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September 9, 2016

VIA EMAIL & U.S. MAIL

Ms. Alice Yeh
Remedial Project Manager
U.S. Environmental Protection Agency, Region 2
290 Broadway, 19th Floor
New York, NY 10007

Re: PPG Industries, Inc. Nexus and Request for *De Minimis* Settlement Lower Passaic River Study Area Operable Unit of the Diamond Alkali Superfund Site

Dear Ms. Yeh:

This report is submitted on behalf of PPG Industries, Inc. ("PPG") regarding its alleged nexus to the Lower Passaic River Study Area Operable Unit of the Diamond Alkali Superfund Site (the "LPRSA"). Please add this letter and enclosure to the administrative record for the LPRSA.[1]

The purpose of this report is to document the facts concerning PPG's alleged connection to the LPRSA and to provide the basis for a *de minimis* settlement. This report contains the following sections: **Part I** provides an executive summary; **Part II** describes PPG's operations in detail; **Part III** details the alleged pathways between PPG and the LPRSA; **Part IV** explains PPG's lack of connection to the LPRSA contaminants driving the remedial action; **Part V** discusses whether the facts support the conclusion that PPG is liable for LPRSA response costs under the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"); **Part VI** discusses PPG's expenditures and cooperation to date concerning the LPRSA; and **Part VII** explains why PPG is eligible for a *de minimis* settlement.

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1 The facts and analyses contained in this letter and the enclosed report are intended to supplement PPG's Section 104(e) responses concerning its former operations in Newark, New Jersey, including but not limited to with respect to the LPRSA and the Riverside Industrial Park Superfund Site.

I. EXECUTIVE SUMMARY

PPG did not directly or indirectly discharge hazardous substances from its former Newark Coatings Facility located at 29 Riverside Avenue in Newark, New Jersey (the "NCF") into the LPRSA before it sold the property and ceased operations in 1971 – and there is no credible evidence that it did so. The NCF was located on what became known after the cessation of PPG's operations as the Riverside Industrial Park Superfund Site (the "RIP"), which was investigated and ultimately listed as a Superfund site due to a 2009 intentional oil discharge into the LPRSA (and not because of any discharges by PPG). In sum, the facts concerning PPG's operation of the NCF show the following:

- PPG operated the NCF from 1902 until 1971. PPG only manufactured paints/enamels, resins, varnishes, linseed oil, and lacquers at the NCF.

- PPG is not a source of, and in most cases did not even use or generate, any of the contaminants of concern that are necessitating remedial action in the LPRSA, namely (i) dioxins/furans, including 2,3,7,8-TCDD ("2,3,7,8-TCDD"), (ii) polychlorinated biphenyls ("PCBs"), (iii) dichlorodiphenyl-trichloroethane and its breakdown products ("DDx"); and (iv) mercury (collectively, the "Remedial Action COCs"). PPG may have used small quantities of mercury as a preservative in some NCF-manufactured paints, but there is no evidence that mercury was ever discharged from the NCF into the LPRSA.

- Despite that PPG operated the NCF before environmental laws were enacted in the late 1970s, it took proactive steps to minimize the potential environmental consequences of its operations and ensure that any waste was properly disposed of. For example, PPG reused non-chlorinated solvents to manufacture lesser quality coatings at the NCF. Solid waste was drummed, picked up by a licensed hauler and disposed of offsite, and process wastewater was sent to the Newark sewer system before 1924 and the Passaic Valley Sewerage Commissioners ("PVSC") system in and after 1924. <u>Upon connection to the PVSC system, it became impossible for any NCF wastewater to overflow and discharge to the LPRSA, as the NCF was connected to a regulator chamber that did not allow overflows even during high flow events</u>. As a result, PPG did not discharge hazardous substances directly, or indirectly via the PVSC system, to the LPRSA.

- PPG did not conduct coating manufacturing outdoors at the NCF, did not store hazardous substances outdoors at the NCF in a manner that would enable them to be carried by stormwater to the LPRSA, and there is no evidence that any PPG hazardous substances were present in any NCF stormwater that reached the LPRSA.

- PPG did not utilize any pipes at the NCF to directly discharge any hazardous substances to the LPRSA.

- Even assuming any PPG hazardous substances reached the LPRSA, these hazardous substances either would have been removed by dredging adjacent to, downstream, and upstream of the NCF, or naturally degraded long ago.

- In any event, to the extent Remedial Action COCs have been detected in RIP soils they have only been present at low concentrations, no Remedial Action COCs have been detected above applicable standards in RIP groundwater monitoring wells, and Remedial Action COC concentrations in sediments downstream of the RIP are higher than sediment concentrations adjacent to the RIP – all of which indicates that PPG's NCF operations specifically (and the RIP generally) are not a source of elevated sediment concentrations in the LPRSA.

At bottom, the facts simply do not show that PPG is responsible for LPRSA contamination because, first and foremost, PPG did ***not*** discharge hazardous substances to the LPRSA – unlike 80 and 120 Lister Avenue in Newark (for which Tierra Solutions, Inc., Maxus Energy Corporation, and Occidental Chemical Corporation (collectively "TMO") are responsible) that *directly and intentionally discharged* 2,3,7,8-TCDD, DDx, and other hazardous substances to the LPRSA to maximize profits. *Diamond Shamrock Chem. Co. v. Aetna Cas. & Surety Co.*, 258 N.J. Super. 167, 183 (App. Div. 1992) ("A number of former plant employees testified concerning Diamond's waste disposal policy which essentially amounted to 'dumping everything' into the Passaic River."); *id.* at 197 (the Lister Site "intentionally and knowingly discharged hazardous pollutants with full awareness of their inevitable migration to and devastating impact upon the environment"); *id.* at 213 ("The only conclusion to be drawn is that Diamond's management was wholly indifferent to the consequences flowing from its decision [to run its reactor at high temperatures]. Profits came first.").

Despite its lack of liability, PPG has spent a decade and incurred substantial cost cooperating with the United States Environmental Protection Agency ("USEPA") to perform the Remedial Investigation and Feasibility Study ("RI/FS") and River Mile ("RM") 10.9 removal action for the LPRSA. With the issuance of the Record of Decision for the lower 8.3 miles of the LPRSA ("FFS ROD"), it is now time for USEPA to offer PPG a *de minimis* settlement for the LPRSA as required by CERCLA.

II. THE FACTS CONCERNING THE RIP AND PPG'S OPERATION

As explained briefly below and at length in the enclosed Report on PPG Industries Nexus to Lower Passaic River Study Area prepared by Woodard & Curran (the "W&C Report"), the facts surrounding PPG's operation of the NCF demonstrate that PPG is not associated with LPRSA impacts.

A. Riverside Industrial Park Has Been Used by Multiple Operators and Is Not a Superfund Site Due to PPG's Operations

The RIP has been in existence and used for a variety of industrial activities for over 100 years. In-filling of the Passaic River to create the RIP began prior to 1892. Said differently, fill

was placed at the RIP prior to the commencement of PPG's operations in 1902. [W&C Report at 2-1.] By 1909, the majority of the current boundaries of the RIP had been developed, although portions remained unreclaimed. [W&C Report at 2-1.] By 1931, additional lots were created by further filling of the Passaic River to establish the current configuration of the RIP. [W&C Report at 2-1.]

As the name suggests, the RIP was operated by different industrial companies at different points in time. From 1902 until early 1971, PPG (or its predecessor Patton Paint Company) operated a coatings facility at the NCF that manufactured paints, lacquer, enamels, varnishes, linseed oils, and resins. [W&C Report at 3-1.] After PPG ceased operations and sold the property in 1971, industrial operations continued at the RIP, including, among other things, (i) chemical manufacturing, distribution and warehousing; (ii) manufacturing of coatings, dyes, soaps, detergents, and consumer beauty products; and (iii) scrap metal recycling. [W&C Report at 2-1 to 2-2.] As of August 2016, current operations at the RIP include (i) warehousing/distribution; (ii) used tire accumulation; (iii) vehicle dismantling and recycling; (iv) construction equipment storage; and (v) chemical research, manufacturing, storage, repacking and/or distribution. [W&C Report at 2-3.]

Given the long history of industrial operations, the RIP is not fairly categorized as, and should be not considered, a site for which only PPG may have responsibility. Indeed, as USEPA's Hazard Ranking System scoring for the RIP explains, the ***only*** reason the RIP was even scored for potential listing on the National Priorities List ("NPL") was because of an intentional, direct discharge from Building 12 into the Passaic River in 2009:

- "The initial investigative actions at the site were in response to a reported spill associated with Source 1 and the focus remained in addressing its release to the Passaic River." [HRS Documentation Record at 16 (Sept. 2012).]

- "On October 29, 2009, the oily content of tanks associated with Source 1 in the basement of Building 12 … released into the Passaic River through a connection to a storm sewer. The tanks were connected to the storm sewer by a hose." [HRS Documentation Record at 20.]

- "Based on the field investigation during removal activities, contents of the two basement tanks appeared to have been intentionally set up to discharge into the sewer; when the valve was closed, the release to the Passaic River ceased." [HRS Documentation Record at 15.]

PPG had nothing to do with a discharge that occurred 38 years after its operations and ownership at the NCF ceased. Nor did PPG have anything to do with the September 22, 1988 spill of approximately 20 pounds of terephthaloyl chloride in Building 7, the November 8, 1990 spill of 50 pounds of plastic in Building 12, any of the other ten (10) known discharges of hazardous substances that occurred at the RIP after 1971, or the "poor waste management practices" observed by the New Jersey Department of Environmental Protection ("NJDEP") in 1987. [HRS Documentation Record at 17, 24; W&C Report at 2-1 to 2-2.] Nevertheless, PPG continues to be a cooperative party and has agreed to perform the RI/FS for the RIP – despite its

lack of connection to the NPL Hazard Ranking System scoring and without participation by any of the other seventeen (17) General Notice Letter ("GNL") recipients for the RIP who will be asked to participate in the remedial action, if there is one.

B. The Nature of PPG's Operations

Contrary to the widespread and varied industrial operations at the RIP since early 1971, PPG's operations at the NCF were limited to manufacturing paints/enamels, resins, varnish, linseed oil, and lacquers. [W&C Report at 3-1.] In general, raw materials were brought to the NCF primarily by rail or truck, although flax seed and coal (for power) were brought onsite by barge until 1946. [W&C Report at 3-1.] Liquid raw materials were stored in aboveground storage tanks ("ASTs"), many of which were located in Buildings 4 and 15. [W&C Report at 3-1.] Ten 10,000-gallon underground storage tanks ("USTs") adjacent to Building 12 stored non-chlorinated solvents. [W&C Report at 3-1.]

The NCF used a gravity-based system, whereby raw materials stored on upper floors of certain buildings were piped to lower floors via gravity for mixing, thinning, and blending. [W&C Report at 3-1.] Vessels and vats used to mix the various coatings were rinsed with caustics or non-chlorinated solvents for cleaning, with the resulting liquid re-used in lesser quality coatings or sent offsite for disposal. [W&C Report at 3-1.] Finished products were transported from the NCF by rail or truck, usually in drums, or 5-gallon and smaller containers. [W&C Report at 3-1.]

Importantly, and unlike the poor waste management practices NJDEP observed at the RIP in 1987, PPG maintained and promoted a culture of strong waste management practices. The NCF had "cement walls" around all of its tanks to contain accidental spills. [W&C Report at 3-1.] Residues generated when the tanks were cleaned were placed in 55-gallon drums and disposed of offsite by a hauling company. [W&C Report at 3-1.] As explained by one former employee who worked at the NCF from 1939 until 1971, PPG "was very concerned about safety and all spills were immediately cleaned up and placed in the 55 gallon drums for disposal." [Affidavit of Edward J. Clark at 3 (Jan. 24, 1994).]

A more detailed summary of PPG's NCF operations is provided below.[2]

1. *Paints*

PPG primarily manufactured oil-based paints at the NCF (although some water-based paints were made). [W&C Report at 3-1.] The raw materials used in paint manufacturing included (i) natural gums, (ii) natural resins, (iii) flax seeds, (iv) non-chlorinated solvents – water, toluene, xylene, ethylbenzene, linseed oil, methyl ethyl ketone, naphtha, turpentine, and mineral spirits, (v) pigments, (vi) caustic soda, (vii) dyes, (viii) alkyd resins, (ix) chromium, (x) lead, (xi) titanium, (xii) zinc, (xiii) lead carbonate, (xiv) mercury, (xv) copper oxide, and (xvi) cadmium. [W&C Report at 3-2.]

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2 PPG's operations at the NCF have no relationship to, and were entirely distinct from, PPG's chromate operations in Jersey City, New Jersey.

Paint manufacturing took place in Buildings 2, 3, and 12 at the NCF. [W&C Report at 3-1.] Dry pigments and mixing varnishes or oils were brought to the top floor and mixed to form a paste. The paste mixture was fed through chutes to grinding mills on the next floor. Batches would then be sent again via chutes to a lower floor where thinning oils and solvents were added in large processing tanks, and if desired, metal pigments (lead, titanium oxides, cadmium, or chromium) could be added to meet certain desired quality or color characteristics for the paints. [W&C Report at 3-2.] A trace amount of mercury probably was added to some paints as a preservative once the manufacturing process was complete. [W&C Report at 3-2.] The paint was then fed via pipes to another area where the finished product was packaged. [W&C Report at 3-2.]

2. *Resins*

Alkyd resin production occurred in Building 17 at the NCF from approximately the 1930s until 1969. [W&C Report at 3-2.] Generally, these resins were produced from polyunsaturated fatty acids (vegetable oil, linseed oil) and glycerin. [W&C Report at 3-2.] With heat, the process created glyceride oil to which phthalic anhydride was added, after which the resins were diluted with non-chlorinated solvents and used in paint and varnish manufacturing.[3] [W&C Report at 3-2.] Phenolic resins were not manufactured at the NCF, but rather were purchased from a supplier. [W&C Report at 3-2.]

3. *Varnish*

Varnish was manufactured in Building 7 at the NCF, where raw materials were heated to form the final product. [W&C Report at 3-2.] Varnish at the NCF was made from drying oils/polymers (*i.e.*, linseed oil) and solvents, primarily white spirits, mineral turpentine, and kerosene (with occasional use of minor amounts of toluene, xylene, and napthas). [W&C Report at 3-2.] Over time, alkyd resins replaced drying oils in varnish manufactured at the NCF. [W&C Report at 3-2.]

4. *Linseed Oil*

Linseed oil was manufactured in Building 10 at the NCF from 1923 until 1947. [W&C Report at 3-1 to 3-2.] To do so, flax seed was unloaded from barges on the Passaic River into grain elevators/silos. The flax seed was then pressed to release the oil, after which it was refined with caustic soda or non-chlorinated solvents to make linseed oil. [W&C Report at 3-2 to 3-3.] The linseed oil was then used in the production of varnish, resins, and paints.

5. *Lacquer*

Lacquer manufacturing occurred in Building 14 at the NCF. [W&C Report at 3-1.] PPG manufactured lacquer by combining nitrocellulose (a resin) and solvents, such as butyl acetate.

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[3] The non-chlorinated solvents used in resin manufacturing include the same non-chlorinated solvents referenced with respect to paint manufacturing. [W&C Report at 3-2.]

[W&C Report at 3-3.] Small amounts of flake naphthalene were used in lacquer manufacturing at the NCF. [W&C Report at 3-3.]

C. PPG's Management of Wastes

PPG did not utilize any lagoons, ponds, landfills, disposal pits, dry wells, settling basins, or other disposal units at the NCF.[4] [W&C Report at 4-1.] Non-chlorinated solvents were recovered and reused or disposed of offsite in 55-gallon drums, and residuals present in mixing vats were removed and disposed of offsite in 55-gallon drums. [W&C Report at 4-1.] Wastewater was sent to the City of Newark sewer system before 1924 and the Passaic Valley Sewerage Commissioners ("PVSC") system in and after 1924. [W&C Report at 4-1.] In short, PPG did not discharge its wastes to the LPRSA, and as mentioned above, the company made a genuine effort to minimize the potential environmental impact of its operations.

III. THE ALLEGED PATHWAYS BETWEEN PPG AND THE LPRSA

On September 15, 2003, USEPA issued a GNL to PPG for the LPRSA. Although the RIP is located along the Passaic River, there are no completed direct or indirect pathways between PPG hazardous substances and the LPRSA – and TMO's attempts to suggest otherwise are unsupported (and often contradicted) by the facts.

A. Direct Discharges

There is no credible evidence that PPG directly discharged hazardous substances into the LPRSA. [W&C Report at 5-1.] PPG has interviewed over 15 former employees of the NCF and ***all of them confirmed that PPG did not directly discharge anything to the LPRSA***. Against this backdrop, TMO suggests that two documents demonstrate that PPG is a direct discharger to the LPRSA: (i) a supposed December 10, 1992 interview of a former NCF employee, Thomas Casiere, and (ii) a September 26, 1994 affidavit of Willie Moore, another former NCF employee.

First, in connection with the New Jersey state litigation involving the Passaic River, TMO served discovery responses that stated, in part: "Former PPG employee Thomas J. Casiere stated in an interview on December 10, 1992 that he recalled instances in which paint from the PPG Site was spilled into the Passaic River when a hose connecting a boat to a tank on shore came loose." [Third Party Plaintiffs' Objections and Responses to Third-Party Defendant PPG Industries, Inc.'s First Set of Interrogatories to Third Party Plaintiffs at 7 (June 22, 2012) ("TMO Discovery Responses").] TMO ***does not cite anything*** memorializing this supposed interview – in stark contrast to other portions of their interrogatory responses that provide bates numbers to allegedly supporting documentation. [*Id.*] That omission is telling. TMO's naked accusation also is undermined by ***USEPA's*** interview of Mr. Casiere in August 1993, in which the agency concluded that Mr. Casiere "could not offer any help" given his age and the fact that he "had a

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4 Nor is there any evidence that PPG used a 100,000-gallon tank, which was an area of inquiry when USEPA was investigating PPG's connection to the Caldwell Trucking Superfund Site in Fairfield, New Jersey. [*See, e.g.*, USEPA Interview Memorandum of E. Clark at 1-2 (Aug. 12, 1993); W&C Report at 2-2.]

great deal of difficulty remembering any kind of details." [USEPA Interview Memorandum of T. Casiere at 2 (Aug. 16, 1993).] Finally, TMO's suggestion that paint (*i.e.*, finished product) was transferred from a tank onsite to a boat is not accurate: finished paint was transported by truck or rail, not boat. [W&C Report at 3-1.]

