UNITED STATES

ENVIRONMENTAL PROTECTION AGENCY

REGION III

FINAL DECISION and RESPONSE TO COMMENTS

Akzo Nobel Incorporated

Delaware City, Delaware

EPA ID: DED 980 551 667

Prepared by

Office of Remediation

Land and Chemicals Division

November 2018

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Section 1: Introduction

The U.S. Environmental Protection Agency (EPA) is issuing this Final Decision and Response to Comments (FDRTC) for the former Akzo Nobel Inc. (Akzo) Facility located at 1385 Schoolhouse Road in Delaware City, New Castle County, Delaware, 19706 (Facility). Expert Management Inc. (EMI), an Akzo subsidiary, currently owns the Facility.

This FDRTC is issued pursuant to the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (RCRA) of 1976, and the Hazardous and Solid Waste Amendments (HSWA) of 1984, 42 U.S.C. Sections 6901, et seq.

On June 8, 2017, EPA issued a Statement of Basis (SB) for the Facility which described the information gathered during the environmental investigations on- and off-site of the Facility and presented a proposed Final Remedy for the Facility. The SB is hereby incorporated into the Final Decision by reference.

EPA solicited public comment on its proposed Final Remedy, consistent with the public participation provisions under RCRA. On June 8, 2017, notice of the SB was published in a local Delaware newspaper called the Middletown Transcript. The 30-day comment period ended on July 7, 2017. During the comment period, EPA received comments from one source, the Delaware Department of Natural Resources and Environmental Control (DREC) by e-mail. After the public comment closed, EPA received comments from the Delaware City Refining Company (DCRC), an adjacent property where Facility-related contaminants have come to be located and Akzo.

Based on comments received from DNREC and DCRC, EPA required Akzo to conduct further off-site groundwater and potential vapor intrusion investigations. The off-site groundwater data is incorporated in Table 1 of this FDRTC and off-site vapor intrusion investigations will be conducted as part of the off-site remedy. The Technical Impracticability (TI) Zone area proposed in the SB was revised, based on comments. The revised TI boundaries encompasses only the metals groundwater plume and are shown in Figure 3. EPA's Response to Comments is included in Attachment A.

Information on the RCRA Corrective Action Program and a fact sheet for the Facility can be found by navigating to https://www.epa.gov/hwcorrectiveaction/hazardous-waste-cleanup-akzo-nobel-chemicals-inc-delaware-city-de.

Section 2: Facility Background

The Facility is located adjacent the Delaware City Refinery and is surrounded by other industrial and

agricultural properties as shown in Figure 1. The Facility is currently unused. The Facility property consists of approximately 190 acres, which includes 57 acres formerly used for manufacturing (the Akzo Study Area) and 132 acres currently and historically used exclusively for agriculture (Agricultural Parcel) (see Figure 1). The Akzo Study Area (shown in Figure 2) is divided into the Carbon Disulfide (CS_2) Plant Area and an area called the Undeveloped Parcel. The CS_2 Plant Area included the manufacturing process units, CS_2 and Sodium Bisulfate (NaHS) plants, waste water treatment plant, drum storage, above ground tanks and other manufacturing support units. The Undeveloped Parcel includes 5-acres of the adjacent Delaware City PVC CERCLA Site and contains a groundwater treatment system and contaminated areas that were capped. The Undeveloped Parcel is overgrown with vegetation with two small marginal wetlands and two former waste areas capped with synthetic membranes overlain by grassed soil covers that were installed by the Akzo for Facility-related wastes.

The Facility was originally part of a manufacturing complex built and operated by Stauffer Chemical Company (Stauffer) and located along Schoolhouse Road. The complex consisted of two manufacturing units, the CS_2 and NaHS plants, and a polyvinyl chloride (PVC) resin plant (PVC Plant). In 1981, Stauffer sold the PVC Plant to Formosa Plastics Corporation (Formosa). The PVC Plant is part of the Delaware City PVC Plant Site (DE City PVC). DE City PVC is located adjacent to and south of the CS_2 Plant Area. In 1987, Akzo acquired the CS_2 and NaHS Plants. In 1992, Akzo ceased production at the Facility and the manufacturing units were dismantled and removed. Currently, the former CS_2 Area is heavily vegetated with remnant concrete slabs, three small one-story structures, an open sided shed, a warehouse, a maintenance shop, and office building and two capped areas. The two capped areas are within the Akzo Study Area on the Undeveloped Parcel and are mowed and maintained by the Facility.

