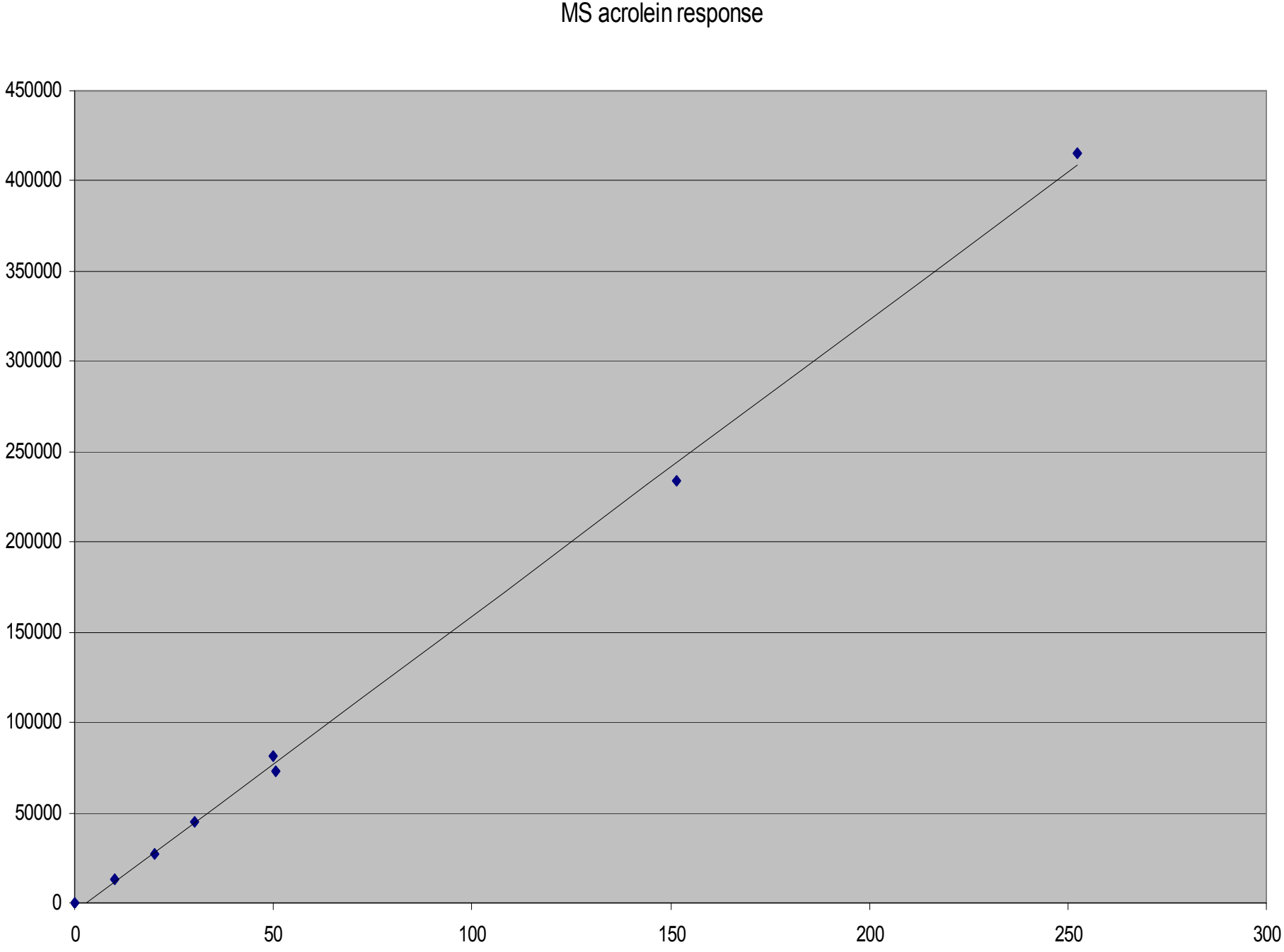
Column is Supelco SPB-1 (nonpolar) with 2 um film thickness, 60 m, 0.32mm id.

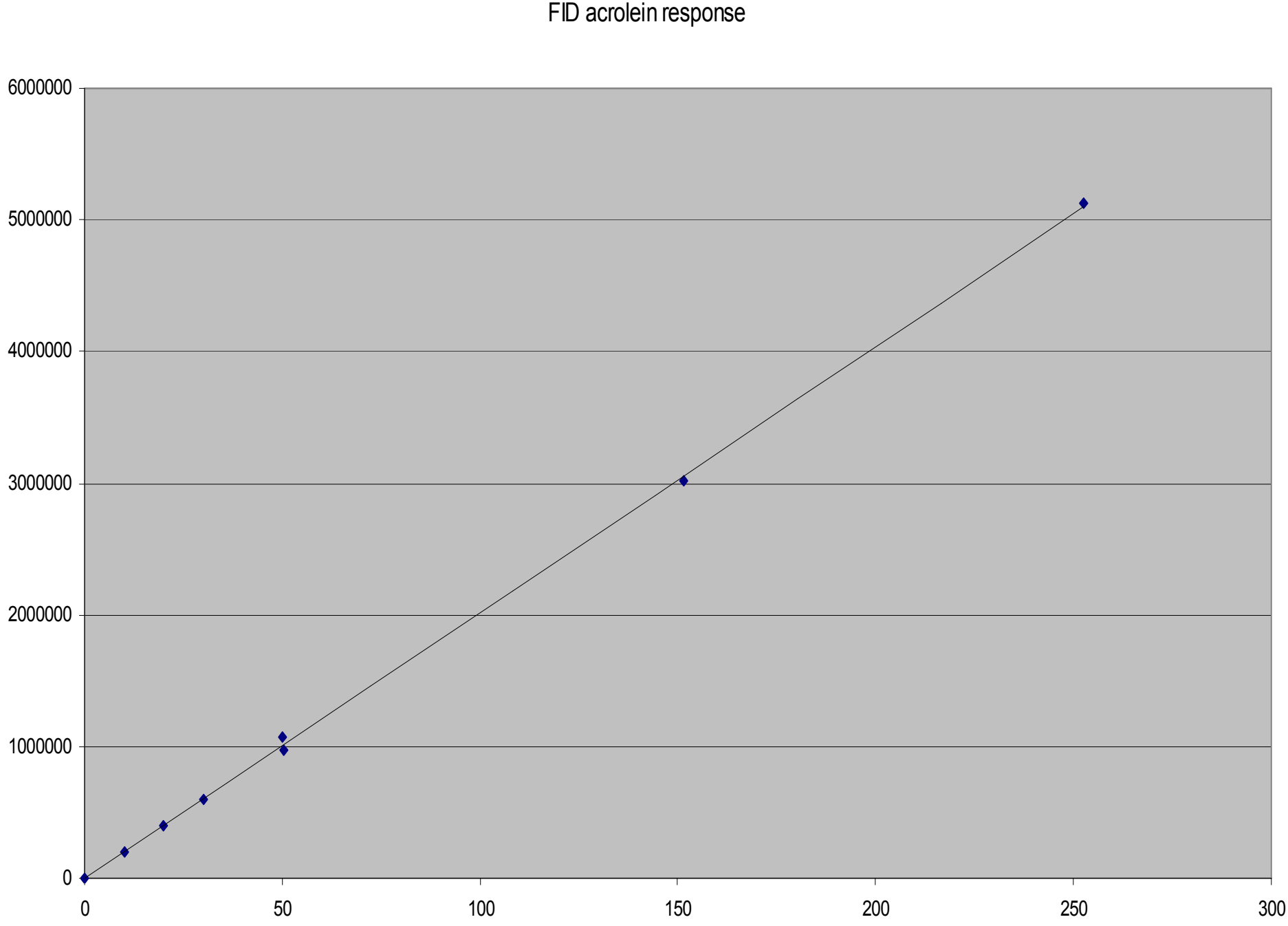
Air samples are all 500 ml

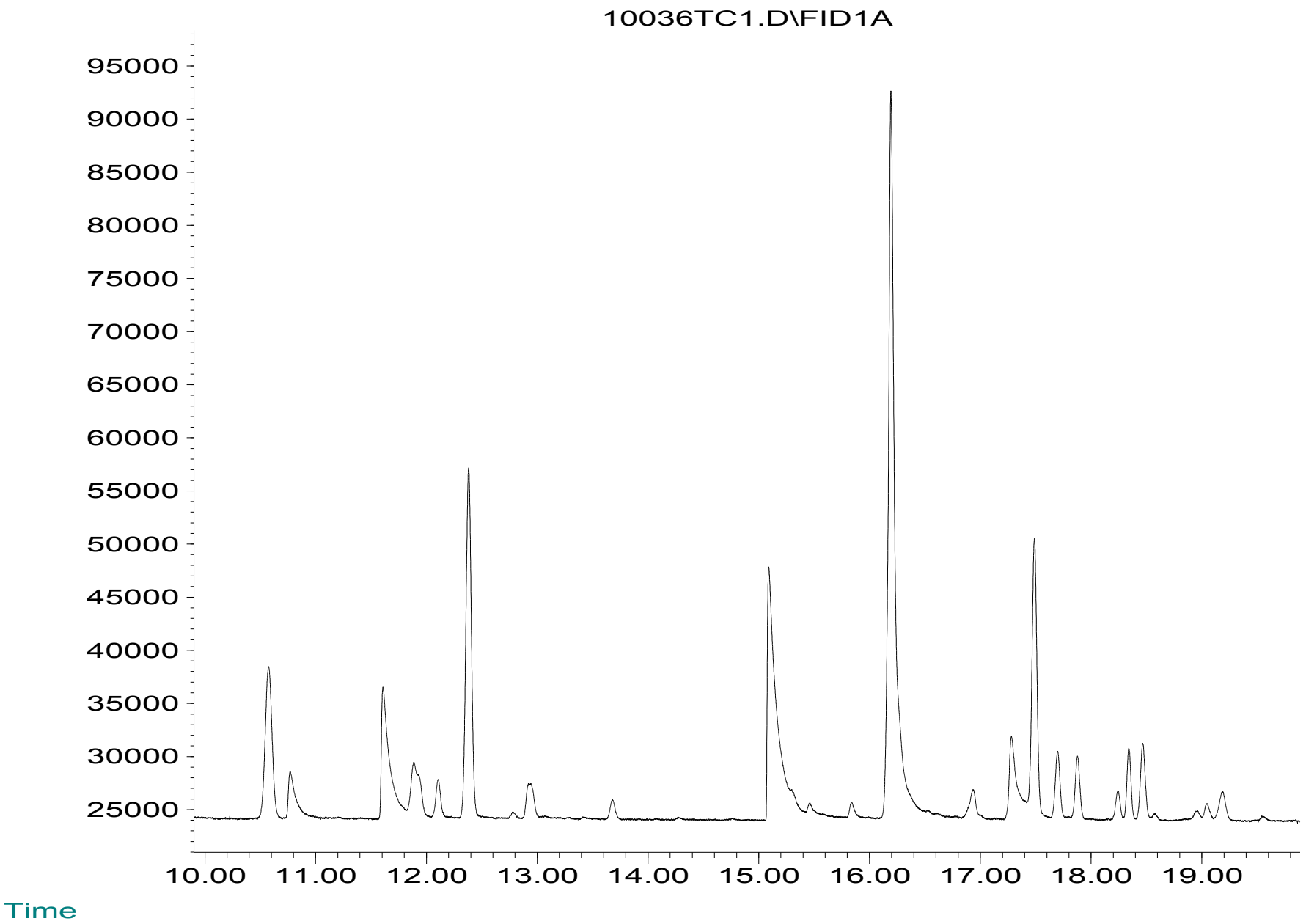
Acrolein is easily detected on both detectors

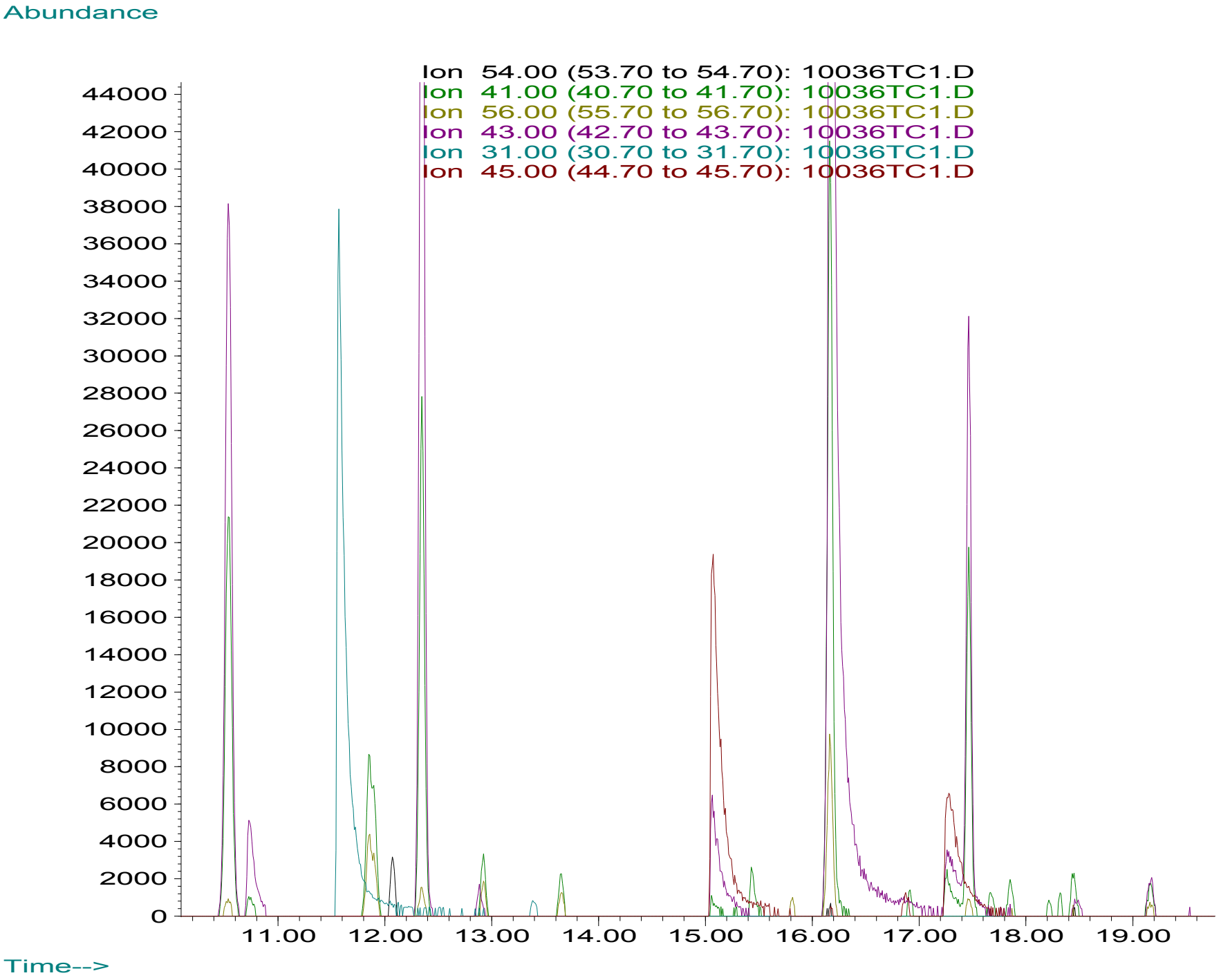

Response_
07286TX3.D\FID1A
07316OX1.D\FID1A (*)
07316OX2.D\FID1A (*)
08016OX1.D\FID1A (*)
08016OX2.D\FID1A (*)
08036TX5.D\FID1A (*)
200000
180000
160000
140000
120000
100000
80000
60000
40000
20000
15.55
15.60
15.65
15.70
15.75
15.80
15.85
15.90
15.95
Time

