Dioxin Fingerprinting in the HSC

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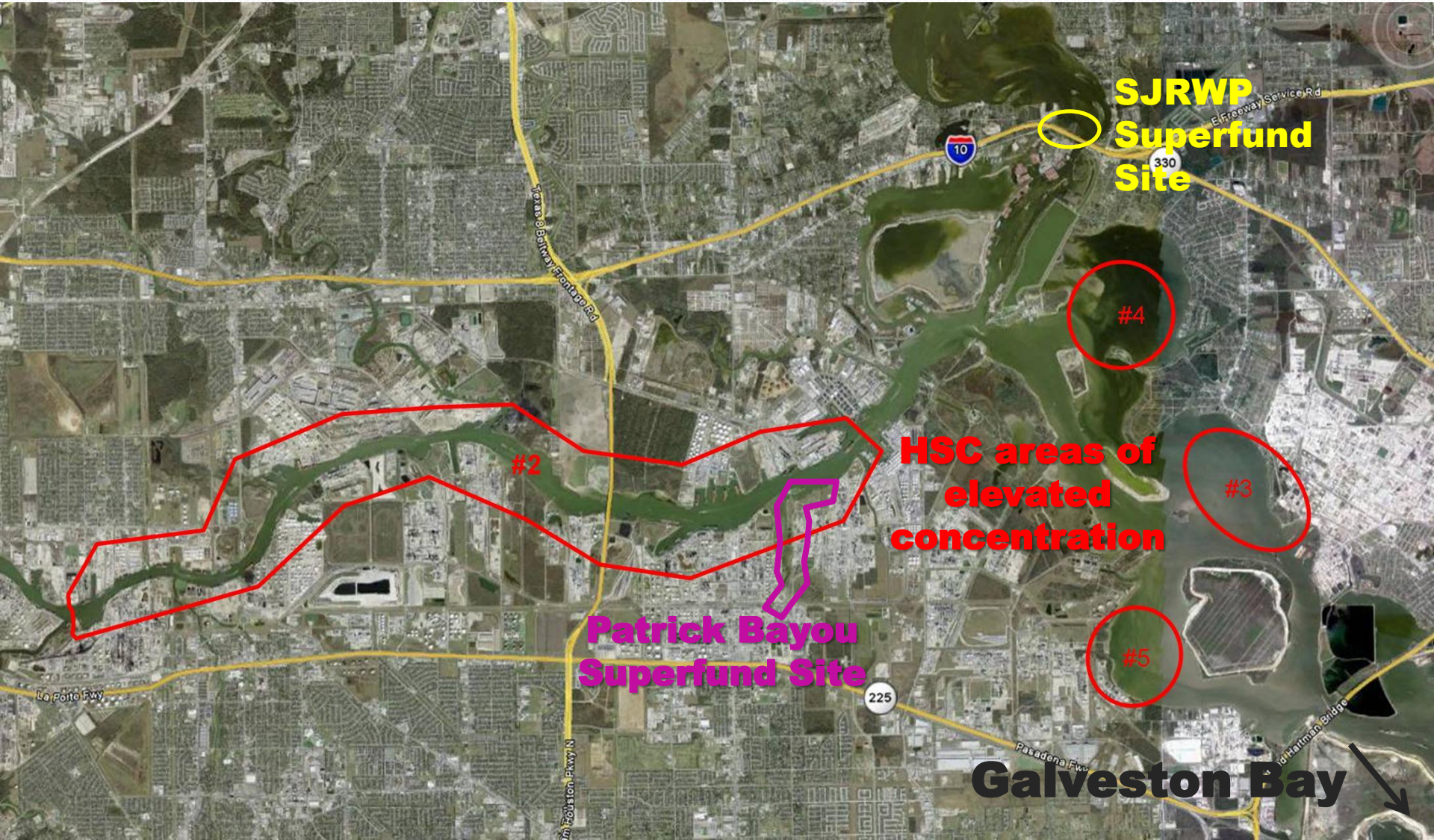
Objectives

- Compare dioxin fingerprints from several areas of the HSC to the SJRWP superfund site:
  - Patrick Bayou superfund site
  - HSC from Sims Bayou to Tucker Bayou
  - Burnett Bay
  - Scott Bay
  - San Jacinto Bay
  - Galveston Bay along the HSC

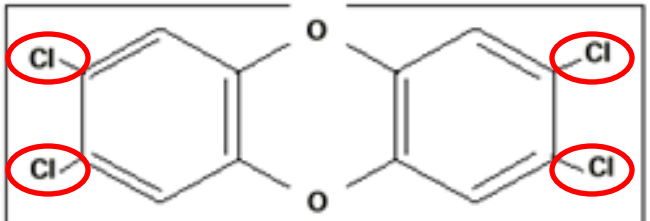
Areas of Interest for this project:



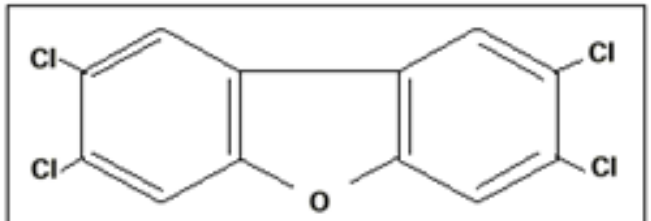
Sediment Data

- Used Surface Sediment data from
  - SJRWP site geodatabase (>300 sample locations), including:
    - Dioxin TMDL data
    - SJRWP Superfund Project data
    - Private dredging project data
  - Patrick Bayou site database (60 sample locations),
  - EPA Marine and Coastal Studies report (7 stations)
- All values given are station averages, if more than one sample was available for a site
- TEQs computed using WHO TEFs with ND=0

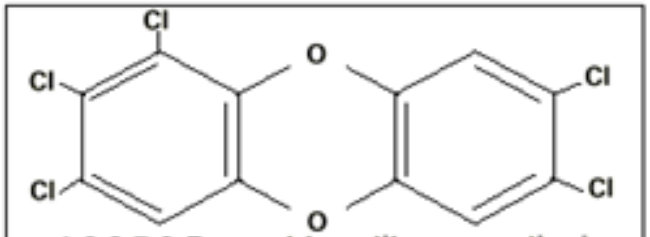
Dioxins and Furans . . .



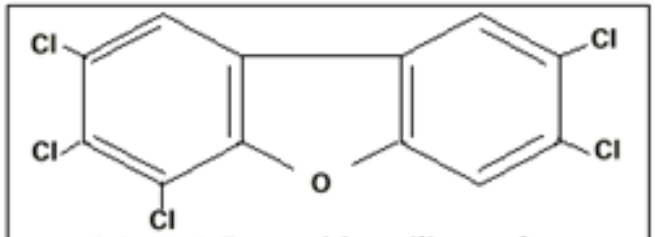
2,3,7,8-Tetrachlorodibenzo-p-dioxin



2,3,7,8-Tetrachlorodibenzofuran



1,2,3,7,8-Pentachlorodibenzo-p-dioxin

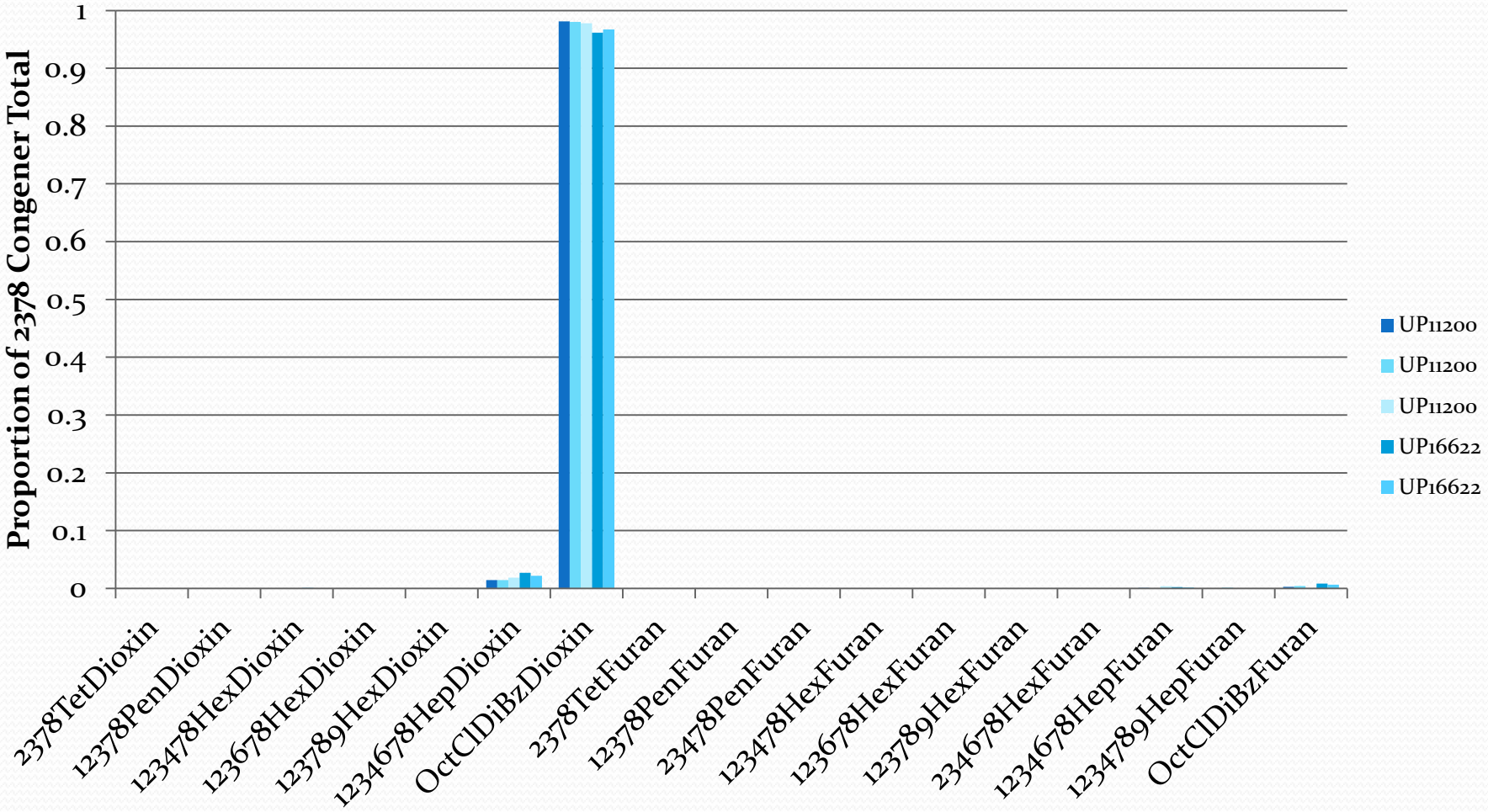


2,3,4,7,8-Pentachlorodibenzofuran

TOXIC EQUIVALENCY FACTORS (TEFs)

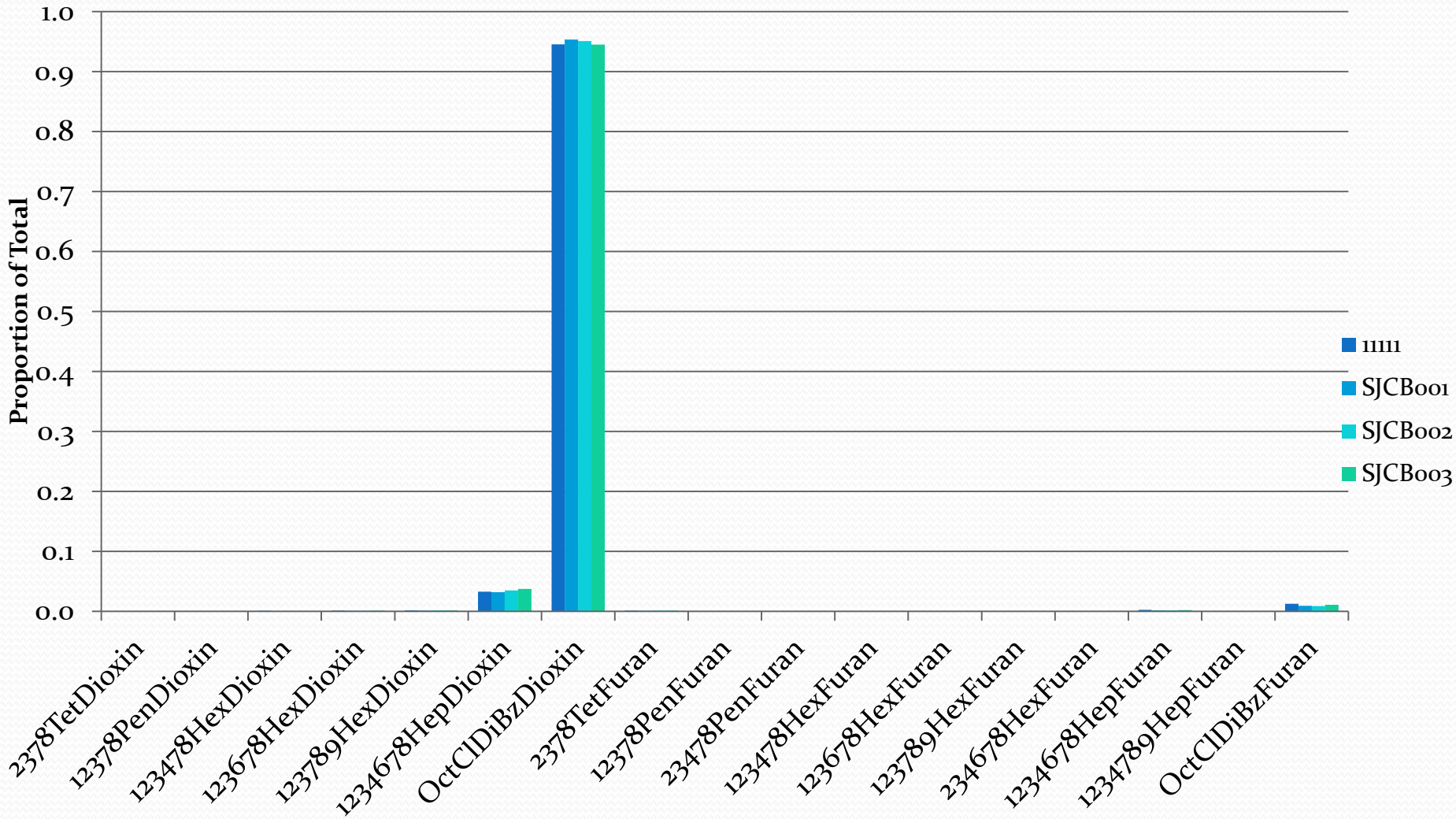
	TEF
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	1
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	0.01
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	0.0003
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.1
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.03
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.3
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.1
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.01
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.01
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	0.0003

