FOURTH FIVE-YEAR REVIEW REPORT FOR CIBA-GEIGY CHEMICAL CORPORATION SUPERFUND SITE

OCEAN COUNTY, NEW JERSEY

Prepared by

U.S. Environmental Protection Agency
Region 2
New York, New York

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Date

Table of Contents

LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
BLA	Backfilled Lagoon Area
CD	Consent Decree
CEA	Classification Exception Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIC	Community Involvement Coordinator
COC	Contaminants of Concern
yds^3	cubic yards
DDA	Drum Disposal Area
EPA	United States Environmental Protection Agency
EQ	Equalization Basins
ESD	Explanation of Significant Differences
FSD	Former South Dye Area
FYR	Five-Year Review
GAC	granular activated carbon
GERS	Groundwater Extraction and Recharge System
GTS	groundwater treatment system
ICs	Institutional Controls
LTMP	Long term monitoring plan
MERA	Mideast Recharge Area
MGD	million gallons per day
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NERA	Northeast Recharge Area
NJDEP	New Jersey Department of Environmental Protection
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Units
PAC	powdered activated carbon
PCOR	Preliminary Close Out Report
PRP	Potentially Responsible Party
RAO	Remedial Action Objectives
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
SERA	Southeast Recharge Area
SWMP	Site-Wide Monitoring Program
TBC	To be considered
UU/UE	Unlimited use and unrestricted exposure
VOC	Volatile Organic Compounds

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP)(40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the fourth FYR for the Ciba-Geigy Chemical Corporation Superfund site (Site). The triggering action for this statutory review is the completion date of the last FYR, May 01, 2013. The FYR has been prepared due to the fact that hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of two operable units (OUs), both OUs will be addressed in this FYR. OU1, which involves the extraction, treatment and on-site recharge of contaminated groundwater, is operational. OU2, which addresses contaminated material and buried drums in source areas on the Site, is complete.

The Site FYR was led by Diane Salkie, EPA remedial project manager (RPM). Other EPA participants included Marian Olsen (human health risk assessor), Michael Clemetson (ecological risk assessor), Edward Modica (hydrogeologist), and Patricia Seppi (Community Involvement Coordinator, or CIC). The current potentially responsible party (PRP), BASF, was notified of the initiation of the FYR. The review began on 10/12/2017.

Site Background

The Site is located in Toms River, Dover Township, Ocean County, New Jersey on approximately 1,350 acres of land (see Figure 1). On-site structures include piping associated with the groundwater collection system, the groundwater treatment plant, and office facilities for remediation personnel. Approximately 320 of the 1,350 acres were developed and used for manufacturing operations, waste treatment, disposal activities, and administrative and laboratory facilities. The remaining acreage is undeveloped and in its natural state. Of the 1,350 acres, 1,240 acres are Dover Township's largest single tract of industrially zoned land. In addition, 72 acres located in Manchester Township are not known to be associated with production or waste disposal and are zoned for residential use. Thirty-nine acres are in Dover Township and are zoned conservation-residential. Based on soil sampling, approximately 790 acres are outside the area requiring remediation and no restriction on their future use is necessary. Approximately 440 acres are within, or close to the remediation zone and are not appropriate for residential use. Finally, the waste management zone comprises 93 acres, the use of which is restricted to waste management activities. The entire 93 acre facility area is fenced with restricted access and is currently only being used to carry out the Site remedy.

Production operations at the Site began in late 1952. At the time, the Site was owned by the Toms River Chemical Company, which was later merged into the Ciba-Geigy Corporation. From 1970 through 1981, the Site was jointly owned by Ciba-Geigy and Sandoz Corporation. In 1981, Sandoz transferred

all interest to Ciba-Geigy. In 2008, Ciba-Geigy was purchased by BASF and all remedial activities are currently BASF's responsibility.

Residential neighborhoods, recreational areas, small commercial establishments and light industrial complexes are present near the Site. The commercial areas are situated primarily southwest of the Site. The area to the west is zoned for industrial use, light manufacturing and warehousing operations. A large recreational area, which includes several parks and the Toms River, is east of the Site. Residential areas exist along the northern and southeastern portions of the Site. Municipal water systems serve Dover Township and the surrounding communities. No residential or commercial drinking water wells are within the confines of the contaminated groundwater plume. Surface waters from the Toms River are not used as potable water.

The seven uppermost geologic members underlying the Site in descending order are: the Upper Cohansey Member, Cohansey Yellow Clay, Primary Cohansey Member, Cohansey/Kirkwood Transitional Member, the Lower Cohansey Member, Upper Kirkwood Member and the Kirkwood Number 1 Member. At some locations, a perched water system is present in the Upper Cohansey. This perched water system is referred to as the Upper Cohansey Aquifer. The perched water system can provide a pathway for movement of contaminants to lower geologic units. The Primary Cohansey Member is a water-bearing unit, referred to as the Primary Cohansey Aquifer, and is a source of drinking water in an area of New Jersey beyond the plume.

The three major Site activities were production-related activities, wastewater treatment operations and solid waste disposal. The two source areas associated with production are the Former South Dye Area (FSD) and the Building 108/Underground Storage Tank Area. During Site operations, a wastewater treatment plant existed for the treatment and disposal of process wastewater. The major source areas associated with the wastewater treatment operations are the East and West Equalization Basins (EQ Basins) and the Backfilled Lagoon Area (BLA).

Several solid waste disposal areas are known to have operated at different times during operations at the Site which include the Filtercake Disposal Area (FCD), Lime Sludge Disposal Area, Drum Disposal Area (DDA), Standpipe Burner Area and the Borrow/Compactor Area, (see Figure 1).

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Ciba-Geigy Chemical Corporation		
EPA ID: NJD001502517		
Region: 2	**State:** NJ	**City/County:** Toms River, Ocean County

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: EPA ***[If "Other Federal Agency", enter Agency name]*:**
Author name (Federal Project Manager): Diane Salkie
Author affiliation: EPA Region 2
Review period: 10/12/2017 - 3/26/2018
Date of site inspection: 1/23/2018
Type of review: Statutory
Review number: 4
Triggering action date: 5/1/2013
Due date *(five years after triggering action date)*: ~~5/1/2018~~5/1/2018

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

In 1984, EPA began a remedial investigation (RI) of the Site. The RI concluded that contaminated source areas on Site resulted in groundwater contamination. Based on this investigation, EPA defined the following OUs: OU1 - pertaining to groundwater; and OU2 - pertaining to known or suspected source areas.

EPA focused on identifying a remedy for groundwater contamination (OU1) first as part of a multi-phase remedy for the Site to quickly address potential public health concerns by preventing further off-site migration of groundwater contaminants. The OU2 RI found that seven source areas continued releasing contamination to the groundwater and were impacting groundwater quality. The OU2 RI and subsequent risk assessment also found that one source area, the FCD, presented a direct-contact risk under a potential on-site worker future use scenario.

A public health evaluation (PHE) in the 1989 OU1 ROD found that the cancer risks to the future resident consuming groundwater from the site were 1×10^{-2} (one in 100) exceeding the NCP risk range of 1×10^{-6} to 1×10^{-4} (i.e., one in a million to one in ten thousand) and the noncancer Hazard Index (HI) was 40 (which is 40 times greater than the goal of protection of an HI = 1) if no action were taken. Other routes of exposure such as dermal contact and inhalation were within the risk range of 1×10^{-4} (cancer risk of 1 in 10,000) to 1×10^{-6} (cancer risk of 1 in 1,000,000) and the noncancer HI was less than 1. Cancer risks and noncancer HI for recreational exposures to surface water in the Toms River, sediments in the marshland, and inhalation of air from the river or wetland were within or below the risk range and the noncancer HI was less than 1.

