TETRA TECH

FIRST FIVE-YEAR REVIEW REPORT
PPG CIRCLEVILLE, OHIO FACILITY

559 Pittsburgh Road
Circleville, Ohio
Site-Wide Operable Unit
Ohio EPA Master Sites ID No. 165-0641

July 2011

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First Five-Year Review Report
PPG Circleville, Ohio Facility

559 Pittsburgh Road
Circleville, Ohio
Site-Wide Operable Unit
Ohio EPA Master Sites ID No. 165-0641

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LIST OF ACRONYMS

AEP	American Electric Power
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirements
CAP	Community Advisory Panel
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
EHS	Environmental Health and Safety
F&O	Director's Findings and Orders (1989)
ft-amsl	Feet above mean sea level
ft-bgs	Feet below ground surface
FS	Feasibility Study
gpm	Gallons per minute
HI	Hazard Index
IGWMP	Interim Groundwater Monitoring Plan
LTGWMP	Long Term Groundwater Monitoring Plan
MCL	Maximum Contaminant Level
NPDES	National Pollution Discharge Elimination System
Ohio EPA	Ohio Environmental Protection Agency
PCB	Polychlorinated Biphenyl
PSA	Potential Source Area
RAO	Remedial Action Objective
RD/RA WP	Remedial Design/Remedial Action Work Plan
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
SCM	Site Conceptual Model
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compound

1.0 BACKGROUND

1.1 Introduction

The purpose of this five-year review is to determine if the selected and implemented remedies at the PPG Industries, Inc. (PPG) Coatings and Resins Facility (Site), located in Circleville, Ohio continue to be protective of human health and the environment. A five-year review is required for sites where the remedial action results in hazardous substances, pollutants or contaminants remaining at the site at levels above those that would allow for unlimited use and unrestricted exposure subsequent to completion of the remedial action. In accordance with the *Comprehensive Five-Year Review Guidance* (USEPA, 2001) the review should determine if the remedy continues to be protective.

This review is the first five-year review subsequent to the selection and approval of the remedial actions at the Site. On January 10, 2002 the Ohio Environmental Protection Agency (Ohio EPA) approved the *Remedial Design/Remedial Action Work Plan* for the Site (RD/RA WP; MFG, 2001). This 5-year review was triggered by the requirement to perform a review every five years subsequent to implementation of the remedy. In this case, and with Ohio EPA concurrence the implementation of the remedy began upon Ohio EPA approval of the RD/RA WP.

The five-year review was conducted by Tetra Tech as a consultant to PPG, in accordance with the Five-Year Review Work Plan (MFG, 2006) and applicable five-year review guidance published by the United States Environmental Protection Agency (USEPA, 2001). The required Site inspection was performed on May 9, 2006 by representatives of the Ohio EPA and Tetra Tech. Interviews with Site neighbors were conducted between November 2006 and January 2007 by Tetra Tech and the Ohio EPA.

1.1.1 Site Background

PPG Industries, Inc (PPG) owns and operates a resin manufacturing facility located at 559 Pittsburgh Road approximately two miles south of Circleville in Pickaway County, Ohio. Figure 1 shows the location of the site on a US Geological Survey (USGS) 7.5-minute Topographic Map. Figure 2 is a plan view map of the Site and surrounding properties showing salient Site features.

In December 1989, PPG entered into an Administrative Order on Consent (AOC) with the Ohio EPA in response to previously identified and documented environmental impacts associated with past

plant operations. In 1990 and 1991, PPG implemented a comprehensive soil and groundwater assessment consistent with the terms of the AOC and in accordance with an approved work plan dated September 1990. Assessment results were submitted to the Ohio EPA in 1991 in the *Comprehensive Groundwater Monitoring Report*, and the *Groundwater Recovery System Assessment Report* (Engineering Science, 1991). In 1992, the *Comprehensive Soil Assessment Report* (Engineering Sciences, 1992) was submitted to the Ohio EPA. A *Phase II Remedial Investigation Report* (ICF Kaiser, 1995) was completed in January 1995 that included an expanded assessment of both soil and groundwater. The remedial activities at the Site are currently being conducted in accordance with the "Director's Final Findings and Orders" dated December 21, 1989. Remediation of the Site is considered to have commenced on January 10, 2002, when the RD/RA WP (MFG, 2000) was approved by the Ohio EPA.

1.1.2 Summary of Prior Reports

1.1.2.1 *Consent Order and Director's Final Findings and Orders*

On December 21, 1989 Ohio EPA journalized the AOC, which includes the Director's Final Findings and Orders (Ohio EPA, 1989) for the Site. The document set forth the requirement to perform a Remedial Investigation (RI) and a Feasibility Study (FS) for the Site.

1.1.2.2 *Remedial Investigation Summary*

The Remedial Investigation for the Site was presented in seven reports as follows:

Document Title	Date	Firm
Groundwater Report for PPG Industries	1980	Burgess & Niple
Summary Report of Groundwater Quality Investigations at PPG, Industries, May 1985-Oct. 1987	1986	Gerharty & Miller
Comprehensive Groundwater Monitoring Report	1991	Engineering Sciences
Groundwater Recovery System Assessment Report	1991	Engineering Sciences
Comprehensive Soil Assessment Report	1992	Engineering Sciences
Technical Memorandum, Development and Construction of the PPG Circleville, Ohio 3-Dimensional MODFLOW Groundwater Model	1992	ICF Kaiser Engineers
Phase II Remedial Investigation Report	1995	ICF Kaiser Engineers

The *Groundwater Investigation Report for PPG Industries* (Burgess & Niple, 1980) concluded that, as a whole, no substantial change in groundwater quality in the vicinity of the former wastewater

ponds has occurred in the last 10 years, and that groundwater in the shallow aquifer had improved since the wastewater ponds were closed. In addition, it was concluded that vertical migration of contaminants was retarded by till layers separating the shallow and intermediate aquifers.

The *Summary Report of Groundwater Quality Investigations at PPG Industries* (Gerharty & Miller, 1987) summarized four groundwater quality investigations completed between May 1985 and October 1987, which verified that the 1,4-dioxane was migrating west of the plant within the intermediate aquifer and that operation of RW-1 would be the most effective means for removal of 1,4-dioxane. An application to Ohio EPA for a National Pollution Discharge Elimination System (NPDES) permit to discharge water from RW-1 was submitted; however treatment prior to discharge to Scippo Creek was not feasible and the remedy was abandoned.

The *Technical Memorandum, Development and Construction of the PPG Circleville, Ohio 3-Dimensional MODFLOW Groundwater Model* (ICF Kaiser, 1992) provided the Ohio EPA with a report of the groundwater flow model for the Site and downgradient vicinity. The flow model provided simulation of the groundwater flow and was coupled with particle tracking to estimate the transport and travel time for groundwater from the PPG Site to the DuPont pumping field.

The *Phase II Remedial Investigation* (Phase II RI; ICF Kaiser, 1995) summarized the nature and extent of Site-related constituents and presented the risk assessment. This document contained a comprehensive summary of the Phase I RI, the Phase II RI, the groundwater model, a quantitative human health and ecological risk assessment, and presented the current Site Conceptual Model (SCM). Constituents of concern identified for the Site included 1,4-dioxane, volatile organic compounds (VOCs), and PCBs. With the exception of 1,4-dioxane in groundwater, the occurrence of significant concentrations of these constituents remained localized around the areas where they were deposited and/or released. The Phase II RI concluded that none of the PSAs posed potentially unacceptable risks to human health or the environment except for a hypothetical user drinking groundwater downgradient of the Site and a hypothetical construction worker in working in subsurface soil in PSA-2. Neither of these exposure pathways is currently complete.

The Phase II RI assessed 16 of the 18 Potential Source Areas (PSAs). Two of the eighteen PSAs were investigated under a separate AOC. The Phase II RI concluded that the risks posed by 15 of the PSAs were within the acceptable risk range established by the OEPA. PSA-2, the Buried Wastewater Pond Residue area, was found to have unacceptable risks for a hypothetical construction worker excavating into the waste. Additionally, the off-property groundwater exceeded the acceptable risk range

for a hypothetical future user drinking the groundwater. PSA-2 and the off-property groundwater were carried forward into the feasibility study (FS).

The shallow groundwater plume on the Site included VOCs that remain localized around specific PSAs, and 1,4-dioxane, which is present in groundwater extending off-site to the west. The real extent of the VOC plume is limited to the shallow aquifer ("S" wells) on the PPG property due primarily to horizontal zones of low permeability, attenuation and degradation in the geology beneath the Site. Due to the location of the DuPont pumping center, the configuration of the local geology and the chemical/physical properties of 1,4-dioxane, the DuPont pumping wells were found to largely control the migration of the 1,4-dioxane plume. In the vicinity of the PPG plant, the 1,4-dioxane plume existed in the shallower portion of the aquifer in the shallow "S" and intermediate "I" depth wells. These wells correspond to screened elevations of >675 feet above mean sea level (ft-amsl) for the shallow wells and between 675 and 650 ft-amsl for the intermediate wells. Moving westward, the confining layers that separate the shallow and intermediate layers from the deeper layers end, and the 1,4-dioxane plume is free to move into the deeper portion of the aquifer. The wells that correspond to the deeper portions of the aquifer include the deep upper "DU" wells (650-620 ft-amsl) the deep lower "DL" wells (620-570 ft-amsl) and the deep basal "DB" wells (<570 ft-amsl). Due to the location of the DuPont pumping center, the configuration of the local geology and the chemical/physical properties of 1,4-dioxane, the DuPont pumping wells largely control the migration of the 1,4-dioxane plume. This SCM of the geology and groundwater flow is presented graphically on Figure 3.

PSA-2, the Buried Wastewater Pond Residue Area, was used for the placement of sludges excavated out of the former Wastewater Treatment Pond (PSA-1). These sludges were covered with a soil cover and seeded after placement. The RI identified PCBs, VOCs and 1,4-dioxane in PSA-2. The Risk assessment concluded that a hypothetical future construction worker could be exposed to unacceptable levels of these constituents during excavation activity in this area.

1.1.2.3 *Feasibility Study Summary*

In accordance with the AOC, PPG completed a Feasibility Study (FS) in February of 1999. The FS specifically addressed potential future risks to a construction worker associated with PSA-2 subsurface soils and to a hypothetical off-Site user drinking groundwater. The FS summarized the RI report by providing brief descriptions relative of the Site background, PSAs, groundwater quality, the risk assessment, and the SCM. The FS established a matrix of potential Applicable or Relevant and Appropriate Requirements (ARARs), identified Remedial Action Objectives (RAOs), identified and

screened potentially applicable remedial technologies, assembled appropriate remedial alternatives from the surviving technologies, and evaluated the alternatives to identify the best suitable remedies for the Site.

The RAOs for the Site included the following:

- Reduction of potential reasonable maximum exposure (RME) risks associated with PSA-2 subsurface soils through elimination or control of the critical complete exposure pathway;
- Reduction of potential RME risks associated with off-Site groundwater through elimination or control of the critical complete exposure pathway; and
- Development of a long-term groundwater monitoring program and the Site controls necessary to establish that potentially Site-associated risks remain unchanged.

For the affected environmental media (e.g., subsurface soils, and groundwater), identified remedial technologies were screened using a two step process that first assessed their usage relative to Site conditions and established RAOs, then further evaluated them based on their applicability, effectiveness, and implementability. Of all the technologies assessed, 13 were retained for further evaluation. A treatability study was also completed and concluded that effective treatment of 1,4-dioxane from the off-property plume was not feasible. Based on their ability to achieve the RAOs, the FS recommended alternative S2 (Insitutional Controls) for the remediation of PSA-2 and W2 (Institutional Controls) for the remediation of off-Site groundwater.

1.1.2.3.1 Alternative S2: Institutional Controls

Alternative S2 proposed institutional controls to prevent contact with contaminated soil at PSA-2. This alternative consisted of:

- Engineering controls;
- Public and employee education programs; and
- Periodic Site reviews

1.1.2.3.2 Alternative W2: Institutional Controls

Alternative W2 proposed institutional controls to reduce exposure to contaminated groundwater and engineering controls in the form of groundwater pumping on the DuPont property to control the plume. This alternative consisted of:

- Deed restrictions;
- Engineering controls;

- Public and employee education programs;
- Long-term monitoring; and
- Periodic Site reviews.

1.1.2.4 *Preferred Plan and Decision Document*

In September 1999 Ohio EPA issued the "Preferred Plan for the PPG Industries, Inc. Site, Circleville, Ohio" (Preferred Plan). The Preferred Plan identified the preferred remedies for subsurface soil in PSA-2 and off-Site groundwater, along with Ohio EPA's rationale for selection of each remedy. The Preferred Plan also solicited public comment on the selected remedies. In June of 2000, the Ohio EPA issued the "Decision Document for the PPG Industries of Ohio, Inc. Site, Circleville, OH" (Decision Document). The purpose of the Decision Document was to present the selected remedial action(s) for the Site subsequent to the public participation/comment period. Included with the Decision Document was Ohio EPA's Responsiveness Summary, which summarizes the public comments received on the Preferred Plan, and Ohio EPA's responses to them. The selected remedy in the Decision Document was unchanged from the Preferred Plan. The selected remedial alternatives for subsurface soils and off-Site groundwater are provided in the following subsections.

1.1.2.4.1 <u>PSA-2 Subsurface Soil</u>

Ohio EPA's preferred alternatives for PSA-2 included institutional and engineering controls and long-term monitoring. Institutional controls include an industrial use deed restriction and contractor and employee training programs. Engineering controls included use of fencing and signage to maintain adequate security and prevent access by the public. In addition, vegetation and soil cover are maintained at PSA-2 to prevent erosion and potential exposure to the constituents remaining in subsurface soil. Long-term monitoring includes a groundwater monitoring program to ensure that releases are not occurring to groundwater.

1.1.2.4.2 <u>Off-Site Groundwater</u>

Ohio EPA's preferred alternative for off-Site groundwater (referred to in the Decision Document as off-property groundwater) included institutional and engineering controls. Institutional controls include deed restrictions restricting potable uses of groundwater, notification to landowners about the groundwater plume and regulatory requirements, an evaluation of the effects of groundwater pumping from industrial users on the plume, and educational programs to inform the community of potential risks associated with groundwater. Engineering controls included plume containment, via pumping in the

DuPont well field. An agreement was required between PPG and DuPont to maintain and monitor the DuPont pumping rates to ensure adequate containment of the plume. A groundwater monitoring program was required to monitor the extent and concentration of the off-site plume and to verify progress toward the remedial objective. Monitoring of the Scioto River was also required.

1.1.2.5 *Summary of Remedial Design/Remedial Action Work Plan*

In December 2001, PPG submitted the final draft of the Remedial Design/Remedial Action Work Plan (RD/RA WP; MFG, 2001) for the Site as required by the Decision Document. The remedial actions required by the Decision Document were summarized above in Sections 2.6.1 and 2.6.2. The RD/RA WP detailed the procedures necessary to implement the remedial measures at the Site and included a summary of other support documents necessary to complete the remediation (e.g. Quality Assurance Project Plan, a Sampling and Analysis Plan, and a Health and Safety Plan). The Ohio EPA approved the RD/RA WP on January 10, 2002.

1.1.2.6 *Summary of Remedial Design Documents*

No remedial design documents were necessary for the project because the remedial measures were all either institutional controls or pre-existing plant pumping systems.

1.2 Purpose of Report

The purpose of this review is to confirm that the selected remedial measures are effective, and that the remedial measures implemented remain protective of human health and the environment.

This report provides a summary of the remedial actions taken at the Site, and presents an evaluation of their effectiveness, both in the initial five-year period and as projected into the future. The report provides a review of the remedial actions being implemented at the Site and compares their effectiveness to that of other available technologies that may be applied to the constituents present.

In addition to reevaluation of the remedial technologies, this report provides a review of the selected remedial standards and of the risk assessment for the Site. The exposure scenarios used in the risk assessment will be evaluated to determine if they are valid both currently and into the future. The toxicology of the constituents present at the Site will be reviewed to ensure that significant changes have not occurred since the risk assessment was published in 1995, and that the selected remedial standards for the Site continue to be protective of human health and the environment.

1.3 Report Organization

This report is presented in five sections as follows:

Section 1.0 Background

Section 2.0 Site Conditions and History: Summarizes the current conditions at the Site and the history of the remedial project.

Section 3.0 Risk Assessment Summary and Review: Provides a summary of the pertinent assumptions in the risk assessment and an evaluation of assumptions and current toxicological values.

Section 4.0 Summary of Activities, Selected Remedial Actions Alternatives, and Future Recommendations: Provides a summary of the remediation to date and an evaluation of the effectiveness and protectiveness of the remedial actions.

Section 5.0 References

1.4 Applicable Laws and Regulations

The Site is regulated pursuant to the Ohio Revised Code Chapter 3734 §6111.03(H). PPG and the Ohio EPA entered into the AOC in December of 1989 and the project has proceeded in accordance with the AOC.

2.0 SITE CONDITIONS AND HISTORY

2.1 Site Description and History

The Site is located approximately 30 miles south of Columbus, Ohio and consists of approximately 60 acres of property (Figure 1). The Site is located among farmland, industrial and commercial facilities with some residential areas to the north. The Site property is bounded to the north by a Georgia Pacific facility, farmland and the former Circle Plastics (now Trimold) property. To the east of the Site is the Norfolk and Western Railroad, Scippo Creek and farmland, and to the south is Scippo Creek and farmland. To the west of the Site is farmland formerly owned by American Electric Power (AEP), now owned by the estate of Mary Virginia Hannan; Route 23 and the E.I. DuPont de Nemours (DuPont) property. The area of the Site and the surrounding salient features are presented on Figure 2.

The PPG Plant began operation in December of 1962 and is still in operation. The plant produces liquid paint resins that are either polymer dispersed or dissolved in a solvent such as water or mineral spirits. The resins are then shipped to other PPG locations where they are combined with pigments and other additives to produce automotive, beverage can, architectural or other industrial paints and coatings. The Circleville plant produces only the resins used in the paints, and does not manufacture the paints themselves.

2.1.1 Physical Characteristics

The Site is located within the Columbus Lowland District of the Southern Ohio Loamy Till Plain Region of the Till Plains Section of the Central Lowlands Province in south-central Ohio. The Columbus Lowland District is characterized as lowland, surrounded in all directions by relative uplands, with a broad, regional slope toward the Scioto Valley. The area generally has low relief (<25 feet) and larger streams emptying into the Scioto River.