UPSTREAM SAN JACINTO RIVER



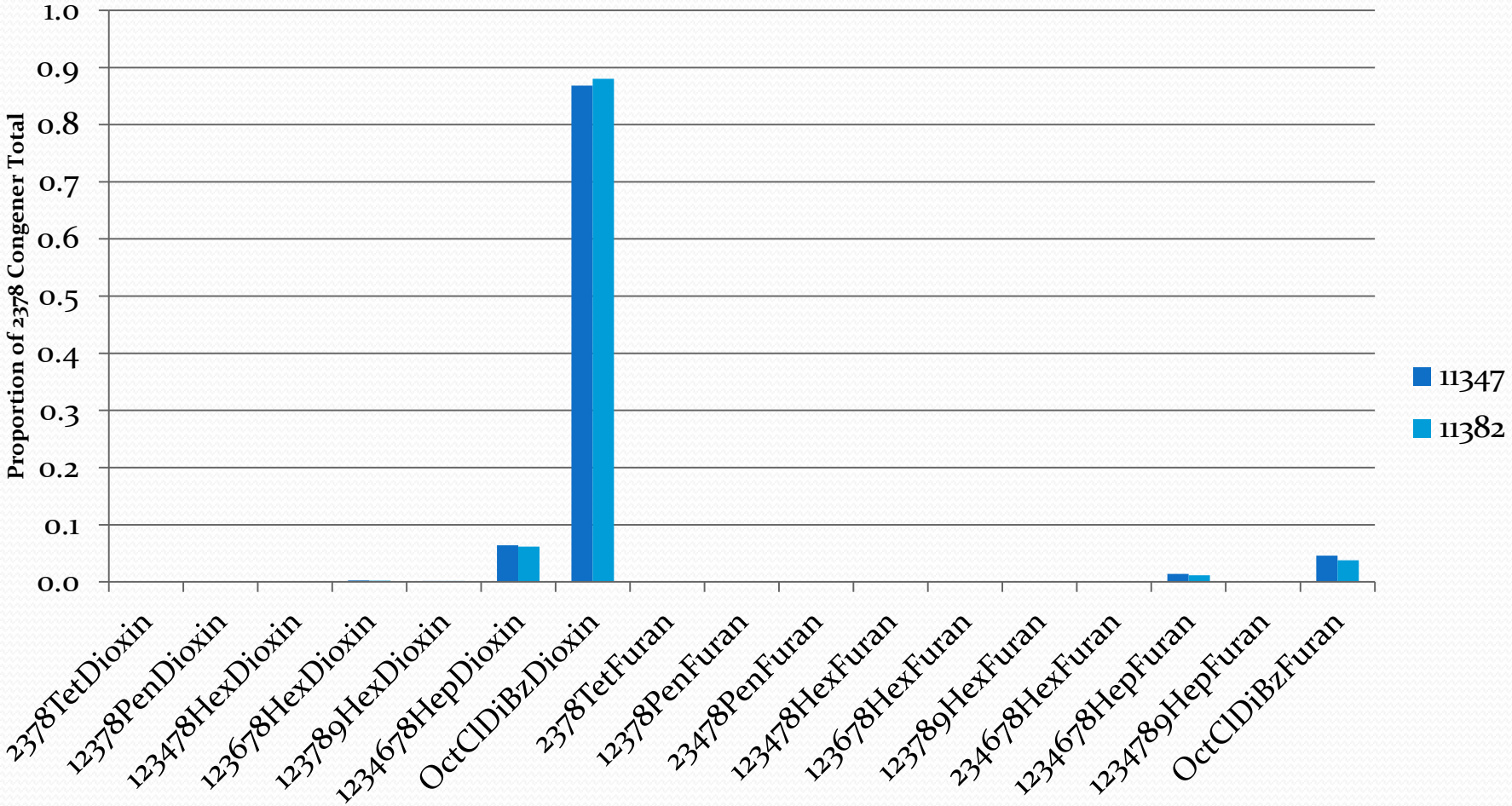
TEQ range = 0.4 to 3.1 ppt

CEDAR BAYOU



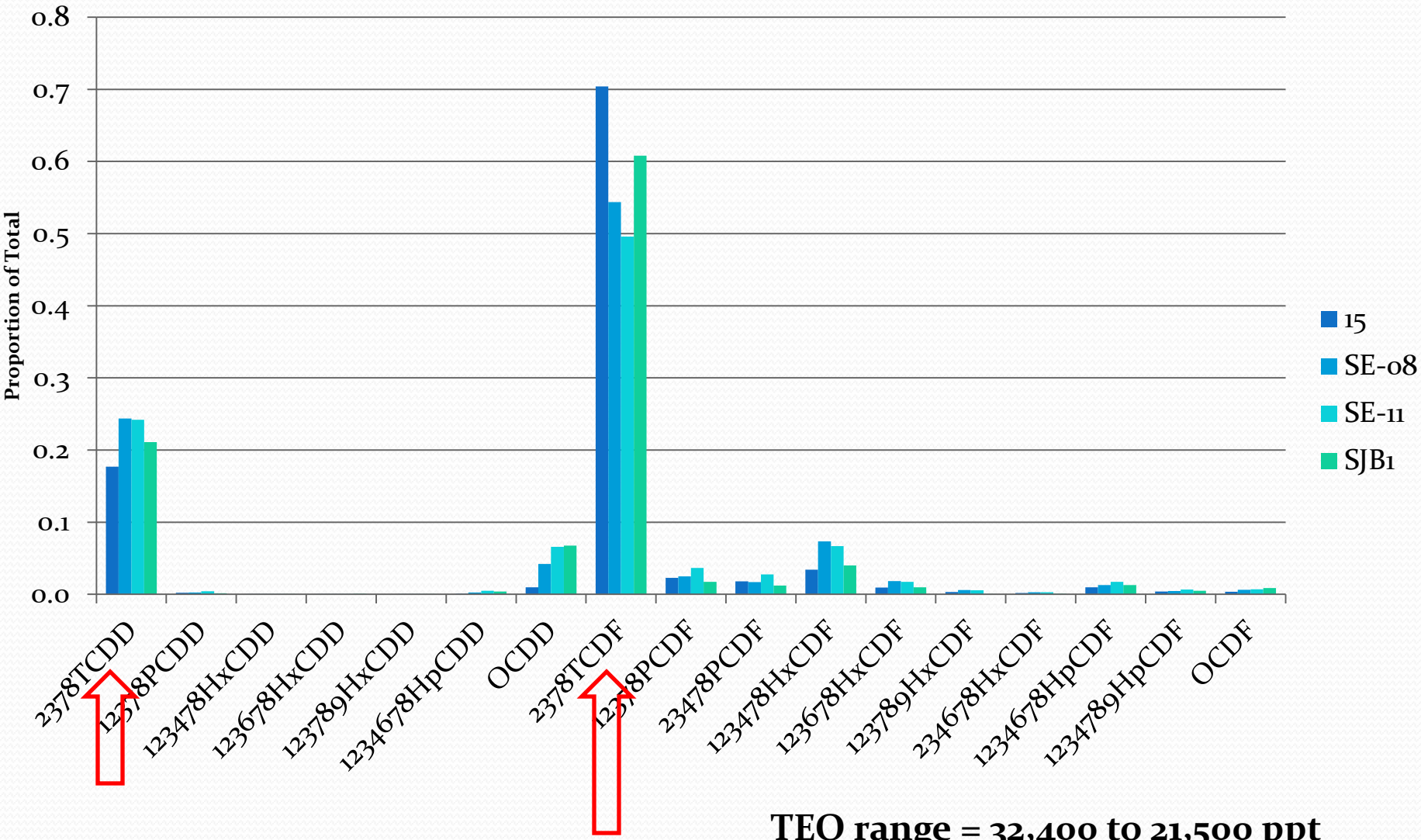
TEQ range = 0.8 to 8.1 ppt

BUFFALO BAYOU nr DOWNTOWN HOUSTON



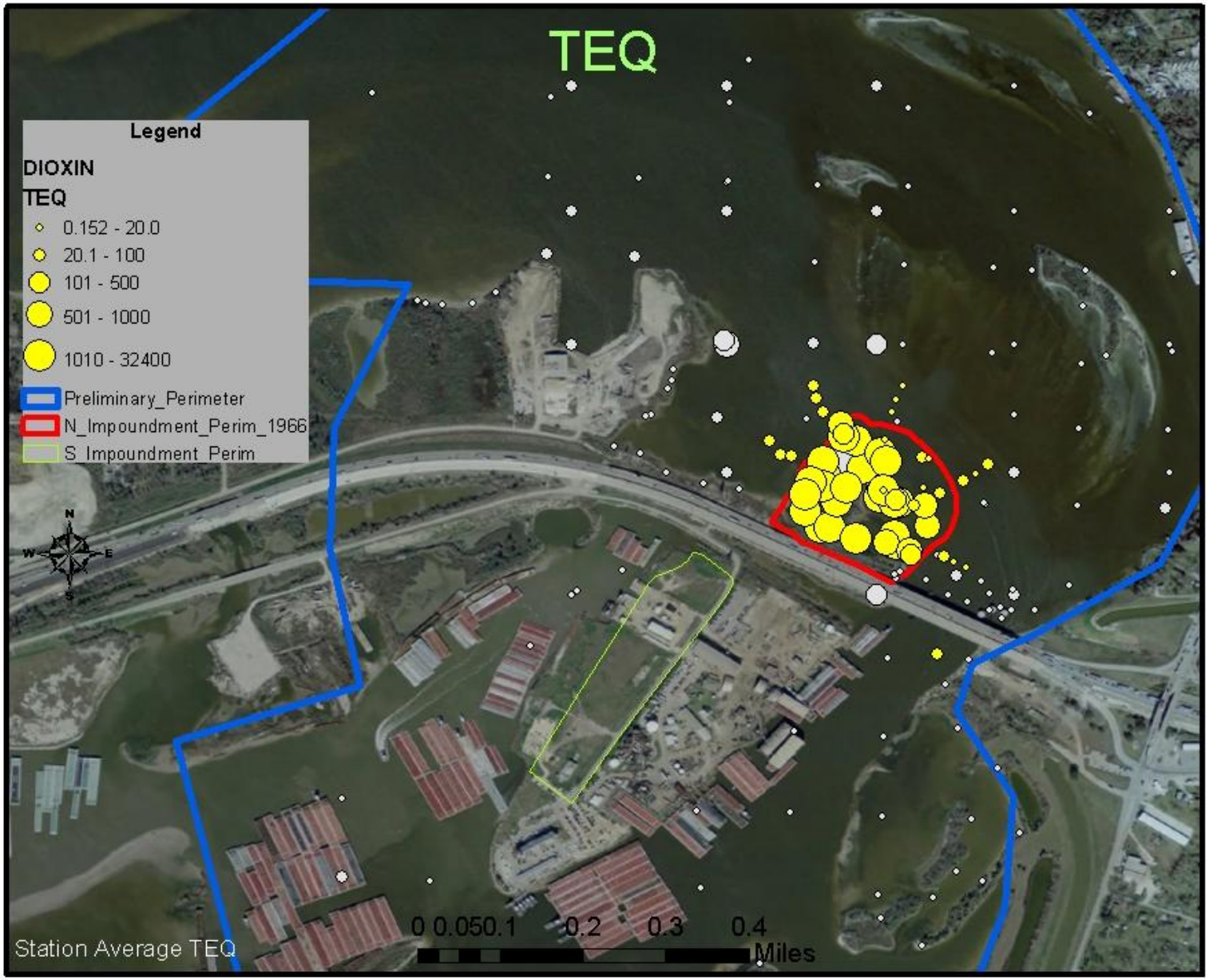
TEQ range = 1.7 to 4.8 ppt

SJRWP – 4 highest TEQ samples

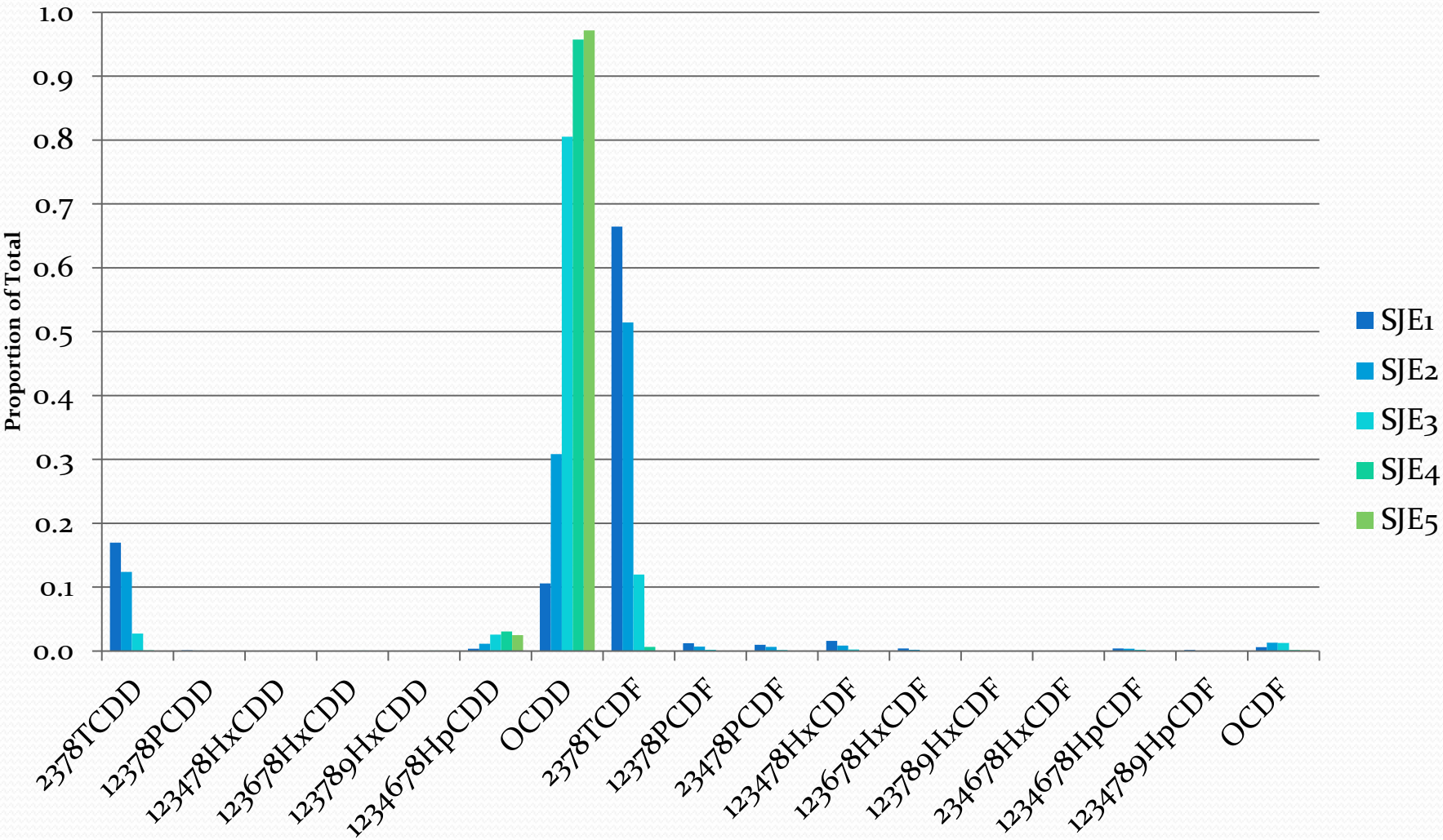


TEQ range = 32,400 to 21,500 ppt

TEQ in SJRWP area



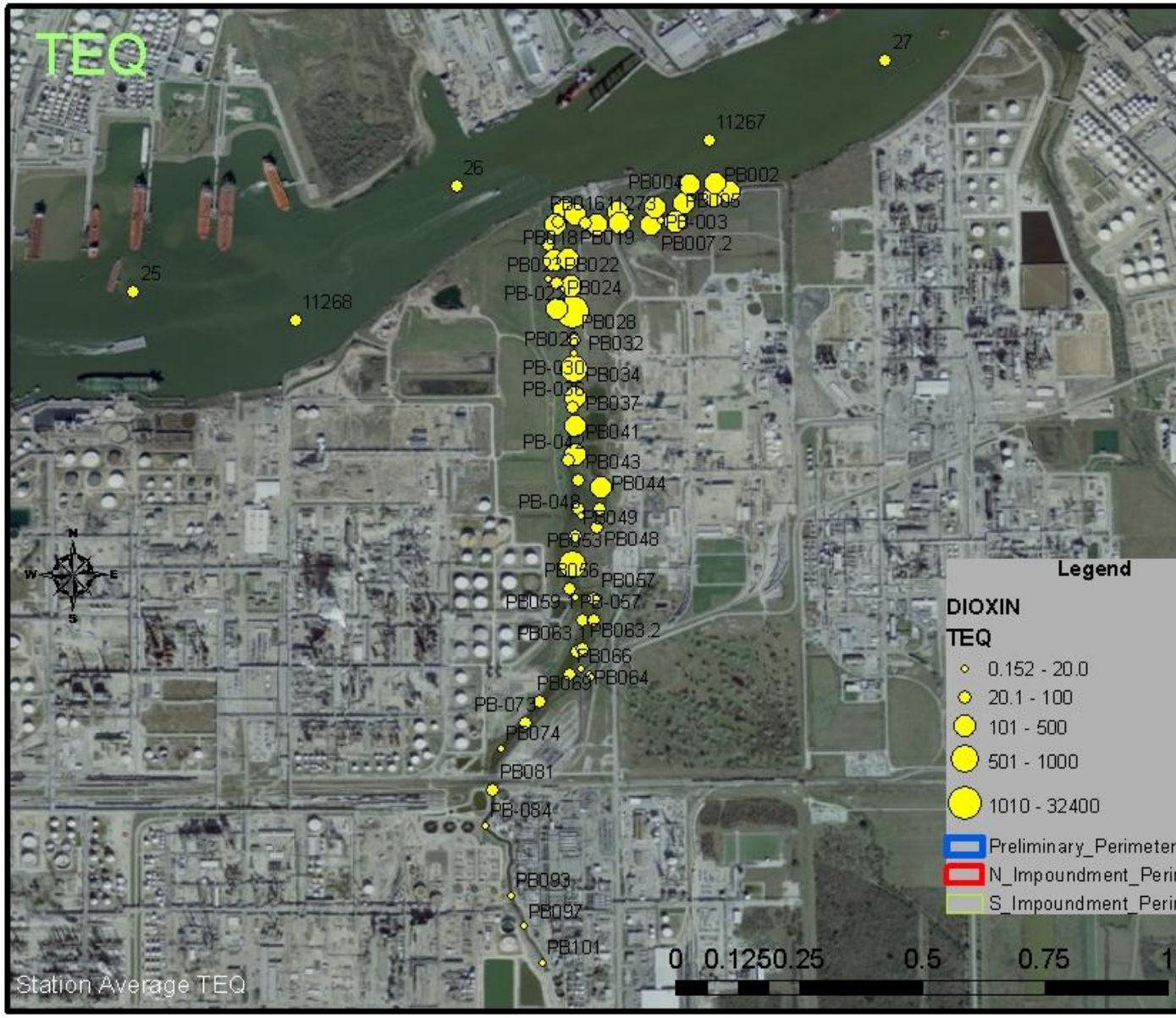
Transect E from TCRA



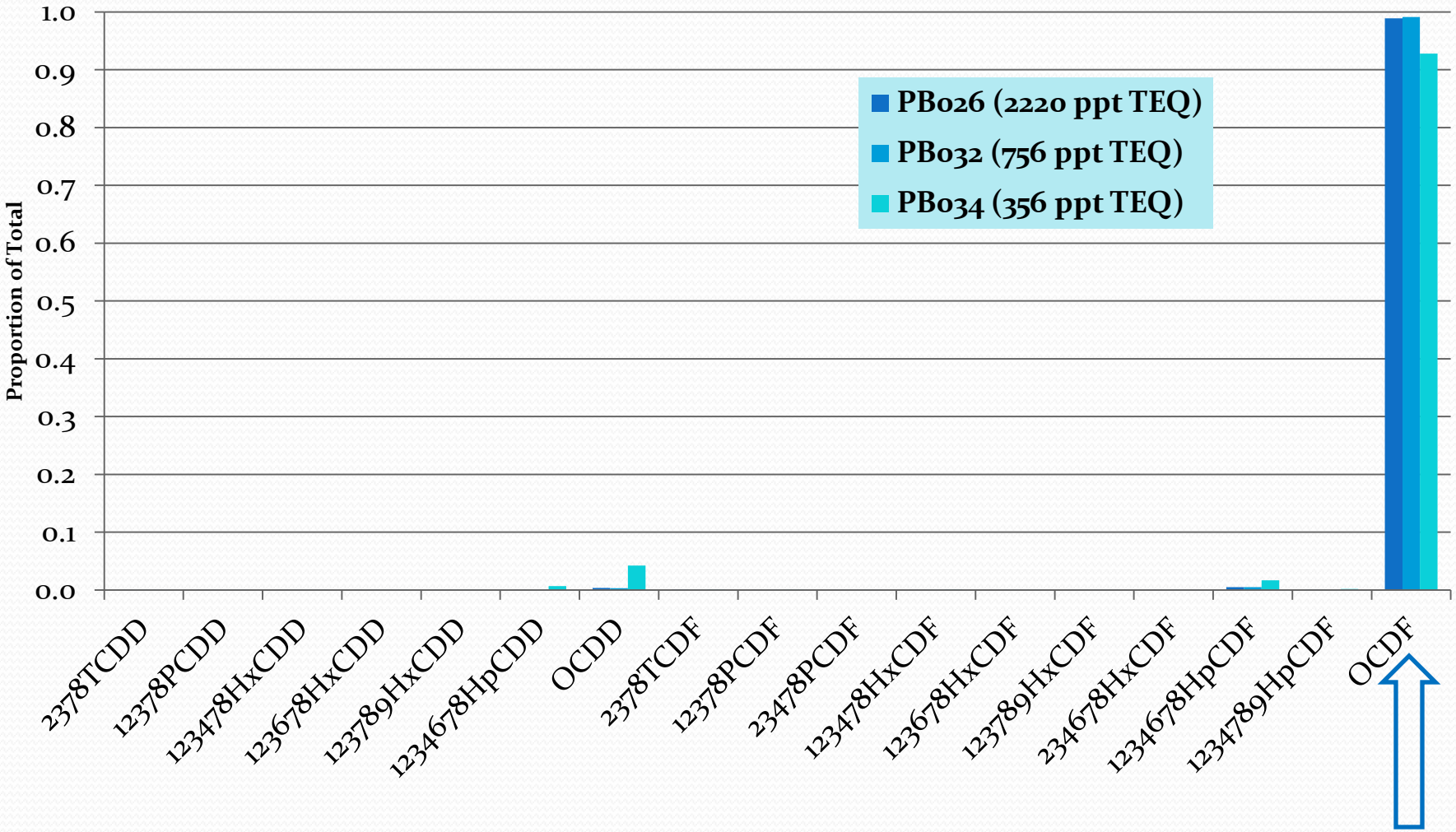
TEQ range = 1460 to 2.4 ppt

Patrick Bayou

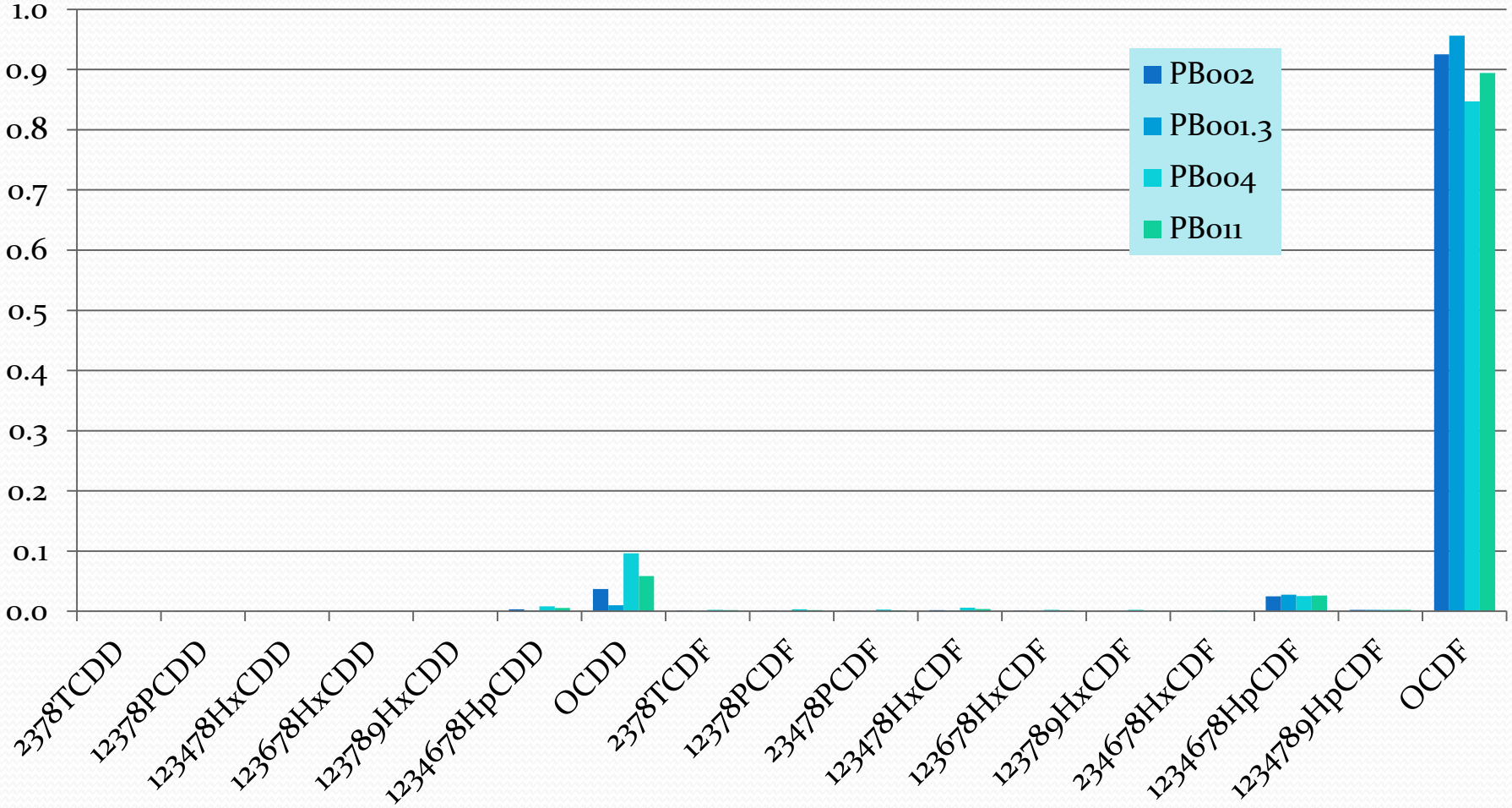
- 60 stations
- TEQ range: 0.2 to 2224 ppt
- Median = 73 ppt