Contamination from the source areas penetrated through the upper five geologic layers to the Lower Cohansey aquifer. The groundwater plume in the Primary Cohansey extends off-site toward the Toms River. The OU1 ROD PHE identified the following indicator chemicals in groundwater: arsenic, barium, benzene, cadmium, chlorobenzene, chloroform, 1,2-dichloroethane, nickel, tetrachloroethene, 1,2,4-trichlorobenzene and trichloroethene.

The OU2 ROD developed a list of 12 contaminants of concern (COCs) to characterize the nature and extent of contamination: arsenic, chlorobenzene, 2-chlorotoluene, 1,2-dichlorobenzene, lead, mercury, naphthalene, nitrobenzene, tetrachloroethene, 1,2,4-trichlorobenzene, trichloroethene and 1,2,3-trichloropropane. The COCs were chosen based on the following criteria: they pose the greatest potential risk to human health and the environment; they are found in the highest concentrations in the source areas and groundwater at the Site; and/or they are most likely to move from the source areas to the groundwater.

The OU2 ROD evaluated potential risks from exposure to the FCD. The risks for the future worker from ingestion were an HI = 1.2 that slightly exceeds the noncancer goal of protection of an HI = 1 and a cancer risk of 1.1×10^{-4} from inhalation. The risks for the residential adults from ingestion of groundwater were 3×10^{-4} and the noncancer HI = 11. The future risks to the child were 2.9×10^{-4} and the noncancer HI = 92. The OU2 ROD also evaluated potential risks to construction workers from exposure to the FCD. The noncancer hazard to the future construction workers was a HI = 9.2, that exceeds the goal of protection of an HI = 1. The COCs were arsenic and mercury.

In 1994, EPA completed a wetlands characterization and ecological assessment to evaluate potential risks to the environment associated with Site contaminants. The wetlands along the Toms River, including the Marshland Area and the river itself, represent the most-likely pathway for ecological impacts related to the Site. The ecological assessment concluded that there were no adverse impacts to terrestrial and aquatic biota in these areas.

Response Actions

Initial Response

During the late 1970s and early 1980s, in response to New Jersey Department of Environmental Protection (NJDEP) directives, Ciba-Geigy performed various closure activities and geohydrologic investigations at the Site. As early as 1979, there were reports of leakage of the double-lined active landfill and remedial measures were taken under the direction of the NJDEP Solid Waste Administration. In 1980, EPA completed an identification and preliminary assessment report of the Site under the Potential Hazardous Waste Site Program. The Site was placed on the Superfund National Priorities List (NPL) in 1983.

OU1

On April 24, 1989, EPA issued a ROD for OU1 describing the selected groundwater remedy. The major remedial objectives of the OU1 ROD are:

- mitigation of the effects of groundwater contamination on public health and the environment; and
- restoration of the upper sand aquifer to drinking water standards.

The major components of this remedy included:

- sealing of contaminated irrigation wells;
- installation of a groundwater extraction and treatment system in a portion of the existing on-site wastewater treatment plan;
- extraction of contaminated groundwater until federal and state cleanup standards are met to the extent that is technically practicable;
- modify the wastewater treatment plant to treat contaminated groundwater to meet NJDEP discharge levels;
- conduct a pilot study to confirm the practability of achieving discharge levels; and
- discharge of treated groundwater to the Toms River.

In accordance with the ROD, irrigation wells near the Site were decommissioned and well restrictions (based on Ocean County Board of Health regulations) were imposed that restrict installation of domestic wells in the plume.

After EPA issued the 1989 ROD, public concerns related to the proposed discharge to the Toms River resulted in continued investigation and public involvement to develop an alternate discharge point for treated groundwater. On September 30, 1993, after conducting a technical review of the groundwater recharge proposal submitted by Ciba-Geigy Corporation, EPA issued an Explanation of Significant Differences (ESD). The ESD eliminated the discharge to the Toms River and called for the on-site recharge of treated groundwater. The ESD also established appropriate standards for discharging the

treated water, (see Table 3). The primary remedial action objective (RAO) of the OU1 ROD and ESD is aquifer restoration.

OU2

On September 29, 2000, EPA issued a ROD for OU2 describing the selected remedy for the on-site source areas. The RAOs of the OU2 ROD are to:

- address the potential risks associated with direct contact with surface soils, and
- shorten the time frame for the OU1 groundwater remedy to achieve the groundwater restoration goals established in the 1993 ESD.

The remedy includes the following major components:

- on-site ex-situ bioremediation of approximately 145,000 cubic yards (yds^3) of contaminated material from the source areas;
- excavation and off-site disposal of approximately 35,000 drums from the DDA and 5,000 yds^3 of soils not suitable for bioremediation;
- installation of caps and slurry walls in areas of the Site where the Cohansey Yellow Clay is present. This perched water management system will prevent the movement of contaminants from the clay into the underlying Primary Cohansey Aquifer. The cap in the filtercake disposal area will also address the potential direct contact risks associated with the surface soils in this area;
- installation of an in-situ bioremediation system in the equalization basins to address contamination below the groundwater table;
- establishment of deed restrictions to regulate the use of certain areas of the Site and to prevent intrusive activities in capped areas;
- optimization of the groundwater extraction and recharge system (GERS) implemented as part of OU1; and
- appropriate environmental monitoring to ensure the effectiveness of the selected remedy.

Status of Implementation

OU 1

In 1993, a consent decree (CD) was lodged between EPA and Ciba-Geigy Corporation, which allowed Ciba-Geigy to design, construct and operate the groundwater extraction, treatment and recharge systems. All work was conducted with EPA oversight.

The groundwater treatment system (GTS) component for the GERS was constructed from the original wastewater treatment plant (existing from site operations) and consisted of aerators and powdered activated carbon (PAC), followed by polishing in granular activated carbon (GAC). The resulting GERS originally included 43 pumping wells designed to extract a maximum of four million gallons per day (MGD) of contaminated groundwater (see Figure 2). The systems became fully operational in March 1996.

Three recharge areas were created: the Northeast Recharge Area (NERA), Mideast Recharge Area (MERA) and the Southeast Recharge Area (SERA), (see Figure 2). Before recharge began, all recharge water went to the NERA to eliminate potential for treated water to enter a public water supply well located across the Toms River. Groundwater electrical conductance is monitored at wells in the NERA

to track groundwater recharge movement and ensure that it does not move to the Pine Lake Park community located northwest of NERA.

OU 2

The design of the OU2 source area remedy was completed in summer 2003 and on-site construction began in October 2003. Construction activities consisted of erection of a pre-engineered building for the ex-situ treatment system, an air emissions treatment system, a shed to house the aboveground components of the in-situ treatment system, excavation of contaminated soil from the source areas and installation of landfill caps and slurry walls at the DDA/FCD/FSD soil depository.

The OU2 ROD identified a number of discrete, pre-determined volumes at each of the source areas, called source blocks, which were calculated using fate and transport and groundwater flow models. The source blocks determined the amount of soil to be removed and treated in the ex-situ treatment system. Once all end-point concentrations were reached within a source block, the treated soil was placed under a landfill cap in the DDA/FCD/FSD soil depository. The OU2 ROD required installation of impermeable caps and slurry walls in the three source areas (DDA/FCD/FSD) underlain by clay, to prevent movement of contaminants from the clay into the Primary Cohansey aquifer. Ciba-Geigy used this perched water management system to redirect the flow of groundwater in the Upper Cohansey around the source areas.

In 2003, 47,055 drums were removed from DDA source area and sent off-site for disposal. Soil was excavated from the DDA as well as the FCD, treated, and backfilled in place.

