Diamond Alkali Superfund Site

Source Investigation of Passaic River Sediments and Upland Samples (2013, 2015)

Comparison of Dioxin/Furan Patterns from Lister and Clifton Sites

March 10, 2016 EPA Meeting
Newark, New Jersey

FOIA-2017-010170_V11744

EPA Passaic River Source Investigation (2013, 2015)

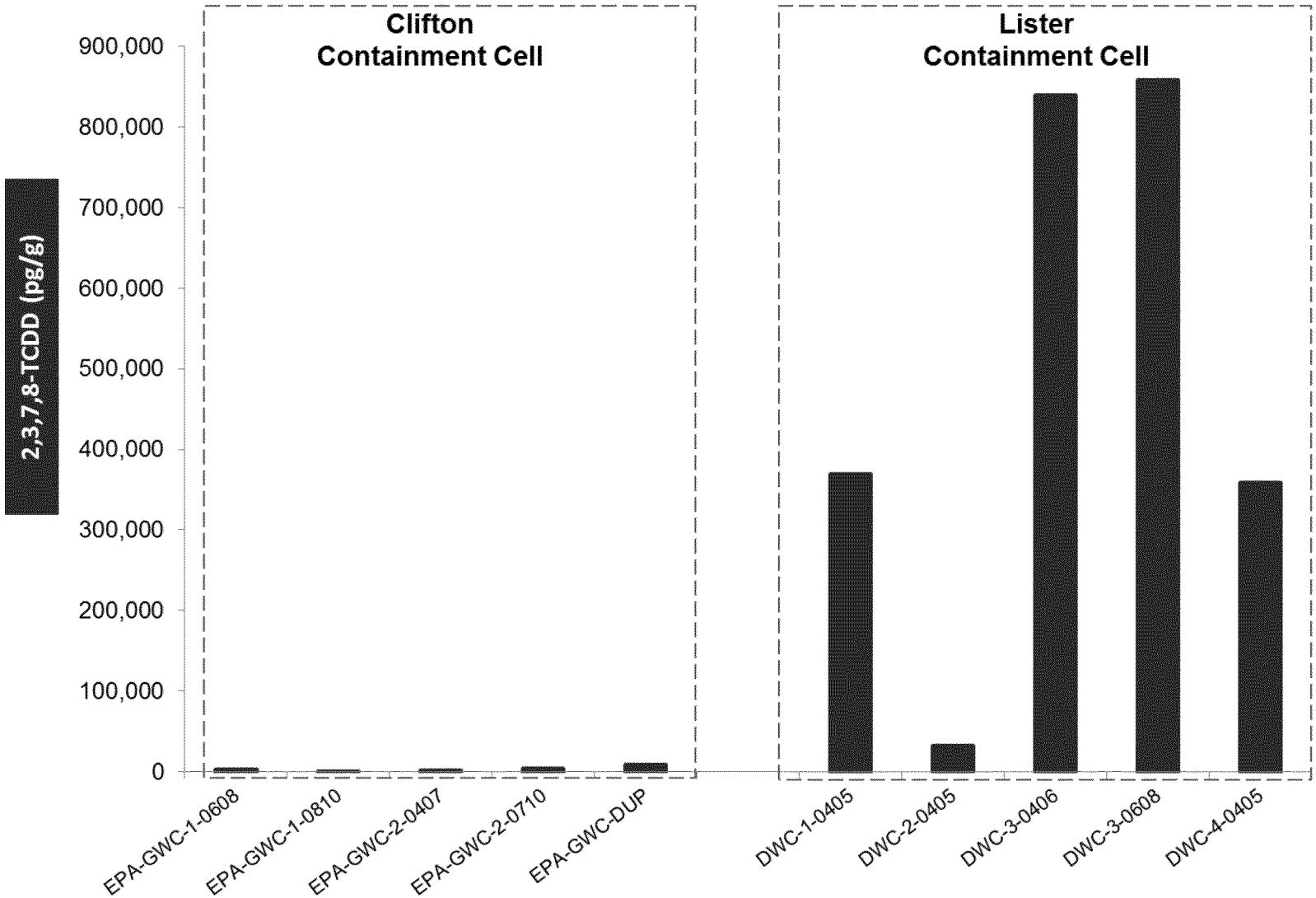
Conclusion:

The Lister Signature Matches the Dioxin/Furan Pattern in the River and TCDT is a Tracer for the Lister Site. The Clifton Signature is unique and not found in the River

- Comparison of Dioxin in Containment Cells
- Comparison of Dioxin/Furan Patterns
- Evaluation of Upland, Lister Removal Area and RM 10.9 Data: Multiple Data Sets, 100's of Samples
- Evaluation of TCDD, TCDT, HCX Compounds in Cells and River
- HCX and HCP are compounds related to background

FOIA-2017-010170_V11745

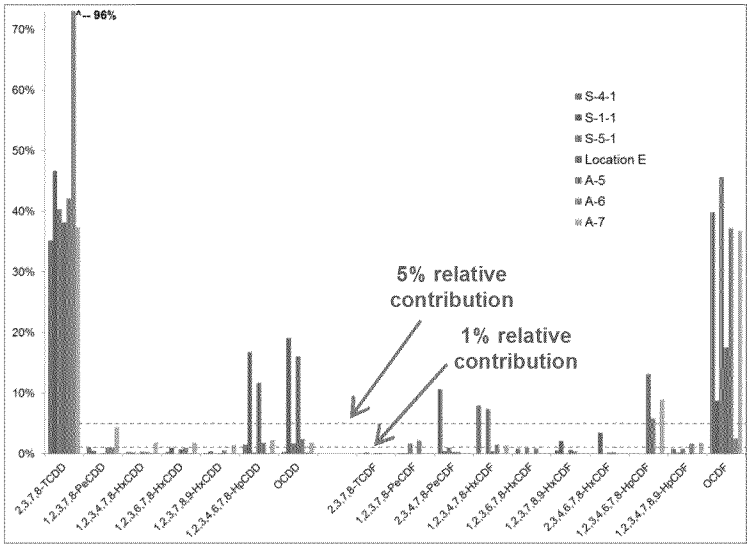
Comparison of 2,3,7,8-TCDD in Samples from Clifton and Lister Containment Cells: Lister has *Exceedingly High* Dioxin Levels



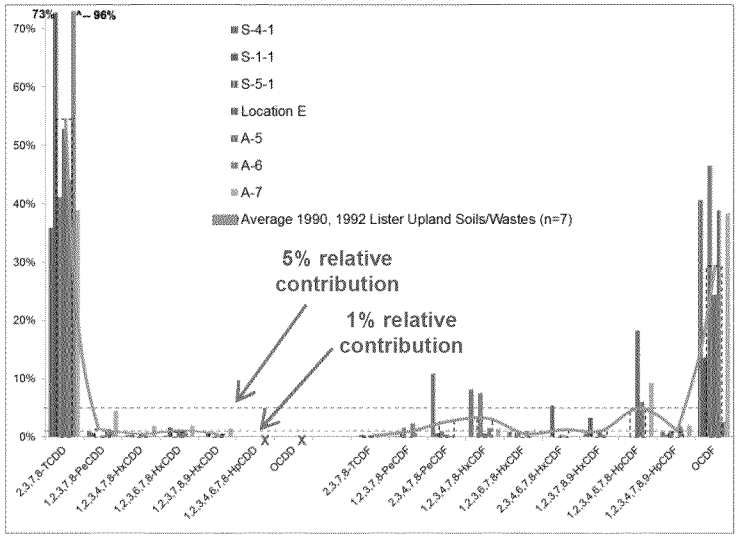
FOIA-2017-010170_V11746

Lister Upland Samples (1990, 1992, 2015)
Dioxin/Furan Signature is Demonstrated by "Bookends" Pattern

Lister Upland Soil and Wastes (n=7)
(all 17 congeners)

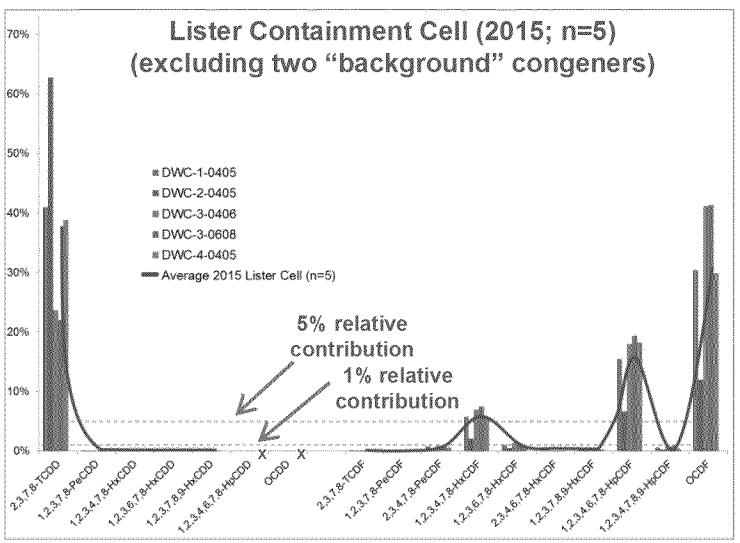


Lister Upland Soil and Waste (1990/1992; n=7)
(excluding "background combustion congeners"
1,2,3,4,6,7,8-HpCD and OCDD)



- **Excluding background, Lister upland samples are dominated by 2,3,7,8-TCDD and dominant furans (HxCDF, HpCDF and OCDF congeners)**
- **On average, PCDD congeners other than 2,3,7,8-TCDD contribute <1% to total PCDD/Fs**
- **Recent EPA containment cell samples (2015) reflect similar pattern as previous 1990s samples and consistently detected 3 dominant furans**

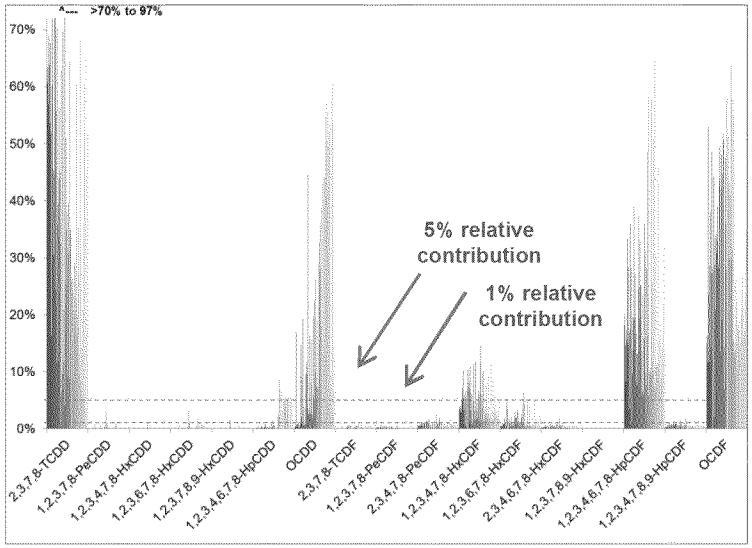
Lister Containment Cell (2015; n=5)
(excluding two "background" congeners)



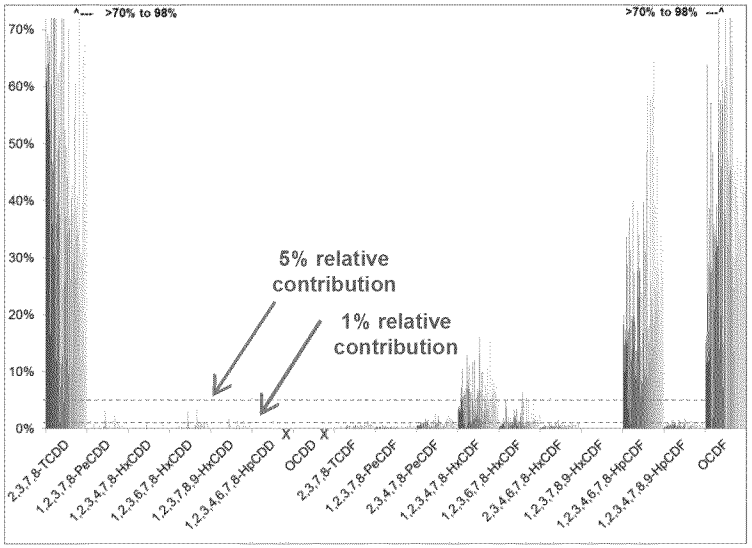
FOIA-2017-010170_V11747

Lister Phase I Removal Area (2011) Dioxin/Furan Signature Demonstrated by "Bookends" Pattern in the River