Lower Patrick Bayou

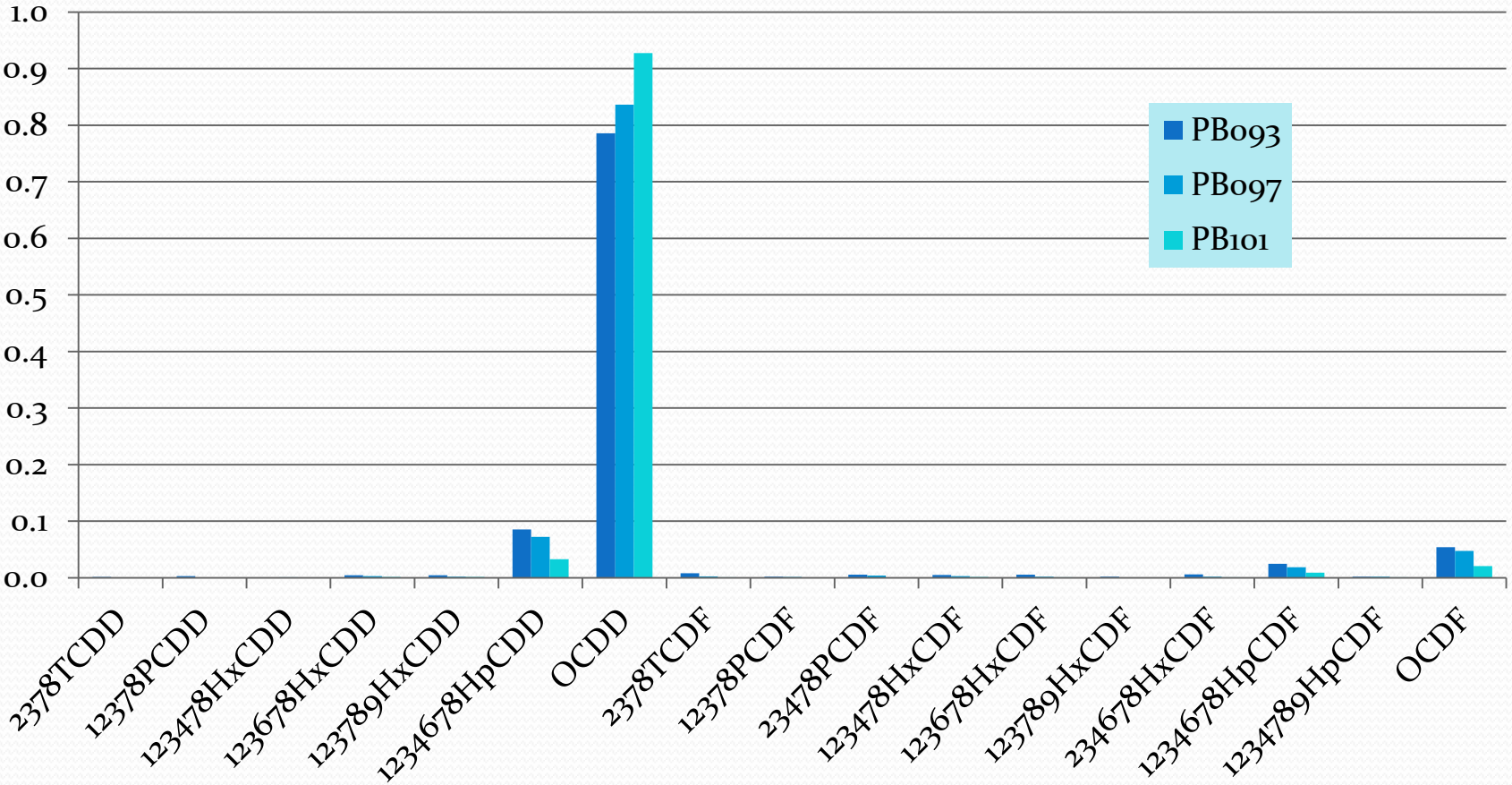


Patrick Bayou - mouth



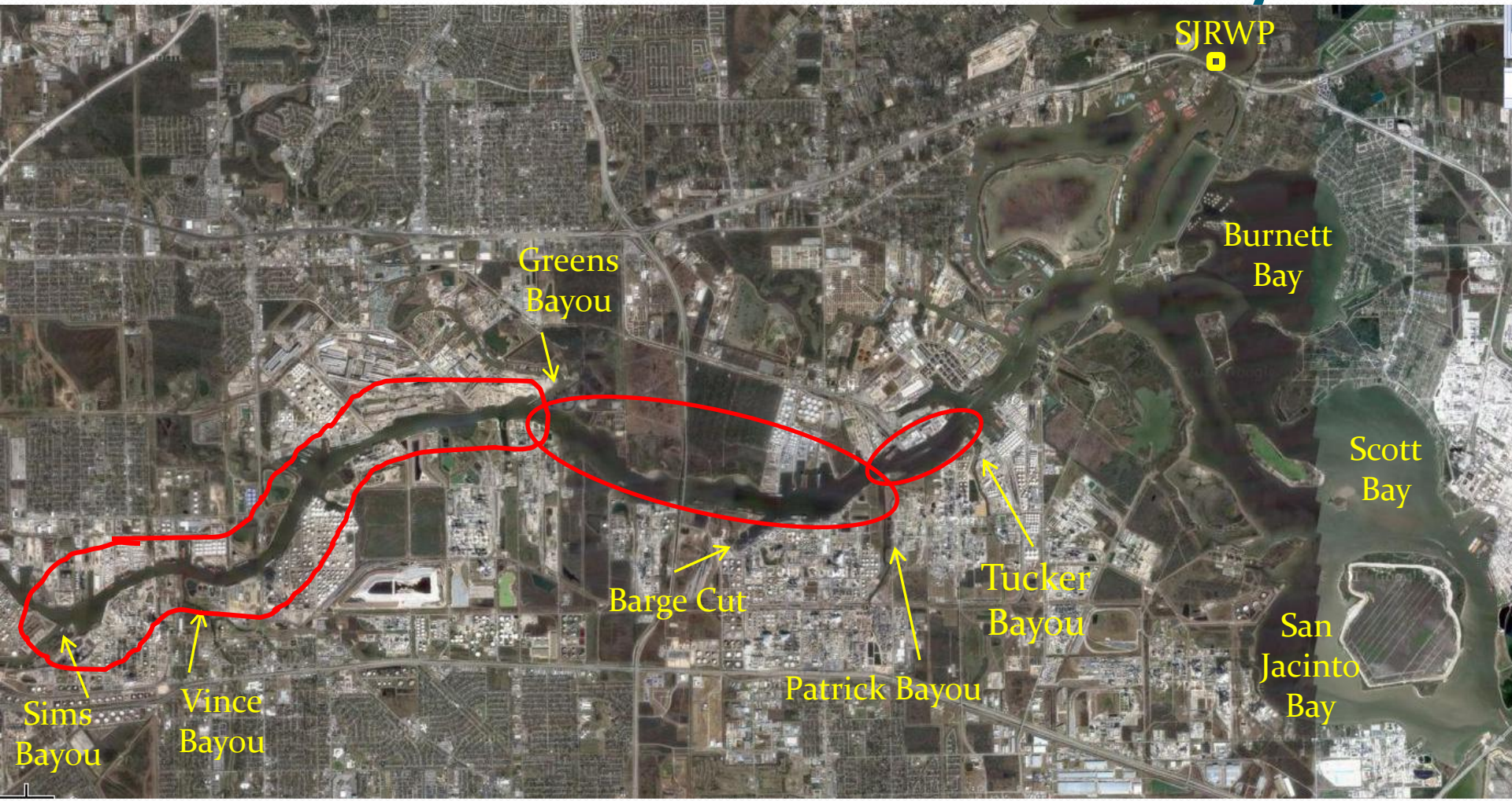
TEQ range = 272 to 181 ppt

Patrick Bayou – gunite portion

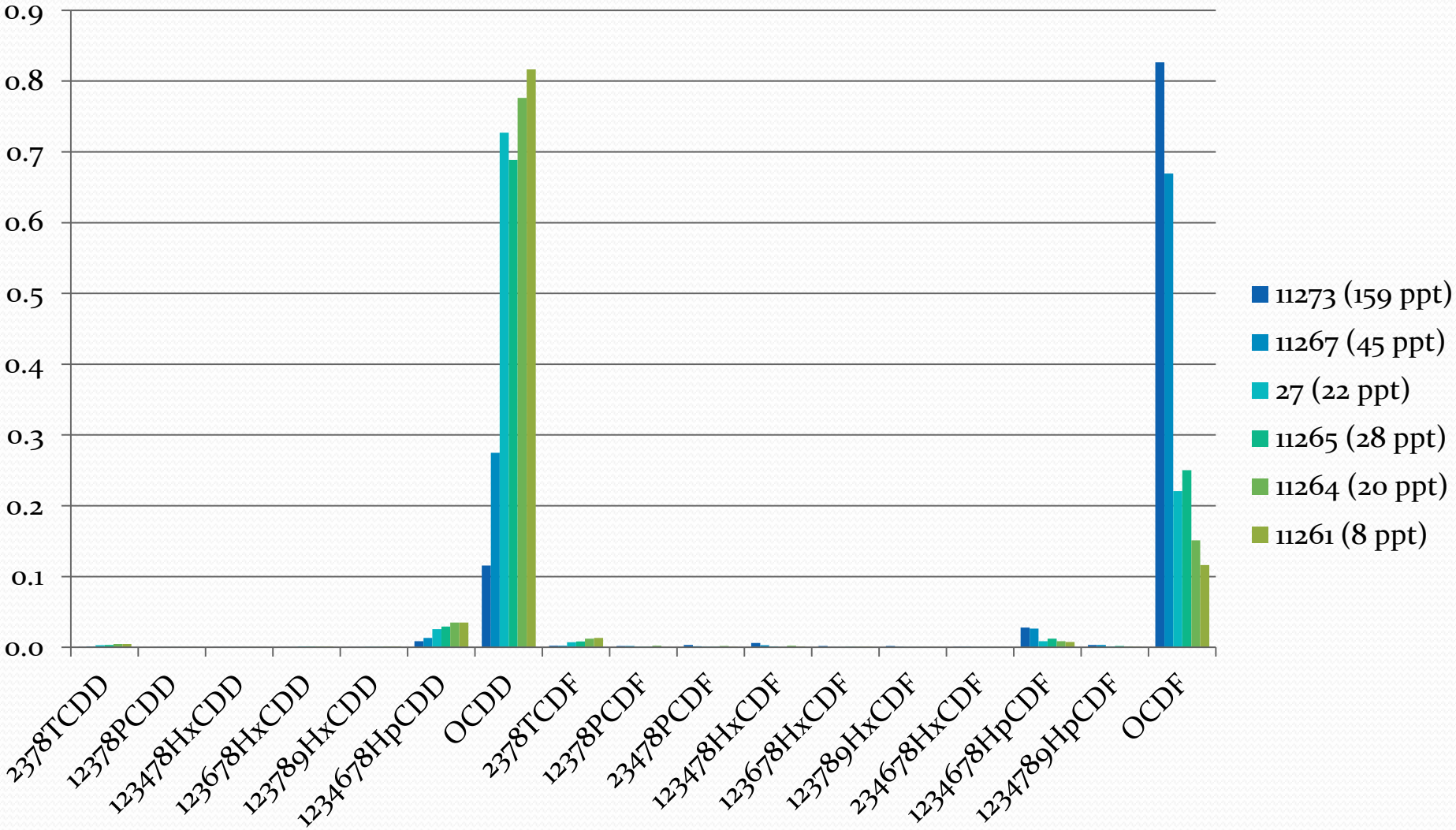


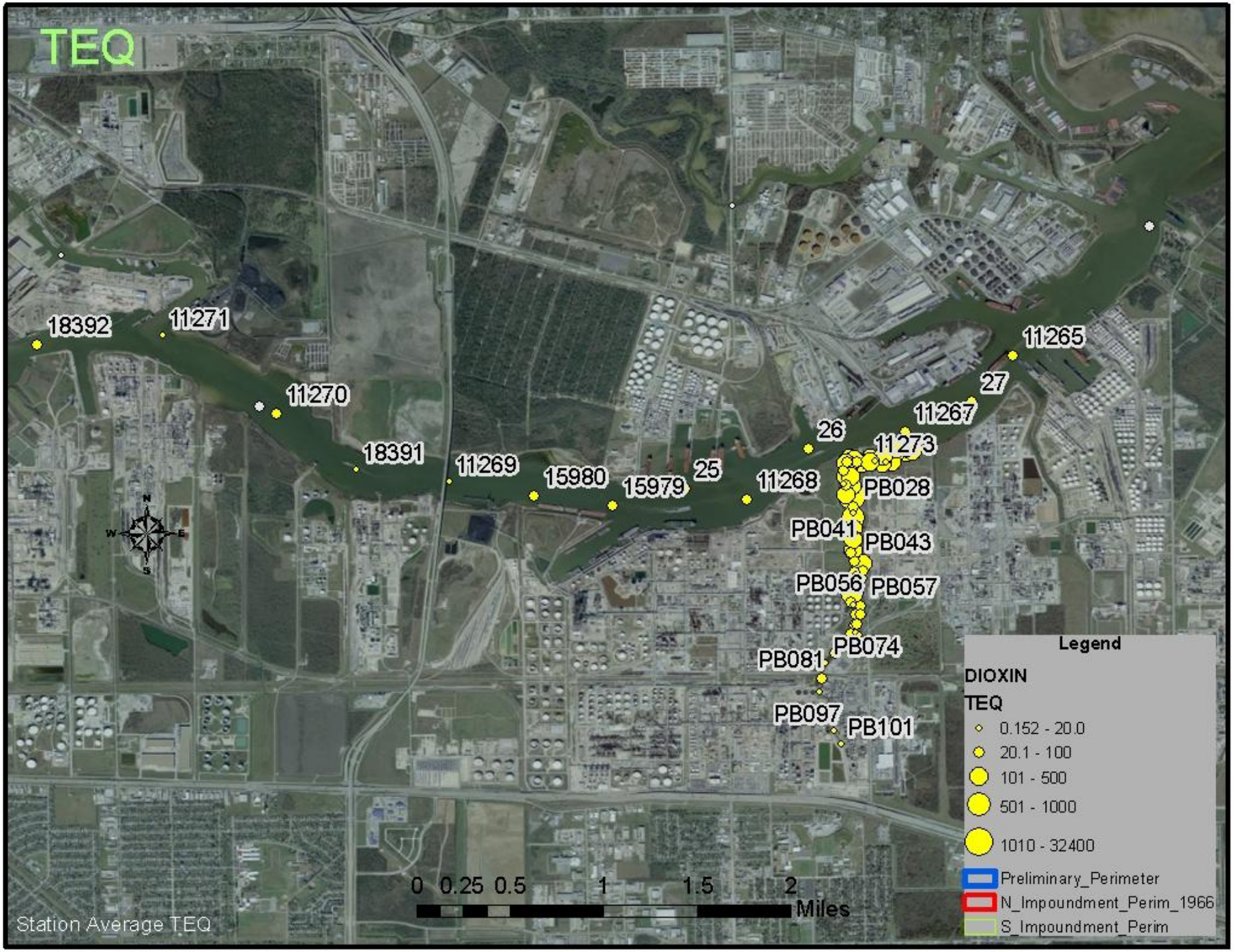
TEQ range = 0.6 to 2.3 ppt

HSC Tributaries and Side Bays

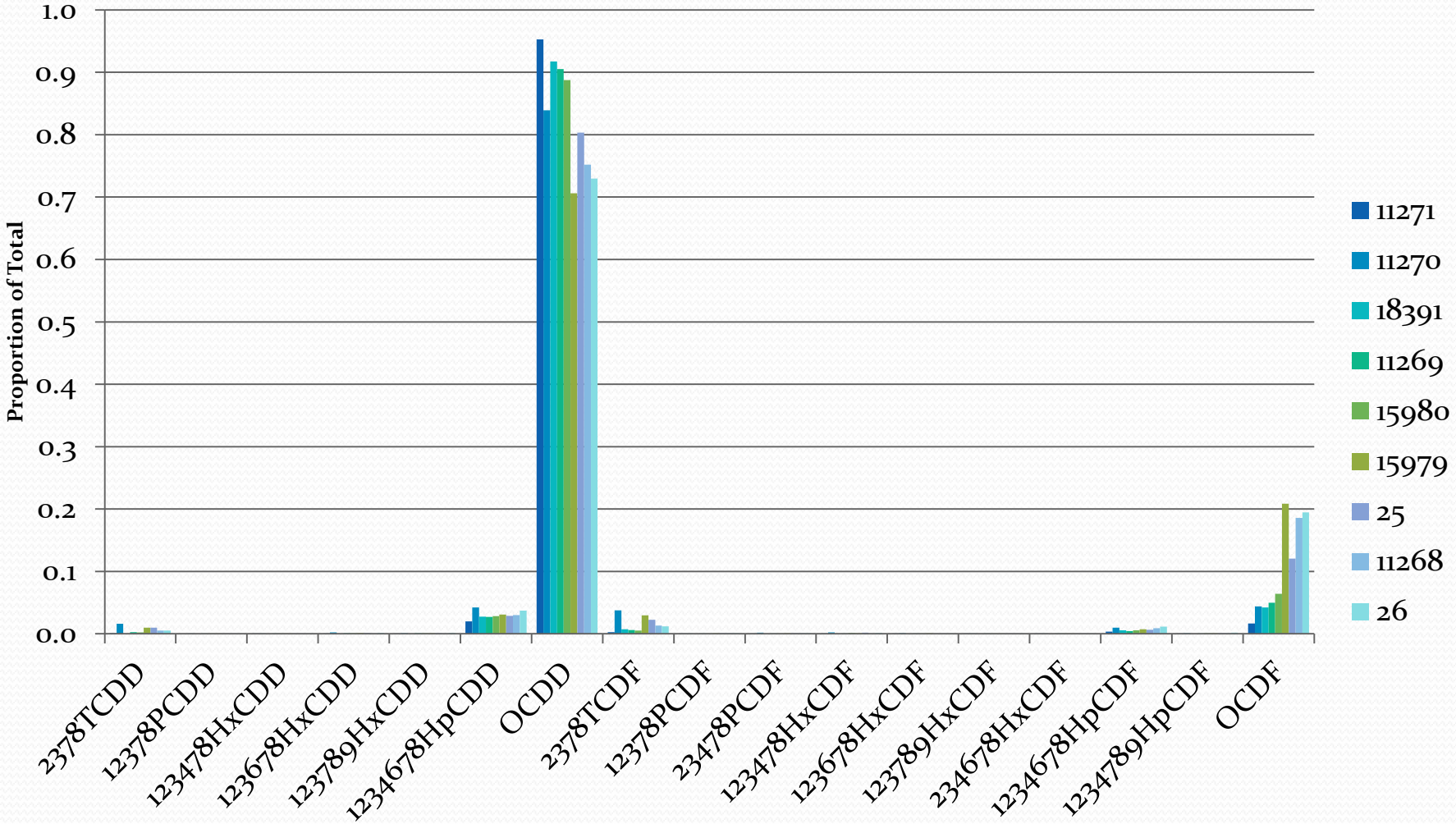


Patrick to SJR

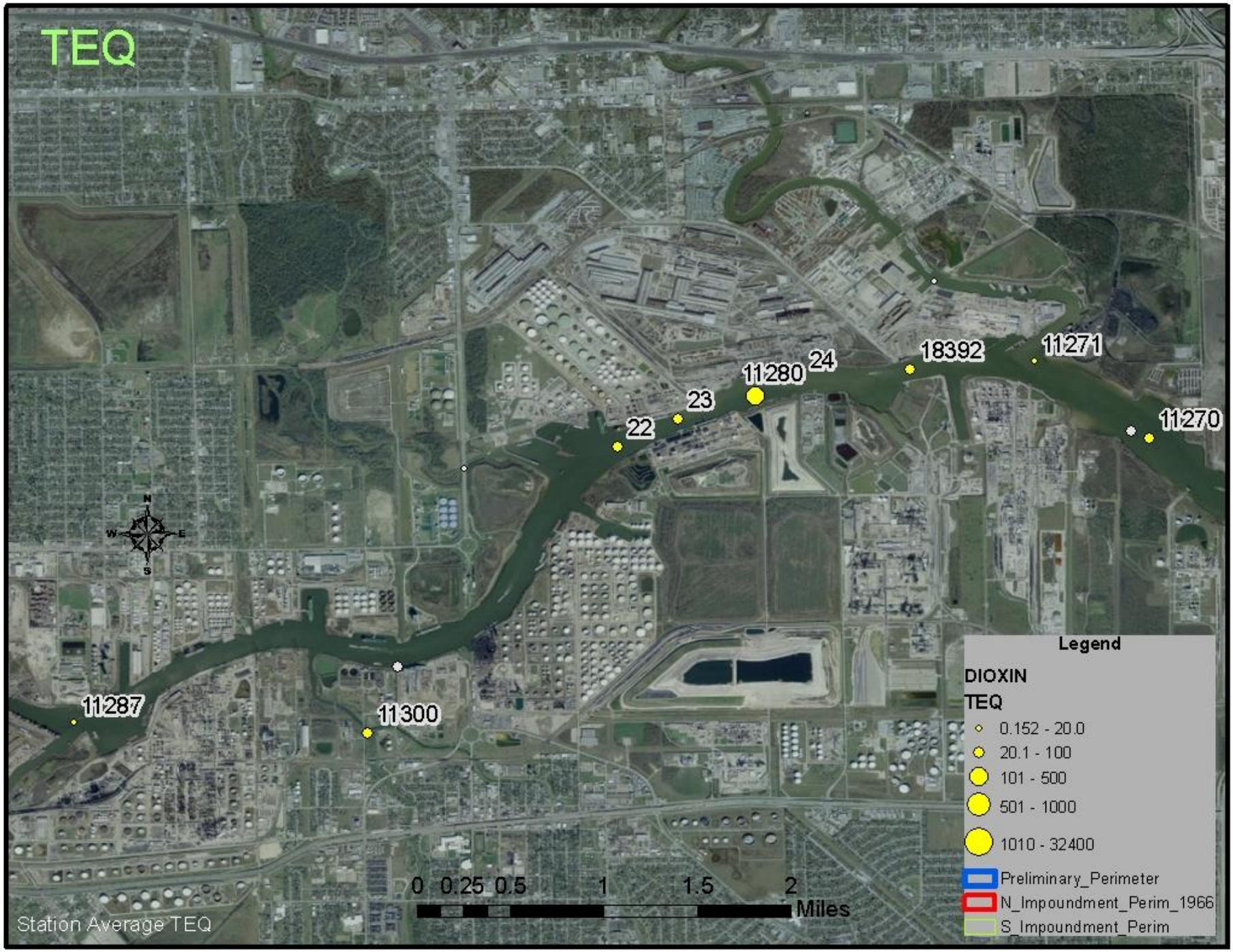



TEQ
18392
11271
11270
18391
11269
15980
15979
25
11268
26
11265
27
11267
11273
PB028
PB041
PB043
PB056
PB057
PB074
PB081
PB097
PB101
N
S
E
W
0 0.25 0.5 1 1.5 2
Miles
Station Average TEQ
Legend
DIOXIN
TEQ
0.152 - 20.0
20.1 - 100
101 - 500
501 - 1000
1010 - 32400
Preliminary_Perimeter