Remediation of the EQ Basins included excavation and ex-situ treatment of contaminated soil as well as in-situ treatment of soil in the saturated zone which could not be effectively excavated. In-situ treatment was implemented in two phases. Phase 1 installation consisted of a single extraction well and single injection well, and operated from 2004 through 2006. Phase 2 involved the installation of additional injection wells and extraction wells, and a horizontal infiltration gallery. Phase 2 operation began in June 2007. In 2009, one additional injection well was installed. Groundwater from the area was pumped from the extraction wells, oxygenated and then re-injected to stimulate aerobic, biological treatment of contamination in the saturated zone. Throughout its operation, the system required extensive maintenance related to the plugging and corresponding decreases in capacity of the extraction and injection wells.

One component of the OU2 remedy is optimization of the GERS implemented as part of OU1. The GERS optimization was initiated in 2000. In 2003-2004, based on groundwater quality, operation and maintenance data, and flow modeling analysis, nine of the original extraction wells were idled and three new wells were installed. In 2016, a second optimiztion idled ten extraction wells located in the PCOPH based on their locations on the periphery of the plume or very low COC mass recovery rates.

In August 2010, BASF conducted a Remedial Process Optimization (RPO) project to evaluate further optimization. One of the recommendations of the RPO was optimization of the EQ Basins. With EPA's concurrence, the operation of aerobic treatment was discontinued in August 2011 in preparation for the characterization activities. From 2011–2014, BASF performed further investigations and characterizations of the EQ Basins to initiate the optimization process.

Soil was excavated, treated on-site and placed in the DDA/FCD/FSD depository from the remaining sources: the BLA, the FSD and the BCA. Before the ex-situ treatment facility was demolished, samples

of the concrete floors and the secondary treatment pad were collected in accordance with an EPA-approved decommissioning plan. The treatment building material, which consisted mostly of metal, was disassembled, decontaminated and recycled. The nonmetal material was disposed of off-site as nonhazardous waste. EPA allowed the concrete and asphalt rubble to be milled, blended and used at the DDA/FCD/FSD depositional area for road material. Decommissioning was completed on November 4, 2010. A Preliminary Close-Out Report was signed in September 2012, documenting that all on-site construction was completed.

In addition, in 2014, BASF upgraded the GTS system from the former wastewater treatment plant to new, self-contained air stripping and liquid granular activated carbon (LGAC) adsorption system. Due to the high levels of iron in the aquifer, BASF added an iron removal system consisting of a sludge thickening unit and geotube. The non-hazardous sludge cake is removed and disposed of at an approved landfill. The update resulted in a more efficient water treatment system with the same end result of meeting discharge permit requirements. A final remedial action completion report, which included optimization of the GTS and GERS was completed by BASF and approved by EPA in 2015.

IC Summary Table

Table 1: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Groundwater	Yes	No	Contaminated groundwater	Restrict the use of groundwater	Classification Exception Area
Soil	Yes	Yes	Block 411, Lots 6.02 and 6.03	Restrict land use	Deed restrictions Planned date 2023

The OU1 ROD required sealing of contaminated residential irrigation wells in the Cardinal Drive area. Drinking water in the area of the Site is provided by supply wells that are owned by the United Water Company. In 2001, NJDEP approved a classification exception area (CEA) restricting the installation of new wells into the Cohansey and Kirkwood aquifers in the vicinity of the Site.

The OU2 ROD requires restrictions on the property deed to prevent any intrusive activities in the capped areas of the Site. The OU2 ROD contained three conceptual future land use areas for the Site based on anticipated conditions following remedy implementation: unrestricted use area, restricted waste management area, and restricted commercial/industrial/recreational use area.

Unrestricted use Area – This area had no known industrial activity. This area which is currently locally zoned as commercial/industrial, requires no land-use restrictions.

Restricted Waste Management Area - This area which includes the footprint of the groundwater treatment facilities, DDA, Standpipe Burner Area, Lime Sludge Disposal Area, FCD and industrial landfill, requires land-use restrictions to prevent any intrusive activities in the capped areas of the Site.

Restricted Commercial/Industrial/Recreational Area – This area which includes the historical industrial production areas requires land-use restrictions to prevent the construction of residential structures.

The deed restriction for the property to ensure future land use, consistent with the OU2 ROD, is expected to be implemented in the future. In preparation of the deed restrictions, in 2013, the Township subdivided the property into three lots with Block 411, lot 6.01, 6.02 and 6.03.

Systems Operations/Operation & Maintenance

The GERS is currently operated by BASF and their contractor, Brown and Caldwell. The OU1 CD required Ciba-Geigy (and now BASF) to perform periodic sampling to determine the effectiveness of the OU1 extraction and recharge system in capturing the groundwater plume. The requirements of this sampling effort are provided in the annual LTMP and involve the collection of on-site groundwater samples and water level measurements. The LTMP incorporates the following monitoring programs: the site-wide monitoring program (SWMP) to monitor groundwater and the GERS; the Toms River Monitoring Program for monitoring surface water of the Toms River; and the NERA monitoring. A Wetlands Monitoring Program was in place from development in 1994 until 2002 when EPA eliminated the requirement because no changes were recorded.

The SWMP is a groundwater data collection program that monitors water quality and elevation and provides information used to evaluate the GERS. The groundwater elevation measurements are taken from 340 wells and one round of water quality data is collected annually from monitoring wells. For the operation year 2016, water samples were collected in 65 monitoring wells. The groundwater quality samples are analyzed for all of the 94 parameters listed in Table 5 on odd numbered years (2015, 2017, etc.). During even numbered years (2016, 2018, etc.) the metals analysis is limited to GERS wells only, see Table 5. To monitor the performance of the OU2 remedial action perched water management system of slurry walls and caps, an OU-2 LTMP was developed. The groundwater monitoring portion of the OU-2 LTMP was developed as part of the 2009 OU-1 LTMP and includes eight extraction wells and 13 monitoring wells located downgradient of the source areas. Some of the downgradient wells have elevated results due to the fact that associated cap and slurry wall work were completed in late 2010, and this area is likely still dewatering, as designed.

The LTMP requires groundwater monitoring in several off-site areas to determine the impact of the groundwater extraction, treatment and recharge systems in protecting these areas. Off-site monitoring is done primarily in two areas; in the parkland east of the Toms River and in the Oak Ridge Area, a residential subdivision south of the Site. Portions of these areas have been impacted by the contaminant plume, which comprises all groundwater that exceeds the standards from Table 2 of the ESD, (Table 3 in this document).

The final part of the SWMP,the Toms River Monitoring Program, is in place to evaluate whether the GERS is effective at containing contaminated groundwater before it discharges to the Toms River, located to the east of the Site. There are two monitoring locations denoted, TR-1 which is located upstream of the Site and TR-5, downstream of the Site. The NERA Monitoring program evaluates changes to flow patterns from recharged groundwater by monitoring groundwater hydraulics and water quality in the northeast portion of the Site. The goal of the NERA monitoring program is to prevent recharge water from entering the residential community of Pine Lake Park.

Potential Site impacts from climate change have been assessed, and the performance of the remedy is currently not at risk due to the expected effects of climate change in the region and near the Site.

III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the third FYR as well as the recommendations from the third FYR and the current status of those recommendations.

Table 2: Protectiveness Determinations/Statements from the 2013 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Protective	The OU1 remedy is protective of human health and the environment.
2	Short-term Protective	The source control remedy at OU2 is protective of human health and the environment in the short term. In order for the remedy to be protective in the long term, deed restrictions need to be established.
Sitewide	Short-term Protective	The remedies at the Site are protective of human health and the environment in the short term. In order for the remedy to be protective in the long term, deed restrictions need to be established.

The only issue identified during the 2013 FYR was that ICs were not implemented and the recommendation was for BASF to implement deed restrictions. During the past five years, to facilitate the implementation of ICs, the property was subdivided by the township, however, deed restrictions have not yet been implemented.