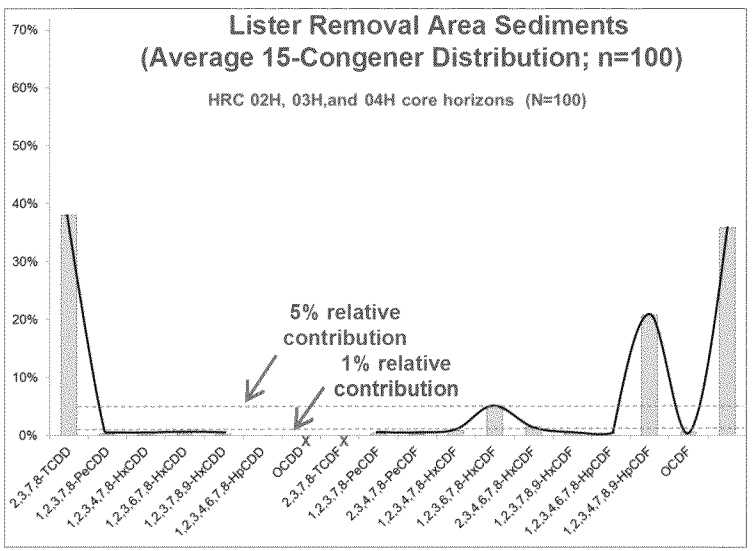
Lister Removal Area Sediments
(all 17 congeners)



Lister Removal Area Sediments
(excluding "background combustion congeners"
1,2,3,4,6,7,8-HpCD and OCDD)



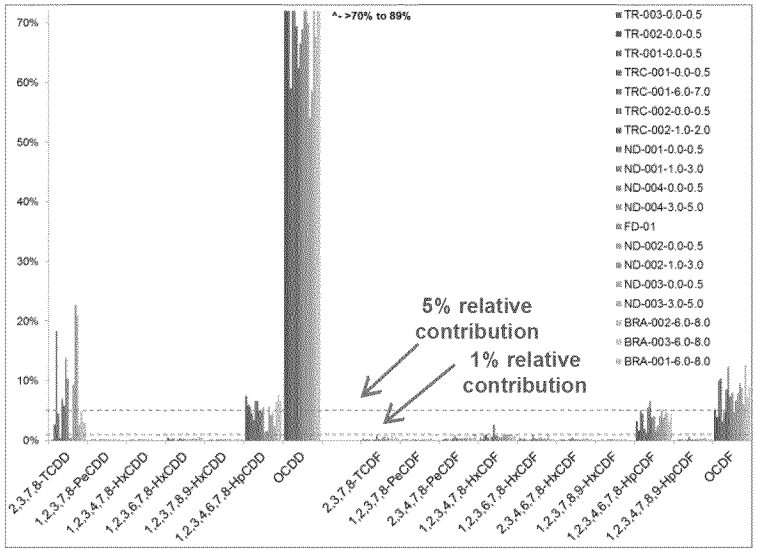
- **Excluding background, the Phase I Removal Area is consistently dominated by 2,3,7,8-TCDD and 3 furans (HxCDF, HpCDF, and OCDF congeners)**
- **<u>Note</u>: PeCDD and HxCDD congeners are undetected or present at <1% of total PCDD/Fs**
- **The composition of 100 core samples reflects mixing of all Lister discharges into the Removal Area, which matches Lister Upland Fingerprint pattern with "bookends"**



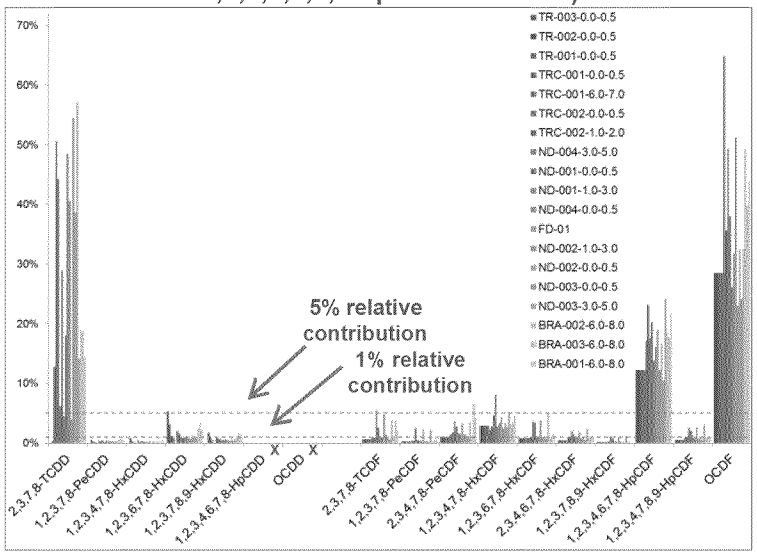
FOIA-2017-010170_V11748

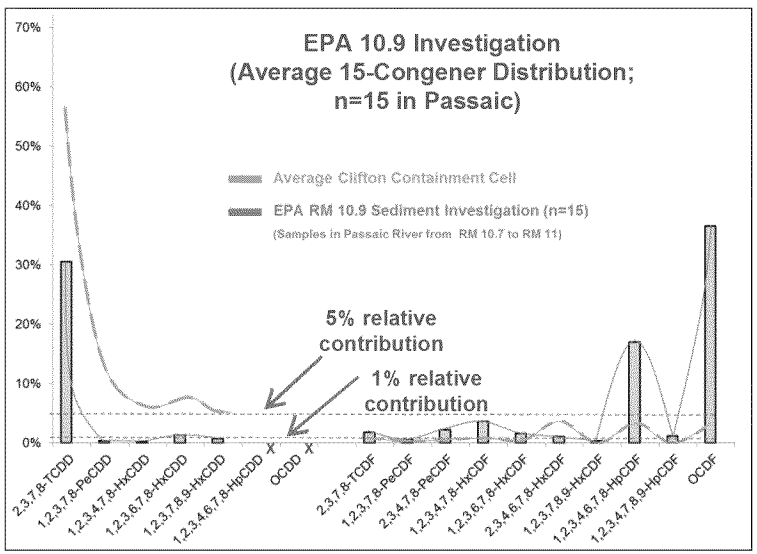
EPA RM 10.9 Investigation (2013) Dioxin/Furan Signature Show "Bookends" Pattern in the River

EPA 10.9 Investigation
(all 17 congeners)



EPA 10.9 Investigation
(excluding "background combustion congeners"
1,2,3,4,6,7,8-HpCD and OCDD)

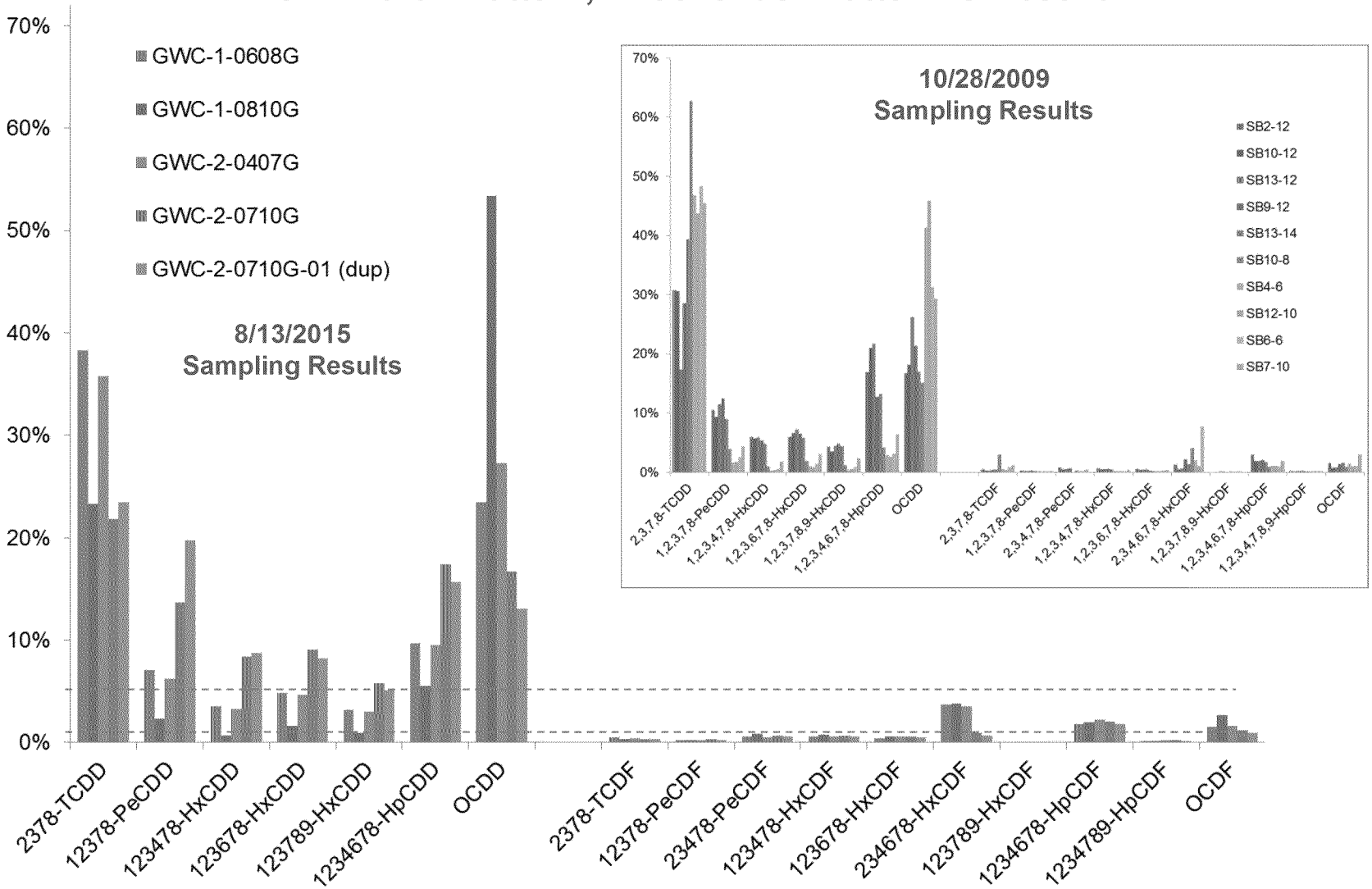




- **Background (combustion) is dominated by 1,2,3,4,6,7,8-HpCDD and OCDD**
- **Excluding background, river sediments are dominated by 2,3,7,8-TCDD, HxCDF, HpCDF, and OCDF congeners – matching Lister "Bookends"**
- **On average, PeCDD and HxCDD congeners individually contribute approximately 1% or less to total PCDD/Fs**

FOIA-2017-010170_V11749

Clifton Containment Cell (2009 and 2015) Samples Show Unique Dioxin/Furan Pattern; "Bookends" Pattern is Absent

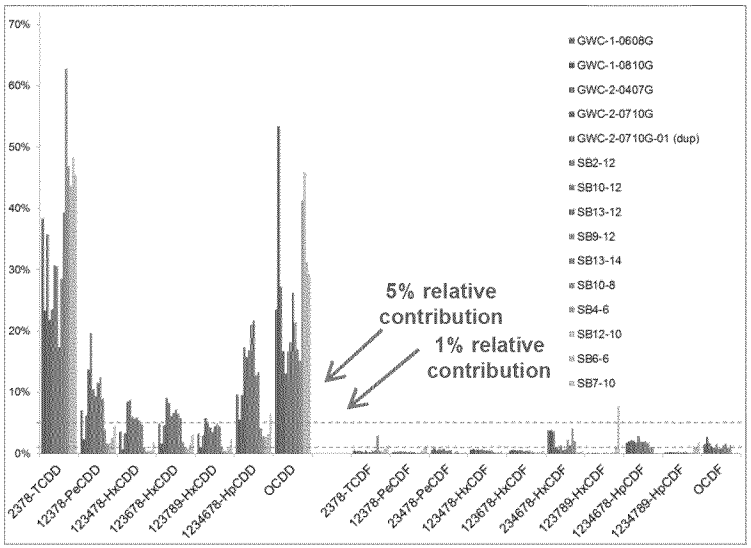


EPA's 2015 samples have the same pattern as the 2009 samples collected by Givaudan, which differs from Lister and the River

