TRC
41 Spring St., Suite 102
New Providence, NJ 07974
T 908.988.1700
TRCcompanies.com

July 27, 2021

New Jersey Department of Environmental Protection
Bureau of Case Management
Mail Code 401-05F
P.O. Box 420
Trenton, NJ 08625-0420

Attn: Aysia Gandy, Case Manager

Re: *Site-Wide Groundwater Progress Report*
Hoffmann-La Roche Inc. Site
340 Kingsland Street
Nutley, New Jersey
SRP PI #s 009949, 614465, and 625447
TRC Project No. 105009/198233

Dear Ms. Gandy:

On behalf of Hoffmann-La Roche Inc. (Roche), TRC Environmental Corp. (TRC) is submitting the attached Site-Wide Groundwater Progress Report, dated July 27, 2021. This report presents the results of semi-annual groundwater monitoring events and monitored natural attenuation (MNA) programs completed between November 2019 and November 2020. The focus of this GWPR is to document groundwater quality along the Site perimeter and in select interior areas of the Site over the reporting period.

The field programs reported herein, were performed in accordance with the NJDEP's Technical Requirements for Site Remediation (N.J.A.C. 7:26E) and applicable NJDEP Guidance, the approved Site-Wide Groundwater Sampling Plan – IRM Implementation Period (July 2015), and associated requests for Modification of the Site-Wide Groundwater Sampling Plan – IRM Implementation Period – July 2015 (February and May 2016), Roche Remediation Road Map (September 2012), associated correspondence (NJDEP comments, Roche Response letters), and the December 2019 Groundwater Remedial Action Work Plan.

If you have any questions or need additional information, please feel free to contact Rebecca Hollender at 908-988-1710 or rhollender@trcsolutions.com, or Dan Nachman at 908-988-1637 or dnachman@trcsolutions.com.

Very truly yours,

Rebecca Hollender, LSRP (No. 585022)
Sr. Principal Consultant
TRC Environmental Corporation

Daniel Nachman
Vice President
TRC Environmental Corporation

Cc: Chandra Patel, Roche

Site-Wide Groundwater Progress Report

July 27, 2021

Nutley Site Remediation NJDEP PI ID Nos. 009949, 614465, and 625447

Prepared For:

Hoffmann-La Roche Inc.
150 Clove Road, 8th Floor, Suite 8
Little Falls, New Jersey 07424

Prepared By:

TRC
41 Spring Street, Suite 102
New Providence, New Jersey 07974

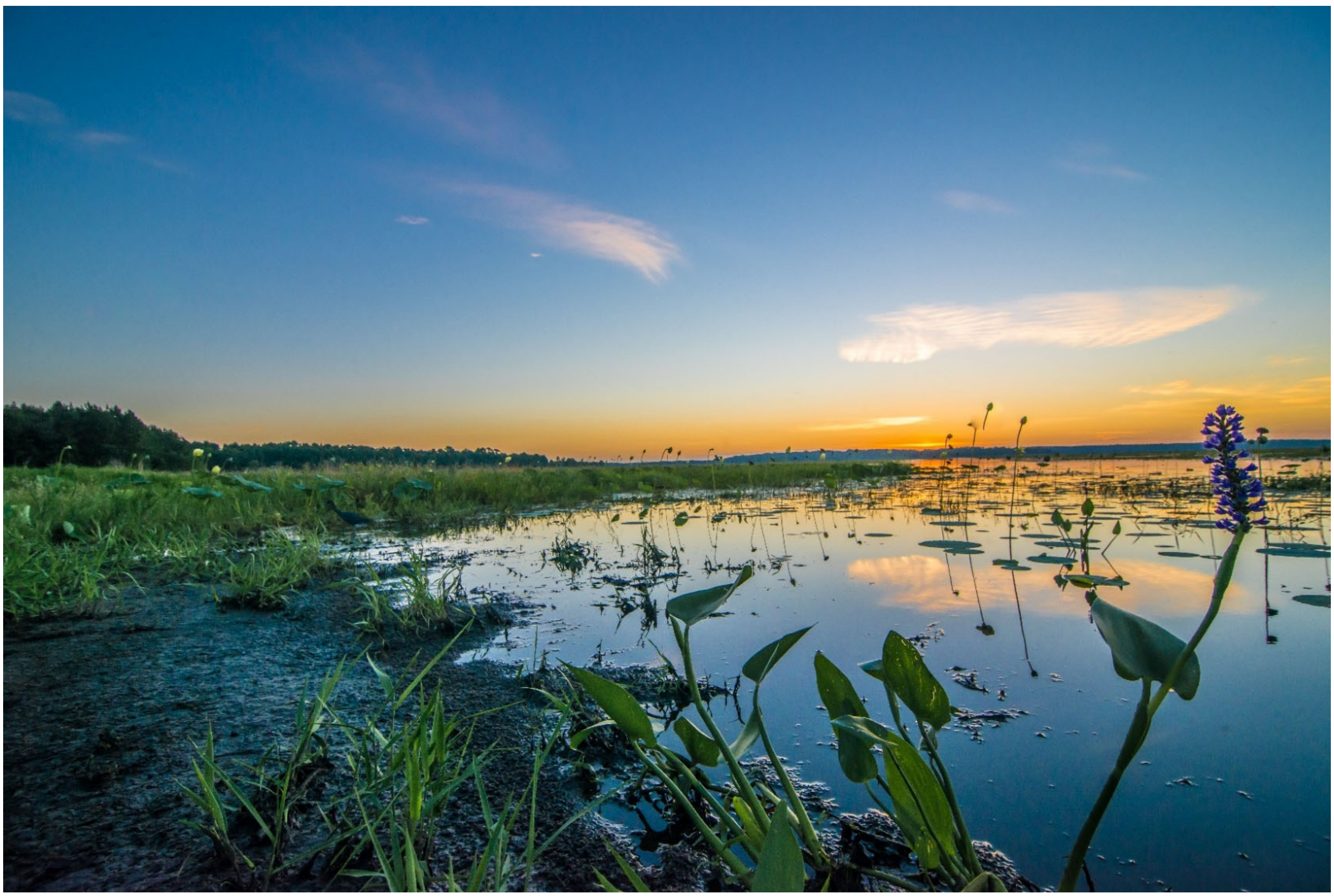

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 Overview 1
1.2 Document Organization 2
2.0 SITE BACKGROUND AND GENERAL INFORMATION 3
2.1 Site Background and History 3
2.2 Current Ownership and Site Redevelopment 3
2.3 Groundwater Contaminants of Concern 3
2.4 Areas Requiring Remedial Actions and Groundwater Monitoring 5
2.5 LTM Program Data Evaluation 5
3.0 GROUNDWATER INTERIM REMEDIAL MEASURES AND REMEDIAL ACTIONS 7
3.1 Groundwater Interim Remedial Measures (IRMs) 7
3.2 Groundwater Remedial Actions 7
4.0 TECHNICAL OVERVIEW 8
4.1 Groundwater Sampling Programs 8
4.2 Water-Level Measurements 8
4.3 Site-Wide Groundwater Sampling 9
4.4 MNA Sampling 11
4.5 Monitoring Well Decommissioning 11
4.6 Monitoring Well Installation 11
4.7 Statistical Analysis 11
4.8 Data Reliability 12
4.9 Factors Influencing Data 12
4.10 Deviation from the Technical Requirements and Guidance 13
5.0 FINDINGS FROM RECENT GROUNDWATER MONITORING 14
5.1 Groundwater Flow Regime 14
5.2 LNAPL Occurrence 14
5.3 Site-Wide Groundwater Quality Assessment 15
5.3.1 PCE+ Groundwater Results – 3Q 2019 and 3Q 2020 15
5.3.2 TCA+ Groundwater Results – 3Q 2019 and 3Q 2020 15
5.3.3 Benzene and Chlorobenzene Groundwater Results – 3Q 2019 and 3Q 2020. 16
5.3.4 Dioxane Groundwater Results – 3Q 2019 and 3Q 2020 16
5.4 Conclusion 16
6.0 REFERENCES 18

FIGURES

Figure No.	Title
1	Site Location Map
2	Monitoring Well Location Map
3	Hydrogeologic Structure
4	Site Investigative Areas and Plumes
5	November 4, 2019 Potentiometric Surface Maps with Evaluation of Groundwater Elevation Stability over Time
6	PCE+ Trends in Groundwater – 3Q 2020
7	TCA+ Trends in Groundwater – 3Q 2020
8	Benzene and Chlorobenzene Trends in Groundwater – 3Q 2020
9	1,4-Dioxane Trends in Groundwater – 3Q 2020

TABLES

Table No.	Title
1	Groundwater Sample Collection Summary – Groundwater and QC Samples
1-1	Sample Summary Table – Groundwater Samples
1-2	Sample Summary Table – Trip Blank Samples
2	Well Construction Details
3	Summary of Monitoring Wells in Hydrogeologic Units
4	Groundwater Elevation Measurements
4-1	Groundwater Elevation Measurements – November 4, 2019
4-2	Multiport Groundwater Elevation Measurements – November 4, 2019
4-3	Groundwater Elevation Measurements - September 17-October 20, 2020
4-4	Multiport Groundwater Elevation Measurements - October 12, 2020
5	Groundwater Analytical Results
5-1	Summary of Volatile Organic Compounds (VOCs) in Groundwater – 3Q 2019 (Site-Wide Monitoring Program)
5-2	Summary of Volatile Organic Compounds (VOCs) in Groundwater – 3Q 2020 (Long-Term Monitoring Program)
5-3	Summary of Volatile Organic Compounds (VOCs) in Groundwater – 3Q 2020 Supplemental Samples (Monitored Natural Attenuation Program)
5-4	Summary of 1,4-Dioxane in Groundwater – 3Q 2019 (Site-Wide Monitoring Program)
5-5	Summary of 1,4-Dioxane in Groundwater – 3Q 2020 (Long-Term Monitoring Program)
5-6	Summary of 1,4-Dioxane in Groundwater – 3Q 2020 (Monitored Natural Attenuation Program)
5-7	Summary of Volatile Organic Compounds (VOCs) in Trip Blanks – 3Q 2019 and 3Q 2020 (Site-Wide Monitoring Program and Long-Term Monitoring Program)

APPENDICES

Appendix	Title
A	Figures 5.1 and 5.2 from the *Site-Wide Groundwater Conceptual Site Model Report* (TRC and B. Kueper & Associates, Ltd., 2018)
B	CD: Well Construction Documentation B-1 Well Construction Documentation (Well Logs, NJDEP Well Permits & Records, Forms A & B) B-2 Well Decommissioning Documentation
C	PDB, RPPS, and Multiport Sampling Information and Groundwater Measurements
D	CD: Laboratory Data Reports and Electronic Data Deliverables
E	CD: Mann-Kendall Trend Analysis

ACRONYM LIST

µg/l	micrograms per liter
1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichloroethene
1,4-Dioxane	Dioxane
1,1,1-TCA	1,1,1-Trichloroethane
CAMS	Clifton-Allwood Municipal Sewer
CEA	Classification Exception Area
cis-1,2-DCE	cis-1,2-Dichloroethene
COC	Contaminants of Concern
DNAPL	Dense Non-Aqueous Phase Liquid
EDD	Electronic Data Deliverables
EDS	Electronic Data Submission
GWPR	Groundwater Progress Report
GWRAP	Groundwater Remedial Action Permit
GWRAR	Groundwater Remedial Action Report
GWRAWP	Groundwater Remedial Action Work Plan
GWRIR	Groundwater Remedial Investigation Report
GWQS	Ground Water Quality Standards
HFM	Historic Fill Material
HGU	Hydrogeologic Unit
IRM	Interim Remedial Measures
ISGWQC	Interim Specific Ground Water Quality Criterion
IA	Investigative Area
LNAPL	Light Non-Aqueous Phase Liquid
LTM	Long-Term Monitoring
MEK	Methyl Ethyl Ketone
MNA	Monitored Natural Attenuation
MTBE	Methyl Tert-Butyl Ether
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
PAH	Polycyclic Aromatic Hydrocarbon
PCE+	Tetrachloroethene, Trichloroethene, cis-1,2-Dichloroethene, and Vinyl Chloride
PCE	Tetrachloroethene
PDB	Passive Diffusion Bag
PID	Photoionization Detector

RA	Remedial action
RI	Remedial investigation
Roche	Hoffmann-La Roche Inc.
RPPS	Rigid Porous Polyethylene Sampler
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
SIM	Selective Ion Monitoring
SVOC	Semi-Volatile Organic Compound
TICs	Tentatively Identified Compounds
TCA+	1,1,1-Trichloroethane, 1,1-Dichloroethane, and 1,1-Dichloroethene
TCE	Trichloroethene
TRC	TRC Environmental Corp.
TRSR	Technical Requirements for Site Remediation
USEPA	United States Environmental Protection Agency
VC	Vinyl Chloride
VOC	Volatile Organic Compound

1.0 INTRODUCTION

On behalf of Hoffmann-La Roche Inc. (Roche), TRC Environmental Corp. (TRC) has prepared this Site-Wide Groundwater Progress Report (GWPR) for submission to the New Jersey Department of Environmental Protection (NJDEP) for the 120-acre former Roche facility (Site) located at 340 Kingsland Street, in Nutley, New Jersey (Figure 1).