N_Impoundment_Perim_1966
S_Impoundment_Perim

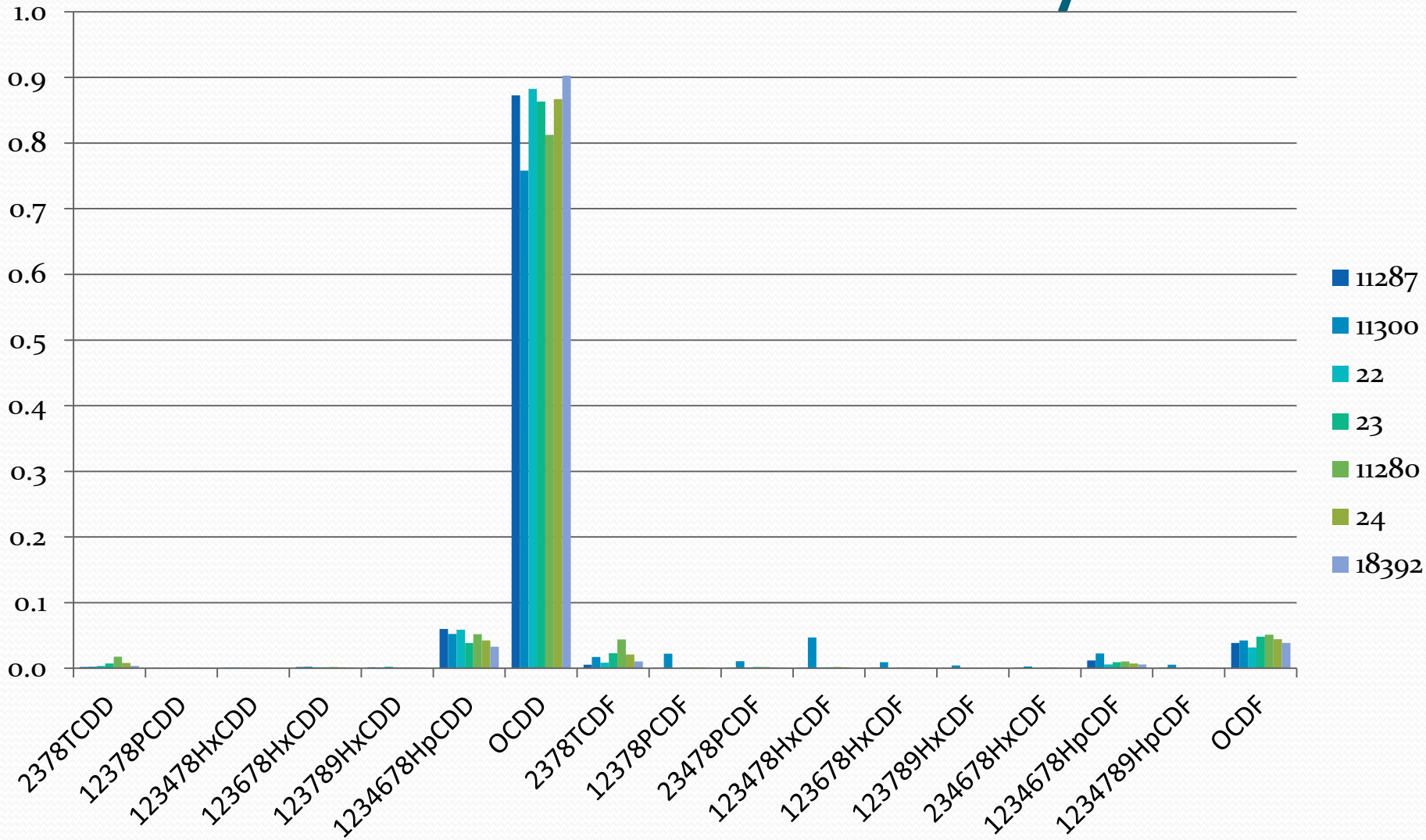
HSC – Greens to Patrick



11270 TEQ = 74 ppt, 15979 TEQ = 71 ppt, Others < 44 ppt

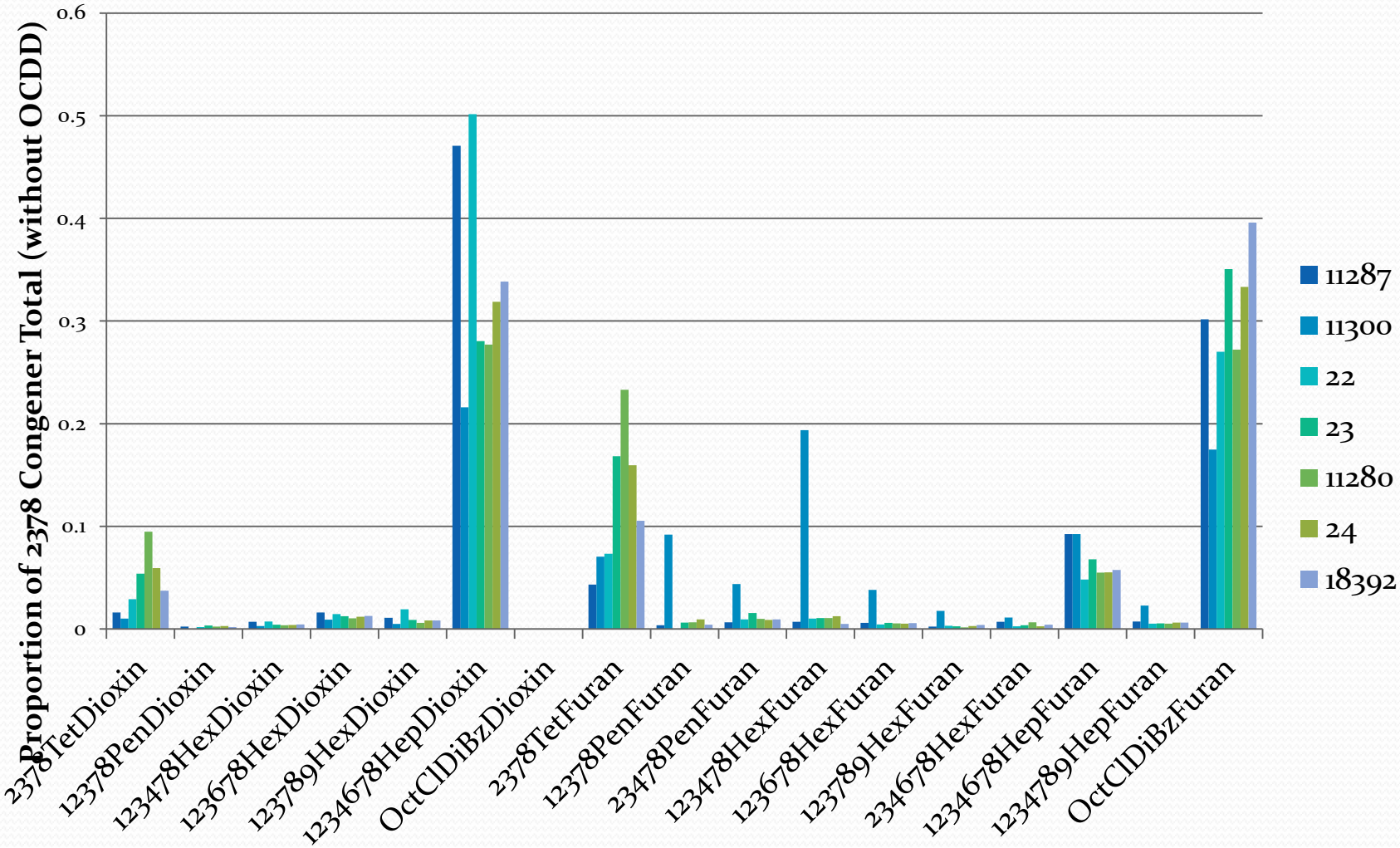

TEQ
11287
11300
22
23
11280
24
18392
11271
11270
N
W
E
S
Legend
DIOXIN
TEQ
0.152 - 20.0
20.1 - 100
101 - 500
501 - 1000
1010 - 32400
Preliminary_Perimeter
N_Impoundment_Perim_1966
S_Impoundment_Perim
0 0.25 0.5 1 1.5 2
Miles
Station Average TEQ

HSC – Sims to Greens Bayou



11287 TEQ = 14 ppt, 11300 TEQ = 84 ppt 11280 TEQ = 194 ppt, others < 63 ppt

HSC - Sims Bayou to Greens Bayou



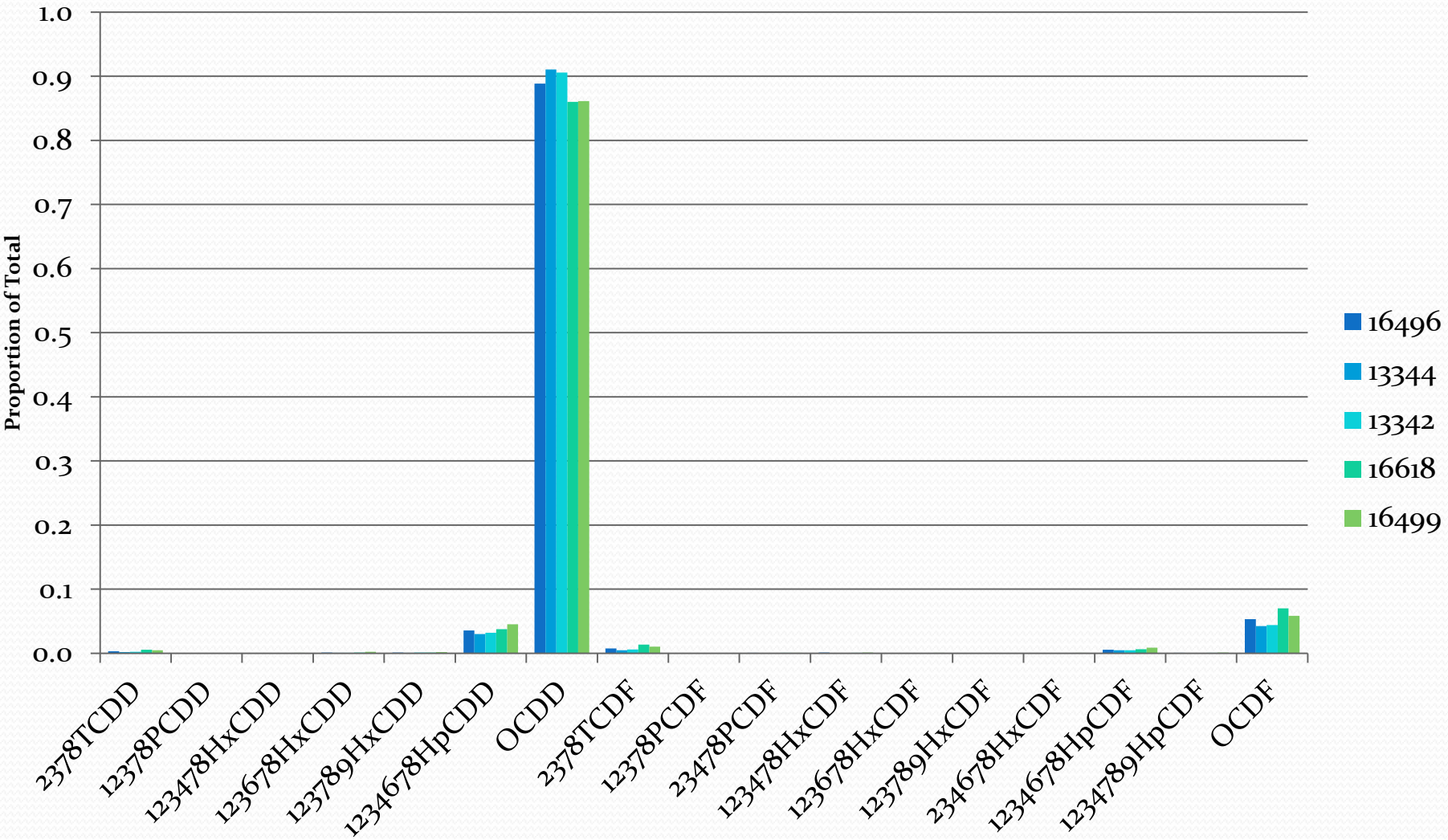
11287 TEQ = 14 ppt, 11300 TEQ = 84 ppt 11280 TEQ = 194 ppt, others < 63 ppt