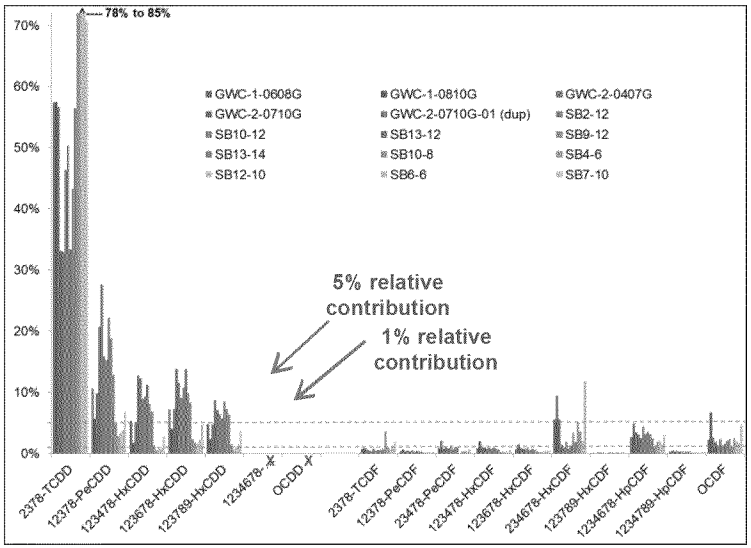
FOIA-2017-010170_V11750

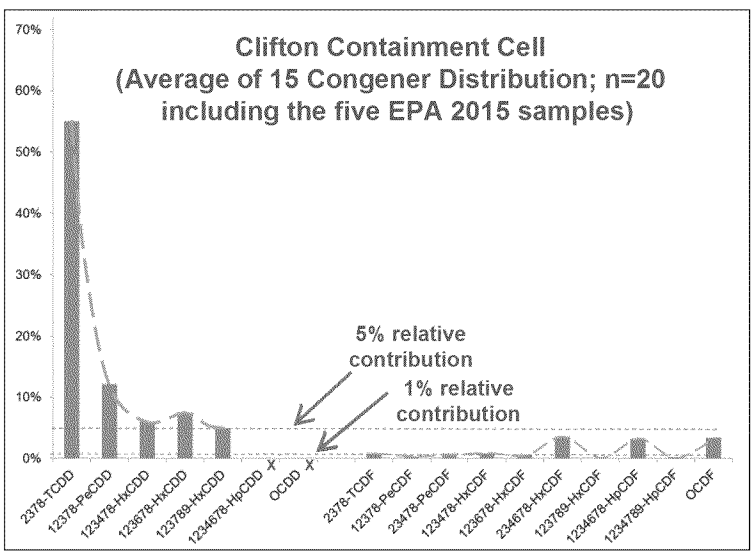
Clifton Containment Cell Samples (2009, 2015) Exhibit a Unique Congener Pattern with No "Bookends"

Clifton Containment Cell
(2009 and 2015; all 17 congeners)



Clifton Containment Cell
(excluding "background combustion congeners" 1,2,3,4,6,7,8-HpCD and OCDD)

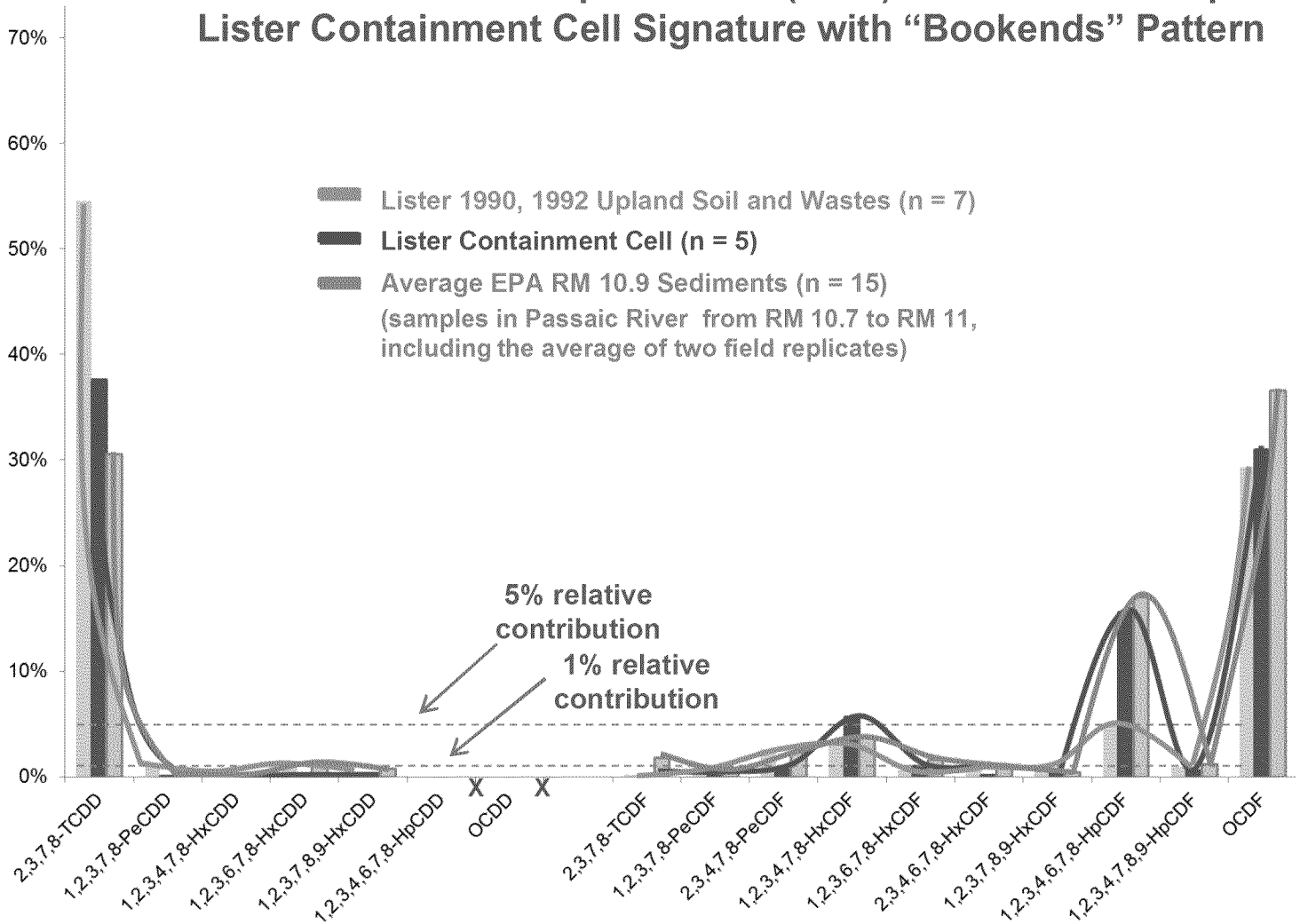




- **All dioxin congeners are detected and each average is > 5% contribution to total dioxin/furans**
- **Furan congeners are undetected or present at < 5% contribution to total dioxin/furans**
- **Clifton Fingerprint Pattern is unique and <u>not</u> seen in any Passaic River or Lister-associated samples**

FOIA-2017-010170_V11751

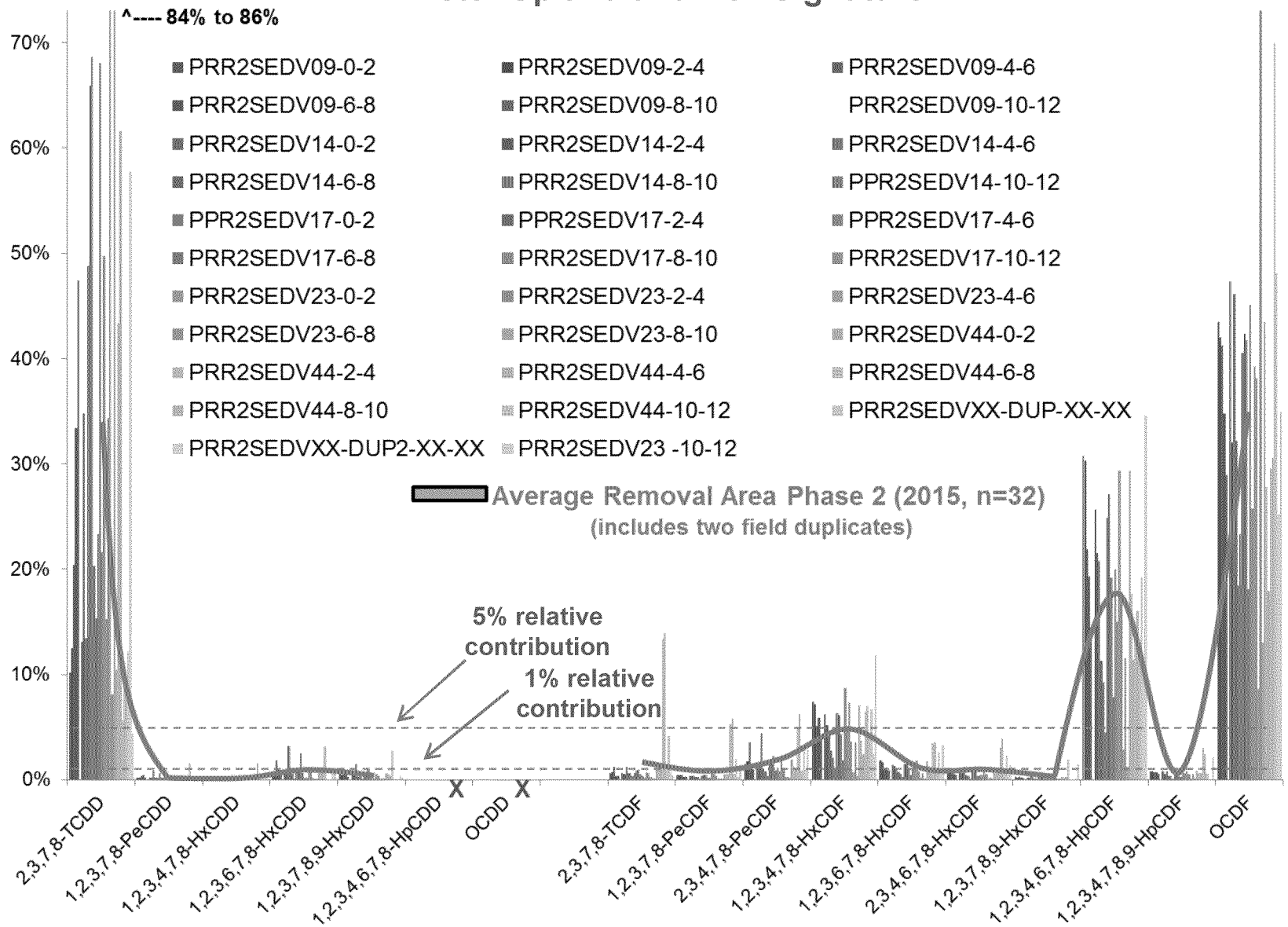
EPA RM 10.9 Sediment Sample Pattern (2013) Matches Lister Upland and Lister Containment Cell Signature with "Bookends" Pattern



- **The average RM 10.9 dioxin/furan pattern corresponds to the pattern for Lister Upland and Cell samples**
- **The average HxCDF and OCDF in sediments also correspond with Lister Upland and Lister Cell samples**
- **The HpCDF component of the EPA RM 10.9 sediments is more pronounced than the Lister Upland samples but matches the Lister Cell samples**