1.1 Overview

The groundwater data presented in this report were collected during the reporting period of July 2019 through November 2020.

This is the seventh GWPR submitted to the NJDEP since the completion of the Remedial Investigation (RI) and submission of the *Site-Wide Groundwater Remedial Investigation Report* (GWRIR) dated April 2, 2014 (TRC, 2014). Previous GWPRs include the following NJDEP submissions:

1. January 2015 Site-Wide GWPR (TRC, 2015a);
2. December 2015 Site-Wide GWPR (TRC, 2015c) and Addendum (TRC, 2016a);
3. January 2017 Site-Wide GWPR (TRC, 2017a);
4. November 2017 Site-Wide GWPR (TRC, 2017b);
5. February 2019 Site-Wide GWPR (TRC, 2019a); and
6. January 2020 Site-Wide GWPR (TRC, 2020a).

Following submission of the April 2014 Site-Wide GWRIR (TRC, 2014), groundwater sampling of all monitoring wells was completed on a quarterly basis. During the implementation of groundwater Interim Remedial Measures (IRMs) at multiple Investigative Areas (IAs)[1], Roche submitted a request to the NJDEP in November 2016 to reduce the existing groundwater sampling program (*i.e.*, *Modification to the Site-Wide Groundwater Sampling – Interim Remedial Measures [IRMs] Implementation Period Rev. 1 – July 13, 2015*) (TRC, 2016b)[2]. The NJDEP approved this plan on December 21, 2016.

In December 2019, Roche submitted the *December 2019 Groundwater Remedial Action Work Plan* (GWRAWP) (TRC, 2019m), which summarized the effectiveness of the IRMs in reducing the contaminant mass in the source areas of six on-Site plumes (Remedial Action Plumes), and proposed Monitored Natural Attenuation (MNA) as the final remedy for residual exceedances of NJDEP's Class IIA Ground Water Quality Standards (GWQS) in those six plumes. Roche also agreed to implement remedial action (RA) at a seventh Remedial Action Plume, which starts off-Site at the municipal sewer in Windsor Place and spreads beneath a portion of the Site[3]; this plume (referred to as the Windsor Place Sewer Plume) was called in as a separate off-Site plume and was assigned a separate Case Number (21-04-30-1515-52).

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[1] To manage the investigation of the large Site, Roche divided the Site into 15 IAs, as shown on Figure 4.
[2] The revised groundwater sampling plan (Site-Wide Monitoring Program) modified the sampling frequency from a quarterly to a semi-annual basis and reduced the list of sampled wells from all on-Site and off-Site wells installed by Roche (more than 800 wells) to approximately 168 wells.
[3] Groundwater quality data from select wells in the area of this seventh plume are also included in this GWPR.

For other plumes that migrate onto or are beneath the Site (Monitored Plumes), Roche agreed to continue to monitor these plumes, and proposed a new network of monitoring wells (*i.e.*, the Long-Term Monitoring [LTM] Program[4]) to replace the former IRM-based Site-Wide Monitoring Program. The LTM Program was proposed in the December 2019 GWRAWP. Pending NJDEP approval of the December 2019 GWRAWP, the Site-Wide Monitoring Program was suspended following the December 2019 GWRAWP submission, and Site-wide groundwater sampling was not completed in 1Q or 2Q 2020.

The December 2019 GWRAWP was approved by the NJDEP on August 20, 2020. Following NJDEP approval of the December 2019 GWRAWP, the first sampling event under the LTM Program was implemented in October 2020 (hereinafter 3Q 2020[5]). The results of this first LTM event are included in this GWPR.

Additionally, as described in the December 2019 GWRAWP, a program of eight quarters of sampling was conducted between 1Q 2019 and 4Q 2020 to evaluate MNA as a potentially viable remedy for the six on-Site Remedial Action Plumes[6].

1.2 Document Organization

This document is organized into the following sections:

- Section 2.0 provides the most recent Site background information;
- Section 3.0 provides a brief overview of the Site's groundwater IRM programs and RAs;
- Section 4.0 provides a technical overview (scope/methods) of the completed groundwater programs;
- Section 5.0 provides the findings for Site-wide groundwater monitoring programs, including an evaluation of groundwater elevations and groundwater quality; and
- Section 6.0 provides a list of references.

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[4] Under the LTM Program as currently designed, approximately 220 wells will be sampled semi-annually for 2 years or until the Groundwater Remedial Action Permit (GWRAP) is issued, then annually for 4 years afterward and every 2 years for the following 4 years. The collection of synoptic Site-wide groundwater levels is discontinued under this program. Instead, water-level trends in select wells will be evaluated from groundwater-level measurements collected during sample collection activities.

[5] Semi-annual sampling events for the Site are typically completed in March (1st Quarter [1Q]) and in September (3rd Quarter [3Q]). Field implementation of the first LTM event was delayed and began in October but is considered a 3rd Quarter semi-annual sampling event for consistency with previous and planned Site groundwater sampling events.

[6] A summary of the complete eight quarter MNA sampling program will be provided in a Groundwater Remedial Action Report (GWRAR), to be submitted under separate cover later in 2021.

2.0 SITE BACKGROUND AND GENERAL INFORMATION

2.1 Site Background and History

A comprehensive Site background (including Site description and history, physical setting, and historical regulatory compliance and deliverables) was provided in the April 2014 Site-Wide GWRIR and subsequent GWPRs.

During the RI and subsequent work, Roche installed monitoring wells at various depths. Monitoring wells have been assigned vertically to distinct Hydrogeologic Units (HGUs). The HGU concept, and the rationale for selecting depth intervals for the HGUs, are explained in a previous GWPR (TRC, 2019a). A cross-section depicting the hydrogeologic structure and the HGUs is provided on Figure 3.

2.2 Current Ownership and Site Redevelopment

Roche officially ceased all business operations at the Site in December 2013 and sold the property to a developer in September 2016. Most of the former Roche on-Site buildings have been demolished, and a new property owner is redeveloping the Site for mixed use, including a medical school.

To facilitate Site redevelopment activities, several wells no longer needed for future monitoring were decommissioned during this reporting period (and two replacement monitoring wells were installed). Refer to Sections 4.1 , 4.5, and 4.6 for monitoring well installation, well sampling, and well decommissioning information. Figure 2 provides the location of all former Roche buildings, but is not updated to reflect recent Site redevelopment.