CS_2 and NaHS were produced at the Facility for approximately 32 years. CS_2 is a solvent mostly used in rayon fiber, and cellophane and insecticide production, and as a fumigant. NaHS is mostly used in cloth and paper manufacturing. PVC resin production continues at DE City PVC located adjacent to and south of the Facility.

Section 3: Summary of Environmental Investigations

3.1 Corrective Action Regulatory History

In 1980, Stauffer sent EPA a Notification of Hazardous Waste (HW) Activity and a RCRA Hazardous Waste Permit Application (Part A) for its PVC and CS_2 operations. EPA determined that Stauffer met interim status requirements. In 1981, Stauffer sold its PVC Plant to Formosa and sent EPA a Part B HW Permit Application for the CS_2 operation, identifying hazardous chemicals on-site, which included: CS_2, hydrogen sulfide, lead acetate, mercury and waste exhibiting HW characteristics. EPA and DNREC each issued Stauffer a HW Storage Permit for NaHS storage. Stauffer later notified EPA that it was also a HW generator, generating waste sodium filter cake and waste oil. Non-hazardous off-specification

sulfur and ceramic brick debris were reportedly disposed of in two areas called the Barren Area and the Landfill Area, respectively. The Landfill Area had been covered with plastic sheeting that had deteriorated over time, exposing the underlying soil in these areas.

Chlorinated volatile organic compounds (cVOCs) in groundwater (GW) were first discovered under the Agricultural Parcel in 1982. EPA determined that the cVOCs were associated with the PVC Plant. PVC-related cVOCs were later found in GW beneath portions of the Undeveloped Parcel. The PVC-related cVOCs were 1,2-dichloroethane (1,2-DCA), trichloroethylene (TCE) and vinyl chloride (VC). The GW contamination findings resulted in EPA listing the PVC Plant on the National Priorities List as the DE City PVC Site in 1983. In May 1984, EPA and DNREC entered into a CERCLA Administrative Order (CERCLA Order) with Stauffer and Formosa. DE City PVC potentially responsible parties (PRPs) retained responsibility for GW clean-up beneath the Agricultural Parcel and other off-Site areas. The DE City PVC PRPs were also ordered to excavate, consolidate and cap PVC resin and resin contaminated soils on the DE City PVC property.

In December 1994, EPA and Akzo entered into a Consent Order pursuant to RCRA § 7003 (RCRA Consent Order), requiring Akzo to investigate the Facility and evaluate clean-up remedies. EPA determined that investigation of soil on the Agricultural Parcel was unnecessary because that parcel was used exclusively for farming and was not impacted by run-off from the Undeveloped Parcel. Corrective Action efforts were focused on the Akzo Study Area because DE City PVC PRPs are responsible for removing chlorinated solvents from GW beneath the Agricultural Parcel.

3.2 Facility Corrective Action Investigation Summary:

Akzo submitted *Phase 1* and *2 RCRA Facility Investigation* (*RFIs*) *Reports* dated August 1999 and May 2002, respectively. As part of the RFIs, Akzo collected soil, sediment and GW samples on the Akzo Study Area and completed a human health risk assessment. EPA approved the RFI Reports.

3.3 Findings of Investigations:

1. Site Geology and Hydrogeology: The Akzo Study Area is approximately 55 to 65 feet above mean sea level and is underlain by Coastal Plain sediments of the Columbia Formation. The Columbia Formation aquifer is a low yield water table aquifer beneath the Akzo Study Area. The Columbia Formation consists of coarse to medium sands and gravels from the surface to approximately 33 to 44 feet below ground surface (bgs) on-Site. The Columbia Formation is underlain by the Merchantville Formation which consists of a distinct dark micaceous fine silt and clay. The Merchantville Formation and the underlying Upper Potomac Formation are considered aquitards or confining units in New Castle County and are approximately 50 feet thick beneath the Facility. The Potomac Formation underlies the Merchantville Formation and is hundreds of feet thick consisting of sand, clay and silt layers with abundant water bearing zones used locally for industrial/commercial water supplies. Facility-related GW

contamination beneath the Akzo Study Area was found only in the Columbia Formation. This observation is supported by GW investigations on the adjacent DE City PVC Site. Under the CERCLA Order, DE City PVC PRPs initiated a GW pump and treatment remedy on the Agricultural Parcel and on DE City PVC property. Currently, GW clean-up levels selected by EPA in a 1986 Record of Decision for DE City PVC (ROD) have been achieved beneath the Agriculture Parcel under the DE City PVC CERCLA clean-up efforts.