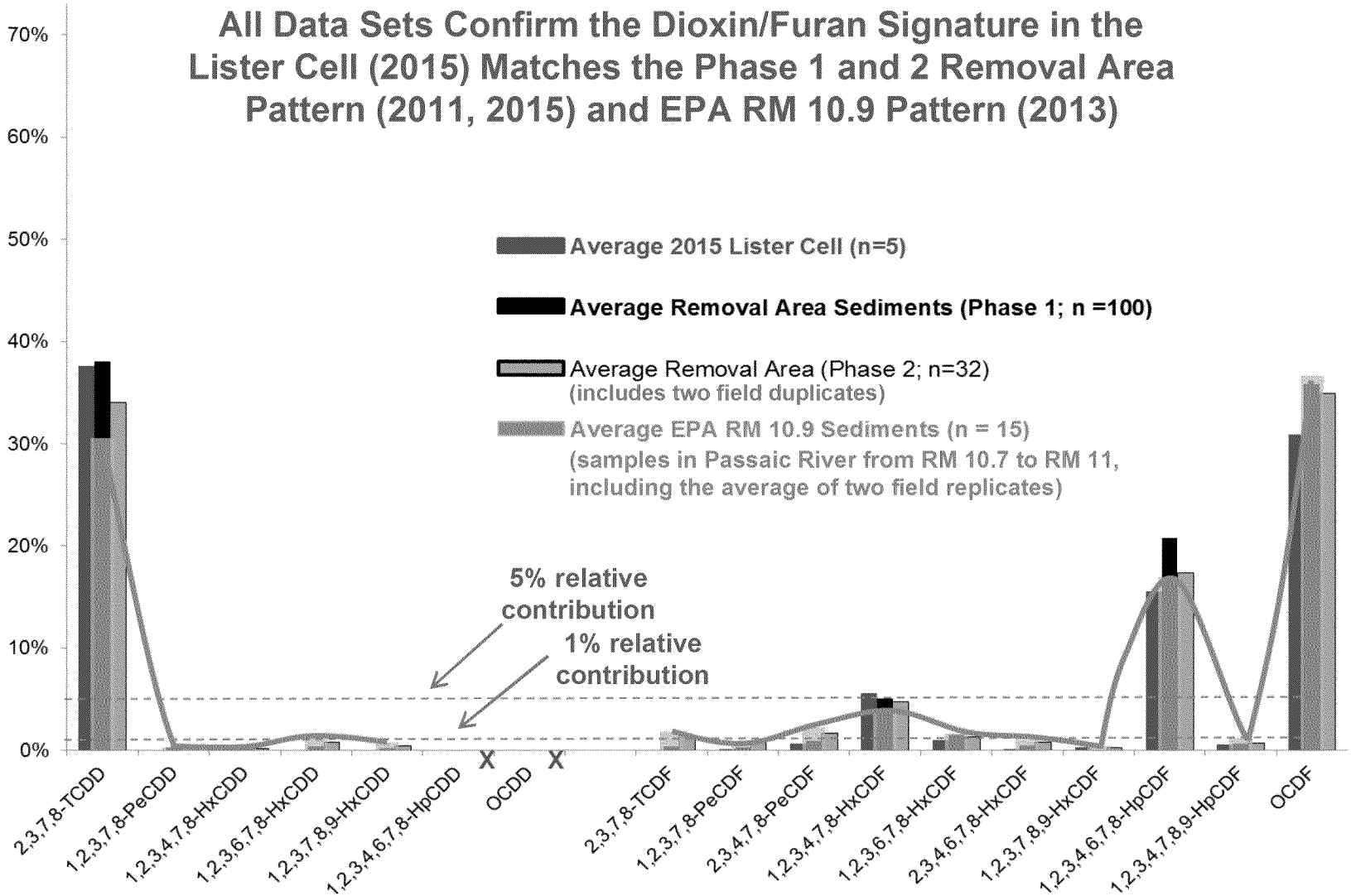
FOIA-2017-010170_V11752

Lister Phase 2 Removal Area Sediment (2015) Dioxin/Furan Pattern Matches RM 10.9 Pattern and Lister Upland and Cell Signature



FOIA-2017-010170_V11753

All Data Sets Confirm the Dioxin/Furan Signature in the Lister Cell (2015) Matches the Phase 1 and 2 Removal Area Pattern (2011, 2015) and EPA RM 10.9 Pattern (2013)

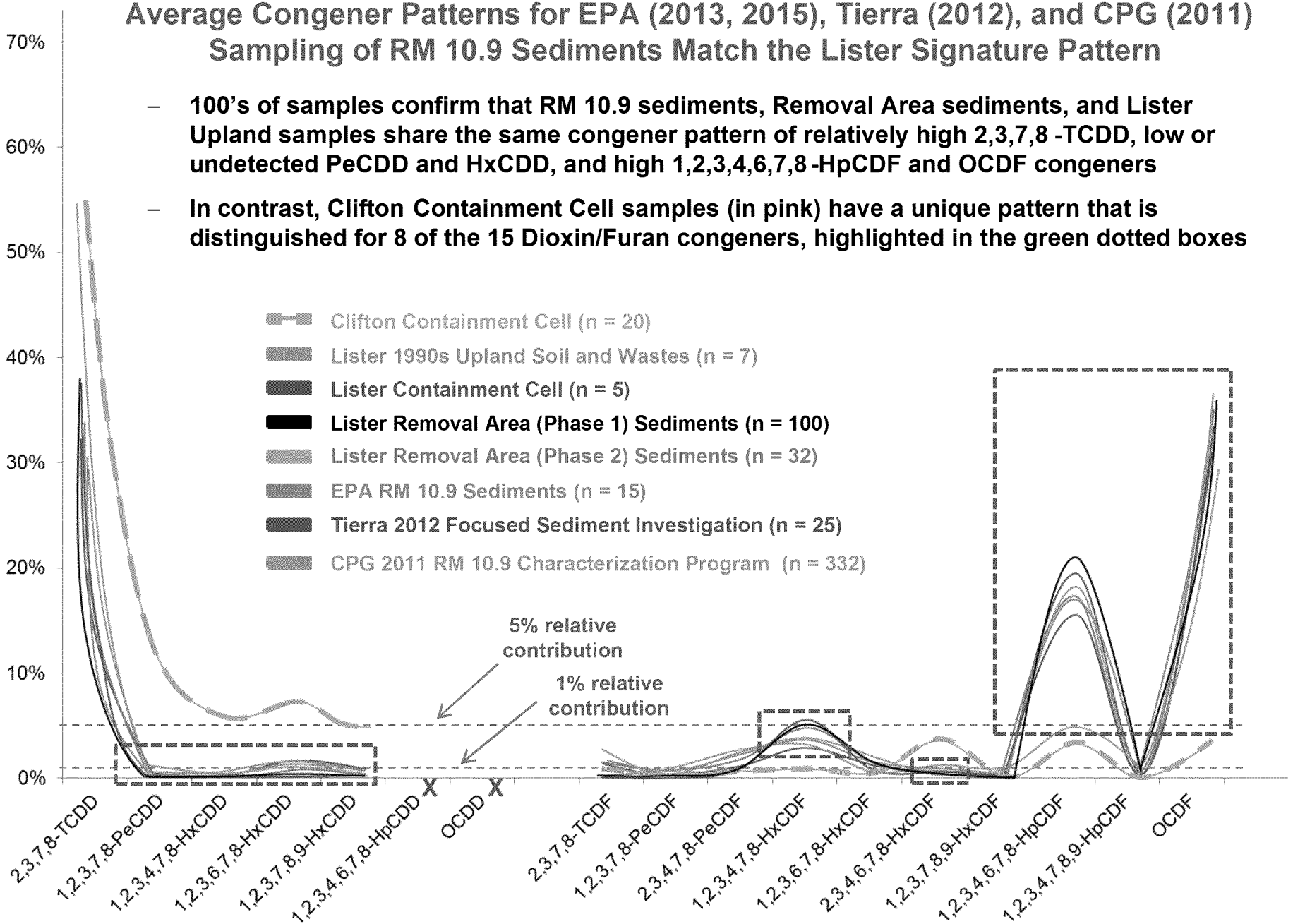


- **Dioxin/Furan pattern in RM 10.9 sediments matches Lister Removal Area (Phase I and 2) sediment pattern, which depict the Lister Cell Signature**
- **The high concentrations of HpCDF and OCDF congeners in Lister Removal Area sediments are consistent with a Lister-specific source dispersed into the river (the "Bookends").**

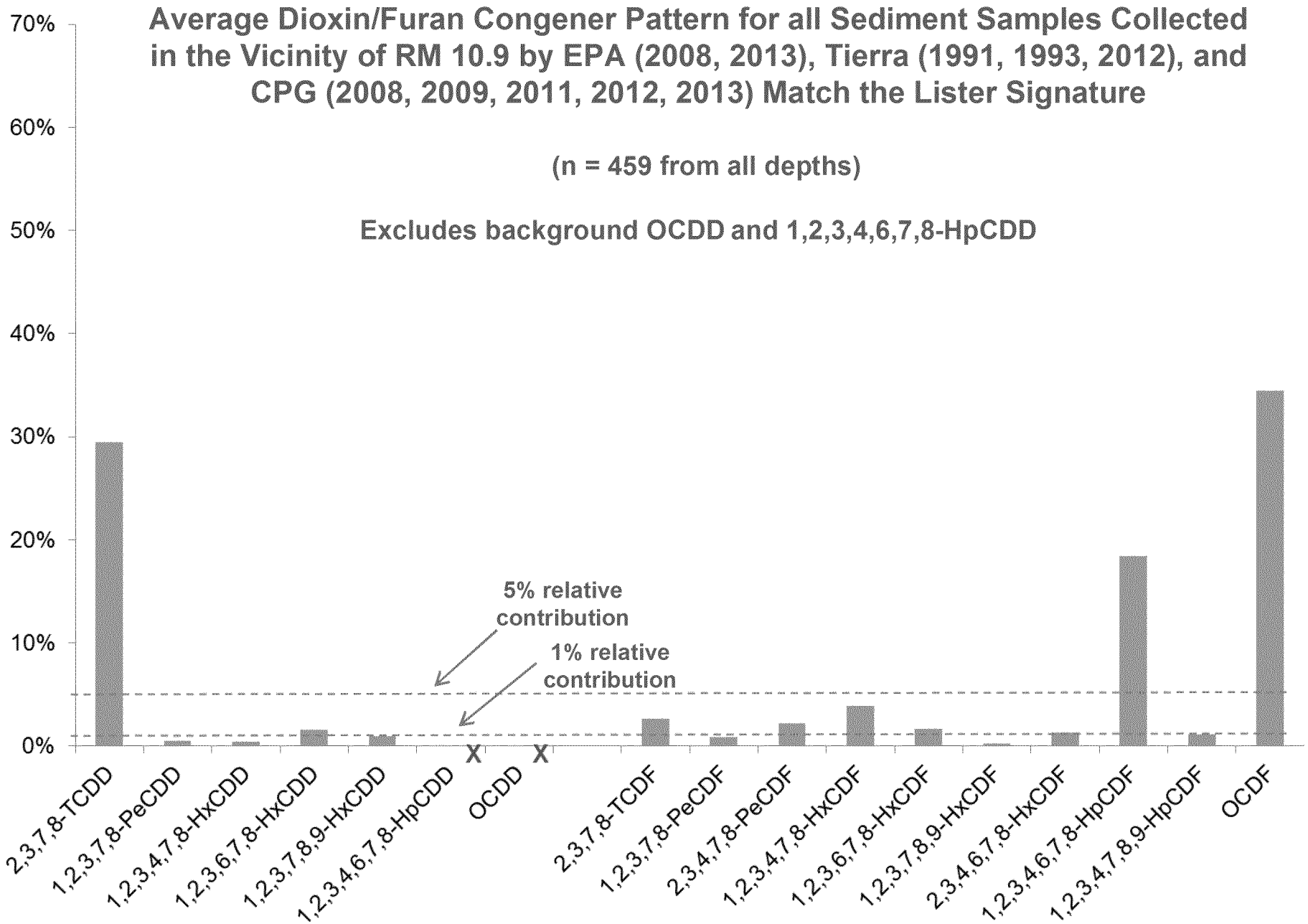
FOIA-2017-010170_V11754

Average Congener Patterns for EPA (2013, 2015), Tierra (2012), and CPG (2011) Sampling of RM 10.9 Sediments Match the Lister Signature Pattern

- **100's of samples confirm that RM 10.9 sediments, Removal Area sediments, and Lister Upland samples share the same congener pattern of relatively high 2,3,7,8 -TCDD, low or undetected PeCDD and HxCDD, and high 1,2,3,4,6,7,8 -HpCDF and OCDF congeners**
- **In contrast, Clifton Containment Cell samples (in pink) have a unique pattern that is distinguished for 8 of the 15 Dioxin/Furan congeners, highlighted in the green dotted boxes**



FOIA-2017-010170_V11755



FOIA-2017-010170_V11756

Sampling Locations EPA RM 10.9 (2013) and Tierra Focused Sediment (2012) Investigations

(excluding samples above Dundee Dam)

- FSI Stations
- EPA Stations
- Mile Markers
- Passaic River

Depth Contours (ft)

- -34 to -25
- -24 to -20
- -19 to -10
- -9 to 0

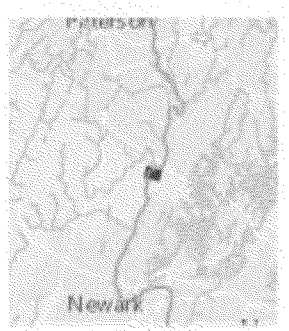
N
W E
S

ESRI Digitial Globe - May, 2014

Coordinate System
New Jersey StatePlane,
NAD 1983

FOIA-2017-010170_V11757

Sampling Locations RM 10.6 to RM 11.2 (2008 to 2013)