Topographic relief in the vicinity of the Site is low with relatively flat to gently rolling terrain. The Site is at an elevation of approximately 705 feet above mean sea level (ft-amsl). The Scioto River is located approximately one mile to the west of the PPG Plant (See Figures 1 and 2) at an approximate pool elevation of 640 ft-amsl. The Scioto River trends north/south in this area and flows south past the DuPont

Plant. Scippo Creek is located south and east of the PPG Plant and discharges to the Scioto River, south of the DuPont Plant.

2.1.2 Site Geology

Unconsolidated deposits in the vicinity of the Site consist of interbedded layers of sand and gravel glacial outwash, separated by layers of discontinuous glacial till. Glacial till is present in up to five depth zones, separated by sand and gravel outwash in the vicinity of the Site. These deposits are typically associated with multiple periods of glacial advance (till) and retreat (sand and gravel outwash). The nature and significance of the till layers is discussed further in Section 2.1.3.

Bedrock in the area of the Site is composed entirely of Devonian-aged shale. The bedrock beneath the PPG Plant is at an approximate elevation of 500 ft-amsl, and is the approximate low point in a v-shaped bedrock valley that trends northeast-southwest. The bedrock slopes upward to the east and west of the PPG Plant to an approximate elevation of 650 ft-amsl in the vicinity of the DuPont Plant and to the east of the PPG Plant.

2.1.3 Site Hydrogeology

Groundwater in the Scioto River Valley is controlled by the buried river valleys (the pre-glacial Teays River and the post-glacial Newark River) as well as the location of the Scioto River and the interbedded till and sand and gravel outwash layers. The historic north-flowing Teays and south-flowing Newark River drainage channels were filled with thick deposits of sand and gravel during inter-glacial periods. The till layers were deposited as ground moraine during glacial periods.

In the vicinity of the PPG plant, the saturated zone consists of three general zones, separated by low-permeability glacial till layers. Vertical groundwater flow is controlled by the continuity of the confining till layers (ground moraine) within the shallow, intermediate, and deep zones in the aquifer. Where the till is present (beneath the PPG Plant), vertical groundwater movement is inhibited by the low-permeability till. Moving westward (away from the PPG Plant), the till layers that separate the shallow and intermediate zones from the deeper zones end, and groundwater is free to move vertically into the deeper portion of the aquifer. The conceptual flow model for the Site groundwater is presented graphically on Figure 3.

Wells near the Site are identified relative to their depth as the shallow “S”, intermediate “I”, deep upper “DU”, deep lower “DL” and deep basal “DB” wells. These wells correspond to screened elevations

of >675 feet above mean sea level (ft-amsl) for the shallow wells, between 675 and 650 ft-amsl for the intermediate wells, 650 and 620 ft-amsl for the deep upper wells, 620 and 570 ft-amsl for the deep lower wells and <570 ft-amsl for the deep basal wells.

2.2 Land and Resource Use

The property downgradient of the Site is light industrial, commercial and agricultural. To the immediate north of the PPG plant is a Georgia Pacific facility. Along the north side of Pittsburgh Road to the west of the Site is agricultural land, the Trimold facility (formerly Circle Plastics) and the Pilot gas station and convenience store. Along the southern side of Pittsburgh Road is agricultural land. West of Route 23 is the DuPont facility, which is bounded on the west by the Scioto River. The nearest residential area to the Site is the Jefferson Addition, which lies approximately 1,600 feet to the north of the Trimold facility. The Earnhart Hill Water District (Earnhart Hill) pumping field lies to the north of the DuPont property, between Route 23 and the Scioto River. The property use in the vicinity of the Site is shown on Figure 2.

Potable well surveys and an evaluation of public water users in the vicinity of the Site have shown that no residential or potable wells are located within the area of the plume. Public water in the area is supplied by Earnhart Hill. Numerous industrial wells are located in the vicinity of the plume. A summary of the industrial wells is provided in Table 1.

On the PPG property, the well designated as "Potable Well" is used for showers and other non-drinking purposes. PPG's pumping wells P-1, P-2 and P-3 are used for process water, which is discharged through PPG's NPDES permit to Scippo Creek. PPG well RW-1 is a remediation well installed to control the 1,4-dioxane plume, but was never used for that purpose due to the permit requirements for the discharge to Scippo Creek. RW-1 is no longer in service. PPG wells RW-2 and RW-3 were installed on the DuPont property in 2004 to control and capture the 1,4-dioxane plume. These wells discharge via a NPDES permit to the Scioto River.

Circle Plastics wells 1 and 2 are within the boundary of the 1,4-dioxane plume. These wells were once used for once-through cooling water and discharged to a trench located to the north of the Circle Plastics plant. In an agreement between PPG and Circle Plastics, two new production wells were drilled outside of the limits of the 1,4-dioxane plume, and the previous wells abandoned.

DuPont currently has four wells operating within the limits of the plume. These include wells P-3, P-4, P-5 and P-6. These wells supply process water to the DuPont plant. The water is ultimately discharged through DuPont's NPDES-permitted Outfall 1 to the Scioto River. DuPont wells DB-2 and DB-3 were installed by DuPont to treat a localized area of groundwater contamination and have now been removed from service. Likewise, DuPont wells P-2 and P-7, which were used for process water, are no longer used.

Earnhart Hill currently operates four wells that produce water for the public water system. All of these wells lie outside of the northern boundary of the 1,4-dioxane plume.

2.3 History of Contamination

The source of soil and groundwater impacts at the Site were the Former Wastewater Ponds (PSA-1), located at the northeast corner of the plant property. Approximately 20,000 gallons/day of wastewater containing polyols (including 1,4-dioxane), aromatic solvents (including toluene xylene, and ethylbenzene) and PCBs were discharged to the Former Wastewater Ponds. In 1973, the former wastewater treatment ponds were closed and the sludge removed. The excavated sludge was placed in an area that would become PSA-2.

Wastewater from the infiltration ponds likely traveled through the highly permeable sand and gravel deposits in the area. An apparently continuous till layer at a depth of approximately 15 feet below ground surface (ft-bgs) impeded vertical flow so that the majority of percolating wastewater flowed with the natural groundwater gradient from east to west. As the shallow water flows westward, the shallow till layer pinches out at an approximate distance of 500 to 800 feet from the plant's western boundary. An intermediate till layer at a depth of approximately 40 feet also appears relatively continuous throughout the Site and also pinches out to the west at a distance of 800 to 1,000 feet from the plant's western boundary. At this point the sand and gravel deposits become more homogenous and the groundwater plume is free to mix with deeper groundwater.

The physical properties of the dissolved organic constituents in groundwater result in significantly different environmental fate and transport for the 1,4-dioxane and the aromatic VOCs. 1,4-Dioxane is infinitely soluble in water and relatively non-biodegradable. Therefore, the 1,4-dioxane was able to migrate in the westward direction to the point where the shallow and intermediate till layers pinch out, and then migrate vertically into the deeper portion of the aquifer. The aromatic VOCs tend to both attenuate and degrade, and, as a result, have not migrated outside of the immediate vicinity of the source

areas. PCBs are relatively insoluble in water and also have not migrated beyond the source area. 1,4-dioxane is the only constituent that has significantly migrated off-Site. Both soil and downgradient groundwater sample results support the conclusion that VOC and PCB migration is limited to the source areas, whereas 1,4-dioxane is more widespread.

2.4 Nature and Extent of Site Related Impacts

During implementation of the RI, 18 PSAs (including PSAs 11A and 11B) were investigated to determine the nature and extent of the constituents present and the physical properties of each PSA. With the exception of 1,4-dioxane in groundwater, the occurrence of significant concentrations of constituents associated with the PSAs remained localized around the areas where they were deposited and/or released. The locations of the PSAs are shown on Figure 4; a list of the PSAs is presented in Table 2.

The RI concluded that:

- The constituents of concern in the soil included only VOCs (ethylbenzene, toluene, and xylene) and PCBs (Aroclor 1248);
- The occurrence of significant concentrations in the soils remained localized around the PSAs where they were likely released; off-Site soil samples did not contain any constituents of concern;
- Shallow groundwater on-Site contained VOCs (primarily ethylbenzene, toluene, and xylene) that remain localized around specific PSAs;
- 1,4-Dioxane has been detected in the intermediate aquifer and sporadically in the deep aquifer on-Site;
- Off-site groundwater contains 1,4-dioxane in the deeper portions of the aquifer, and the plume is effectively controlled by pumping at PPG and DuPont;
- The calculated human health risks for all PSAs and the Site as a whole were within acceptable levels; and
- The ecological risk assessment also demonstrated that no adverse impacts to the environment have occurred as a result of PPG activities.

3.0 RISK ASSESSMENT SUMMARY AND REVIEW

The analytical data collected during the RI were evaluated in a Baseline Human Health Risk Assessment presented in the Phase II RI Report, (January 1995). Compounds considered by the USEPA to be carcinogenic were compared to the range of acceptable risk for human receptors (a carcinogenic risk within the range of $1x10^{-4}$ to $1x10^{-6}$ increased incremental cancer risk). Non-carcinogenic compounds were compared to a Hazard Index (HI) of less than 1.0 established by the USEPA. .

3.1 Evaluation of Applicability of Risk Assessment

The RI Risk Assessment has been reviewed in light of continued relevance of exposure assumptions, changes in toxicity data that would affect risk assessment conclusions, and validity of the cleanup levels and RAOs. This review is summarized below.

3.1.1 Exposure Assumptions

In accordance with the most current USEPA guidance and the understanding that the Circleville Site is an industrial facility and will remain as such for the foreseeable future, potential receptors and exposure pathways for both current and future land use determined in the RI Risk Assessment are still valid for the Site.

Overall, the exposure assumptions that were presented in the RI Risk Assessment are still valid. The risk assessment considered the following exposure assumptions/pathways:

- The exposure setting for the Site is an active industrial facility located in a mixed industrial/residential area;
- There are potential complete exposure pathways for soil contact for lawn maintenance contractors and construction contractors with site-related constituents in soil, including inhalation of particulates generated from soil, incidental ingestion of soil and dermal contact with soil;
- There is a potential complete exposure pathway for groundwater contact by PPG plant workers showering in water obtained from the PPG Potable Well.

The risk assessment evaluated potential risks to human health and the environment associated with chemicals of potential concern in surface and subsurface soil, on-Site groundwater, and air. In addition, potential ecological impacts were determined to be negligible or non-existent.

3.1.2 Updated Toxicity Assessment

The toxicity assessment in the RI Risk Assessment indicated that six constituents of concern were identified on the Site, based on all potential exposure pathways. These included 1,4-dioxane, three polychlorinated biphenyl (PCB) Aroclors (Aroclors 1242, 1248 and 1254), benzo(a)pyrene and beryllium. These constituents were reviewed relative to the toxicity criteria that were available upon completion of the RI in 1994 and those presently used. The following table provides a summary of the toxicity criteria review for these constituents.

	Oral Rfd		**Inhalation Rfd**		**Oral Csf**		**Inhalation Csf**	
Constituent	1994	2006	1994	2006	1994	2006	1994	2006
1,4-Dioxane	--	--	--	--	0.011	0.011	0.011	0.011
Aroclor 1242	0.0025		--	--	7.7	7.7	7.7	7.7
Aroclor 1248	0.0025		--	--	7.7	7.7	7.7	7.7
Aroclor 1254	0.0025	**0.00002**	--	--	7.7	7.7	7.7	7.7
Benzo(a)pyrene	0.039	**0.03**	--	--	7.3	7.3	6.1	**3.08**
Beryllium	0.005	**0.002**	--	**0.00000571**	4.3	4.3	8.4	8.4

All units in mg/kg-day^{-1}

Bold indicates new or revised value.

Based on the comparison of the toxicological criteria used in the 1994 assessment and those currently available, the risks that would be calculated using the current toxicological values would be the same as or lower than those previously calculated in the RI.

3.2 Groundwater Cleanup Criterion

The cleanup criterion for the off-Site groundwater plume was identified in the Decision Document (Ohio EPA, 2000). The Ohio EPA requires that the off-Site plume meet the "USEPA Maximum Contaminant Levels (MCLs) or risk-based cleanup levels (hazard quotient less than 1 and a cancer risk of $1x10^{-5}$) if no MCL exists" (Ohio EPA, 2000). In the case of 1,4-dioxane, an MCL has not been promulgated, and therefore, a 35 microgram per liter (µg/l) cleanup level was established for 1,4-dioxane, which is based on a lifetime excess cancer risk of $1x10^{-5}$ for a drinking water scenario. The Decision Document indicates that "No further action will be required for the plume when the cleanup objective of 35 µg/l for 1,4-dioxane has been achieved throughout the entire plume" (Ohio EPA, 2000), but requires that appropriate monitoring must be completed to document achievement of the cleanup level for five years after the cleanup level is met.

3.3 Risk Assessment Review Conclusions

The review of the RI Risk Assessment evaluated the exposure assumptions and toxicological criteria used in the risk assessment. The review findings indicate that the 1994 exposure assumptions remain valid and that the current toxicological criteria are either the same as or lower than those used in the RI. Consequently, the risks that would be calculated presently equal to or lower than those that were calculated in the RI. As a result, the evaluation of the risk assessment indicates that the actions recommended in the Feasibility study, Decision Document and Preferred Plan remain protective of human health and the environment.

The following conclusions were reached with respect to industrial or commercial use of the Site prior to remediation:

- Potential risks to human health were determined to be within the acceptable range for current exposure scenarios for all PSAs at the Site and for the Site as a whole.
- In the absence of any controls, the potential risks for a hypothetical construction worker in PSA-2 exceeded the acceptable risk range; and
- The potential risks for dermal contact with Site groundwater from the PPG Potable Well were within the acceptable range.

The RI Risk Assessment did not directly assess the potential for groundwater use as a drinking water source, and therefore risks were not calculated for exposures to off-Site groundwater. Risks were calculated for the on-Site use of groundwater for non-drinking exposures such as showering due to the use of the Potable Well on the PPG Site.

Ecological risks were also considered in the RI report. The ecological risk evaluation concluded that there were no significant ecological habitats on the Site and potential ecological impacts were determined to be negligible or non-existent.

4.0 SUMMARY OF ACTIVITIES, SELECTED REMEDIAL ACTIONS, AND FUTURE RECOMMENDATIONS

4.1 Summary of Selected Remedial Actions

The remedial options for the Site were first presented in the FS (ICF Kaiser, 1999) and were approved in the Decision Document (Ohio EPA 2000). The FS evaluated a wide range of remedial approaches to reduce potential exposure risks in PSA-2 and to the off-Site groundwater plume. Seven technologies received a detailed evaluation in the FS. Based on the results of the FS, the selected remedies for PSA-2 and the off-Site groundwater plume were:

- Buried Pond Residue Area (PSA-2):
  - Institutional and Engineering Controls; and
  - Long-Term Monitoring.
- Off-Property Groundwater:
  - Institutional and Engineering Controls;
  - Groundwater Extraction; and
  - Long-Term Monitoring.

The Preferred Plan, issued by Ohio EPA concurred with the FS for the selection of remedies for the Site. Subsequent to the public comment period on the Preferred Plan, the Ohio EPA issued the Decision Document (Ohio EPA 2000), which selected the remedies identified in the FS as the final remedies for the Site. The Decision Document, in turn, required PPG to prepare the RD/RA WP, which identified the tasks necessary for implementation of the remediation.

The RD/RA WP identified eight major tasks necessary for the completion of the remedial actions. Tasks 1 through 3 were necessary to address the subsurface soil issues in PSA-2 and Tasks 5 through 9 were necessary for the completion of the off-Site groundwater plume remedy. Tasks 4 and 10 included the five-year reviews of the remedial actions. The following sections provide a summary of the tasks and their completion status.

4.1.1 Buried Pond Residue Area (PSA-2) Remedial Action

The remedial action in PSA-2 is comprised of institutional and engineering controls as well as long-term monitoring.

4.1.1.1 *Task 1: PSA-2 Institutional Controls*

The institutional controls consist if restrictive covenants, training and posting signs as follows:

4.1.1.1.1 Task 1A: PSA-2 Restrictive Covenants

The PPG property is zoned for industrial land use. A registered land surveyor has surveyed the perimeter of PSA-2, and its location and legal description were recorded for reference in the restrictive covenant. PPG is currently in the process of drafting an Environmental Covenant for the PSA-2 Area that satisfies the requirements of the State of Ohio's recently promulgated Uniform Environmental Covenants Act and anticipates submission to the Ohio EPA by March 2007.

4.1.1.1.2 Task 1B: PSA-2 Signs

PPG posted four signs, one per side, around the perimeter of PSA-2 that state: "Soil excavation or other intrusive activities are strictly prohibited in this area without a signed work permit from the EHS Department." The sign dimensions are two feet wide and one foot tall. The fencing and signs are inspected on a quarterly basis for damage and repaired or replaced if necessary.

4.1.1.1.3 Task 1C: PSA-2 Training

PPG expanded its existing training programs to include the issues at PSA-2 to ensure protection of employees and contractors. The following sections describe the PSA-2 training activities.

Subtask 1C-1: PSA-2 Employee Training

PPG has a health and safety orientation program in place to train new employees on the potential Site hazards. The training program was expanded to educate employees that may work in or near PSA-2 on the potential health and safety issues related to PSA-2. Specifically, the training provides notification to the Site workers that no soil excavation is to take place in PSA-2 without a signed work permit from the PPG Environmental Health and Safety (EHS) Department. Additionally, the signs posted on the PSA-2 fence provide sufficient hazard warning for all Site workers.

Subtask 1C-2: PSA-2 Contractor Training

PPG maintains a mandatory safety orientation program for all contractors that perform work at the Site. The training is required for each contractor a minimum of once annually and includes Site

access procedures, work permits, Site hazards, Site emergency procedures, and several additional safety topics. All contractors must work with a PPG Site Project Manager to fill out a Contractor's Safety Checklist prior to initiating a new project at the Site. The Contractor's Safety Checklist includes a line item specifically indicating whether the contractor will be working in PSA-2. Each individual contractor whose job may involve work at PSA-2 (e.g., mowing, cover repair, or seeding) receives training specific to the issues at PSA-2. The training prohibits excavation by the contractor in the PSA-2 area without a health and safety plan compliant with 40 CFR 1910.120.

4.1.1.2 *Task 2: PSA-2 Engineering Controls*

The engineering controls for PSA-2 consist of a security fence and a vegetated soil cover over the waste material. Each of these is described below.