Second, the September 26, 1994 affidavit of Willie Moore contains factual errors and is contradicted by other information about the NCF, including a prior affidavit Mr. Moore signed a mere eight months earlier, as set forth in the following table. (It bears noting that the September 26, 1994 affidavit of Mr. Moore apparently was prepared by Kroll Associates, a then-consultant to Tierra, in an effort to build a seemingly credible nexus package against PPG.)

Tierra Prepared Moore Affidavit	**Contradictory Evidence**
"During my tenure at the facility I had personally witnessed other PPG employees dumping containers into the Passaic River." [Affidavit of W. Moore ¶ 3 (Sept. 26, 1994).]	In the same paragraph, Mr. Moore admits he has no knowledge of the contents of the containers: "I am ***not*** knowledgeable regarding the contents of those containers." [Affidavit of W. Moore ¶ 3 (Sept. 26, 1994) (emphasis added).]
"Every building at the PPG facility had a 4" to 6" sewer pipe running directly to the river. Although my knowledge is limited regarding the use of these sewer lines, each building had floor drains that were covered by grates. I have witnessed PPG employees sweeping residue, including spills of products and raw materials, down these floor drains." [Affidavit of W. Moore ¶¶ 4-5 (Sept. 26, 1994).]	"While I was employed at this facility, the ***only*** procedure for disposing of any waste products was to transfer the material into 55 gallon drums." [Affidavit of W. Moore ¶ 4 (Jan. 24, 1994) (emphasis added).] No floor drains associated with PPG's operations have been identified at the RIP by PPG, NJDEP, or USEPA. [W&C Report at 5-1.] It would be illogical for a coatings operation to dispose of waste in floor drains, as the coatings themselves would coat the piping and eventually clog it.

As PPG previously stated in its Section 104(e) responses to USEPA, PPG did not directly discharge hazardous substances to the LPRSA. [PPG 104(e) Responses at 7 (Sept. 18, 1996).][5]

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5 The only other information of which PPG is aware concerning potential direct discharges from the NCF is a single sentence contained in the 1915 U.S. Army Corps of Engineers Chief's Report, alleging that PPG's predecessor, Patton Paint Company, dumped ashes, tin cans, waste paint, and refuse into the Passaic River. No other information is available (whether in the Chief's Report, PPG files, USEPA files, or NJDEP files) to substantiate this allegation. In any event, even assuming this disposal occurred, these materials would have been removed by dredging for the barge berth adjacent to the NCF property. [*See* W&C Report at 5-10.]

Furthermore, the two pipes near Building 7 that are present on the top of the river bulkhead wall were not present when PPG operated the NCF – a conclusion drawn from the absence of these pipes on PVSC notes created in or around 1971. [W&C Report at 5-2.] One of these pipes appears to be the source of the 2009 "oil spill" from the RIP into the LPRSA. [W&C Report at 5-1 to 5-2.] As USEPA has explained, this pipe appears to have been "intentionally set up to discharge" into the LPRSA. [HRS Documentation Record at 15.] PPG had no involvement with this intentional discharge, which, in any event, occurred long after 1971.

B. Indirect and Other Discharges

There are three possible indirect pathways from PPG's NCF to the LPRSA: (i) stormwater, (ii) pipes in the river bulkhead wall, and (iii) wastewater discharges to the sewer system.

1. *Stormwater*

There was no stormwater drainage system at the NCF. [W&C Report at 5-1.] Instead, stormwater flow was based on land topography.[6] [W&C Report at 5-1.] While the general direction of stormwater flow at the NCF was towards the LPRSA, hazardous substances, if any, present in stormwater from PPG's operations would have been, at worst, negligible for four reasons: (i) PPG did not conduct manufacturing operations outdoors, (ii) there is no information indicating that hazardous substances were stored outdoors in a manner that would enable them to be present in stormwater reaching the LPRSA, (iii) there is no indication that RIP soils were eroded by stormwater flowing towards the LPRSA, and (iv) there is no evidence that any hazardous substances were present in any NCF stormwater that reached the Passaic River.[7] [W&C Report at 3-1.]

2. *Pipes in the River Bulkhead Wall*

There are two sets of pipes associated with the river bulkhead wall at the RIP: (i) seven (7) pipes that are located approximately 3 feet below the top of the bulkhead wall, and (ii) a reference in a 1910 NCF blueprint for the varnish building to a possible pipe connected to a possibly constructed 6-inch deep concrete sink. [W&C Report at 5-6.] None of this piping indirectly discharged PPG hazardous substances from the NCF to the LPRSA.

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6 In its discovery responses, TMO cites to specifications from a 1902 construction diagram to allege that, for at least one building (a warehouse) at the NCF, stormwater would flow from a gutter on the building roof to the LPRSA. [TMO Discovery Responses at 7.] This document is of extremely limited value, as there is no suggestion that any hazardous substances were stored or used on the roof of this warehouse building.

7 TMO assumes that hazardous substances must have reached the LPRSA as a result of a fire at the resin building in 1969. That is incorrect. Former employees who were present at the time reported that materials were confined to the building and did not reach the LPRSA. [W&C Report at 6-1.]

At the outset, none of the buildings used in the NCF had floor drains.[8] [W&C Report at 5-1.] PPG's decision not to use floor drains, of course, makes perfect sense: paints and other coatings would have clogged these floor drains, thereby defeating the very purpose of using a floor drain to dispose of material.[9]

The pipes located in the river bulkhead wall are not associated with process waste water from NCF operations. While TMO relies on PVSC notes from Seymour Lubetkin to argue that "there were seven outlets from the facility at the PPG Site that ran directly to the Passaic River," TMO's categorization of the PVSC notes is, at best, disingenuous. [TMO Discovery Responses at 7.] The PVSC notes – apparently created near the time when PPG ceased operating the NCF in early 1971 (as they reference PPG ceasing operations) – indicate that the seven outlets were used for water tank drain or compressor cooling water, *not* process wastewater. [W&C Report at 5-6.]

Finally, it is unknown whether the 6-inch deep concrete sink or pipe connecting that sink to the LPRSA, as identified in a 1910 blueprint, were ever built because there were "alternative" blueprints for other portions of the varnish building. [W&C Report at 5-6.] Regardless, given that the pipe would have, at worst, received material from a 6-inch deep sink, it is likely that the sink, if built, would have been used for sanitary wastewater and *not* process wastewater.

3. *Wastewater Discharges to the Sewer System*

PPG operated the NCF from 1902 until 1971. For that entire period, NCF wastewater was discharged to the sewer system. NCF wastewater discharged to the Newark sewer system from 1902 until 1924. [W&C Report at 5-3.] Since 1924, the Newark sewer system was connected to the main PVSC sewer system, and the NCF discharged to the Delavan connection line located north of the RIP.[10] [W&C Report at 5-4.]

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8 The only floor drain detected at the RIP was located in Building 14, then operated by Ardmore Chemical. [W&C Report at 5-1.] There is no information to suggest that this floor drain was used by PPG at the NCF, which in any event, is connected to the PVSC system. [W&C Report at 5-1.]

9 Nor did PPG use a sump in Building 12 that "was piped directly to the Passaic River." [TMO Discovery Responses at 7.] The actual document TMO relies on references *Frey Industries'* use of a sump in Building 12 in 1988 – sixteen years after PPG ceased operations at the NCF. [TSI-AK-00127321.]

10 The Herbert Place line of the PVSC system, located south of Buildings 7 and 12, runs underneath the southern portion of RIP. [W&C Report at 5-3.] However, there are no historical drawings or observations that any RIP building discharges (or has ever discharged) to the Herbert Place connector to the PVSC system. [W&C Report at 5-5.] Simply put, PPG was not connected to the Herbert Place line, and TMO's allegation that PPG wastewater discharged through the Herbert Street CSO system and into the LPRSA is unfounded. [TMO Discovery Responses at 7.]

Significantly, except for wastewater from Building 17 (on the southern portion of the NCF) that, based on available information, discharged directly to the main PVSC sewer line, NCF wastewater was connected to the Delavan interceptor line in a manner that ***prevented it*** from discharging to the LPRSA. [W&C Report at 5-4.] Specifically, both the sanitary and industrial wastewater at NCF discharged to a 12-inch diameter pipe that connected to the Delavan line regulator chamber. [W&C Report at 5-4.] The Delavan line is constructed such that wastewater enters the diversion chamber, then flows into the regulator chamber, and then flows into the PVSC main trunk line and to the PVSC treatment works. [W&C Report at 5-4.] During high flow events, wastewater is overflowed from the diversion chamber and discharges directly to the LPRSA – thereby bypassing the regulator chamber, main PVSC trunk line, and PVSC treatment works. [W&C Report at 5-4.] The 12-inch wastewater sewer line at the NCF ***was connected to the Delavan regulator chamber***, not the diversion chamber – making it impossible for PPG wastewater to overflow during high flow events and discharge to the LPRSA. [W&C Report at 5-4.]

IV. PPG'S OPERATIONS AT THE NCF DID NOT DISCHARGE LPRSA REMEDIAL ACTION COCS

A. PPG is Not a Source of Dioxin or DDx Discharges

PPG manufactured paints and other coatings at the NCF. [W&C Report at 6-1.] These operations would not (and did not) use or generate dioxins or DDx, and there were no chlorine sources at the NCF that would allow such generation. [W&C Report at 6-1.] TMO contends that PPG is a dioxin discharger because (i) it allegedly manufactured 2,4-D and 2,4,5-T at the NCF from approximately 1950 until 1954; and (2) it used phthalic anhydride in its resin manufacturing operation. [TMO Discovery Responses at 7, 9-10; TMO, "Sources of Dioxin in the PRRI Area," Vol. I of V at 14 (Sept. 4, 2002).] Neither allegation supports the conclusion TMO seeks.

PPG did not manufacture 2,4-D or 2,4,5-T at the NCF. [W&C Report at 3-1, 7-2.] As supposed support for its allegation, TMO relies on excerpts of certain U.S. Tariff Commission directories of manufacturers of synthetic organic chemicals. [TMO Discovery Responses at 9.] A closer inspection of the directories, however, shows that they do not support TMO's assertion. The directories identify ***multiple PPG facilities*** and ***multiple synthetic chemicals*** at the same time, and, even putting aside the fact that it is known – by USEPA and NJDEP – that the NCF manufactured coatings, the directories do not show that 2,4-D or 2,4,5-T were manufactured at the NCF. [*See, e.g.*, TSI-AK-00261043 (listing PPG facilities in (i) Pittsburgh, PA; (ii) Springdale, PA; (iii) Milwaukee, WI; (iv) Newark, NJ; (v) Detroit, MI; (vi) Cleveland, OH; (vii) Dayton, OH; (viii) Barberton, OH; and (ix) Natrium, WV in the 1950 directory); TSI-AK-00261050 (listing PPG facilities in (i) Pittsburgh, PA; (ii) Torrence, CA; (iii) Detroit, MI; (iv) Newark, NJ; (v) Cleveland, OH; (vi) Dayton, OH; (vii) Barberton, OH; (viii) Springdale, PA; (ix) Houston, TX; (x) Natrium, WV; and (xi) Milwaukee, WI in the 1951 directory).] Said differently, the directories only indicate that, at ***one of the facilities listed***, PPG manufactured 2,4-D or 2,4,5-T. NCF-specific information confirms that pesticide manufacturing did not occur at the NCF.

Also, only non-chlorinated phthalic anhydride was used at the NCF to manufacture paints. [W&C Report at 6-1.] Because there was no chlorinated source present in PPG's operation, it is not possible for phthalic anhydride (or any other compound) to generate dioxins/furans. [W&C Report at 6-1.]

Finally, to the extent that there are low concentrations of dioxins/furans or DDx in RIP soils, these concentrations are less than applicable screening levels and less than the concentrations of dioxins/furans and DDx detected in sediments adjacent to the RIP. [W&C Report at 7-1.] More importantly, the dioxin/furan impacts in RIP soils ***are attributable to deposition of LPRSA sediments on the RIP due to flooding, and are fully consistent with the 2,3,7,8-TCDD to total TCDD ratio and congener fingerprint for the Lister Site.*** [W&C Report at 7-1.] In any event, there is no basis upon which to believe that PPG's operations would have generated these Remedial Action COCs.[11] [W&C Report at 6-1.]

B. PPG is Not a Source of PCBs Discharges

There is no evidence that PPG used PCBs in its NCF operations. [W&C Report at 6-2.] TMO suggests otherwise because (i) PCBs were detected in RIP soils, and (ii) PCBs generally were used in the production of automobile paints in the 1950s and 1960s. [TMO, "Potential PCB Sources to PRSA" Vol. IV (Dec. 18, 2001); TMO Memorandum to USEPA at 4 (Apr. 11, 1995).] *First*, although PCBs have been detected in RIP soils in the 1980s and thereafter, these PCB detections are attributable to either historic fill or post-PPG operations at the RIP (most likely Federal Refining Company) – not PPG's operations. [W&C Report at 6-2.] For example, baseline environmental testing prior to Federal Refining Company's operations did not detect PCBs, but soil samples collected after fifteen (15) years of Federal Refining Company operations did detect PCBs, indicating that those operations are a source of PCBs. [*Id.* at 7-1 to 7-2] *Second*, PPG ***has*** documentation on what raw materials were used in NCF manufacturing and PCBs were ***not*** among those raw materials. [W&C Report at 6-2.]

C. PPG is Not a Source of Mercury Discharges

Mercury was used in trace amounts at the NCF, probably as a preservative in certain paints. [W&C Report at 6-2.] As a component of PPG's *finished product*, mercury would not be part of PPG's waste stream. [W&C Report at 3-2.] Furthermore, mercury detections at the RIP are present in low concentrations and observed sporadically, which is not indicative of a material release of mercury or a source area. [W&C Report at 7-2.] In any event, there is no evidence that PPG discharged any mercury, directly or otherwise, into the LPRSA.

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11 Although TMO alleges that flooding of the NCF enabled drums of hazardous substances to reach the LPRSA, this allegation has been refuted by numerous interviews of witnesses who indicated that any drums carried into the LPRSA by flood events were empty (*i.e.*, did not contain hazardous substances).

D. RIP Soils and Groundwater are Minimally Impacted

The LPRSA Remedial Action COCs, if detected in RIP soils at all, typically have been detected at low concentrations below USEPA screening levels and are not attributable to discharges by PPG. Instead, these low level impacts result from (i) LPRSA sediments being deposited on RIP soils during flood events, (ii) discharges by post-PPG operators at the RIP, and (iii) historic fill. [W&C Report at 7-3.] With respect to groundwater, there are low concentrations of hazardous substances, but ***not*** the Remedial Action COCs. Again, these impacts are likely attributable to (i) historic fill, or (ii) discharges by post-PPG operators at the RIP. [W&C Report at 7-3.]

E. Sediments Adjacent to the RIP are Not Impacted by PPG's Operations

The concentration of Remedial Action COCs in sediments upriver (RM 7.05-8.05), adjacent to (RM 6.80-7.05), and downriver (RM 5.80-6.80) of the RIP further confirm that NCF/RIP discharges, if any, have not impacted the LPRSA. Overall, average and median shallow sediment (0-2.5 feet) concentrations generally increase moving downriver, and average and median concentrations of 2,3,7,8-TCDD, DDx, mercury, and PCBs are higher in downriver sediments than in sediments adjacent to the RIP. [W&C Report at 8-2.] Concentrations patterns in deep sediments (2.5-6 feet) are broadly comparable to the pattern observed in shallow sediments. [W&C Report at 8-4.]

Further, statistical analysis demonstrates that, for all Remedial Action COCs, concentrations in shallow sediments adjacent to the RIP are consistent with concentrations detected in upriver sediments. [W&C Report at 8-3.] Statistical differences, however, exist when downriver sediment concentrations were considered, namely that downriver concentrations are typically higher than both (i) sediment concentrations adjacent to the RIP, and (ii) sediment concentrations upriver of the RIP. [W&C Report at 8-3 to 8-4.]

Sedimentation rates and the cesium-137 peak indicate that the 2,3,7,8-TCDD in sediments adjacent to the RIP originated at the Lister Site. *First*, the highest 2,3,7,8-TCDD concentrations in the sediments adjacent to RIP correspond with the highest cesium-137 concentrations. [W&C Report at 8-7.] Peak cesium-137 deposition occurred during the 1950s and 1960s, which coincides with the period of peak discharges from the Lister Site. [W&C Report at 8-6.] *Second*, the congener and homolog fingerprint of the dioxin in RIP-adjacent sediments ***matches the Lister Site fingerprint***. [W&C Report at 8-5.] In short, the Lister Site is responsible for the key risk driver in sediments adjacent to the RIP, not PPG.[12]

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12 The Lister Site fingerprint is evidenced by the following dioxin/furan congeners: 2,3,7,8-TCDD (approximately 50% of the total percentage of dioxin/furan congeners detected), octochlorodibenzofuran (approximately 30% of the total percentage of dioxin/furan congeners detected), 1,2,3,4,6,7,8-heptachlorodibenzofuran ("HpCDF") (approximately 5% of the total percentage of dioxin/furan congeners detected), and 1,2,3,4,7,8-hexachlorodibenzofuran (approximately 4% of the total percentage of dioxin/furan congeners detected). [Quadrini *et al.*, *Fingerprinting 2,3,7,8-Tetrachlorodibenzodioxin*

Finally, the peak cesium-137 concentration in RIP-adjacent sediments and the known sedimentation rate of 2 cm/yr for RIP-adjacent sediments indicate that any Remedial Action COCs (or any COCs) detected in the top 1.5-4.2 feet of sediment (depending on exact location) were deposited after 1971. Said differently, COC concentrations located in the top 1.5-4.2 feet of RIP-adjacent sediments cannot be attributed to PPG because those sediments were deposited ***after*** PPG ceased operations at the NCF. [W&C Report at 8-7.]

F. Summary

PPG did not discharge, and in most cases did not even use, the Remedial Action COCs for the LPRSA at the NCF. To the extent there are some COCs present in RIP soils, those impacts likely are attributable either to operations that have taken place in the 45 years since PPG operated the NCF, residual LPRSA sediments that have been deposited on the RIP during flood events, or historic fill. [W&C Report at 7-3.] Even assuming PPG discharged the Remedial Action COCs (for which there is zero evidence), the concentrations of Remedial Action COCs in sediments adjacent to the RIP are lower than those concentrations found in sediments one mile downriver of the RIP, indicating the RIP is not a source area.

V. PPG IS NOT LIABLE FOR LPRSA RESPONSE COSTS

In order to establish CERCLA liability, USEPA must prove that (i) "the defendant falls within one of the four categories of 'responsible parties'" under Section 107(a); (ii) "hazardous substances are disposed at a 'facility'"; (iii) "there is a 'release' or 'threatened release' of hazardous substances from the facility into the environment"; and (iv) "the release causes the incurrence of 'response costs.'" *Outlet City, Inc. v. West Chem. Prods., Inc.*, 60 Fed. Appx. 922, 926 (3d Cir. 2003) (citing *United States v. Alcan Aluminum Corp.*, 964 F.2d 252, 266 (3d Cir. 1992)). As explained below, PPG is not liable for LPRSA response costs.