River Mile Markers

Passaic River

Study ID

- River Mile 10.9 Characterization Program
- 2007-2008 Sediment Sampling Program
- 2008 CPG Low-resolution Coring Program
- 2009 RI FSP2 Benthic Sediment Sampling
- 2012 Focused Sediment Investigation, Passaic River
- 2013 EPA Passaic Sediments RM 10.9 Investigation
- High Res Core Sampling

Depth Contours (ft)

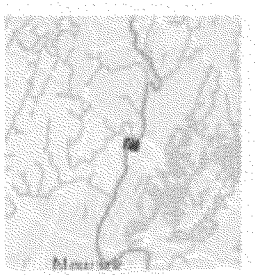
- -34 to -25
- -24 to -20
- -19 to -10
- -9 to 0

N
W E
S

ESRI Digital Globe
May 2014, 1966
New Jersey StatePlane
NAD 1983

FOIA-2017-010170_V11758

Sampling Locations RM 11.2 to RM 12 (1990 to 2013)



River Mile Markers

Passaic River

Study ID

- 2013 Low Resolution Coring Second Supplemental Sampling Program
- 1990 Surface Sediment Investigation
- 1993 Core Sediment Investigation - 01 (March)
- 2012 Low Resolution Coring Supplemental Sampling Program
- 1991 Core Sediment Investigation
- 2007-2008 Sediment Sampling Program
- 2008 CPG Low-resolution Coring Program
- 2009 RI FSP2 Benthic Sediment Sampling
- 2012 Focused Sediment Investigation, Passaic River
- 2013 EPA Passaic Sediments RM 10.9 Investigation

Depth Contours (ft)

- -34 to -25
- -24 to -20
- -19 to -10
- -9 to 0

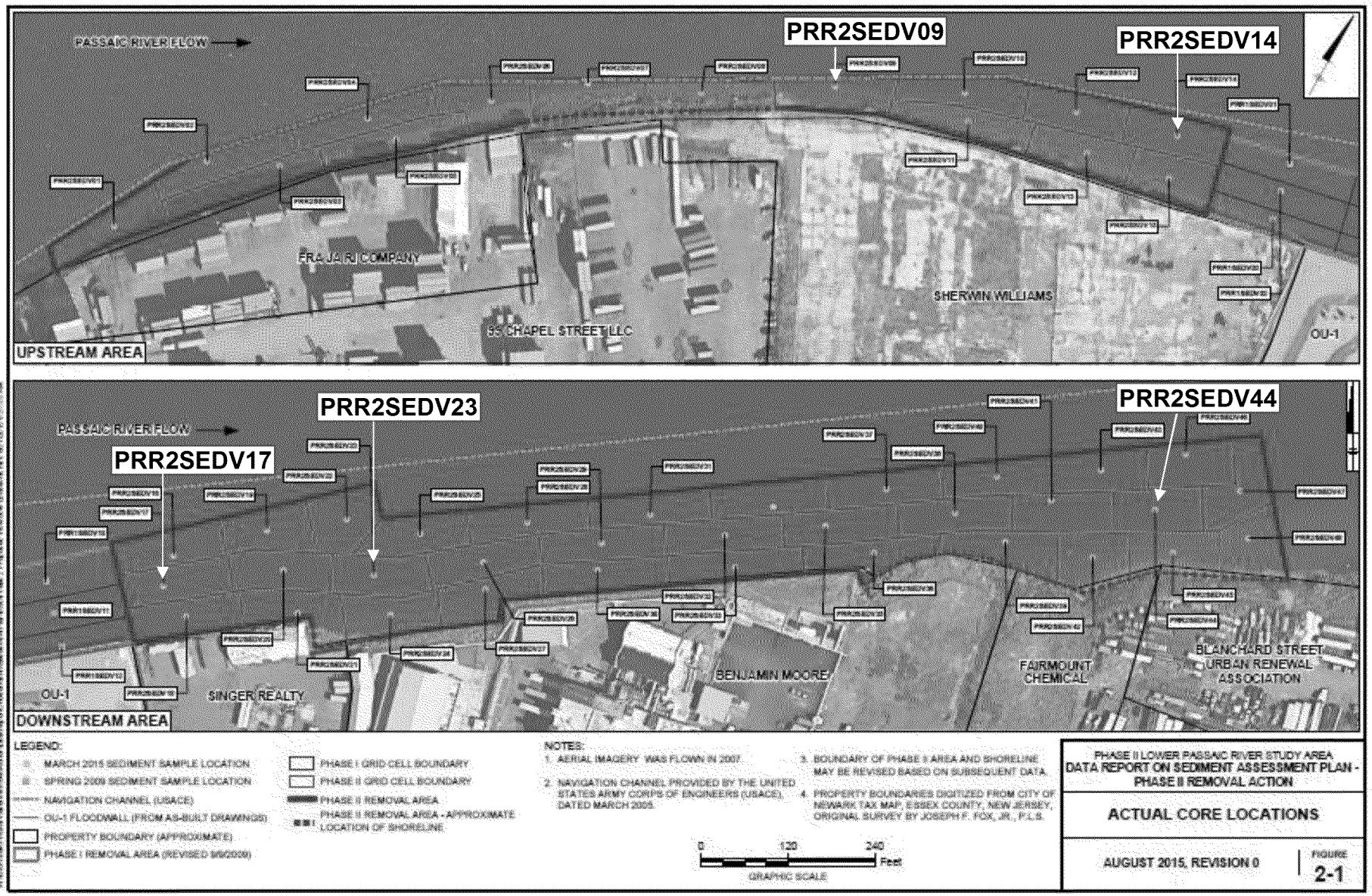
N
W E
S

ESRI Digital Globe
May 2014, 1995
New Jersey StatePlane
NAD 1983

FOIA-2017-010170_V11759

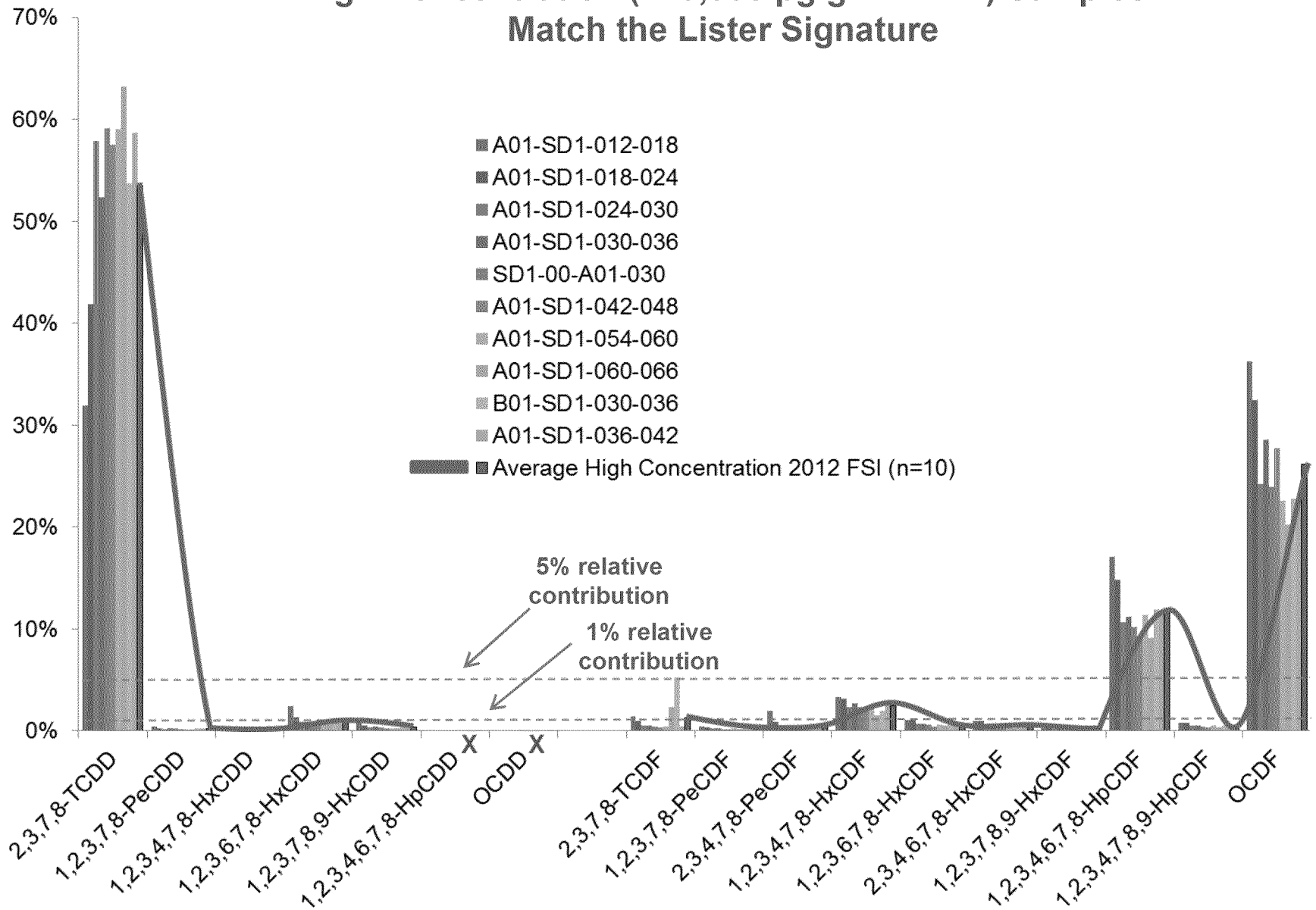
Location of March 2015 Removal Area Phase 2 Sediment Cores (Tierra 2015) Results Reported for 5 Cores (PRR2SEDV09, -14, -17, -23, -44)

Source: Tierra August 2015 Data Report



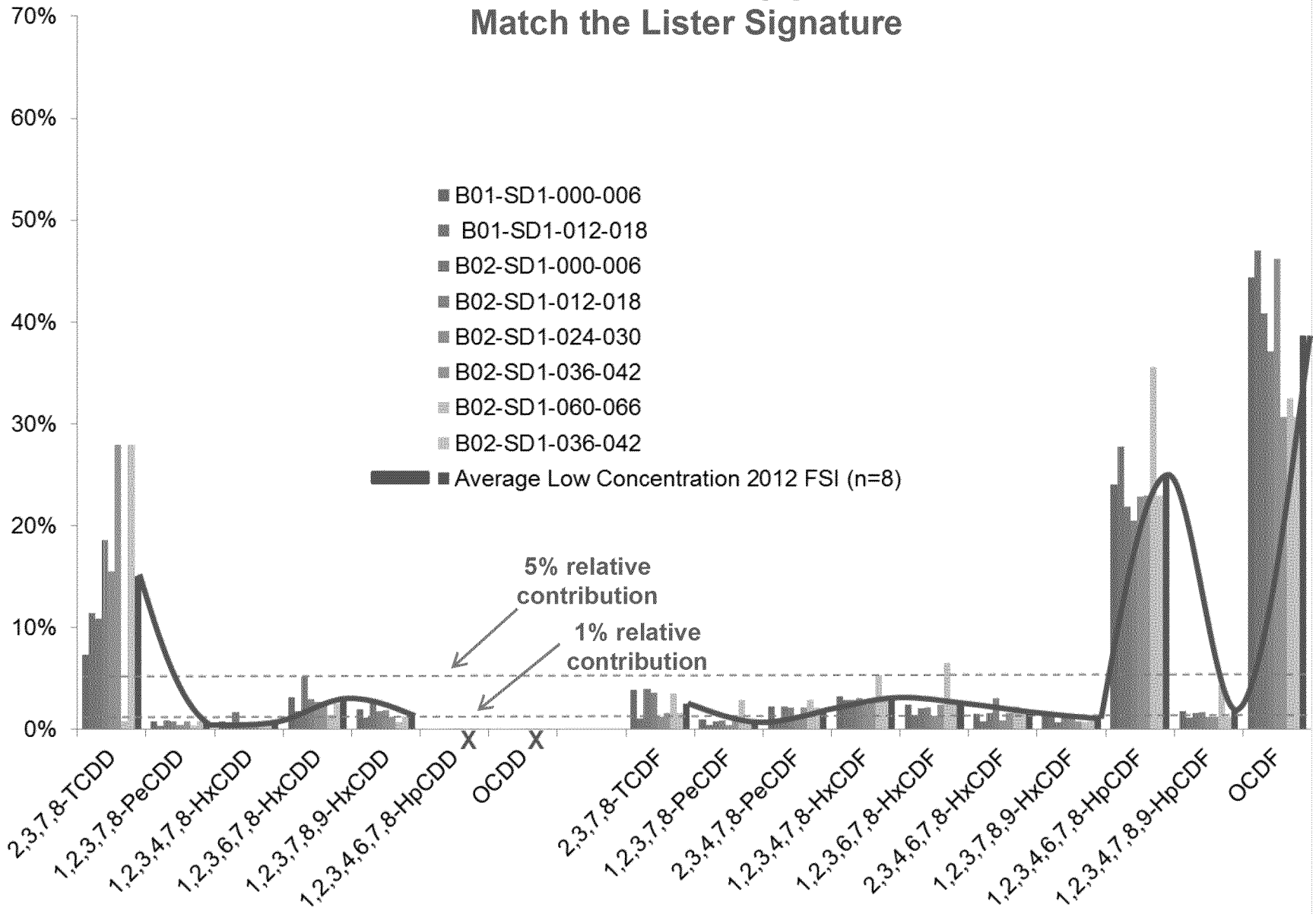
FOIA-2017-010170_V11760

Tierra's Focused Sediment Investigation (2012) High Concentration (>25,000 pg/g PCDD/F) Samples Match the Lister Signature