2.3 Groundwater Contaminants of Concern

During the 2013 RI and supplemental investigations (2014-2017), a total of 59 confirmed Site-specific contaminants of concern (COCs)[7] were identified in groundwater samples collected from monitoring wells installed at and surrounding the Site. The list of Site-specific COCs included volatile organic compounds (VOCs) (primarily chlorinated VOCs), semi-volatile organic compounds (SVOCs), pesticides, and metals. The SVOC, pesticide, and metal exceedances in groundwater were attributed to impacted historic fill material (HFM) placed throughout most of the Site and/or from naturally occurring conditions. In March 2017, the NJDEP established a HFM Classification Exception Area (CEA) (NJDEP, 2017), eliminating Roche's obligation to monitor or remediate those HFM-related SVOCs, pesticides, and metals.

As described in the NJDEP-approved April 2018 *Semi-Volatile Organic Compound Groundwater Sampling Report* (TRC, 2018), hexachlorobenzene, 2-methylnaphthalene, 2-methylphenol, 3&4-

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[7] Any chemical compound detected in groundwater at a concentration that exceeds the NJDEP GWQS for Class IIA Aquifers (N.J.A.C. 7:9C) is defined as a groundwater contaminant of concern (COC). In November 2015, the NJDEP revised the Interim Specific Ground Water Quality Criterion (ISGWQC) for 1,4-dioxane (dioxane), reducing the ISGWQC from 10 micrograms per liter (µg/L) to 0.4 µg/L. Laboratory analyses associated with monitoring events after November 2015 achieved the lower contaminant detection limits for dioxane, which allowed for the detection of this compound at or below the established 0.4 µg/L ISGWQC. Effective January 16, 2018, the NJDEP adopted amendments to the GWQS rules (N.J.A.C. 7:9C). As part of this change, the dioxane 0.4 µg/L ISGWQC became a specific GWQS and is now listed in N.J.A.C. 7:9C Appendix Table 1.

methylphenol, and pentachlorophenol are no longer present in Site groundwater at concentrations above the GWQS.

The table below summarizes the current list of Site-specific groundwater COCs, which has been revised to exclude the remediated contaminants, as well as the HFM-related constituents and other SVOCs discussed above.

VOCs†	SVOCs‡
1,1,1-Trichloroethane (1,1,1-TCA)	Tentatively Identified Compounds (TICs)
1,2,4-Trichlorobenzene	
1,1-Dichloroethane (1,1-DCA)	
1,1-Dichloroethene (1,1-DCE)	
1,2-Dichloroethane	
Methyl Ethyl Ketone (MEK)	
Acetone	
Benzene	
Bromodichloromethane	
Carbon disulfide	
Carbon tetrachloride	
Chlorobenzene	
Chloroethane	
Chloroform	
cis-1,2-Dichlorethene (cis-1,2-DCE)	
Cyclohexane	
Ethylbenzene	
Methyl Tert-Butyl Ether (MTBE)	
Methylcyclohexane	
Methylene chloride	
Tetrachloroethene (PCE)	
Toluene	
trans-1,2-Dichloroethene	
Trichloroethene (TCE)	
Vinyl chloride (VC)	
Xylenes (total)	
1,4-Dioxane (Dioxane)	
TICs	

† The following VOCs have only been detected at a concentration above their respective GWQS once in a limited number of monitoring wells since the 2013 monitoring period: 1,1,2,2-tetrachloroethane, 1,2-dibromoethane, 1,2-dichloropropane, 1,3-dichloropropene (total), bromomethane, chloromethane, and dibromochloromethane. These compounds are therefore not considered Site-specific COCs and have been excluded from the above table.

‡ The groundwater contaminants captured under the HFM CEA have been excluded from this table. Specifically the following polycyclic aromatic hydrocarbons (PAHs) were removed from the SVOC column: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene; as well as all identified metal exceedances including aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, iron, lead, manganese, nickel, sodium, thallium, and zinc; and exceeding pesticides dieldrin, lindane, and chlordane. Likewise, SVOCs no longer present after remediation of Site groundwater were also excluded from this table, namely hexachlorobenzene, 2-methylnaphthalene, 2-methylphenol, 3&4-methylphenol, and pentachlorophenol.

2.4 Areas Requiring Remedial Actions and Groundwater Monitoring

This report (and previous GWPRs) uses the term "plume" to refer to areas where groundwater contaminants exceed the GWQS, and to depict the overall extent of contaminant distribution at on- and off-Site locations for a specific group of chemicals. The December 2019 GWRAWP identified the following plumes of on-Site origin (Remedial Action Plumes) that were subject to IRM and RA activities, and associated groundwater monitoring (including groundwater elevation measurement and groundwater sampling):

Plumes attributable to on-Site activities (Remedial Action Plumes):

- IA-9 Pipe Trench Area Plumes;
- IA-2 Tank Farm Area Plume;
- IA-6 Chlorobenzene Plume;
- IA-10 Building 104 Area Plume;
- IA-10 Building 70 Area Plume; and
- On-Site Dioxane Plume.

Roche, at the request of the NJDEP, agreed to assume responsibility for an off-Site plume, the Windsor Place Sewer Plume, that emanates from a source area directly under a small municipal sewer line that runs down a Nutley street. This release was called into the NJDEP's Hot Line and assigned a separate Incident Number (21-04-30-1515-52) and will be remediated as a separate case with its own regulatory deadlines.

Roche identified four discrete on-Site VOC plumes that emanated from breaches in the Clifton-Allwood Municipal Sewer (CAMS) that runs north to south through the center of the former Roche Site. Roche did not discharge any wastes to the CAMS. Even though Roche was not responsible for these releases, Roche implemented aggressive IRMs at these four plumes and greatly reduced the contaminant mass in each of the four source areas.

Roche has identified several plumes migrating onto the Site from off-Site sources. Some of these plumes emanate from known contaminated sites. The case numbers for these known contaminated sites and the incident numbers for other off-Site plumes will be provided in the Groundwater Remedial Action Report (GWRAR) that will be submitted separately later in 2021. Roche has agreed to monitor these plumes as they migrate onto, under, and downgradient of the Site. These off-Site plumes, together with the four on-Site CAMS plumes, are collectively referred to as the Monitored Plumes. The outlines of the Remedial Action Plumes (which incorporates the Windsor Place Sewer Plume), and the Monitored Plumes are shown on Figure 4.

2.5 LTM Program Data Evaluation

The 3Q 2020 samples were the first samples collected under the LTM Program. Unlike previous reporting associated with the Site-Wide Sampling Program, sampling analytical results collected under the LTM Program are presented on figures to show contaminant trends over time by parameter suite (PCE+[8], TCA+[9], chlorobenzene and benzene, and 1,4-dioxane [dioxane]) for each HGU, providing a comprehensive presentation of groundwater contaminant plume stability and remedial progress.

[8] PCE+ refers to tetrachloroethene (PCE) and its associated degradation products: trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride (VC).