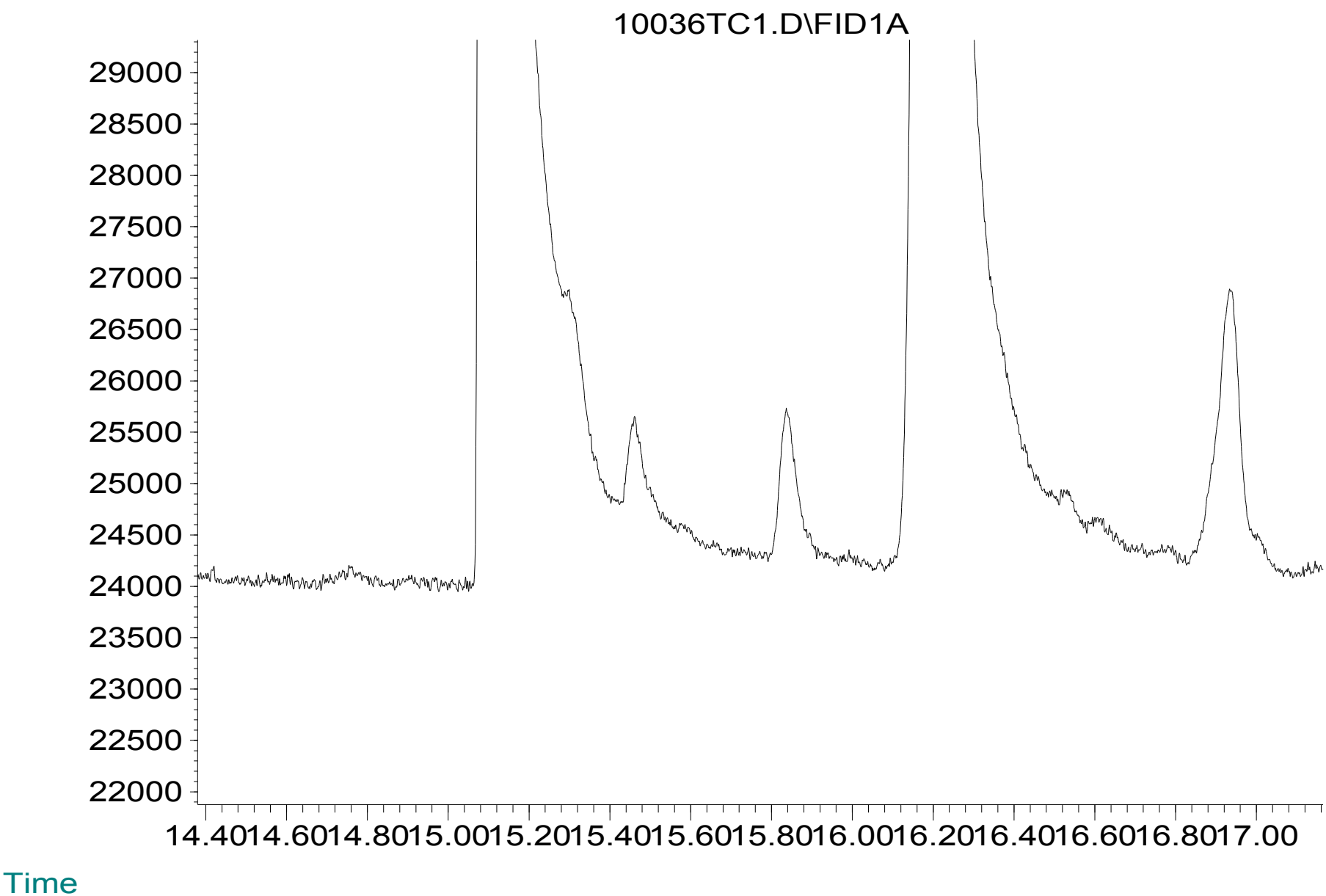

Abundance
Ion 56.00 (55.70 to 56.70): 07286TX3.D
Ion 56.00 (55.70 to 56.70): 07316OX1.D (*)
Ion 56.00 (55.70 to 56.70): 07316OX2.D (*)
Ion 56.00 (55.70 to 56.70): 08016OX1.D (*)
Ion 56.00 (55.70 to 56.70): 08016OX2.D (*)
Ion 56.00 (55.70 to 56.70): 08036TX5.D (*)
130000
120000
110000
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
15.40
15.50
15.60
15.70
15.80
15.90
16.00
16.10
Time-->

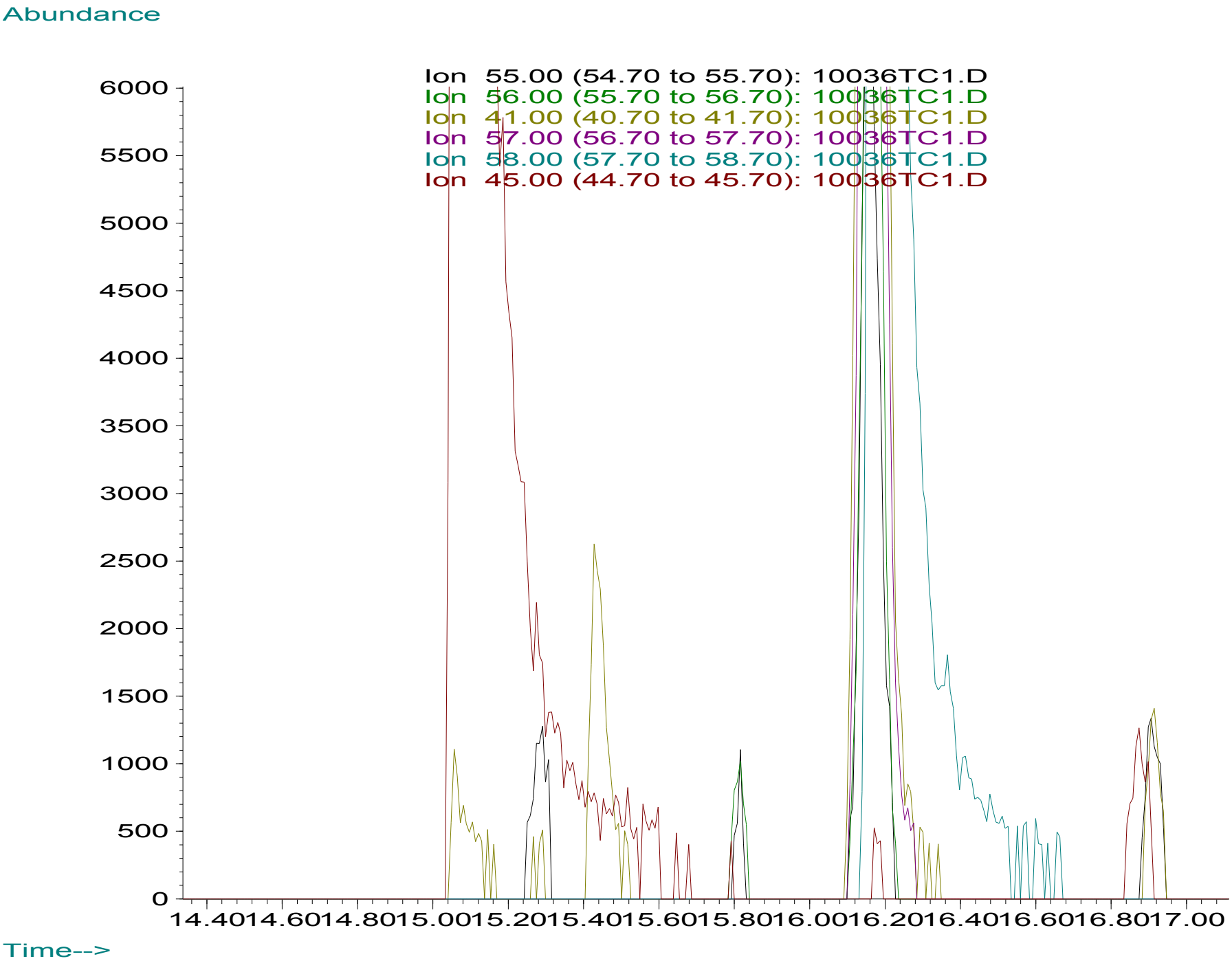

MS acrolein response
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
0
50
100
150
200
250
300

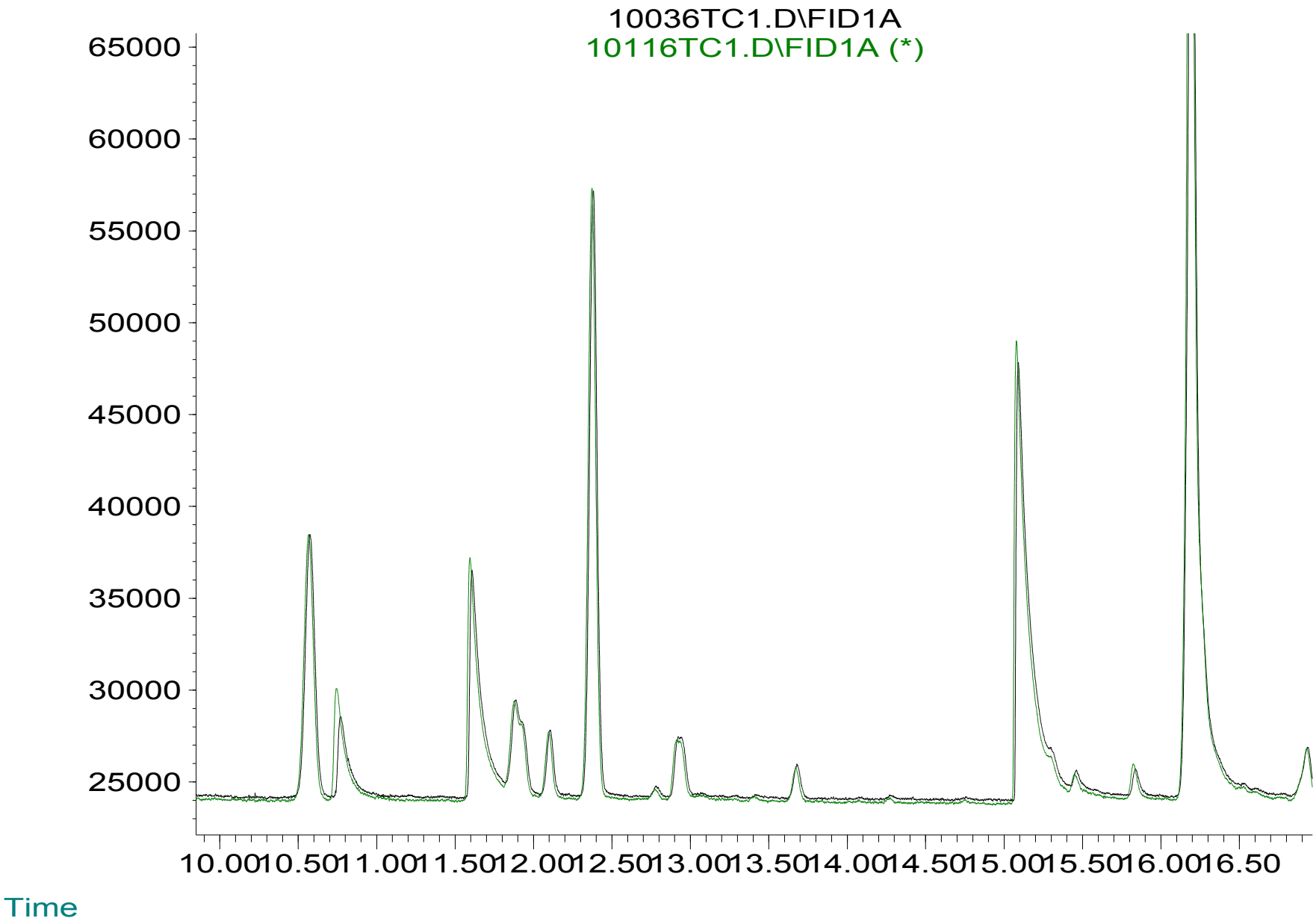

FID acrolein response
6000000
5000000
4000000
3000000
2000000
1000000
0
0
50
100
150
200
250
300

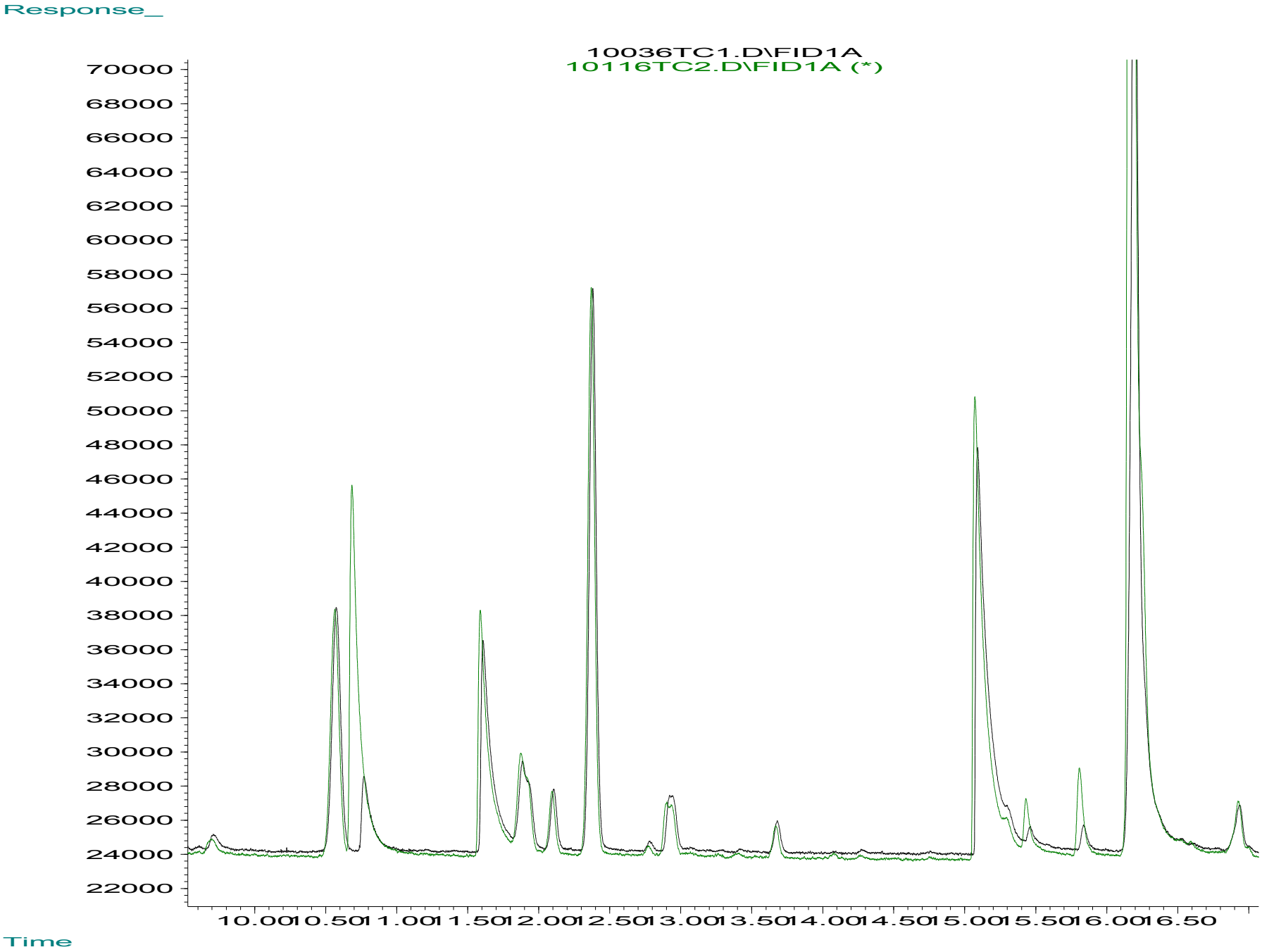

Response_
10036TC1.D\FID1A
95000
90000
85000
80000
75000
70000
65000
60000
55000
50000
45000
40000
35000
30000
25000
10.00
11.00
12.00
13.00
14.00
15.00
16.00
17.00
18.00
19.00
Time