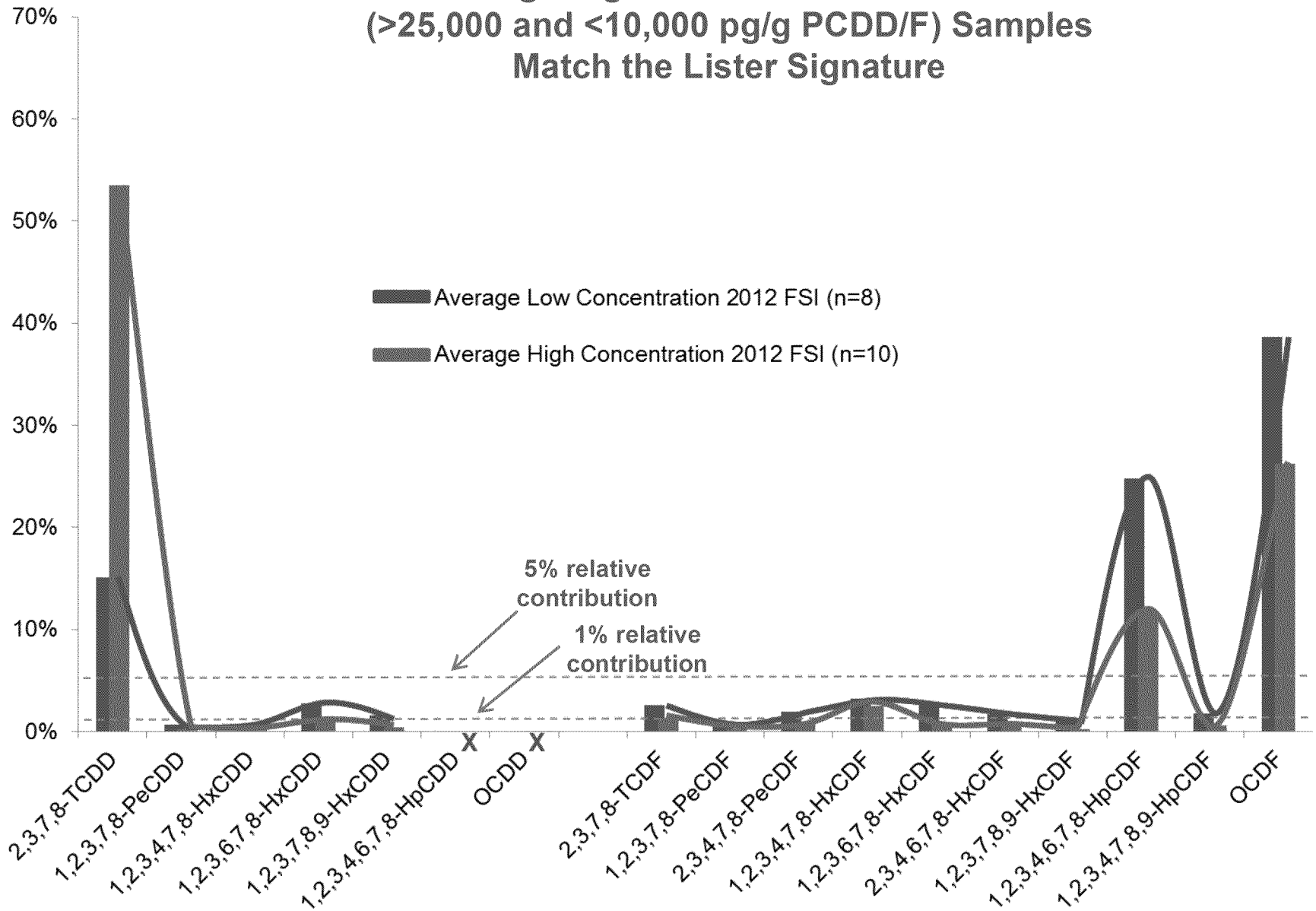
FOIA-2017-010170_V11761

Tierra's Focused Sediment Investigation (2012)
Low Concentration (<10,000 pg/g PCDD/F) Samples Match the Lister Signature



FOIA-2017-010170_V11762

Tierra's Focused Sediment Investigation (2012) Average High and Low Concentration (>25,000 and <10,000 pg/g PCDD/F) Samples Match the Lister Signature



FOIA-2017-010170_V11763

EPA Sampling Data for HCX and HCP is Not Relevant to the Dioxin/Furan Signature in the River

- HCX and HCP are not hazardous or regulated compounds
- HCX Test Method has not been established as reliable or approved
- Even assuming the data are valid, HCX has been reported in background at other sites and is associated with pulp/paper and textile/dye effluents
- HCP was a widely used product present in municipal waste water from consumer and commercial use
- Both HCX and HCP would have been discharged via multiple CSOs to the Passaic River and its Tributaries
- The presence of HCX and HCP in the river is not a relevant marker for Clifton

FOIA-2017-010170_V11764

Disposal of Consumer and Commercial Products Containing HCP is the Source of Background HCP and HCX

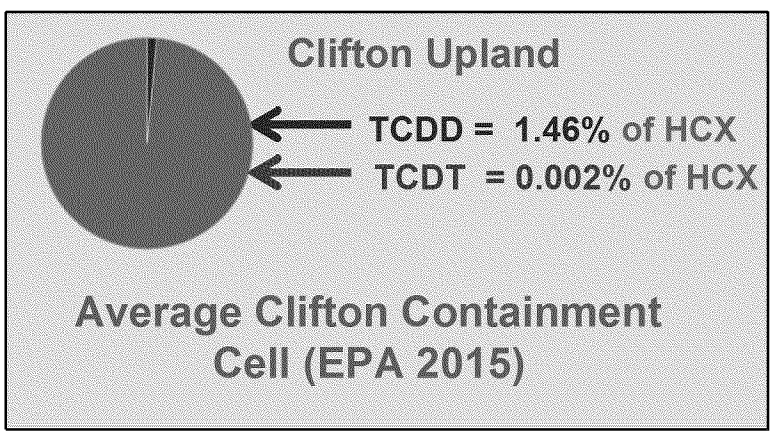
- In 1970, approx. 5MM pounds of HCP were produced for 1,500 consumer products such as tooth paste, cosmetics, soaps, shampoos, deodorants, shaving creams, etc. in the United States (The Lancet, 1/9/82).
  - Equivalent of 0.025 lbs/person in the U.S. (based on 1970 population of 200MM).
- PVSC served approx. 1.3MM non-industrial users in 1970
- Equivalent to 32,500 lbs. of HCP in products used and subsequently disposed via the PVSC system in 1970 (1.3MM non-industrial users multiplied by 0.025 lbs/user).
- Even assuming that only half this volume was consumed between 1950-1970, approx. 325,000 lbs. of HCP would have entered the PVSC system during that time period (32,500 multiplied by 0.5, multiplied by 20 years).
- Commercial HCP is reported to have contained HCX at levels of approx. 100ppm (WHO, Environmental Health Criteria, 88), which translates into approx. 32.5 lbs. of HCX entering the PVSC system from 1950-1970 through the disposal of consumer products.

FOIA-2017-010170_V11765

EPA's Lister AvenueContainment Cell Samples and Clifton Containment Cell Samples (2015) are Completely Different and Show an Inverse Relationship between Dioxin Levels and other Compounds

2,3,7,8-TCDD dominates the 2,4,6,8-TCDT; 1,2,4,5,7,8-HCX is a trace (background) component in the Lister Cell

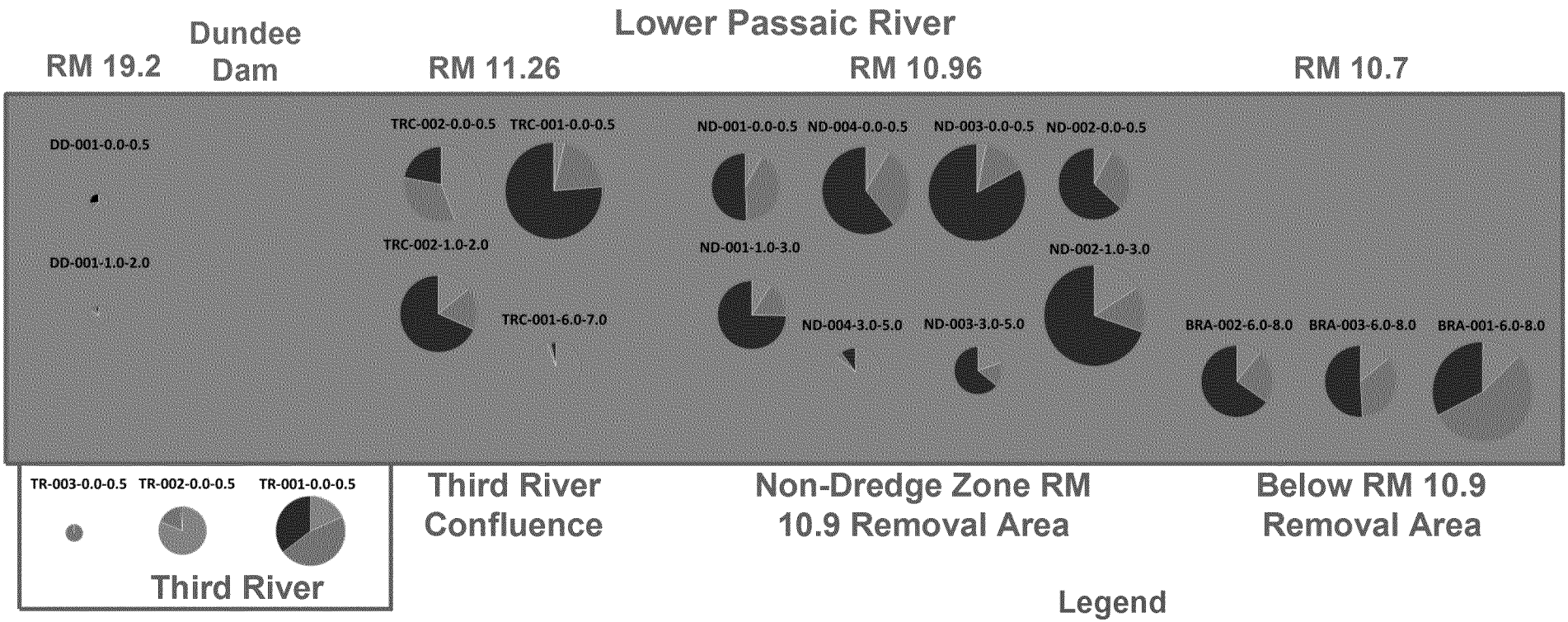
- 2,3,7,8-TCDD
- 2,4,6,8-TCDT
- 1,2,4,5,7,8-HCX



1,2,4,5,7,8-HCX dominates the 2,3,7,8-TCDD; 2,4,6,8-TCDT is present as a trace (background) component in Clifton Cell

FOIA-2017-010170_V11766

Lister's 2,3,7,8-TCDD and 2,4,6,8-TCDT Dominate at EPA RM 10.9 Sediment (2013) Sampling Locations, HCX at Background



- RM 10.9 Samples show 2,3,7,8-TCDD dominates along with 2,4,6,8-TCDT showing Lister is the Source; HCX is at trace/background levels, unlike samples from the Clifton Cell.