A. PPG is Not a Potentially Responsible Party

There are four categories of potentially responsible parties ("PRPs") under CERCLA: (i) current owners and operators of the relevant CERCLA "facility"; (ii) former owners or operators of the relevant CERCLA facility at the time a hazardous substance was disposed; (iii) persons who arranged for the disposal or treatment of a hazardous substance at the relevant CERCLA facility; and (iv) persons who transported a hazardous substance to the relevant CERCLA facility. *See, e.g., Burlington Northern & Santa Fe Ry. v. United States*, 556 U.S. 599, 608-09 (2009); *Litgo N.J., Inc. v. N.J. Dep't of Envtl. Prot.*, 725 F.3d 369, 379 (3d Cir. 2013).

The CERCLA "facility" here is the LPRSA, defined as the "the 17-mile stretch of the Lower Passaic River and its tributaries from Dundee Dam to Newark Bay." [USEPA, Administrative Settlement Agreement and Order on Consent for Remedial Investigation/Feasibility Study ¶ 24 (May 10, 2007) ("The Lower Passaic River Study Area is a 'facility' as defined in Section 101(9) of CERCLA"); *id.* ¶ 14(*l*) (defining LPRSA).] PPG is not

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Contamination within the Lower Passaic River, ENVTL. TOXICOLOGY AND CHEMISTRY at 8 (2015).]

and has never been the "current owner or operator" or "former owner or operator" of the LPRSA. Nor is there is any evidence or suggestion that PPG was a transporter of hazardous substances to the LPRSA. Accordingly, it appears that USEPA is contending that PPG may be liable under CERCLA as an "arranger."

Arranger liability requires that PPG took "intentional steps to dispose of a hazardous substance." *Burlington Northern*, 556 U.S. at 611. As the United States Supreme Court has explained, "intentional steps" means that it must be proven that PPG actually ***intended*** to dispose of hazardous substances in the LPRSA. *Id.* at 612 ("In order to qualify as an arranger, Shell must have entered into the sale of D-D *with the intention* that at least a portion of the product be disposed of") (emphasis added); *id.* at 612-13 ("the evidence does not support an inference that Shell *intended* such spills to occur") (emphasis added); *see also United States v. Cornell-Dubilier Elecs., Inc.*, No. 12-5407, 2014 U.S. Dist. LEXIS 140654, at *24 (D.N.J. Oct. 3, 2014) ("Nothing in the record indicates that the Government took *intentional steps to dispose of any pollutants at the facility*. In light of this lack of evidence, the Court concludes that the Settling Parties had a rational basis for finding the Government not liable as a prior arranger").

There is no evidence that PPG hazardous substances were discharged from the NCF to the LPRSA. Yet, even if such evidence *did* exist (and it does not), there is no evidence that PPG intended to dispose of any hazardous substances in the LPRSA. Without intent, PPG cannot be an arranger under CERCLA – even if PPG knew or should have known that it was possible that some hazardous substances could be spilled at the NCF and reach the LPRSA. *Burlington Northern*, 556 U.S. at 611 ("knowledge alone is insufficient to prove that an entity 'planned for' the disposal").[13]

B. PPG's Discharges, Even if Assumed, Have Not and Will Not Cause the Incurrence of Response Costs

Even putting aside the lack of evidence that PPG is an arranger, there is another problem with seeking to hold PPG liable under CERCLA for LPRSA impacts: PPG's hazardous substances, if any, have not caused and will not cause the incurrence of response costs.

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[13] To the extent USEPA considers TMO's allegation that the Bayonne Barrel & Drum Superfund Site located at 150-154 Raymond Boulevard in Newark, New Jersey ("BBD Site") connects PPG to the LPRSA, it does not provide evidence of a nexus for several reasons: (i) PPG only sent a minimal amount of empty drums to the BBD Site from facilities that predominantly manufactured water-based paints (and PPG is not responsible for drums its customers sent directly to the BBD Site); (ii) any residuals in these empty drums would not have contained chlorinated compounds or solvents that could result in the generation of dioxins/furans; (iii) there is no evidence that BBD Site effluent contained hazardous substances attributable to PPG; (iv) there is no evidence that any BBD Site effluent that may have contained PPG hazardous substances overflowed, bypassed the PVSC treatment works, and discharged into the LPRSA; and (v) there is no evidence that PPG intended for any residual products to be discharged to the LPRSA from the BBD Site. *See Burlington Northern*, 556 U.S. at 612.

In order to be liable under CERCLA, ***PPG's*** releases of hazardous substances must cause the incurrence of response costs. *N.J. Turnpike Auth. v. PPG Indus.*, 197 F.3d 96, 104 (3d Cir. 1999) ("In order to prove [arranger liability], our prior case law is clear that such a plaintiff 'must simply prove that the defendant's hazardous substances were deposited at the site from which there was a release and that the release caused the incurrence of response costs.'"); *Alcan Aluminum*, 964 F.2d at 271 (if a party "can establish that the hazardous substances in its emulsion could not, when added to other hazardous substances, have caused or contributed to the release or the resultant response costs, then it should not be liable for any of the response costs"); *see also Hatco Corp. v. W.R. Grace & Co.*, 849 F. Supp. 931, 979 (D.N.J. 1994) (determining that plaintiff was not responsible for any response costs because, even though it discharged hazardous substances, the PCBs discharged by the defendant "will drive the cost of the clean-up").

PPG's hazardous substances (even if assumed to have reached the LPRSA) are not and will not cause the incurrence of response costs for three reasons: (i) PPG did not use or generate the COCs driving the risk for the LPRSA remedial action, (ii) any PPG hazardous substances would have been removed by previous dredging, and (iii) any residual PPG hazardous substances remaining in sediments would have naturally degraded long ago.

First, two COCs are overwhelmingly driving the risk and therefore response costs at the LPRSA: dioxins/furans and, to a lesser extent, PCBs. [FFS ROD at 29 ("The primary contributors to the excess risk are dioxins/furans (70 percent for fish consumption and 82 percent for crab consumption), dioxin-like PCBs (11 percent for fish consumption and 12 percent for crab consumption), and non-dioxin-like PCBs (16 percent for fish consumption and 5 percent for crab consumption). *The other COPCs contributed a combined 3 percent to the excess cancer risk.*") (emphasis added); *id.* at 30 ("Dioxins/furans and PCBs combined contribute more than approximately 98 percent of the excess hazard, while the remaining excess hazard is associated with methyl mercury for all receptors for ingestion of both fish and crab.").] PPG did not use, generate, or discharge dioxins/furans or PCBs. [W&C Report at 6-1.] Nor did it discharge mercury to the LPRSA, as it was likely added in trace amounts as a preservative to NCF finished product and would not have been included in PPG's waste. [W&C Report at 3-2.]

Second, there has been repeated maintenance dredging by the U.S. Army Corps of Engineers adjacent to, upstream, and downstream of the RIP. Specifically, the Arlington reach of the LPRSA was dredged 6 times between 1906 and 1930, and the Kearny reach of the LPRSA was dredged 7 times between 1906 and 1950. [W&C Report at 5-8 to 5-9; FFS ROD at 2 ("The channel above RM 1.9 was dredged periodically through the 1950s").] In addition, the sediment adjacent to the NCF was periodically dredged from 1902 until 1946 to allow flax seed and coal to be brought onto the Riverside property. [W&C Report at 5-9 to 5-10.] These dredging events would have removed any PPG hazardous substances that reached LPRSA sediments.

Third, to the extent any PPG hazardous substances reached the river and were not removed by dredging (and there is no evidence of either), those hazardous substances likely would have naturally degraded in the 45 years since PPG operated the NCF. [W&C Report at 3-3.] Consequently, any PPG hazardous substances will not cause the incurrence of any LPRSA response costs.

VI. PPG HAS ALREADY PAID SUBSTANTIAL SUMS FOR LPRSA RESPONSE COSTS AND IS SOLELY FUNDING THE RIP RI/FS

Despite its lack of liability, as a result of the GNL and its desire to be a good corporate citizen, PPG has voluntarily participated in the RI/FS and RM 10.9 removal action in the LPRSA – at substantial cost. On September 15, 2003, USEPA issued a GNL to PPG for the LPRSA. PPG subsequently agreed to execute the RI/FS Administrative Settlement Agreement and Order on Consent and join the LPRSA Cooperating Parties Group (the "CPG"). As USEPA knows, the RI/FS for the LPRSA has cost over $150 million. PPG, for its part, has already paid a substantial share of RI/FS costs and will continue to incur RI/FS costs in the future until USEPA deems the study complete, despite determining that its former NCF operations are not driving risk or any LPRSA response costs.

In addition, in 2012, USEPA requested that the CPG perform a removal action of a sediment deposit near RM 10.9 with elevated concentrations of dioxins and PCBs. PPG, and other CPG members (but not TMO – the dominant PRPs for the LPRSA given the intentional discharges from the Lister Site), agreed to perform the RM 10.9 removal action, which involved, in part, the dredging of approximately 16,000 cubic yards of sediment. [USEPA, Administrative Settlement Agreement and Order on Consent for Removal Action (June 18, 2012).] PPG has paid its share in connection with the RM 10.9 removal action to date.

Finally, PPG is the only party cooperating with USEPA to perform the RI/FS at the RIP. Although that work is still at an early stage, RIP RI/FS costs will be material.

VII. PPG SEEKS A *DE MINIMIS* SETTLEMENT TO AVOID FURTHER TRANSACTION COSTS FOR THE LPRSA

USEPA has a statutory obligation to provide parties with a limited nexus to a site an opportunity to enter a *de minimis* settlement "whenever practicable" and "as promptly as possible." 42 U.S.C. § 9622(g)(1). PPG is entitled to a *de minimis* settlement offer because it meets the statutory requirements for *de minimis* status. Specifically, under CERCLA, a party is *de minimis* when both of the following are minimal in comparison to other hazardous substances at the site: (i) the amount of the hazardous substances contributed by that party to the site, and (ii) the toxic or other hazardous effects of the substances contributed by that party to the site. 42 U.S.C. § 9622(g)(1)(A). PPG satisfies both criteria.

A. <u>PPG's Discharges to the LPRSA, if Any, Were Minimal in Amount</u>

CERCLA does not provide a specific threshold under which a party's discharges are considered *de minimis*. *See* 42 U.S.C. § 9622(g)(1)(A). USEPA's guidance, however, indicates that *de minimis* parties often are responsible for 1% or less of all hazardous substances at a given site. [USEPA, "Streamlined Approach for Settlements With De Minimis Waste Contributors under CERCLA Section 122(g)(l)(A)," at 2 n.5 (July 30, 1993) ("1993 *De Minimis* Guidance") ("[T]he *de minimis* cutoff has ranged from .07% to 10.0%, the mean was 1.059%, and the median was 1.0%).]

Here, there is no ***evidence*** that PPG discharged anything to the LPRSA – and there is no basis to assume otherwise. [W&C Report at 5-1.] Even if there *were* occasional indirect discharges of hazardous substances from the NCF to the LPRSA, it is difficult to imagine how these discharges could not be "minimal in comparison to other hazardous substances" given that they would have occurred, at best, over 45 years ago, and the LPRSA has received other direct and indirect discharges both before and after that entire 45-year period.

B. PPG's Discharges to the LPRSA, if Any, Were Minimal in Toxicity

In order to be *de minimis* in terms of toxicity, PPG's hazardous substances must be less toxic than those hazardous substances that are driving response costs at the LPRSA. As USEPA's guidance explains:

> Even if multiple waste types exist at a site, [a finding of "minimal in comparison" for toxicity purposes] should not be burdensome. As noted above, "minimal in comparison" has been interpreted to mean "not significantly more toxic than." However, *where a particular class of wastes drives response costs substantially higher than others*, the party that contributed *that waste type* may be disqualified or a separate allocation formula may be necessary.

[USEPA, "Methodologies for Implementation of CERCLA Section 122(g)(1)(A) De Minimis Waste Contributor Settlements at 10 (Dec. 20, 1989) (emphasis added) ("1989 *De Minimis* Guidance); *see also* 1993 *De Minimis* Guidance at 2 ("minimal toxicity" *de minimis* requirement is not met "if the hazardous substances at a site are of similar toxicity and hazardous nature").]

There can be no dispute that dioxin, and to a lesser extent PCBs, are driving toxicity at the LPRSA. [FFS ROD at 29 ("The primary contributors to the excess risk are dioxins/furans (70 percent for fish consumption and 82 percent for crab consumption), dioxin-like PCBs (11 percent for fish consumption and 12 percent for crab consumption), and non-dioxin-like PCBs (16 percent for fish consumption and 5 percent for crab consumption). *The other COPCs contributed a combined 3 percent to the excess cancer risk.*") (emphasis added); *id.* at 30 ("Dioxins/furans and PCBs combined contribute more than approximately 98 percent of the excess hazard, while the remaining excess hazard is associated with methyl mercury for all receptors for ingestion of both fish and crab.").]

The facts demonstrate that PPG is not associated with any dioxin/furans or PCBs, or any discharges of mercury from the NCF. That lack of connection is more than sufficient to establish that PPG's hazardous substances (even if any reached the LPRSA) present minimal toxicity when compared to other hazardous substances in the LPRSA.

C. Offering PPG a *De Minimis* Settlement Is in the Public Interest

As PPG satisfies the statutory requirements for a *de minimis* settlement, the only remaining question is whether such a settlement is "in the public interest." 42 U.S.C. § 9622(g)(1)(A). The answer is a resounding "yes." As USEPA's own guidance recognizes, entering into a final *de minimis* settlement with PPG now would have several benefits, including

(i) reducing transaction costs for PPG and USEPA, (ii) reimbursing USEPA's past costs, (iii) providing funds for future response actions at the LPRSA, and (iv) providing an incentive for non-*de minimis* parties to settle their potential liability. [USEPA, Standardizing the *De Minimis* Premium, at 1 (July 7, 1995) ("In addition to reducing transaction costs and resolving the liability of small volume contributors, *de minimis* settlements also serve to reimburse the Agency's past costs and provide funds for future site cleanup."); 1989 *De Minimis* Guidance at 2 (*de minimis* settlements "provide an incentive to non-*de minimis* parties to settle simultaneously by offsetting the contributions of *de minimis* parties from the total cost of the response action"). Moreover, it is fundamentally unfair to seek to keep PPG involved in LPRSA proceedings given the lack of evidence supporting its liability and the reality that such evidence already exists against potentially thousands of other parties.[14]

VIII. CONCLUSION

PPG has already paid its fair share of any LPRSA response costs. In truth, it has grossly overpaid, as there are no facts demonstrating that PPG discharged anything to the LPRSA. Nevertheless, PPG is willing to discuss and negotiate a *de minimis* settlement with USEPA to avoid further transaction costs for the LPRSA matter.

Sincerely,

Gary P. Gengel
of LATHAM & WATKINS LLP

Enclosure

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14 As a matter of fundamental fairness, given the thousands of *de minimis* contributors to the LPRSA, USEPA should develop a *de minimis* or cash out process and focus on significant contributors who are driving response costs.

Report on PPG Industries Nexus to Lower Passaic River Study Area

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EXECUTIVE SUMMARY

INTRODUCTION

This report focuses on PPG Industries, Inc. operations at its former Newark, New Jersey coatings facility and possible influences and interactions with the Passaic River, specifically the Lower Passaic River Study Area Operable Unit of the Diamond Alkali Superfund Site.

The industrial complex at 29 Riverside Avenue, Newark, Essex County, New Jersey (the Riverside Industrial Park or RIP) has had a number of owners, leasees, and industrial operations since the beginning of the twentieth century. The initial use of the property was as a coatings facility (the Newark Coatings Facility or NCF) owned and operated by PPG Industries, Inc. or its predecessors (PPG). The property was reclaimed from the Passaic River with historical fill. The NCF began operations in 1902 and grew over time until it was closed early in 1971. In this report, the use of RIP refers to post-PPG ownership while NCF refers to when the facility was owned and operated by PPG. RIP is located at River Mile (RM) 6.8.

While subsequent uses during and after 1971 will not be fully enumerated in this report, some examples of post-PPG operations have been included to clarify materials brought on the property and potential contaminant contributions associated with those post-PPG owners and operators.

New Jersey Department of Environmental Protection (NJDEP) and United States Environmental Protection Agency (USEPA) have undertaken investigations and interim remedial actions at RIP. The most prominent Interim RA was their response to a 2009 oil spill and removal of wastes from Buildings 7 and 12. In addition, USEPA collected and analyzed container, soil, and sediment samples. Under NJDEP auspices, responsible parties have conducted investigations and in some cases performed remedial actions.

The RIP was designated the Riverside Industrial Park Superfund Site on May 24, 2013 when it was listed on the National Priorities List ("NPL"). PPG is only one of 18 parties associated with RIP that agreed to fund or perform the RI/FS (Administrative Settlement Agreement and Order on Consent [ASAOC], 2014).

PPG'S NCF OPERATIONS

The NCF manufactured paints, lacquer, enamels, varnishes, linseed oil, and resins, and the manufacturing processes and the raw materials used evolved throughout the period PPG owned and operated the NCF (1902-1971). There is no evidence of direct waste or hazardous substance discharges by PPG into the Passaic River from the NCF. Documented releases occurred to the Passaic River after 1971 with the most notable release being the 2009 "Mystery Oil Spill". During this release, contents were released from tanks located in the basement of Building 12 on the property into the river via underground pipes that appear to be installed after 1971.

Based upon PPG operations at NCF, the primary compounds used would be non-chlorinated solvents and oils. Organic solvents used would be mixtures of various natural hydrocarbons (e.g., linseed oil, turpentine), petroleum hydrocarbons (e.g., mineral spirits, naphtha) and specific solvents (e.g., xylenes, toluene). If any of these organic materials were present in the environment at the beginning of 1971 (when PPG ceased NCF operations) environmental processes would have been degrading them for a period of 45 years and some reduced fractional part of the compounds, if anything, may remain. Pigments containing metals (titanium and lead) were also used with the primary metals at the NCF.

NCF had no lagoons, ponds, landfills, disposal pits, dry wells, settling basins or other disposal units. The waste management practices employed by PPG generated wastes that were either reused in products or sent off-property for disposal. There are no surface water control measures (catch basins, storm sewer system) at RIP and

approximately 80 percent is paved. Overland flow toward the river occurs during precipitation events, but no erosion channels or ditches are present at RIP indicating overland flow causing soil erosion is minimal.