In addition, an upgrade of the GTS system from PAC to an air stripper was completed in 2014 and BASF is further investigating the EQ Basins as part of an optimization recommendation.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On October 2, 2017, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at 31 Superfund sites in New York and New Jersey, including the Ciba-Geigy site. The announcement can be found at the following web address: https://wcms.epa.gov/sites/production/files/2017-10/documents/five_year_reviews_fy2018_final.pdf.

In addition to this notification, a public notice was made available in the Toms River website, on 4/6/2017, stating that there was a FYR and inviting the public to submit any comments to the EPA. The results of the review and the report will be made available at the Site information repository located at the Ocean County Public Library, 101 Washington Street, Toms River, NJ or the EPA Region 2, Superfund Records Center at 290 Broadway, 18th Floor, New York, New York 10007.

Data Review

LTMP Annual reports have been submitted from 2005 through 2016. In 2016, of the 37 wells that comprised the GERS at the time of the LTMP reporting, 12 achieved less than 75% of their designed pumping rate. In addition, 56 pumps were replaced and 19 wells were redeveloped due to iron fouling. Compared to 2011, the number of pumps replaced and wells redeveloped have increased. As previously mentioned, seven extraction wells were idled near the end of 2016 and three more in early 2017. While the extraction wells have shown difficulty in achieving design specifications due mostly to iron fouling, the system has achieved its goal of reducing and containing contaminated groundwater, as shown through monitoring of the groundwater and Toms River. In addition, an upgrade of the GTS system from PAC to an air stripper in 2014 continues to meet surface water discharge requirements.

BASF had addressed the above referenced iron fouling issue with a deposit control agent, FeREMED, which is designed to prevent precipitation and deposition of metal oxides. However, with the upgrade to the GTS system and more frequent pump maintenance, the additive is no longer necessary. The effluent continues to meet standard requirements specified in the ESD (see Table 3).

The LTMP incorporates the following monitoring programs: the SWMP to monitor groundwater and the GERS; the Toms River Monitoring Program for monitoring surface water of the Toms River; and the Northeast Recharge Area monitoring.

The off-site monitoring results, which are presented in the LTMP Annual reports, show a reduction in chemical concentrations in areas impacted by the plume and indicate that the system has been effective in preventing the migration of the plume. Figures 7-1, 7-2 and 7-3 located in Appendix C, are figures from the 2016 LTMP showing the plume concentrations of total contaminants of concern (TCOC) in the Primary Cohansey, Lower Cohansey and Kirkwood Sands aquifers, respectively. A comparison of the 2016 data with the 1995-1996 data indicates both a reduction in contaminant concentrations and in the number of COCs detected that exceed groundwater restoration standards. Overall, analysis of groundwater monitoring data indicates that the groundwater remedy is functioning as designed in order to attain the more stringent of the federal and/or state MCLs established in the 1993 ESD.

The 2011 LTMP annual report began to provide monitoring results from groundwater wells located downgradient of the OU2 remediated sources. The 2016 LTMP report concludes that the treatment system consistently meets performance criteria. Results in wells downgradient of the SDA, DDA and the FDA still show elevated results, however, the cap and slurry wall which were completed in 2010 are still dewatering these areas as designed. Data will continue to be collected form the downgradient wells, to ensure the OU2 remedy is functioning as designed.

The Toms River has been sampled repeatedly in the past to determine the impact of the Site on river quality. Surface water, sediment and toxicity samples have been collected in the river. Based on the results of these samples, it was determined that river quality was not negatively affecting environmental receptors. Although site-related chemicals have been detected in the river, concentrations have been below New Jersey's surface water and drinking water standards. In 2016, no volatile organic compounds (VOCs) were detected in the surface water samples. Aluminum was found at similar levels upstream and downstream in 2016 as has been the case, at fluctuating levels, in the previous five years.

The 2016 groundwater monitoring results from along the Site's northern border supports the conclusion that no treated water from the recharge areas has migrated under the Pine Lake Park residential area.

In 2010, BASF initiated an RPO project, to optimize the existing OU1 system at Site. As part of the RPO, an evaluation report was submitted to the EPA in May 2011 recommending continuing remedial efforts at the site of the EQ Basins. In 2013 and 2014, BASF conducted an investigation in the EQ Basins, to further define the nature and extent of contamination, define groundwater flow behavior and update the conceptual site model. Sampling was conducted via a membrane interface probe system, confirmation soil sampling, installation of additional monitoring wells and review of hydrogeologic data. The sampling delineated sources in the groundwater and BASF is currently assessing options for remediation.

Site Inspection

The inspection of the Site was conducted on 1/23/2018. In attendance were Diane Salkie, Jeff Josephson and Michael Clemetson of the EPA and EPA's oversight consultant, Kavitha Subramaniam of CDM Smith. Representing the PRPs were Steve Havlik, Fred Goelz, Laura McMahon, Karyllan Mack, and Dave Johnson of BASF. In addition, their consultants attended as follows: Jeff Caputi, Marek Ostrowski and Peter Randazzo of Brown and Caldwell; Tom Legel of AGC; and Jay Ash of AMO. The purpose of the inspection was to assess the protectiveness of the remedy. Brown and Caldwell provided a presentation consisting of background information as well as progress and changes made since the last FYR. This included GERS update, EQ basin status, deed notices and CEA recertification. Following the presentation, some members accompanied the EPA personnel on a site tour, visiting the GTS, capped areas, recharge basins and locations of demolished structures.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Question A Summary:

Analysis of data over the past five years indicates that the groundwater treatment system has consistently met the treatment standards provided in the 1989 ROD and 1993 ESD. The Pine Lake Park residential areas have not been impacted by the contaminant plume or treated recharge water. Actions such as the fencing around the Site and the continuous security activities are in place to interrupt exposures to potential trespassers. The effectiveness of the extraction, treatment and recharge system is continually monitored through groundwater, river and effluent sampling. Optimization of the GTS occurred in 2014 and continues to meet discharge requirements. An additional optimization to the number of GERS wells was initiated in 2016 resulting in discontinuation of extraction wells. Future monitoring will assess the effect of this action on the plume. NJDEP approved a CEA restricting the installation of new drinking water wells into the Cohansey and Kirkwood aquifers in the vicinity of the Site.

Remedial Action Performance

According to the 2016 LTMP report, the VOC plume has been reduced in size over time, especially away from the source areas. Based on model data, the performance of the GERS over the 2016 operational year has led to a capture envelope that has reduced in size relative to the design or target envelope. Throughout the plume, both near the sources and especially away from the sources, the

predominant concentration trends in the monitoring wells are either decreasing, or are stable at levels lower than prior to the GERS.

The OU-2 source area remedy has been completed in 2010 for all sources except the saturated zone at the EQ Basins. The EQ Basin was further delineated to define the nature and extent of contamination, define groundwater flow behavior and update the conceptual site model. The sampling delineated sources in the groundwater and BASF is currently assessing options for optimization of the remedy.

Changes in distribution and magnitude of the dissolved-phase impacts are expected to occur as a result of OU-2 implementation, and will be monitored over time.

System Operations/O&M

Analysis of groundwater system monitoring data indicates that the groundwater remedy is functioning as designed in order to treat extracted water to the more stringent of the federal and/or state MCLs as specified in the 1993 ESD.

In 2014, BASF upgraded the GTS system from the former wastewater treatment plant to a new, self-contained air stripping and LGAC adsorption system. The update resulted in a more efficient water treatment system with the same end result of meeting discharge permit requirements.

The OU2 remedy addressing soil contamination was completed in 2012. This remedy addressed the direct contact exposure to soils through caps to prevent direct exposure and prevent contamination from spreading from the clay into the Primary Cohansey aquifer through the installation of slurry walls. Groundwater monitoring is in place to ensure the remedy is functioning as designed.