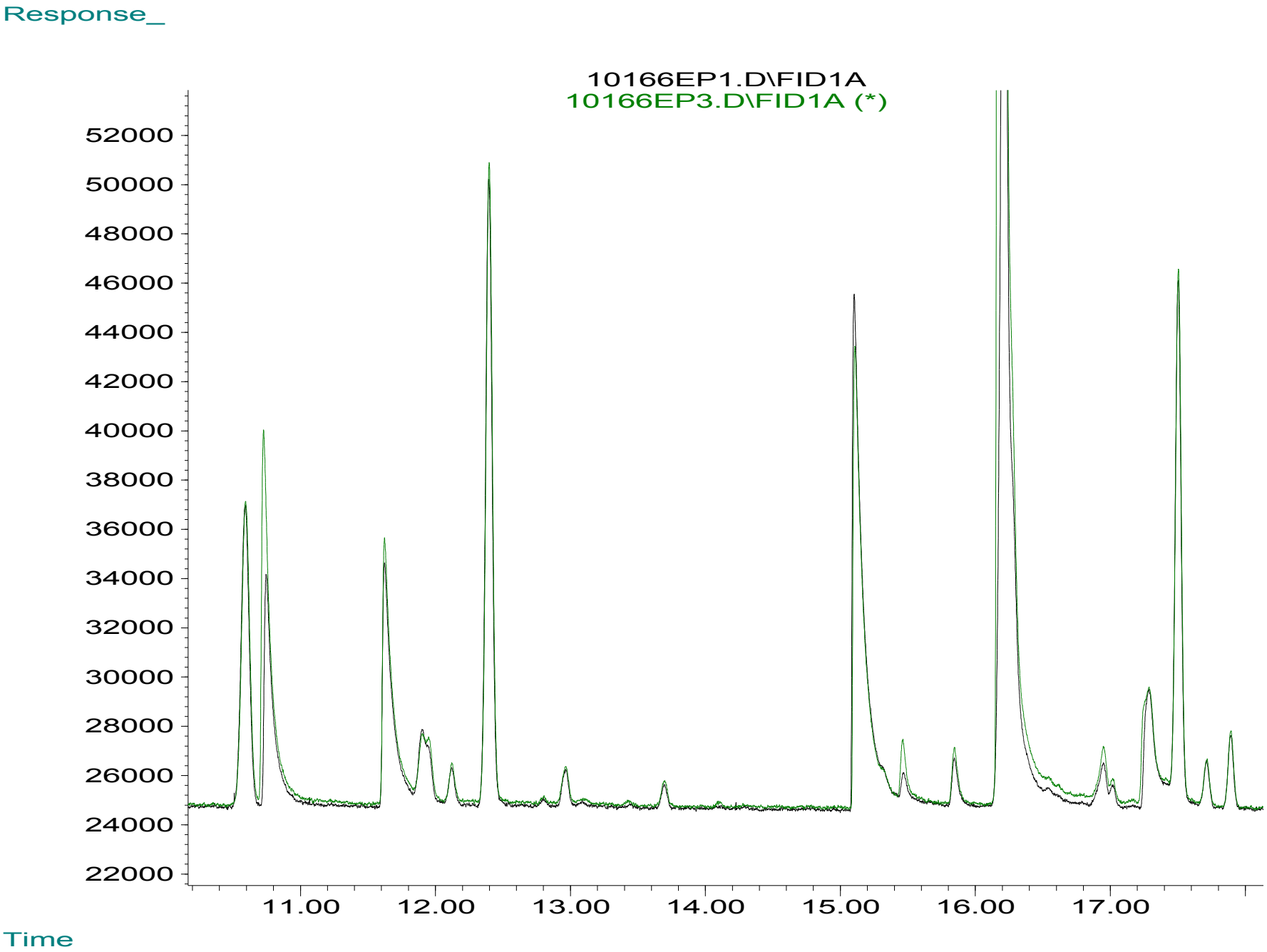

Abundance
Ion 54.00 (53.70 to 54.70): 10036TC1.D
Ion 41.00 (40.70 to 41.70): 10036TC1.D
Ion 56.00 (55.70 to 56.70): 10036TC1.D
Ion 43.00 (42.70 to 43.70): 10036TC1.D
Ion 31.00 (30.70 to 31.70): 10036TC1.D
Ion 45.00 (44.70 to 45.70): 10036TC1.D
44000
42000
40000
38000
36000
34000
32000
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
11.00
12.00
13.00
14.00
15.00
16.00
17.00
18.00
19.00
Time-->

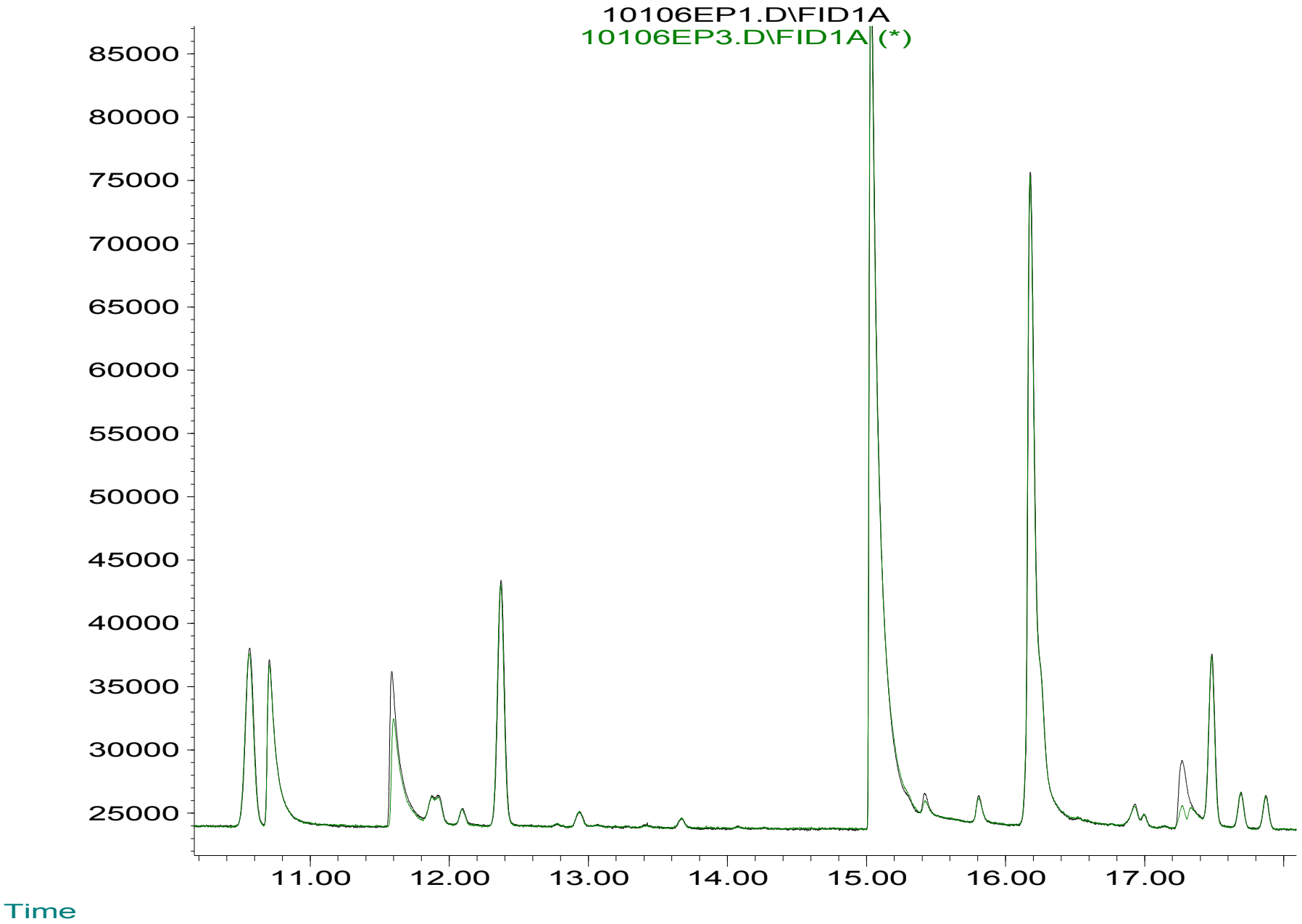

Response_
10036TC1.D\FID1A
29000
28500
28000
27500
27000
26500
26000
25500
25000
24500
24000
23500
23000
22500
22000
14.40
14.60
14.80
15.00
15.20
15.40
15.60
15.80
16.00
16.20
16.40
16.60
16.80
17.00
Time

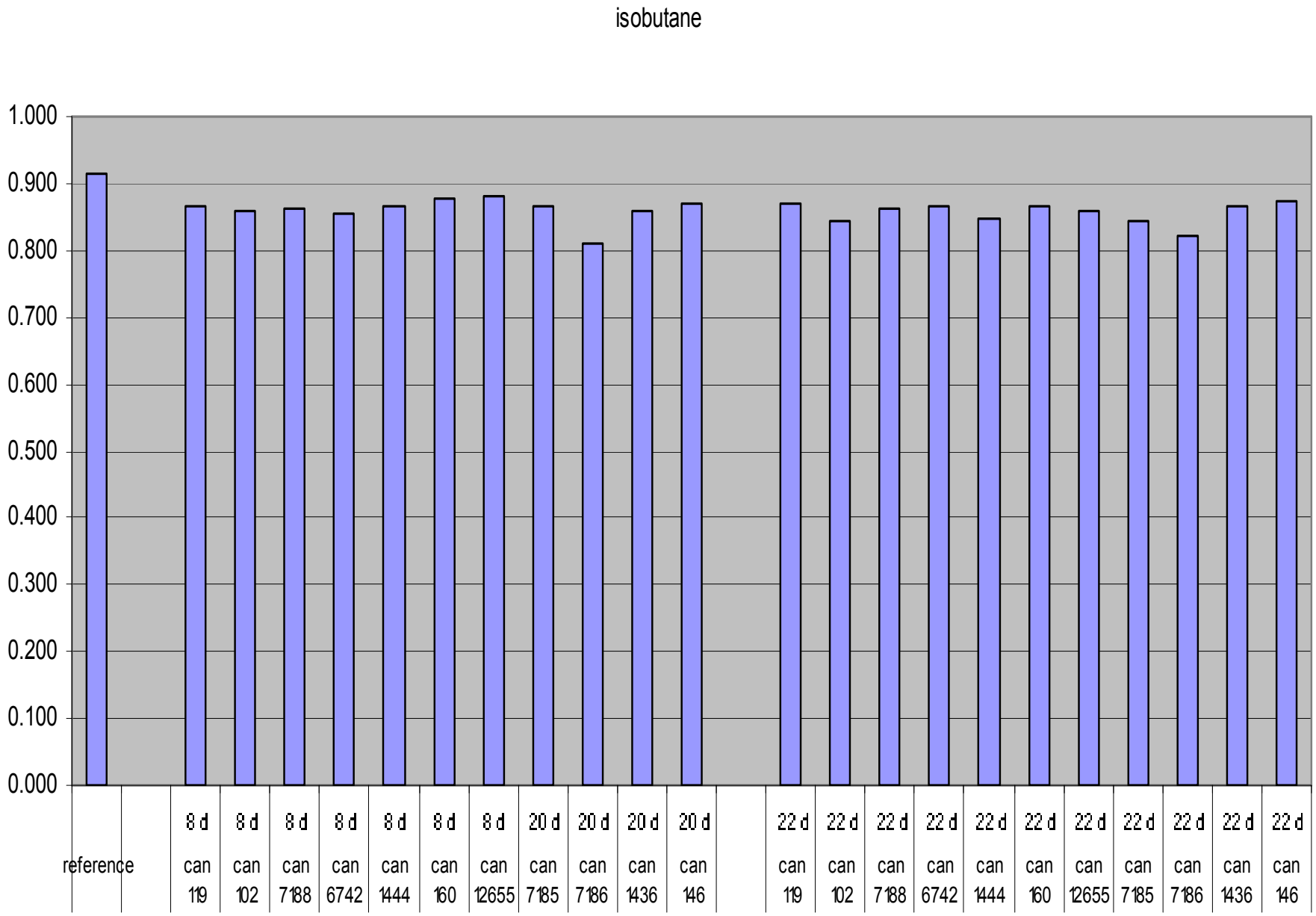

Abundance
Ion 55.00 (54.70 to 55.70): 10036TC1.D
Ion 56.00 (55.70 to 56.70): 10036TC1.D
Ion 41.00 (40.70 to 41.70): 10036TC1.D
Ion 57.00 (56.70 to 57.70): 10036TC1.D
Ion 58.00 (57.70 to 58.70): 10036TC1.D
Ion 45.00 (44.70 to 45.70): 10036TC1.D
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
14.40 14.60 14.80 15.00 15.20 15.40 15.60 15.80 16.00 16.20 16.40 16.60 16.80 17.00
Time-->


Response_
10036TC1.D\FID1A
10116TC1.D\FID1A (*)
65000
60000
55000
50000
45000
40000
35000
30000
25000
10.00
10.50
11.00
11.50
12.00
12.50
13.00
13.50
14.00
14.50
15.00
15.50
16.00
16.50
Time

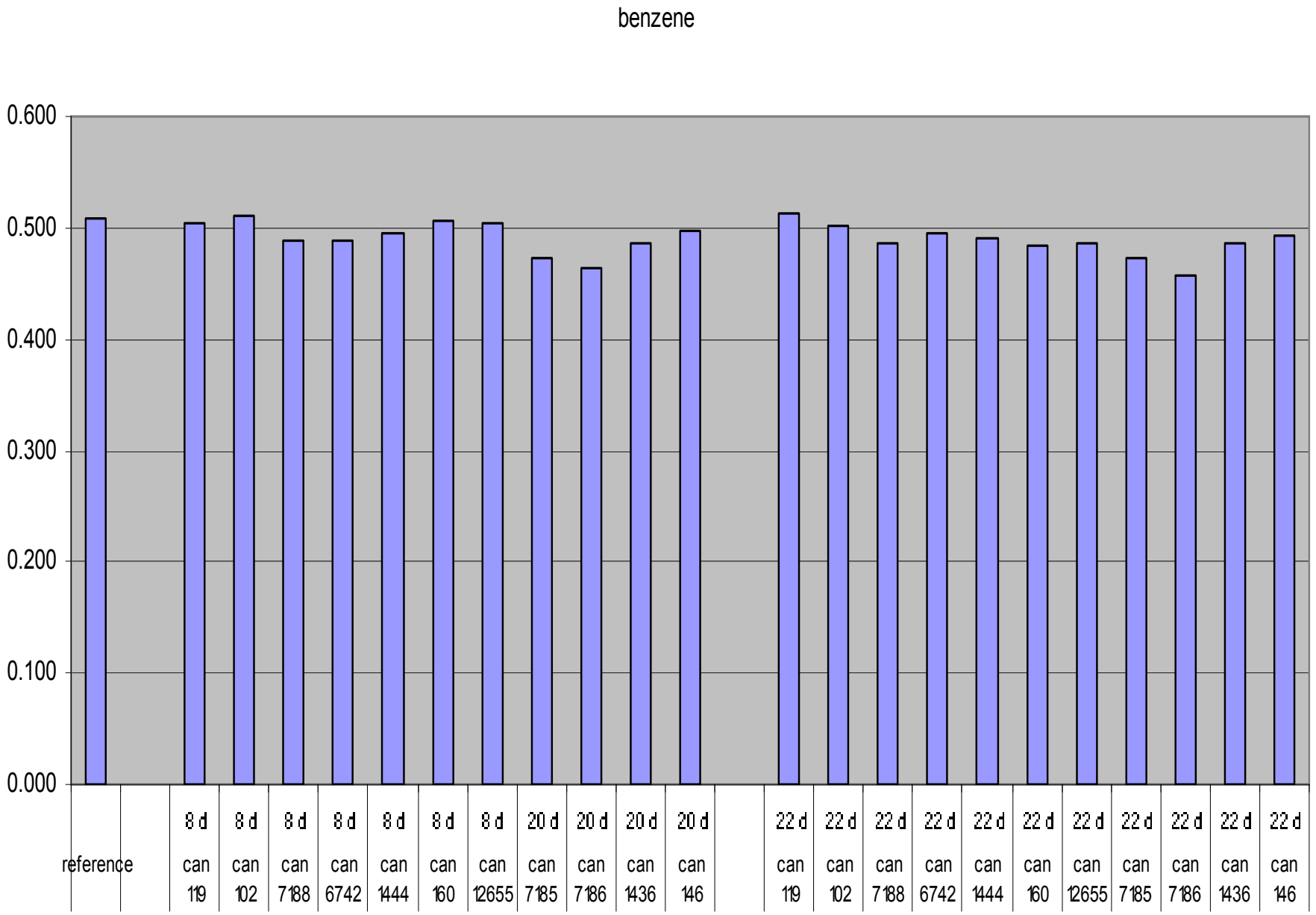

Response_
10036TC1.D\FID1A
10116TC2.D\FID1A (*)
70000
68000
66000
64000
62000
60000
58000
56000
54000
52000
50000
48000
46000
44000
42000
40000
38000
36000
34000
32000
30000
28000
26000
24000
22000
10.00
10.50
11.00
11.50
12.00
12.50
13.00
13.50
14.00
14.50
15.00
15.50
16.00
16.50
Time