[9] TCA+ refers to 1,1,1-trichloroethane (1,1,1-TCA) and its associated degradation products: 1,1-dichloroethane (1,1-DCA) and 1,1-dichloroethene (1,1-DCE).

3.0 GROUNDWATER INTERIM REMEDIAL MEASURES AND REMEDIAL ACTIONS

Following submission of the April 2014 GWRIR, groundwater IRMs were implemented from 2015 through 2019, resulting in significant reduction of COC concentrations in the source areas of the six on-Site Remedial Action Plumes and the four on-Site CAMS plumes. Following the implementation of the groundwater IRM programs, the December 2019 GWRAWP proposed RAs to address contaminant concentrations in the six on-Site Remedial Action Plumes remaining in excess of the GWQS following the completion of the IRM programs. These IRMs and RAs are summarized below.

3.1 Groundwater Interim Remedial Measures (IRMs)

The groundwater IRMs targeted treatment in the following on-Site plumes: the IA-9 Pipe Trench Area Plumes (PCE+ and toluene), the IA-2 Tank Farm Area Plume (benzene, chloroform, and methylene chloride), the IA-6 Chlorobenzene Plume (chlorobenzene and PCE+), the IA-10 Building 104 Area Plume (PCE+), the IA-10 Building 70 Area Plume (benzene), and the On-Site Dioxane Plume (dioxane, benzene, and toluene).

In addition, Roche implemented IRMs to address elevated PCE+ constituents in plumes emanating from the CAMS (CAMS IA-12 Plume, CAMS IA-3/IA-7 North Plume, CAMS IA-7 South Plume, and CAMS IA-11 Plume), even though Roche never discharged wastes to the CAMS, nor was Roche responsible for the discharges from the CAMS. These plumes are shown on figures provided in Appendix A.

IRM implementation activities and associated performance monitoring data were documented in previous groundwater IRM Progress Reports (TRC, 2017c; 2019b; 2019c; 2019d; 2019e; 2019f; 2019g; 2019h; 2019i; 2019j; 2019k; 2019l; 2020c).

3.2 Groundwater Remedial Actions

The IRMs implemented at the source areas of each of the six on-Site Remedial Action Plumes significantly reduced contaminant mass and concentrations. The remedy proposed in the December 2019 GWRAWP for the residual groundwater exceedances in those six plumes is MNA. The results of the MNA sampling program will be provided and discussed in the GWRAR.

The LTM Program described in the NJDEP-approved December 2019 GWRAWP will monitor groundwater quality conditions in the Remedial Action Plumes (as part of the MNA remedy) and will continue to assess the stability of the Monitored Plumes.

4.0 TECHNICAL OVERVIEW

This section provides a technical overview of the groundwater sampling and gauging activities completed at the Site during the reporting period. Table 1 provides a sample collection summary (including the quality assurance [QA] and quality control [QC] samples). Detected concentrations were compared with NJDEP GWQS for Class IIA Aquifers (New Jersey Administrative Code [N.J.A.C.] 7:9C).

4.1 Groundwater Sampling Programs

A description of the implemented groundwater sampling methodologies and field activities is provided below. Table 2 provides a summary of well construction details. Table 3 lists the established HGUs and the total number of on- and off-Site monitoring wells associated with each of them. NJDEP well reporting forms for wells (permits, records, Forms A and B, and decommissioning reports) detailing well construction are included in Appendix B. Figure 2 shows the location of on- and off-Site monitoring wells included in the 3Q 2020, MNA, and LTM sampling programs.

The field sampling forms, Electronic Data Deliverables/Electronic Data Submission (EDD/EDS), and laboratory reports associated with the sampling programs described below are included in Appendices C and D.

4.2 Water-Level Measurements

On November 4, 2019, synoptic water-level measurements were collected from accessible monitoring wells (nearly 600 Roche-owned wells) consistent with the procedures described in the *Site-Wide Groundwater Sampling Plan – Interim Remedial Measures (IRM) Implementation Period Rev. 1 – July 13, 2015* (TRC, 2015b). The groundwater elevation measurements for this event are provided in Table 4-1.

Prior to initial water-level measurements, the integrity of each well was inspected, and a photoionization detector (PID) was used to screen the well opening for the presence of volatile gases. An oil-water interface probe was used to record depth-to-water measurements from established surveyed points and to assess for the potential presence of light non-aqueous phase liquid (LNAPL) in each well[10].

Groundwater gauging also included measurements collected at the four Westbay multiport wells (DW-65, DW-69, DW-70, and DW-72) using Westbay's proprietary pressure transducer system. The pressure transducer is lowered to the sample port, where it engages and seals the sampling port. The sampling port is then opened, allowing the hydrostatic pressure at the sampling port to be directly measured and recorded. Following collection of the pressure measurement, the sample port is closed again. The measured hydrostatic pressure is subsequently converted to equivalent depth to water, correcting for atmospheric pressure at the time of the hydrostatic pressure measurement, and groundwater elevation values are then calculated. The calculated groundwater elevation measurements are included in Table 4-2. The individual depth to water measurements collected at each port and the formulae used to calculate the potentiometric heads

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[10] Multiple previous gauging and sampling events have established that there is no cause to suspect the presence of dense non-aqueous phase liquid (DNAPL), and therefore the nearly 600 Roche-owned wells were not gauged for DNAPL in order to complete the synoptic groundwater gauging event in 1 field day.

(from the measured hydrostatic pressures) within the monitored HGUs are also presented in Table 4-2.

For consistency, the water levels used for the HGU groundwater elevation contour maps were generally selected from monitoring wells screening the mid-section of the HGU. Shallow groundwater is considered as the saturated zone in the overburden (where present) or in wells with an approximate screen interval within the upper 30 feet of the saturated zone; therefore, the shallow groundwater elevation contour maps (the upper-left panel of Figure 5) represent elevations of the water table, which is intercepted within the screened intervals of select wells. For HGU 5 (E and W), water levels were used from a consistent interval closer to the top of the unit owing to the undefined thickness of the unit. A discussion of the Site's groundwater flow regime is provided in Section 5.1.

Water-level measurements were collected during sampling of the LTM well network between September 28 and October 2, 2020 (Passive Diffusion Bag [PDB]/Rigid Porous Polyethylene Sampler [RPPS] deployment), and October 12 and November 13, 2020 (PDB/RPPS retrieval). Using these water-level measurements, a representative subset of LTM wells were evaluated for groundwater elevation trends[11]. Water-level trends in these select wells are shown on Figure 5. The water-level measurements collected during sampling are provided on Tables 4-3 and 4-4.