HSC Side Bays

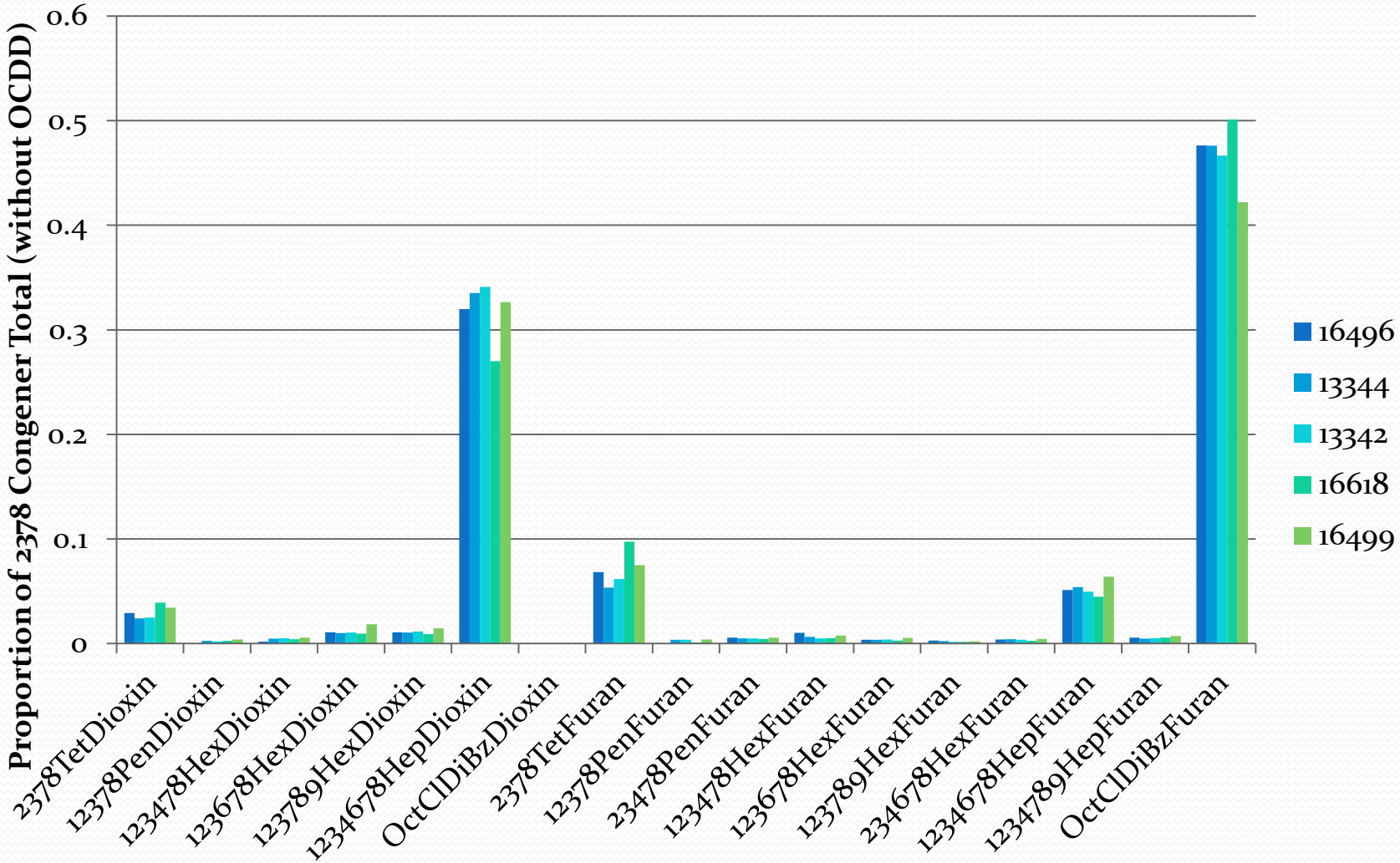
- All have similar fingerprints and TEQ levels

- Burnett Bay
  - 16496, TEQ = 34 ppt
  - 13344, TEQ = 29 ppt
- Scott Bay
  - 13342, TEQ = 29 ppt
  - 16618, TEQ = 24 ppt
- San Jacinto Bay
  - 16499, TEQ = 21.6 ppt

Side Bays


1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Proportion of Total
2378TCDD
12378PCDD
123478HxCDD
123678HxCDD
123789HxCDD
1234678HpCDD
OCDD
2378TCDF
12378PCDF
23478PCDF
123478HxCDF
123678HxCDF
123789HxCDF
234678HxCDF
1234678HpCDF
1234789HpCDF
OCDF
16496
13344
13342
16618
16499

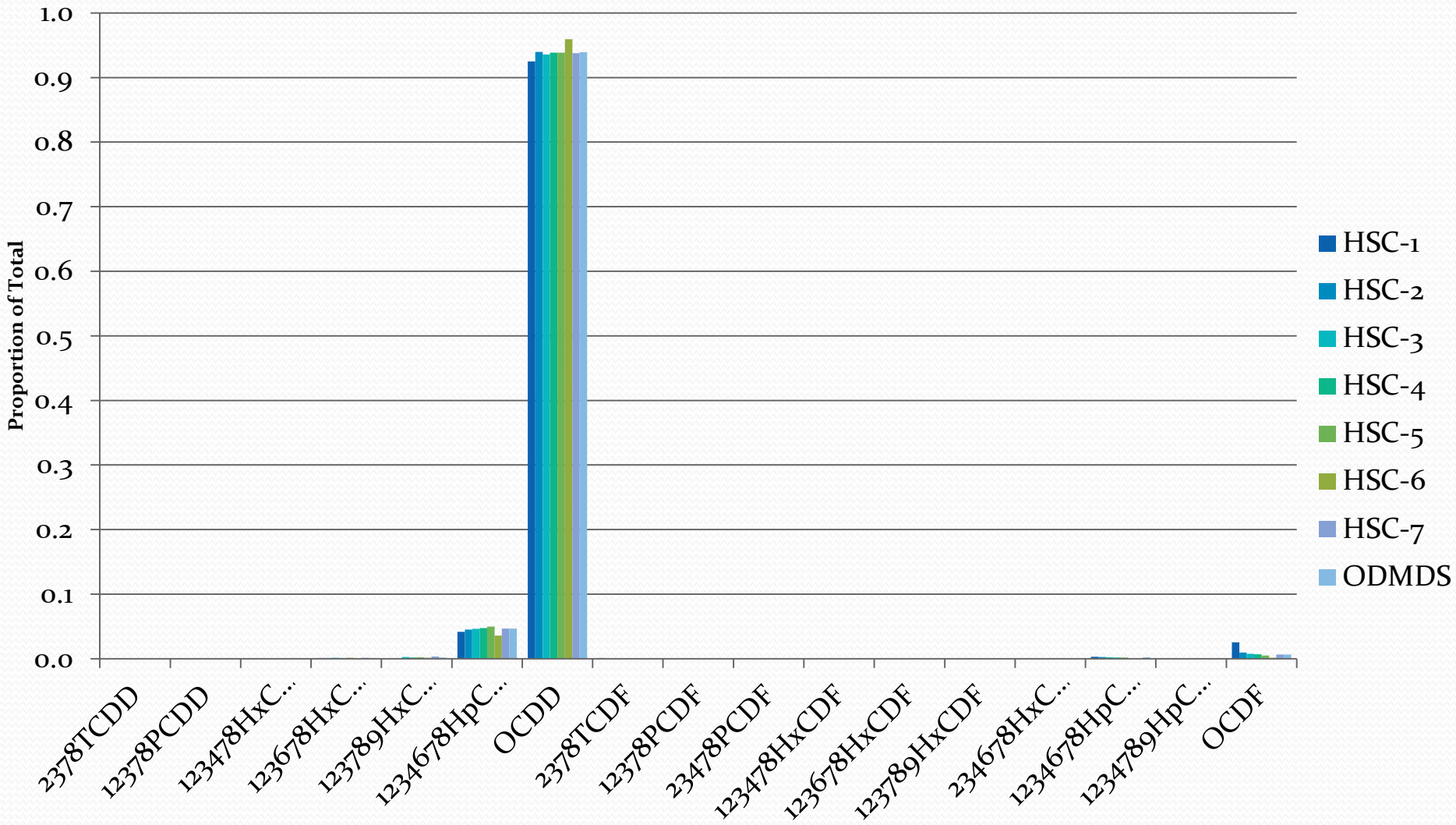
HSC Side Bay Congener Fingerprint



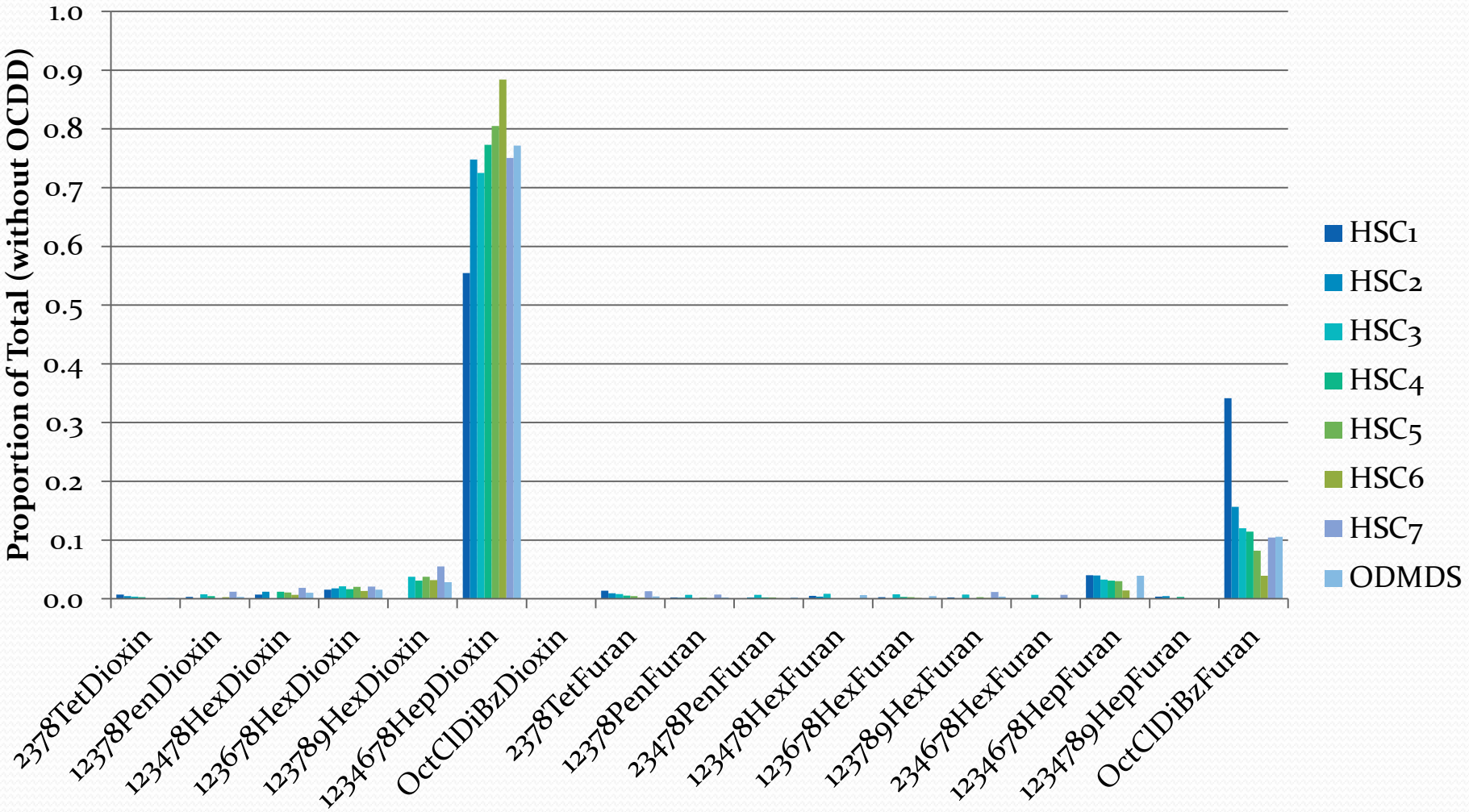
Galveston Bay Samples

- TEQs range from 6.4 ppt to less than 1 ppt
- Fingerprint similar to Upstream SJR background fingerprint
- TEQs on the picture (right) were calculated using WHO 2005 TEFs

Galveston Bay

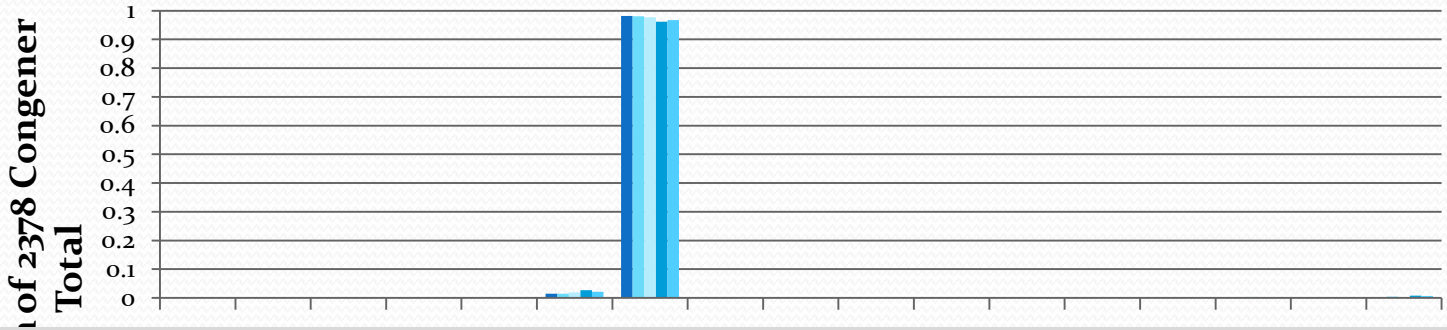


Galveston Bay Samples without OCDD

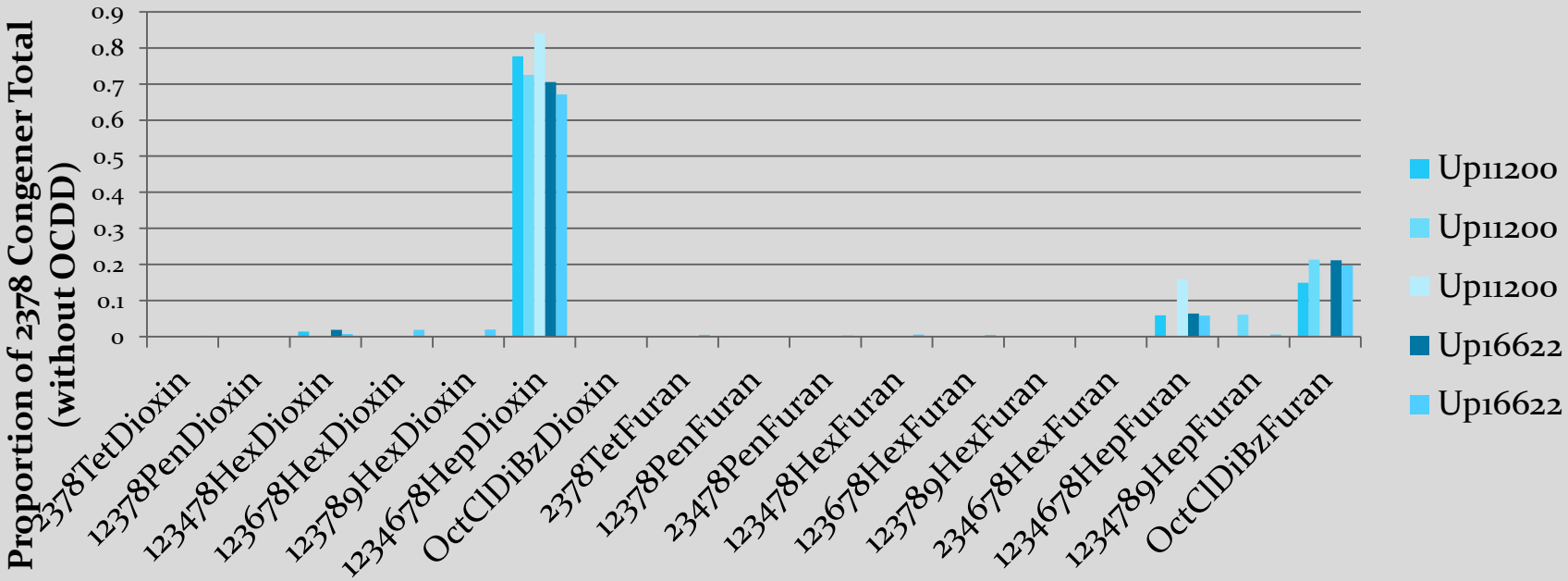


TEQ range from 0.2 to 6.4 ppt

Upstream SJR samples with OCDD

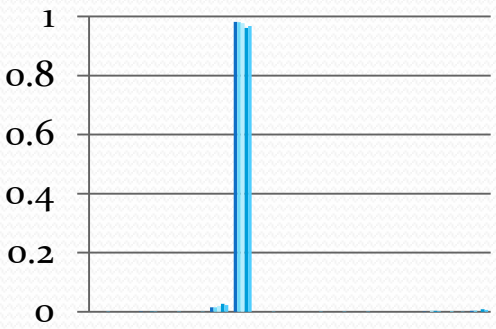


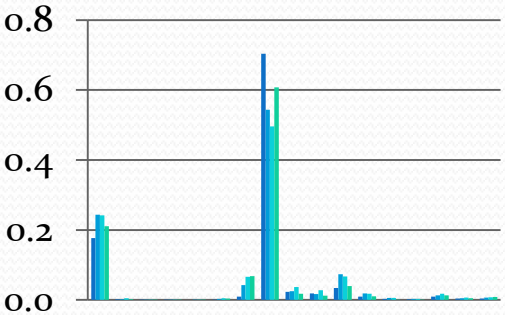
Upstream SJR samples without OCDD

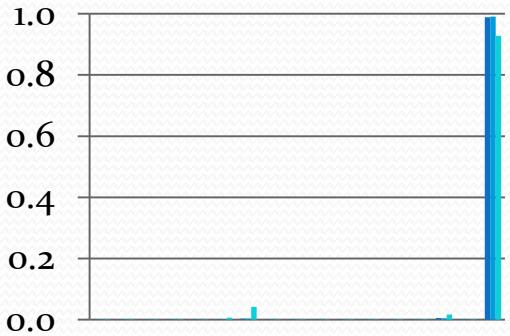


Summary

- Several fingerprints in the HSC project area
  1. Primarily OCDD (background)
  2. Elevated TCDD & TCDF (SJRWP)
  3. High OCDF
  4. Mixtures of these
- OCDD associated with lower TEQs
- #2 & #3 associated with higher TEQs