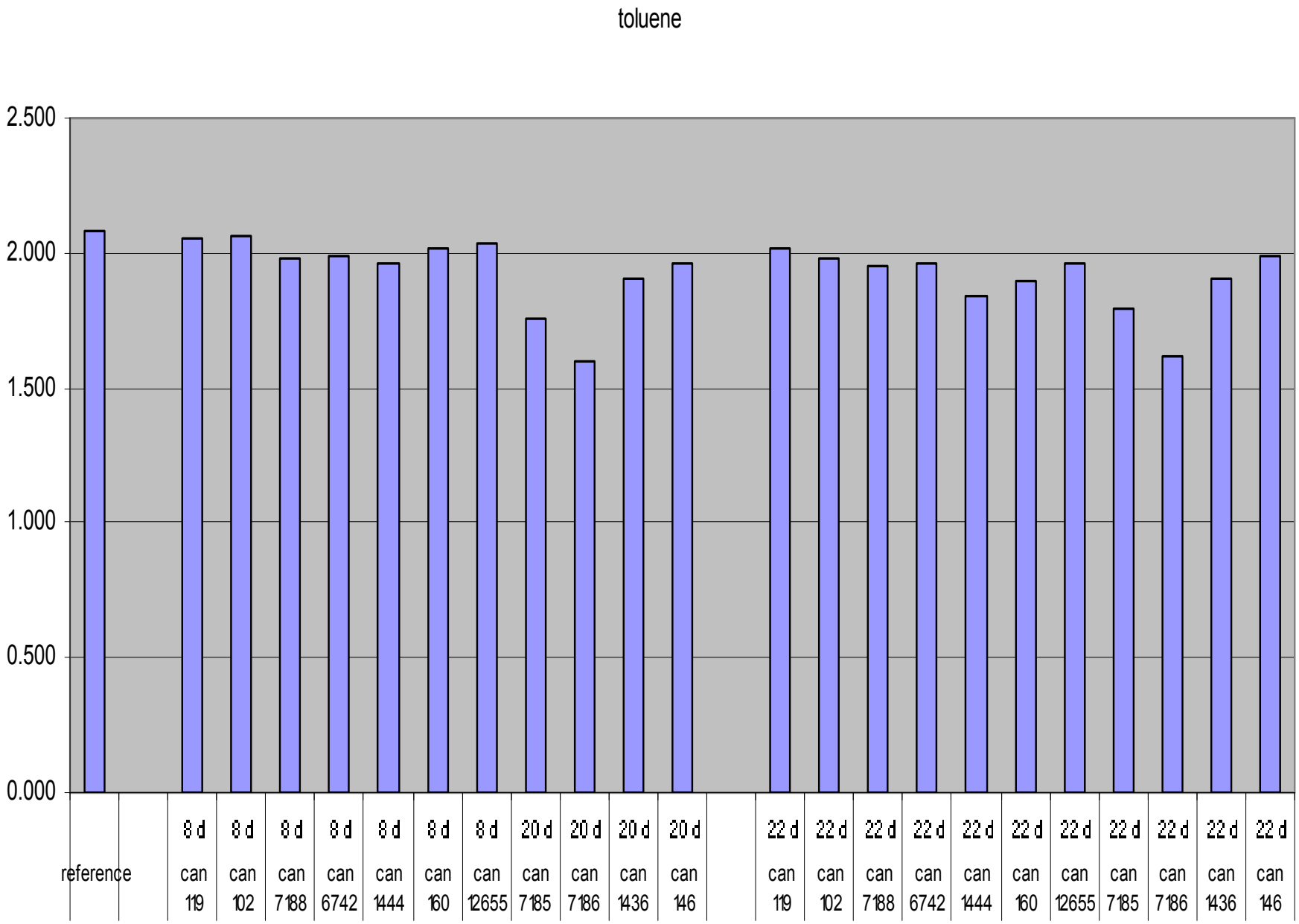

Response_
10166EP1.D\FID1A
10166EP3.D\FID1A (*)
52000
50000
48000
46000
44000
42000
40000
38000
36000
34000
32000
30000
28000
26000
24000
22000
11.00
12.00
13.00
14.00
15.00
16.00
17.00
Time

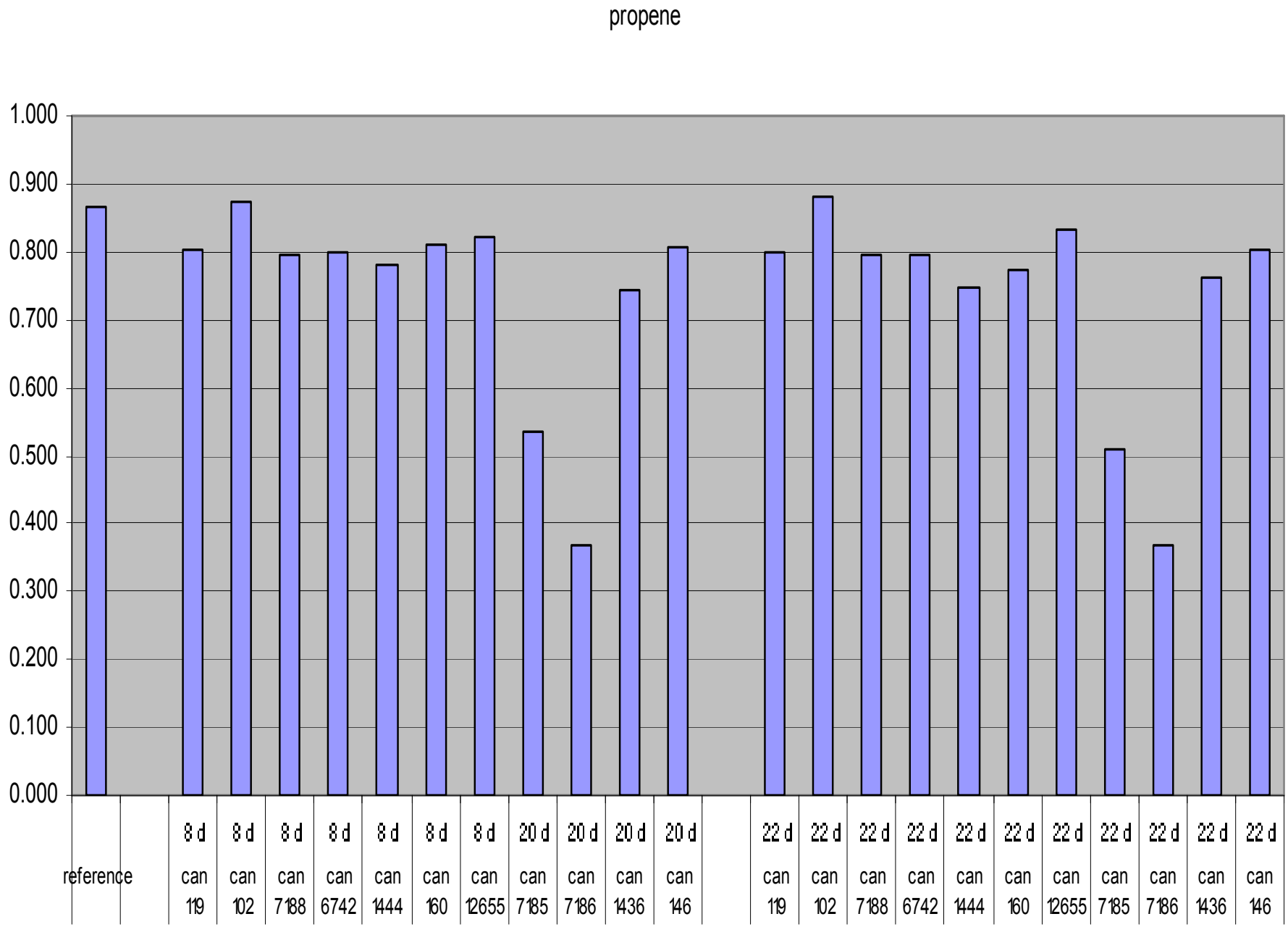

Response_
10106EP1.D\FID1A
10106EP3.D\FID1A (*)
85000
80000
75000
70000
65000
60000
55000
50000
45000
40000
35000
30000
25000
11.00
12.00
13.00
14.00
15.00
16.00
17.00
Time

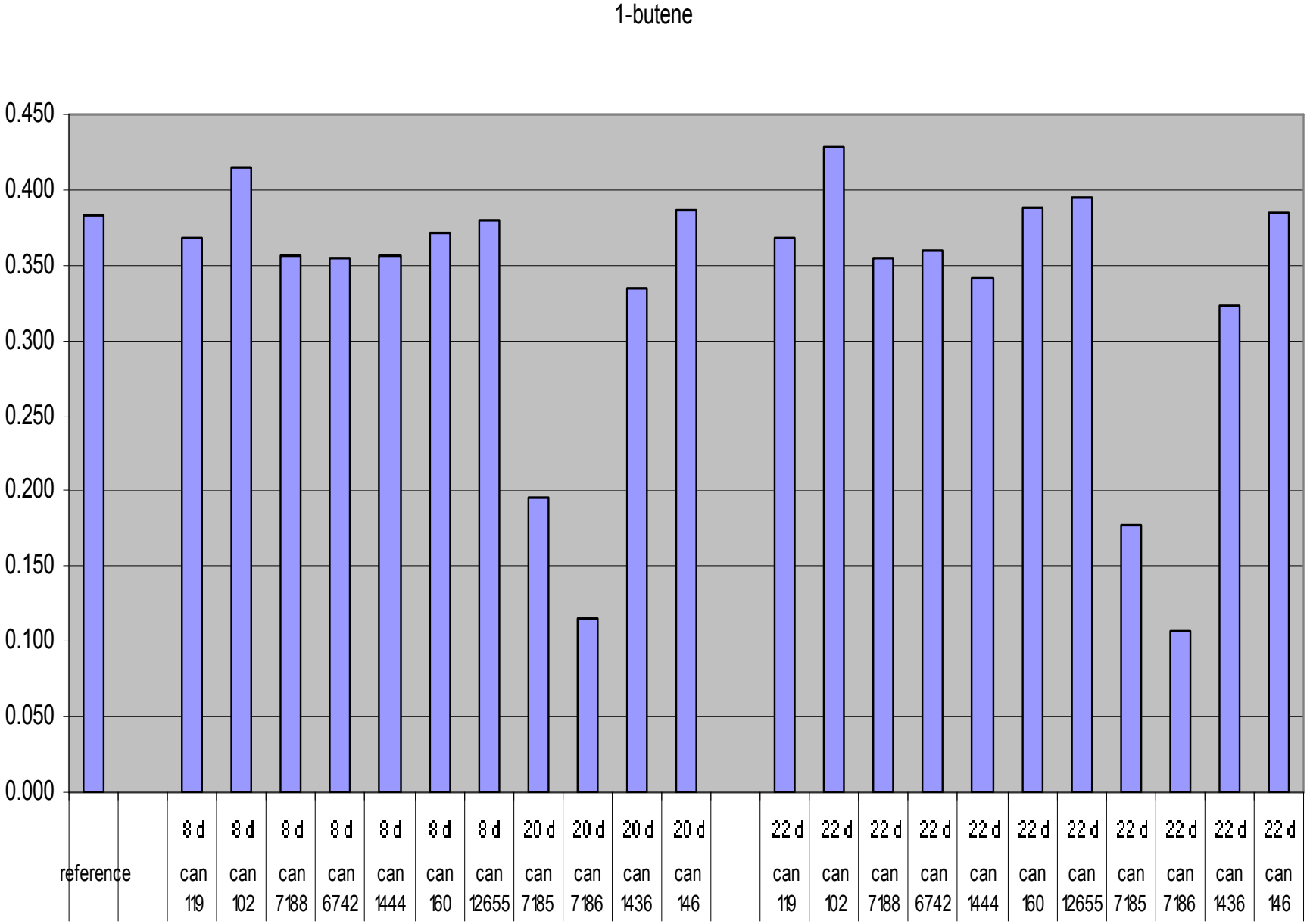

isobutane
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
reference
8 d can 119
8 d can 102
8 d can 7188
8 d can 6742
8 d can 1444
8 d can 160
8 d can 12655
20 d can 7185
20 d can 7186
20 d can 1436
20 d can 146
22 d can 119
22 d can 102
22 d can 7188
22 d can 6742
22 d can 1444
22 d can 160
22 d can 12655
22 d can 7185
22 d can 7186
22 d can 1436
22 d can 146

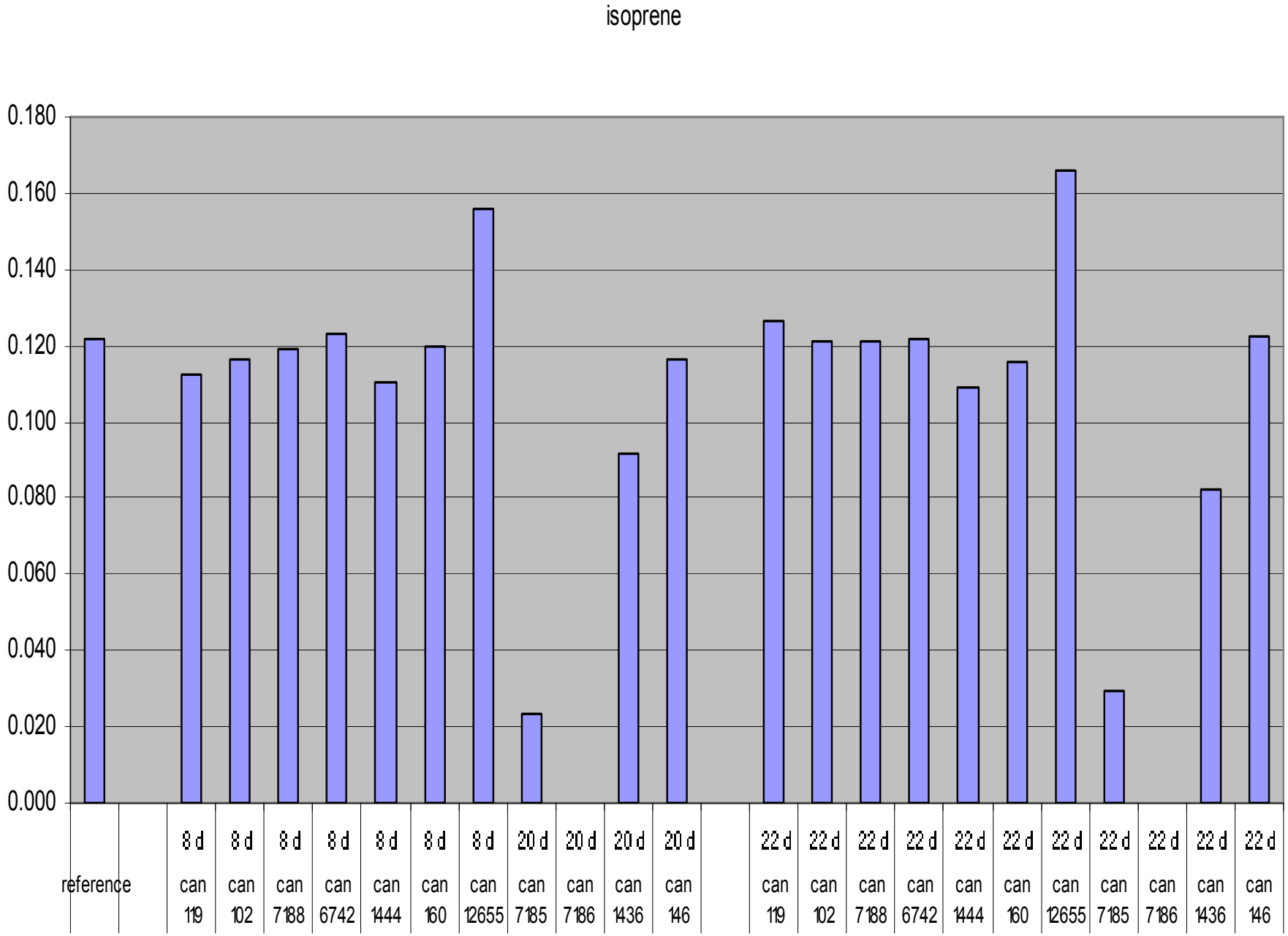

butane
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
reference
8 d can 119
8 d can 102
8 d can 7188
8 d can 6742
8 d can 1444
8 d can 160
8 d can 12655
20 d can 7185
20 d can 7186
20 d can 1436
20 d can 146
22 d can 119
22 d can 102
22 d can 7188
22 d can 6742
22 d can 1444
22 d can 160
22 d can 12655
22 d can 7185
22 d can 7186
22 d can 1436
22 d can 146