4.3 Site-Wide Groundwater Sampling

Groundwater samples were collected using PDBs for analysis of VOCs (SW-846 Method 8260C and 8260D) and RPPSs for analysis of dioxane (SW-846 Method 8260C and 8260D with selective ion monitoring [SIM]). The PDBs and RPPSs were filled with laboratory-grade deionized water and deployed at the 5-foot depth interval displaying the highest VOC or dioxane concentrations detected during vertical screening the first time a well was sampled. The PDBs and RPPSs were kept in the well to equilibrate for at least 14 days prior to removal and sample collection.

Groundwater samples were collected using Westbay's proprietary sampling system, consisting of an evacuated (*i.e.*, under vacuum) sealed stainless steel canister. This evacuated canister is lowered to the sample port, where it engages and seals the sampling port. The canister and sampling port are then both opened, allowing groundwater to flow through the sample port and into the canister under negative (vacuum) pressure. Following sample collection, the canister and sample port are closed, the canister is retrieved from the multiport well, and the collected groundwater is transferred to laboratory glassware for analysis.

All groundwater samples were submitted to Eurofins TestAmerica of Edison, New Jersey for analysis. Summary lists of groundwater samples collected during the semi-annual sampling and

[11] Instead of completing a synoptic groundwater gauging event and preparing groundwater potentiometric surface maps in association with the 3Q 2020 groundwater sampling event, groundwater elevation data collected during PDB/RPPS deployment and retrieval were evaluated on time-series plots of groundwater elevations at the subset of wells within each HGU, in order to evaluate stability of the groundwater flow regime over time. In this evaluation, the consistency of groundwater elevations (as exhibited by the subset of wells) over time indicates that groundwater flow directions and overall groundwater flow regime have also remained consistent over time, relatively unchanged from the numerous groundwater gauging events completed between 2013 and 2019.

LTM events are provided in Table 1-1[12]. Groundwater analytical data from the 3Q 2019 and 3Q 2020 sampling events are presented in Tables 5-1, 5-2, 5-4, 5-5, and 5-7. Field sampling forms are provided in Appendix C. The groundwater sampling results are discussed in Section 5.3.

3Q 2019 Sampling Event

On November 5, 2019, TRC initiated sampling activities at the on- and off-Site Westbay multiport wells, collecting groundwater samples from a total of 84 sampling ports. Between November 4, 2019 and December 10, 2019, TRC installed PDBs and RPPSs in on- and off-Site monitoring wells. Between November 21 and December 31, 2019, groundwater samples (including duplicates) were collected from 227 wells.

The following deviation from the monitoring program is noted:

- The water column in MW-286A was only 1.2 feet, therefore, samples were not collected.

3Q 2020 Sampling Event

Between September 28 and October 30, 2020, TRC installed PDBs and RPPSs in on- and off-Site monitoring wells. On October 12, 2020, TRC initiated sampling activities at the on- and off-Site Westbay multiport wells, collecting groundwater samples from a total of 26 sampling ports. Between October 13 and 20, 2020 and on November 13, 2020, groundwater samples (including duplicates) were collected from approximately 196 wells.

The following deviations from the monitoring program are noted:

- MW-24C was obstructed by an apparent rock at the time of PDB and RPPS installation and was replaced with substitute well MW-225B (MW-24C was subsequently repaired).
- At well MW-104B, the PDBs deployed were damaged during sample collection and, therefore, no sample was submitted to the laboratory for VOC analysis.
- At well MW-274A, sample collection was successful; however, it was noted that the groundwater in the well was discolored by the apparent presence of potassium permanganate, used as an injected remedial reagent at the adjoining former Deluxe Site (non-Roche) property.
- At the time of PDB and RPPS installation, MW-276B was found to be obstructed by an apparent rock that had fallen into the well; no sample was collected (MW-276B was subsequently repaired).
- At the time of PDB and RPPS installation, MW-383A was found to have been damaged (crushed), apparently by heavy equipment, and was replaced by substitute well MW-380A (MW-383A was subsequently repaired).

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[12] Except for the multiport well samples, each groundwater sample collected in 3Q 2019 and 3Q 2020 is listed as two separate entries in Table 1-1 to individually track and more easily differentiate between samples collected via PDB and RPPS methods. This approach was taken as a quality control (QC) measure to reduce potential errors in the field (*e.g.*, collecting samples, completing the chain-of-custody) and in the laboratory (*e.g.*, running the sample for the correct analytical method).

4.4 MNA Sampling

MNA sampling for the Remedial Action Plumes was initiated in 1Q 2019. With the completion of the eight MNA events in 4Q 2020, a subset of 20 MNA wells[13] (plus one additional well, MW-487A) were selected for inclusion in the LTM in future sampling events to evaluate groundwater quality trends and the long-term stability of the sources, plume axes, and fringes of each of the on-Site Remedial Action Plumes. Where available[14], the data for these 20 wells are included in the evaluation of the 3Q 2020 LTM event and figures displaying groundwater quality trends over time (Figures 6 through 9) to supplement LTM network spatial coverage. A list of the MNA samples collected and used in this GWPR is presented in Table 1-1. Groundwater analytical data from the 3Q 2020 MNA sampling event are presented in Tables 5-3, 5-6, and 5-7.

4.5 Monitoring Well Decommissioning

The current property owner notified Roche of their intention to re-grade and pave portions of the Site for development, including construction of roadways, parking lots, parking structures, and buildings. To accommodate this development, some monitoring and remedial wells that are no longer needed for MNA or LTM Program sampling were decommissioned by New Jersey-licensed drillers (HRS Drilling [Netcong, NJ] and SGS Drilling [West Creek, NJ]) under TRC supervision. Available NJDEP decommissioning reports are included in Appendix B[15]. A summary of wells decommissioned since the January 2020 GWPR is provided in Appendix B.

4.6 Monitoring Well Installation

To accommodate Site redevelopment (*i.e.*, the construction of a 175,000 square foot medical laboratory building and associated parking garage), several monitoring wells used to monitor the IA-10 Building 104 plume were decommissioned in 2018. To supplement the Site monitoring well network in this area and compensate for the wells that were decommissioned in 2018, on October 5 and 6, 2020, two replacement monitoring wells (138RI-MW1R and MW-259BR) were installed south of the newly-constructed medical laboratory building. These two replacement wells have been incorporated into the LTM network.

Well construction details are provided in Table 2. Monitoring well documentation is included in Appendix B. Refer to Table 1-1 for a summary of groundwater samples collected from these two wells.