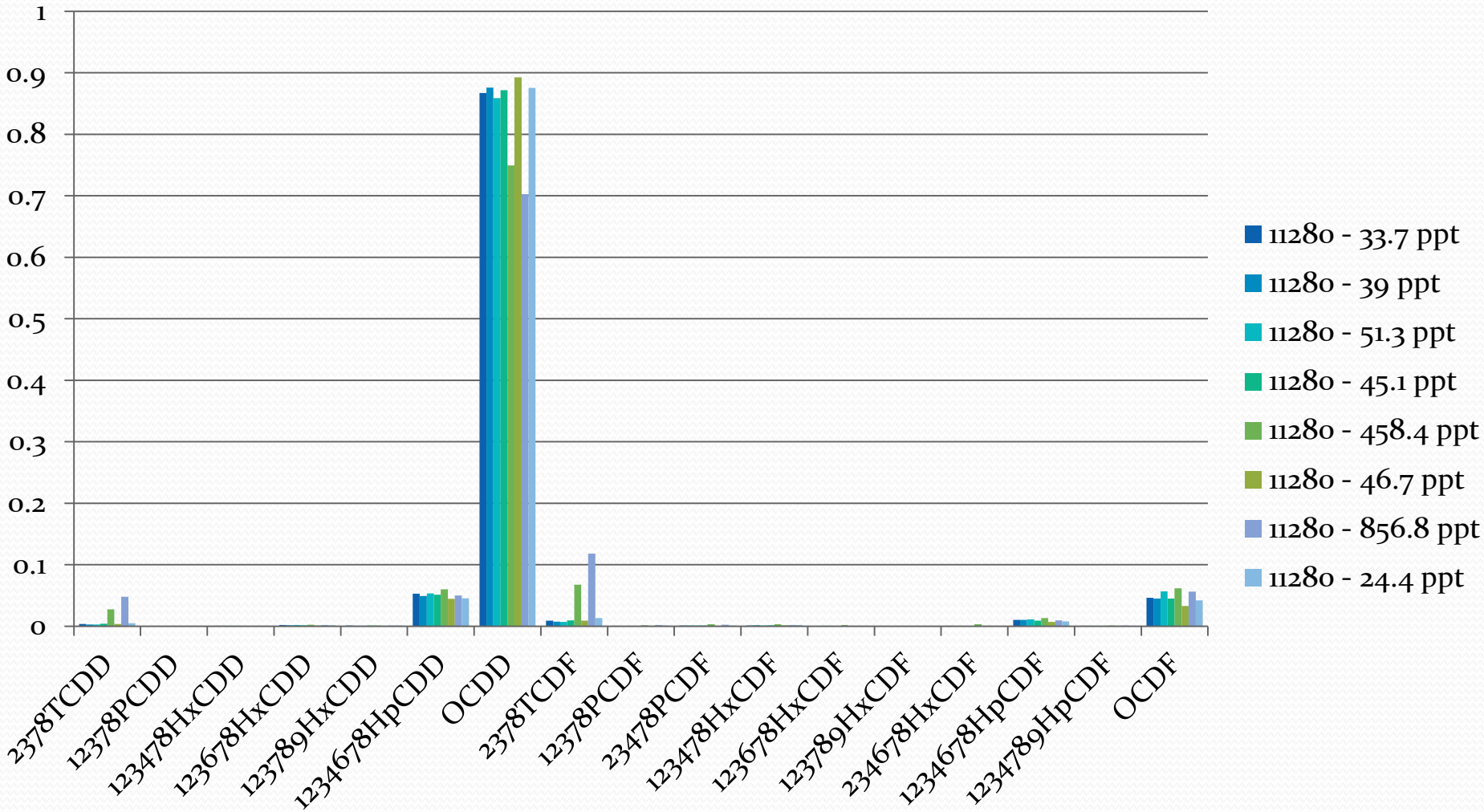




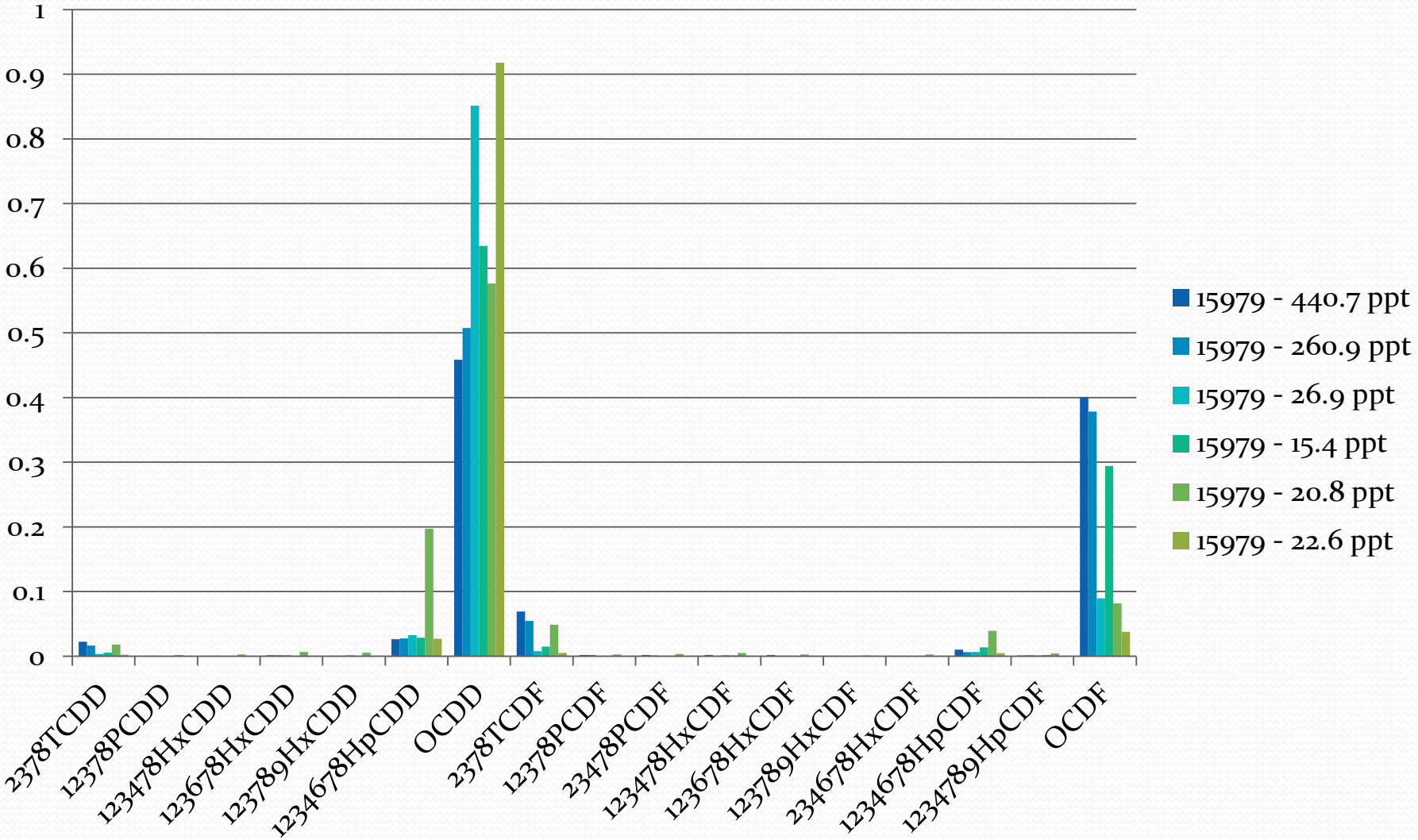
Questions?

Cabela's

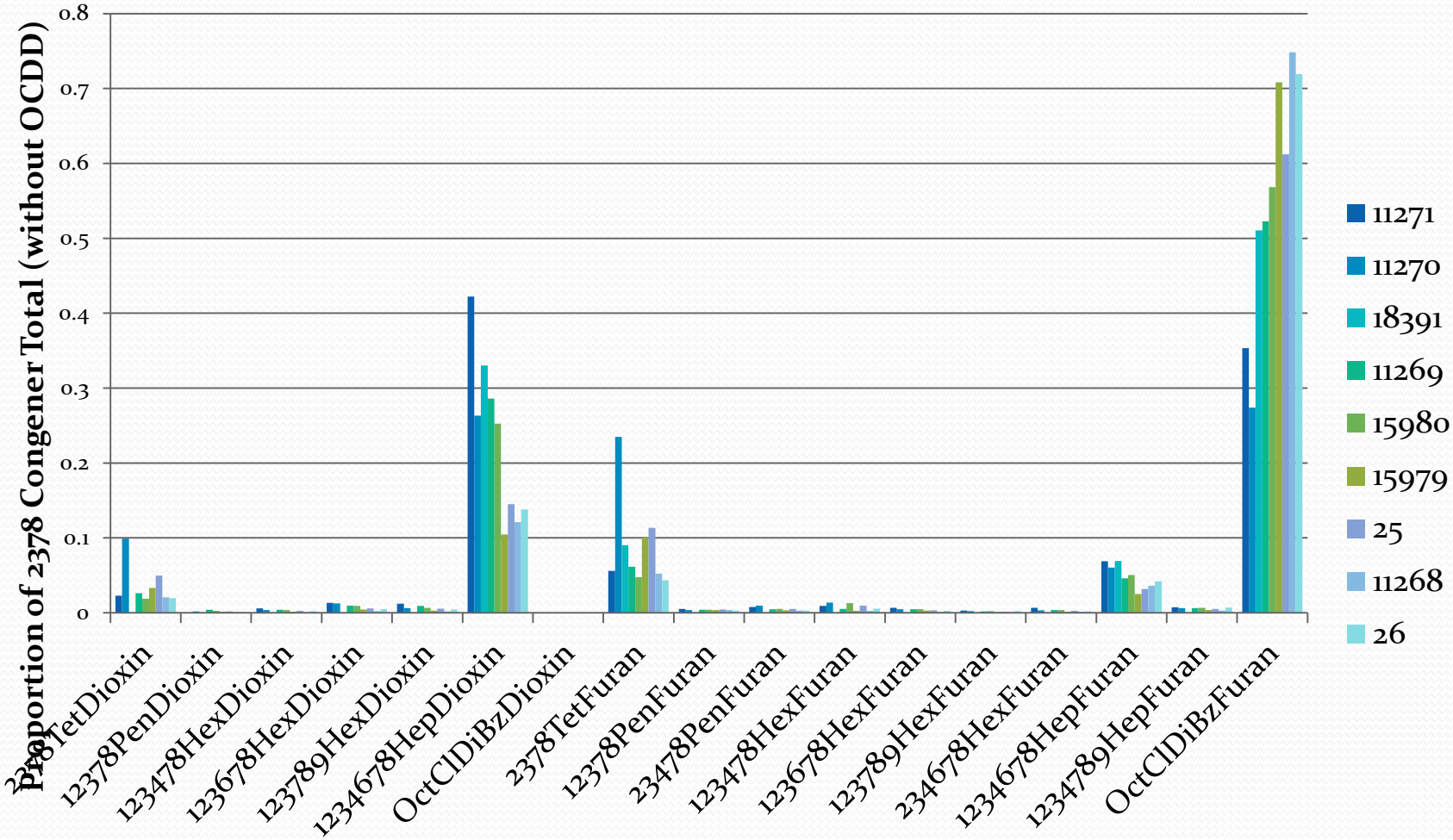
11280 – Aug 02 to Aug 05



15979 – Sept 02 to Nov 04

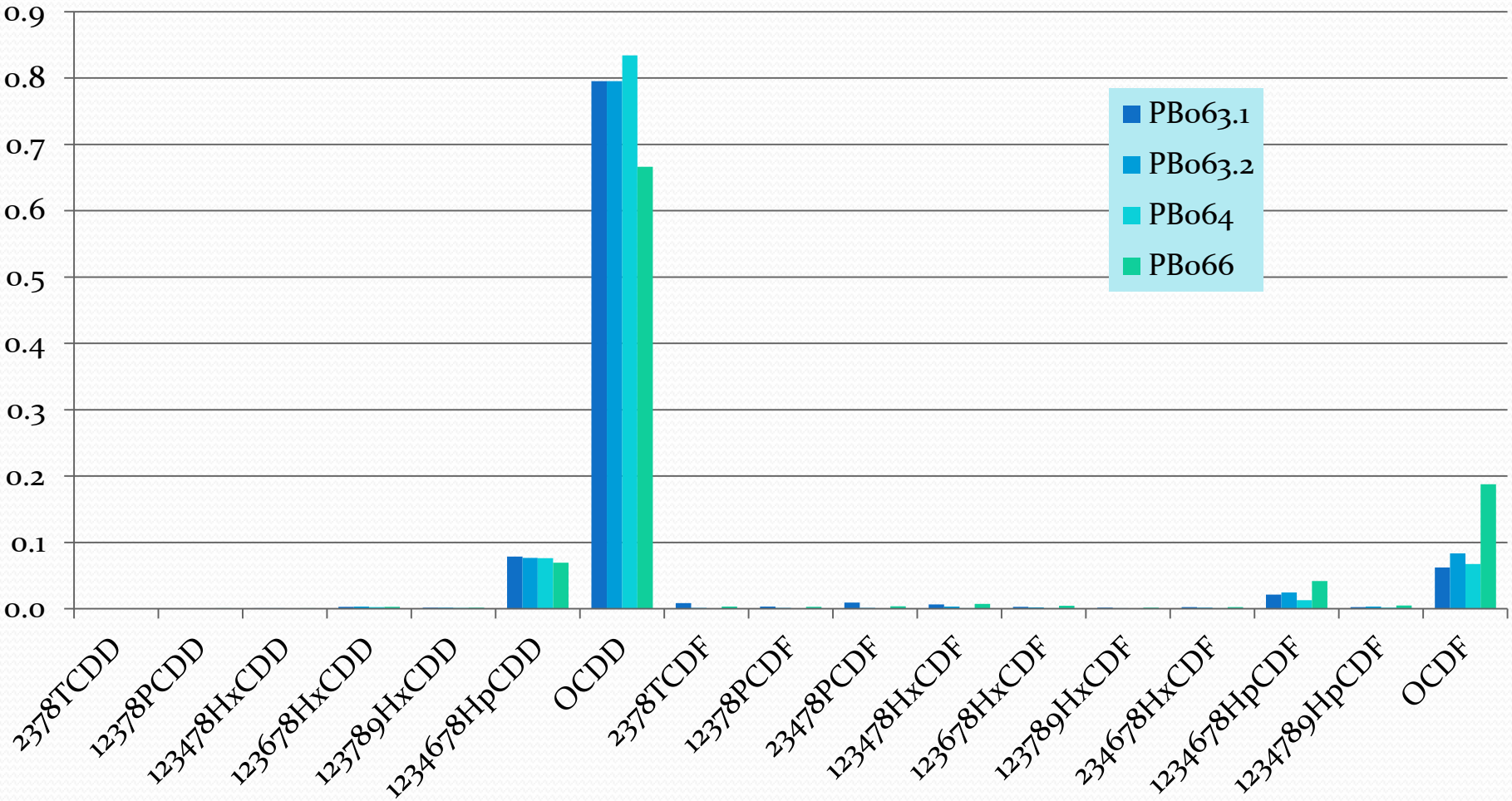


HSC - Greens Bayou to Patrick Bayou – No OCDD



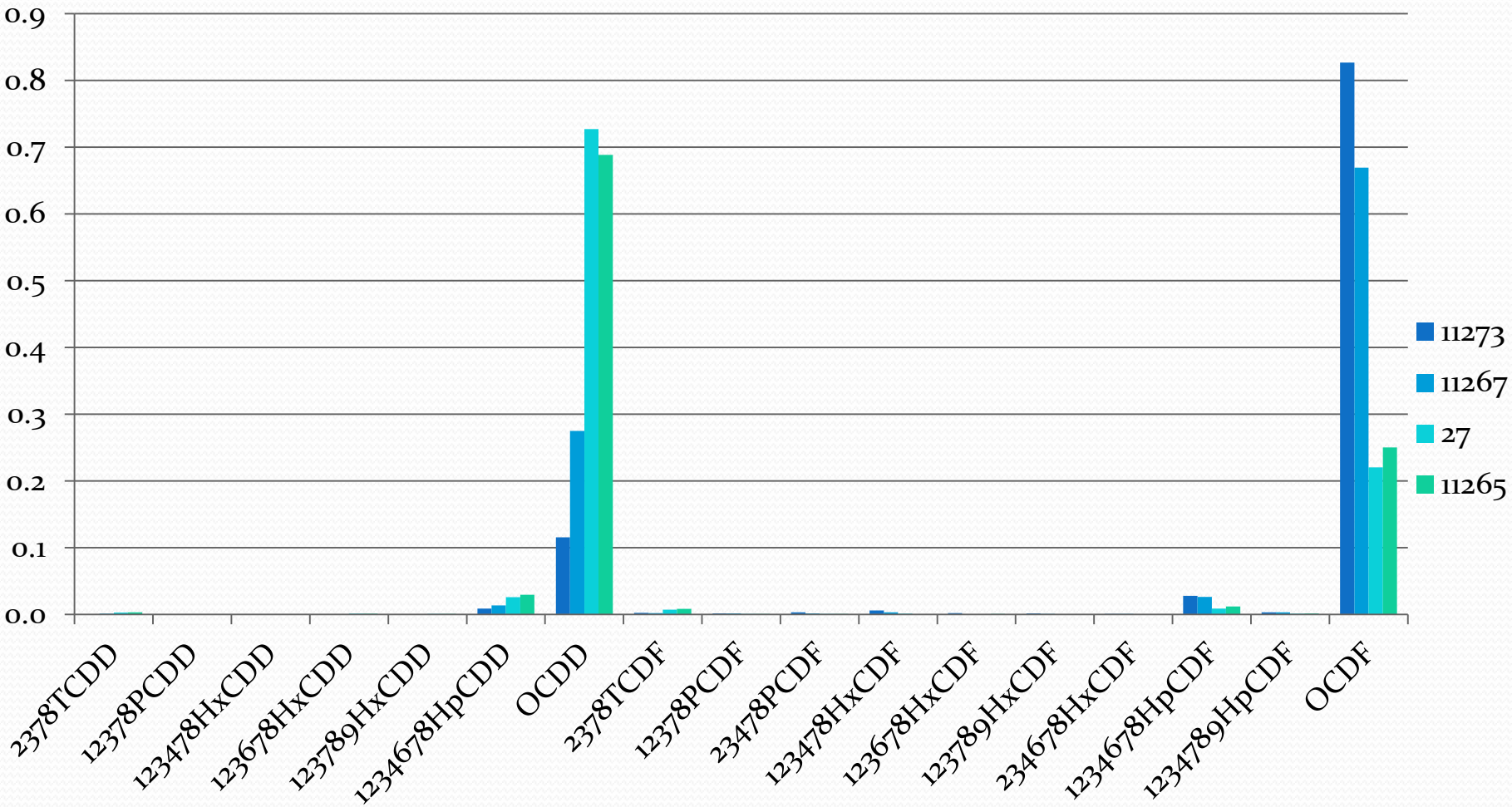
11270 TEQ = 74 ppt, 15979 TEQ = 71 ppt, Others < 44 ppt