NCF was and RIP is connected to the PVSC sewer system. Prior to the Passaic Valley Sewerage Commission (PVSC) connection, NCF connected to the City of Newark sewer system. The NCF connections to the PVSC sewer system were constructed in a manner that prevents direct discharge of NCF waste water to the Passaic River even during high-flow condition. NCF waste water could not reach the PVSC chamber where the bypass flow to the river occurs.

PPG IS NOT ASSOCIATED WITH ANY OF THE REMEDIAL ACTION CONTAMINANTS OF CONCERN FOR THE LOWER PASSAIC RIVER

The key contaminants of concern (COCs) based upon the risks being addressed by the Lower Passaic River Study Area Record of Decision (ROD) are dioxins/furans, polychlorinated biphenyls (PCBs), mercury, dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethylene (DDE), and dichlorodiphenyldichloroethane (DDD) (DDx refers to the total of DDD, DDE, DDT in this report). None of the materials used by PPG at NCF were known to contain dioxins, furans, PCBs, or DDx. PPG's operations in Newark were limited to manufacturing paints, varnishes, and other coatings; chlorinated compounds were not manufactured at the NCF. In addition, there were no known processes where dioxins, furans, PCBs, or DDx would have been generated as by-products, as chlorinated materials were not used in coating manufacturing process at NCF. Mercury probably was used by PPG in trace amounts as a preservative in some paints, but there is no known release of mercury during PPG operations.

Even if there were discharges of hazardous substances during PPG's NCF operations, historical U.S. Army Corps of Engineers (USACE) and commercial dredging adjacent and downriver of RIP removed sediment until the late 1940s (barge berth) and 1950 (Kearny Reach navigation channel). It is projected that infilling of the PPG barge berth along the bulkhead would decrease over time as the depression filled in. Dredging would have removed hazardous substances in the dredged sediment.

Groundwater investigations conducted by responsible parties under NJDEP auspices documented contaminated groundwater associated with the responsible party operations or historical fill. None of the groundwater contaminants above USEPA or NJDEP standards are dioxins/furan, PCBs, DDX or mercury.

Dioxins/furans, mercury, and DDx, if detected in RIP soils, are below USEPA Regional Screening Levels (RSLs) and/or within the concentration range for sediments adjacent to RIP. Any PCB concentrations above screening levels are attributable to post-PPG operators at the RIP or historical fill. The highest soil 2,3,7,8-TCDD concentration at RIP is less than the average sediment 2,3,7,8-TCDD concentration adjacent to RIP indicating the NCF/RIP is not a source of dioxin, but its proximity to the river probably reflects residual sediment from past flooding events. The 2,3,7,8-TCDD/ total TCDD ratio and congener fingerprint profile indicates that the source of the RIP soil dioxin is herbicide manufacturing and is consistent with the Lister Avenue site.

Polychlorinated dibenzodioxin/polychlorinated dibenzofuran (PCDD/F) data from sediment sample locations adjacent to RIP were evaluated to determine the 2,3,7,8-TCDD/ total TCDD ratio and congener and homolog fingerprinting. Like the soil samples, these ratios and congener and homolog fingerprints support the finding that PCDD/F being reported in RIP-adjacent sediment can be attributable to PCDD/F discharges from the Lister Avenue site.

In addition, statistical analyses were completed to further evaluate any potential impact from the NCF/RIP to the Lower Passaic River sediments. The findings show that average and median shallow and deep sediment concentrations generally increase moving downriver within the river segments evaluated. Downriver sediment concentrations of 2,3,7,8-TCDD, total DDx, mercury, and total PCB aroclors are higher than sediments adjacent to the RIP or sediments upriver to the RIP. The sediment COC concentrations are lower in sediment adjacent to RIP, indicating that the RIP is not a source area for 2,3,7,8-TCDD, DDx, mercury, and PCBs.

The highest Cesium-137 (Cs-137) concentrations directly correspond to the highest 2,3,7,8-TCDD concentrations in sediment. This supports that the deposition of the most contaminated 2,3,7,8-TCDD in sediments adjacent to RIP occurred in the mid 1950s and 1960s (i.e., during the period of peak discharges from Lister Avenue).

Depending on location, sediments deposited adjacent to the RIP after 1971 (when the NCF operations ceased) range from 1.5 to 4.2 feet below the sediment surface. Any COCs in sediments deposited after 1971 would not be associated with PPG.

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1. INTRODUCTION

This report focuses on PPG operations at its former Newark, New Jersey coatings facility (Figure 1-1) and possible influences and interactions with the Passaic River. The main components of the report are as follows:

- Property development and uses summary.
- An evaluation of raw material used and finished products made by PPG.
- Overview of PPG's waste management practices, and any spills/releases, fires or other environmental incidents, including on-property waste water management system(s) and connections to the City of Newark and Passaic Valley Sewerage Commission (PVSC) systems.
- Possible Newark Coatings Facility (NCF) / Riverside Industrial Park (RIP) interactions with the river including flooding, dredging, and discharges.
- Statistical evaluation of river sediment contaminants of concern (COC) concentrations in the vicinity of RIP (adjacent, upriver and downriver).
- Evaluation of the presence and use in soil and groundwater of key COCs at NCF for the Lower Passaic River Study Area as identified in the March 4, 2016 Record of Decision (ROD).

The 29 Riverside Avenue property is currently identified as the RIP. For the purposes of this report, the use of RIP refers to post-PPG ownership while NCF refers to when the facility was owned and operated by PPG.

RIP is located at Passaic River Mile (RM) 7.2 based upon the U.S. Army Corps of Engineers (USACE) or RM 6.8 based upon United States Environmental Protection Agency (USEPA) designation as presented in the 2014 Focused Feasibility Study (FFS) for the Lower Eight Miles of the Lower Passaic River (Louis Berger, 2014). Other than summarizing previous river dredging, RM 6.8 is used in this report as the river location of NCF/RIP. The Passaic River adjacent to the RIP is a tidal estuary.

The RIP was designated as the Riverside Industrial Park Superfund Site on May 24, 2013 when it was listed on the National Priorities List ("NPL"). By letter, dated April 18, 2013, USEPA notified PPG, as well as 17 additional parties currently or formerly owning and/or operating at one or more of the parcels comprising the RIP Superfund Site, that USEPA considered the letter recipients to be potentially liable under Section 107(a) of Comprehensive Environmental Response, Compensation & Liability Act of 1980 (CERCLA) for conditions at the RIP Superfund, which PPG is undertaking a remedial investigation/feasibility study (RI/FS) in accordance with an Administrative Settlement Agreement and Order on Consent (ASAOC, 2014).

The information presented in this report is based on consideration of the following:

- ROD and FFS for the Lower Passaic River Study Area
- PPG historical records and maps including PPG 104(e) responses
- Former PPG employee interviews concerning NCF operations
- Observations of RIP in 2015 and 2016 by Woodard & Curran
- New Jersey Department of Environmental Protection (NJDEP) correspondence, files, and reports
- USEPA correspondence, files, and reports
- Documents related to the RIP Superfund Site prepared by Woodard & Curran, USEPA, and others

- USACE, Passaic Valley Sewerage Commission, and City of Newark files
- Sediment and surface water results from the Lower Passaic River Study Area

Other documents, published articles, and records used are also noted in this report.

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2. RIVERSIDE PROPERTY

2.1 1890s TO 1971 DEVELOPMENT

The filling to create the property began before 1892. An 1892 Sanborn Map indicates that the majority of the Riverside property was part of the Passaic River. Boating docks shown on the north and central portions of the RIP in 1892 also appear to be the result of reclaiming land from the Passaic River prior to 1892.

In 1902, Patton Paint Company started operations on Block 614, Lot 1. By 1909, the majority of the Riverside property had been created via backfilling the Passaic River and improvements included Patton Paint Company structures on current Lots 1, 60, 61, and 62, a hotel, and a boat club (Figure 2-1). Portions of the current RIP remained unreclaimed in 1909 (in the vicinity of current Lots 57 and 70). These lots were created (backfilled) by 1931 (Woodard & Curran, 2015). The 1931 Sanborn map Riverside property boundaries are consistent with the current configuration.

The origin of the fill material is unknown, but soil boring data from several NJDEP related investigations (NJDEP Case Numbers E88434; E20110199; E88483; E20080157; E98132; E89257; and E2000550) describe the presence of ash, cinders, and brick in the fill. River dredge spoils also could have been used for fill. The Riverside property is identified on NJDEP's historical fill map as having fill material (http://www.nj.gov/dep/njgs/geodata/dgs04-7.htm).

Patton Paint Company merged into the Paint and Varnish Division of Pittsburgh Plate Glass Company in 1920, which in April 1968 changed its name to PPG Industries, Inc. (PPG). By 1950, PPG had expanded its NCF operations to the majority of the property excluding some southern lots. After discontinuing all operations in April 1971, PPG sold the 7.6-acre Riverside property later that year.

2.2 1971 TO 2016 DEVELOPMENT AND OPERATIONS

After PPG's sale of the property in 1971, the Riverside property was subdivided into 15 parcels/lots (Lots 1, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, and 70) (Figure 2-2) and became known as the RIP. In the past 45 years, RIP was the home of a wide variety of industrial manufacturing operations conducted by a multitude of companies. For example, manufacturing and chemical handling operations after PPG's ownership and operation of the property included the following (Woodard & Curran, 2015):

- Frey Industries (Frey)/Jobar Packaging – Facility involved with the packaging, blending, repackaging, and distribution of chemicals including polyester resins, flammable liquids, corrosives, and poisons. Operated as a hazardous waste treatment, storage, and disposal (TSD) facility. NJDEP Case #237938.

- Baron Blakeslee Inc. (BBI)/Allied Signal/Honeywell – Warehousing, distribution, and chemical analysis of various chemical blends and wastes. Frey Industries did chemical blending and packaging for BBI. NJDEP Case #E88434.

- Samax Enterprises – Chemical manufacturing of deck strippers, deck wash, Marine-Safer Products (strippers, marine paint removers), restoration cleaners, lead paint removers, masonry cleaners, paint hardener, and various solvents such as acetone, kerosene, lacquer thinner, linseed oil, xylenes, methyl ethyl ketone (MEK), muriatic acid, paint thinners, and toluene. NJDEP Case #E20110199.

- HABA International, Inc. (HABA) / Division of Davion Inc. / Acupac Packaging, Inc. – Manufacturing of nail polish remover and other cosmetic and soap products. NJDEP Case #E88483.

- Roloc Film Processing – Manufacture of foils utilized in various commercial products. NJDEP Case # E20080157.

- Chemical Compounds, Inc./Celcor Associates LLC /Teluca – Manufacture of hair dyes, facial creams, and bleaches. NJDEP Case #E98132.
- Gloss Tex Industries, Inc. – Manufacture of nail enamel, lacquer, and related cosmetic products. NJDEP Case #E89257.
- Federal Refining Company (FRC) – Scrap metal recycler specializing in precious metal recovery. NJDEP Case #E2000550.
- Ardmore Inc. / Ardmore Chemical Company – Manufacture of soaps, detergents and consumer beauty products.

Post 1971 operations at RIP included the use and storage of petroleum-based materials as well as hazardous materials. Some of the raw materials and products are the same materials (i.e., acetone, kerosene, lacquer thinner, xylenes, paint thinners, and toluene) as used or made by PPG. Documented discharges from post-PPG operations to the Passaic River occurred in the following years (Woodard & Curran, 2015):

- 1990 - Ardmore Chemical
- 1992 - Chemical Compounds Inc. (two discharges)
- 1993 - Chemical Compounds Inc.
- 2009 - Mystery Oil Spill from Building 12

There have been allegations concerning the existence of a 100,000-gallon UST existing at RIP. There are no records or observations that a 100,000-gallon UST existed during PPG operations.

An early record (1980s) of a "100,000-gallon tank" is the Jobar application for a hazardous waste TSD facility at RIP (Appendix A). Based upon NJDEP and USEPA records, Jobar and then Frey used the Building 7 basement as an unpermitted solid waste management unit. NJDEP reports included in Appendix A state wastes from hoses were discharged into the basement, which may be the "100,000-gallon UST" referenced by others. The basement material (sludge and liquid) was removed and the basement cleaned by USEPA contractors in 2012-2013. In early 2016, the basements of Buildings 7 and 12 (and small connection tunnel) contained water, which is likely an accumulation of precipitation (leaking building roofs), and does not appear to reflect tidal influences.

During PPG's operation, the varnish manufacturing process in Building 7 would have precluded the basement being used as a 100,000-gallon tank. Building 7 had heat applied to varnish pots on the ground floor. The Building 7 basement likely contained the heat source equipment for these varnish pots. Exhaust capture duct work associated with the varnish process vessels is still present. There also appears to have been a utility tunnel connecting Buildings 7 and 12, all of which precludes the basement being used as a tank. There is no documentation or observations that a 100,000-gallon tank existed in Building 7 (or elsewhere) during PPG operations.

Another claim is that the 100,000-gallon tank "did not have a bottom" (NJDEP, 1992). The Building 7 basement has concrete walls and a concrete floor based upon June 2015 observations by Woodard & Curran. The first floor was partially removed by USEPA contractors to access the basement. During removal of wastes from the basement, USEPA did not report that the basement did not have a bottom.

As of August 2016, current operations at RIP include:

- Warehousing/distribution
- Used tire accumulation warehouse

- Vehicle dismantling and recycling
- Construction equipment storage
- Chemical research, manufacturing, storage, repacking, and/or distribution

Based upon observations in 2015 and 2016, unauthorized disposal of surficial solid waste is widespread and frequent on the southern portion of RIP.

2.3 ADJOINING PROPERTIES

Adjoining properties to RIP are and have been occupied by a fuel oil distributor (north side of property) and a concrete manufacturing company (south side of property). The fuel oil distributor had documented discharges into the Passaic River in 1987, 1990, 1991, and 1999. Railroad tracks and Riverside Avenue form the western boundary. The Passaic River bulkhead forms the eastern boundary of RIP.

2.4 NJDEP AND USEPA ACTIVITIES AT RIP

NJDEP and USEPA have undertaken investigations and interim remedial actions at RIP. The most prominent Interim Remedial Action was the response to the 2009 oil spill (Section 5.2) and removal of wastes from Buildings 7 and 12. In addition, USEPA contractors collected and analyzed storage tank, container, soil and sediment samples. Under NJDEP auspices, responsible parties have conducted investigations and in some cases performed remedial actions. Relevant findings and results from agency activities are presented in this report.

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3. PPG OPERATIONS

The NCF was operated into early 1971 by PPG to manufacture paints, lacquer, enamels, varnishes, linseed oil, and resins. Based upon available information, the processes used in each of those operations are summarized below.

Raw materials were brought onto the property primarily by rail, tanker truck, or trailer truck. Flax seed and coal (for power) were brought onto the property by barge until 1946. The majority of liquid raw materials were stored in above ground storage tanks (ASTs) with ASTs in two buildings (Buildings 4 and 15). Large exterior ASTs were located south of Building 12, north side of Building 7, adjacent to the Riverside Avenue vehicle entrance, with flax seed silos/grain elevators along the river next to the flax seed oil mill. Ten 10,000-gallon underground storage tanks (USTs) adjacent to Building 12 also stored non-chlorinated solvents.

The primary coating manufacturing operations took place in the following buildings:

- Building 2/3 - paint (early 1900s)
- Building 12 - paint
- Buildings 7 and 9 - varnish
- Building 10 - flax seed oil mill
- Building 14 - lacquer
- Building 17 - resin

PPG's NCF operations were gravity-based systems. Raw materials were stored on upper floors and piped to lower floors via gravity for mixing, thinning, and blending. Paint and resins vessels and vats were rinsed with caustics or non-chlorinated solvents to clean them. The resulting rinseate was reused typically in lesser quality coatings, recycled, or sent off site for disposal/treatment. For a period of time, non-chlorinated solvents were recovered in a small building between Buildings 12 and 17. This building is no longer present.

Despite that its operations occurred before environmental laws were enacted in the late 1970s, PPG took proactive steps to minimize the potential environmental consequences of its operations. For example, employees reported the NCF had "cement walls" around all the tanks to contain accidental spills. Residues generated when the tanks were cleaned were placed into 55-gallon drums and disposed of by a hauling service; the tanks themselves were cleaned manually and were not pumped out, and no tanker trucks were used in the cleaning process. Based on available information considered by Woodard & Curran which included historical maps, company records, and employee interviews, PPG did not store hazardous substances outdoors in a manner that would allow these substances to reach the environment.

Finished products were transported from the NCF by truck and rail primarily in drums and 5-gallon and smaller containers.

3.1 PAINT MANUFACTURING

The primary product produced at NCF were oil-based paints and enamels. Paints are primarily composed of binders (e.g., polymers, resins), solvents or diluents, primary pigments (e.g., fine organic or inorganic particles), extenders (e.g., clays, chalk, gypsum, anhydrite), and additives (e.g., catalysts, driers). A simplified version of the paint making process included resin preparation and filtering, grinding pigments and mixing with the resins, adding additional resins if needed, adding and/or adjusting solvents and driers, and including any other additives, quality control checks, and product packaging. The primary products made by PPG at NCF were oil-based coatings. Fifty years ago, essentially all paints were oil based (Paint Quality Institute, 2016). Water-based paints also known as latex or acrylic paints became commercially available in the 1950s (Wikipedia, 2016). No documentation on the manufacturing duration or

quantities of water-based coatings at NCF was found. Extensive process and equipment changes would be required at NCF to produce water-based coatings.

According to company history, dry pigments and mixing varnishes or oils were brought to the top floor and mixed to form a paste. The paste mixture was fed through chutes to grinding mills on the next floor. Batches would then be sent again via chutes to a lower floor where thinning oils and solvents were added in large processing tanks. Tinting was also typically done on this floor. The product was then fed via pipes to the filling department. The filled one- and five-gallon cans were transferred by conveyer for packing for shipment or storage. Some paint was placed into 55-gallon drums. The filling equipment along with other equipment were air pressure operated machines.

The raw materials known to have been used by PPG during the paint manufacturing process include: natural gums, natural resins, flax seeds, non-chlorinated solvents, pigments, caustic soda, dyes, alkyd resins, chromium, lead, titanium, zinc, lead carbonate, mercury, copper oxide, and cadmium. Solvents included water, toluene, xylene, ethylbenzene, linseed oil, MEK, naphtha, turpentine, and mineral spirits. Some of these solvents were also used in making resin, varnish, and lacquer.

The primary metal pigments used at NCF contained lead or titanium oxides. Cadmium (yellow color) and chromium (durability) were used in some paints. Mercury was probably used in certain paints as a preservative.