4.7 Statistical Analysis

To evaluate groundwater contaminant concentration trends over time, wells with 3Q 2020 analytical results above the NJDEP Class IIA GWQS were evaluated statistically using Mann-Kendall trend analysis via the United States Environmental Protection Agency (USEPA) ProUCL Version 5.1 (USEPA, 2015) (Appendix E). Results from this analysis were used to determine potential temporal trends (*i.e.*, increasing, decreasing, or insufficient statistical evidence of a

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[13] Including recently installed replacement monitoring wells 138RI-MW1R and MW-259BR, as described in Section 4.6.

[14] The MNA sampling program (1Q 2019 through 4Q 2020) had a reduced laboratory analytical parameter list, targeting contaminants of concern for each of the Remedial Action Plumes evaluated. For each of the 20 MNA wells added to the LTM program, data from the 3Q 2020 MNA sampling event were used where the applicable analyses were collected under the MNA sampling program.

[15] Some decommissioning reports are still in review by the NJDEP and will be provided once available.

significant trend) of contaminant (PCE+, TCA+, benzene, chlorobenzene, and dioxane) concentrations over time. The results are presented in Appendix E by contaminant and grouped by trend. Additionally, concentration vs. date graphs are included for these wells along with locations that had any exceedance of GWQS since 2018, even if it was below the GWQS in 3Q 2020. These trend plots were used to determine if the various plumes are stable or unstable (USEPA, 2015).

To complete the Mann-Kendall analysis, analytical results from the past 2 years (January 2018 through November 2020) were used. For most of the wells evaluated using the Mann-Kendall trend analysis, four to seven data points were available over the 2-year timeframe, fewer than the minimum of eight analytical results (*i.e.*, data points) necessary to consider the results as statistically significant. Therefore, the findings summarized in Figures 6 through 9 and in Appendix E show a qualitative trend assessment generated using ProUCL. The Mann-Kendall trend test was not performed for wells that exceeded the GWQS in 3Q 2020 for wells with fewer than four data points (January 2018 through November 2020)[16].

4.8 Data Reliability

All sampling activities were completed in accordance with the Roche *Quality Assurance Project Plan* (QAPP) (TRC, 2013d), the NJDEP's Technical Requirements for Site Remediation (TRSR) (N.J.A.C. 7:26E) (NJDEP, 2018), the *NJDEP Field Sampling Procedures Manual* (NJDEP, 2005), appropriate groundwater sampling standard operating procedures, the NJDEP-approved groundwater RI Workplans for shallow and deep bedrock investigations (TRC, 2012a; 2012b; 2013a; 2013b; 2013c; 2013e), and the NJDEP-approved sampling plan in effect at the time of sample collection.

A QA review was performed on the laboratory analytical reports for all VOC samples collected as part of the Site-wide semi-annual monitoring, LTM, and MNA sampling programs. The method-specific calibrations and QC performance criteria were met for the data generated during this investigation, except as indicated in the conformance/non-conformance summaries provided in the laboratory reports.

Based on a review of the laboratory reports, no data were rejected, and the overwhelming majority of the data were not qualified. All data were deemed usable for decision-making purposes.

4.9 Factors Influencing Data

No significant events or seasonal variations are known to have influenced the sampling procedures or the results of the sampling programs presented in this GWPR. As discussed in Section 3.0, groundwater IRMs have been implemented at selected IAs. As documented herein and detailed in the IRM Progress Reports (TRC, 2019b; 2019c; 2019d; 2019e; 2019f; 2019g; 2019h; 2019i; 2019j; 2019k; 2019l; 2020c), the IRMs have resulted in significant improvement in groundwater quality in targeted areas.

[16] It is noted that a larger and statistically significant evaluation using Mann-Kendall trend analysis will be presented in the GWRAR and is not included in this GWPR.

4.10 Deviation from the Technical Requirements and Guidance

Due to the large number of monitoring wells sampled via PDBs and RPPSs, NJDEP's PDB Data Checklist forms (documenting the field activities associated with the deployment of PDBs at each well) were not completed. Instead, relevant data (*e.g.*, monitoring well ID, time/installation depth/depth to water during deployment and retrieval, etc.) for the groundwater samples collected using PDBs and RPPSs are documented in Appendix C.

5.0 FINDINGS FROM RECENT GROUNDWATER MONITORING

This section presents results from groundwater monitoring events conducted in 3Q 2019 and 3Q 2020 and describes current groundwater conditions.

5.1 Groundwater Flow Regime

The semi-annual Site-wide groundwater sampling program monitored groundwater elevations at the Site over time to assess groundwater flow conditions and temporal variability in the data (*e.g.*, seasonal fluctuations), and to monitor for potential changes to the groundwater flow system.

Figure 5 is a six-panel map that provides the potentiometric surfaces in the shallow groundwater (*i.e.*, the water table) and HGUs 1 through 5. Data collected during the 3Q 2019 gauging event (including depth to water, groundwater elevation measurements, presence/absence of product [LNAPL], PID readings, etc.) are summarized in Table 4-1.

Figure 5 shows that groundwater has a southerly and southeasterly flow component toward St. Paul's Brook in shallow groundwater and all HGUs. Shallow groundwater flow is convergent in the vicinity of the Valley Drain and St. Paul's Brook, which are local shallow groundwater discharge zones. Consistent with the regional topography, groundwater then flows to the southeast (parallel with St. Paul's Brook), toward the Third River, and ultimately toward the Passaic River (Figure 1).

Overall, there is minimal variability in the horizontal groundwater gradient and hydraulic heads measured in 3Q 2019 relative to previous synoptic groundwater gauging events and the 3Q 2020 groundwater elevations, as displayed on the graphs on Figure 5.

5.2 LNAPL Occurrence

LNAPL has been historically detected in well MW-237A located near the northern Site boundary and is attributed to an off-Site source[17]. No LNAPL was measured in MW-237A during the 3Q 2019 gauging or 3Q 2020 LTM sampling events.

Approximately 0.8 foot of LNAPL was measured in monitoring well MW-28 in the southern portion of IA-10 during the November 2019 gauging event (and LNAPL recovery was implemented). In response to the discovery of LNAPL in well MW-28, monthly gauging of MW-28 was initiated, and on January 6, 2020 the NJDEP was notified of the LNAPL discovery (TRC, 2020b). Free product was subsequently detected in monthly gauging of MW-28 in January, August, September, October, and November 2020, with product thicknesses ranging from 0.02 ft to 0.3 foot. The LNAPL was sampled for fingerprint analysis on September 9, 2020, and the analytical results indicate the LNAPL most closely resembles mineral oil.

On November 20, 2020, the recently discovered MW-28 mineral oil was called into the NJDEP Spill Hotline as a new release; the release was assigned Incident No. 20-11-20-1335-00. An LNAPL IRM Report for the product detected in MW-28 was submitted to the NJDEP on December 3, 2020 (TRC, 2020d). Plans to remediate this LNAPL are currently in development.