Patrick Bayou - Middle

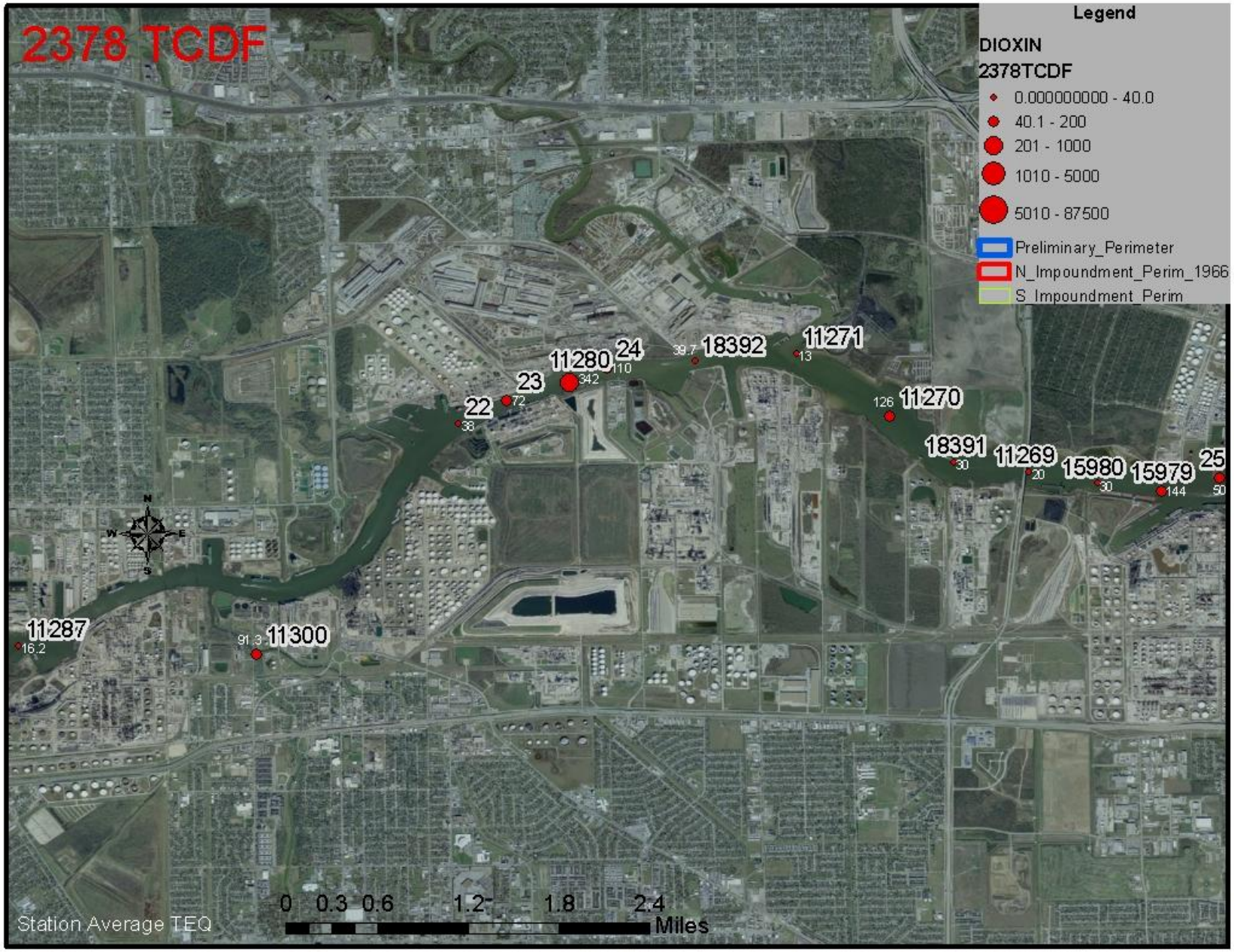


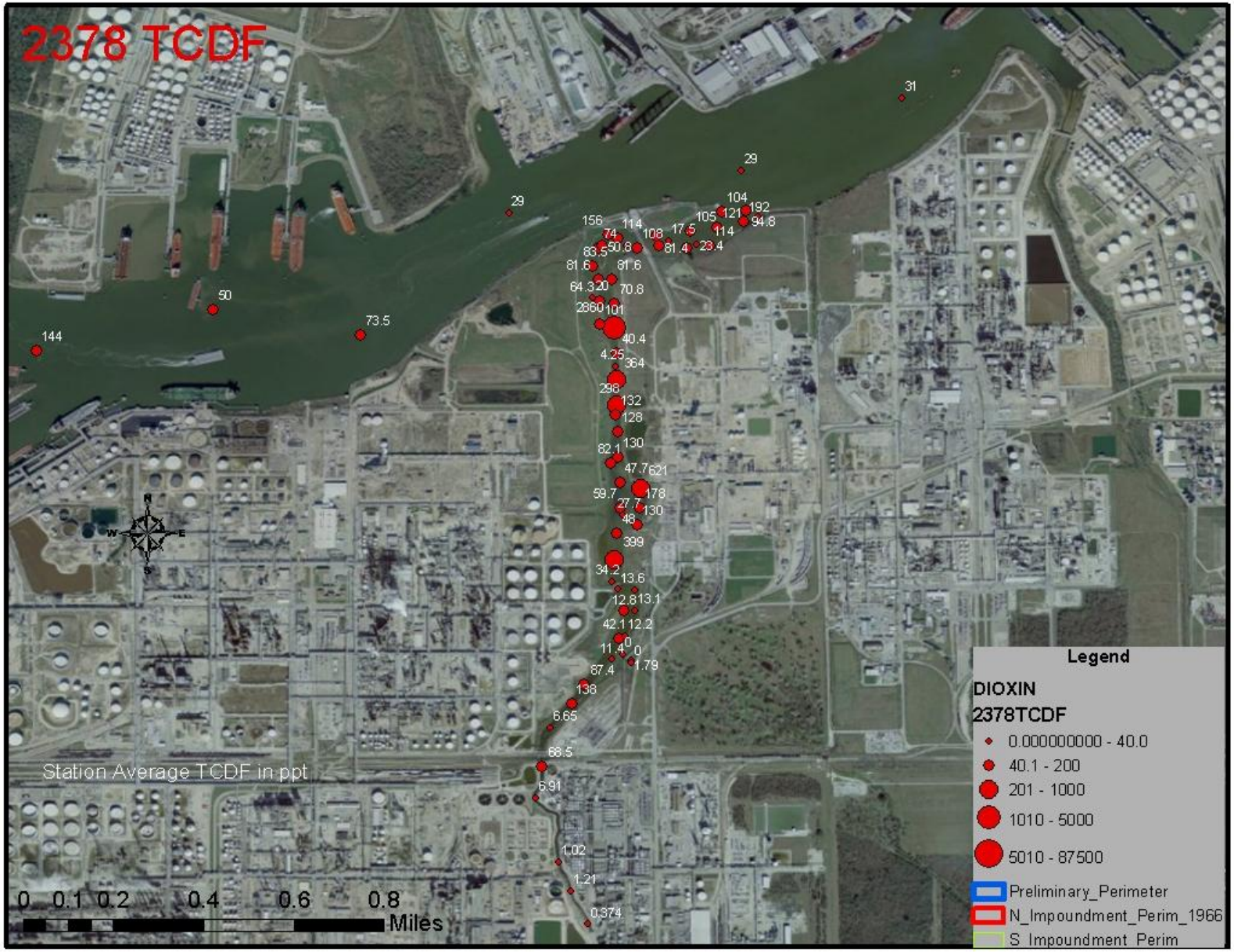
TEQ range = 11 to 39 ppt

HSC – Patrick to Tucker Bayou



TEQ range = 22 to 159 ppt

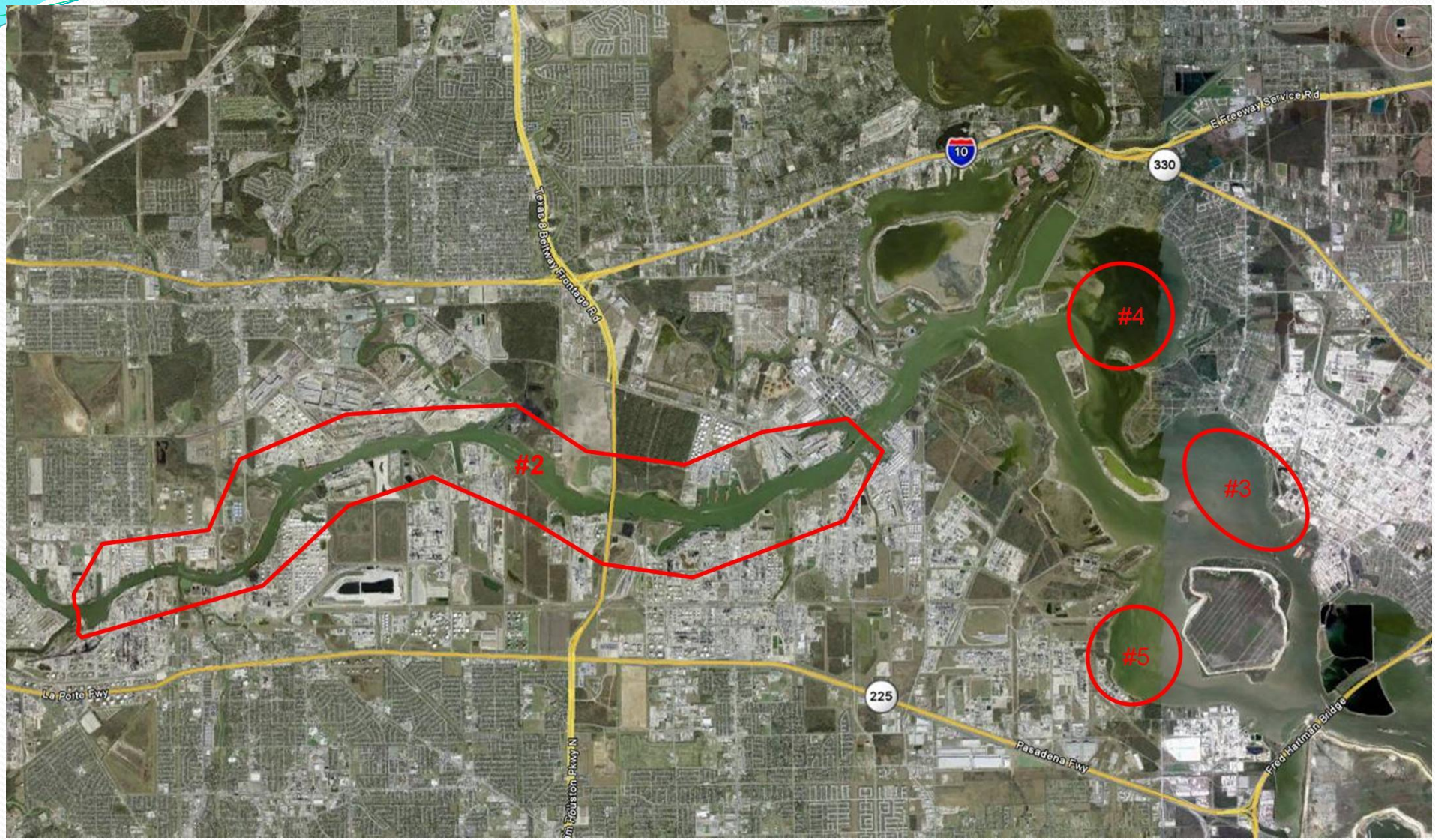

2378 TCDF
Legend
DIOXIN
2378TCDF
0.000000000 - 40.0
40.1 - 200
201 - 1000
1010 - 5000
5010 - 87500
Preliminary_Perimeter
N_Impoundment_Perim_1966
S_Impoundment_Perim
11287
16.2
91.3
11300
22
38
23
72
11280
342
24
110
39.7
18392
11271
13
126
11270
18391
30
11269
20
15980
30
15979
144
25
50
N
S
E
W
Station Average TEQ
0 0.3 0.6 1.2 1.8 2.4
Miles


2378 TCDF
Station Average TCDF in ppt
0 0.1 0.2 0.4 0.6 0.8
Miles
Legend
DIOXIN
2378TCDF
0.000000000 - 40.0
40.1 - 200
201 - 1000
1010 - 5000
5010 - 87500
Preliminary_Perimeter
N_Impoundment_Perim_1966
S_Impoundment_Perim

OCDF

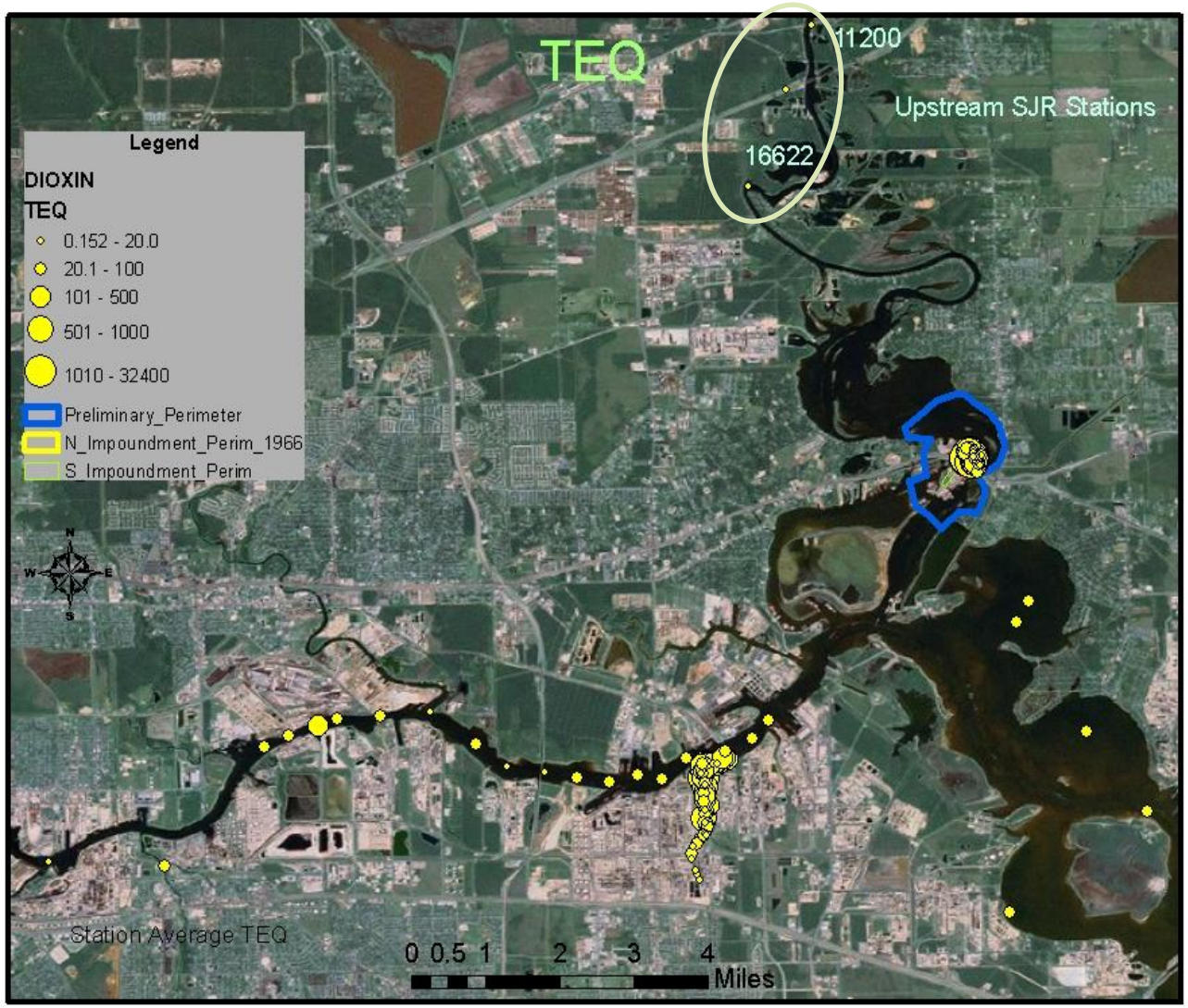
140
80
68
56
310
58
63
93
46
54
390
56
89
35
420
8
9
33
86
65
73
36
54
304
335
111
107
375
1235
940
9250
480
38500
1651
270
1050
21
292
293

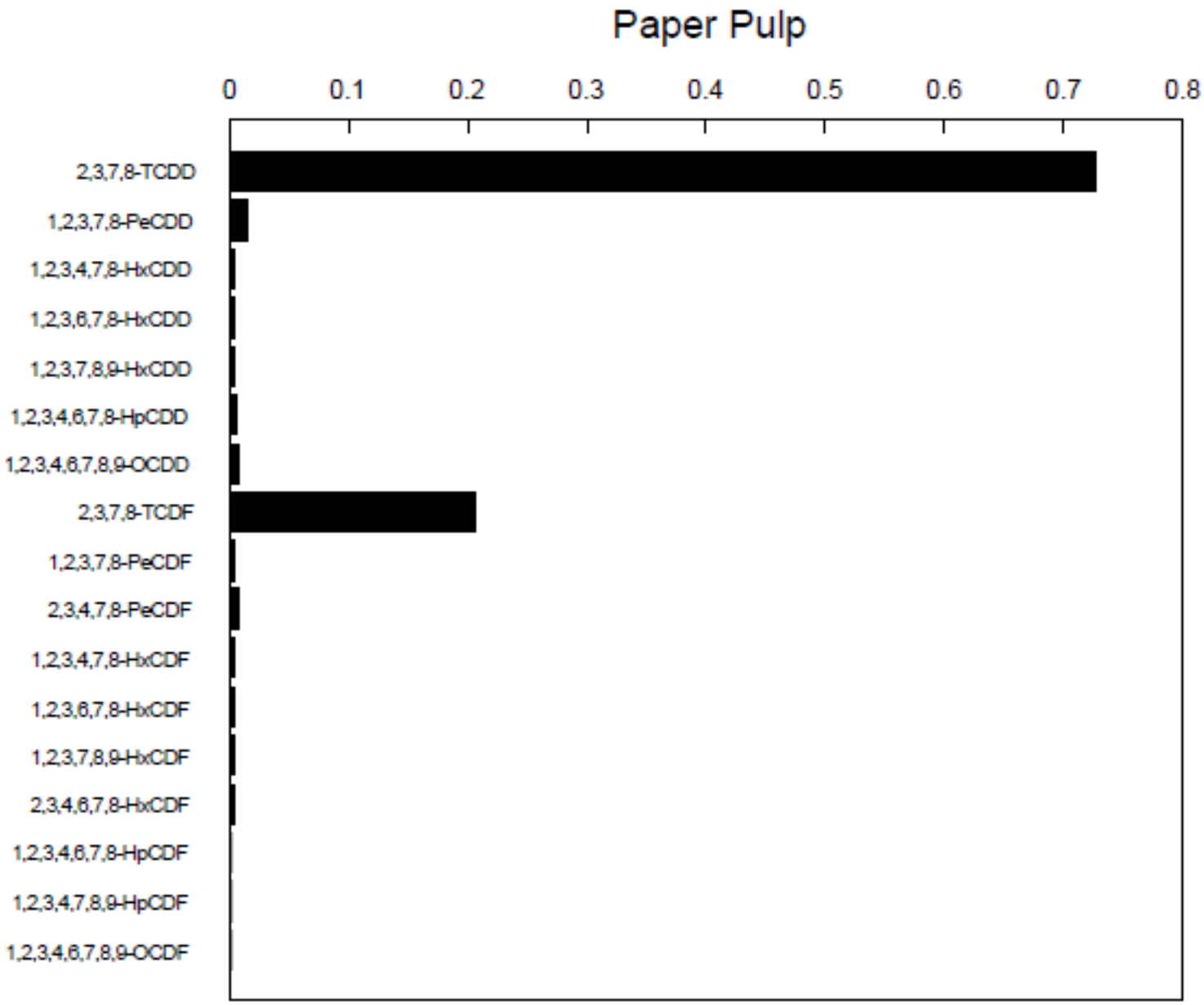
HSC – areas of noted elevated concentrations



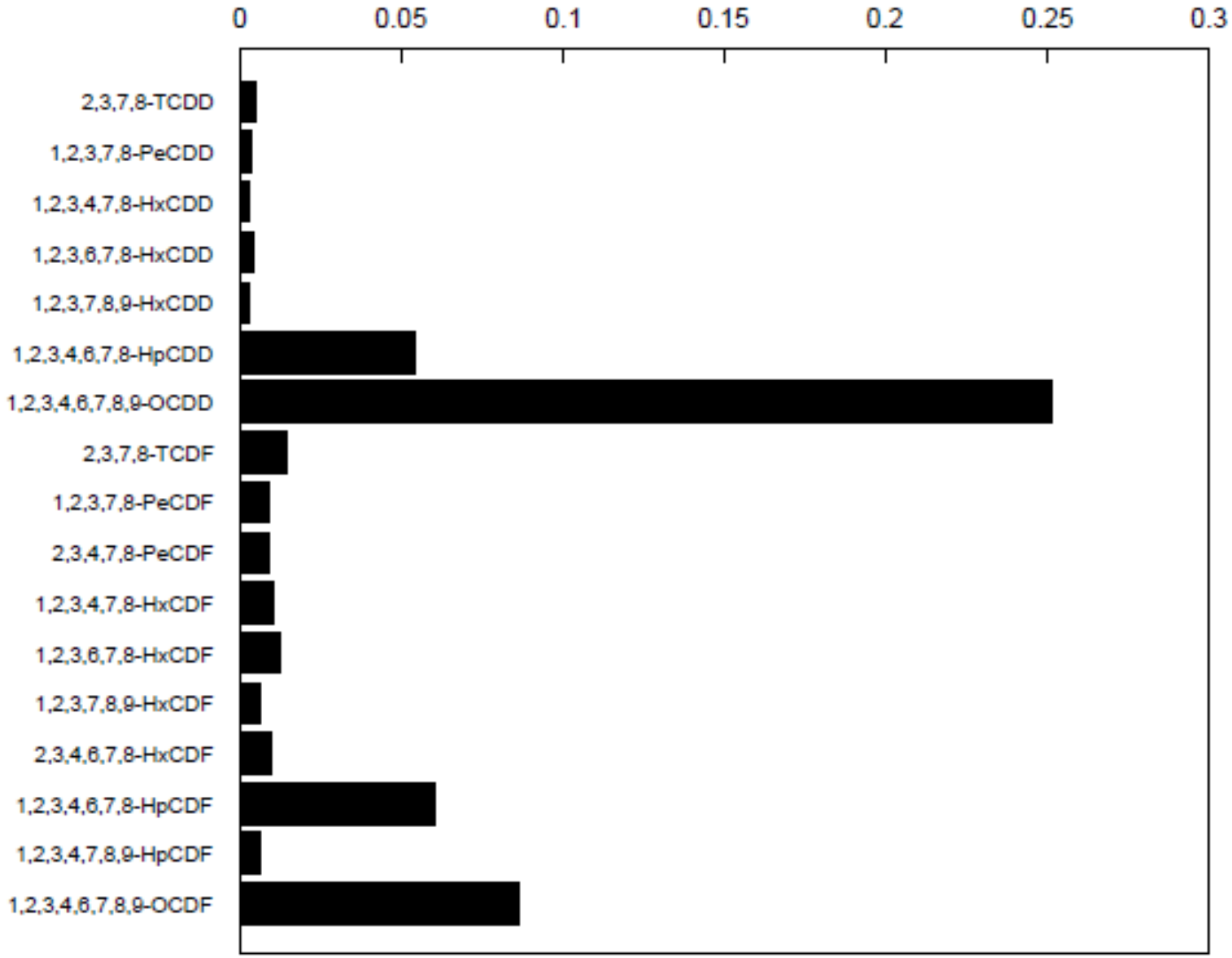
#2 = Buffalo Bayou of HSC; #3 = Scott Bay; #4 = Burnett Bay; #5 = San Jacinto Bay