4.1.1.2.1 Task 2A: PSA-2 Security Fence

A security fence is present around the perimeter of the PPG Circleville facility that prevents access by the public to PSA-2. The only access to the plant is through gates that are controlled by security guards. The security fence is inspected by PPG on a quarterly basis and repaired as necessary to prevent access by the public. The existing fence is effective at securing PSA-2 against public access.

4.1.1.2.2 Task 2B: PSA-2 Soil and Vegetation Cover

PPG maintains a vegetated soil cover at PSA-2 to prevent direct contact and/or erosion of the waste material. The PSA-2 area is routinely mowed during the spring, summer, and fall months and the vegetative cover maintained. PPG inspects the soil cover on a quarterly basis for signs of erosion, bare areas and for the presence of trees.

4.1.1.3 *Task 3: PSA-2 Performance Standard Monitoring*

4.1.1.3.1 Task 3A: PSA-2 Groundwater Monitoring

Long-term monitoring of groundwater downgradient of PSA-2 is performed on a semiannual basis to assure there have been no impacts exceeding MCLs or risk-based clean-up levels. Groundwater sampling of monitoring wells WP-33-S, WP-22-S and CWP-23-S have been incorporated into the Long-Term Groundwater Monitoring Plan (LTGWMP; MFG, 2002). The locations of the monitoring wells for PSA-2 are shown on Figure 2. The groundwater samples are analyzed for VOCs by USEPA SW-846 Method 8260 and for 1,4-dioxane by USEPA SW-846 Method 8270. PPG provides the Ohio EPA, as

well as others, a semiannual groundwater monitoring report that summarizes the findings of the semiannual monitoring. An evaluation of the data collected under the LTGWMP is provided in Section 4.5.4.

4.1.1.3.2 Task 3B: PSA-2 Soil Monitoring

No soil monitoring is performed because it is only required in the event that excavation were to take place in PSA-2.

4.1.1.3.3 Tasks 3C and D: PSA-2 Institutional and Engineering Controls Monitoring

Institutional controls are monitored through:

- Review and documentation of any changes or updates to the education program status applicable to PSA-2;
- Documentation of persons receiving training;
- Review and documentation of any changes in PSA-2 development status; and
- Review and documentation of any changes to the status of the industrial land use restrictions.

PPG performs monitoring of the engineering controls through:

- Inspection of the fence;
- Inspection of the condition of the signs; and
- Inspection of the soil and vegetative cover.

Information on the institutional and engineering control monitoring was provided in the appropriate sections above.

4.1.2 Off-Property Groundwater Contaminants Remedial Action

The remedial action for off-property groundwater is comprised of institutional controls, engineering controls, and groundwater extraction. The effectiveness of the remedial action is being assessed and documented through a long-term monitoring program. The following sections present the tasks and subtasks being performed by PPG to fulfill the remedial action requirements for off-property groundwater contaminants.

4.1.2.1 *Task 5: Site Access Agreements*

In order to execute the long-term monitoring requirement, PPG required access to several neighboring properties. Specifically, access for groundwater monitoring purposes is needed to the DuPont, Trimold (Circle Plastics/Night Owl), Don Goodchild and the Mary Virginia Hannan (AEP) properties. Access to the off-Site properties was obtained by PPG through written agreements with all but Don Goodchild, although Mr. Goodchild verbally agreed to allow access to the property for monitoring. Per the RD/RA Work Plan, monitoring access to the Georgia Pacific property is not needed because the concentration of 1,4-dioxane is less than the 35 µg/l clean-up goal, nor to the Pilot property because because groundwater samples from this property are not necessary to effectively monitor the off-Site groundwater plume.

Access is also needed to these properties as well as the Pilot property to verify the effectiveness of the institutional controls in preventing the use of groundwater for potable purposes. In addition, access to DuPont is needed to allow collection of groundwater samples, to collect DuPont production well pumping rate data, and to operate and maintain the PPG's remediation wells RW-2 and RW-3.

4.1.2.1.1 Tasks 5A: DuPont Agreement, 5B: Circle Plastics Agreement and 5C: Night Owl Agreement

PPG had entered into agreements with DuPont, Trimold (Circle Plastics and Night Owl) prior to preparation of the RD/RA Work Plan. These agreements are still in effect and PPG has obtained access to these properties as needed to monitor the plume and the institutional and engineering controls. A summary of these agreements follows.

PPG and DuPont have a signed a written "Groundwater Use/Notification Agreement" dated September 2, 1998. Under this agreement, PPG provided for the replacement of DuPont groundwater production well P-5 and the installation of flow monitoring equipment on DuPont production wells P-2, P-3, P-4, P-5, P-6, and P-7 and recovery wells DB-2 and DB-3.

In exchange for the well and flow monitoring equipment, DuPont has agreed to a 20-year term (automatically renewable annually thereafter) to cooperate with PPG to operate their production wells in a manner that ensures plume capture. The agreement includes meetings between PPG and DuPont as necessary to review all pumping and analytical information and implementation of alternate pumping strategies that may be necessary to achieve on-going containment of the plume.

In addition, the agreement with DuPont allows PPG the following:

- Access to the DuPont production and recovery wells on a monthly basis to record flow rate information;
- Access to mutually agreed upon DuPont production wells, recovery wells, and/or groundwater monitoring wells on a quarterly basis to collect groundwater samples for laboratory analysis of 1,4-dioxane and/or other chemical analyses mutually agreed upon;
- Access to copies of daily production and recovery well pumping records and chart recorders for the previous 90 days; and
- Access to install, maintain and close monitoring wells on the DuPont property should data reviews suggest that such action is warranted.

The agreement also has a notice provision whereby DuPont will provide PPG 180 days advance notice of any decision to abandon, sell, or lease its property or alter the nature or operation of the production wells such that control of the plume would no longer be maintained. DuPont is to provide timely notice of any equipment and/or operational malfunctions to PPG. In the event DuPont provides notice to PPG that its operations will change such that the groundwater plume will no longer be contained, DuPont has agreed to enter into good faith negotiations with PPG to pursue alternative options to permit the necessary continuing containment of the groundwater plume. This may include, but not be limited to, PPG's purchase or lease of pumping operations, wells or other necessary equipment or services from DuPont to maintain continuing containment as well as a right of access to conduct such operations. This provision was exercised by PPG to install wells RW-2 and RW-3 and to lay a portion of the discharge line.

In September 2000, PPG, Circle Plastics/Night Owl and the Ohio EPA entered into an "Agreement for Creation of Equitable Servitudes." Under the agreement, Circle Plastics agreed to:

- Not use groundwater beneath the affected property for potable purposes;
- Provide notice to Ohio EPA and PPG at least 30 days prior to installing any well for non-potable purposes on the affected property; and
- Permit PPG and Ohio EPA, upon reasonable notice, access to the property to perform soil or groundwater sampling and to visually inspect for compliance with the restrictions to confirm or refute the performance of the remedy set forth in the Decision Document.

In addition, Circle Plastics filed a "Declaration of Restrictions" in the Pickaway County Recorders Office. The Declaration of Restrictions assures future owners or leasers are aware of and legally bound to the restrictions. The term of the agreement is 25 years. The current owners of Trimold are aware of and continue to honor the agreement.

4.1.2.1.2 Task 5D: AEP Agreement

PPG entered into a Declaration of Restrictions with Colomet, Inc., a subsidiary of AEP and the Ohio EPA on August 17, 2004, which was filed in the Pickaway County Office of the Recorder on August 18, 2004. The Declaration provides access for PPG and its contractors to complete groundwater monitoring activities and establishes a restriction on the potable use of groundwater on the former AEP property immediately west of the PPG plant within the boundary of the plume exceeding 35 µg/l.

Subsequent to obtaining the agreement, AEP sold the property to Mary Virginia Hannan (now deceased), who continued to provide PPG with access for monitoring. The former AEP property is now managed by Mr. Robert H. Huffer, Esq. of Huffer & Huffer Co. LPA, executor of the Mary Virginia Hannan estate.

4.1.2.1.3 Task 5E: Pilot Travel Centers, LLC Agreement

PPG has not yet obtained an agreement with Pilot (for the property formerly owned by Marathon Oil); however, Pilot has been cooperative in responding to PPG's requests to document that groundwater on the property is not used for potable purposes.

4.1.2.1.4 Task 5F: Don Goodchild Agreement

Attempts to negotiate an access agreement for the Don Goodchild property have been unsuccessful. However, Mr. Goodchild has granted verbal approval to sample groundwater monitoring wells and the verbal approval is anticipated to continue. The CWP-22 cluster of wells are the only wells located on the Goodchild property.

PPG continues to visually inspect the property for evidence of well installation, and contact Mr. Goodchild with the annual questionnaire regarding new well installation. To date no activities have been noted that would indicate that wells have been installed. The area of Mr. Goodchild's property that may be affected by the plume is currently an open field used for agricultural purposes.

4.1.2.2 *Task 6: Off-Property Groundwater Institutional Controls*

4.1.2.2.1 Task 6A: Groundwater Restrictive Covenants/Equitable Servitudes

As discussed above, PPG has entered into written legal agreements with DuPont, Trimold and AEP (pertaining to the property owned by the Mary Virginia Hannan Estate). The DuPont agreement is

limited to the access agreement described above, while the Mary Virginia Hannan property and the Trimold property contain either deed restrictions or written agreements that prohibit installation of drinking water wells. The Declaration of Restrictions applicable to the Mary Virginia Hannan property prohibits the installation of drinking water wells in the area where the 1,4-dioxane concentration exceeds 35 µg/l. As previously noted, this deed restriction has been completed and recorded on the deed for the property. The Trimold property (formerly Circle Plastics and Night Owl) has a written agreement with PPG prohibiting the installation of drinking water wells. PPG has attempted, but been unable to obtain, a written agreement for placing deed restrictions on the Don Goodchild and Pilot properties.

4.1.2.2.2 Task 6B: Groundwater Training

PPG has expanded its existing training programs to include the on-Site groundwater issues to assure the protection of employees and contractors. Training for Site visitors is not necessary because there is no realistic potential for their exposure to contaminated groundwater. PPG has also made the community aware of the off-property groundwater contaminants through participation on the Community Advisory Panel (CAP).

4.1.2.2.3 Task 6C: Notification

PPG currently mails annual notifications to representatives of the Trimold, Mary Virginia Hannan, Pilot, and Don Goodchild properties. The notices remind the owners of the neighboring properties about 1) the requirement for non-use of contaminated groundwater for potable purposes, 2) the requirement not to alter the plume dimensions through groundwater pumping, and 3) the requirement for proper disposal of pumped groundwater. The letters are sent via registered mail and the return-receipts are maintained on file in accordance with PPG's record retention policy. PPG also includes a compliance verification form along with each annual notification. The compliance verification form requests that property owners verify they are in compliance with the deed restrictions by signing the form and returning it to PPG. In response to the most recent notification (August 2006), PPG received compliance verification notices from all of the owners. Therefore, all properties appear to be in compliance with the groundwater use restrictions.

4.1.2.3 *Tasks 7 and 8: Off-Property Groundwater Engineering Controls and Extraction*

The engineering control for off-Site groundwater contaminants is containment and extraction by pumping of the DuPont groundwater production wells. PPG entered into a 20-year agreement with

DuPont, whereby DuPont agreed to cooperate with PPG to operate their production wells in a manner that provides on-going containment of the plume. Specifically, subject to the production-related demand, DuPont agreed to exercise a good-faith effort to: 1) operate well P-4 at a monthly average flow rate of 800 gallons per minute (gpm), or 2) P-4, DB-2, and DB-3 at a combined average monthly rate of 1,000 gpm. These rates were determined through groundwater flow modeling to be sufficient to contain the plume.

PPG provided for a contingency if the DuPont pumping rates were not achievable, or if modeling showed that the DuPont pumping scenario would not contain the plume. The contingency included contacting DuPont to alter the pumping to ensure capture of the plume, or to initiate discussions with DuPont and the Ohio EPA to identify another method of controlling the plume. Both of these options have been exercised in the time since the Decision Document was issued. The following discussion provides a summary of the contingencies that have been instituted.

DuPont's process water demand, and as a result, its well field production, dropped significantly following the issuance of the Decision Document. PPG continually monitored the pumping rates and modeled the effect to determine if the decrease in pumping impacted the plume containment. In January of 2002, DuPont notified PPG of a detection of 1,4-dioxane in DuPont's monitoring well MW-10, located at the northern border of the DuPont property. Concurrently, Earnhart Hill was planning an expansion of their pumping well field to meet an increased demand for water. In response to these potential issues, PPG asked DuPont to shift pumping in their well field to well P-6, located nearest MW-10. The increase in pumping from P-6 began to reduce the 1,4-dioxane concentration in MW-10; however, the shift in pumping was not a desirable long-term solution due to the potential to move the center of the plume to the northwest, low productivity of the well and high maintenance costs related to the high iron content in the vicinity of the P-6 well.

In 2003, PPG evaluated several options to either contain or degrade the plume. These options included the use of biobutane to promote cometabolism of the 1,4-dioxane by indigenous bacteria, injection of peroxide and ozone to oxidize the 1,4-dioxane and the installation of a separate pumping system to capture the plume. The results of the evaluation indicated that any technology requiring the injection of materials to degrade the plume would be cost prohibitive due to the size of the area that would need to be treated. Based on the results of the evaluation, PPG elected to install two large-capacity (750+ gpm each) pumping wells on the DuPont property, between Route 23 and the existing DuPont pumping wells P-3, P-4 and P-5. PPG also installed a discharge pipeline from the pumping wells to the

Scioto River. The purpose of the pumping system was to increase the DuPont well field pumping to its historic pumping rates without increasing the amount of water pumped through DuPont's system. PPG notified DuPont, Earhnart Hill and the Ohio EPA of the plan and began obtaining the access agreements, easements and permits necessary to complete the installation of the wells and the discharge system. PPG began construction of the system in April of 2004 and completed the work in November of 2004. PPG was granted a NPDES permit for the discharge to the Scioto River and began pumping water in November of 2004.

Currently, these PPG pumping wells (RW-2 and RW-3), are operating at a combined total flow rate of approximately 1,500 gpm and the DuPont pumping system is operating at a combined total rate of of approximately 750 to 800 gpm. The 1,4-dioxane concentrations in the area downgradient of the PPG pumping wells have decreased in both DuPont MW-10 and DuPont pumping well P-6 as a result of the pumping. It is anticipated that continued operation of DuPont well P-6 will be unnecessary when the concentration of 1,4-dioxane in well MW-10 falls below the detection limit, which it is currently approaching.

4.1.2.4 *Task 9: On- and Off-Property Groundwater Performance Standard Monitoring*

4.1.2.4.1 Task 9A: On- and Off-Property Groundwater Monitoring

Monitoring of the on- and off-Site groundwater conditions is accomplished via groundwater monitoring. The groundwater monitoring is performed as described in the Long Term Groundwater Monitoring Plan (LTGWMP; MFG, 2002). The LTGWMP identifies the wells to be sampled and the methods to be employed in sampling and analysis to effectively monitor the location and concentrations of the 1,4-dioxane plume on a semiannual basis. The locations of the semiannual groundwater sampling points are shown on Figure 2. Seventeen of the LTGWMP wells (excluding the three PSA-2 monitoring wells) are sampled for 1,4-dioxane by USEPA SW-846 Method 8260. Three of the LTGWMP monitoring wells (excluding the three PSA-2 monitoring wells) are sampled for VOCs by USEPA SW-846 Method 8260.

In addition to those wells monitored via the LTGWMP, PPG has, since the initial detection of 1,4-dioxane in MW-10 in January 2002, voluntarily collected samples from several wells on the northern end of the DuPont property (DuPont wells MW-09 and MW-10) and on the Earnhart Hill property (Earnhart Hill wells MW-1 MW-6, P-5 and P-6). The voluntary monitoring was initially performed on a monthly basis and is now performed on a bimonthly basis. The locations of the bimonthly sampling

points are shown on Figure 5. An evaluation of the groundwater data collected at the Site is provided in Section 4.5.4.

4.1.2.4.2 Task 9B: Scioto River Surface Water Monitoring

Under the LTGWMP, monitoring is performed in the Scioto River on an annual basis. The surface water samples are collected from locations upgradient, cross gradient and downgradient of DuPont Outfall 1. The upgradient location was moved slightly after November of 2004 to ensure that it would be upstream of PPG's outfall from the new pumping wells. The locations of the surface water samples are provided on Figure 2 and are further evaluated in Section 4.5.4 of this report.

4.1.2.4.3 Task 9C: Off-Property Groundwater Institutional Controls Monitoring

Institutional controls are monitored through routine audits of training records and inspection of neighboring properties with respect to groundwater use. PPG currently performs institutional controls monitoring that includes:

- Review and documenting changes or updates to the status of public awareness programs;
- Review and documentation of changes in on- and off-Site groundwater use;
- Review and documentation of changes in property uses and development plans; and
- Maintaining records of the annual notifications sent and property owner responses regarding the non-potable use of contaminated groundwater, the requirement for not altering the plume, and the proper disposal of pumped groundwater.

The preceding documentation is be maintained by PPG on file at the Site. PPG's quarterly Site remediation status report to Ohio EPA includes a summary of institutional controls issues and the actions taken to correct them.

4.1.2.4.4 Task 9D and 9E: Off-Property Groundwater Engineering Controls and Extraction Monitoring

PPG currently collects pumping rate information from the DuPont groundwater production wells, the PPG remediation wells, the Earnhart Hill wells and the PPG production wells. PPG assembles and reviews the engineering controls monitoring data on a semiannual basis. Groundwater modeling is performed as necessary to assess capture. PPG's semiannual monitoring reports to Ohio EPA include a summary of the groundwater pumping rates in the vicinity of the Site.

4.2 Summary of Activities since Work Plan Approval

Subsequent to approval of the RD/RA Work Plan, PPG began implementing the required remedial measures at the Site. The following subsections provide a summary of the actions completed for PSA-2 and for the Off Property Groundwater.

4.2.1 PSA-2

The remedial actions for PSA-2 were initiated upon approval of the RD/RA Work Plan in January of 2002. The deed restriction on PSA-2 has not yet been completed; however, a draft document is currently in progress to be submitted to OEPA by March 2007. The training and public communication procedures have been established. As stated previously, the institutional and engineering controls as well as the monitoring have all been implemented and are effective in preventing exposure to the wastes in PSA-2.