GW beneath the Facility forms a thin layer on top of the Merchantville Formation confining unit. The water column ranges from approximately 3 to 20 feet thick. A GW high point or mound on the adjacent DE City PVC property creates a GW divide under the Undeveloped Parcel. East of the GW divide, GW flows east from the Barren Area towards the CS_2 Plant Area and towards Schoolhouse Road and the DE City Refinery. West of the divide, GW flows towards the Agricultural Parcel. Contaminated GW in the Akzo Study Area does not impact any surface water bodies located in the areas surrounding the Facility.

2. Soil and sediment: *Phase 1 RFI* soil samples were collected from 28 soil borings located on the Akzo Study Area. Samples were collected from three depths, 0-2 feet, 3 to 4.3 feet respectively, and from above the water table. Samples were collected from the CS_2 Plant Area, Barren Area and Capped Area (see Figure 2). One sediment sample was collected from a concrete stormwater collection pit where sediment settled out. The samples were analyzed for inorganics (metals), volatile and semi-volatile organic compounds (VOCs and SVOCs, respectively), with a subset of samples analyzed for polychlorinated biphenyls (PCBs) and total petroleum hydrocarbons (TPHs).

The only constituent detected in Facility soils above EPA's 2001 Regional Screening Levels (RSLs) for industrial sites was arsenic. Arsenic levels were not confined to a particular area or unit, indicating that it is not from a specific release from the Facility. Arsenic levels in the soil is considered within normal background ranges calculated for New Castle County soils. DNREC concluded that arsenic is not considered a Site-related contaminant. Aroclor-1260 (PCB) was found in the sediment sample from the stormwater collection pit. The PCB level was above the residential RSL but below the industrial RSL.

Phase 2 RFI sediment samples were collected from the Undeveloped Parcel in four areas of accumulated sediment that had apparently washed off from the Landfill and Barren Areas. Another sediment sample was collected from the concrete stormwater collection system. The four Undeveloped Parcel sediment samples were analyzed for metals only. Only hexavalent chromium and arsenic exceeded their industrial RSL in all four samples. The arsenic levels were within established background levels for New Castle County. The sediment sample from the stormwater collector was analyzed for sVOCs, metals and PCBs, with no RSL exceedances. A human health risk assessment was completed using soil, sediment and GW data from *Phase I* and *II RFIs*. HHRA results are discussed in Section 5.

3. Groundwater: For initial GW monitoring in 2001, Akzo sampled 19 monitoring wells (MWs), which included wells located on the Facility property and on DE City PVC property. Akzo MWs screens are

set at the bottom of the Columbia Formation, on top of the underlying Merchantville Formation confining unit. All samples were analyzed for VOCs and metals and three MWs were selected for sVOCs analysis.

In 2016, Akzo sampled 16 MWs including four MWs located on DE City Refinery's property. Figure 3 shows MW locations and GW flow directions. Table 1 below lists constituents (in parts per billion or ppb) that exceeded applicable drinking water standards known as National Primary Drinking Water Standard Maximum Contaminant Levels (MCLs) promulgated pursuant to Section 42 U.S.C. §§ 300f et seq. of the Safe Drinking Water Act and codified at 40 CFR Part 141 or Regional Screening Levels (RSLs) if an MCL has not been established for a contaminant. Table 1 lists contaminant concentrations that were the highest exceedances from the 2001, 2006, 2016 and 2018 data sets. Sampling of GW in the Delaware City Refinery MWs began in 2006.