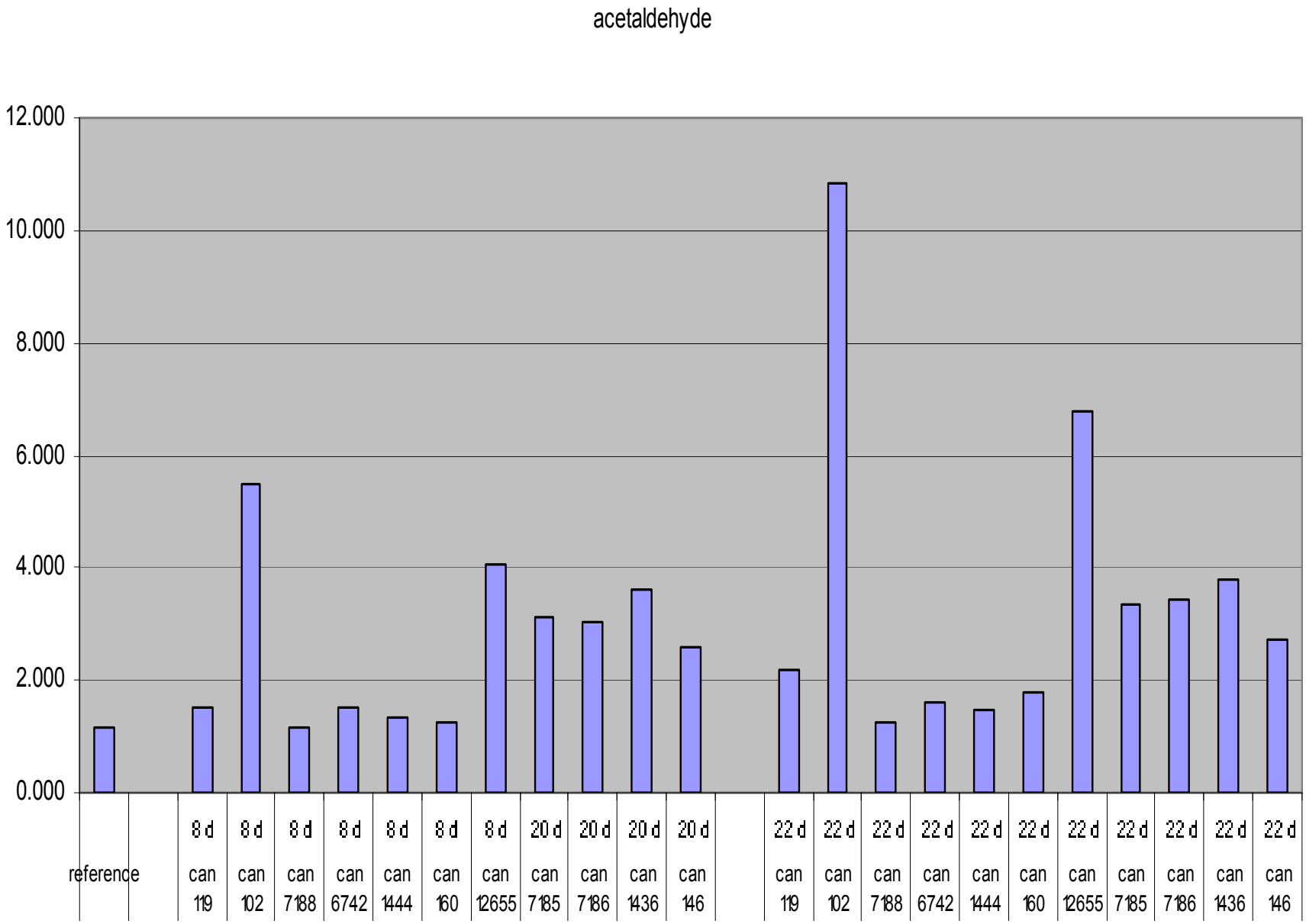

benzene
0.600
0.500
0.400
0.300
0.200
0.100
0.000
reference
8 d can 119
8 d can 102
8 d can 7188
8 d can 6742
8 d can 1444
8 d can 160
8 d can 12655
20 d can 7185
20 d can 7186
20 d can 1436
20 d can 146
22 d can 119
22 d can 102
22 d can 7188
22 d can 6742
22 d can 1444
22 d can 160
22 d can 12655
22 d can 7185
22 d can 7186
22 d can 1436
22 d can 146

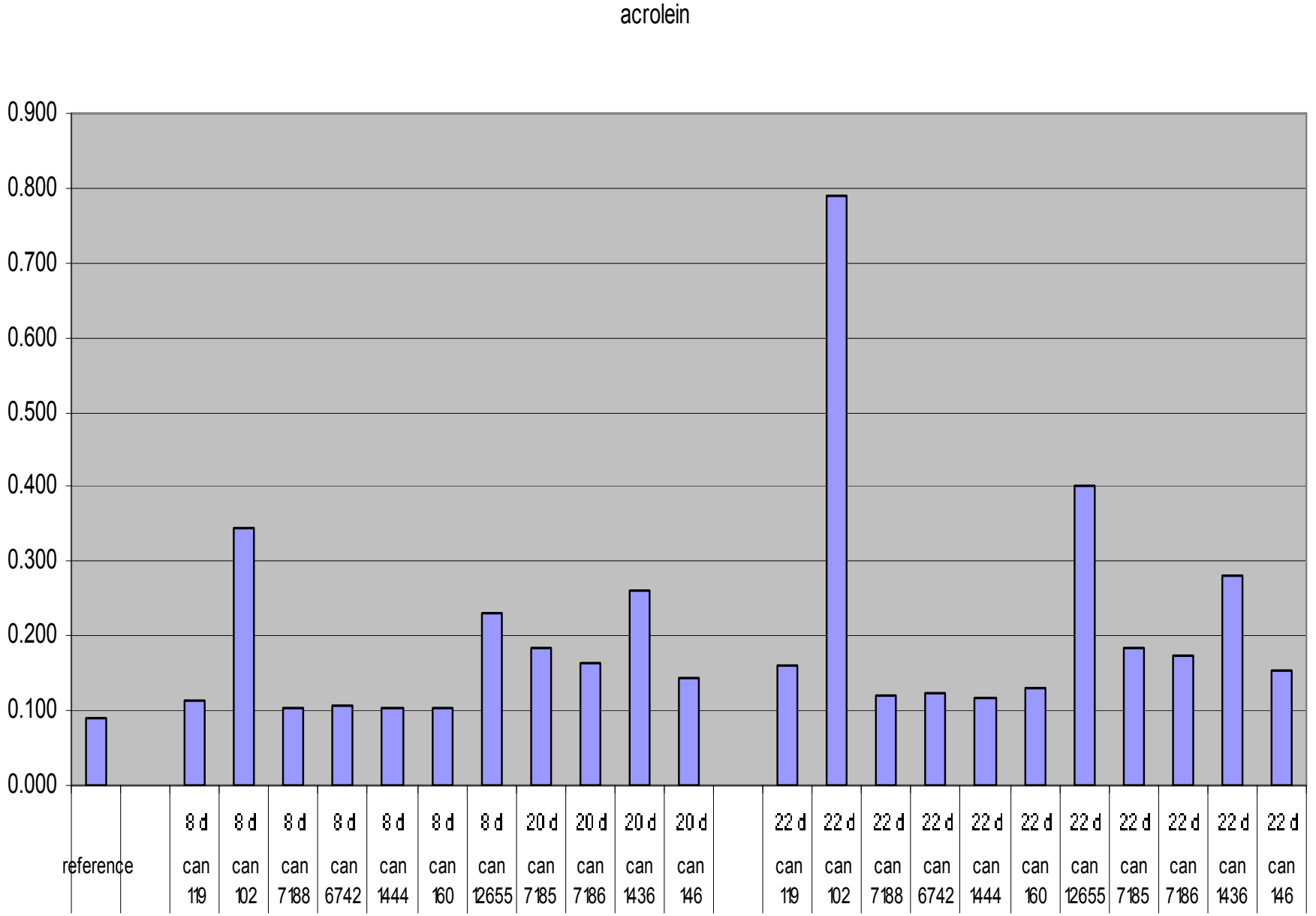

toluene
2.500
2.000
1.500
1.000
0.500
0.000
reference
8 d can 119
8 d can 102
8 d can 7188
8 d can 6742
8 d can 1444
8 d can 160
8 d can 12655
20 d can 7185
20 d can 7186
20 d can 1436
20 d can 146
22 d can 119
22 d can 102
22 d can 7188
22 d can 6742
22 d can 1444
22 d can 160
22 d can 12655
22 d can 7185
22 d can 7186
22 d can 1436
22 d can 146


propene
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
reference
8 d can 119
8 d can 102
8 d can 7188
8 d can 6742
8 d can 1444
8 d can 160
8 d can 12655
20 d can 7185
20 d can 7186
20 d can 1436
20 d can 146
22 d can 119
22 d can 102
22 d can 7188
22 d can 6742
22 d can 1444
22 d can 160
22 d can 12655
22 d can 7185
22 d can 7186
22 d can 1436
22 d can 146

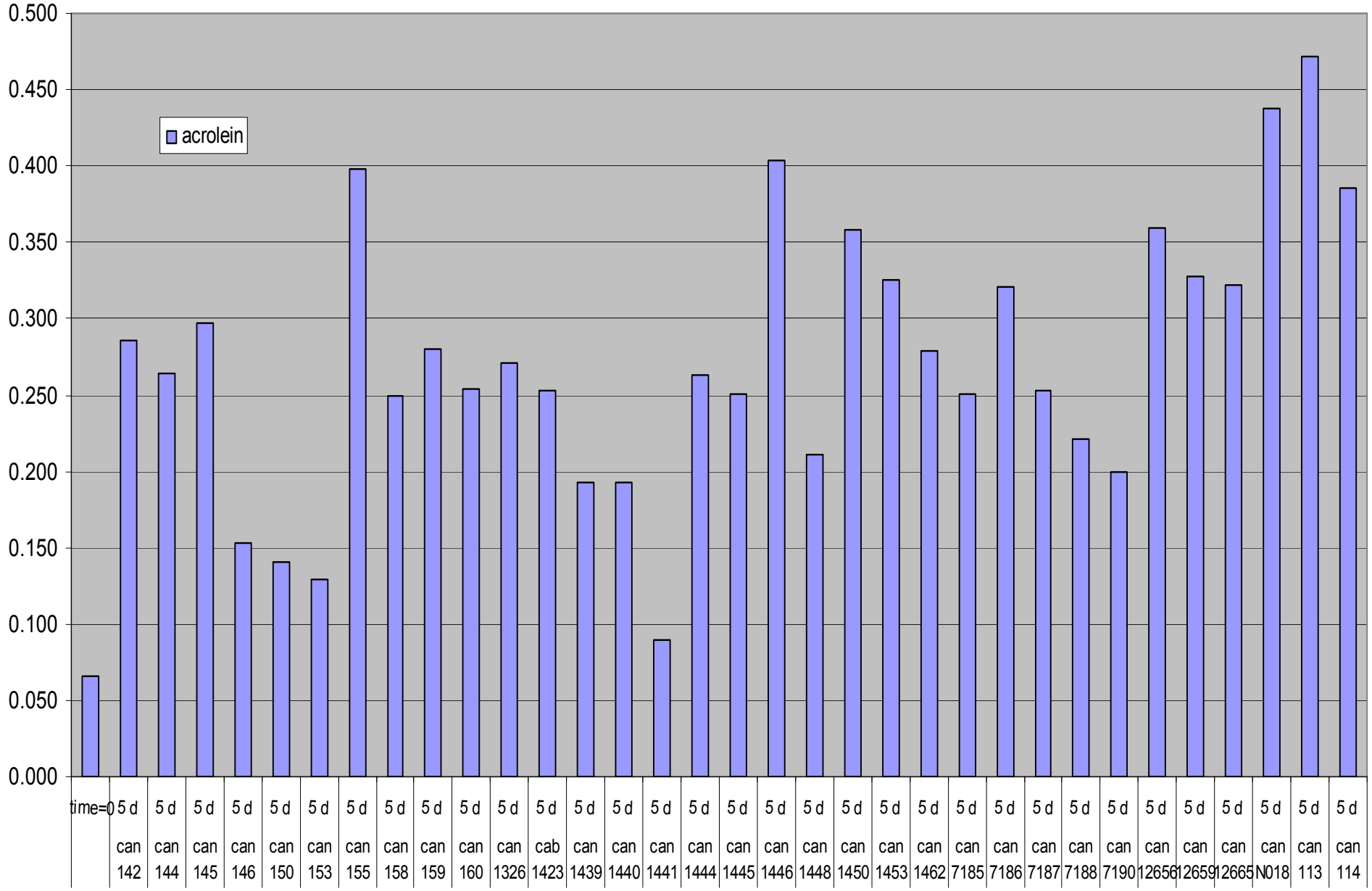

1-butene
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
reference
8 d can 119
8 d can 102
8 d can 7188
8 d can 6742
8 d can 1444
8 d can 160
8 d can 12655
20 d can 7185
20 d can 7186
20 d can 1436
20 d can 146
22 d can 119
22 d can 102
22 d can 7188
22 d can 6742
22 d can 1444
22 d can 160
22 d can 12655
22 d can 7185
22 d can 7186
22 d can 1436
22 d can 146


isoprene
0.180
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
reference
8 d can 119
8 d can 102
8 d can 7188
8 d can 6742
8 d can 1444
8 d can 160
8 d can 12655
20 d can 7185
20 d can 7186
20 d can 1436
20 d can 146
22 d can 119
22 d can 102
22 d can 7188
22 d can 6742
22 d can 1444
22 d can 160
22 d can 12655
22 d can 7185
22 d can 7186
22 d can 1436
22 d can 146

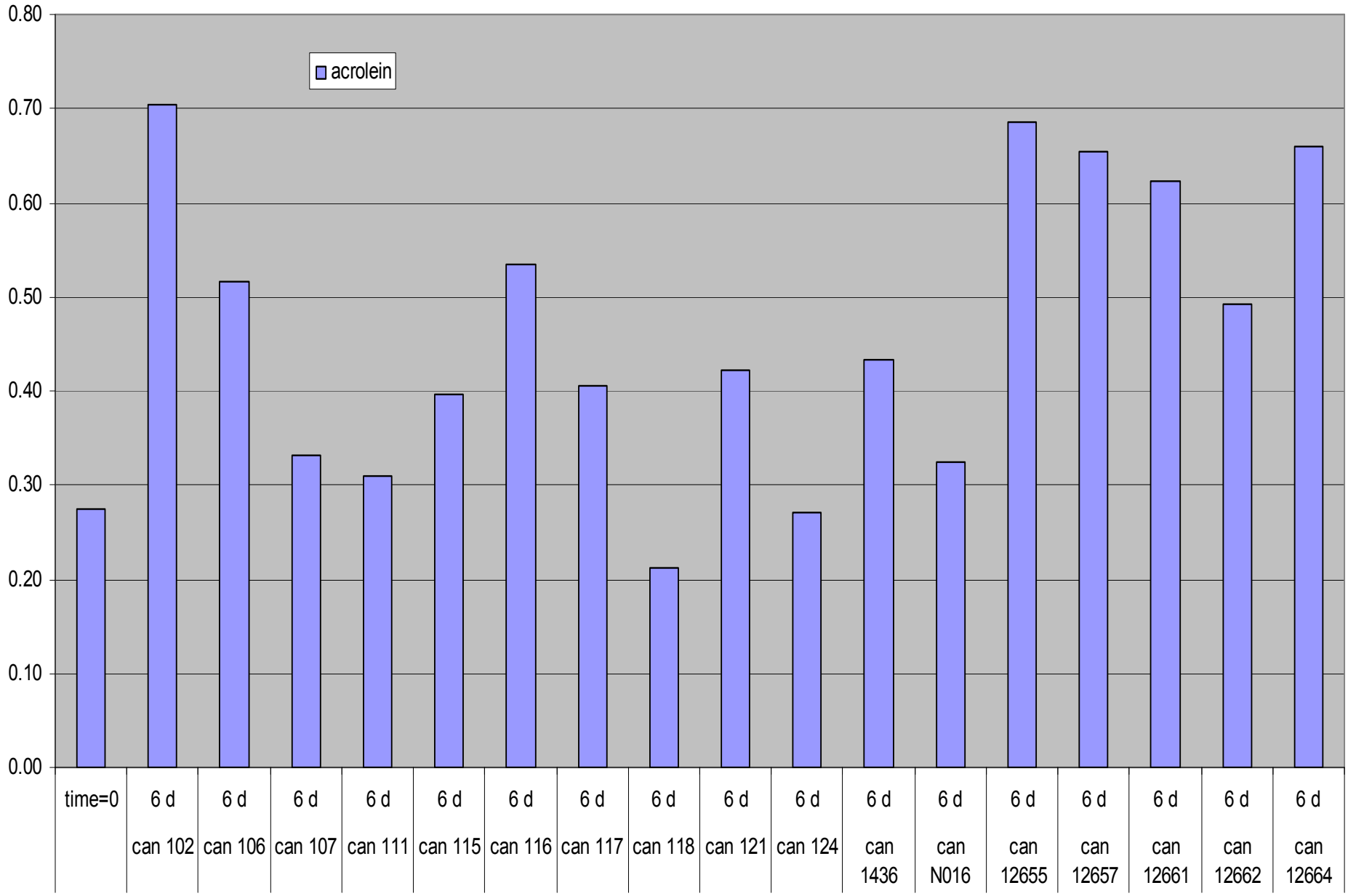

acetaldehyde
12.000
10.000
8.000
6.000
4.000
2.000
0.000
reference
8 d can 119
8 d can 102
8 d can 7188
8 d can 6742
8 d can 1444
8 d can 160
8 d can 12655
20 d can 7185
20 d can 7186
20 d can 1436
20 d can 146
22 d can 119
22 d can 102
22 d can 7188
22 d can 6742
22 d can 1444
22 d can 160
22 d can 12655
22 d can 7185
22 d can 7186
22 d can 1436
22 d can 146