4.2.2 Off-Property Groundwater

Many of the remedial measures such as the plume control, monitoring and most of the access agreements were instituted prior to the approval of the RD/RA Work Plan. Initially, the engineering controls and groundwater extraction for the off-Site groundwater were performed as part of DuPont's normal plant operations. DuPont pumped nearly 3,000 gpm of groundwater until production demands dropped upon removal of the Mylar® lines in the DuPont Plant. As stated above, the drop in groundwater demand at the DuPont Plant led to PPG asking DuPont to temporarily shift their pumping regime northward toward P-6 and to install the two PPG remediation wells on the DuPont property. On- and off-Site monitoring was performed under the Interim Groundwater Monitoring Plan (IGWMP; ICF Kaiser, 1998) until the LTGWMP was completed and approved in February of 2002. The IGWMP and LTGWMP are similar in scope with the exception of the VOCs collected in PPG monitoring wells MW-35, MW-29S and MW-29I and the surface water samples, which are all included in the LTGWMP monitoring program.

As discussed above, PPG has negotiated an agreement with Colomet, Inc., a subsidiary of AEP, to record a Declaration of Restrictions on the Deed for the property immediately east of the Site, which has since been purchased by Mary Virginia Hannan and is currently owned by her estate. The restriction requires that groundwater in the area of the plume exceeding 35 µg/l not be used for drinking water purposes.

In addition to the specific requirements of the RD/RA WP, PPG has undertaken actions to rectify the decrease in groundwater production at the DuPont Plant. Continuous monitoring of the DuPont pumping rates and groundwater indicated that plume capture could be lost if the DuPont pumping rated continued to fall. PPG continually evaluated the plume capture using the groundwater model developed during the RI. Upon detecting 1,4-dioxane in DuPont monitoring well MW-10, coupled with Earnhart Hill's intent to increase groundwater production, PPG began evaluating options to maintain control of the plume. PPG worked closely with DuPont, Earnhart Hill and the Ohio EPA to ensure that the municipal well field was protected. Specific actions taken by PPG included:

- Instituting a monthly (now bi-monthly) monitoring program along the northern DuPont property boundary and within Earnhart Hill's well field;
- Asking DuPont to begin pumping P-6;
- Assisting Earnhart Hill and the OEPA in the development of Earnhart Hill's Wellhead Protection Plan;
- Evaluating potential remedial options to either capture or degrade the 1,4-dioxane plume;
- Installing the two PPG remediation wells (RW-2 and RW-3) and the associated discharge pipeline; and
- Performing remediation well maintenance on RW-2 in 2005 to return the well to the design efficiency.

These measures have been effective in continuing to control the 1,4-dioxane plume in the aquifer.

4.3 Technology Assessment and Recommendations

This section provides an assessment of the remedial technologies used for the Site, and evaluates the potential for emerging technologies to be applied to the Site. The following subsections discuss the applicability of the remedial technologies used and the potentially applicable emerging technologies for PSA-2 and the Off-Site groundwater respectively.

4.3.1 Subsurface Soils

No new or emerging technologies were identified that were not already evaluated in the FS. Given that the selected remedies for PSA-2 are effective, and meet the RAOs, it is recommended that they continue to be used for the remedial action.

4.3.2 Off-Site Groundwater

1,4-Dioxane has recently become an emerging constituent of concern on sites where chlorinated solvents are an issue. As a result, several new/emerging technologies have become available for the treatment of 1,4-dioxane in groundwater. These technologies include treatment with hydrogen peroxide and ozone, and cometabolism using butane as a carbon source/substrate. As discussed above, these technologies were evaluated in 2003 and rejected in favor of the installation of the PPG remediation wells. Each of these technologies is discussed in the following sections.

4.3.2.1 Hydrogen Peroxide/Ozone Treatment

The hydrogen peroxide/ozone treatment technology injects hydrogen peroxide from a holding tank and ozone generated on-site into a water stream containing 1,4-dioxane. The 1,4-dioxane is oxidized and destroyed. This technology is generally used in a stream of water pumped from the ground; however, it can be adapted to degrade 1,4-dioxane in-situ. In an in-situ application, the hydrogen peroxide and ozone would be injected into a series of wells placed in a grid in the area of the plume exceeding the cleanup criterion. Evaluation of this technology indicated that it would be cost-prohibitive in the case of the Site due to the large area and depth of the aquifer that would need to be treated.

4.3.2.2 *Butane Cometabolism*

In the butane cometabolism treatment technology, butane is injected into the aquifer as a substrate for bacterial growth. The bacterial growth destroys the 1,4-dioxane via a cometabolic process during the metabolism of the butane. This technology has similar limitations to the hydrogen peroxide/ozone technology in that the area that would require injection is very large. Additionally, butane is flammable and injection on the vicinity of the groundwater plume at the Site would carry the risk of introducing flammable substances into buildings that overlie the plume. As a result of these limitations, butane cometabolism was eliminated from further consideration as a remedial technology.

4.4 Issues

The remedial system is performing according to expectations. Issues have been limited to the need for periodic maintenance and cleaning. During the Spring of 2006, the efficiency of remediation well RW-2 began to drop due to iron fouling in the well screen. PPG contracted Moody's of Dayton to remove both well pumps and clean the well screens. Upon completion of this work, the well pumping rates returned to design capacities. No other issues have occurred with the pumping wells.

Monitoring of the pumping system includes daily checks to ensure the pumps are running, continuous recording of the flow rates, monthly NPDES monitoring and bi-monthly groundwater monitoring. The monitoring program has proven effective in identifying potential issues as evidenced by the detection and control of the northern edge of the plume.

4.5 Five-Year Review Process, Timing, and Scope of Next Review

4.5.1 Administrative Components

This Section provides a summary of the administrative components of the five-year review. The administrative components were discussed in the Five-Year Review Work Plan (MFG, 2006). These components and any deviations form the Work Plan are presented in the following subsections.

4.5.1.1 *Notification of Potentially Interested Parties*

Potentially interested parties were notified through the public participation process. Notifications to the public were made by the Ohio EPA prior to initiation of the Five-Year Review and through the interviews with stakeholders.

4.5.1.2 *Identification of Members of the Review Team*

The review team for the Five-Year Review and their respective roles in the project are as follows:

- Mr. Douglas Crandall, Ohio EPA Project Manager provided regulatory and administrative input regarding the project, supported the interview process and conducted the Site inspection; .
- Mr. Brian McGuire, PPG Project Manger provided information regarding remedial activities;
- Mr. Robert Crowley, MFG Project Manager provided technical input for the Five-Year Review team;
- Dr. Jennifer Choich, Toxicologist, provided review of the risk assessment and support to the interview process.

4.5.1.3 *Review Schedule*

The review schedule was presented in the Five-Year Review Work Plan (MFG, 2006). The review began in January of 2006 and continued through the publication of this Draft Five-Year Review Report in January of 2007.

4.5.2 Community Notification and Involvement

In anticipation of the completion of the Five-Year Review, the Ohio EPA made a public notification. Additionally, the Ohio EPA placed the Five-Year Review Work Plan on their website and PPG made a copy available in the Pickaway County Public Library. To date, no public comment has been received on the five-year review process.

4.5.3 Document Review

All of the pertinent administrative, investigative, design and remedial implementation documents were reviewed in the completion of the Five-Year Review. These documents constitute the vast majority of the work performed throughout the remedial process starting at the initial investigation through the remedial implementation and current operation of the remediation system.

4.5.4 Data Review

Two types of data were reviewed to complete the Five-Year Review, including analytical and cost data. The review of the analytical data is useful in determining the effectiveness of the remedial actions, and the cost data can be an early indicator of failure of the remedial systems. The following subsections provide a summary of the analytical and cost data.

4.5.4.1 *Analytical Data Review*

PPG currently collects analytical data under the LTGWMP, under the NPDES permit for the PPG pumping wells and voluntarily from wells on the DuPont property and Earnhart Hill property. The following subsections provide a summary and evaluation of these data.

4.5.4.1.1 IGWMP/LTGWMP Monitoring

The groundwater monitoring at the Site was initially conducted under the IGWMP and continued after finalization of the RD/RA Work Plan under the LTGWMP. During preparation of the LTGWMP,

the Ohio EPA requested that PPG add three surface water samples from the Scioto River and three wells near PSA-1 (MW-35S, MW-29S and MW-29I). The surface water samples were to be analyzed for 1,4-dioxane and the three additional monitoring wells were to be analyzed for VOCs. The results of each facet of the groundwater/surface water monitoring program are discussed below.

Surface Water

Three surface water samples are collected from the Scioto River on an annual basis. The surface water samples are collected from points upgradient, cross gradient and downgradient of DuPont's outfall 001, and analyzed for 1,4-dioxane. The upgradient sample has historically been collected from the area of the current PPG NPDES-permitted discharge from the remedial pumping system. In 2005, this sampling point was moved approximately 50 feet upstream to avoid the influence of the PPG discharge.

1,4-Dioxane was detected at 6.37 µg/l in May 2003 in the cross gradient sample. Subsequent to the installation of the PPG pumping system, 1,4-dioxane has been detected once, in May 2006, in the cross gradient and downgradient locations, at concentrations between 6.9 µg/l and 3.8 µg/l respectively. A summary of the surface water sample results is provided in Table 3. It is presumed that the 2003 detection was related to DuPont's discharge, and that the 2006 detections are related to a combination of the DuPont and PPG discharges. The observed concentrations are well below any applicable surface water criteria for 1,4-dioxane.

Groundwater at PSA-2

Three wells (WP-33S, WP-22S and CWP-23S) are monitored to the west of PSA-2 to monitor the 1,4-dioxane and VOC concentrations downgradient of PSA-2. The VOC concentrations in these wells are generally non-detect, which continues to support the conclusion that the VOCs are not migrating from PSA-2. 1,4-Dioxane concentrations in these wells were below the 35 µg/l cleanup criterion during the RI, and continue to be low to non-detect. PSA-2 does not appear to be a continuing source of 1,4-dioxane to groundwater. Table 4 provides the VOC data for these wells and Table 5 provides the 1,4-dioxane data.

Aromatic VOCs in Groundwater

Three wells (WP-26S, WP-26I and WP-35S) are sampled in the East Yard of the plant, west of the tank farm to monitor aromatic VOCs (ethylbenzene, toluene and xylene) and methylisobutyl ketone (MIBK) present in groundwater in the area. These wells were added to the Site monitoring program in

the LTGWMP. The VOC concentrations in WP-35 S and WP-26S continue to be elevated; however, they are significantly lower than those observed during the Remedial Investigation, and the toluene and MIBK are no longer detectable. Well WP-26I generally has minor detections of VOCs, which continues to support the Site conceptual model that the VOCs do not migrate into the deeper portions of the aquifer in significant concentrations, or they degrade as they do. It should also be noted that well WP-26S met the MCLs for ethylbenzene and xylene in November 2004 and continues to be below the MCL for both compounds. Table 4 provides the VOC data from the wells containing the aromatic VOCs throughout the term of the project.

Off-Property Groundwater

Off-property groundwater samples have been collected on a semiannual basis from August 1998 through the present. Table 5 shows the results of the samples collected from the off-property groundwater monitoring network as well as the results from these wells during the RI. The monitoring program initially used a modified SW-846 Method 8270 with a separatory funnel extraction. This method was initially used by NET of Indianapolis, IN, who was eventually purchased by TestAmerica, and had a reporting limit of 10 µg/l. In May of 2003, KEMRON of Marietta, Ohio was selected to perform the 1,4-dioxane analyses using a modified SW-846 Method 8260 with a heated purge. The KEMRON method had a detection limit of 2.0 µg/l. In November of 2004, Severn Trent Laboratories (STL) of North Canton, Ohio was selected to conduct the 1,4-dioxane analyses using a modified SW-846 Method 8270 with a liquid-liquid extraction method. The current detection limit for the STL method is 1.0 µg/l.

Throughout the monitoring program, three wells (CWP-23I, CWP-26I and CWP-27DL) have consistently exceeded the 35 µg/l cleanup criterion. Currently, only CWP-23I and CWP-26I exceed the criterion; CWP-27DL fell below 35 µg/l in November of 2005. 1,4-Dioxane concentrations in CWP-23I and CWP-27DL have fallen steadily since the RI, although CWP-23I appears to have rebounded slightly since the well was replaced in November of 2005. The 1,4-dioxane concentration in CWP-26I was non-detect in the first two semiannual monitoring rounds and rose to 332 µg/l in November of 2003 before beginning to decline to its present concentration slightly above 35 µg/l. It appears as if groundwater containing higher concentrations of 1,4-dioxane (i.e. a “slug”) moved through the area of CWP-26I between November of 1999 and the most recent sampling events. Figure 6 shows the configuration of the plume in April of 1999, and Figure 7 shows the configuration of the plume in May of 2005. Comparison of these figures shows that the area of 1,4-dioxane exceeding 35 µg/l is slightly smaller in the May 2005

map. However, the concentrations within the area have fallen significantly. These maps also show the area between the detection limit and 35 µg/l has increased in size; however this increase is due primarily to the lower detection limit for 1,4-dioxane in the 2005 event.

Monitoring has been conducted at DuPont pumping wells P-5 and P-6 in conjunction with both the semi-annual monitoring and the voluntary monitoring. A discussion of the P-5 and P-6 monitoring is provided below in Section 4.5.4.1.3 because the voluntary monitoring data set is more comprehensive than, and includes the semi-annual monitoring samples.

4.5.4.1.2 Voluntary Monitoring

Between January 2002 and December 2004, PPG voluntarily collected groundwater samples monthly from monitoring wells along the northern boundary of the DuPont property and from monitoring and pumping wells on the Earnhart Hill property. Subsequent to December 2004, groundwater samples have been voluntarily collected from this network on a bi-monthly basis. The voluntary samples have been collected in conjunction with the shifted pumping in the DuPont well field in response to a detection of 1,4-dioxane in DuPont monitoring well MW-10 in December of 2001. The results of these samples between January 2002 and November 2006 are presented in Table 6.

The results of the voluntary sampling have confirmed that 1,4-dioxane is not present at detectable levels within the Earnhart Hill pumping field. Samples collected from DuPont well MW-10 have declined steadily throughout the voluntary monitoring program. Note however, that the analytical method and laboratory used changed, both in April of 2003 and in July of 2004 and that some variability is evident between the three data sets. The 1,4-dioxane results from DuPont pumping wells P-5 and P-6 both increased until early in 2004, at which time, the began to decrease. The 1,4-dioxane concentrations in both of these wells have decreased significantly since the PPG pumping wells went on-line in November of 2004.

4.5.4.1.3 NPDES Monitoring

PPG pumping wells RW-2 and RW-3, located on the DuPont property discharge to the Scioto River via a NPDES permitted outfall. The terms of the NPDES permit require monthly sampling of the effluent for pH, total suspended solids (TSS) and 1,4-dioxane. These data have been collected monthly since startup of the pumping wells in November of 2004, and represent a mixture of water from PPG remediation wells RW-2 and RW-3. The pH of the discharge water has ranged from 7.1 to 7.7 since

pumping began. The TSS values ranged from non-detect, at a detection limit of 4.0 milligrams per liter (mg/l), to 9.0 mg/l. The 1,4-dioxane concentrations have ranged from 3.7 µg/l to 33 µg/l. The pH and TSS have been within the permit limits throughout the time the discharge has been monitored. The NPDES permit does not specify a limit for 1,4-dioxane because the concentrations in the plume are significantly lower than the allowable in-pipe concentration for the system. The 1,4-dioxane concentration in the discharge water was 33 µg/l at the initiation of the pumping, and has generally decreased through time.

4.5.4.2 *Remedial Cost Data Review*

To date, the actual remedial costs have exceeded the anticipated costs. The added costs were related to the unanticipated reduction in pumping rates at the DuPont facility and included evaluation of potential remedial alternatives, the installation, operation and maintenance of the remediation wells and additional precautionary monitoring costs to ensure continued protection of the water supply. As a result, the additional costs associated with the implementation of the remedy are unrelated to the effectiveness of the remedial effort.

4.5.5 Site Inspection

The Site inspection was performed on May 9, 2006 by Mr. Robert E. Crowley of Tetra Tech and Mr. Doug Crandall of the Ohio EPA. The results of the inspection did not reveal any serious issues with the remedial systems in place at the Site. Minor issues identified included several cracked surface seals on monitoring wells. A copy of the completed Ohio EPA Five-Year Review Site Inspection is provided in Appendix A.

4.5.6 Interviews

MFG and Ohio EPA jointly conducted interviews with the stakeholders in the project. The stakeholders are as follows:

- Trimold (Mr. Todd Jones);
- Pilot Travel Centers, LLC (Mr. Jason McCain);
- Don Goodchild Property (Mr. Don Goodchild);
- DuPont (Mr. Jim Riley);
- Earnhart Hill (Mr. Dennis Williams);
- Mary Virginia Hannan Estate (Mr. Robert Huffer, Esq.).

The interviews were conducted via telephone with Mr. Robert E. Crowley and Dr. Jennifer Choich of Tetra Tech and Mr. Douglas Crandall of Ohio EPA in attendance. Summaries of the interviews are provided in Appendix B.

In general, the interviewees were satisfied with the progress of the remedial action, and indicated that the remedial implementation had little impact on their operations. Mr. Goodchild expressed concerns over the potential impact of the groundwater plume on the marketability of his property and the Earnhart Hill well field; however, he was unaware that PPG had already taken measures to ensure protection of the well field. Mr. Robert Huffer indicated that the Mary Virginia Hannan property will be sold in the near future, although the end use of the property has not been identified.

4.6 Statement on Protectiveness

The five-year review of the remedial actions at the PPG Site in Circleville, Ohio has shown that the remediation is effective in reducing the concentrations of VOCs in groundwater at the Site. Additionally, the institutional and engineering controls in PSA-2 continue to be effective in reducing the potential for exposure to PCBs and VOCs at the Site. Review of the risk assessment exposure assumptions and toxicology of the constituents on the Site show that the remedies continue to be protective of human health (i.e. cancer risks between $1x10^{-4}$ and $1x10^{-6}$ and HIs less than 1.0) and the environment, now, and into the foreseeable future.

The remediation is ongoing at this point; however, the 1,4-dioxane concentrations are decreasing as the plume is captured by the PPG and DuPont well networks. Continued monitoring will be effective in evaluating the remedial measures at the Site. PPG wells RW-2 and RW-3 and DuPont wells P-3, P-4, P-5 and P-6 continue to control the groundwater plume and the institutional controls prevent exposure to the groundwater. The LTGWMP monitoring is effective in evaluating the location and migration of the plume. Review of the off-Site exposure assumptions in the risk assessment indicates that the assumptions are still valid and that the remedies continue to be protective of human health and the environment.