Implementation of Institutional Controls and Other Measures

A CEA has been established to prevent direct exposure through the use of groundwater as a drinking water source. Consistent with the OU2 ROD, appropriate deed restrictions and ICs will be put in place or maintained to protect human health from direct exposure to soils based on potential future land use.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Question B Summary:

There have been no changes in the physical conditions at the Site that would affect the protectiveness of the remedy. There have been no changes in the Applicable or Relevant and Appropriate Requirements (ARARs), and there are no new standards which would affect the protectiveness of the remedy.

Changes in Standards and TBCs

Table 4 provides a comparison of the remediation levels established in the OU1 ROD and updated in Table 2 of the ESD with their respective current residential risk-based concentrations. The current risk-based concentration for total arsenic is below the remediation level of 50 micrograms per liter (µg/L). The MCL of 50 µg/L was subsequently updated in 2001 to 10 µg/l. Additionally, the ESD revised the effluent standard to 8 µg/L. However, due to the GERS treatment and slurry walls, the plume is

contained and the most recent effluent arsenic result reported in the fourth quarter of 2016 was undetected at a detection level of 0.4 µg/L.

Changes in Toxicity and Other Contaminant Characteristics

The following chemicals being re-evaluated through the Integrated Risk Information System (IRIS) process include inorganic arsenic, chromium VI, and vanadium and compounds. The toxicity data and cleanup levels for these chemicals will need to be re-evaluated when the IRIS chemicals are updated. Although the risk numbers may change, the remedial alternatives developed for the Site focus on addressing the risk by capping the area and preventing direct contact with surface soils. The remedy also prevents further groundwater contaminant migration through the Perched Water Management System and groundwater monitoring.

Changes in Exposure Pathways

The exposure assumptions used to estimate the potential cancer risks and noncancer hazards in the risk assessment supporting the RODs and ESD for human health followed the risk assessment guidance for Superfund and associated guidance used by the Agency remain valid. During the Site RI, EPA determined that the contaminated soil under current conditions and industrial zoning posed no unacceptable human health risk from direct soil contact. Under future conditions ingestion of soils from the FCDA by future residents (adult and child) and construction workers exceeded the risk range. In 2014, EPA's Superfund program updated exposure assumptions (OSWER directive 9285.6-03). These updates do not change the conclusions of the risk assessment or the cleanup goals.

Region 2 has evaluated a number of properties with elevated concentrations of groundwater contaminants where potential vapor intrusion may occur. EPA conducted sampling in October 2007 at properties near the facility. EPA found that contaminant concentrations in the soil gas beneath the structures and in the indoor air at these properties did not require any further investigation or remediation.

Although the ecological risk assessment screening values used to support the OU1 and OU2 RODs may not necessarily reflect the current methodology, the remedy remains protective of ecological receptors as the contaminated soil has been addressed by the remedy. Additionally, based on the monitoring the Toms River does not appear to be adversely impacted by the Site.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

There is no information that calls into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
None

Issues and Recommendations Identified in the Five-Year Review:

OU(s): 02	**Issue Category: Institutional Controls**			
	Issue: Deed restrictions have not been completed			
	Recommendation: BASF, NJDEP and the Township of Toms River need to complete the deed restrictions.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	2023

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)		
Operable Unit: 01	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The OU1 groundwater remedy is protective of human health and the environment		
Operable Unit: 02	*Protectiveness Determination:* Short-term Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The OU2 source control remedy is protective of human health and the environment in the short-term. However, in order for the remedy to be protective in the long term, deed restrictions need to be established.		

Sitewide Protectiveness Statement	
Protectiveness Determination: Short-term Protective	*Planned Addendum Completion Date:* Click here to enter a date

Protectiveness Statement:
The OU2 source control remedy is protective of human health and the environment in the short-term. However, in order for the remedy to be protective in the long term, deed restrictions need to be established.

VIII. NEXT REVIEW

The next FYR report for the Ciba-Geigy Superfund Site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

- Brown and Caldwell. March 2014. *2013 Annual Report for OU-1 Long-Term Monitoring Plan (LTMP) and Groundwater Portion of OU-2 LTMP Ciba-Geigy Toms River Site Toms River, New Jersey*. Project No. 003-6045
- Brown and Caldwell. June 2015. *2014 Annual Report for OU-1 Long-Term Monitoring Plan (LTMP) and Groundwater Portion of OU-2 LTMP Ciba-Geigy Toms River Site Toms River, New Jersey*. Project No. 003-6045
- Brown and Caldwell. May 2016. *2015 Annual Report for OU-1 Long-Term Monitoring Plan (LTMP) and Groundwater Portion of OU-2 LTMP Ciba-Geigy Toms River Site Toms River, New Jersey*. Project No. 003-6045
- Brown and Caldwell. June 2017. *2016 Annual Report for OU-1 Long-Term Monitoring Plan (LTMP) and Groundwater Portion of OU-2 LTMP Ciba-Geigy Toms River Site Toms River, New Jersey*. Project No. 003-6045
- Brown and Caldwell. June 2016. *Equalization Basins Source Characterization Report Ciba-Geigy Toms River Site Toms River, New Jersey*
- Brown and Caldwell. June 2017. *Groundwater Extraction and Recharge System (GERS) Optimization Analysis Ciba Geigy Toms River Site, Toms River, New Jersey*
- BASF. June 2013 – September 2017. *Operable Unit 1 Operations, Maintenance and Monitoring and Remedial Process Optimization Progress Report*

APPENDIX B – ADDITIONAL TABLES

TABLE 3 – ESD EFFLUENT DISCHARGE LIMIT (µg/L)			
PARAMETER	**STANDARD**	**PARAMETER**	**STANDARD**
ORGANIC		**INORGANIC**	
1,1,1-Trichloroethane	15	Total Arsenic	8
1,1,2,2-Tetrachloroethane	2	Total Cadmium	3
1,1,2-Trichloroethane	2	Total Chromium	50
1,1-Dichloroethylene	2	Total Copper	10
1,2,3-Trichlorobenzene	8	Total Iron	300
1,2,3-Trichloropropane	20	Total Lead	10
1,2,4-Trichlorobenzene	5	Total Mercury	2
1,2-cis-Dichloroethylene	5	Dissolved Nickel	22
1,2-Dichlorobenzene	77	Total Selenium	10
1,2-Dichloroethane	2	Total Zinc	15
1,2-Dichloropropane	1		
1,2-trans-Dichloroethylene	10	**PHYSICAL**	
1,3-Dichlorobenzene	31	Chloride	250
1,3-trans-Dichloropropylene	Monitor	Nitrogen, nitrate	10
1,4-Dichlorobenzene	10	Sulfate	250
2-Butanone	150	Total dissolved solids	500
2-Chloroethyl Vinyl Ether	Monitor	Total suspended solids	40
Acetone	700	pH	SU 5-9
Acrylonitrile	50		
Benzene	1		
Benzidine	50		
Bis(2-ethylhexyl)phthalate	30		
Carbon tetrachloride	2		
Chlorobenzene	3		
Chloroform	3		
Dibromochloromethane	5.5		
Ethylbenzene	32		
Methylene chloride	2		
Naphthalene	15		
Nitrobenzene	10		
o-Chlorotoluene	Monitor		
p-Chlorotoluene	Monitor		
PCBs	0.5		
Phenol	10		
Styrene	50		
Tetrachloroethylene	1		
Toluene	26		
Trichloroethylene	1		
Vinyl chloride	2		
Xylenes, total	20		

Table 4 Groundwater Remediation Levels Compared with Residential Risk-Based Concentrations

Chemical	Cleanup standard (ppb)	Concentration with Risk Level of 10-6 (ppb)	Concentration with noncancer Hazard Quotient (HQ) = 1 (ppb)	Conclusion
Arsenic	50 (new standard is 10 ppb as of 2001)	0.052	6	MCL (50 ppb) is in upper bound or risk range but exceeds an HI = 1. MCL (10 ppb) is within the risk range but exceeds the non-cancer HQ = 1.
Benzene	1	0.46	33	MCL within the risk range and non-cancer HQ = 1.
Cadmium	5.0	None	9.2	Below HQ = 1.
Chlorobenzene	4.0	None	78	Below HQ = 1.
Chloroform	NA	0.22	97	No cleanup level in ROD for comparison.
1,2-dichloroethane	2.0	0.17	13	Level within the risk range and below HQ = 1.
Nickel	NA	None	390 (based on soluble salts)	No cleanup level in ROD for comparison.
Tetrachloroethylene	1.0	11	41	Below risk range and HQ = 1
1,2,4-trichlorobenzene	NA	1.2	4.1	No cleanup level in ROD for comparison.
Trichloroethylene	1.0	0.49	2.8	Within risk range and below HQ = 1.