- Lister Dioxin/Furan Signature is found in Third River and other sample locations with HCX (see next slide)

Legend

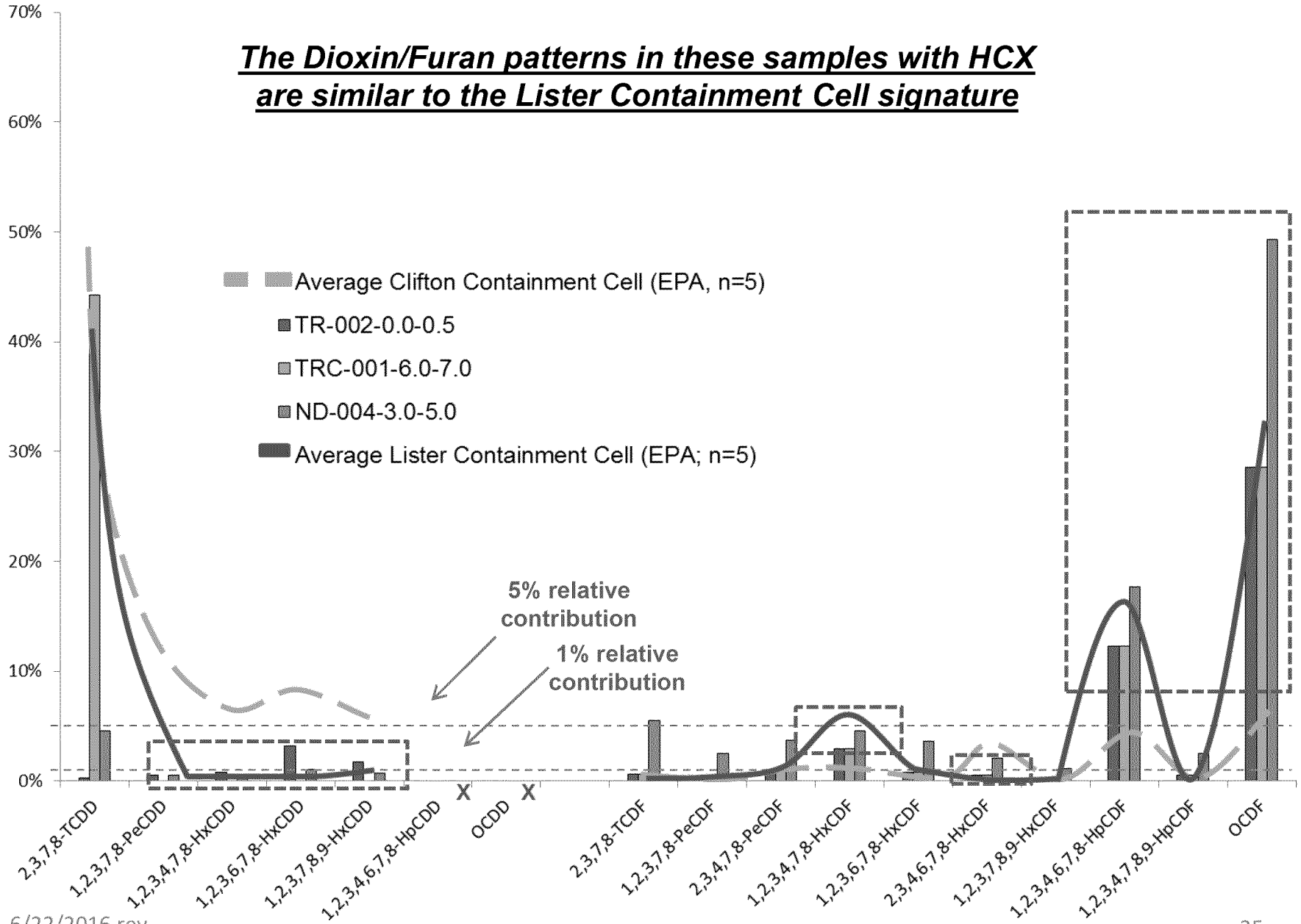
- 2,3,7,8-TCDD
- 2,4,6,8-TCDT
- 1,2,4,5,7,8-HCX

Total HCX + TCDT + TCDD

- < 6 pg/g
- 15 to 95 pg/g
- 480 to 1,500 pg/g
- 1,680 to 11,200 pg/g

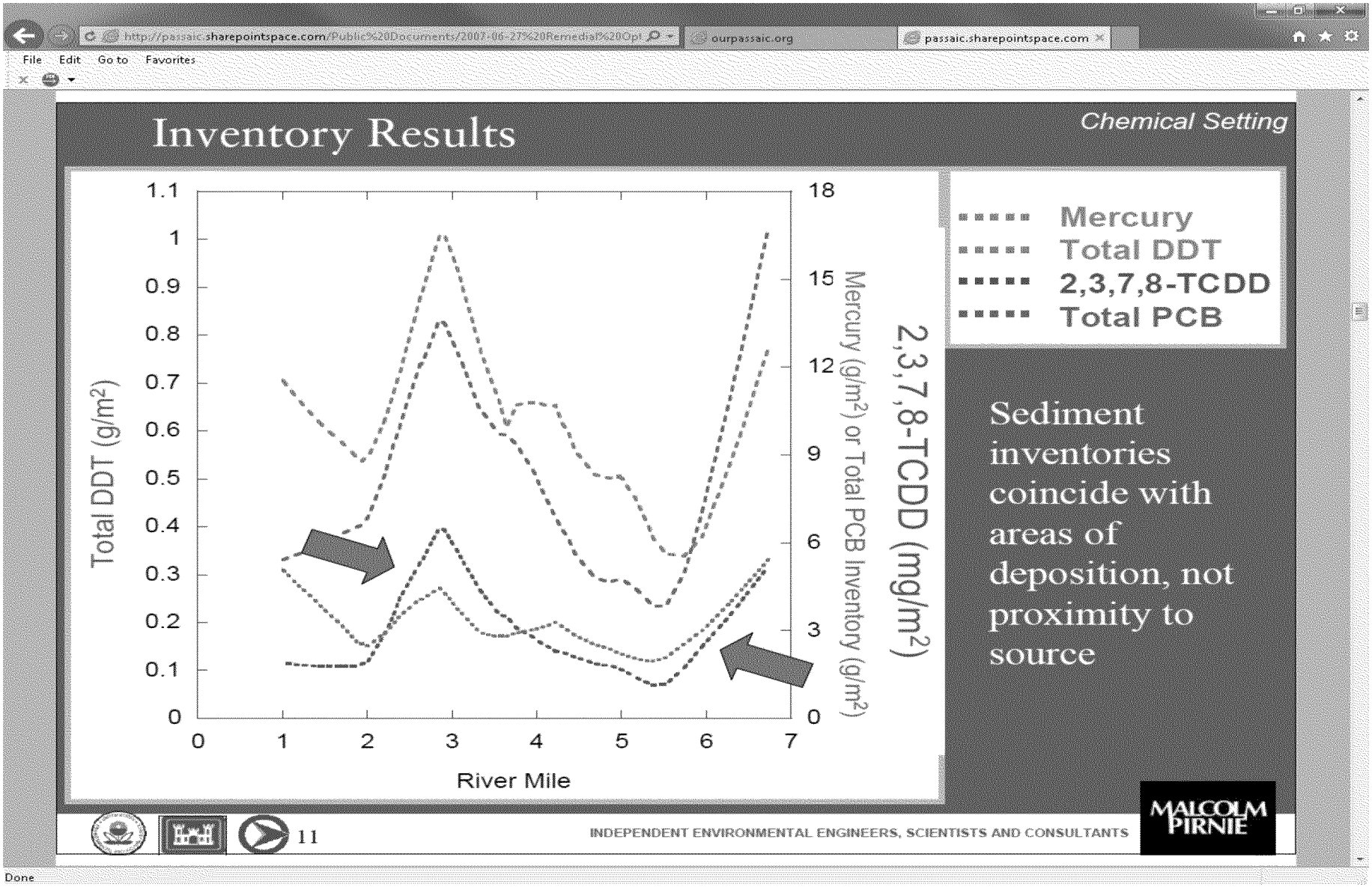
FOIA-2017-010170_V11767

EPA Samples with HCX in Third River and at Confluence (2013) Do Not Match Dioxin Pattern in the Clifton Containment Cell Samples (2015)



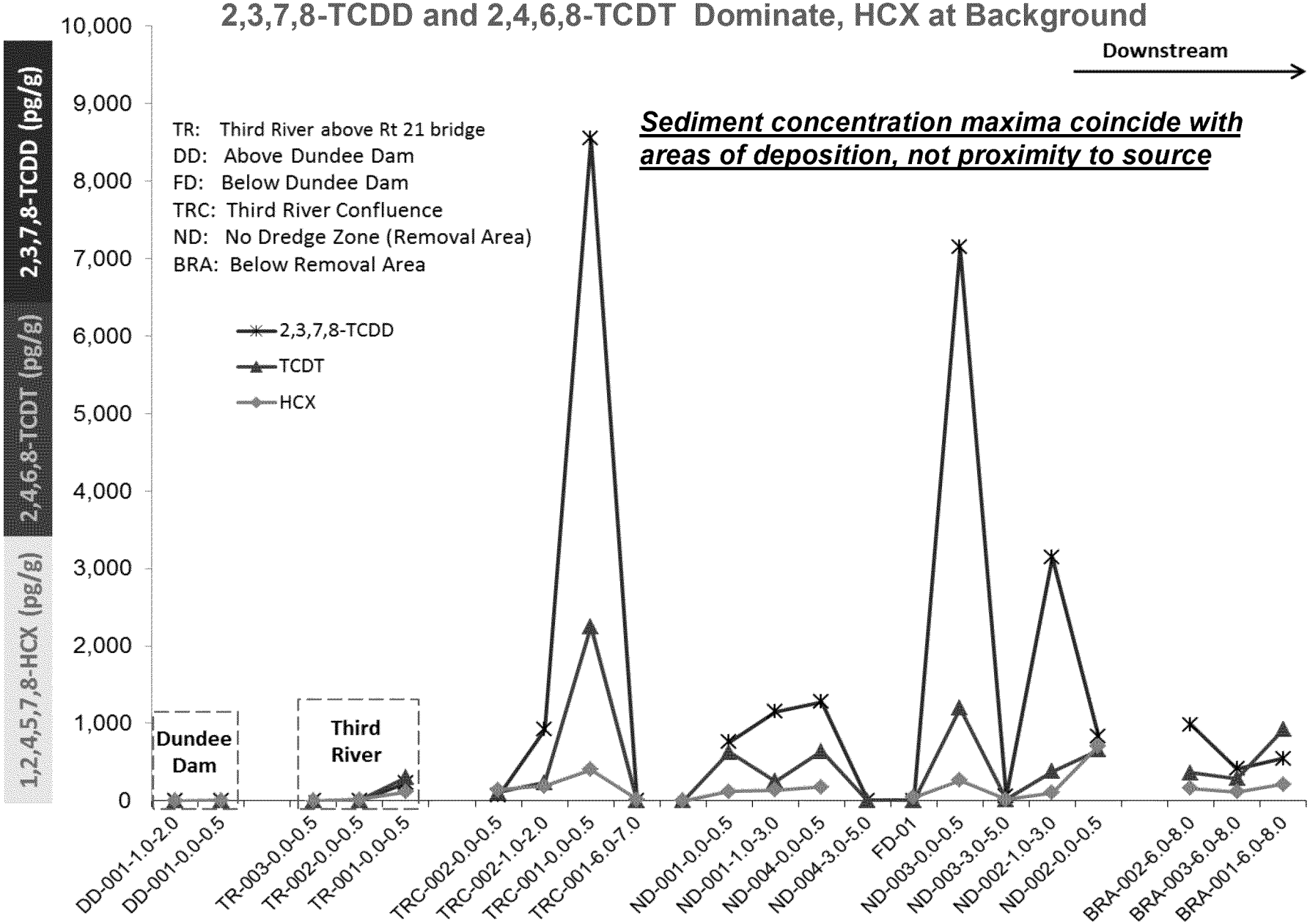
FOIA-2017-010170_V11768

EPA / Malcolm Pirnie Conclusion that Location of Sediment Inventory is Not Indicative of Source Also Applies to RM 10.9 and Other Depositional Areas in the Upper River