4.7 Implementation Requirements and Recommendations for Follow-up Actions

Given that no significant issues were identified at the Site, no recommendations for corrective action are necessary, nor are any follow-up actions required.

4.7.1 Monitoring

Given the current configuration of the plume, and the remedial measures being implemented, the following recommendations are offered for the monitoring program:

- Elimination of the surface water samples, which were initially included to monitor unpermitted diffuse discharge to the Scioto River. Because the pumping discharge is permitted and monitored the surface water samples currently serve no purpose.
- Monitor wells NO-1. NO-2, CWP-22DU, CWP-27DB, CWP-25 DU and CWP-25DL on an annual rather than semi-annual basis because 1,4-dioxane concentrations are low or have not been detected at these locations.

4.8 Next Review

The second five-year review began in January 2011 and the report is scheduled for submittal to Ohio EPA in February 2012. The second five-year review work plan was submitted to Ohio EPA in March 2011.

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TABLES

TABLE 1

PUMPING WELLS LOCATED IN THE
VICINITY OF THE SITE
PPG INDUSTRIES, INC. CIRCLEVILLE, OHIO

Well Designation	Location	Use
PPG		
PW-1	On-site	Process Water
PW-2	On-site	Process Water
PW-3	On-site	Process Water
PW-4 (Potable Well)	On-site	Potable uses except drinking
RW-1	North of PPG Plant	Not Used
RW-2	North of Route 23	Plume Control
RW-3	North of Route 23	Plume Control
Circle Plastics		
North*	Night Owl Property	Once-Through Cooling Water
South*	Night Owl Property	Once-Through Cooling Water
DuPont		
P-2	Northeast of the DuPont Production Area	Not Used
P-3	Southwest of DuPont Plant	Process Water
P-4	West of DuPont Plant	Process Water
P-5	West-Northwest of DuPont Plant	Process Water
P-6	Northwest of DuPont Plant	Process Water
P-7	DuPont parking lot, west of P-3	Not Used
DB-2/3	Between P-4 and DuPont Production Area	Remediation – Currently Not Used
Earnhart Hill		
W-3	Central Area of EH Property	Public Water Supply
W-4	Central Area of EH Property	Public Water Supply
W-5	Southcentral Area of EH Property	Public Water Supply
W-6	Southwest Area of EH Property	Public Water Supply

* Wells were not named by Circle Plastics. Names reflect position of wells relative to each other.

Table 2
POTENTIAL SOURCE AREAS AT THE
PPG INDUSTRIES, INC. CIRCLEVILLE, OHIO SITE

PSA Number	PSA Name
PSA-1	Former Wastewater Pond Area
PSA-2	Buried Wastewater Pond Residue Area
PSA-3	Building No. 1 Tank Farm
PSA-4	Building No. 2 Tank Farm
PSA-5	Former Contractor Area
PSA-6	West Pad Drum Storage Area
PSA-7	South Pad rum Storage Area
PSA-8	Building No. 2 Drainage Ditch
PSA-9	Former Liquid Waste Incinerator
PSA-10	Pipeline to Scioto River
PSA-11A	East Yard, Storm Sewer Area
PSA-11B	Inactive Storm Sewer System
PSA-12	Scippo Creek
PSA-13	Meteorological Station Area
PSA-14	Soil Stockpile Area
PSA-15	Former Oil Unloading Area
PSA-16	Test Resin Disposal Area
PSA-17	Solvent Management Tanks

TABLE 3

SUMMARY OF SURFACE WATER SAMPLE RESULTS BETWEEN MAY 2002 AND MAY 2006 PPG INDUSTRIES, INC. CIRCLEVILLE, OHIO

Sample Location	**SW-001UP**	**SW-001CR**	**SW-001DN**
Date Collected	**Upstream**	**DuPont Outfall 001**	**Downstream**
May-02	10 U	10 U/10 U	10 U
May-03	2 U/2 U	**6.37**	2 U
May-04	2 U/2 U	2 U	2 U
May-05	1 U	1 U/1 U	1 U
May-06	1 U	**5.8/6.9**	**3.8**

Notes:

All results reported in micorgrams per liter (µg/l) or parts per billion.

Bold indicates a positive detection.

(1) "U" indicates not detected; value shown is the reporting limit.

TABLE 4

SUMMARY OF HISTORICAL VOC GROUNDWATER DATA COLLECTED UNDER THE RI, IGWMP AND LTGWMP PPG INDUSTRIES, INC. CIRCLEVILLE, OHIO SITE

	PSA-2 Wells			East Yard Wells		
Well No.	**WP-22S**	**WP-33S**	**CWP-23S**	**WP-35S**	**WP-26S**	**WP-26I**
	TOTAL VOCs					
Date Collected						
Feb-94	**155.2**	**70.1**	NA	**170,000**	**80,920**	ND
Aug-98	ND	**28**	ND	NA	NA	NA
Apr-99	ND	ND	ND	NA	NA	NA
Nov-99	**12.1**	**12.9**	**15.3**	NA	NA	NA
May-00	ND	ND	**9.8**	NA	NA	NA
Nov-00	ND	ND	ND	NA	NA	NA
May-01	ND	ND	ND	NA	NA	NA
Nov-01	ND	ND	ND	NA	NA	NA
Apr-02	ND	ND	ND	**91,800**	**13,300**	**3.72**
Nov-02	**4.1**	ND	**0.39**	**64,100**	**5,400**	**10.1**
May-03	**7.74**	**7.38**	ND	**100,020**	**4,430**	ND
Nov-03	ND	ND	ND	**74,890**	**9,600**	ND
May-04	ND	ND	ND	**98,030**	**7,470**	**2.37**
Nov-04	**6.73**	**31.75**	**2.9**	**86,400**	**4,524**	**5.5**
May-05	**2.98**	ND	ND	**98,190**	**5,648**	**11.5**
Nov-05	**3.0**	ND	ND	**68,350**	**5,386**	**3.0**
May-06	ND	ND	ND	**41,860**	**3,830**	**9.89**
Nov-06	**4.5**	**10.3**	**9.6**	**31,005**	**3,236**	**17.59**

Notes:

All results reported in micrograms per liter (µg/l) or parts per billion.

Bold indicates a positive detection; the value shown is the sum of all detected compounds.

(1) "NA" indicates not analyzed.

(2) "ND" indicates not detected.

TABLE 5

SUMMARY OF HISTORICAL 1,4-DIOXANE GROUNDWATER DATA
COLLECTED UNDER THE RI, IGWMP AND LTGWMP
PPG INDUSTRIES, CIRCLEVILLE, OHIO

	PSA-2 Wells			Off-Property Groundwater Monitoring Wells						
Well No:	**WP-22S**	**WP-33S**	**CWP-23S**	**CWP-22DU**	**CWP-23I**	**CWP-23DU**	**CWP-23DL**	**CWP-25DU**	**CWP-25DL**	**CWP-26I**
Date Collected										
Feb-94	16	ND	NA	ND	620	17	ND	ND	12	340
Aug-98	10 U	10 U	10 U	10 U	430	15	10 U	10 U	10 U	10 U
Apr-99	10 U	10 U	10 U	12	530	10 U	10 U	10 U	16	10 U
Nov-99	10 U	10 U	31	10 U	260	10 U	10 U	10 U	13	15
May-00	10 U	10 U	10 U	NA (2)	91	10 U	10 U	10 U	10 U	17
Jan-01	2 J / 5 J (3,4)	10 U	10 UR	10 UR (5)	47 J	5 J	10 UR	4 J	5 J	73 J
May-01	10 U	10 U	10 U	10 U	45	7.4 J	10 U	4.8 J	12	42
Nov-01	6.5 J	2.9 J	10 U	10 U	52	16	2.6 J	6 J	16	180
Apr-02	10 U	10 U	10 U	10 U	29 / 38	10 U	13	5.9 J	9.9 J	116
Nov-02	4.1 J / 6.1 J	3.1 J	2.8 J	10 U	28	15	1.4 J	7.2 J	15	220
May-03	7.74 / 7.94	3.97	2 U	3.7	55	29.3	2.98	10.5	23.1	163
Nov-03	8.43 J / 8.57 J	4.16 J	5.99 J	2 U	54.6	27.3	4.21 J	10.5 J	21.4	332
May-04	6.5/6.07	2.29	2.08	3.47	48.3	22.4	2.76	8.13	16.7	281
Nov-04	4.5/3.8	1.9	2.4	2.3	69	14	2.5	3.9	11	190
May-05	13/14	1.4	1 U	1.1	NA	13	1.7	4.0	12	97
Nov-05	3/3	1 U	3.5	1 U	39	4.9	1.4	1.2	3.2	80
May-06	3.6/3.7	1.5	1.2	1 U	110	13	2.7	3.7	6.5	110
Nov-06	1.0	2.3	12	1 U	160	16	2.8	3.7	8.6	32 / 40

Notes:

All results reported in micrograms pe liter (µg/l) or parts per billion.

(1) "U" indicates not detected; value shown is the reporting limit.

(2) "NA" indicates not analyzed.

(3) "J" indicates estimated value.

(4) "# / #" indicates duplicate sample; both results provided.

(5) "R" indicates rejected by data validator.

TABLE 5

SUMMARY OF HISTORICAL 1,4-DIOXANE GROUNDWATER DATA
COLLECTED UNDER THE RI, IGWMP AND LTGWMP
PPG INDUSTRIES, CIRCLEVILLE, OHIO

	Off-Property Groundwater Monitoring Wells									
Well No:	**CWP-26DL**	**CWP-27DL**	**CWP-27DB**	**MW-1**	**P-3**	**P-4**	**P-5**	**P-6**	**NO-1**	**NO-2**
Date Collected										
Feb-94	ND	450	80	ND	10	110	45	ND	NI	NI
Aug-98	170	10 U	10 U	10 U	10 U	15	12	10 U	NI	NI
Apr-99	10 U	300	10 U	10 U	10 U	25	17	22	10 U	10 U
Nov-99	10 U	220	10 U	10 U	10 U	11	10 U	10 U	10 U	10 U
May-00	10 U	83	10 U	10 U	10 U	18	16	10 U	10 U	10 U
Jan-01	10 UR	69 J	10 UR	10 U	10 UJ	7 J	10 J	12 J	10 UR	10 U
May-01	10 U	62	10 U	10 U	10 U	12	15	4.6 J	10 U	10 U
Nov-01	2.6 J	76	10 U	10 U	4.1 J	19	17	16	10 U	10 U
Apr-02	10 U	60	10 U	10 U	4.3 J	22	18	25	10 U	10 U
Nov-02	2.9 J	66	10 U	10 U	NA	26	18	28	10 U	10 U
May-03	5.38	89.6	2 U	2 U	9.14	29	25.4	35.8	2 U	2 U
Nov-03	7.04 J	78	2 U	2 U	2.6 J	33.5	23.9	30.5	2 U	2 U
May-04	9.26	69.7	2 U	2 U	6.56	38.5	25.6	33.9	2 U	2 U
Nov-04	4.7	45	1 U	1 U	1.6	19	14	22	1 U	1 U
May-05	4.2	44	1 U	1 UJ	3.5	25	--	15	1 U	1 U
Nov-05	2	15	1 U	1 U	1.4	12	6.8	11	1 U	1 U
May-06	4.1	38	1 U	1 U	1.6	18	8.6	13	1 U	1 U
Nov-06	1.5	8.8 / 14	1 U	1 U	2.8	1 U	7.3	11	1U	1U

Notes:

All results reported in micrograms pe liter (µg/l) or parts per billion.

(1) "U" indicates not detected; value shown is the reporting limit.

(2) "NA" indicates not analyzed.

(3) "J" indicates estimated value.

(4) "# / #" indicates duplicate sample; both results provided.

(5) "R" indicates rejected by data validator.

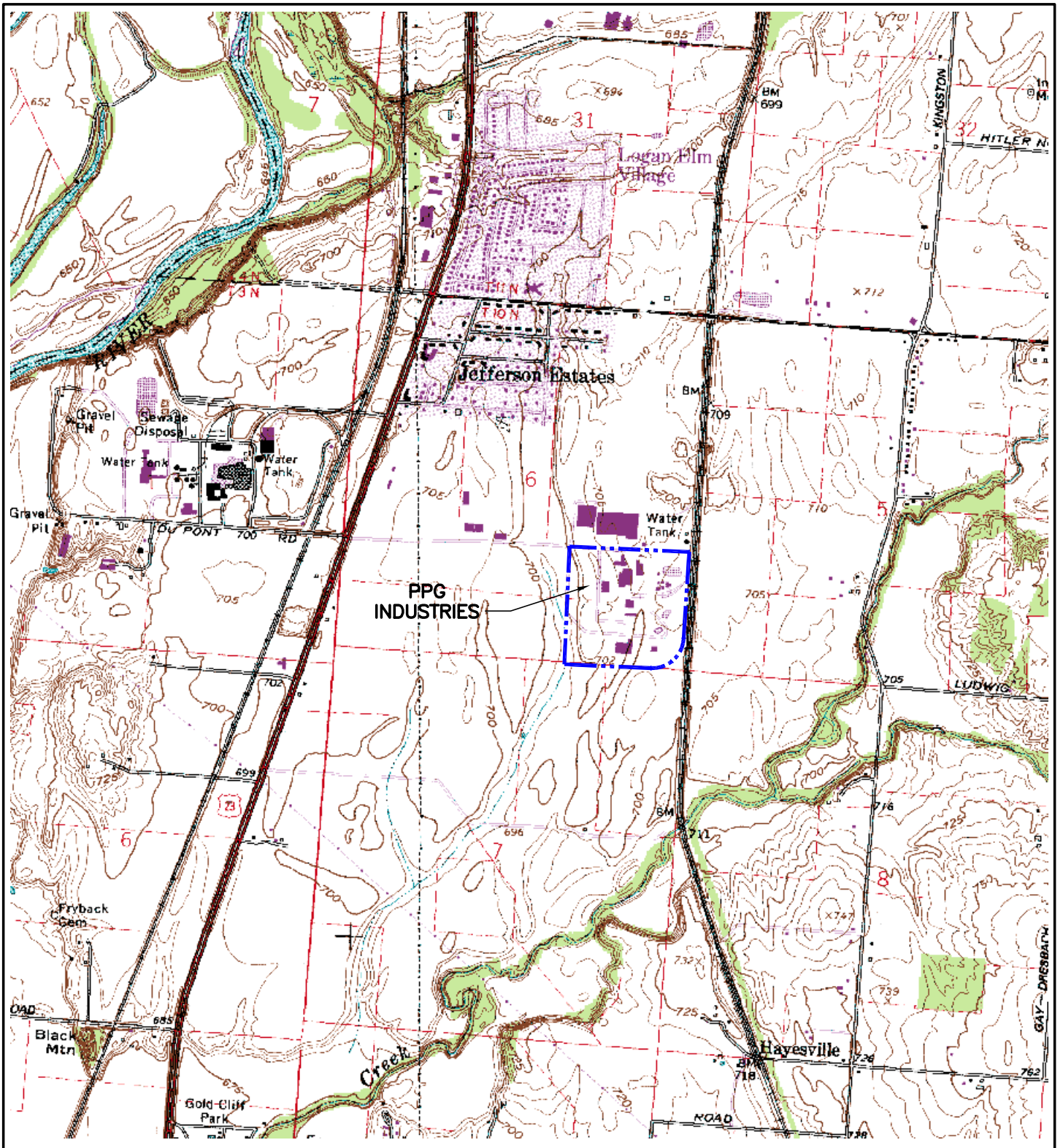
TABLE 6

RESULTS OF VOLUNTARY GROUNDWATER SAMPLES
COLLECTED FROM DUPONT AND EARNHART HILL WELLS
PPG INDUSTRIES, INC. CIRCLEVILLE, OHIO SITE

Sample Location:	DuPont				Earnhart-Hill			
Well Number:	P-5	P-6	MW-9	MW-10	MW-1	MW-6	PW-5	PW-6
Date Collected								
10-Jan-02	**9.2 J**	**15**	10 U	**8.5 J**	10 U	--	10 U	--
6-Feb-02	**15**	**12**	10 U	**11**	10 U	--	10 U	--
21-Mar-02	**12/14**	**22**	10 U	**8.5 J**	10 U	--	10 U	--
24-Apr-02	**18**	**25**	10 U	**7.5 J**	10 U	--	10 U	--
30-May-02	**21**	**25**	10 U	**6.7 J**	10 U	--	10 U	--
11-Jul-02	**14 J**	**21**	10 U	**4.4 J/4.9 J**	10 U	--	10 U	--
17-Sep-02	**13**	**18**	10 U	10 U	10 U	--	10 U	--
11-Nov-02	**18**	**28**	10 U	**3.5 J/3.4 J**	10 U	--	10 U	--
18-Dec-02	--	--	--	**4.2 J**	10 U	--	10 U	--
16-Jan-03	--	--	--	**3.0 J**	10 U	--	10 U	--
20-Feb-03	**8.3 J**	--	--	**1.8 J**	10 U	--	--	--
13-Mar-03	**6.6 J**	**8.8 J**	10 U	10 U/10UJ	10 U	--	10 U	--
23-Apr-03	**26.8**	**12 J**	--	**7.2**	10 UJ	--	10 U	--
19-May-03	**25.4**	**35.8**	2 U	**5.5**	2 U	--	2 U	--
15-Jul-03	**24.9**	**30.7**	--	**4.8**	2 U	--	2 U	2 U
14-Aug-03	--	--	--	**7.6**	2 U	--	2 U	2 U
16-Sep-03	**34.9**	**55.2**	--	**7.9**	2 U	--	2 U	2 U
14-Oct-03	--	**36.4**	--	**5.2**	2 U	--	2 U	2 U
18-Nov-03	**23.9**	**30.5**	2 U	**5.8**	2 U	--	2 U	2 U
22-Dec-03	--	**33.3**	--	**5.5**	2 U	--	2 U	2 U
22-Jan-04	--	--	--	**5.0**	2 U	--	2 U	2 U
18-Feb-04	**23.0**	**31.5**	--	**4.3**	2 U	--	2 U	2 U
23-Mar-04	--	--	--	**4.2 J**	2 UJ	--	2 UJ	2 UJ
13-May-04	**25.6**	**33.9**	2 U	**3.9**	2 U	2 U	2 U	2 U
17-Jun-04	--	--	--	3.6 U	2 U	2 U	2 U	2 U
7-Jul-04	--	--	--	**2.5**	--	1 U	1 U	1 U
13-Jul-04	--	--	--	--	--	--	--	--
3-Aug-04	--	--	--	**1.7**	1 U	1 U	1 U	1 U
9-Sep-04	--	--	--	**1.7**	1 U	1 U	1 U	1 U
6-Oct-04	--	--	--	**1.2**	1 U	1 U	1 U	1 U
9-Nov-04	**14**	**22**	1 U	**1.7**	1 U	1 U	1 U	1 U
15-Dec-04	**--**	**13**	--	**1.2**	1 U	1 U	1 U	1 U
10-Jan-05	**--**	**14**	--	**1.5**	1 U	1 U	1 U	1 U
3-Mar-05	**--**	**13 J**	**--**	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
3-May-05	**--**	**15**	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ
7-Jul-05	**--**	**10**	**--**	1 U	1 U	1 U	1 U	1 U
7-Sep-05	**--**	**9.3 J**	**--**	1 U	1 U	1 U	1 U	1 U
8-Nov-05	**6.8**	**11**	1 U	1 U	1 U	1 U	1 U	1 U
5-Jan-06 [(1)]	**--**	**18**	**--**	**1** /1U	50 U/1 U	1 U	1 U	1 U
16-Mar-06	**--**	**12**	**--**	**1.1**	1 U	1 U	1 U	1 U
9-May-06	**8.6**	**13**	1 U	**1**	1 U	1 U	1 U	1 U
14-Jul-06	**--**	**13**	**--**	**1.2**	1 U	1 U	1 U	1 U
12-Sep-06	**--**	**9.3**	**--**	**1**	1 U	1 U	1 U	1 U
8-Nov-06	**7.3**	**11**	1 U	**1.2**	1 U	1 U	1 U	1 U

[(1)] Samples recollected due to high detection limit in MW-1. Recollection occurred on January 19, 2006.
Results presented in ug/l.
Bold indicates 1,4-dioxane detected in sample.
"J" indicates estimated value.
"U" indicates not detected at the stated value.
"--" indicates no sample collected.
"12/14" indicates duplicate sample; both results shown.
Indicates suspect result reported by TestAmerica; results between April 23, 2003 and June 17 2004 reported by Kemron. Results beginning on July 7, 2004 reported by Severn Trent Laboratories (STL) of North Canton, Ohio.
Note: Analysis of samples collected in August 2002 was not completed due to a laboratory error.