- Risk levels obtained from the November 2017 Regional Screening Levels.

TABLE 5 - SITE-WIDE MONITORING PROGRAM - ANALYTICAL PARAMETERS

Organics (µg/L)	MDL	Organics (µg/L)	MDL	Organics (µg/L)	MDL	Organics (µg/L)	MDL
1,1,1,2-Tetrachloroethane	0.5	1,3-Dichlorobenzene	1	Chloroethane	0.5	Methyl-T-Butyl Ether	0.5
1,1,1-Trichloroethane	0.5	1,3-Dichloropropane	0.5	Chloroform	0.5	Naphthalene	1
1,1,2,2-Tetrachloroethane	0.5	1,3-Trans-Dichloropropylene	0.5	Dichlorobromomethane	0.5	N-Butylbenzene	1
1,1,2-Trichloroethane	0.5	1,4-Dichlorobenzene	1	Dichlorodifluoromethane	0.5	N-Propylbenzene	1
1,1-Dichloroethane	0.5	2,2-Dichloropropane	0.5	Diethyl Ether	2	O-Xylene	0.5
1,1-Dichloroethylene	0.5	2-Chloroethyl Vinyl Ether	2	Ethyl Methacrylate	1	P-Chlorotoluene	1
1,1-Dichloropropylene	1	2-Chlorotoluene	1	Ethylbenzene	0.5	Pentachloroethane	1
1,2,3-Trichlorobenzene	1	2-Hexanone	3	Hexachlorobutadiene	2	P-Isopropyltoluene	1
1,2,3-Trichloropropane	1	3-Chloropropene	1	Hexachloroethane	1	Sec-Butylbenzene	1
1,2,4-Trichlorobenzene	1	Acetone	6	Isopropylbenzene	1	Styrene	1
1,2,4-Trimethylbenzene	1	Acrolein	40	M+P-Xylene	0.5	Tert-Butylbenzene	1
1,2-CIS-Dichloroethylene	0.5	Acrylonitrile	4	Methacrylonitrile	10	Tetrachloroethylene	0.5
1,2-Dibromo-3-Chloropropane	2	Benzene	0.5	Methyl Bromide	0.5	Tetrahydrofuran	4
1,2-Dibromoethane	0.5	Bromobenzene	1	Methyl Chloride	0.5	Toluene	0.5
1,2-Dichlorobenzene	1	Bromochloromethane	1	Methyl Ethyl Ketone	3	Trans-1,4-Dichloro-2-Butene	15
1,2-Dichloroethane	0.5	Bromoform	0.5	Methyl Iodide	0.5	Trichloroethylene	0.5
1,2-Dichloropropane	0.5	Carbon Disulfide	1	Methyl Isobutyl Ketone	3	Trichlorofluoromethane	0.5
1,2-Trans-Dichloroethylene	0.5	Carbon Tetrachloride	0.5	Methyl Methacrylate	1	Vinyl Chloride	0.5
1,3,5-Trimethylbenzene	1	Chlorobenzene	0.5	Methylene Bromide	0.5	Xylenes,Total	0.5
1,3-Cis-Dichloropropylene	0.5	Chlorodibromomethane	0.5	Methylene Chloride	2		

Inorganics (mg./L)	MDL		Other Parameters			
Arsenic	0.0078		TSS (mg/L)	1		
Cadmium	0.00064		TDS (mg/L)	9.7		
Chromium	0.002		pH (standard units)	---		
Copper	0.0032		Nitrite (mg/L)	0.04		
Iron	0.0333		Sulfate (mg/L	0.3		
Lead	0.0051		Chloride (mg/L)	0.2		
Mercury	0.00005					
Nickel	0.0021					
Selenium	0.0082					
Zinc	0.0042					