3.2 RESIN MANUFACTURING

Alkyd resin production occurred at the NCF in Building 17 from approximately the 1930s until 1969. The alkyd resins are polyesters derived as the reaction products of vegetable oil triglycerides, polyols (e.g., glycerol) and dibasic acids or their anhydrides (e.g., phthalic anhydride) (Lambourne and Strivens, 1987). At NCF, alkyd resins were produced from polyunsaturated fatty acids (i.e., vegetable oil, linseed oil) and polyols (i.e., glycerin). With heat, the process creates glyceride oil to which anhydride is added to increase the molecular weight. Synthetic phenolic resins were added as a secondary component for some coatings. Resins manufactured at NCF were then diluted with a non-chlorinated solvent and used in paint and varnish manufacturing. Phenolic resins were not made at the NCF, but rather purchased in solid flake form from a supplier.

3.3 VARNISH MANUFACTURING

In 1910, the original varnish building was constructed. In 1936, a new varnish building was constructed at the current Building 7 location. The new building was identified as Building 7 while the original Building 7 was subsequently identified as Building 7A. Building 7A has been torn down.

Like with the paint operation that occurred in other buildings at NCF, upper levels of the varnish building were used for mixing and preparing the varnish for heat treatment in the first floor pots. Varnish was made from drying oils/polymers (i.e., linseed oil) and non-chlorinated solvents. The primary non-chlorinated solvents were white spirits, mineral turpentine and kerosene with minor amounts occasionally of toluene, xylene, and naphtha. The turpentine was obtained from the distillation of natural resins like pine sap while the mineral spirits used were petroleum based. Over the years, alkyd resins mostly replaced drying oils in varnish at NCF.

3.4 LINSEED OIL MANUFACTURING

Linseed oil was manufactured from flax seed at NCF from 1923 to 1947. According to the company history, flax seed was unloaded from barges on the Passaic River into grain elevators/silos at the NCF. The typical primary steps were pressing the seed to release the oil, then refinement of the oil with caustic soda. The discontinued manufacturing of linseed oil coincides with the last known use of barges at NCF in 1946 (PPG, 104e response).

Due to its polymer-forming properties, linseed oil was used on its own or blended with other oils, resins, or solvents as a drying oil or as a pigment binder in oil paints. A drying oil is an oil that hardens to a tough, solid film after air exposure (oxidation). The oil hardens through a chemical reaction in which the components polymerize by the action of oxygen (not through the evaporation of water or other solvents like lacquer). Drying oils were a key component of oil-based paint and some varnishes at the NCF. In the coating industry, the use of linseed oil in paints has been replaced by alkyd resins and other binders over time.

3.5 LACQUER MANUFACTURING

Lacquer is a fairly broad term that primarily addresses finishes that dry by solvent evaporation. Lacquers are a subset of paints with a high solvent content. At NCF, lacquer was primarily a combination of nitrocellulose (a resin) and solvents (such as butyl acetate). Nitrocellulose-based lacquers were developed in the early 1920s, and extensively used in the automobile industry for 30 years. Small amounts of flake naphthalene were used in lacquer (PPG 104e response).

3.6 PPG CONSTITUENTS OF INTEREST

Based upon PPG operations at NCF, the primary possible constituents of interest (COI) would be non-chlorinated organic solvents and oils. In the early days of paint manufacturing, the organic solvents used would be mixtures of various natural hydrocarbons (linseed oil, turpentine) and petroleum hydrocarbons (mineral spirits, naphtha). Later solvents became more specific like xylene and toluene, but hydrocarbon mixtures (as opposed to chlorinated compounds) continued to be used.

The organic materials that PPG used could be degraded by a number of environmental processes including photolysis, chemical oxidation or reduction, biological oxidation or reduction, or some combination of these or other processes. If any of these organic materials were present in the environment at the beginning of 1971, the combination of environmental processes had been degrading them for a period of 45 years such that some reduced fractional part of the compounds may remain. The remaining fraction can be estimated if a half-life for the compound has been determined.

For example, if a compound had a half-life of one year, then one-half of the original amount would be present at the end of the year. The estimate for longer periods of time can be made by multiplying 0.5 by itself as many times as the number of half-lives that have passed. The estimated fraction remaining after a period of 45 years if the half-life were one year would be 0.000000000000028 (Table 3-1), which is an extremely small amount. The literature values for the anaerobic half-lives for toluene, xylene, and ethylbenzene are 0.577 year, 1 year, and 0.625 year, respectively (Howard et. al., 1991). The half-lives for other non-chlorinated solvents are in this general range or even shorter (MEK – half-life of 0.077 year, Howard et. al., 1991). The shorter half-lives would mean more half-lives were contained in the 45-year period and even smaller fractions might remain today. The biodegradation half-life of naphthalene varies based upon media and has been reported to be up to 4.6 years, but the half-life in sea water was reported at 0.8 day (Howard et. al, 1991; ATSDR, 2005). Another consideration is that the 45-year period is the shortest period of time, if additional time was added (going back to 1960 or 1900) more half-lives would have incurred and even smaller fractions might remain.

Pigments containing metals may also be possible COI. The primary metals used in pigments at the NCF were titanium and lead. Metals used in smaller quantities would include zinc, chromium, and cadmium and possibly mercury as a

preservative in some paints. The pigments when mixed with solvents, cure/solidify leaving a solid film. The solvents would be degraded via evaporation, oxidation or by a process described above. Once in film form, the mobility of these metals in the environment is greatly reduced. Their primary movement would be by physical movement of the film particles.

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4. WASTE MANAGEMENT

NCF had no lagoons, ponds, landfill, disposal pits, dry wells, settling basins or other disposal units, and none were documented in the NJDEP case findings, USEPA hazard ranking documents (USEPA, 2012), historical records, or employee interviews.

4.1 SOLID WASTE

Wastes were reused in production or disposed of off property. In some cases, liquids (i.e., water-based paint wastes and other water-based liquids) were discharged to the PVSC sewer system. Off-specification products were reused in lesser quality coating products.

Tanks, mixing pots, and reaction vessels were rinsed with non-chlorinated solvents or caustic liquids. At times, manual scraping was employed to remove solid residue. The resulting solid waste material was placed in drums for offsite disposal. For a period of time, used solvent was recycled by a solvent recovery process.

There has been some suggestion in historical documents that, in 1963, a PPG spill or leak occurred and required a tanker truck to clean up or dispose of the materials. This suggestion has been dispelled by the Chief Chemist at the NCF, who stated that to his recollection no such event took place in the 36 years that he worked at the NCF. Another affidavit by the 1960s plant manager supports the Chief Chemist's recollection.

4.2 SEWER SYSTEM

The NCF was and RIP is connected to the PVSC system. Based upon Woodard & Curran observations (July and August 2016) of the RIP sewer system, there appears to be two waste water sewer systems. As described in Section 5.3, NCF was likely connected to the PVSC system in the 1920s when the main truck line was completed adjacent to NCF. Prior to NCF connection to the PVSC, the facility was connected to the local Newark sewer system (Section 5.3). The July 2016 observation and PVSC records indicate sewer connections from the NCF/RIP were to sewer pipes that are beneath Riverside Avenue (Section 5.3).

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5. POTENTIAL PATHWAYS TO RIVER

An evaluation of possible pathways to the Passaic River is summarized below. This evaluation includes possible direct discharges of hazardous substances, indirect discharges and river influences (e.g. flooding, and dredging).

5.1 POTENTIAL PATHWAYS RELATED TO HAZARDOUS SUBSTANCES

There is no evidence of direct waste discharges by PPG into the Passaic River from the NCF. The manufacturing practices employed generated wastes that were either reused in products or sent off property for disposal. Some water-based wastes (i.e., caustic wash water) were discharged to the sewer system.

There were no major spills or releases at the NCF based upon employee statements and lack of any records of spills. Employees recalled that the company was very concerned about safety and that minor spills were cleaned up promptly and placed in 55-gallon drums for disposal off property.

The only significant incident mentioned by former employees was a resin building fire in 1969. According to former employees, the 1969 resin building fire did not result in resin material reaching the river. The resin material was confined to the building (which is consistent with the physical state of hot resins being viscous that when cooled quickly solidified).

There is no storm drainage system at RIP. There are no existing catch basins for storm water as any overland flow occurs based upon topography. Approximately 80 percent of ground surface is pavement or buildings (Figure 5-1). There are no ditches or drainage swales. The ground surface is relatively flat with a slight slope toward the river. No signs of erosion due to storm water were observed in 2015 and 2016. Flooding of RIP is addressed in Section 5.3.

Based upon buildings observed in June 2015 and July 2016, there are no floor drains on the ground floor except in Ardmore Chemical building (Building 14). Building 14 floor drains are connected to the PVSC system (Appendix B, Attachments 5, 10, and 11). During the remedial investigation/feasibility study (RI/FS) Work Plan development phase for the RIP Superfund Site, owners/tenants in June 2015 stated that there were no floor drains in their buildings. In 2015 and 2016, the Building 7 basement and floors of Buildings 12 and 15 could not be observed by Woodard & Curran because of safety concerns and access restrictions. However, USEPA's removal action notes related to the Building 7 basement did not report the presence of floor drains or sumps.

NJDEP reported in a 1992 memorandum (Appendix A) covering Frey's operations that Buildings 6, 7, 9, 12 and 15 had no floor drains. In summary, NJDEP, tenant/owner comments, and the June 2015 observations did not document floor drains except as noted above.

5.2 2009 MYSTERY OIL SPILL

In October 2009, NJDEP and USEPA responded to a reported oil spill into the Passaic River from RIP. The oily content of tanks in the basement of Building 12 were released into the Passaic River through an underground pipe. The tanks were connected to the underground pipes by a hose (USEPA, 2012).

Based on NJDEP and USEPA investigation during removal activities, contents of the two basement tanks appeared to have been intentionally set up to discharge into the sewer; when the valve was closed, the release to the Passaic River ceased. Using the Haz-Cat Chemical Identification System, the spilled material tested positive for chlorinated solvents (USEPA, 2012). Based upon Woodard & Curran July 2016 observations, the tanks in the basement of Building 12 were removed.

Two pipes are located near the northeast corner of Building 7. Unlike the pipes noted originally by PVSC (discussed below), these pipes are not in bulkhead wall cut outs. These pipes are in the top part of the wall where the wooded

bulkhead was removed. The pipes are approximately two feet below the wall top and are exposed with one to two feet of pipe clearly visible. Based upon June 2016 observations, one pipe has a polyvinyl chloride (PVC) plug and, based upon USEPA notes related to their actions in response to the 2009 oil spill, the plug was likely installed by USEPA.

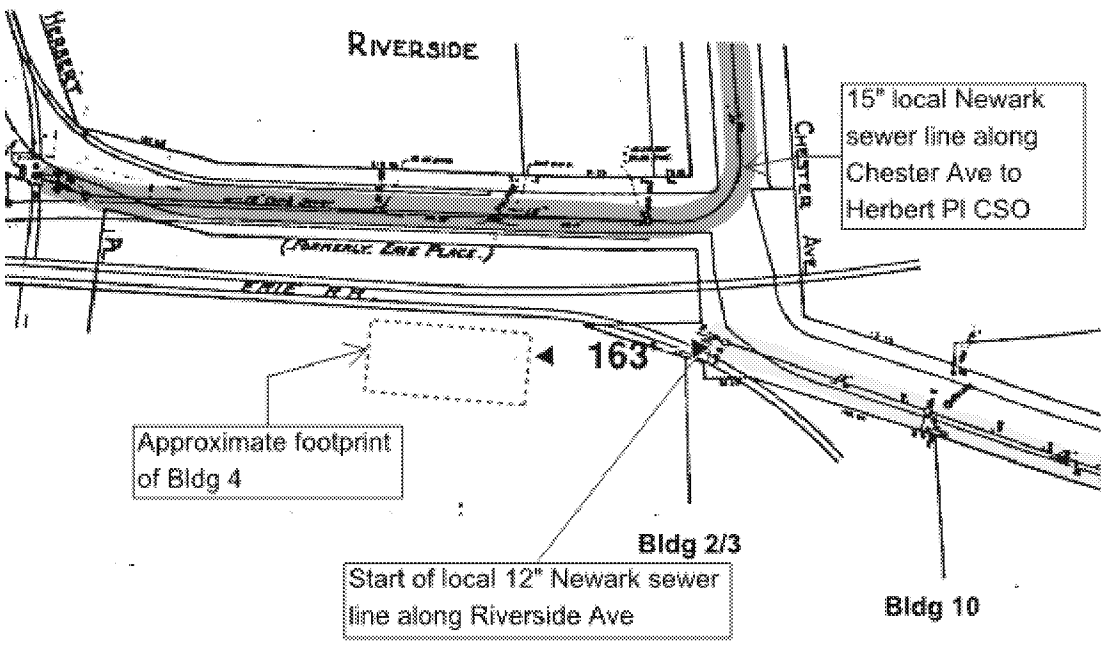
Based upon their location being close to the other pipes observed by PVSC, these pipes should have been observed by PVSC if they were present at the time of PPG's operations. Also, river bulkhead wall blueprints do not show cut outs for pipes or any pipes in the bulkhead (PPG, undated). Their different construction (bulkhead removed instead of through a cut out opening) and not being noted by PVSC suggests that these two pipes near the northeast corner of Building 7 were not present during PPG's ownership and operation of the NCF, but subsequently added after 1971.

5.3 INDIRECT AND OTHER PATHWAYS

5.3.1 Local Newark Sewer

When Patton Paints began operations in the early 1900s, there was a Newark installed sewer system in the Riverside Avenue area. Both the Herbert Place and Delavan Avenue sewers (Newark-owned sewers) were in existence when the PVSC trunk line was installed in the Riverside Avenue area in 1924.

As shown on a historical figure (Appendix B, Attachment 1), the Riverside Avenue area was connected to the local Newark sewer system which was operational as early as 1854 (Modica, 2007). Based upon a 1902 plumber specification document (Appendix C) for Building 4 (five-story manufacturing building), sewer piping is described as being connected to an existing sewer pipe. The specification lists the existing sewer system being 163 feet from the northwest building corner. This distance matches very closely to the beginning of the Delavan pipe connection on the PVSC drawing as show below:



As noted above, Building 4 is connected to the local Newark sewer. It is likely that other pre-1924 buildings would also connect to the local sewer system near the northwest corner of Building 2.

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5.3.2 PVSC Sewers

In the 1920s, the PVSC system connected existing local municipal systems like Newark's Herbert Place and Delavan Avenue sewers to a main PVSC intercepting sewer. A 1923 Newark drawing shows the connections to be made to the existing local sewer system at Herbert Place (Appendix B, Attachments 2, 2a, and 4). A 1915 PVSC figure (Appendix B, Attachments 5 and 6) shows the Delavan Avenue connection.

Based upon PVSC records, the Newark sewer system was likely connected to the PVSC in the 1920s when the main intercepting sewer was completed in the area. A main intercepting sewer parallels the Riverside property under Riverside Avenue and in the adjacent railroad track right-of-way. 1915 PVSC construction drawings display the pipe at this location (Appendix B, Attachment 1a). A 1924 PVSC drawing states construction in the area of the NCF was completed in December 1924 (Appendix B, Attachment 2a). Existing manholes in Riverside Avenue and railroad right-of-way near the RIP align with the historical construction drawing layout.

There are two PVSC combined sewer outfall (CSO) pipes that run west to east beneath RIP to the south of Buildings 7 and 12. These pipes are identified by PVSC as the Herbert Place CSO.

Woodard & Curran has been unable to identify any NCF sewer waste water connection to the Herbert Place connector, which is expected as Chester Avenue homes and businesses west of RIP connect to the PVSC system at Herbert Place. Appendix B, Attachment 8/8a shows the local sewer system in the RIP vicinity. The local pipes leading to the Herbert Place connection are surface drains along the railroad tracks and are upslope from RIP based upon PVSC drawings. These local surface drainpipes connect to the CSO pipe and not the diversion chamber (Appendix B, Attachment 2a). Based upon these findings, the Herbert Place CSO did not accept waste water discharges from the NCF.

Major facility expansion occurred with six buildings constructed around the same time as the PVSC system became operational in 1924. The remaining buildings were constructed after 1931.

- Buildings #1, 2, 4, and 6 – present before 1909
- Building #2 – 1937 (apparent rebuild at same location)
- Building #3 – between 1909 and 1926
- Building #5 – between 1909 and 1926
- Building #7 – original 1910, rebuild 1936
- Building #7A – originally the 1910 Building 7
- Building #9 – 1919
- Building #10 – 1923
- Building #12 – 1925
- Building #13 – between 1926 and 1931
- Building #14 – 1930
- Building #15/15A – between 1926 and 1931
- Building #16 – between 1931 and 1950 (shed in 1931)
- Building #17 – between 1931 and 1942
- Building #19 – between 1950 and 1973

Based upon Woodard & Curran observations (July and August 2016) of the RIP sewer system, there appears to be two waste water sewer systems. Evaluations were made by observing manholes and reviewing historical sewer records. As detailed below, both systems discharge to the PVSC system.

One system is primarily for sanitary wastes (although current tenants also use it for their industrial waste water), and it is in active use on the north end of the property. This system has brick circular manholes with a flow groove in the

bottom. The second system is designated as the industrial waste water (IWW) system for this report and is comprised of non-circular concrete structures typically with several pipe openings. In July 2016, most IWW manholes were dry and inactive. A IWW manhole with standing water observed in 2016 is the inoperable pump station near Building 3. Based upon nearby manholes, waste water in Buildings 7 and 12 would have drained to this IWW manhole which connects to the sewer pipes in the basement of Buildings 2/3.

Both waste water systems discharge to a 12-inch diameter pipe beneath Riverside Avenue connecting to the Delavan Connector of the PVSC system. As shown on attached figures, there are two local collector sewers along the RIP property (Appendix B, Attachments 2, 2a, 5, 6). Both sewer lines originate near the Chester and Riverside Avenues intersection. The Chester Avenue sewer flows south to the Herbert Place connector while the Riverside Avenue sewer flows north to the Delavan Avenue connector via a 12-inch pipe. There is no evidence that NCF/RIP waste water is connected to Herbert Place sewer.

NCF/RIP are only connected to the Delavan Avenue connector (except for Building 17 during PPG operations, which was connected directly to the main PVSC truck line [as discussed below]). The Delavan connector (Appendix B, Attachment 7) has an inlet to the PVSC main intercepting sewer which flows south toward PVSC Newark Bay facility. PVSC Section 8N drawing (Appendix B, Attachment 2, 2a, and 3) also shows the beginning to the Riverside-Delavan pipe which originates between the railroad spur entering RIP and Building 2. This is the PVSC pipe which receives waste water from NCF and RIP.