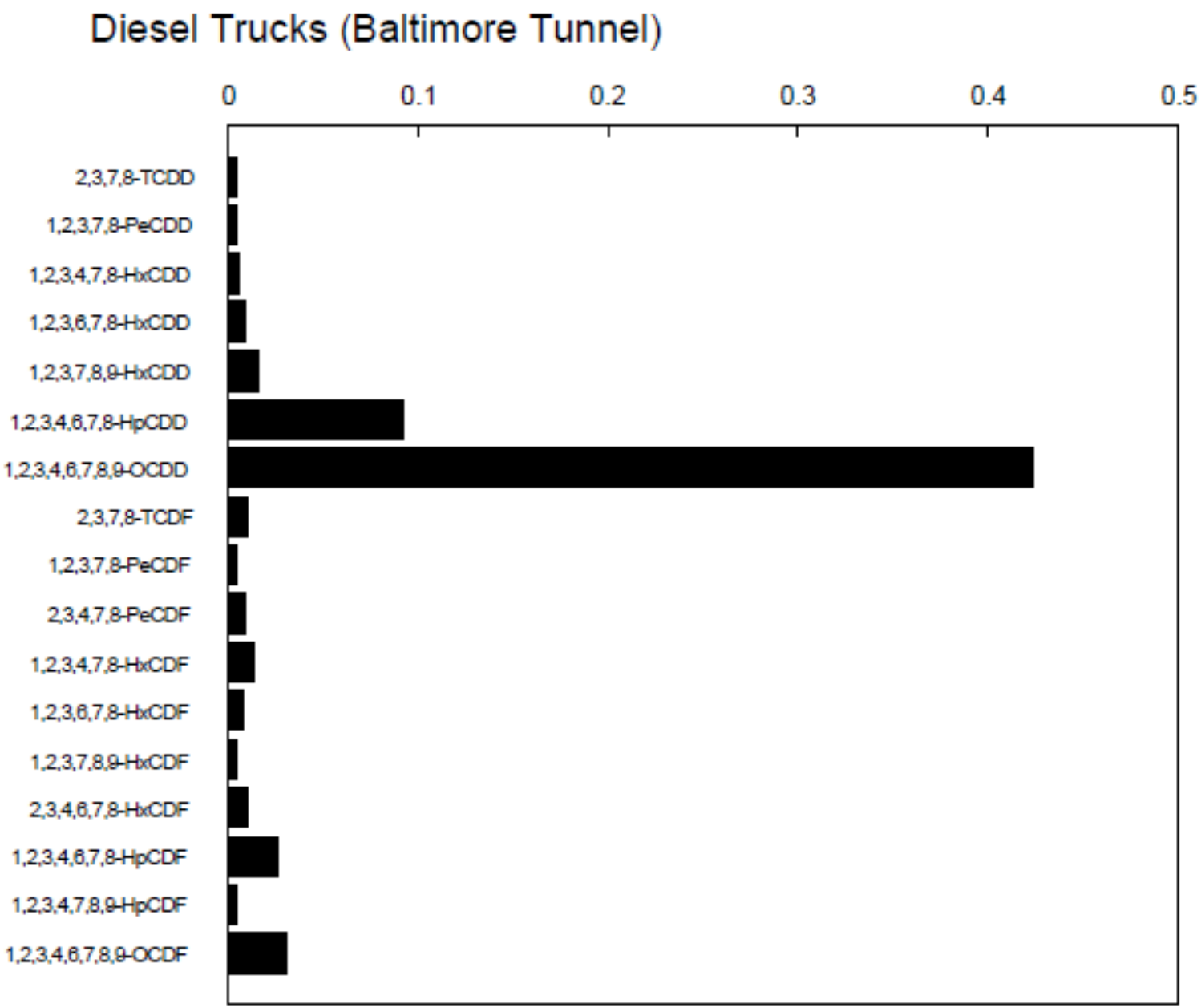
Upstream Station Locations

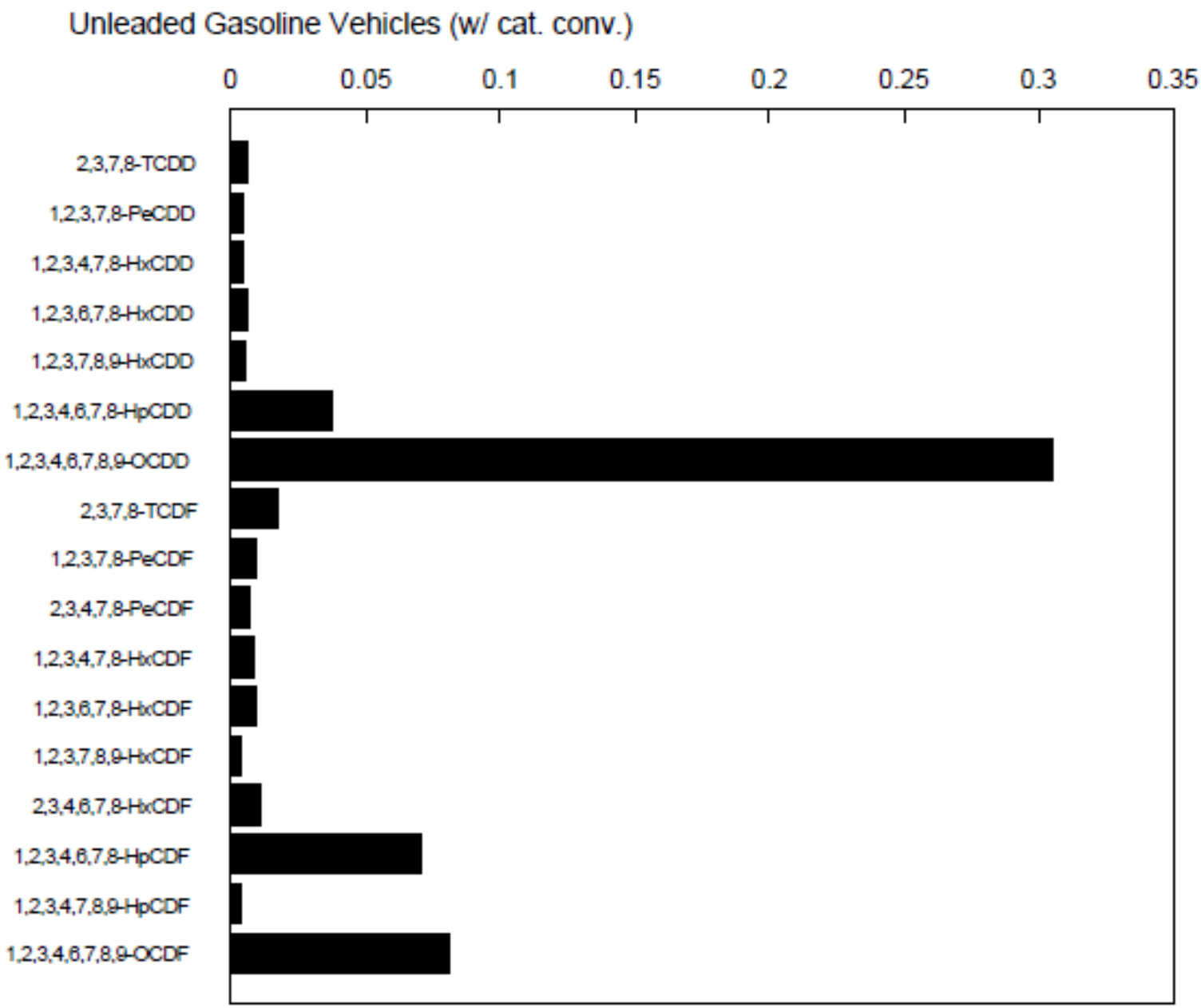



Paper Pulp
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
2,3,7,8-TCDD
1,2,3,7,8-PeCDD
1,2,3,4,7,8-HxCDD
1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-HxCDD
1,2,3,4,6,7,8-HpCDD
1,2,3,4,6,7,8,9-OCDD
2,3,7,8-TCDF
1,2,3,7,8-PeCDF
2,3,4,7,8-PeCDF
1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-HxCDF
1,2,3,7,8,9-HxCDF
2,3,4,6,7,8-HxCDF
1,2,3,4,6,7,8-HpCDF
1,2,3,4,7,8,9-HpCDF
1,2,3,4,6,7,8,9-OCDF

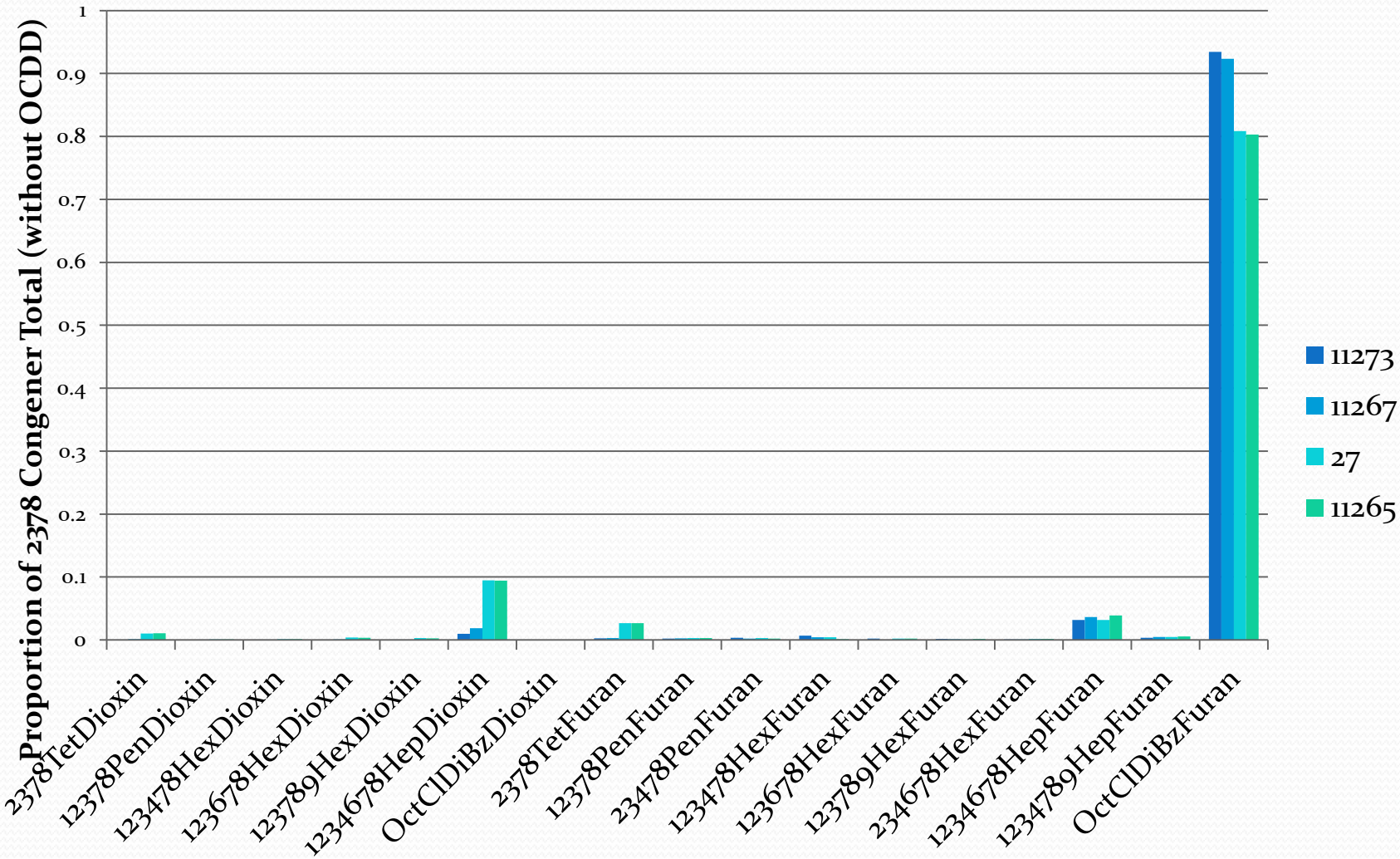
Diesel Trucks (tailpipe emissions)




Diesel Trucks (Baltimore Tunnel)
0
0.1
0.2
0.3
0.4
0.5
2,3,7,8-TCDD
1,2,3,7,8-PeCDD
1,2,3,4,7,8-HxCDD
1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-HxCDD
1,2,3,4,6,7,8-HpCDD
1,2,3,4,6,7,8,9-OCDD
2,3,7,8-TCDF
1,2,3,7,8-PeCDF
2,3,4,7,8-PeCDF
1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-HxCDF
1,2,3,7,8,9-HxCDF
2,3,4,6,7,8-HxCDF
1,2,3,4,6,7,8-HpCDF
1,2,3,4,7,8,9-HpCDF
1,2,3,4,6,7,8,9-OCDF


Unleaded Gasoline Vehicles (w/ cat. conv.)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
2,3,7,8-TCDD
1,2,3,7,8-PeCDD
1,2,3,4,7,8-HxCDD
1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-HxCDD
1,2,3,4,6,7,8-HpCDD
1,2,3,4,6,7,8,9-OCDD
2,3,7,8-TCDF
1,2,3,7,8-PeCDF
2,3,4,7,8-PeCDF
1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-HxCDF
1,2,3,7,8,9-HxCDF
2,3,4,6,7,8-HxCDF
1,2,3,4,6,7,8-HpCDF
1,2,3,4,7,8,9-HpCDF
1,2,3,4,6,7,8,9-OCDF

HSC - Patrick Bayou to Tucker Bayou

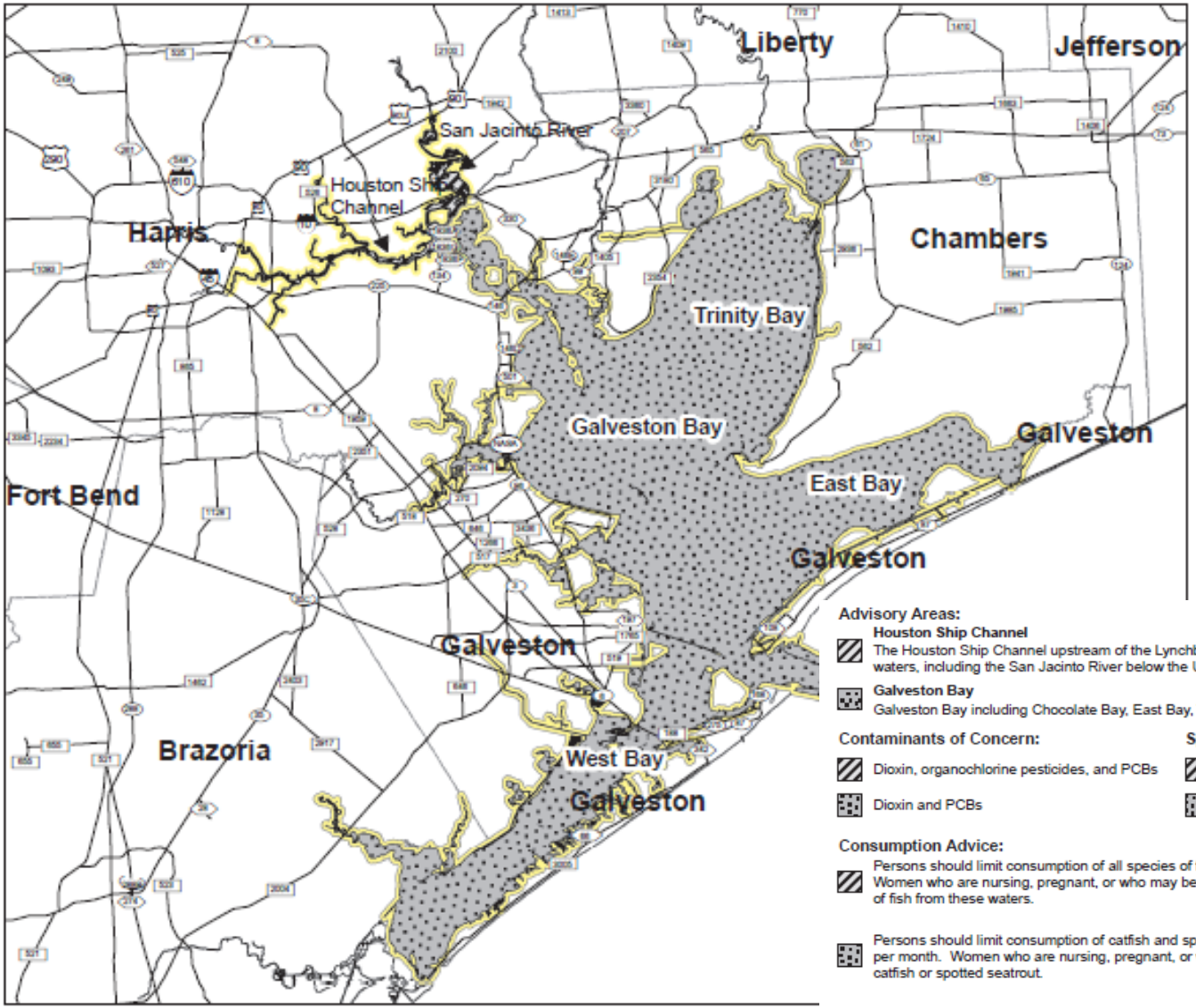


TEQ range = 22 to 159 ppt

Fish Tissue Advisories for Dioxin

Houston Ship Channel and Galveston Bay

Brazoria, Chambers, Galveston, and Harris Counties
ADV-20 Issued October 9, 2001
ADV-35 Issued July 8, 2008



Advisory Areas:

Houston Ship Channel
The Houston Ship Channel upstream of the Lynchburg Ferry crossing and all contiguous waters, including the San Jacinto River below the U.S. Highway 90 bridge.

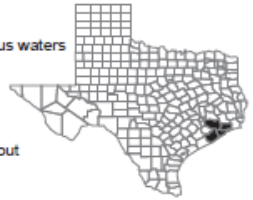
Galveston Bay
Galveston Bay including Chocolate Bay, East Bay, Trinity Bay, and West Bay and contiguous waters

Contaminants of Concern:

- Dioxin, organochlorine pesticides, and PCBs
- Dioxin and PCBs

Species Affected:

- All species of fish
- All catfish species and spotted seatrout



Consumption Advice:

Persons should limit consumption of all species of fish from this area to no more than one eight-ounce meal per month. Women who are nursing, pregnant, or who may become pregnant and children under 12 should not consume any species of fish from these waters.

Persons should limit consumption of catfish and spotted seatrout from this area to no more than one eight-ounce meal per month. Women who are nursing, pregnant, or who may become pregnant and children under 12 should not consume catfish or spotted seatrout.