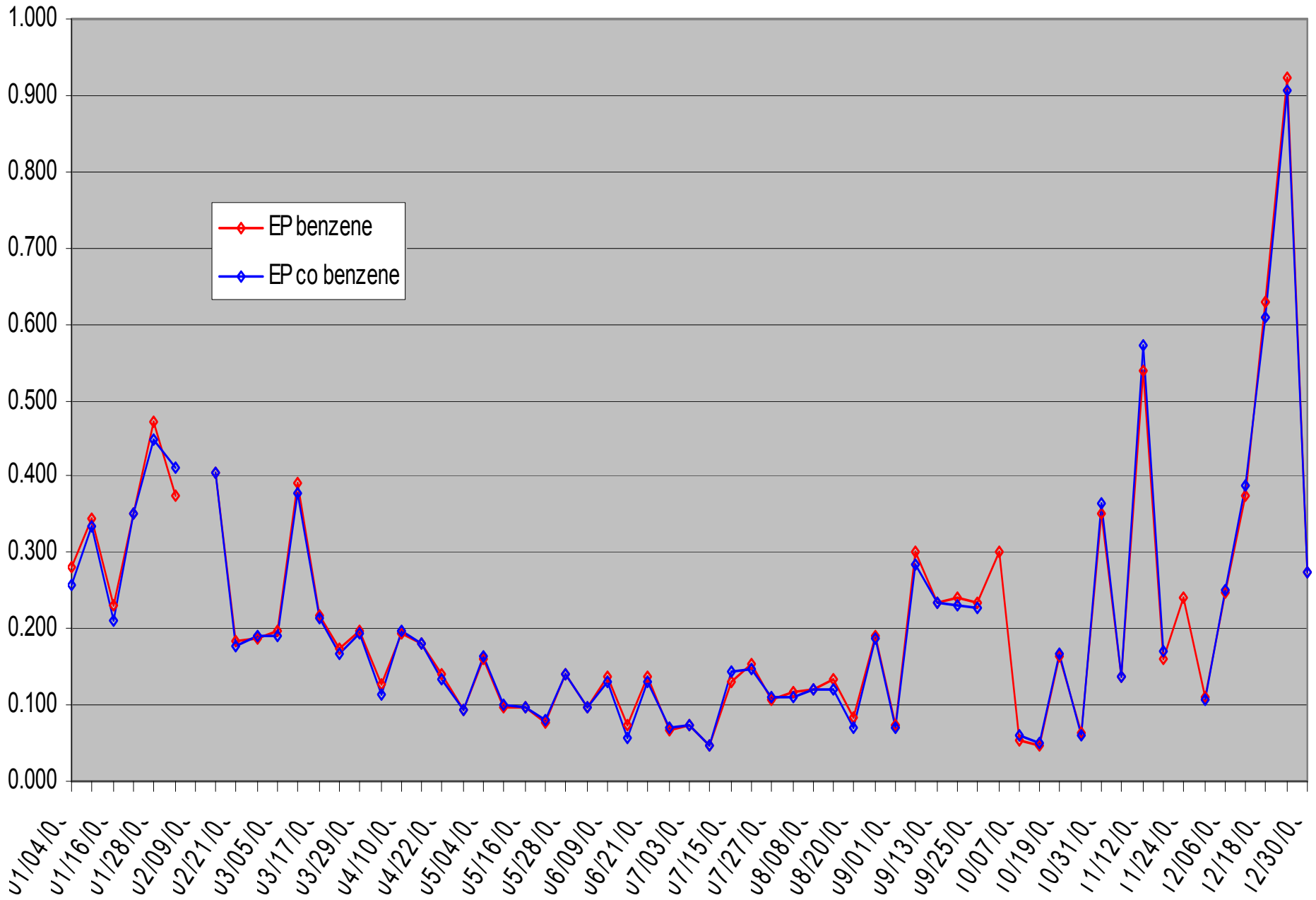

acrolein
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
reference
8 d can 119
8 d can 102
8 d can 7188
8 d can 6742
8 d can 1444
8 d can 160
8 d can 12655
20 d can 7185
20 d can 7186
20 d can 1436
20 d can 146
22 d can 119
22 d can 102
22 d can 7188
22 d can 6742
22 d can 1444
22 d can 160
22 d can 12655
22 d can 7185
22 d can 7186
22 d can 1436
22 d can 146

Can testing in 2002



Can testing in 2002




1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
EP benzene
EP co benzene
01/04/0-
01/16/0-
01/28/0-
02/09/0-
02/21/0-
03/05/0-
03/17/0-
03/29/0-
04/10/0-
04/22/0-
05/04/0-
05/16/0-
05/28/0-
06/09/0-
06/21/0-
07/03/0-
07/15/0-
07/27/0-
08/08/0-
08/20/0-
09/01/0-
09/13/0-
09/25/0-
10/07/0-
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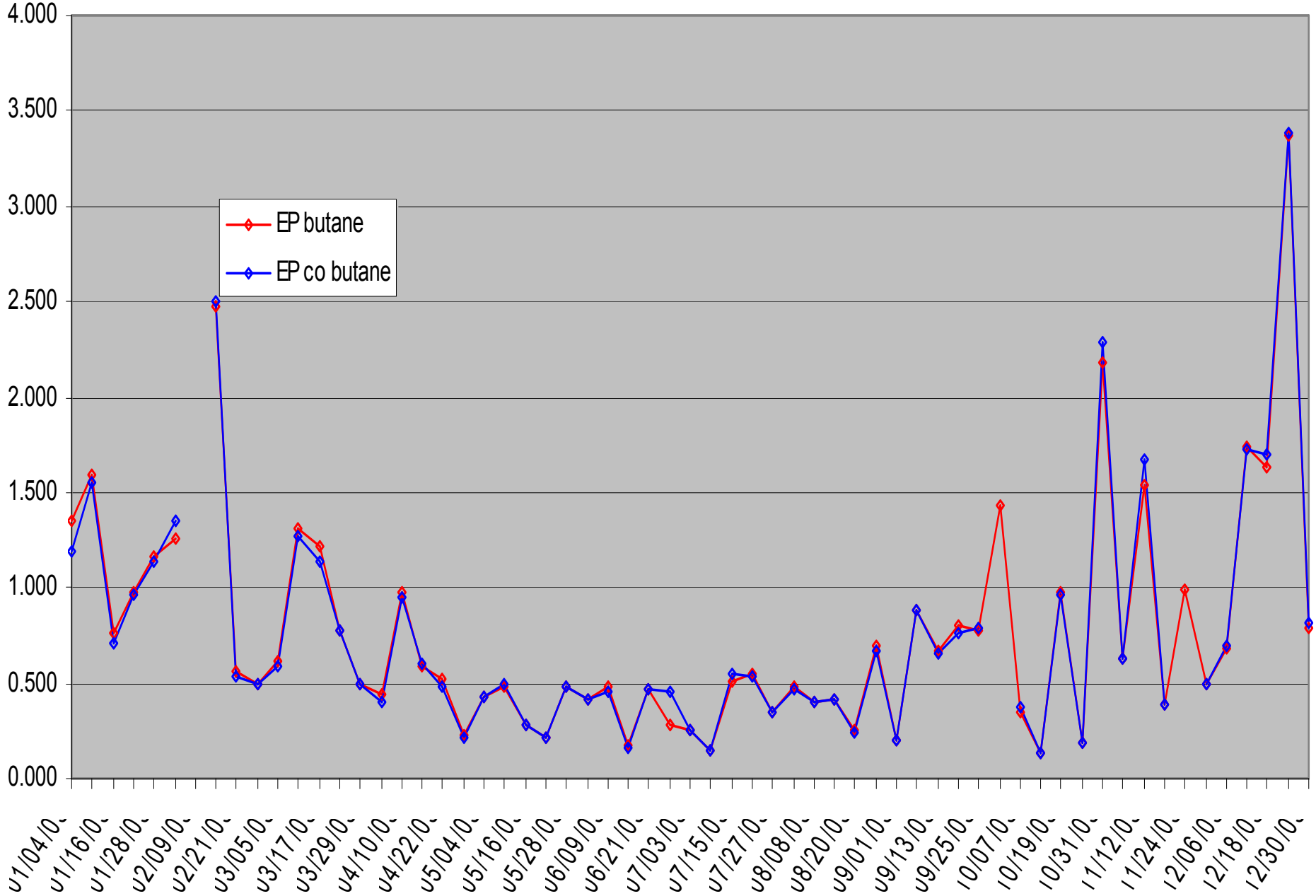
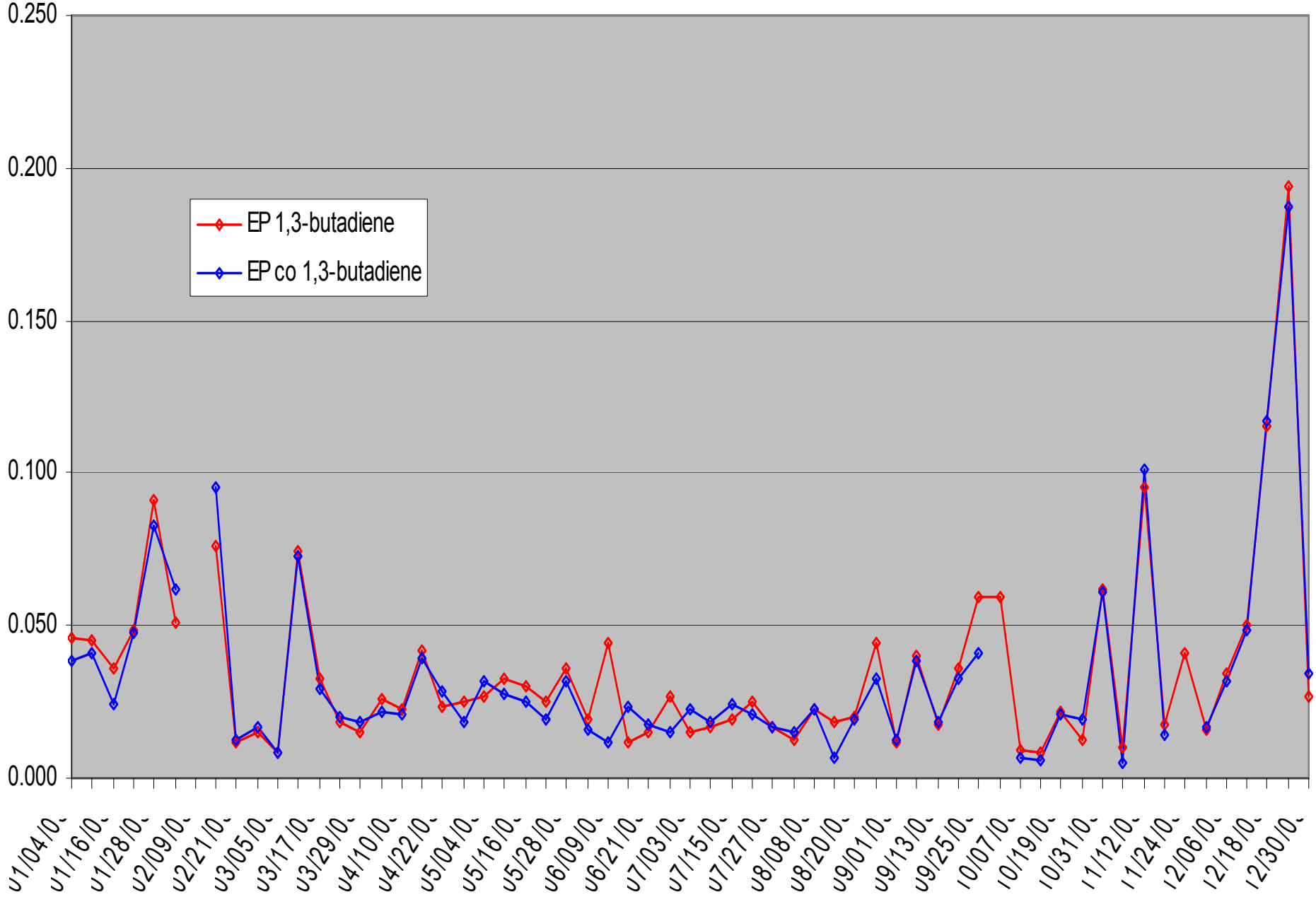
11/24/0-
12/06/0-
12/18/0-
12/30/0-