FIGURES



NORTH

SCALE IN FEET

0 2000

REFERENCE:

USGS 7.5 MINUTE QUADRANGLE
CIRCLEVILLE, OHIO
REVISED 1995

PPG INDUSTRIES, INC. CIRCLEVILLE, OHIO		
FIGURE 1 SITE LOCATION		
PROJECT: 120403	DATE: JANUARY 2007	
REV:	BY: MAW	CHECKED: REC
TETRA TECH		

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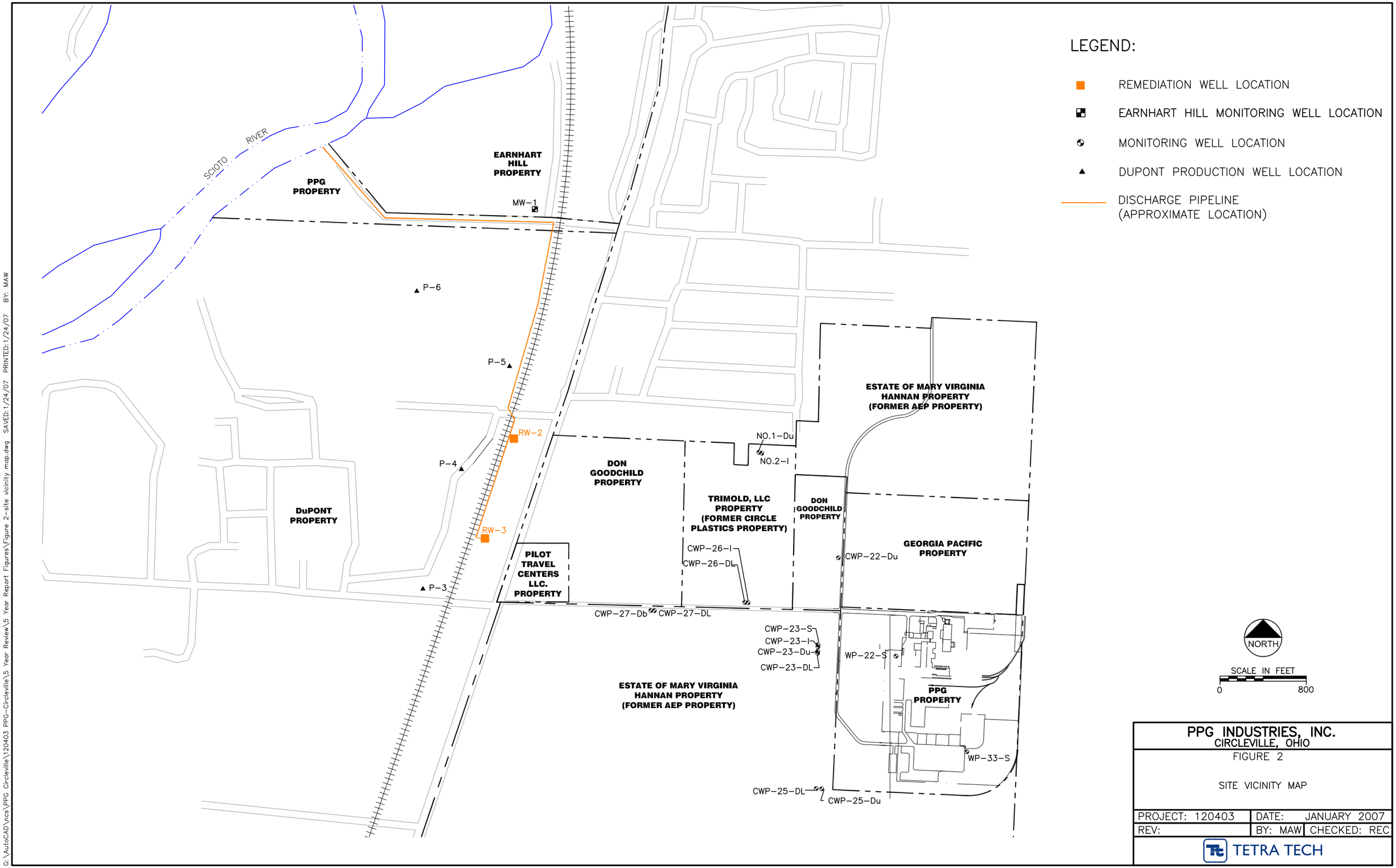

PPG INDUSTRIES, INC.
CIRCLEVILLE, OHIO

FIGURE 2

SITE VICINITY MAP

PROJECT: 120403	DATE: JANUARY 2007	
REV:	BY: MAW	CHECKED: REC

TETRA TECH

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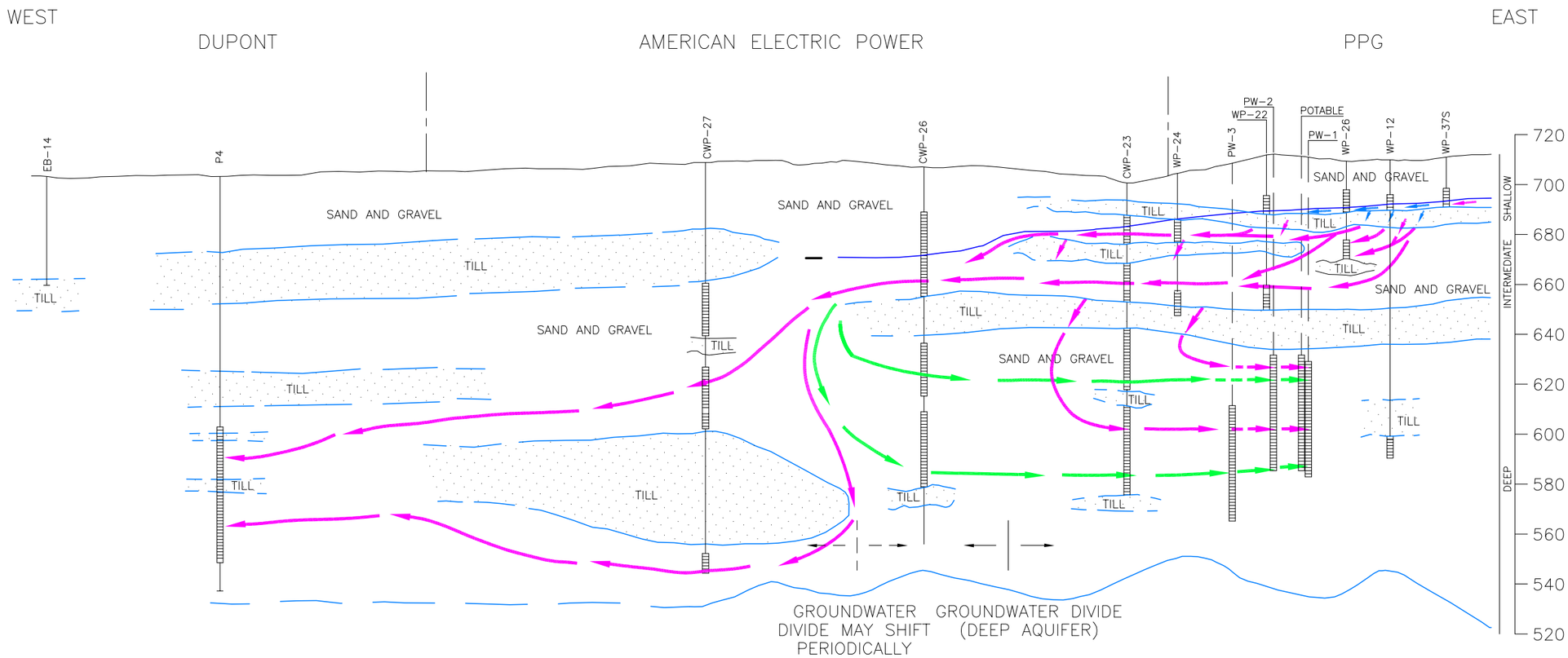

LEGEND

- VOC MIGRATION PATH
- 1,4 DIOXANE MIGRATION PATH
- 1,4 DIOXANE MIGRATION PATH DUE TO SHIFT OF GROUNDWATER DIVIDE
- PROJECTED 1,4 DIOXANE FLOW PATH
- PW-1 — PROJECTED PPG PUMPING WELL

NOTES:

PPG PUMPING WELLS (PW-1, PW-2, PW-3, AND POTABLE)
PRODUCE AT A COMBINED RATE OF APPROXIMATELY 1,260 GALLONS PER MINUTE.
DUPONT PUMPING WELLS (P3, P4, P5, P6, P7, DB-2, AND DB-3)
PRODUCE AT A COMBINED RATE OF APPROXIMATELY 5,000 GALLONS PER MINUTE.

PPG INDUSTRIES, INC.
CIRCLEVILLE, OH

FIGURE 3

SCHEMATIC CROSS SECTION SHOWING GROUNDWATER FLOW AND CONTAINMENT TRANSPORT BETWEEN PPG AND DUPONT

PROJECT: 120403	DATE: JANUARY 2007	
REV:	BY: JAT	CHECKED: REC

TETRA TECH

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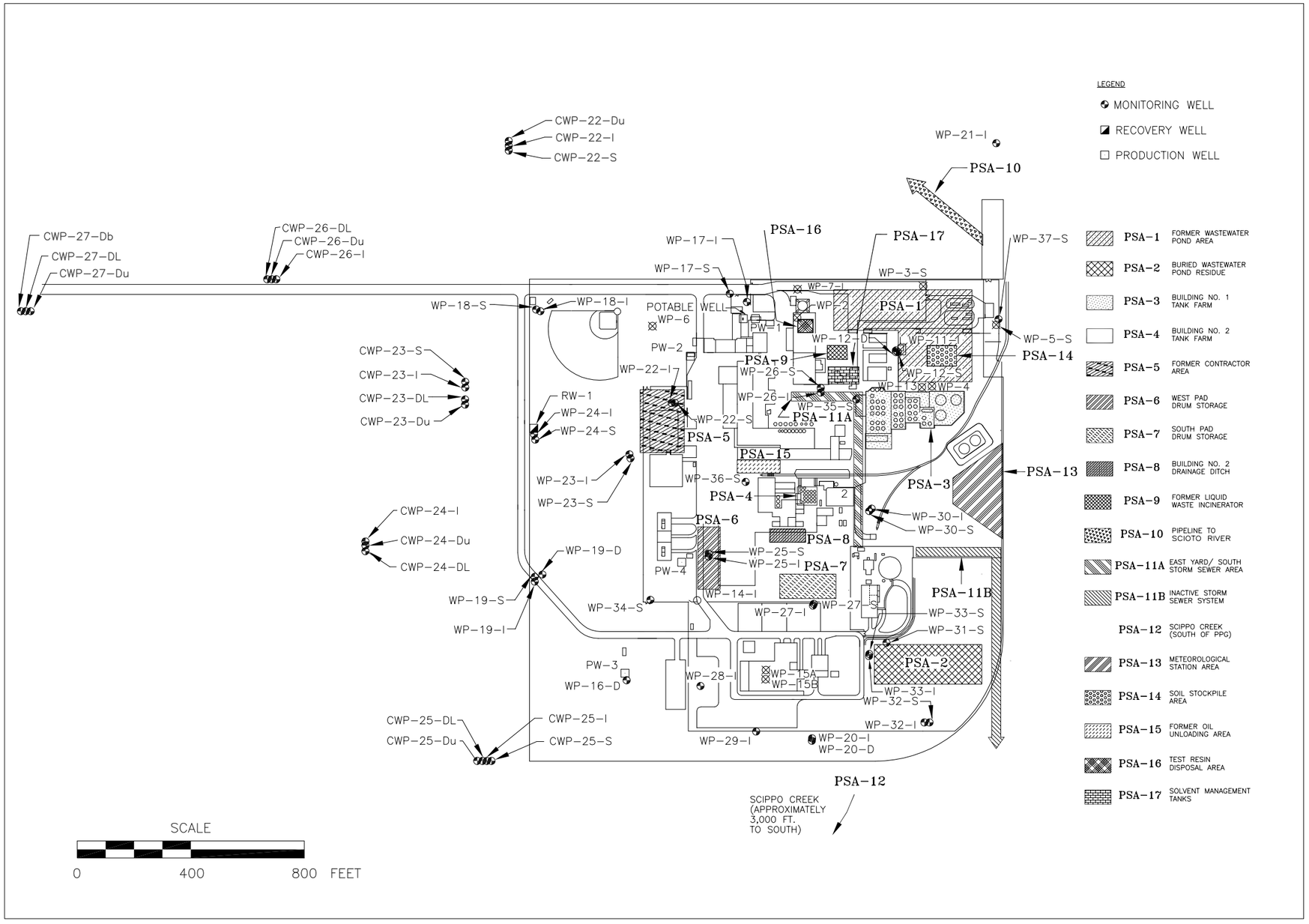

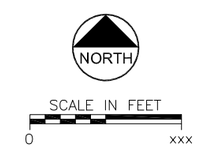

PPG INDUSTRIES, INC.
CIRCLEVILLE, OH

FIGURE 4

SITE LAYOUT AND POTENTIAL SOURCE AREAS

PROJECT: 120403	DATE: JANUARY 2007	
REV:	BY: JAT	CHECKED: REC

TETRA TECH

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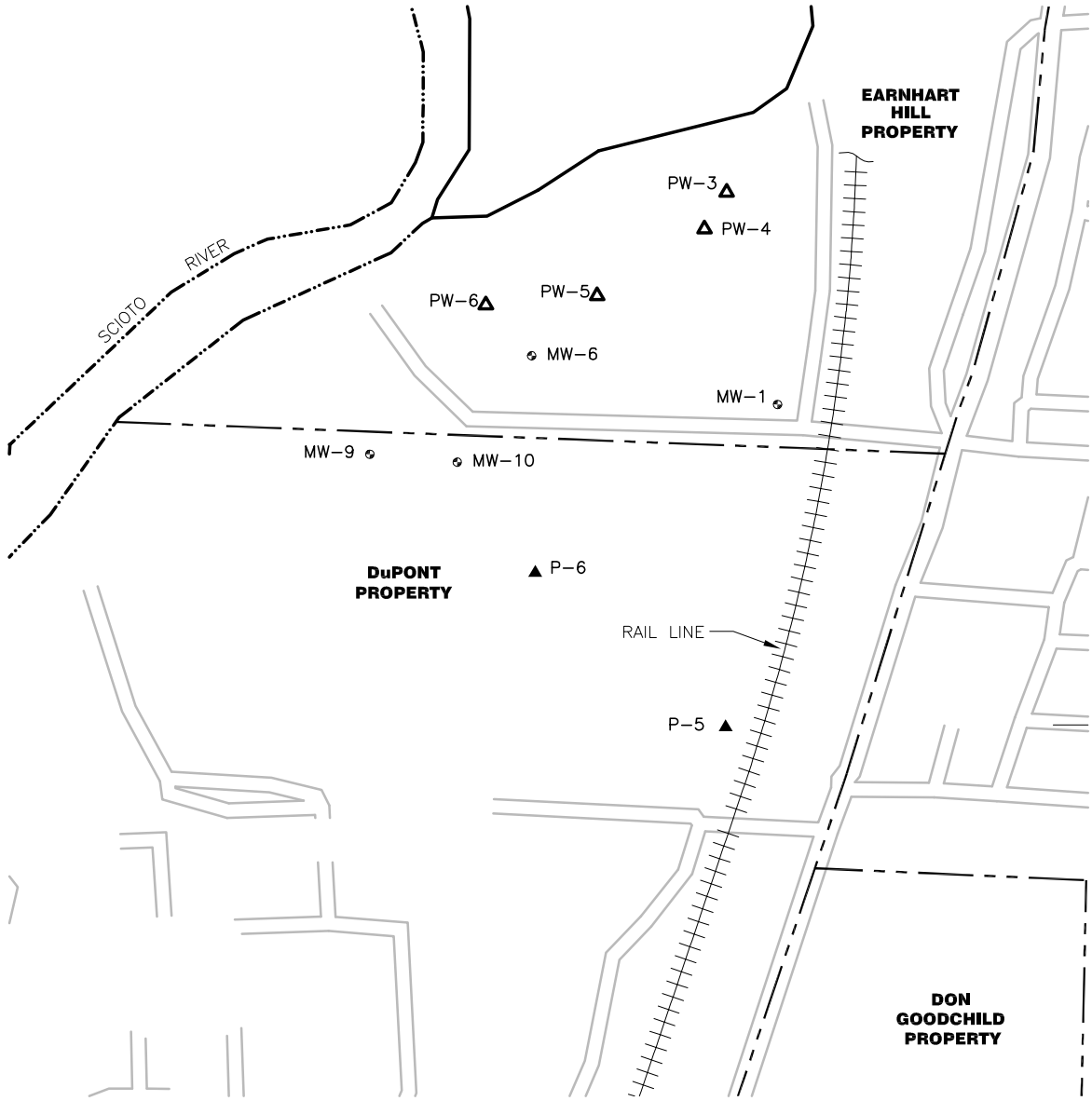

LEGEND:

PW-3 △ LOCATION AND DESIGNATION OF EARNHART-HILL PUMPING WELL

◐ LOCATION OF MONITORING WELL

P-5 ▲ LOCATION AND DESIGNATION OF DuPONT PRODUCTION WELL

SCALE

800 0 800 FEET

TETRA TECH

REV.:	JANUARY 2007/JAT
PROJ NO:	120403
DATE:	JUNE 2004
PCP/PC2:	
DRAWN BY:	MAW
CHECKED BY:	REC

NORTH

SCALE IN FEET

0 800

PPG INDUSTRIES, INC.
CIRCLEVILLE, OHIO

FIGURE 5

LOCATIONS OF DuPONT PRODUCTION WELLS, EARNHART HILL PUMPING WELLS, AND MONITORING WELLS

THE INFORMATION PROVIDED ON THIS DRAWING WAS PRODUCED USING BOTH TECHNICAL INFORMATION AND KNOW HOW. ANY ADAPTATION OR MODIFICATION OF THE INFORMATION OR DRAWING SHALL BE AT THE USER'S SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO THE ENGINEER.