[17] NJDEP Spill No. 14-01-08-1157-33.

LNAPL was not detected in any other on- or off-Site well, during the time period covered by this GWPR.

5.3 Site-Wide Groundwater Quality Assessment

Groundwater analytical results and QA/QC sample results for the 3Q 2019 sampling event are summarized in Tables 5-1, 5-4, and 5-7.

Groundwater analytical results and QA/QC sample results for the 3Q 2020 sampling event are summarized in Tables 5-2, 5-3, 5-5, 5-6, and 5-7.

Figure 6 presents Mann-Kendall PCE+ concentration trend analysis results for the wells that exceeded the GWQS during the 3Q 2020 sampling event (shown in red [increasing], black [stable], green [decreasing], or yellow [insufficient data points for analysis]) using data from January 2018 through November 2020), and identifies wells for which no PCE+ compounds were detected at concentrations above the GWQS (shown in blue). Similarly, Figures 7, 8, and 9 present the same information for TCA+, benzene and chlorobenzene, and dioxane, respectively. Mann-Kendall trend analysis graphs are provided in Appendix E. The discussions presented below are based on these maps.

As shown in Table 5-1 and 5-2, other VOCs (listed in the COC table of Section 2.3) were detected in groundwater at concentrations slightly exceeding their respective GWQSs; however, these VOC groundwater impacts are localized and limited to specific Site areas.

5.3.1 PCE+ Groundwater Results – 3Q 2019 and 3Q 2020

The data shown on Figure 6 indicate that the margins of the PCE+ plumes are generally similar in extent to what was reported in previous progress reports (TRC, 2015c; 2017a; 2017b; 2019a; 2020a). Furthermore, Mann-Kendall statistical analyses (summarized on Figure 6 and in Appendix E) indicate decreasing contaminant concentration trends in most of the wells within the Remedial Action Plumes, which is indicative of plume stability. The few instances of increasing trends are either located upgradient off-Site, at the upgradient property boundary, or in the Site interior.

Roche's groundwater IRM programs have significantly improved groundwater quality conditions in the shallow groundwater and HGUs 2 and 3 in the interior portions of the Site. The historical maximum PCE+ concentration in IA-9 well MW-170 was 145,790 micrograms per liter (µg/L), as compared to 150 µg/L in MW-170BR in 3Q 2020. Similarly, PCE+ concentrations as high as 93,006 µg/L were detected in CAMS IA-12 well MW-60, as compared to 66 µg/L in MW-24 in 3Q 2020. As a result of IRM activities, the analytical data reflect declines in PCE+ concentrations approaching five orders of magnitude.

5.3.2 TCA+ Groundwater Results – 3Q 2019 and 3Q 2020

The data shown on Figure 7 indicate that the margins of the TCA+ plumes are generally similar in extent to those reported in previous progress reports (TRC, 2015c; 2017a; 2017b; 2019a; 2020a). Furthermore, Mann-Kendall statistical analyses (summarized on Figure 7 and in Appendix E) indicate decreasing or stable contaminant concentration trends in most of the wells, which is indicative of plume stability. The few instances of increasing trends are either located upgradient off-Site or in the Site interior.

5.3.3 Benzene and Chlorobenzene Groundwater Results – 3Q 2019 and 3Q 2020

The data shown on Figure 8 indicate that the margins of the benzene and chlorobenzene plumes are generally similar in extent to those reported in previous progress reports (TRC, 2015c; 2017a; 2017b; 2019a; 2020a). Furthermore, Mann-Kendall statistical analyses (summarized on Figure 8 and in Appendix E) indicate decreasing contaminant concentration trends in most of the wells within the Remedial Action Plumes, which is indicative of plume stability. Benzene and chlorobenzene concentrations above the GWQS are limited in areal extent and do not extend beyond the downgradient boundaries of the Site.

Prior to implementation of groundwater IRM programs, benzene concentrations in the former IA-2 Tank Farm and immediately downgradient in the northern IA-6 area exceeded 113,000 µg/L. Most recent sampling showed that benzene concentrations in this area are now less than 220 µg/L. Prior to implementation of groundwater IRM programs, chlorobenzene concentrations in IA-6 exceeded 12,000 µg/L. Chlorobenzene concentrations are now less than 180 µg/L.

As shown on Figure 8, benzene and chlorobenzene exceedances occur in very limited areas. Benzene was detected at low concentrations in small, localized areas in IA-6, IA-1, IA-4, IA-10, and IA-12. A large benzene plume emanates from the Sunoco[18] site, an area upgradient of IA-12 (north of Route 3) in HGU 2 (see Appendix A, Figure 5.2).

5.3.4 Dioxane Groundwater Results – 3Q 2019 and 3Q 2020

As shown on Figure 9, most of the dioxane exceedances of the GWQS occur in the western portion of the Site. Mann-Kendall statistical analyses (summarized on Figure 9 and in Appendix E) indicates decreasing contaminant trends or plume stability in most of the wells within the Remedial Action Plume, supporting the conclusion of dioxane plume stability over time. One well in the interior portion of the Site shows an increasing trend, likely due to matrix diffusion as the plume concentrations become stable following treatment.

The off-Site margins of dioxane in the Monitored Plumes are similar in extent to those reported in previous GWPRs (TRC, 2017a; 2017b; 2019a; 2020a), and dioxane concentrations at the outer edges of the Monitored Plumes are similar to those detected earlier, indicating that dioxane in the Monitored Plumes is stable and not expanding or increasing in concentration.

An on-Site source of dioxane was identified near the IA-1/IA-4 boundary, between former Buildings 56 and 44. An IRM for dioxane was initiated in July 2016 and operated until January 2019. This IRM has significantly reduced dioxane concentrations in the source area from a historical maximum concentration of 3,550 µg/L in MW-392B to a current maximum of 250 µg/L in MW-416C in 3Q 2020. As reported in the IRM Progress Report for IA-1/4, an optimization study was performed to reduce the persistent concentrations present in IA-1 until no further benefit was observed (TRC, 2019b).

5.4 Conclusion

The results from the 3Q 2019 and 3Q 2020 sampling events show that most of the COCs on Site are below their respective GWQS at many locations. Most wells where exceedances are observed show a decreasing or stable trend. The only wells showing increasing trends are located

[18] The NJDEP preferred ID number of the Sunoco site is 014555.

upgradient off-Site or within the Site interior; these interior wells are surrounded by wells with stable or decreasing trends, or no exceedances, which is indicative of overall plume stability. Overall, these results indicate contaminant plume stability over time, and that the current (LTM program) monitoring well network remains sufficient to both monitor groundwater plume conditions and verify no additional potential impact to receptors until the Site's remedy is approved and implemented.

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