The PVSC Delavan CSO schematic displays how the overflow works (Appendix B, Attachment 4). During low flow, liquids enter the primary or diversion chamber and are then diverted to the regulator chamber which has an outlet to the PVSC main intercepting pipe. During high flows, Delavan Avenue flow is diverted to the river from the diversion chamber.

Based upon PVSC Drawing Section 8N, the 12-inch pipe from NCF/RIP connects to the Delavan Avenue regulator chamber (Appendix B, Attachment 3/3a). The connection of the NCF/RIP sewer pipe to this chamber prevents NCF/RIP waste water from being discharged to the river during high flow or bypass events at the Delavan Avenue CSO connection. Instead, NCF/RIP waste water enters the regulator chamber and flows into the main PVSC intercepting sewer and to the PVSC treatment plant. During high-flow conditions, this waste water cannot reach the diversion chamber where the bypass flow to the river occurs. Below is a portion of the PVSC drawing showing the 12-inch sewer from RIP connected to the regulator chamber that is connected directly to the PVSC main intercepting sewer.

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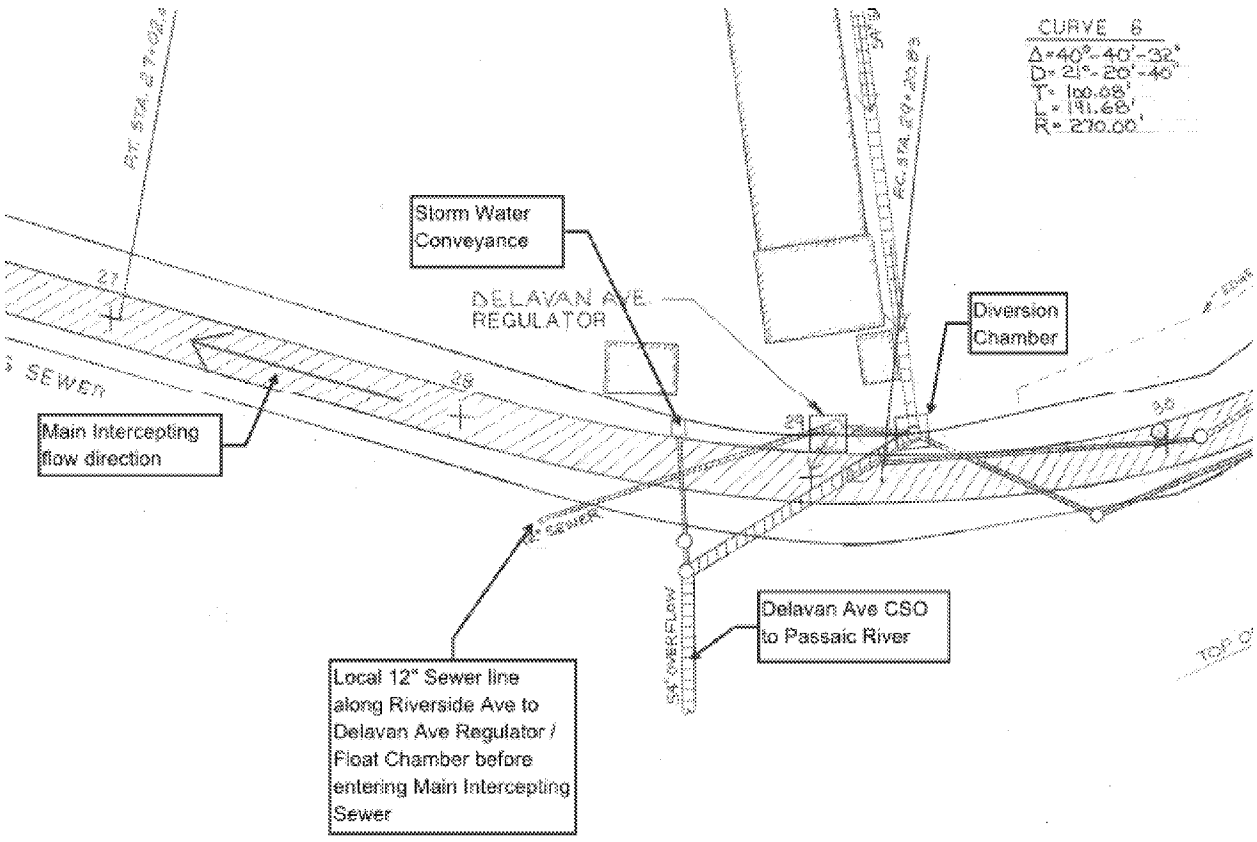


Appendix B, Attachments 10 and 11 show current sewers associated with Ardmore Chemical, which shows the same pipe connection beneath Riverside Avenue as during PPG operations.

As mentioned above, the only building not to discharge to the Delavan connector was Building 17. Based on a 1959 revision of a 1942 drawing, a sewer line from Building 17 existed going to the southwest presumably connecting to the PVSC main sewer line (PVSC connection is off map and not shown). In 1992, Chemical Compounds Inc. installed a sewer pipe to connect Building 17 to the main RIP sewer (Appendix B, Attachment 9). After 1992 Building 17 waste water was combined with wastes from the other RIP buildings and discharged to the PVSC system at the Delavan Avenue connector.

In summary:

- There is no evidence that NCF/RIP waste water discharged to the Herbert Place sewer at any time,
- With the exception of Building 17, NCF/RIP waste water was discharged to Delavan Avenue connector and those waste water discharges could not be diverted to Passaic River given the connection of the NCF/RIP piping to the Delevan Avenue regulator chamber (where no bypass option is available), and
- Building 17 discharged its waste water directly to the PVSC main truck line prior to 1992 and to the Delavan Avenue connector after 1992.

5.3.3 PVSC Noted Pipes

Several pipes are present in the river bulkhead wall adjacent to the former NCF. The pipes that come through the river bulkhead wall are consistent with the PPG era PVSC notes documenting pipes in the river wall (Appendix B, Attachment 12). Based upon these PVSC notes, the pipes are related to a water tank drain or compressor cooling water and not coating manufacturing. These pipes are approximately 3 feet below the river bulkhead top. Observations conducted in 2015 and 2016 noted that at least one pipe had vegetation growing out of it, and there were no visible liquids leaving the pipes. Although the PVSC notes are not dated, it is inferred that the observations were made in approximately 1970 as there is mention of PPG ceasing production. River bulkhead wall blueprints (Appendix C) do not show cut outs for pipes or any pipes in the bulkhead.

5.3.4 PPG Building Blue Prints and Construction Specifications

Woodard & Curran considered blueprints, construction specifications and other historical records concerning the construction and renovations of the PPG buildings. Only one set of blueprints show a possible connection to the Passaic River.

As noted in Section 3.3, Building 7 was rebuilt in 1936 at its current location which is adjacent and south of its original location. The original Building 7 was subsequently identified in PPG records as Building 7A. The 1910 Building 7 (Varnish Building) blueprints and specification indicate a 6-inch-deep concrete sink was to be installed. A pipe from the sink is installed to the river 50 feet away. Original Building 7 (a.k.a. Building 7A after 1936) has been demolished. No other information was located by Woodard & Curran on the existence or purpose of the sink. It is not known whether the sink and/or pipe to the river were ever constructed, especially since other portions of the original Varnish Building had "alternate" 1910 blueprint plans.

5.4 PASSAIC RIVER INFLUENCES

5.4.1 Flooding

The Passaic River has a history of flooding onto RIP. From the FEMA flood map (Panel 34013C0118F, 6/4/2007), the elevation of the 100-year flood at RIP is 9 feet mean sea level (MSL). From the topographic survey map of RIP (Figure 5-2), ground surface elevations range from approximately 6 to nearly 12 feet above MSL. It appears that 40 to 50 percent of RIP lies below elevation 9 MSL, including Buildings 6, 10, 13, 14, and 16, and portions of Buildings 1, 7, and 9. The top of the river bulkhead is between 6 and 7 feet MSL. This means water levels above 6 feet MSL would cause flooding at RIP.

There have been several specific accounts of flooding of the RIP including:

- In a letter to Lance Richman, USEPA, dated September 18, 1996 (Response to Question 10.a., TIERRA-B-004351), there was recollection by at least one PPG employee of flooding of the facility to an unknown extent in the 1960s.
- More recently, Chemical Compounds Inc. (occupant of Lots 62, 66, and 67) was named as the responsible party for six to eight empty drums that washed into the Passaic River during a storm event in August 1993 (NJDEP Case #93-8-17-1551-05).
- Additionally, flooding occurred from Hurricane Sandy in October 2012 based upon verbal reports from RIP tenants/owners at that time.

In addition to these accounts, there are river gauge readings that indicate flooding conditions at the RIP. The nearest U.S. Geological Survey (USGS) stream gauge station on the Passaic River (USGS Station 01392650) is approximately 6.5 miles downstream from RIP at the PVSC treatment plant at Newark Bay, where gauge elevations (gauge datum elevation is sea level) are available from March 2005 to present. Prior to March 2005, the gauge was located closer to

the RIP (approximately 2 miles downstream of RIP) and published as USGS Station 01392590 with peak streamflow and corresponding gauge elevations available from December 1992 to September 1999 and March 2001 to August 2003.

The nearest upstream gauge is behind Dundee Dam in Garfield City, New Jersey, where gauge elevations would not be representative of downstream river levels. Likewise, stream gauge readings on the Second, Third, and Saddle Rivers, although relatively close to the RIP, may not directly correlate to water levels in the Passaic River, and these gauge measurements were not evaluated.

The following gauge measurements correspond to overtopping of the bulkhead (i.e., gauge height above 6 feet):

- USGS Station 01392590
  - December 11, 1992 - 9.8 feet MSL
  - October 19, 1996 - 6.4 feet MSL
- USGS Station 01392650
  - March 13, 2010 - 6.47 feet MSL
  - August 28, 2011 - 7.21 feet MSL
  - October 29, 2012 - 12.13 feet MSL (Hurricane Sandy)

These dates correspond to the river overtopping the bulkhead. Based upon these stream gauge readings covering slightly over 20 years, it is expected that the Passaic River overtops the bulkhead to flood RIP approximately once every 4 to 5 years. Two 100-year floods at the RIP have occurred since 1992.

Flooding would have deposited river sediment along with erosion of RIP exposed surface soil. As mentioned previously, there are no surface water control measures at RIP and the majority of RIP is paved. Overland flow toward the river occurs during precipitation events, but no erosion channels or ditches are present at RIP indicating that overland flow causing soil erosion is minimal. As described in later sections, RIP soils have lower concentrations of the Lower Passaic River Study Area COCs than the river sediment, therefore, any erosion of RIP soil is not the source of the higher concentrations in the river sediments and might have diluted concentrations of Lower Passaic River Study Area COCs in sediment. In addition, river dredging (Section 5.4.3) occurred in the vicinity of RIP that would have removed sediment during PPG's operational years.

5.4.2 Residual Flooding Effects

As summarized in Section 7, there have been few exceedances of applicable USEPA Regional Screening Levels (RSLs) in RIP soil. There are low concentrations of PCBs, mercury, and DDx in soil. The source of these contaminants have been attributed to historical fill in some NJDEP cases. The low residual soil concentrations listed below also suggest that sediment deposited during Passaic River flood events may be a source of these impacts:

- PCBs - not detected to 33.5 milligrams per kilogram (mg/kg) (after Lot 70 remedial action)
- Mercury - not detected to 15.1 mg/kg
- DDx - not detected to 0.0075 mg/kg

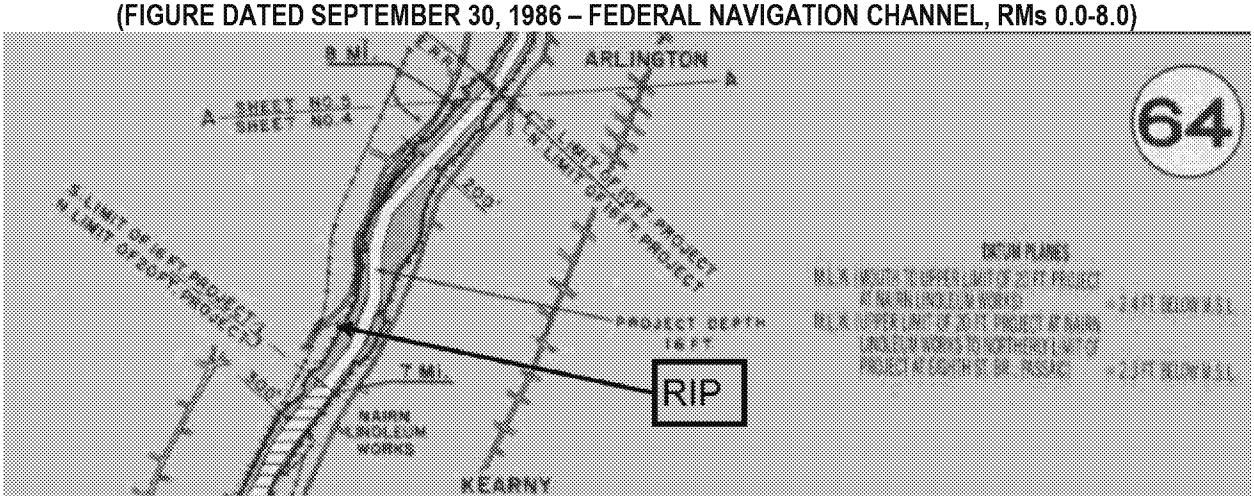
Importantly, these results are lower than the maximum river sediment concentrations adjacent to RIP (Section 8).

As summarized in Section 7.1, the highest RIP dioxin soil results (219 picogram/gram [pg/g] 2,3,7,8-TCDD) and the corresponding sample location and fingerprint suggest its source is sediment from river flooding.

5.4.3 USACE Dredging

As shown on Figure 1a from the *Lower Passaic River Commercial Navigation Analysis* (USACE, New York District, Revision 2, July 2010), the RIP is located at approximately RM 7.2 of the Passaic River federal navigation channel that begins at the confluence with Newark Bay.

EXCERPT OF FIGURE 1A – USACE JULY 2010
(FIGURE DATED SEPTEMBER 30, 1986 – FEDERAL NAVIGATION CHANNEL, RMs 0.0-8.0)



It is noted that the starting point for distance measurements to points upstream in the Passaic River used by the USACE (Junction Light in the Newark Bay Turning Basin) differs from that used for purposes of the FFS (Louis Berger, 2014). The FFS measurements begin approximately 0.25 mile further north in Newark Bay than the USACE measurements. Accordingly, RM measurements from the FFS and ROD will be approximately 0.25 mile less than those using the USACE starting point. As an example, RM 7.0 using the USACE starting point would correspond to approximately RM 6.75 using the FFS ROD starting point. Because the RIP is very close to the border between the Kearny Reach and Arlington Reach (as defined by the USACE as RM 7.2), there is a discrepancy between the FFS/ROD and USACE in the assignment of the appropriate reach (Arlington Reach) to the RIP.

From the USACE report (July 2010), the Lower Passaic River has been deepened between RM 0.0 and RM 15.4 (Wallington, New Jersey) as a result of several federally authorized projects to promote commercial navigation. Woodard & Curran focused on the Kearny and Arlington Reaches.

- Kearny Reach (RM 6.1 to 7.1) - Constructed to a 16-foot depth and 300-feet-wide navigation channel.
- Arlington Reach (RM 7.1 to RM 8.1) - The channel was constructed to a depth of 16 feet and is 200 feet wide.

The construction and maintenance of the Kearny and Arlington Reaches of the Lower Passaic River is summarized in the USACE report (July 2010) as follows:

Dredging History

Passaic River Reaches	Dredging History (*USACE, 2010*)
Kearny Reach: RM 6.1-7.1	1883 – Constructed to 6 Feet 1906 – Deepened to 12 Feet (to RM 6.5) 1906 – Deepened to 12 Feet (from RM 6.5) 1913 – Deepened to 16 Feet (to RM 5.8) 1916 – Maintained/Deepened at 16-17 Feet 1919 – Maintained at 16 Feet (to RM 6.4) 1933 – Maintained at 16 Feet (to RM 6.3) 1950 – Maintained at 16 Feet (to RM 7.0)
Arlington Reach: RM 7.1-8.1	1883 – Constructed to 6 Feet 1906 – Deepened to 10 Feet (to RM 8.0) 1915 – Constructed to 6-7 Feet (from RM 8.0) 1916 – Deepened to 16-17 Feet (to RM 8.0) 1927 – Maintained to 6 Feet (from RM 8.0) 1929 – Maintained to 6 Feet (from RM 8.0) 1930 – Constructed to 10 Feet (from RM 8.0)

The last dredging event for the Kearny Reach, immediately downstream of RIP, occurred in 1950. Furthermore, the above history indicates that the channel in the vicinity of RIP would have been dredged to a maximum depth of 16 feet in 1916, with no USACE dredging maintenance after 1916 near RIP. Post-1916 dredging in the Arlington Reach occurred at RM 8.0 and proceeded upriver into the Belleville Reach.

As previously mentioned, the Arlington Reach was federally authorized for a navigation width of 200 feet (USACE, July 2010). From aerial map measurement, the river spans approximately 430 feet in the RIP vicinity from bank to bank. The authorized navigational channel would be slightly less than half of the full channel width at this location, which appears to be generally consistent with Figure 1a from the USACE report (ASAOC, 2010).

In addition to the navigation channel, the USACE would dredge a transition zone. For a 16-foot dredging depth and 3H:1V transition slopes, the transition from the edge of the navigation channel to the flanks would extend 48 feet toward the RIP bulkhead, leaving a distance of 67 feet from the edge of the dredge channel to the RIP bulkhead.

Upon maintenance dredging stopping in 1950, infilling downriver from RIP would have occurred at higher sedimentation rates for these areas. Once these areas filled in, the sediment rates would decrease and become consistent with non-dredged area sedimentation rates (Louis Berger, 2014).

5.4.4 Barge Berth Dredging

The USACE dredging focuses on the navigational channel and transition zone. Barge access from the channel to dock would be the responsibility of each user. No records have been located on barge berth dredging near PPG's NCF operations.

Based on information provided in PPG's letter to Lance Richman, USEPA, dated September 18, 1996 (Response to Question 9, TIERRA-B-004351), there was a dock at NCF that was used for commercial activity:

"The dock was used in the first half of the century to unload flax seed and coal for use in the factory and to ship products. Based on discussions with former employees, the dock was not used after 1946."

Given the berth was used by PPG for commercial operations until 1946, it is reasonable to assume that dredging between the navigation channel and the bulkhead would have been undertaken, including maintenance dredging until 1946. Such dredging would have to extend for some distance upstream and downstream of the docking berth to allow

maneuvering of a commercial vessel. There are barge tie-downs on the RIP bulkhead where barges would be positioned for offloading. Sediment infilling of the barge berth would occur after maintenance dredging stopped.