MDL – Method Detection Limit

APPENDIX C – SITE FIGURES

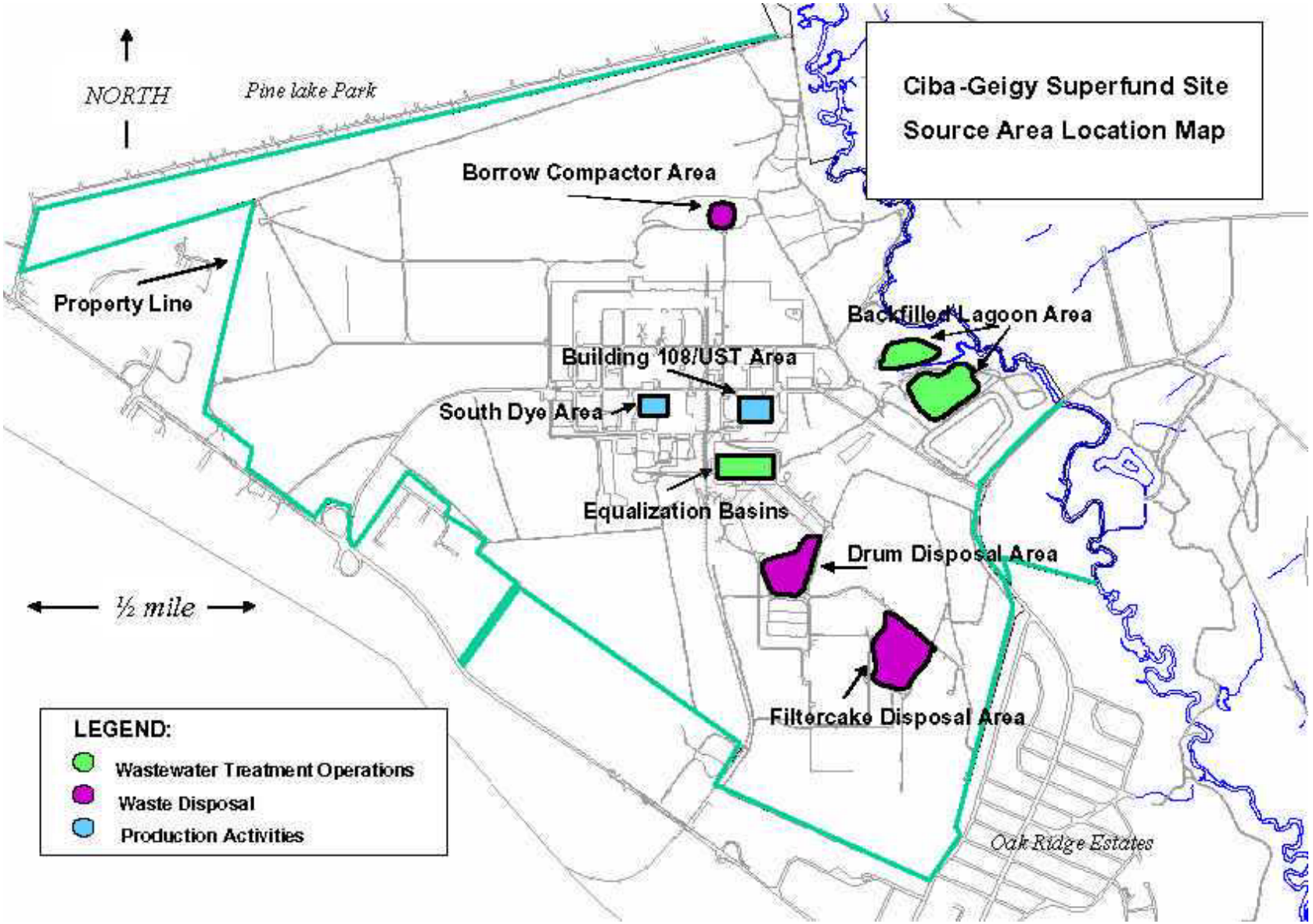

Figure 1 – OU2 Source Areas

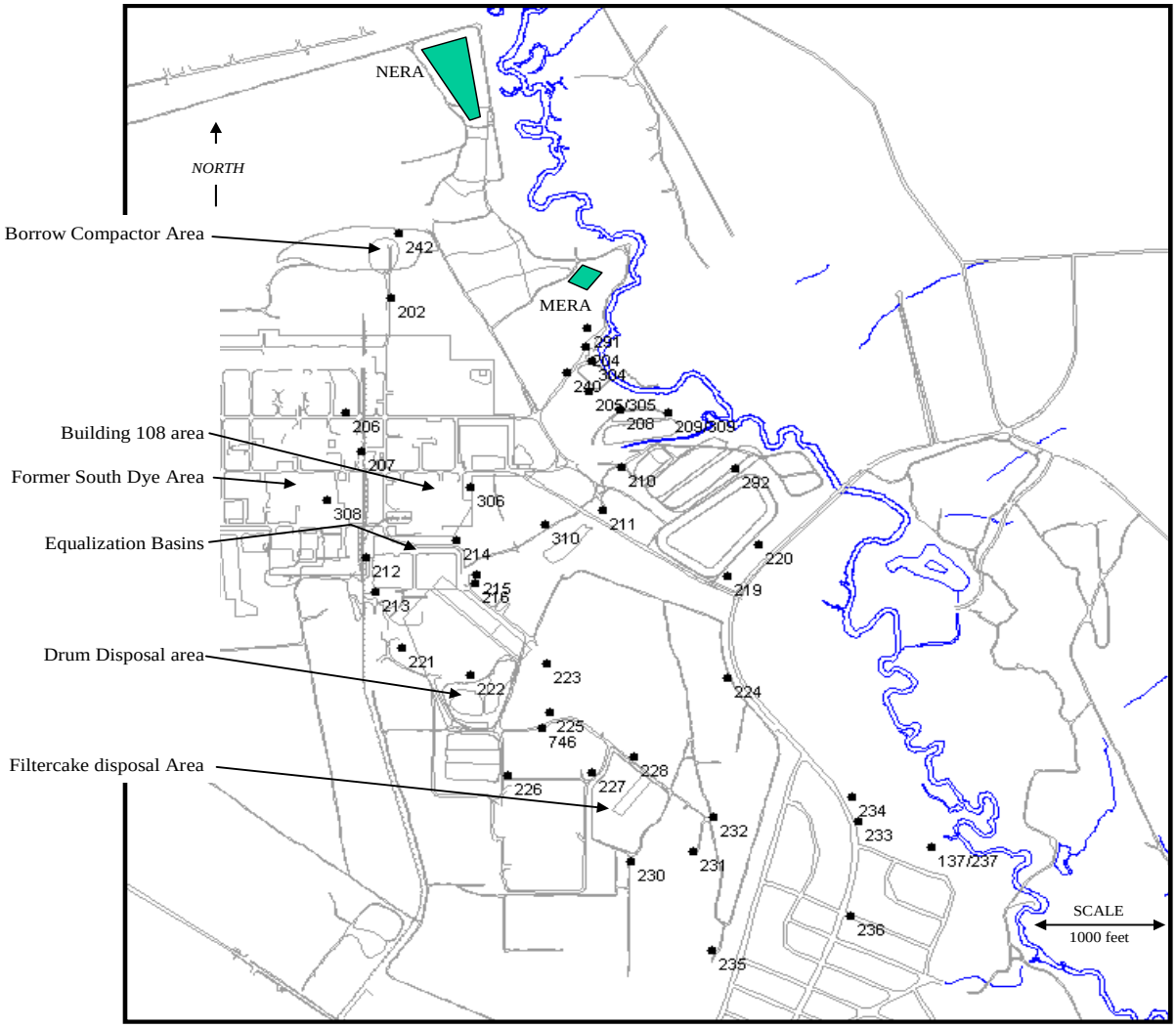

Figure 2 GERS Original Design

* from the Brown and Caldwell, 2011 Annual Report fo OU-1 Long-Term Monitoring Plan (LTMP) and Groundwater Portion of OU-2 LTMP, Ciba-Geigy Toms River Site, Toms River, New Jersey, August 2012

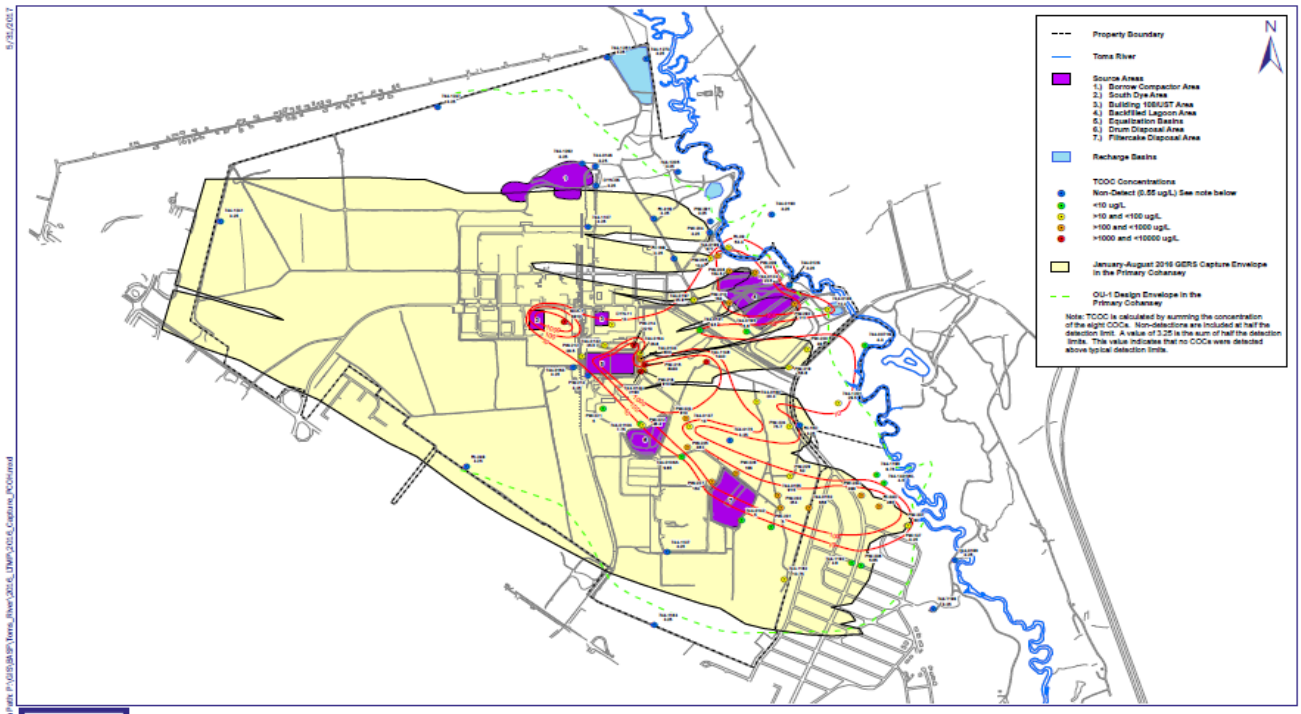

FIGURE 7-1
2016 TCOC CONCENTRATIONS AND MODELED CAPTURE IN THE PRIMARY COHANSEY MODEL LAYERS 1, 2, 3
CIBA-GEIGY TOMS RIVER SITE, TOMS RIVER NJ