4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
EP butane
EP co butane


0.250
0.200
0.150
0.100
0.050
0.000
EP 1,3-butadiene
EP co 1,3-butadiene
01/04/0-
01/16/0-
01/28/0-
02/09/0-
02/21/0-
03/05/0-
03/17/0-
03/29/0-
04/10/0-
04/22/0-
05/04/0-
05/16/0-
05/28/0-
06/09/0-
06/21/0-
07/03/0-
07/15/0-
07/27/0-
08/08/0-
08/20/0-
09/01/0-
09/13/0-
09/25/0-
10/07/0-
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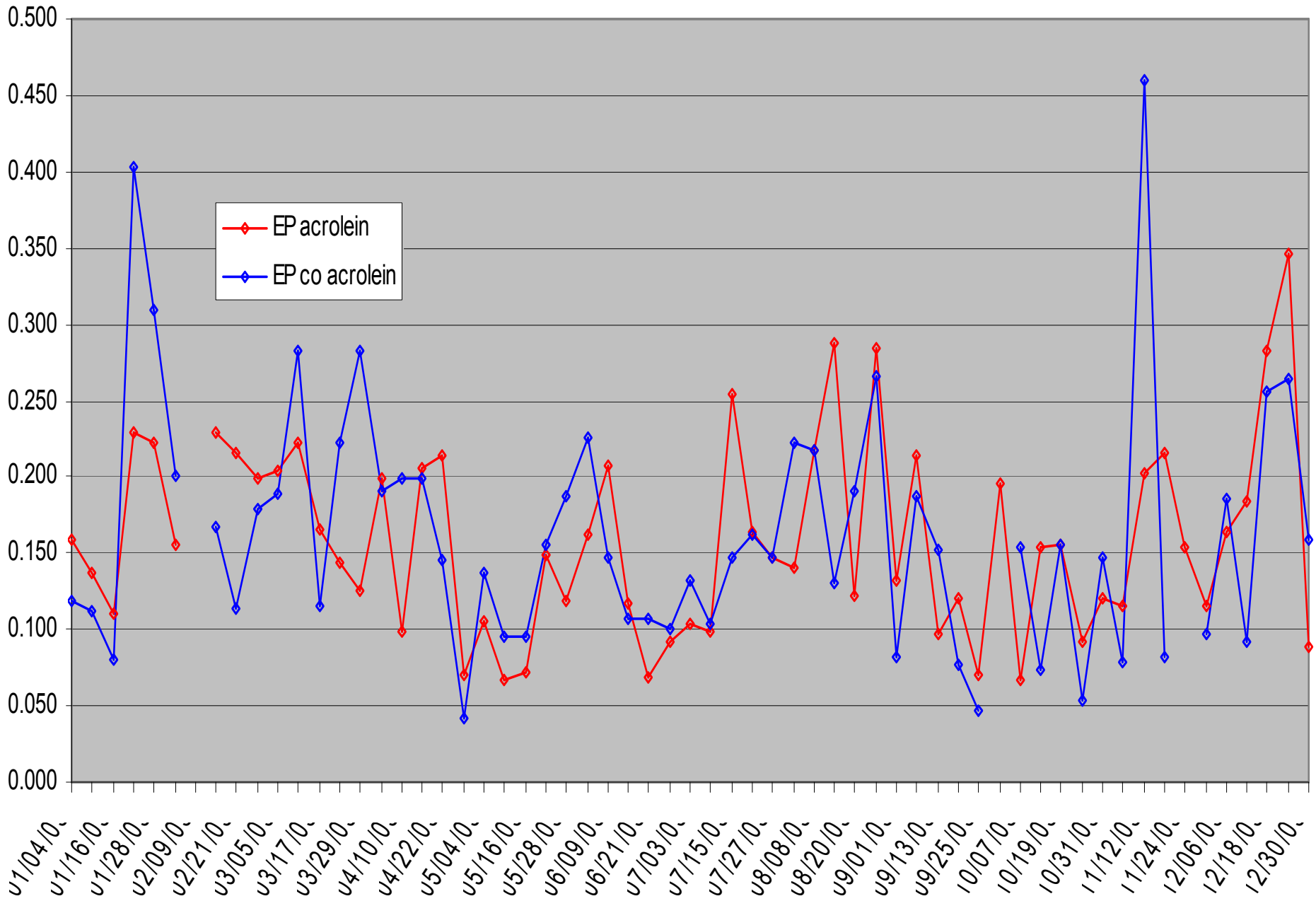
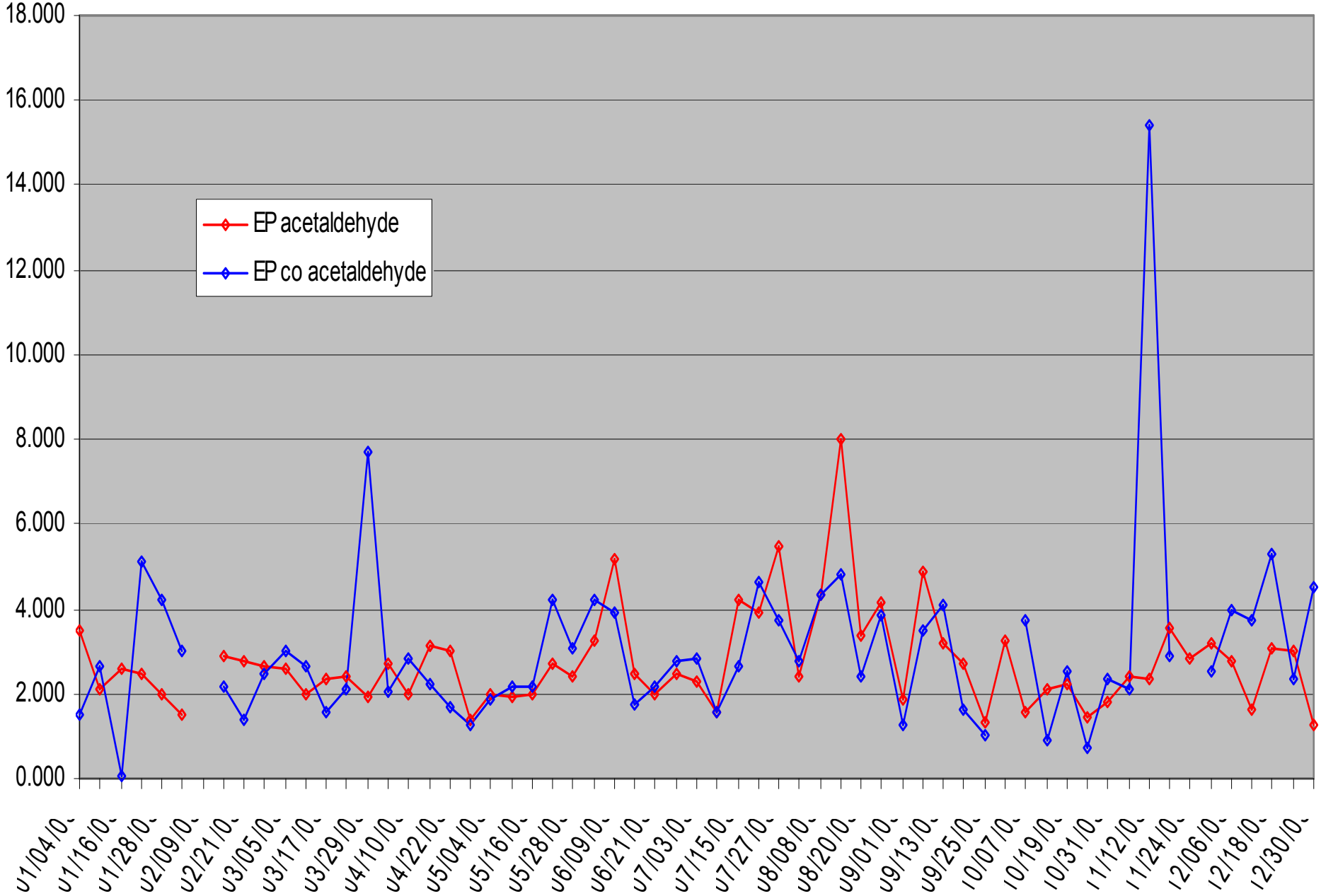
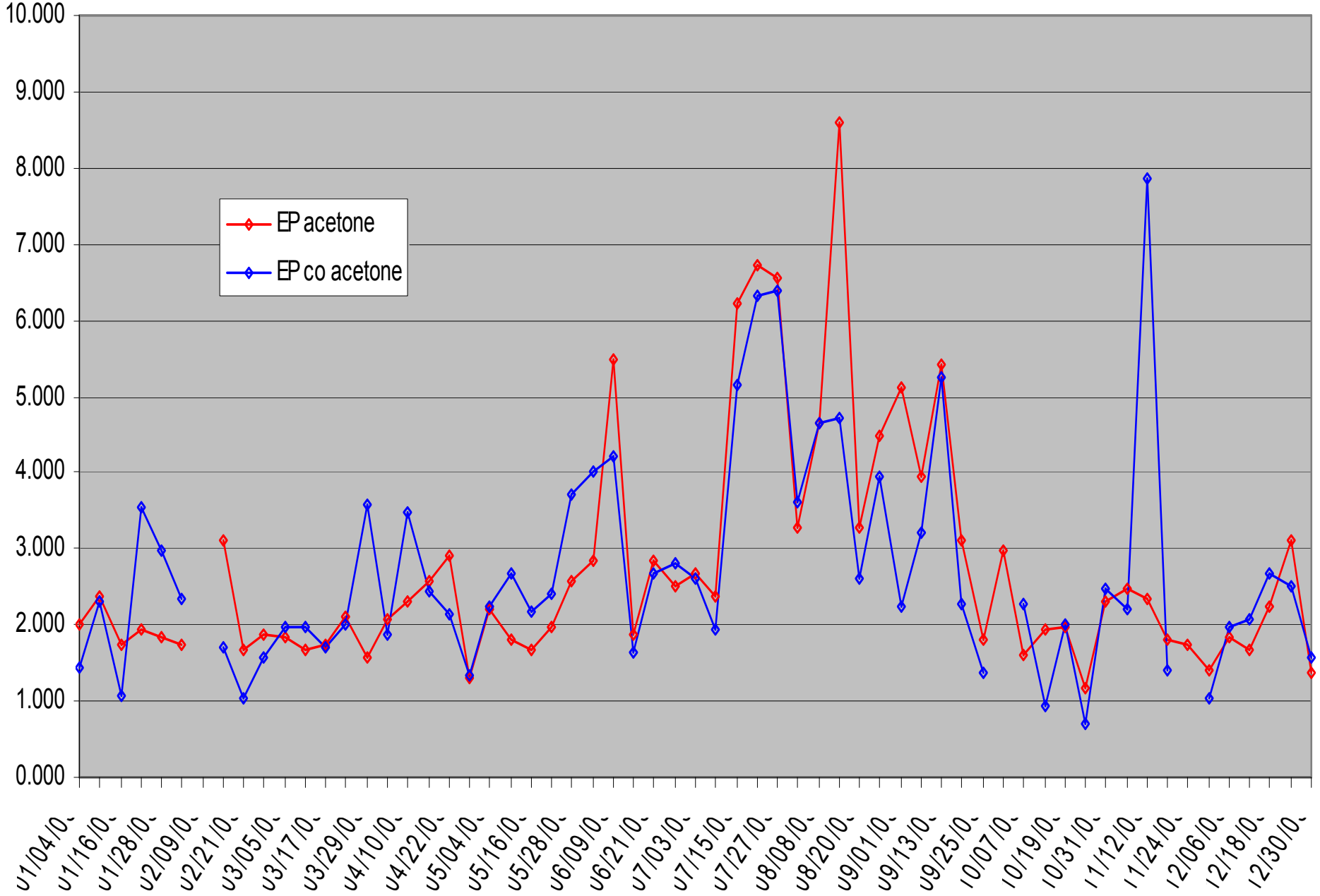
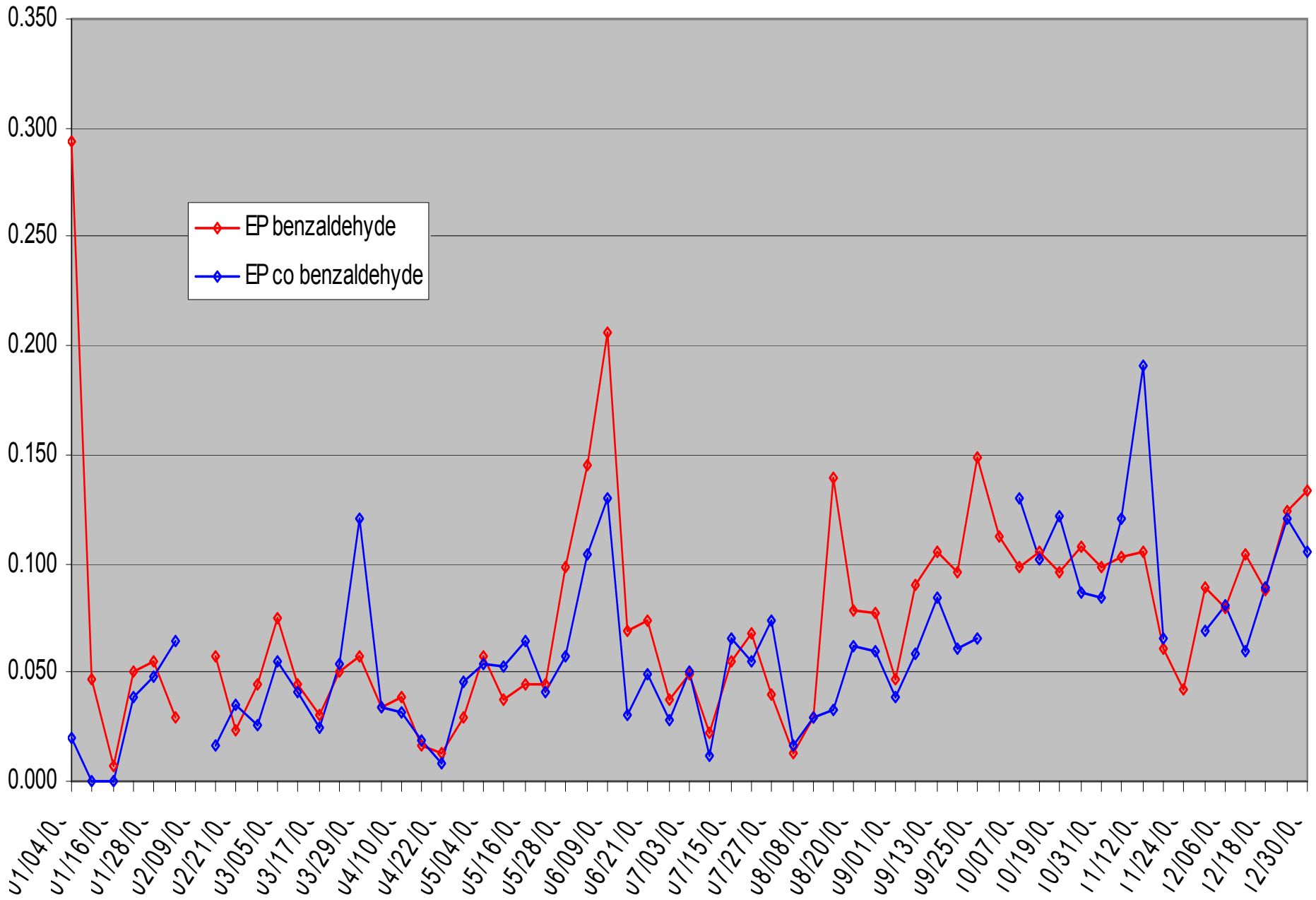
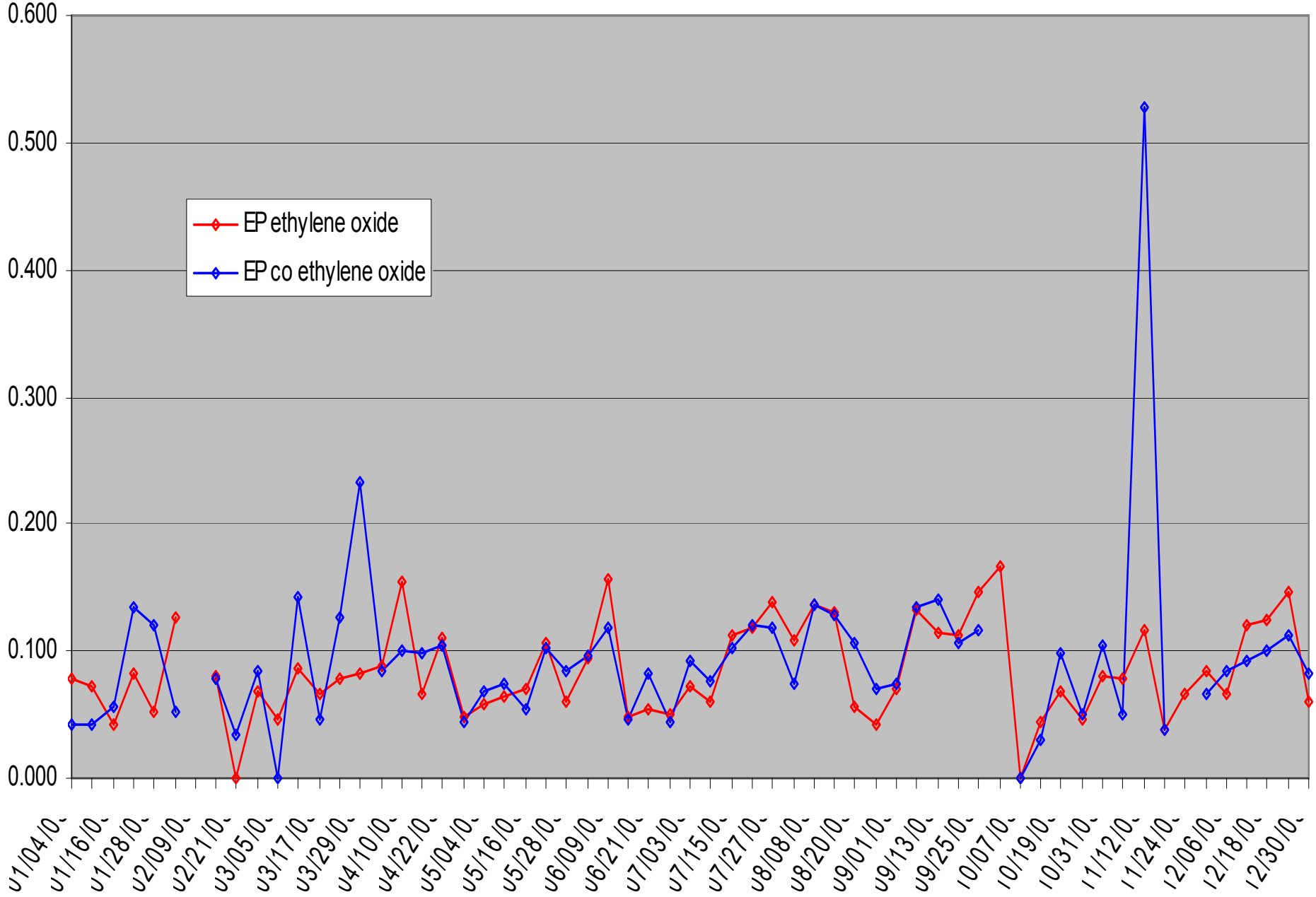
11/24/0-
12/06/0-
12/18/0-
12/30/0-

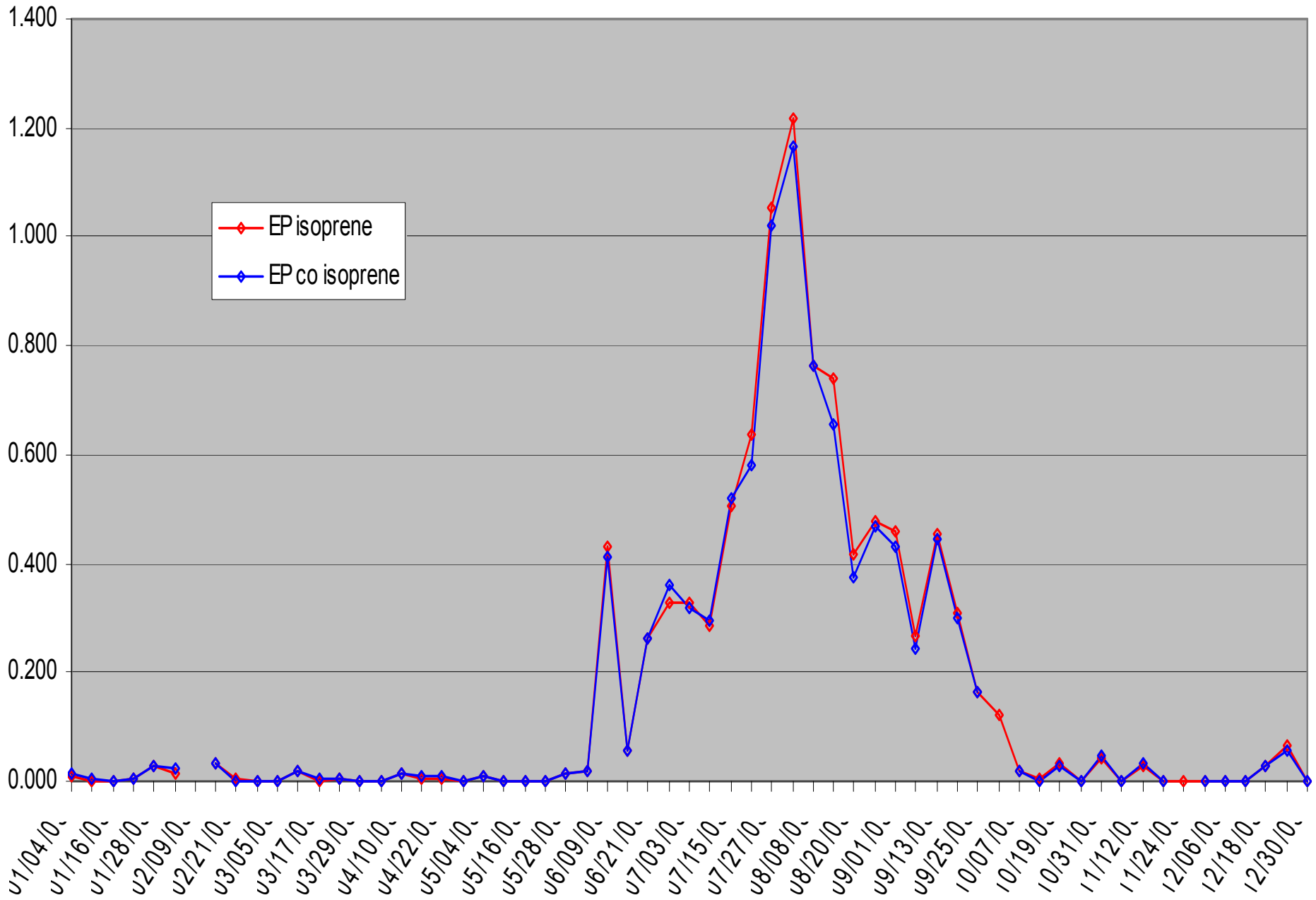

0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
EP acrolein
EP co acrolein
01/04/0-
01/16/0-
01/28/0-
02/09/0-
02/21/0-
03/05/0-
03/17/0-
03/29/0-
04/10/0-
04/22/0-
05/04/0-
05/16/0-
05/28/0-
06/09/0-
06/21/0-
07/03/0-
07/15/0-
07/27/0-
08/08/0-
08/20/0-
09/01/0-
09/13/0-
09/25/0-
10/07/0-
10/19/0-
10/31/0-
11/12/0-
11/24/0-
12/06/0-
12/18/0-
12/30/0-