FOIA-2017-010170_V11769

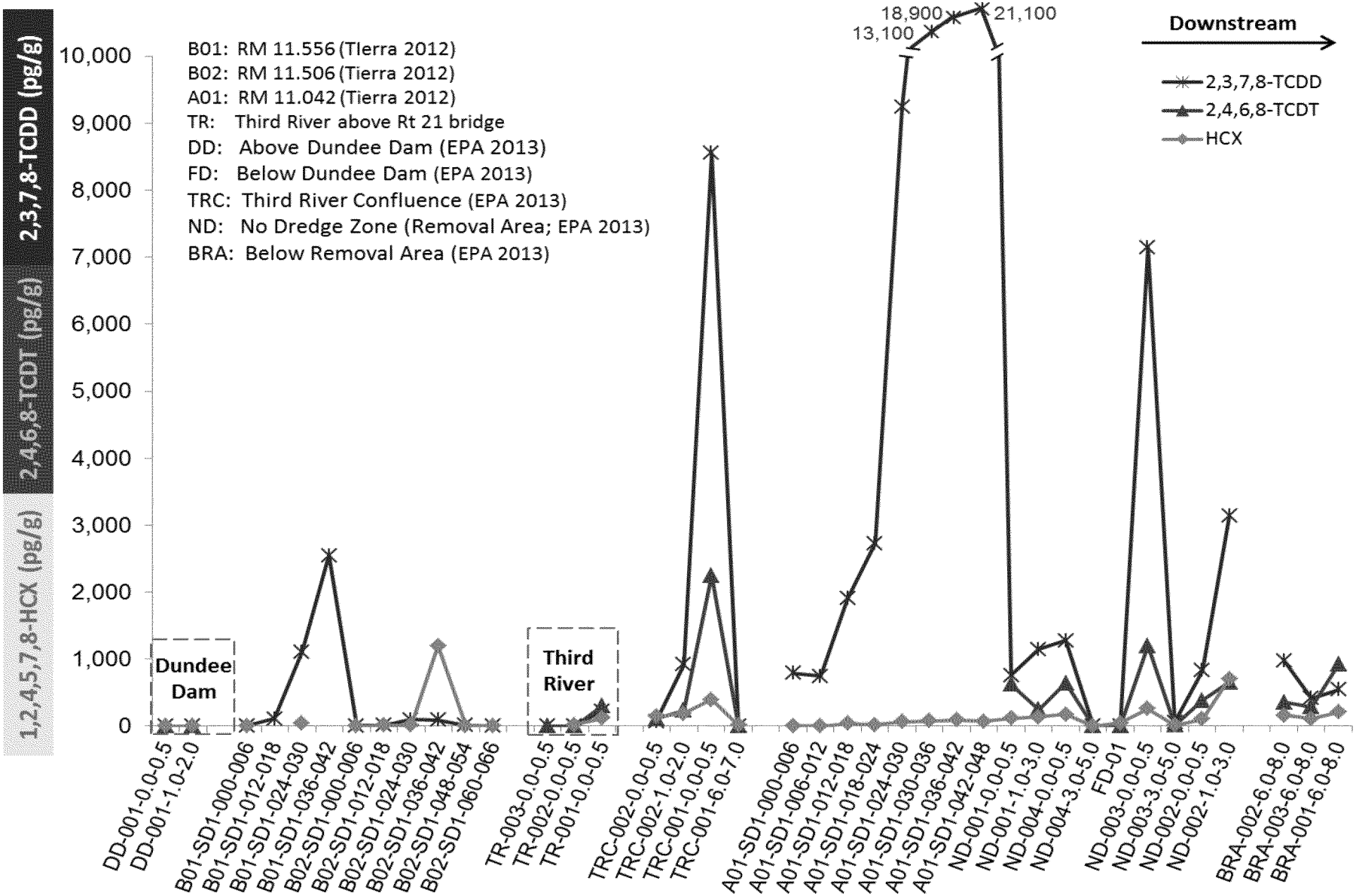
EPA RM 10.9 Sediment Investigation (2013)
2,3,7,8-TCDD and 2,4,6,8-TCDT Dominate, HCX at Background



Sediment concentration maxima coincide with areas of deposition, not proximity to source

FOIA-2017-010170_V11770

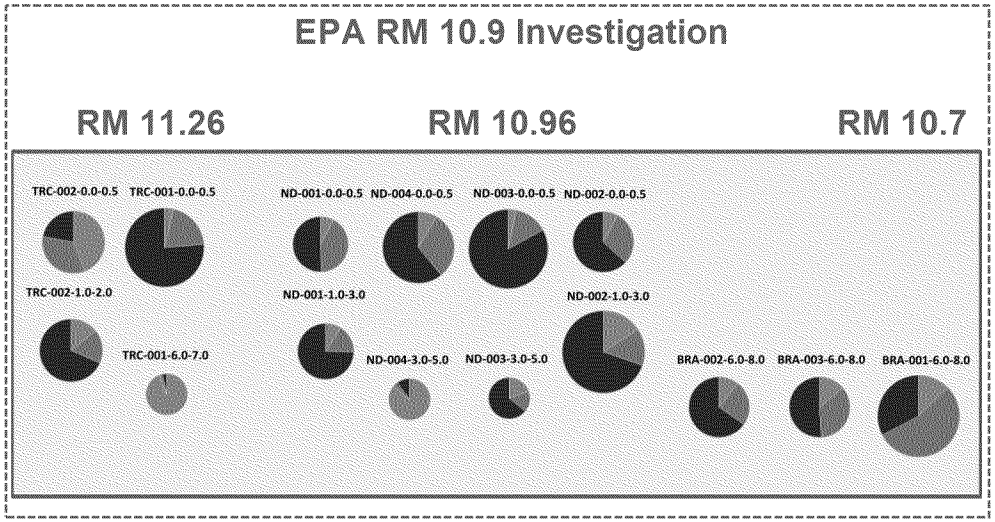
EPA RM 10.9 (2013) and Tierra FSI (2012) Sediment Investigations
2,3,7,8-TCDD and 2,4,6,8-TCDT dominate, HCX at Background

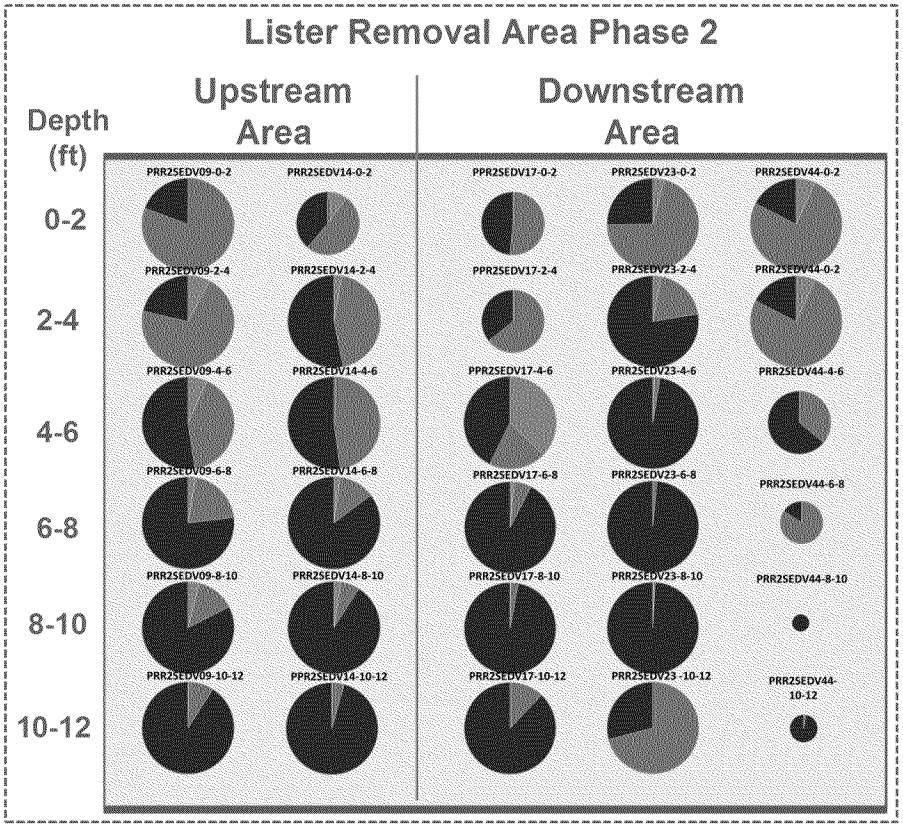


FOIA-2017-010170_V11771

EPA Passaic River Sediment Investigations
RM 10.9 (2013; n=15 in immediate vicinity) vs.
EPA Lister Removal Area Phase 2 (2015; n=30)

<u>The dominant 2,3,7,8-TCDD and 2,4,6,8-TCDT show</u>
<u>Lister, not Clifton, is the source in the river</u>





Legend

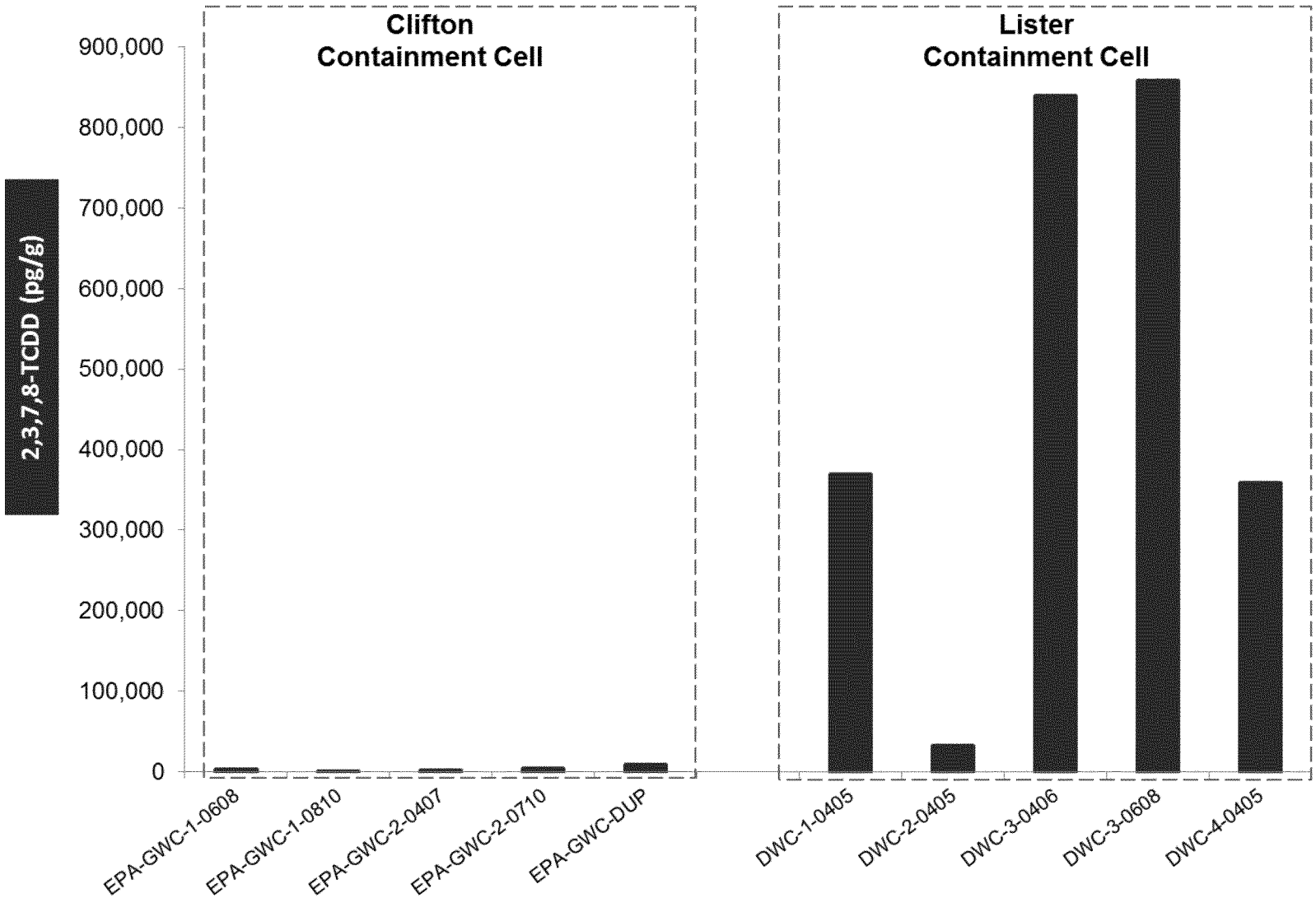
- 2,3,7,8-TCDD
- 2,4,6,8-TCDT
- 1,2,4,5,7,8-HCX

Total HCX + TCDT + TCDD

- < 6 pg/g
- 15 to 95 pg/g
- 480 to 1,500 pg/g
- 1,680 to 845,000 pg/g

FOIA-2017-010170_V11772

Comparison of 2,3,7,8-TCDD in Samples from Clifton and Lister Containment Cells – Lister has *Exceedingly High* Dioxin Levels



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Conclusion from EPA Source Investigation:

The Lister Signature Matches the Dioxin/Furan Pattern in the River and TCDT is a Tracer for the Lister Site. The Clifton Signature is unique and not found in the River

FOIA-2017-010170_V11774