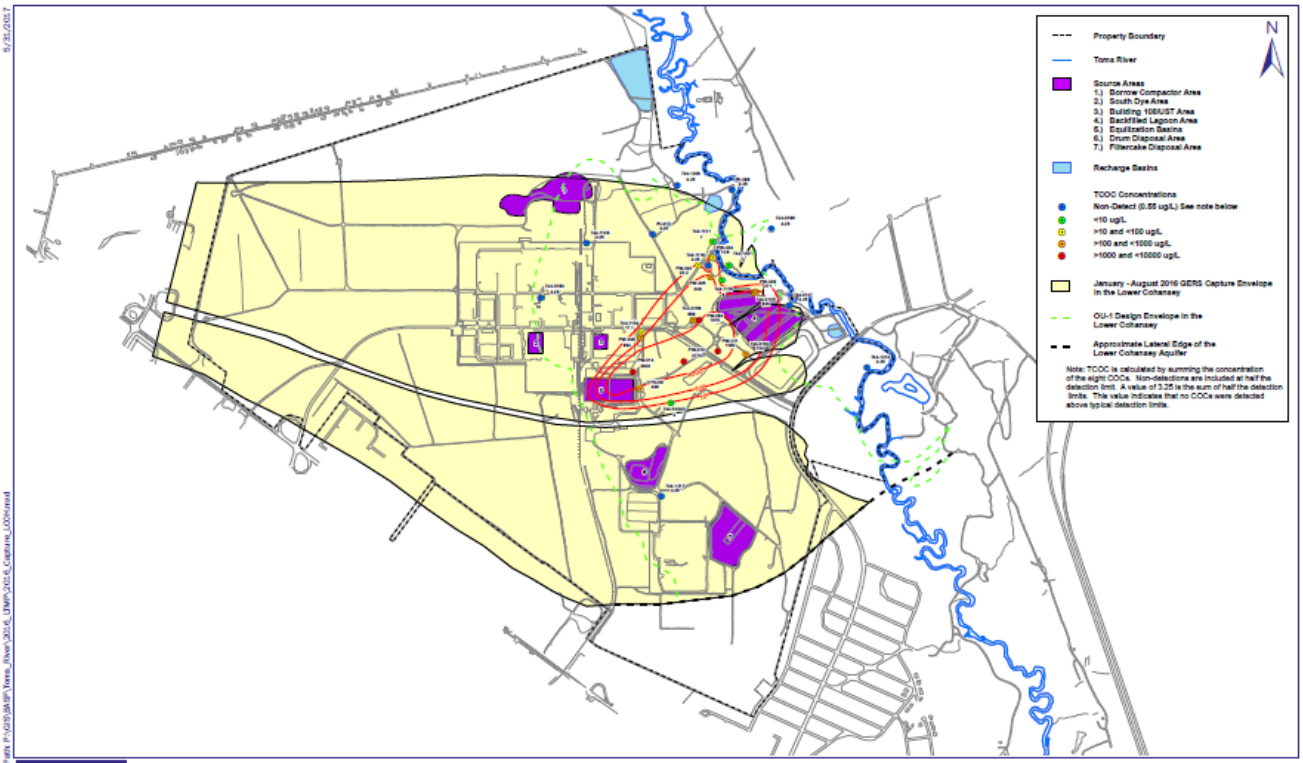

FIGURE 7-2
2016 TCOC CONCENTRATIONS AND MODELED CAPTURE IN THE LOWER COHANSEY MODEL LAYER 5
CIBA-GEIGY TOMS RIVER SITE, TOMS RIVER NJ

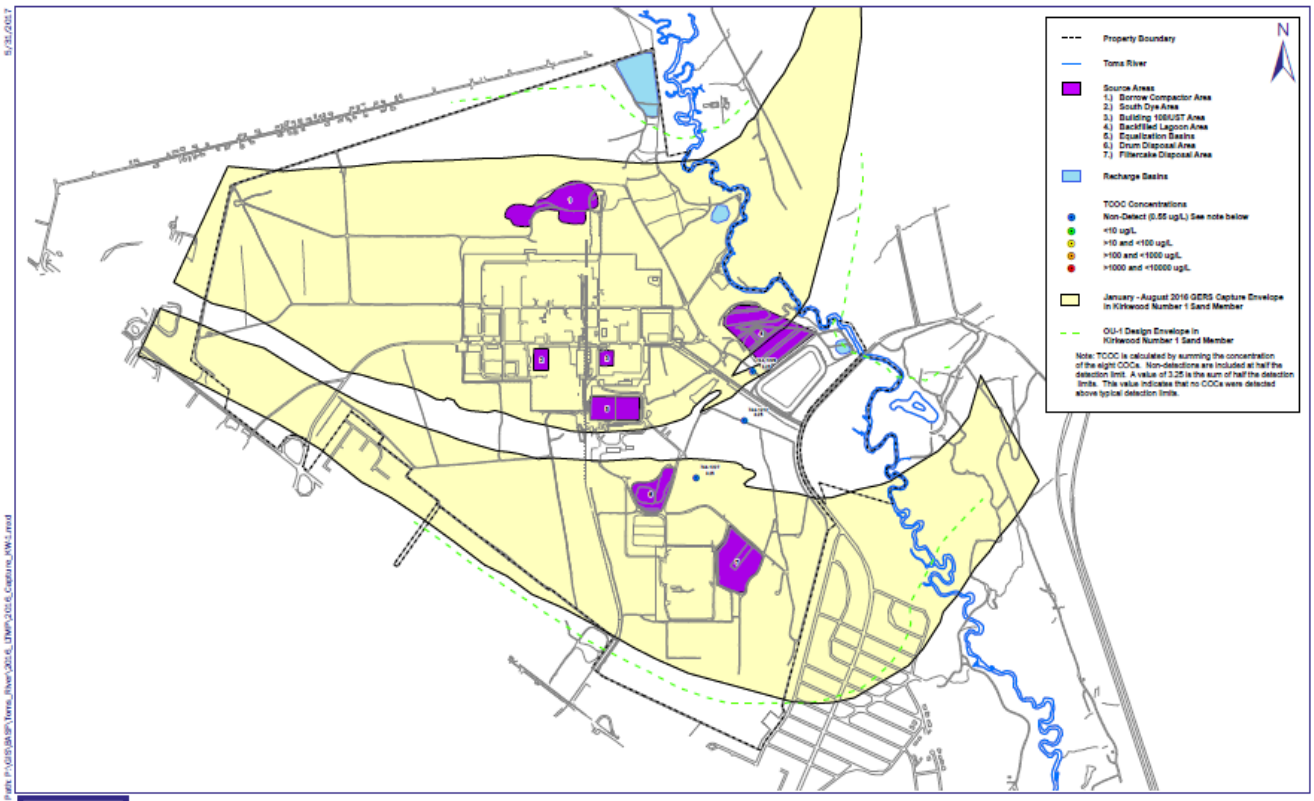

FIGURE 7-3
2016 TCOC CONCENTRATIONS AND MODELED CAPTURE IN THE KIRKWOOD NUMBER 1 SAND MEMBER MODEL LAYER 7
CIBA-GEIGY TOMS RIVER SITE, TOMS RIVER NJ