Table 1.
GW Contaminant Ranges in ppb

Contaminant	DE MCL	RSL	2001	2006	2016	2018
Former CS_2 Area						
PCE	1		1,100	2,300	840	380
TCE	1		31	60	12	6.7
Chromium (VI)		0.035	21	--	24.6 J*	21.1
Manganese		430	6,120	--	1,030	141
Nickel	100		188	--	--	325
Iron		14,000	26,800	--	NS	NS
DE Refinery MWs						
PCE	1		--	1,700	500	410
TCE	1		--	45	8.1	17
Chromium (VI)		0.035	--	--	--	16.4
Undeveloped Parcel						
TCE	1		4.6	--	0.84 J*	--
1,2-DCA	1		130	--	13	--
Vinyl Chloride	1		39	--	2.3	--
Bis(2-eh) phthalate	6		430	--	ND	--
Arsenic	10		22.4	--	NS	--
Beryllium	4		11.6	--	NS	--
Manganese		430	17,100	--	10,800	--
Nickel	100		3,640	--	1,490	--
Chromium (total)	100		349	--	609	--
Chromium (VI)		0.035	647	--	737	--

*J – a lab 'flag' denoting that the analyte was detected at levels below lab detection limits.
NS – not sampled, considered background levels (naturally occurring) or attributed to off-Site source.
ND – non-detect.

The GW monitoring data summarized in Table 1 shows that two distinct plumes exist under the Akzo Study Area: (1) a small VOC PCE plume, located beneath the eastern part of the CS_2 Plant Area, that

migrated off-site beneath the DE City Refinery, and; (2) an inorganics plume, located beneath the Undeveloped Area and the western portion of the CS_2 Plant Area, consisting of dissolved manganese, nickel and hexavalent chromium. The dissolved manganese plume appears to have its source from DE City PVC to the south of the Facility and the hexavalent chromium plume source appears to be the Landfill and Barren Areas. Although arsenic exceeded its MCL in groundwater beneath the Undeveloped Parcel, EPA has determined the concentrations of arsenic are within naturally occurring background levels for GW in New Castle County.

Akzo sampled GW in 2001, 2003, 2004, 2006, 2007, 2013 to 2018. The 2003 GW investigation was centered around MW P-5 to locate a PCE source (see Figure 4). No source was found. Beginning in 2004, Akzo sampled six MWs on the Delaware City Refinery property. Refinery MW-4S, located nearest to MW P-5, had PCE at 1,700 ppb, significantly above the MCL, indicating that the Facility is a source of PCE. The data presented in Table 1 shows that PCE concentrations in the plume are attenuating, with some fluctuations due to wet and dry season variation. Akzo prepared a *Corrective Measures Study* (*CMS*) in which it proposed GW remedies for the PCE plume. The *CMS* is discussed in Section 6, below.

Section 4: Summary of Interim Remedial Activities

1. GW Remediation: In 1982, Stauffer began GW studies on the DE City PVC Site and the Agricultural Parcel, where PVC-related GW contaminants were first identified. These investigations found that: (1) the PVC-related cVOCs were restricted to the Columbia Formation on the Facility; and (2) the major source of contamination was the unlined PVC Impoundments located on DE City PVC, and (3) an aquitard (Merchantville and/or Upper Potomac Formations below the Columbia Formation) restricts the vertical migration of contaminants into the underlying Potomac Formation. Under the CERCLA Order, the DE City PVC Potentially Responsible Parties (PRPs) were required to install a series of GW recovery wells in the Columbia Formation, along Route 13 (west of the Facility). Currently, the PVC contaminants beneath the Agricultural Parcel have attained the clean-up levels selected in the ROD.

2. Closure of Hazardous Waste storage pad: In 1983, Stauffer constructed a HW drum storage pad, constructed primarily for storage of sodium hydrosulfide filter cake which is a listed hazardous waste (D002, D003). The 20 by 20 feet storage pad was in a larger 20 by 100 feet building with a curbed reinforced concrete floor. As part of the DNREC HW Storage Permit, Akzo submitted a closure plan to DNREC for this unit in 1991. Akzo demolished the concrete floor and excavated 12 cubic feet of soil for off-site disposal. DNREC approved the closure in 1992. Also, in 1992, Akzo removed all CS_2 and NaHS Plant equipment, including above ground storage tanks and 3 gasoline containing underground storage tanks, power systems (including four transformers), pipes and buildings.

3. PVC Resin Removal: During excavation of a PVC impoundment located on DE City PVC, a buried thin layer of white resin was discovered extending onto the Facility property into the Barren Area.

Contractors excavated a portion of a wetland located on the Facility property to remove the buried resin. Further investigation in the Barren Area uncovered a one to six-inch resin layer beneath fill which consisting of lumps of sulfur, brick and concrete. The resin was analyzed and PVC-related chemicals, TCE, 1,2-DCA and PCE, were found in the resin. The resin was excavated from the wetland area adjacent to the Barren Area. Some resin was left in place as approved by EPA under the 1983 CERCLA Order.