Based upon 2015 soundings performed by USACE (Department of the Army, New York District Corps of Engineers, New York, New York, Operations Division, Survey Section CENAN-OP-S, Request No. 4400/N2/A, http://www.nan.usace.army.mil/Missions/Navigation/Controlling-Depth-Reports/) sediment deposition has filled in previously dredged areas between the navigation channel and the bulkhead.

5.4.5 Dredging Summary

RIP is located in the southern end of the Arlington Reach and immediately upriver from Kearny Reach. The southern RIP property line is very close to the dividing line between these reaches.

Sediment next to RIP and downriver would have been removed up until the late 1940s (barge berth) and 1950 (Kearny Reach navigation channel). It is projected that infilling of the PPG barge berth along the bulkhead would decrease over time as the depression filled in. Rapid sedimentation rates immediately after dredging followed by lower sedimentation rates are documented in the FFS, Report 3 (Louis Berger, 2014).

There could be more recent localized dredging for berths in these reaches by commercial facilities.

Historical USACE and commercial dredging adjacent and downriver of RIP removed sediment, and the dredging would have removed hazardous substances in the removed sediment.

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6. PASSAIC RIVER COCS AND PPG OPERATIONS

The COCs identified by USEPA in the FFS ROD as presenting the greatest risk in the Lower Passaic River Study Area are polychlorinated dibenzo-p-dioxins and furans (dioxins and furans), PCBs, mercury, and dichlorodiphenyltrichloroethane (DDT) and its primary breakdown products, dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE) (https://semspub.epa.gov/work/02/396055.pdf). This section discusses data relevant to these compounds and PPG's NCF operations.

None of the materials used by PPG at NCF were known to contain dioxins, furans, PCBs, or DDx. PPG's operations in Newark were limited to manufacturing paints, varnishes, and other coatings; chlorinated compounds were not manufactured at the NCF. In addition, there were no known processes where dioxins, furans, PCBs, or DDx would have been generated as by-products. While parts of PPG's manufacturing process applied heat to various natural compounds, there were no reactions at high temperatures with chlorinated compounds. Any residues remaining from the heating processes were either reused or put in drums and disposed of off-site. The facility collected its non-chlorinated solvents and distilled them onsite for reuse. Any distillation residuals were drummed and removed by waste haulers.

There have been a series of speculative suggestions about PPG by other entities. Those entities have suggested that because PPG was listed nationally as a manufacturer or provider of various chlorinated compounds and that PPG had an operation on the Passaic River that the chlorinated compounds were manufactured or otherwise handled at NCF. This is an incorrect interpretation of the facts. PPG did not manufacture chlorinated compounds at NCF. PPG also did not use chlorinated compounds in its operations at NCF. PPG manufactured and handled chlorinated compounds at other locations in the United States, but not at the NCF.

6.1 DIOXINS AND FURANS

It has been suggested that phthalic anhydride used at NCF is a dioxin precursor. USEPA (1980) lists phthalic anhydride as a Class III compound, one which has the possibility but less likelihood of forming dioxin. USEPA also has indicated that Class III Compounds may require conditions such as an unusual combination of reaction steps to produce dioxins. Unchlorinated phthalic anhydride is widely used in a variety of industrial organic syntheses including paint, but in its chlorinated form, it is more often used as a compounding ingredient for plastics. No chlorinated phthalic anhydrides were used at the NCF based upon the information considered, nor would it be expected to be used in the production of coatings. There would have to have been a chlorine source present in PPG's operation to create chlorinated dioxins and/or furans from the phthalic anhydrides, but chlorinated compounds were not used in PPG's operations (Section 3).

The speculation that chlorinated dioxins would have been generated in the resin building fire at NCF would also have required a chlorine source. As described previously, PPG's resin-making process did not include chlorinated material. In addition, a PPG employee specifically sent to the NCF to investigate the explosion and fire which took place in 1969 recalled that most of the released material was confined inside the resin plant building itself. That employee stated that there was no evidence of any material flowing to the river from the resin building area, let alone any material spilling or discharging from the fire area.

It should be noted that in a list of Raw Materials and Wastes (Bates No. 853340010) that purports to list raw materials used in the manufacture of NCF products, the compounds *trans*-1,2-dichloroethene and chloroform are listed, and Exhibits 2 and 3 are listed as the purported source of that reference, but no mention of these compounds could be found in those exhibits. These compounds are the only chlorinated compound in the raw material list produced by Kroll Associates in 1994, and no other chlorinated solvents were identified in the material considered by Woodard & Curran.

6.2 PCBS

There is no documentation that PCBs were used as a component in any NCF produced coatings. As noted in Section 7.2, there are few exceedances of USEPA screening levels in soil that support information that PCBs were not a coating component. PCBs have been detected in soil by others as part of their NJDEP-related investigations at RIP. As noted earlier, RIP has been subjected to numerous Passaic River floods, which likely deposited PCB-contaminated sediments onto RIP. Some NJDEP-related investigations have also attributed PCB soil contamination to historical fill.

In the "Summary of Potential PCB Sources to PRSA (As of December 18, 2001)" submitted by Tierra Solutions Inc. on Page 6-B of Tab 71 for "PPG/Frey Industries," there is a reference to P-5460 under "Other Aroclors". It should be noted that Monsanto used the term Aroclor for some non-PCB products as well as its PCB products. P-5460 may have been misconstrued as a PCB because of Monsanto's product nomenclature, but it is not a PCB. Tierra Solutions jointly references "PPG/Frey Industries". It is unknown if Frey Industries managed PCBs but Frey did manage chlorinated compounds at RIP; PPG did not manage either chlorinated compounds or PCBs at the NCF.

6.3 DDX - DDT, DDD, AND DDE

No records considered indicate that DDx were used or generated by PPG, nor are they present in soils or groundwater at RIP above USEPA screening levels. Some DDx concentrations at RIP likely result from deposition of Passaic River sediments onto RIP as a result of flooding. Refer to Section 7.4 for discussion on pesticides/herbicides in RIP soils. The term DDx is used in this report to reflect these three pesticides.

6.4 MERCURY

Mercury in trace amounts was used by PPG probably as a preservative in some paints (PPG 104e response). There is no known release of mercury during PPG operations. See Section 7.3 for a discussion of mercury in RIP soils.

7. RIP SOIL AND GROUNDWATER DATA

Numerous NJDEP cases undertaken at RIP since 1985 have produced a significant amount of soil and groundwater data. The data are summarized in the USEPA approved Site Characterization Summary Report for the RIP Superfund Site. This section focuses on RIP soil results for the key contaminants associated with the Lower Passaic River Study Area (ROD, FFS Remedy).

Figure 7-1 displays the soil sample locations collected under NJDEP auspices and shows the widespread locations sampled at RIP. The soil concentrations of dioxins/furans, PCBs, mercury, and DDx were compared to current USEPA RSL for industrial soil (TR-10-6; THR - 0.1) (USEPA, 2016).

The use of RSLs at Superfund sites is to identify areas and contaminants that require further focus. Generally, at a site where contaminants are below RSL, no further action is warranted under the Superfund program (USEPA, 2016). As presented below, there are few RSL exceedances in RIP soil. The exceedances are within an order of magnitude of applicable RSL. The highest PCB exceedances noted below are related to the operations of others and not PPG.

7.1 DIOXINS AND FURANS

There were no NJDEP cases at RIP where samples were collected for dioxins and furan analyses. In 2011, a USEPA-retained contractor (Lockheed Martin) collected surface soil samples (zero to 1 inch) for dioxins and PCBs (Appendix D) "to support the Passaic River Site Investigation". The soil samples were collected from the area north of Buildings 7 and 12 (Figure 7-2). Dioxins, if detected, were below USEPA's RSLs. The highest concentration (dioxin TEQ – 234 pg/g) was in a sample (NS-11) along the river wall at an approximate elevation (8 MSL) that is a foot below the 100-year flood plain elevation (9 MSL). The 2,3,7,8- TCDD concentration was 216 pg/g (Table 7-1). The ratio of 2,3,7,8-TCDD to total TCDD was 0.7 (Table 7-1).

The soil dioxin concentration at RIP is less than the average sediment 2,3,7,8-TCDD concentration adjacent to RIP (Table 8-4) indicating this area is not a source of dioxin, but its proximity to the river probably reflects residual sediment from past flooding events. The 2,3,7,8-TCDD/total TCDD ratio indicates that the source of the RIP soil dioxin is herbicide manufacturing and is consistent with the 2,3,7,8-TCDD/total TCDD identified by others for a former manufacturing facility located at 80 and 120 Lister Avenue in Newark, New Jersey (near RM 3), which began producing DDT and other products in the 1940s (Quadrini, 2015).

Following the procedures described in Section 8.2.1, congener fingerprint profile was calculated for NS-11 dioxins/furans. The congener pattern is displayed on Figure 7-3, and it is consistent with the pattern reported by others for soil samples from the Lister Avenue site (Quadrini, 2015).

7.2 PCB

Figure 7-4 displays the soil samples collected for PCB analyses at RIP. Sixteen samples have concentrations exceeding a RSL. The highest concentration is 721 mg/kg for Aroclor 1254 and 411 mg/kg for Aroclor 1260, both located on Lot 70 (Figure 7-5).

Fourteen of the 16 PCB exceedances are associated with Building 16 on Lot 70 (Figure 7-5) and NJDEP Case #E2000550 (FRC). PPG used Building 16 as a maintenance shop, which did not involve the use of PCBs based upon documents considered. Beginning in 1985, FRC operated a scrap metal recycling process that used an incinerator with various acidic and caustic liquids on Lot 70/Building 16 (TRC,2015). Prior to initiating its operations and after the previous company (railroad ties and rails storage) vacated the property, FRC undertook an environmental assessment of Lot 70 which included the sampling and analyses of soil samples. Their findings reported that organic compounds were not detected other than trace concentrations of pesticides. PCBs were not detected in 1985.

In the early 2000s, FRC undertook an environmental assessment under Industrial Site Recovery Act (ISRA) Case Number E2000550. These findings indicated contaminated soil for metals and organic compounds including PCBs on Lot 70. FRC undertook a soil removal action to address the contaminated soil and implemented engineering and institutional controls to address the remaining contamination. In March 2012, contractors for FRC excavated soil containing PCBs greater than 50 mg/kg (TRC, 2015). Post-excavation soil samples are shown on Figure 7-6 that display the RIP PCB soil concentration above RSL after the soil removal action at Lot 70.

The remaining RIP soil sample (LD-1A) from an NJDEP case with a PCB concentration (1.7 mg/kg Aroclor 1254) above USEPA RSL was collected near Building 5 on Lot 64 (Figure 7-6). This PCB concentration is consistent with the PCB concentration USEPA reported in 2011 in that area (below) with the same Aroclor (1254).

Eleven surface soil samples were collected in 2011 by USEPA contractor (Lockheed Martin/SERAS) for PCBs (Appendix D). One sample (NS-1) contained PCB concentrations (Aroclor 1254) at 3 mg/kg above the USEPA selected screening level. This sample was collected from a soil pile where former Building 5 was located (Figure 7-2) and is located close to Sample LD-1A described above. In 1971 when PPG exited the property, Building 5 existed. Sometime after 1971 Building 5 was demolished and soil was subsequently stockpiled. The source of the stockpiled material is not known. Trees and other vegetation is growing in the pile based on observations in 2016.

Overall the PCB soil results and their locations confirm that the source of PCBs at RIP is post PPG. Other than Lot 70 PCB results which are associated with others, soil PCB concentrations are consistent with or less than the river PCB sediment concentration. The low PCB soil concentrations (other than on Lot 70) likely reflect residual contaminated sediment from past flooding events.

7.3 MERCURY

Figure 7-7 shows the locations of soil samples collected for mercury analyses under NJDEP auspices as well as samples with mercury concentrations above the USEPA industrial soil RSL (4.6 mg/kg). The soil mercury concentration range from not detected to 15.1 mg/kg (Figure 7-6). As listed in Section 8.2, mercury concentrations are higher in the river sediments both upriver and downriver of RIP than in the RIP soil.

7.4 PESTICIDES - DDX

For the soil samples collected and reported under various NJDEP cases, DDx was not reported in soil samples at concentrations above USEPA industrial soil RSL (Woodard & Curran, 2015). Figure 7-8 shows the locations of the samples collected for pesticides.

The soil individual DDx concentrations are also less than background concentrations listed in Table 26 of the March 2016 Decision Summary for the Lower 8.3 Miles of Lower Passaic River. There were no detections of DDE. This information, in combination with PPG operations not involving pesticides, indicate any pesticide concentrations are not related to PPG. The extremely low concentrations (or not detected) of pesticides indicate the RIP is not a source of DDx contaminated sediment in the Passaic River.

7.5 GROUNDWATER

Groundwater investigations have been conducted by responsible parties under NJDEP auspices. Permanent NJDEP permitted monitoring wells were installed and sampled as part of some of these investigations. The majority of groundwater samples were collected from the water bearing zone within the shallow fill material. The depth to groundwater is typically less than six feet below ground surface at the RIP. The groundwater results from these monitoring wells indicate that impacts above USEPA maximum contaminant levels (MCLs) and/or NJDEP Groundwater Quality Standards (NJGQS) are present for select metals, volatile organic compounds (VOCs), and one polyaromatic hydrocarbon (PAH), as presented below:

- Arsenic, barium, beryllium, cadmium, chromium, iron, lead, magnesium, and sodium have been reported at concentrations that exceed their respective MCLs and/or NJGQS. Several of the applicable responsible parties have attributed these impacts to historic fill.

- Four VOCs (tetrachloroethylene [PCE], trichloroethene [TCE], *cis*-1,2-dichloroethene [DCE], and vinyl chloride) were detected in the area of Lot 68 that is related to a 1987 PCE spill. An NJDEP Classification Exception Area (CEA) with a Monitored Natural Attenuation remedy has been instituted by the responsible party for the area impacted by PCE, TCE, *cis*-1,2-DCE, and vinyl chloride. An asphalt cap has also been installed in this area as an NJDEP-approved engineering control.

- Benzene and methyl tert-butyl ether (MTBE) (Lot 1 only) have been detected at concentrations above the NJGQS. Lot 1 is being investigated by the responsible party.

- The responsible party for Lot 70 has instituted an NJDEP CEA for benzene and select metals (arsenic, barium, cadmium, lead, and zinc). An asphalt cap has also been installed at Lot 70 as an NJDEP-approved engineering control.

- One PAH, benzo(a)anthracene, exceeded its respective MCL. Like metals, the presence of this compound has been attributed to historic fill.

- Total VOC tentatively identified compounds (TICs) and base neutral (BN) TICs concentrations have exceeded the NJGQS on several of the lots.

As indicated by the above, none of the groundwater exceedances are for dioxins/furans, PCBs, mercury, or DDx.

7.6 SUMMARY

As presented above, the Lower Passaic River Study Area COCs if detected at RIP were typically at low concentrations and below RSLs. The highest PCB concentrations detected in RIP soil were addressed by the responsible party (not PPG) under NJDEP's program. Dioxins/furans, mercury, and DDx if detected in RIP soils are below RSLs and/or within the concentration range for sediments adjacent to RIP listed in Table 8-4. The soil concentration range is as follows:

- PCBs - not detected to 33.5 mg/kg (after Lot 70 remedial action); Aroclor 1254 RSL - 0.97 mg/kg; Aroclor 1260 RSL - 0.99 mg/kg; total PCBs RSL - 0.94 mg/kg

- Mercury - not detected to 15.1 mg/kg (RSL – 4.6 mg/kg)

- DDx - not detected to 0.0075 mg/kg (DDD RSL – 9.6 mg/kg, DDE RSL – 9.3 mg/kg, DDT RSL – 8.5 mg/kg)

The source of these contaminants has been attributed to historical fill in some NJDEP cases. The low and widespread residual concentrations also suggest another possible source of sediment deposited during Passaic River flood events. As noted above, these results are lower than the river sediment concentrations adjacent to RIP.

As summarized in Section 7.1, the highest dioxin soil results (219 pg/g 2,3,7,8-TCDD) and its location suggest its source is sediment from river flooding.

Groundwater investigations conducted by responsible parties under NJDEP auspices documented contaminated groundwater associated with the responsible party operations or historical fill. None of the groundwater contaminants above USEPA or NJDEP standards are dioxins/furan, PCBs, DDX or mercury.

8. PASSAIC RIVER DATA

An evaluation of sediment data from the Passaic River in the vicinity of the RIP was conducted. The data were obtained beginning in the 1990s by several organizations, 20 years after PPG terminated its NCF operations.

8.1 SEDIMENT RESULTS

A statistical evaluation of Lower Passaic River (river) sediment data was completed with the goal of assessing the concentrations of several constituents in sediment adjacent to the RIP relative to upriver and downriver concentrations. Historical sediment data from samples collected in the river from 1990-2013 were evaluated. The sediment samples are listed by river mile in Table 8-1, and their locations are shown on Figures 8-1 through 8-5. For the purposes of the analyses conducted, only sediment data between river miles noted below were analyzed. The objective of the evaluation is to determine if there are differences in concentrations between upriver and adjacent sediments to RIP, and adjacent and downriver sediments to RIP.

Sample results have undergone various levels of data validation and data qualification. With the exception of samples qualified as rejected ("R"-flagged), all U- (nondetect), J- (estimated), and otherwise qualified data were considered to be usable for purposes of this evaluation. Data listed as "rejected" were omitted from the data sets. In instances where both a primary and duplicate sample was collected at a sample location, results from only the primary sample were used in the analyses. Similarly, certain pesticide samples were observed to have been analyzed as split samples at two different laboratories. In such cases, the results analyzed by the more sensitive method (those with lower reporting limits) were retained.

The data were segregated based upon location with respect to RIP, which begins at RM 6.8. For a comparison of sediment characteristics, the Lower Passaic River was divided into three segments as follows:

- Upriver from RIP – RM 7.05 to 8.05 (Figures 8-1 and 8-2)
- RIP adjacent – RM 6.80 to 7.05 (Figure 8-3)
- Downriver from RIP – RM 5.8 to 6.80 (Figures 8-4 and 8-5)

Samples are assigned to a segment based upon river mile in the data set. The sediment results were further divided into two-depth intervals; 0 to 2.5 feet and 2.5 to 6.0 feet. Sediment samples deeper than 6 feet were too few in number to provide reliable statistical analyses.

The sediment results were evaluated via two statistical processes. The first process developed a summary of the number of samples and non-detects by parameter, minimum and maximum concentrations (Tables 8-2 and 8-3). Average COC concentrations were calculated for each river segment (Table 8-4).