18.000
16.000
14.000
12.000
10.000
8.000
6.000
4.000
2.000
0.000
EP acetaldehyde
EP co acetaldehyde

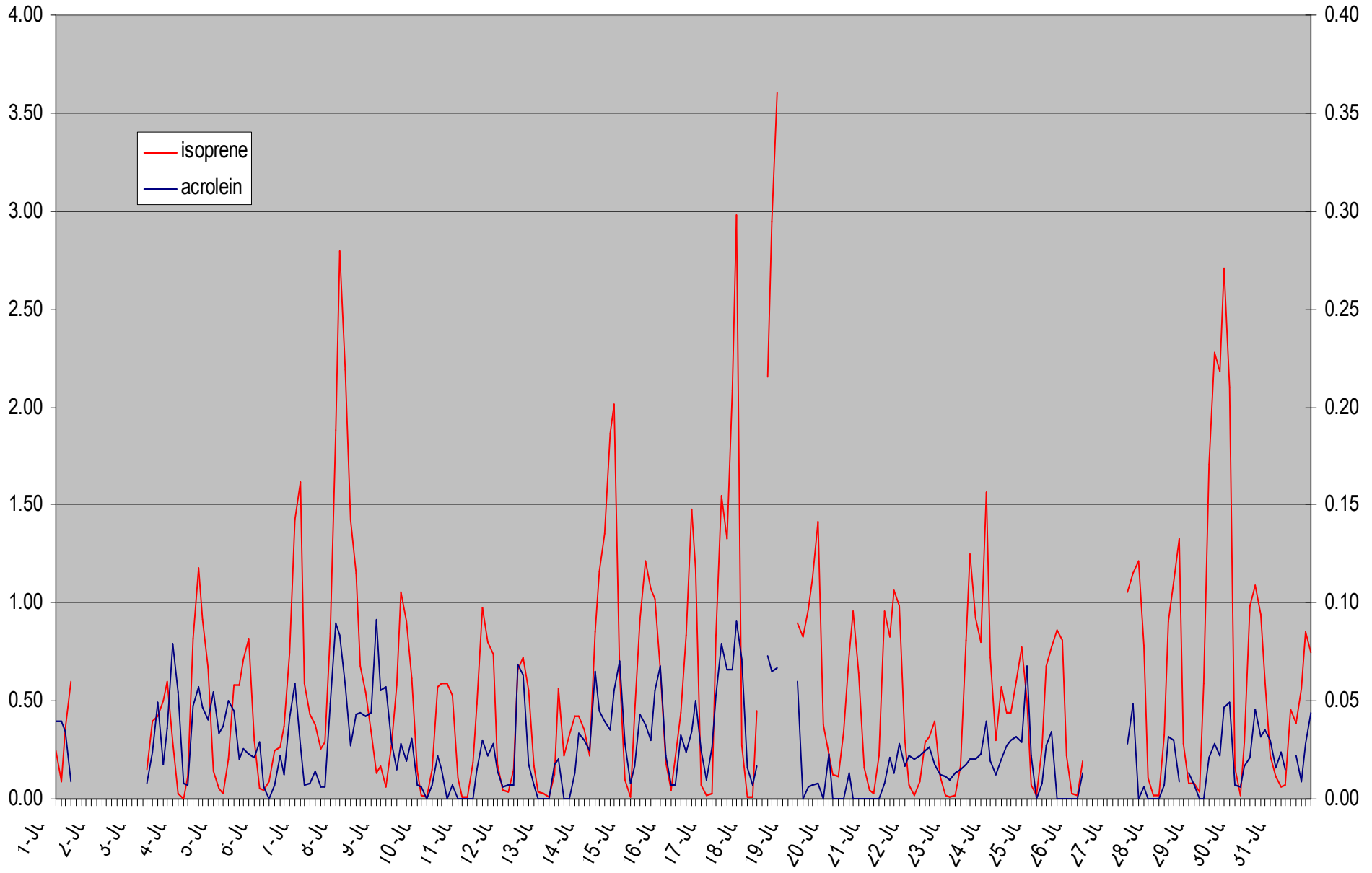

10.000
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
EP acetone
EP co acetone

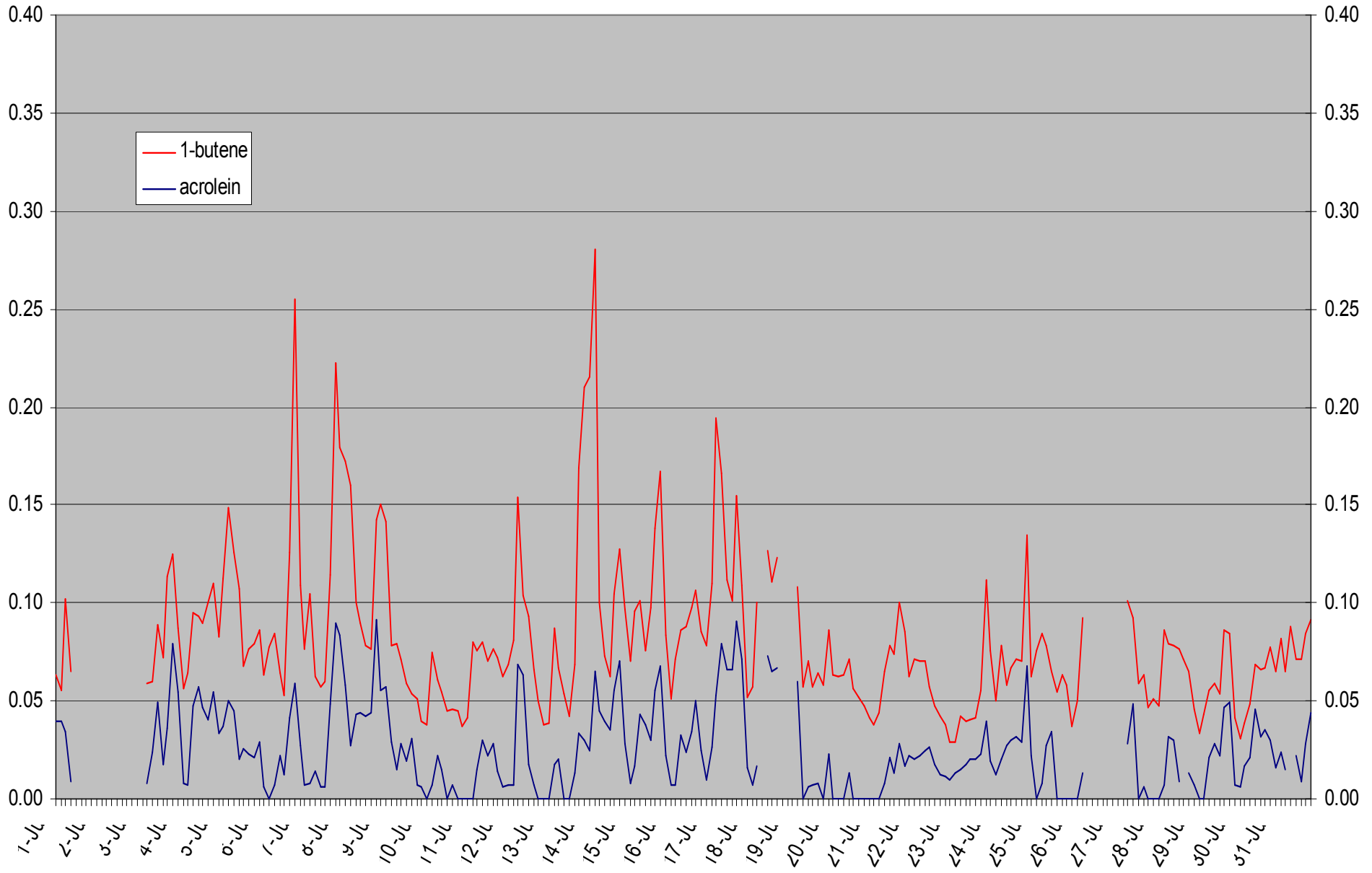

0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
EP benzaldehyde
EP co benzaldehyde
01/04/0-
01/16/0-
01/28/0-
02/09/0-
02/21/0-
03/05/0-
03/17/0-
03/29/0-
04/10/0-
04/22/0-
05/04/0-
05/16/0-
05/28/0-
06/09/0-
06/21/0-
07/03/0-
07/15/0-
07/27/0-
08/08/0-
08/20/0-
09/01/0-
09/13/0-
09/25/0-
10/07/0-
10/19/0-
10/31/0-
11/12/0-
11/24/0-
12/06/0-
12/18/0-
12/30/0-


0.600
0.500
0.400
0.300
0.200
0.100
0.000
EP ethylene oxide
EP co ethylene oxide
01/04/0-
01/16/0-
01/28/0-
02/09/0-
02/21/0-
03/05/0-
03/17/0-
03/29/0-
04/10/0-
04/22/0-
05/04/0-
05/16/0-
05/28/0-
06/09/0-
06/21/0-
07/03/0-
07/15/0-
07/27/0-
08/08/0-
08/20/0-
09/01/0-
09/13/0-
09/25/0-
10/07/0-
10/19/0-
10/31/0-
11/12/0-
11/24/0-
12/06/0-
12/18/0-
12/30/0-


1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
EP isoprene
EP co isoprene
01/04/0-
01/16/0-
01/28/0-
02/09/0-
02/21/0-
03/05/0-
03/17/0-
03/29/0-
04/10/0-
04/22/0-
05/04/0-
05/16/0-
05/28/0-
06/09/0-
06/21/0-
07/03/0-
07/15/0-
07/27/0-
08/08/0-
08/20/0-
09/01/0-
09/13/0-
09/25/0-
10/07/0-
10/19/0-
10/31/0-
11/12/0-
11/24/0-
12/06/0-
12/18/0-
12/30/0-

Precision data for 2005		All data					Higher-concentration data				
East Prov VOC co-located samplers		pairs with a non-detect are excluded					values below 5 x the MDL excluded				
data in % diff		n	average	first quartile	median	third quartile	n	average	first quartile	median	third quartile
43203	ethylene	58	7%	2%	4%	8%	57	7%	2%	4%	7%
43206	acetylene	58	3%	1%	3%	5%	56	3%	1%	3%	5%
43202	ethane	55	8%	2%	4%	10%	55	8%	2%	4%	10%
43205	propene	58	14%	3%	11%	19%	56	13%	3%	10%	19%
43204	propane	58	4%	1%	3%	6%	58	4%	1%	3%	6%
43214	isobutane	58	5%	1%	3%	4%	58	5%	1%	3%	4%
43280	1-butene	58	15%	3%	10%	18%	51	14%	3%	10%	17%
43218	1,3-butadiene	58	21%	7%	15%	25%	5	9%	3%	6%	10%
43212	butane	58	4%	1%	2%	5%	58	4%	1%	2%	5%
43221	isopentane	58	8%	2%	4%	10%	57	7%	2%	4%	9%
43220	pentane	58	9%	3%	5%	8%	57	9%	3%	5%	8%
43285	2-methylpentane	58	10%	3%	7%	14%	53	9%	2%	7%	12%
43230	3-methylpentane	58	9%	4%	7%	11%	41	7%	3%	5%	9%
43231	n-hexane	58	6%	2%	4%	7%	41	5%	2%	4%	7%
45201	benzene	58	4%	1%	3%	5%	58	4%	1%	3%	5%
43232	n-heptane	57	12%	4%	9%	19%	23	9%	3%	6%	13%
45202	toluene	58	5%	2%	4%	9%	58	5%	2%	4%	9%
45203	ethylbenzene	58	8%	3%	6%	12%	44	6%	2%	5%	10%
45109	p & m xylenes	58	8%	4%	7%	11%	57	8%	4%	7%	11%
45204	o-xylene	58	9%	3%	7%	13%	45	8%	3%	7%	12%
NOT REPORT	acetaldehyde	58	42%	18%	31%	53%	56	42%	17%	31%	53%
43601	ethylene oxide	55	30%	8%	25%	41%	0				
43505	acrolein	58	34%	15%	33%	46%	0				
NOT REPORT	acetone	58	25%	7%	20%	34%	13	29%	6%	19%	34%
43552	methyl ethyl ketone	58	22%	8%	22%	29%	13	27%	16%	23%	30%
NOT REPORT	benzaldehyde	56	36%	16%	26%	47%	0				
43372	Methyl-t-butyl-ether	58	6%	2%	5%	8%	34	6%	3%	5%	7%
43801	chloromethane	58	4%	1%	2%	5%	58	4%	1%	2%	5%
43814	1,1,1-trichloroethane	58	18%	6%	11%	21%	0				
43802	dichloromethane	58	6%	2%	5%	9%	4	4%	2%	3%	5%
43803	chloroform	58	12%	4%	9%	19%	0				
43804	Carbon tetrachloride	58	6%	3%	4%	7%	0				
43824	trichloroethylene	35	31%	12%	27%	45%	0				
43817	tetrachloroethylene	55	16%	5%	10%	21%	0				


3-hour real-time samples at East Providence Summer 2006
isoprene
acrolein
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00


3-hour real-time samples at East Providence Summer 2006
1-butene
acrolein
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00

Comparison of 3-hour averages with 24-hour samples
Summer 2002

	acrolein			Methyl-t-butyl-ether			benzene		
	avg of 8 3hr samples	24hr sample	24hr co-lo sample	avg of 8 3hr samples	24hr sample	24hr co-lo sample	avg of 8 3hr samples	24hr sample	24hr co-lo sample
	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb
1-Jun									
7-Jun	0.021	0.292	0.280	0.323	0.324	0.381	0.144	0.148	0.157
13-Jun	0.000	0.056	0.190	0.151	0.162	0.166	0.086	0.086	0.089
19-Jun	0.004	0.218	0.115	0.232	0.244	0.235	0.088	0.100	0.095
1-Jul	0.093	0.451	0.335	0.854	0.815	0.864	0.217	0.228	0.227
7-Jul	0.054	0.238	0.169	0.565	0.686	0.544	0.135	0.157	0.138
13-Jul	0.267	0.468	0.296	0.352	0.323	0.312	0.461	0.475	0.453
19-Jul		0.329	0.231		0.518	0.497		0.156	0.145
25-Jul	0.077	0.239	0.241	0.285	0.287	0.298	0.139	0.145	0.139
31-Jul	0.035	0.135	0.168	0.317	0.349	0.366	0.118	0.123	0.124
6-Aug	0.077	0.238	0.186	0.302	0.308	0.316	0.113	0.118	0.108
12-Aug	0.006	0.177	0.057	0.089	0.109	0.113	0.054	0.063	0.062
18-Aug	0.073	0.320	0.244	0.685	0.666	0.635	0.170	0.173	0.164
24-Aug		0.302	0.278		0.788	0.820		0.203	0.194
	0.028	0.380	0.311	0.396	0.413	0.390	0.155	0.167	0.160

conclusion

Canister samples should be analyzed as soon as possible, if acrolein or any of the other polar oxygenates are of interest.

At the low end of the concentration range, production of acrolein and other oxygenates is likely to be a problem. Anyone trying to measure them needs to carefully test their canister inventory.