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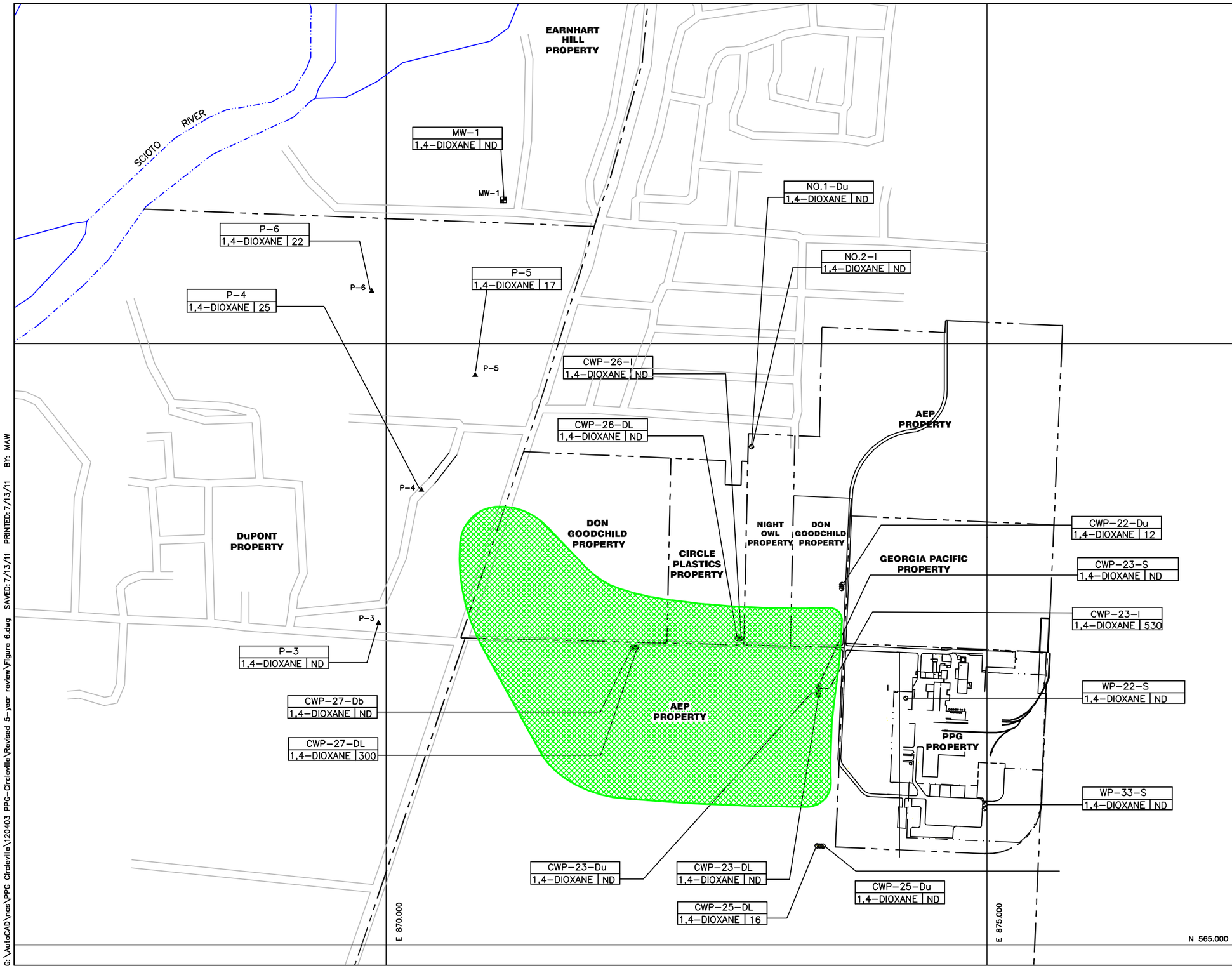


LEGEND

MW-1 — LOCATION AND DESIGNATION OF EARNHART HILL MONITORING WELL

MONITORING WELL

P-5 — LOCATION AND DESIGNATION OF DUPONT PRODUCTION WELL SAMPLED DURING THIS EVENT

PLAN VIEW OF ESTIMATED PLUME BOUNDARY BASED ON 35 ug/l CLEANUP LEVEL

WELL NUMBER

WP-22S	
1,4-DIOXANE	<10
TOTAL VOCs	ND

PARAMETER — CONCENTRATION REPORTED IN ug/l

NOTES:
"<" – NOT DETECTED AT INDICATED DETECTION LIMIT
NA – NOT ANALYZED
ND – NONE DETECTED
DATA BASED ON APRIL 1999 MONITORING EVENT

NORTH

SCALE IN FEET
0 800

PPG CIRCLEVILLE
Circleville, OH

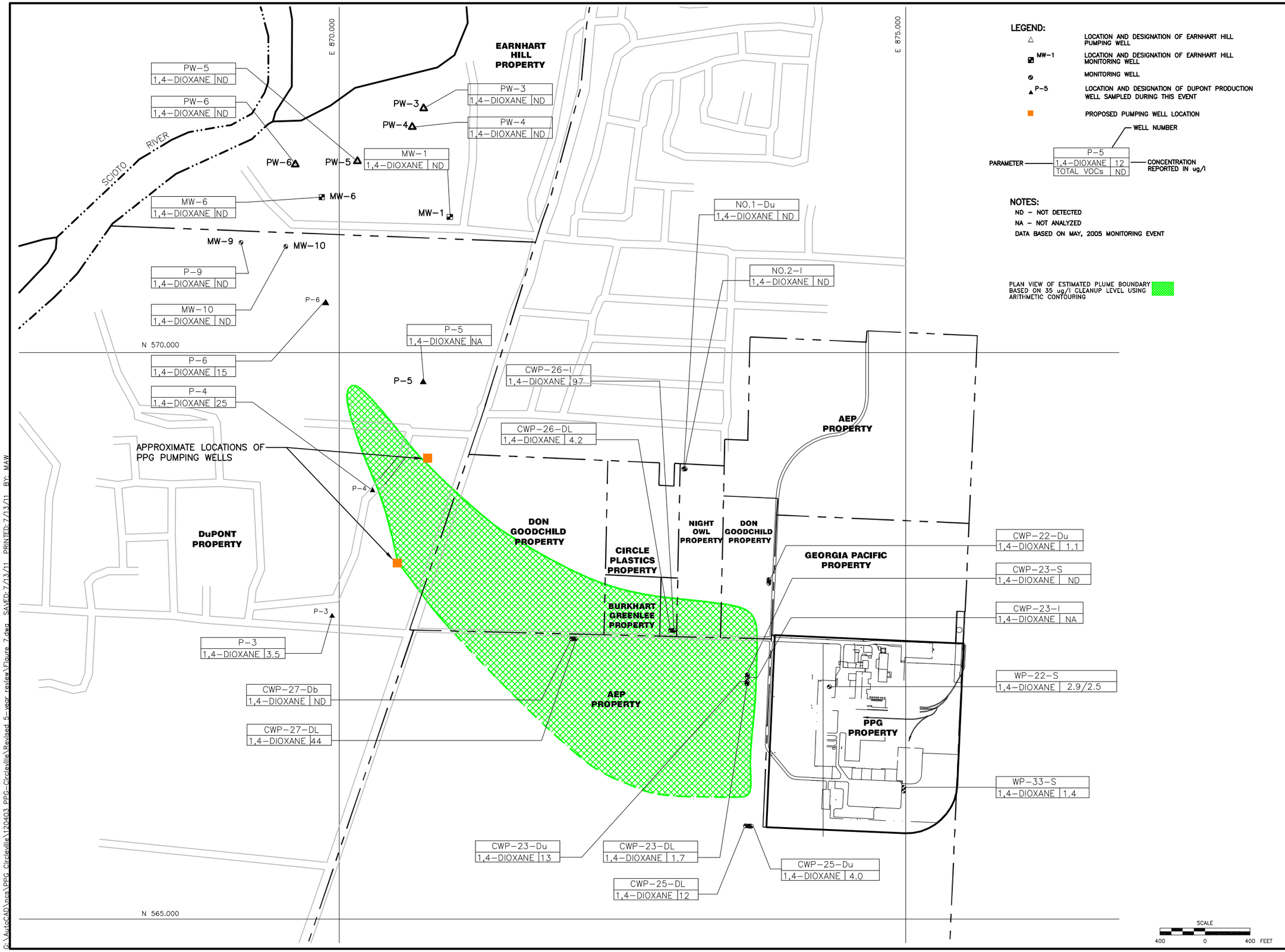
FIGURE 6

1,4-DIOXANE PLUME CONFIGURATION

PROJECT: 120403	DATE: JULY 2011	
REV: JAT	BY: MAW	CHECKED: MEP

TETRA TECH

G:\AutoCAD\ncs\PPG Circleville\120403 PPG-Circleville\Revised 5-year review\Figure 6.dwg SAVED: 7/13/11 PRINTED: 7/13/11 BY: MAW



LEGEND:

- △ LOCATION AND DESIGNATION OF EARNHART HILL PUMPING WELL
- MW-1 LOCATION AND DESIGNATION OF EARNHART HILL MONITORING WELL
- MONITORING WELL
- P-5 LOCATION AND DESIGNATION OF DUPONT PRODUCTION WELL SAMPLED DURING THIS EVENT
- PROPOSED PUMPING WELL LOCATION

WELL NUMBER

P-5	
1,4-DIOXANE	12
TOTAL VOCs	ND

PARAMETER — CONCENTRATION REPORTED IN ug/l

NOTES:

ND – NOT DETECTED
NA – NOT ANALYZED
DATA BASED ON MAY, 2005 MONITORING EVENT

PLAN VIEW OF ESTIMATED PLUME BOUNDARY BASED ON 35 ug/l CLEANUP LEVEL USING ARITHMETIC CONTOURING

TETRA TECH

600 River Avenue, Suite 203
Pittsburgh, Pennsylvania 15212
Phone (412) 321-2278
Fax (412) 321-2283

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REFERENCE

NO.	REVISIONS	BY	DATE
0	ISSUE FOR REVIEW	–	–

DESIGNED BY:	---
DRAWN BY:	WPZ
CHECKED BY:	---
APPROVED BY:	---
PCP/PC2:	MFG-STD
VIEW NAME:	
ORIGINATION DATE:	01/09/03
PLOT SCALE:	1:1 OR 1:2
DATE:	JULY 2011

PPG INDUSTRIES, INC.

CIRCLEVILLE, OH

FIGURE 7
1,4 DIOXANE PLUME CONFIGURATION MAY, 2005

DRAWING NO. 120403-SP1

REV.NO. 1

SHEET 1 OF 1

G:\AutoCAD\ncs\PPG Circleville\120403 PPG-Circleville\Revised 5-year review\Figure 7.dwg SAVED: 7/13/11 PRINTED: 7/13/11 BY: MAW

APPENDIX A

Ohio EPA Site Inspection Documentation

Five-Year Review Site Inspection
PPG Circleville
DERR project number 165-0641-003
June 7, 2011

1. Introduction

PPG Industries Inc. (PPG) and Ohio EPA entered into findings and orders on December 21, 1989 addressing remedial action, effectiveness monitoring, and additional sampling at PPG's Circleville, Ohio facility (1989 orders). On June 27, 2000, Ohio EPA signed a decision document identifying the Agency's selected remedial action and performance standards for the PPG Circleville facility (2000 decision document). The 1989 orders required that PPG develop a detailed work plan. In response, PPG's consultant MFG developed the "Remedial Design/Remedial Action Work Plan" dated December 2001 (2001 work plan). The items discussed in the 2001 work plan included five-year reviews. Also, the 2001 work plan referenced the "Model Statement of Work for Remedial Design and Remedial Action" (1995 statement of work). The 1995 statement of work provided further information regarding five-year reviews and included an outline of a five-year review report. The 1995 statement of work also referenced U.S. EPA guidance on five-year reviews (OSWER Directive 9355.7-02) titled "Structure and Components of Five–Year Reviews." The updated June 2001 version of this guidance (OSWER No. 9355.7-03B-P) is titled "Comprehensive Five-Year Review Guidance."

The time period for the first five-year review began on January 10, 2002, when Ohio EPA approved the 2001 work plan, and ended on January 9, 2007, five years from the work plan approval date. The five-year review was performed by PPG's consultants MFG, which later became part of Tetra Tech. MFG developed a five-year review work plan dated February 6, 2006 and a final five-year work plan dated April 28, 2006. As part of the five-year review, MFG, PPG and Ohio EPA performed a joint site inspection on May 9, 2006. Also, Tetra Tech and Ohio EPA interviewed neighboring landowners by telephone on November 20, 2006 and January 12, 2007. Tetra Tech prepared a draft of the First Five-Year Review Report dated January 31, 2007.

Ohio EPA prepared this document to summarize its portions of the five-year review. This document was prepared to be included as Attachment A of the First Five-Year Report. It includes two sections. First, Section 2 addresses the site inspection. Second, Section 3 addresses the performance standards from the 2000 decision document.

2. Site Inspection

PPG, MFG and Ohio EPA performed a joint inspection at the PPG Circleville facility on May 9, 2006. This section summarizes the inspection following the organizational outline of the Five-Year Review Site Inspection Checklist from

Appendix D of U.S. EPA's Comprehensive Five-Year Review Guidance (OSWER No. 9355.7-03B-P).

2.1. Site Information

2.1.1. Site Name: PPG Industries, Inc., 559 Pittsburgh Road, Circleville, Ohio 43113
2.1.2. Date of Inspection: May 9, 2006
2.1.3. Weather: Clear, 60 to 70 degrees F, Wind 5 to 10 mph from South to Southeast
2.1.4. Remedy includes landfill cover/containment, access controls, instructional controls, groundwater pump and discharge (without treatment)
2.1.5. Inspection team roster: Megan Roe, PPG Industries; Rob Crowley, MFG; Robin Roth, Ohio EPA/DERR/CO; Mike Bondoc, DDAGW/CDO; and Doug Crandall Ohio EPA/DERR/CDO

2.2. Interviews

Rob Crowley and Jennifer Choice of Tetra Tech, and Doug Crandall of Ohio EPA interviewed, by telephone, representatives of neighboring properties on November 20, 2006 and January 12, 2007. A summary of these interviews was included in the First Five-Year Review Report in Section 4.5.6 and Appendix B.

2.3. On-Site Documents and Records Verified

Ohio EPA inventoried the public repository for the PPG Circleville facility on March 17, 2004 at the Pickaway County District Public Library, 1160 North Court Street, Circleville, Ohio 43113. Ohio EPA confirmed that the library was maintaining the public repository and 23 individual documents were available regarding environmental activities at the PPG Circleville facility.

2.4. O&M Costs

O&M costs were not specifically evaluated by Ohio EPA as part of this review.

2.5. Access and Institutional Controls

2.5.1. Fencing

The PPG Circleville facility relied upon fencing around the entire facility to limit access to the buried pond residue area (PSA-2). Access within the fence is limited by a guarded entrance. During the inspection, observed portions of the fence were in good condition.

2.5.2. Other access restrictions

No other access restrictions were observed regarding PSA-2.

2.5.3. Institutional controls

PPG relied upon deed restrictions for both PSA-2 and for neighboring properties impacted by the off-property ground water contamination where negotiations were successful. In cases where negotiations were not successful, PPG has relied upon alternative measures, as provided for in the 2000 decision document, including notification letters to inform neighboring properties regarding ground water conditions and periodic inspections to watch for potential well installation activities. Additional details regarding the institutional controls are discussed in Section 3.

2.5.4. General

2.5.4.1. Vandalism/trespassing

No issues regarding vandalism/trespassing were observed during the site inspection.

2.5.4.2. Land use issues

Land use has been relatively consistent both on and off site over the time period of the five-year review.

2.6. General Site Conditions

The PPG Circleville facility was in operation during the period of the five-year review. Roadways were in good condition.

2.7. Landfill Covers

2.7.1. Landfill surface

The PSA-2 area was observed to be grass-covered and in relatively good condition without evidence of settlement, cracks, erosion, holes, bulges, or wet or water damaged areas. The landfill area is relatively flat and no slope instability issues were noted. PSA-2 has no benches or letdown channels. PSA-2 has no gas collection, detention or sedimentation ponds, retaining walls or perimeter ditches.