The statistical analyses were completed using ProUCL Version 5.1.002, USEPA's Technical Support Center for Monitoring and Site Characterization statistical program (EPA/600/R-07/038, *ProUCL Version 5.1.002 User Guide*). The data were downloaded from the database into either Microsoft® Access® or Excel® for initial processing, reformatting, and quality assurance checks as described above, and then further analyses were completed in ProUCL. Additional summary statistics calculations were supplemented by using JMP® Version 8.0.2 (JMP), a commercially available statistical package by SAS Institute, Inc. ProUCL does not have a function to calculate the median using the

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Kaplan-Meier (KM) method, so median concentrations were calculated using the survival statistics platform in JMP® Version 8.0.2 as well as Practical Stats, KM Stats Version 1.6®. Other assumptions for ProUCL analyses are listed in Appendix E along with statistical analyses output.

The COCs identified by USEPA in the FFS and ROD as presenting the greatest risk in the Lower Passaic River Study Area are dioxins and furans, PCBs, mercury, and DDx. For dioxins and furans, the most toxic dioxin or furan is 2,3,7,8-TCDD, and hence, the statistical evaluation was limited to that congener. To simplify the analysis, total PCBs and total DDx were evaluated. If total analytical results for these constituents were not available from the laboratory, the individual aroclors or DDx pesticide analytical results were summed to obtain a "total" result. In cases where the evaluated constituent or constituent group (for total PCBs and DDx) was non-detect in a particular sample, the highest reporting limit for that analyte or group of analytes was used as the concentration for the purpose of these statistics.

The ProUCL results and conclusions relative to the evaluated constituents are presented on Tables 8-5 and 8-6. Note that the summaries provided below focus on the inferential statistics and the calculated median concentrations provided on these tables. For non-normal (or "skewed") data such as these, the median is a better indicator of the central tendency of the data versus the arithmetic mean concentration.

Fewer deep sediment sample results were available than shallow results, therefore, some of the deep data sets do not meet ideal sample size requirements. As presented in Table 8-6, the reliability of these tests is lower, and the results should be viewed as preliminary.

As shown on Figure 8-3, the sediment samples in the RIP adjacent segment are from the "mud flat sediment" next to the RIP bulkhead. Many of these sediment locations are near the 2009 spill pipes (Section 5.2) and PVSC observed pipes (Section 5.3.3). These locations and other locations next to the RIP river bulkhead would be expected to have elevated concentrations if a release of COCs to the river occurred at RIP. As described below, the sediment COC concentrations are lower in sediment adjacent to RIP when compared to downriver concentrations, indicating that the RIP is not a source area. Overall median and average shallow sediment concentrations generally increase moving downriver. Deep sediment average and median concentrations of 2,3,7,8-TCDD, the total DDx, mercury, and total PCBs are higher in downriver sediments than in sediments adjacent to the RIP. These findings provide another line of evidence that NCF did not contribute COCs to the Passaic River.

8.1.1 2,3,7,8-TCDD

Average and median 2,3,7,8-TCDD concentrations in shallow and deep sediment downriver are higher than the average and median 2,3,7,8-TCDD concentrations in sediment in the RIP adjacent and upriver segments. The highest 2,3,7,8-TCDD concentrations are located in the downriver shallow and deep sediment.

ProUCL statistical findings are downriver shallow sediment 2,3,7,8-TCDD concentrations are higher than in the upriver segments (Table 8-5). RIP adjacent shallow sediment concentrations are statistically similar to the other segments. For deep sediment, the statistical findings for the comparison of concentrations between segments are considered unreliable based upon the low number of samples (Table 8-6).

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8.1.2 Total PCBs

Average and median total PCB concentrations in shallow and deep sediment downriver are higher than the average and median total PCB concentrations in sediment in the RIP adjacent and upriver segments (Tables 8-4, 8-5 and 8-6). The median total PCB concentrations are higher in the shallow sediment when compared to deep sediment concentration in each segment. The highest total PCB concentrations are located in the downriver shallow and deep sediment.

Statistically, total PCB concentrations in downriver shallow sediment are higher than in the RIP adjacent and upriver segments. For deep sediment, the statistical findings for the comparison of concentrations between segments are considered unreliable based upon the low number of samples.

8.1.3 Total DDx

Average and median total DDx concentrations in downriver shallow and deep sediment are the highest among the three segments (Tables 8-4, 8-5 and 8-6). The highest total DDx concentrations are located in the downriver shallow and deep sediment.

The ProUCL findings are total DDx concentrations in downriver shallow sediment are higher than in the RIP adjacent and upriver sediment.

For deep sediment, the ProUCL statistical findings are considered unreliable based upon the low number of samples.

8.1.4 Mercury

The average and median mercury concentrations are basically the same in the RIP adjacent and downriver segments with the average downriver concentration slightly higher. Among all three segments, the average mercury concentration is similar with the highest average concentration located in the upriver segment. In shallow sediment, the highest mercury concentration was located in the upriver sediment. The highest deep sediment mercury concentration is located in the downriver segment.

The ProUCL findings are mercury concentrations in downriver shallow sediment are higher than in the upriver shallow sediment. Statistically, RIP adjacent shallow sediment mercury concentrations are similar to upriver and downriver sediment concentrations. The deep sediment findings are considered unreliable based upon the low number of samples (Table 8-6).

Eight of the 11 mercury concentrations that exceed the average and/or median mercury concentration in the shallow sediment are from a depth of less than 1.5 feet. Because of the limited number of samples in the RIP adjacent segment, these samples influence the shallow sediment median and average concentrations noted in Tables 8-4 and 8-5. As noted in Section 8.4, these samples collected above 1.5 feet represent sediment deposited after NCF operations such that the presence of mercury at these locations and depths is not attributable to PPG.

8.1.5 Sediment Results Findings

Median shallow sediment concentrations generally increase moving downriver from upriver to downriver. Downriver median concentrations of 2,3,7,8-TCDD, the total DDx, mercury, and total PCB aroclors are higher in downriver sediments than in sediments adjacent to the RIP or upriver. For all four evaluated constituents/groups, 2,3,7,8-TCDD, total DDX, total PCBs, and mercury, shallow sediment results adjacent to the RIP were statistically consistent with those found upriver. More significant differences were observed between upriver and downriver and adjacent to the RIP and downriver comparisons, with downriver concentrations typically being higher than either RIP adjacent or

upriver concentrations. Overall, the pattern of results from the deep sediment comparisons are broadly comparable to the shallow sediment concentrations with the highest median COC concentrations being downriver.

The finding that sediments adjacent to RIP have lower COC concentrations than downriver sediments provides an additional line of evidence that NCF did not contribute COCs to the Passaic River.

8.2 PCDD/F FINGER PRINTING

PCDD/F data were selected from nine sediment sample locations adjacent to or slightly downriver from RIP for congener and homolog fingerprinting. The ratios of 2,3,7,8-TCDD to total TCDD, along with congener and homolog analyses, have been utilized by several investigators as a fingerprint to identify a TCDD source site (Quadrini, 2015; Chaky 2003). The samples selected had the highest 2,3,7,8-TCDD concentrations in sediment samples adjacent to RIP and sediment samples evaluated for sedimentation patterns (Section 8.3).

Data were analyzed using methodology and interpretations consistent to those presented in the article "Fingerprinting 2,3,7,8-Tetrachlorodibenzodioxin Contamination within the Lower Passaic River" published in the *Environmental Chemistry* journal in February 2015 (Quadrini, 2015). The results of this analysis have been compared directly to fingerprints developed for the Lister Avenue site (Quadrini, 2015) for the purpose of evaluating source of PCDD/F contamination.

8.2.1 Methodology

PCDD/F data were selected from sediment core sample intervals at Locations 10A, 75A, 76, 276, 277, 278, HP3, and LPRC07B. The sample interval with the highest 2,3,7,8-TCDD was retained for analysis.

Bias-corrected data were not used for the analysis to ensure consistency across all data sets. This approach was also used in the Quadrini article as it was noted that bias correction factors did not have an impact on the results of fingerprint analysis. Also, consistent with the Quadrini article, analytes that were reported below the detection limit were set to zero prior to analysis. During data review, it was noted that the results for total tetra-furans at Sample Location HP3-TSI was not available in the project database and a value of zero was assigned to this homolog.

First, the ratio of 2,3,7,8-TCDD to total tetra-dioxins was calculated for each location. Second, PCDD/F congener weight ratios were calculated and plotted for each sample interval. Consistent with the Quadrini article, 1,2,3,4,6,7,8-heptachlorodibenzodioxin (HpCDD) and octachlorodibenzo-p-dioxin (OCDD) were excluded from the analysis because of their ubiquity in the regional environment. The other 15 congeners (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; 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-Heptachlorodibenzofuran [HpCDF]; 1,2,3,4,7,8,9-HpCDF; and octachlorodibenzofuran [OCDF]) were retained for the analysis and plotted on a weight percentage basis. Third, PCDD/F homolog weight ratios including total tetra-dioxins, total penta-dioxins, total hexa-dioxins, total tetra-furans, total penta-furans, total hexa-furans, total hepta-furans, and OCDF were calculated and plotted for each interval.

Average congener/homolog fingerprint profiles were calculated from the arithmetic mean of weight percentages for each sample interval. Error bars represent the range of weight percentages for each class.

8.2.2 Findings

The 2,3,7,8-TCDD to total tetra-dioxins ratio at each sample interval is greater than 0.6 (average of 0.85). Ratios of 0.6 and above in Lower Passaic River sediment samples have been associated with the Lister Avenue site (Quadrini, 2015; Chaky 2003). Ratios above 0.6 are also associated with the herbicide manufacturing of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), which was conducted at the Lister Avenue site (Chaky, 2003). As listed in

the Lower Passaic River Study Area FFS, the 2,3,7,8-TCDD to total tetra-dioxins ratio for urban runoff and sewage discharge is less than 0.1, and typically in the 0.04 to 0.06 range (Louis Berger, 2014).

Congener fingerprints for this analysis were compared directly to profiles for samples at/adjacent to the Lister Avenue site and sediments throughout the Lower Passaic River presented in the Quadrini article. The average congener fingerprint (Table 8-7) was found to be very similar to the fingerprint plots developed for samples at/adjacent to the Lister Avenue site and RM 0-8 (Quadrini article). The similarity is to be expected since the RIP is located at RM 6.8 upstream of the Lister Avenue site (RM 3), and Lister Avenue site impacts have been found to reach as far upstream as RM 14 (Israelsson, 2013).

As discussed in the Quadrini article, congener fingerprints dominated by 2,3,7,8-TCDD; OCDF; and 1,2,3,4,6,7,8-HpCDF are predominantly related to the Lister Avenue site source. The homolog profile for the RIP sediments (Table 8-7) is very similar to the Lister Avenue site fingerprint.

These ratios and congener and homolog fingerprints support the finding that PCDD/F being reported in the sediment near RIP is attributable to PCDD/F discharges from the Lister Avenue site.

8.3 SEDIMENTATION PATTERNS

Many investigators have used radiodating processes for developing sedimentation patterns in the Lower Passaic River (Erikson, 2007; Huntley, 1995). In 1991 and 1995, sediment core samples were collected at four locations adjacent to the RIP (Figure 8-6) as follows:

- 10A – Along bulkhead, adjacent to Building 6 (barge area)
- 75A – Next to 10A, toward navigation channel
- 76A – Along bulkhead, adjacent to Building 7
- 90A – Along bulkhead, adjacent to Building 17

The samples were analyzed for Cesium-137 (Cs-137). The primary source of Cs-137 in the environment was due to atmospheric testing of nuclear weapons. Cs-137 did not appear in the soils and sediment until approximately 1954 (Jaakkola et. al., 1983). The deepest initial detection of Cs-137 in sediment would be associated with 1954. Sediment with no detectable Cs-137 is considered to be deposited prior to 1954. The maximum atmospheric deposition of Cs-137 is projected to be 1963 (Robbins & Edgington, 1975; Albrecht et. al., 1998) because extensive weapon testing occurred prior to the Nuclear Test Ban Treaty becoming effective. Atmospheric deposition rates decreased dramatically after 1963.

A comparison of Cs-137 and 2,3,7,8-TCDD results from sediment samples was undertaken. As displayed in Table 8-7, the highest Cs-137 concentrations directly correspond to the highest 2,3,7,8-TCDD concentrations. This supports the information that the deposition of the most contaminated 2,3,7,8-TCDD occurred in the mid 1950s and 1960s (i.e., during the period of peak discharges from Lister Avenue) (Quadrini 2015).

For 10A, sediment deeper than four feet has no detectable Cs-137. This indicates deep sediment was in place prior to 1954. Cs-137 concentrations increase in shallower sediment with the highest concentration in the 1- to 3-foot depth. This also corresponds to the highest 2,3,7,8-TCDD concentration in Sample 10A (Table 8-8).

Sample 75A (located next to Sample 10A) also has the highest Cs-137 concentrations at 2 to 4 feet. The highest 2,3,7,8-TCDD (4,500 parts per trillion) is also from that depth (Table 8-8). A decrease in Cs-137 concentration is observed in shallow sediment also. Deep sediment samples were not collected at this location.

Sample 76A had Cs-137 samples to a depth of 5 feet. As shown in Table 8-8, Cs-137 was not detected in any samples which indicates the sediment was in place prior to 1954. 2,3,7,8-TCDD concentrations are also very low at Sample 76A. Sample 76A is the most downriver sample from the other samples. The lack of Cs-137 supports that this area was not dredged for barges and undistributed sediment from at least 1954.

Sample 90A was only analyzed for Cs-137 (no 2,3,7,8-TCDD analyzed). A significant Cs-137 concentration was at a sample depth of 4 to 5 feet. This depth was the highest Cs-137 concentration of the five samples adjacent to RIP locations. The deepest interval sampled (8 to 9 feet) contains Cs-137 indicating deposition at this depth occurred after 1954. No deeper samples were collected to determine pre-1954 sediment depth.

In 1995 sediment samples were collected slightly downriver from RIP at approximately RM 6.73. These samples are identified as Sediment Samples 276, 277, and 278 (Figure 8-6).

The correlation of the highest Cs-137 results corresponding to the highest 2,3,7,8-TCDD results is also demonstrated in three core samples (276, 277, 278) collected immediately downriver from RIP (Table 8-8). The Cs-137 results indicate that sediment deposition with the highest 2,3,7,8-TCDD also occurred in the 1960s at these locations. Sample 276 is located downriver from RIP on the west side of the river (same side as RIP) while Samples 277 and 278 are located in the navigation channel.

The highest Cs-137 concentration at Sample 276 also has the highest 2,3,7,8-TCDD concentration (9 to 10 feet). No Cs-137 or 2,3,7,8-TCDD was detected below 12 feet, indicating sediment below 12 feet would have been deposited before 1954.

In Sample 277, the highest Cs-137 concentration (1-2 feet) also has the highest 2,3,7,8-TCDD concentration. Cs-137 was not detected at 3 to 4 feet. 2,3,7,8-TCDD was not detected at 4 to 5 feet depth.

In Sample 278, the highest 2,3,7,8-TCDD concentration corresponds to samples between 1 to 3 feet which are also the highest Cs-137 concentrations. The deepest sample collected at Sample 278 (3 to 4 feet) contained 2,3,7,8-TCDD and Cs-137 (Table 8-8).

8.4 SEDIMENTATION RATES AND 1971 SEDIMENT HORIZON

Expanding on the Cs-137 data presented in Section 8.3, analysis of sedimentation rates was conducted for the Passaic River adjacent to RIP. The objective of the sedimentation rate analysis is to estimate the sediment horizon in 1971 when PPG ceased operations at NCF.

As explained in Section 8.3, the highest Cs-137 concentration in Passaic River sediment is associated with the year 1963. Erikson (2007) calculated average sedimentation rate of 2 cm/year for the Arlington Reach (RIP is located in this reach). Four sediment sample locations centrally located along the RIP bulkhead wall were considered by Erickson (2007) in determining the average sedimentation rate (Locations 10A, 75A, 76A, and 90A). These locations (Figure 8-3) are in the barge berth dredging area (Section 5.4.4).

Using the average sedimentation rate determined by Erikson (2007), an accumulation of 18 cm (0.6 foot) would occur between 1963 (peak Cs-137 concentration) and 1971 (when PPG ceased NCF operations). Table 8-9 shows the Cs-137 concentration by depth for the samples evaluated for the 1971 sedimentation horizon. As shown in Table 8-10 and Figure 8-7, the estimated sediment depth in 1971 would range from 1.5 (Sample 10A) to 4.2 (Sample 90A) feet below the sediment surface. As a result, any COC concentrations detected in RIP sediment above the 1971 sediment horizon were deposited after 1971 and are not associated with the NCF. For example, the highest mercury concentration identified adjacent to the RIP is at sediment Sample Location 90A (16.3 mg/kg) and collected at a depth between 1.84 and 2.0 feet. As noted above, the 1971 sediment horizon at Sample Location 90A is at 4.2 feet, two feet below this sample.

8.5 PASSAIC RIVER SEDIMENT SUMMARY

The overall concentration pattern is that shallow sediment concentrations are higher in the downriver segment. This pattern is also consistent for deep sediments. The sediment concentrations adjacent to RIP are lower than downriver concentrations indicating that NCF/RIP is not a source of the key Lower Passaic River COCs (dioxins/furans, PCBs, DDx and mercury) in the Passaic River sediments.

Depending on location, sediments deposited adjacent to the RIP after 1971 (when the NCF operations ceased) range from 1.5 to 4.2 feet below the sediment surface. Any COCs in sediments deposited after 1971 would not be associated with NCF.

The highest 2,3,7,8-TCDD concentrations correspond to the highest Cs-137 concentration, which is consistent with the FFS findings (Louis Berger, 2014). This finding indicates the most contaminated sediment was deposited during the mid-1950s and 1960s, which is consistent with peak discharges from the Lister Avenue site.

The ratios of 2,3,7,8-TCDD to total TCDD are above 0.6. Ratios above the value are associated with 2,4,5-T manufacturing, and are consistent with ratios calculated by others for fingerprinting the Lister Avenue site source.

The average congener fingerprint (Table 8-7) was found to be very similar to the fingerprint plots developed for samples at/adjacent to the Lister Avenue site. As discussed in the Quadrini article, congener fingerprints dominated by 2,3,7,8-TCDD; OCDF; and 1,2,3,4,6,7,8-HpCDF are predominantly related to the Lister Avenue site source. Similarly, the homolog profile for the RIP sediments is very similar to that developed for RM 0-8 in the Quadrini article.

These ratios and congener and homolog fingerprints support the conclusion that PCDD/F being reported in the sediment near RIP can be attributable to PCDD/F discharges from the Lister Avenue site.

These findings indicate that NCF did not contribute COCs to the Passaic River.

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