2.8. Groundwater/Surface Water Remedies

2.8.1. Ground water extraction wells, pumps, pipelines

The off-property ground water remedial action relied upon institutional and engineering controls, ground water extraction, and long-term monitoring. The extraction system initially relied exclusively on DuPont pumping wells located west of Route 23. These wells supplied water for operations at the DuPont facility. After use, the water was routed to DuPont's treatment plant operated under an NPDES permit and discharged to the Scioto

River. PPG and DuPont have signed a “Groundwater Use/Notification Agreement” dated September 2, 1998 to allow for specified access and information for plume capture. The agreement provides for a 20-year term automatically renewed annually thereafter.

PPG installed two extraction wells on DuPont property, which began operation during the fall of 2004. These wells were installed because DuPont discontinued a product line, which reduced their water needs. Also, because the two extraction wells were installed specifically for plume extraction, they could be optimally positioned in accordance with plume location. The two new wells discharged to the Scioto River through a pipeline constructed along a right of way owned by PPG. PPG obtained an NPDES permit for this surface water discharge. Based on allowable surface water limits, the concentrations of 1,4-dioxane in the water extracted in these two wells is such that it could be discharged to the Scioto River without treatment. During the inspection, the two extraction wells were observed (Photographs 16, 17, 18, 19, and 20). Also the inspection team walked along the pipeline to the Scioto River and observed the NPDES discharge point (Photographs 23, 24, 25, and 26).

One concern has been protection of the Earnhart Hill public water system well field from the 1,4-dioxane-impacted ground water. Use of the existing DuPont wells for the off-property ground water remedy was cost effective because the wells were in place and pumping was already underway with water used for DuPont operations. However, the pumping wells were not ideally placed for plume extraction. One result was that it appears that the northern most DuPont pumping well both extracted water and drew impacted water further north, closer to the Earnhart Hill well field. During the period of the five-year review, PPG took several actions to protect the Earnhart Hill well field including voluntary ground water monitoring at wells associated with the Earnhart Hill well field and installation of the two new extraction wells. During the period of this five-year review, 1,4-dioxane was not detected in the Earnhart Hill public water system wells.

2.8.2. Surface water collection structures, pumps, and pipelines

There is no surface water collection that is part of site remedial actions.

2.8.3. Treatment system

The water pumped by the DuPont wells is discharged to the Scioto River after use. The water passes through DuPont’s treatment plant under a NPDES permit. The water pumped by the PPG wells is discharged to the Scioto River via a pipe installed for this purpose leading from the wells following a right-of-way owned by PPG leading to the Scioto River. Because the discharge concentrations were well below allowable discharge concentrations to the Scioto River, PPG was able to obtain a NPDES permit allowing discharge without treatment.

2.8.4. Monitoring data

Between January 10, 2002 and January 9, 2007, PPG performed ground water monitoring on ten occasions. 1,4-dioxane showed overall increases in concentrations up until the startup of the two extraction wells in 2004. After pumping began, the concentrations decreased in all wells except CWP-23I, which had an increasing trend. During this time period, the risk-based action level for 1,4-dioxane was exceeded in DuPont Wells P-4 and P-6, CWP-23I, CWP-26I and CWP-27DL.

Total volatile organic compounds (VOCs) decreased or remained stable in all sampled wells. Exceedance of maximum contaminant levels (MCLs) for ethylbenze and xylene occurred only in WP-35S.

Water levels and inferred ground water flow direction remained consistent with historical measurements during this time period.

2.8.5. Monitored natural attenuation

The primary chemical of concern that resulted in off-property ground water contamination is 1,4-dioxane. This compound is relatively resistant to microbiological degradation. However, it is infinitely soluble in water and therefore, dispersion, over time, has helped reduce concentrations.

The primary chemicals of concern in ground water related to PSA-2 include ethylbenzene, toluene and total xylenes, which are susceptible to microbial degradation. Historically, the VOC plume extent has remained relatively stable likely due to natural attenuation, the limited lateral extent of the uppermost aquifer and the presence of an underlying, relatively impermeable, clay layer.

2.9. Other Remedies

No other remedies have been implemented at the site.

2.10. Overall Observations

2.10.1. Implementation of the remedy

During the period of the five-year review, the remedy has been implemented in accordance with the 1989 orders and the 2000 decision document.

2.10.2. Adequacy of O&M

During the period of the five-year review, the remedy has been implemented in accordance with the 1989 orders and the 2000 decision document.

2.10.3. Early indicators of potential remedy problems

The biggest concern regarding the remedy has been the encroachment of the 1,4-dioxane plume on the Earnhart Hill public water system well field. The concentrations in this area are well below the 35 ug/L ground water risk-based action level. PPG has acted to avoid any detectable concentration in the Earnhart Hill public water supply. Within the time frame of this five-year review, PPG has responded taking several steps to address this issue. PPG began monthly then bimonthly sampling of several wells in the vicinity of the Earnhart Hill public water system to better understand plume behavior in this area. PPG also installed the two extraction wells and discharge system in response to the drop in pumping quantities on the part of DuPont.

During the site inspection, ground water monitoring locations were visited by the inspection team. Some issues were noted regarding the condition of monitoring wells. As noted by the inspection team, monitoring well caps were missing at MW-25DU and MW-25S. The furthest west of the MW-25 well cluster had been damaged by farming operations. Also, in several cases, the concrete pad surrounding the monitoring well had cracked, which could allow surface water to enter the annular space. See Photographs 6, 7, and 15 showing conditions at Monitoring Wells CWP-23, CWP-26, and CWP-23, respectively. These issues need to be addressed as part of ongoing O&M activities.

2.10.4. Opportunities for optimization

During the period for the five-year review, the only major modification was the installation by PPG of the two new extraction wells on DuPont property to improve extraction of the plume.

3. Review of Performance Standards

The 2000 decision document described performance standards for the selected remedies for PSA-2 and ground water. The following table was assembled to compare performance standards in the 2000 decision document with events over the period of the first five-year review.

Performance standard	Findings from five-year review
PSA-2 - Performance standards for Soil Alternative 2, institutional controls with monitoring	
• Institutional and engineering controls must be effective, be maintained and include periodic evaluation of current property uses, and future building plans. Institutional and engineering controls will achieve performance standards if:	
1. There remains a legal	PPG initially provided a draft deed restriction for

Performance standard	Findings from five-year review
restriction for industrial use of the PPG property.	PSA-2 to Ohio EPA on December 20, 2004. The institutional control for this 0.661 acre portion of PPG's property was finalized as an environmental covenant recorded July 6, 2007 with the Pickaway County recorder.
2. Fences, security, education, programs, cover soil, and vegetation are maintained.	The PPG perimeter fence and guarded security gate were observed during the site inspection. The PSA-2 soil cover and vegetation were observed to be in good condition. PPG provides a checklist with quarterly reports that document issues regarding institutional controls and engineering controls. The institutional controls addressed on the checklist include the PSA-2 education program, occurrence of development activities, and changes to land use restrictions on property deed. The engineering controls addressed on the checklist include fence condition, soil or vegetation cover, and the need for repair or maintenance. No issues have been noted on these checklists.
3. A means to detect and correct within 90 days is employed.	The quarterly reporting frequency allows for detection and correction within 90 days.
• No impacts to ground water occurring above U.S. EPA, maximum contaminant levels (MCLs) or risk-based cleanup levels (hazard quotient less than 1 and concurrent risk of 1 x 10^{-5})if no MCL exists. Compliance will be documented through the long-term ground water monitoring program. Exdeedances of cleanup levels at the edge of PSA-2 will require a re-evaluation of the selected remedial alternative.	Ground water monitoring results indicated that concentrations of 1,4-dioxane continued to exceed the 35 ug/L action level at the end of the five-year review period. Concentrations of 1,4-dioxane below the action level encroaching on the Earnhart Hill well field led to additional actions including installation of two extraction wells.
• Continuous monitoring and evaluation activities for as long as the soil contamination remains in place. No restrictions will be necessary when risk-based clean up goals for soil are met for unrestricted uses. All monitoring, evaluation activities, notification and appropriate work plans are required should future development be considered for PSA-2.	No development activities have occurred at PSA-2.
Ground Water, Institutional Controls, Existing Extraction, and Monitoring	
• Institutional and engineering controls will be effective, be maintained, and include an evaluation of compliance, property ownership, property uses and development plans. This will also include periodic evaluation of the	DuPont discontinued a product line reducing water needs. As a result, PPG installed two extraction wells to augment the loss in pumping by DuPont. The wells are located on DuPont property. The wells discharge though a pipeline to the Scioto River under an NPDES permit with

Performance standard	Findings from five-year review
pumping agreement with DuPont to ensure appropriate production rates are maintained and to monitor contaminant concentrations. Institutional and engineering controls will achieve performance standards if:	no treatment. Ohio EPA received drawings and specifications for the new wells on February 20, 2004. The wells were in operation by September 2004.
1. There remains a legal prohibition against ground water use for potable purposes.	PPG was able to establish institutional controls limiting groundwater use for Circleville Plastics in 2000, for Night Owl Trucking in 2000, and for the Colomet/AEP/Hannon estate property in 2004. However, negotiations were not successful establishing institutional controls limiting ground water use for the Don Goodchild property or the Marathon Oil property. Therefore, PPG used alternative procedures, as provided for under the 2000 decision document, including notification about the 1,4 dioxane contaminated ground water and regulatory requirements regarding its non-potable use. However, there has not been a mechanism for Ohio EPA to receive copies of these notifications for documentation purposes. It is recommended that Ohio EPA receive copies of notifications with quarterly reports. PPG has also indicated that they have watched for indications of well installation activities at these properties without institutional controls during other work on site.
2. Owners and/or users are made aware of restrictions and the need for them, at least annually, including regulatory requirements for the non-potable use of 1,4-dioxane-contaminated ground water.	PPG has indicated to Ohio EPA that they notified property owners regarding groundwater conditions. However, there has not been a mechanism for Ohio EPA to receive copies of these notifications for documentation purposes. It is recommended that Ohio EPA receive copies of notifications with quarterly reports.
3. A means to detect and correct violations within 90 days is employed.	The quarterly reporting frequency allows for detection and correction within 90 days.
• Future industrial ground water users will not alter current plume dimensions. The plume will be defined by concentrations that exceed the risk-based cleanup standards. The plume will not be substantively modified by future industrial pumping anywhere in or around the existing plume. All current and future property owners or lessees above or near the plume will be notified that ground water is contaminated and pumping for industrial uses could impact the plume and the extracted ground water must be property handled and disposed. Technical assistance and ground water modeling to establish the potential impacts of additional	During the period of the five-year review, no industrial ground water users moved into the area. Other than DuPont, the one major groundwater user in the area is the Earnhart Hill public water system well field located north of DuPont. No impacts to the Earnhart Hill well field were reported during the five-year review period. However, subsequent to the five year-review period, PPG worked with Earnhart Hill after possible concentrations below detection limits were observed in analytical results from one well. PPG has indicated to Ohio EPA that they notified property owners regarding ground water conditions. However, there has not been a mechanism for Ohio EPA to receive copies of these notifications for documentation purposes.

Performance standard	Findings from five-year review
pumping due to ground water uses for industrial purposes are required. Any additional assistance to neighboring property owners or lessees to develop future ground water uses without impacting the plume must also be considered.	It is recommended that Ohio EPA receive copies of notifications with quarterly reports.
• A long-term ground water monitoring program must include ground water monitoring wells located within the highest concentrations of the plume, at the edges of the plume and outside the plume. The monitoring program will be used to:	During the five-year review period, monitoring of ground water continued in accordance with the Long Term Groundwater Monitoring Plan dated February 28, 2002.
1. Confirm the fate and transport model of residual soil contamination at PSA-2.	Ground water monitoring was performed downgradient of PSA-2 in Monitoring Wells WP-33-S, WP-22-S, and CWP-23-S in accordance with the Long Term Groundwater Monitoring Plan dated February 28, 2002.
2. Assess contamination within the shallow, intermediate, and deep ground water zones, both on- and off-property.	During the five-year review period, monitoring of ground water continued in accordance with the Long Term Groundwater Monitoring Plan dated February 28, 2002. .
3. Assess the results of the remedial investigation ground water modeling.	The ground water model was modified to include the two new extraction wells installed in 2004. The predicted time frame for cleanup of 1,4-dioxane to below the action level was revised by PPG from 10-20 years to 8 years after taking into account the influence of the extraction wells and the reduction in pumping of the DuPont wells on regional ground water flow. PPG reported that monitoring data indicated that “the 1,4-dioxane plume is migrating and attenuating as expected per the conceptual model.” No changes were made to the conceptual site model. There has been no mechanism for Ohio EPA to receive detailed documentation of the ground water flow and fate and transport modeling results each time the model is evaluated and/or updated by PPG. It is recommended that PPG submit appropriate documentation. Guidance on types of data to be documented and submitted is available on the DDAGW website at http://www.epa.ohio.gov/ddagw/tgmweb.aspx
4. Determine that current exposure pathways remain unchanged.	During the five-year review period, exposure pathways remained unchanged.
5. Determine the horizontal and vertical extent of contamination to below detection limit values.	The Long Term Groundwater Monitoring Plan included monitoring wells designed to determine the horizontal and vertical extent of contamination.
Appropriate steps shall be taken to prevent exposures to human health or	DuPont’s reduction in pumping quantities resulted in PPG’s decision to install two new

Performance standard	Findings from five-year review
the environment should the long-term monitoring program indicate significant changes form the site conceptual model of the remedial investigation report.	extraction wells on DuPont property.
• A long term surface water monitoring program. The water quality of the discharge and the downstream reach of the Scioto River will be monitored for 1,4 dioxane to determine concentrations being discharged to the river. This monitoring will be used to determine the concentration of contaminant transferred to the river. Action by PPG will be necessary if DuPont's NPDES discharge limit for 1,4 dioxane is exceeded. Surface water monitoring will continue until no further action is required for the off-property plume.	During the five-year review period, samples were collected from the Scioto River. There has been no mechanism for Ohio EPA (DERR) to receive water quality data for the discharge from the extraction wells to the Scioto River. It is recommended that a summary table of these data be included in five-year review reports and in future ground water monitoring reports.

PHOTOGRAPHS

SITE INSPECTION – PPG CIRCLEVILLE

MAY 9, 2006

Photograph 1: Well Cluster CWP-22

Photograph 2. Well Cluster CWP-22 west of Georgia Pacific

Photograph 3: Circleville Plastic production wells near north end of Night Owl Trucking property

Photograph 4: Well NO-1 near north end of Night Owl Trucking property

Photograph 5: Well NO-2 located near north end of Night Owl Trucking property

Photograph 6: CWP-23 well south of Circleville Plastics property

Photograph 7: Well CWP-26 showing cracking of pad

Photograph 8: Well CWP-26DL

Photograph 9: Well CWP-26

Photograph 10: Well Cluster CWP-26

Photograph 11: Well Cluster CWP-27 at north end of AEP property

Photograph 12: ODNR observation well near Well Cluster CWP-27

Photograph 13:Well Cluster CWP-23

Photograph 14: Well Cluster CWP-25

Photograph 15: Well CWP-23

Photograph 16: Northern PPG pumping well installed on DuPont property

Photograph 17: Spigot used for NPDES sampling for combined discharge of north and south well

Photograph 18: Northern PPG pumping well installed on DuPont property

Photograph 19: Southern PPG pumping well installed on DuPont property

Photograph 20: Power supply control for southern PPG pumping well

Photograph 21: Well MW-10 near north end of DuPont property

Photograph 22: Well MW-9 near north end of DuPont property, well purging with Grumphos pump was under way.

Photograph 23: NPDES discharge with flow of approximately 1100 gpm

Photograph 24: NPDES discharge.

Photograph 25: NPDES discharge, riprap leading to Scioto River

Photograph 26: NPDES discharge, flow into Scioto River

Photograph 27: Well CWP 25

Photograph 28: Well CWP 23

APPENDIX B

Interview Summaries

Don Goodchild (Interview date: 11/21/06)

Don Goodchild indicated that he believes that PPG is trying to “do the right thing” with regard to the remediation. However, Don was clear that he believes that he has lost value to his property because of the groundwater issue. Don indicated that he has had the property sold twice and that the deals have fallen through due to the environmental issues. Don also suggested that he would like PPG to purchase the property “for what I had it sold for”. Don also indicated that he purchased the property in 1989, and was fully aware of the groundwater issues when he purchased it. Don indicated that Marathon Oil was aware of the environmental issues when they purchased their parcel, but that they were not concerned with them, given the intended use of the property. Don indicated that he had a concern regarding the Earnhart Hill well field and the potential for the plume to get to the EH wells.

DuPont – Jim Riley (Interview date: 11/21/06)

DuPont is very pleased with the progress of the remedial action and with the communication of PPG on the issue. Jim indicated that PPG has been proactive in managing the issue from the standpoint of the decrease in DuPont pumping. Jim is very happy with the sampling that has occurred on the DuPont property and stressed the importance of continued notification and adherence to DuPont’s safety policies.

Earnhart Hill – Dennis Williams/Brent Hayes (Interview date: 11/21/06)

Earnhart Hill is very pleased with the progress of the remedial efforts and the communication between them and PPG. EH is also pleased with the sampling efforts on their property and the general trend in the concentrations at the property line. The EH Board of Trustees is also comfortable with the success of the effort to avoid allowing contaminated groundwater to enter their well field. EH indicated that they replaced well P3 with a new well, P7, which had the same capacity as P3 had. EH will notify PPG when P7 goes on-line. EH anticipates that the demand in the well field will decrease in the next 3 years as they develop their well field to the north of Circleville.

TriMold – Todd Jones (Interview date: 1/12/07)

TriMold’s impression of the remedial activity is generally favorable. They are pleased about the communication of sampling activities and general progress. TriMold noted that they will be increasing their pumping to meet increased process needs; however they will stay within the design capacity of the existing wells. TriMold also indicated that they own the former Night Owl property.

Jason McCain – Pilot Travel Centers/Marathon Oil (Interview date: 1/12/07)

Jason McCain was somewhat familiar with the remedial activities being conducted related to the groundwater. Mr. McCain confirmed they have no drinking water wells on the property and was not aware of any groundwater use changes on adjacent properties. The project objectives of plume capture and clean-up were discussed.

Robert Huffer/Mary Hannan Estate (Interview date: 1/12/07)

Mr. Robert Huffer was aware of the remediation work being conducted related to the groundwater including the well pumping activities. Mr. Huffer confirmed no groundwater use changes on the property and indicated the property was being farmed. Mr. Huffer indicated there have been no issues associated with the sampling of wells on the property. He also indicated the groundwater issue has not caused any problems for the Hannan property and that they would be selling the property in the near future.