4. Barren and Landfill Area Remedy: In April 2001, Akzo installed temporary erosion control (hay bales and silt fencing) to control soil erosion from the Barren Area and the Landfill Areas. In August 2003, Akzo submitted an *Interim Measures (IM) GeoSynthetic Cap* design for the Barren and Landfill Areas. EPA approved the design in September 2006. The GeoSynthetic Caps' purposes are to: (1) shed precipitation from the Barren and Landfill Areas, preventing further leaching of contaminants (metals) into GW, and; (2) remove potential ecological receptor exposure to metal contaminants in eroded soil/debris from the Landfill Area. Cap construction began on the Landfill Area with moving eroded sediment from around the Landfill and placing it back on the Landfill, prior to grading and capping. The Barren Area Cap covered the Barren Area and the surrounding area where resin was delineated and left in place. The material in the Barren and Landfill Areas was compacted and High Density Polyethylene (HDPE) 40-mil thick geosynthetic membranes were installed over both the Barren and Landfill Areas. The membranes were covered with 18 inches of cover soil that was seeded with grass. Gas vents were installed through the Landfill Area and Barren Area Caps. Cap installation was completed in October 2007. Currently, Akzo maintains both Caps and mows the grass covers.

Section 5: Human Health Risk Assessment

The *Phase II RFI* Report included a Human Health Risk Assessment (HHRA). The likely future use of the Facility is industrial or commercial. On-site GW is not currently being used and will not be used in the future as a potable supply as directed by DNREC under the 2008 Groundwater Management Zone (see Figure 5). For future Facility and construction workers, the calculated risk is within EPA's acceptable cancer and non-cancer risk range. For future adult and child residential exposures, the calculated risk is also within EPA's acceptable cancer and non-cancer risk range, when on-Site GW use is excluded. When on-site GW use is considered in the residential risk calculations, the risk exceeds EPA's acceptable range. For vapor intrusion screening, EPA used the 2018 cVOC GW results from the cVOC plume and the DCRC property as inputs to EPA's vapor intrusion screening level calculator (VISL) to calculate potential indoor air levels of cVOC levels. The results of the VISL indicate that if occupied structures were located directly above or near to the plume, further investigation of potential indoor impact is recommended. Currently there are no occupied structures located directly above or within 100 feet of the plume, on-site. The Facility will conduct an off-site vapor intrusion investigation as part of the final remedy.

5.1 Environmental Indicators

Under the Government Performance and Results Act (GPRA), EPA set national goals to address RCRA corrective action facilities. Under GPRA, EPA evaluates two key environmental clean-up indicators for each facility: (1) Current Human Exposures Under Control; and (2) Migration of Contaminated Groundwater Under Control. The Facility met both indicator goals in May 2001 and September 2007, respectively.

Section 6: Corrective Measures Study

Akzo submitted its Final *Corrective Measures Study* (*CMS*), dated May 2010 to EPA. The *CMS* evaluated GW remedies for the two distinct contaminant plumes beneath the Facility. EPA and DNREC requested that Akzo include GW treatment for the PCE plume in the CS_2 Plant Area. Akzo proposed an in-situ pilot scale oxidation study for the CS_2 Plant Area as an interim measure. The oxidation study consisted of injecting hydrogen peroxide into 20 temporary injection wells situated in and around the plume. A total of 19,500 gallons of hydrogen peroxide (10% by weight) was injected into the plume starting in June 2013. The study ended in January 2014 and results were mixed regarding successful elimination of PCE. Also, the wells only accepted low volumes of peroxide, and in some wells, peroxide returned to the surface rather than flowing into the aquifer as planned. These results indicate the low permeability of the aquifer and show that the CS_2 Plant Area is not suitable for further injection treatment.

Section 7: Corrective Action Objectives (CAOs)

EPA's Corrective Action Objectives (CAOs) for the environmental media at the following:

1. Soil - EPA's CAO for Facility soils is to prevent exposures to soil with concentrations exceeding EPA's acceptable cancer risk range (10^{-4} to 10^{-6}) and non-cancer hazard quotient (HQ no greater than 1) for industrial sites. Based on the Facility HHRA, industrial soil exposures are within EPA's acceptable cancer risk range and non-cancer HQ.

2. Groundwater - EPA expects final remedies to return usable groundwater to its maximum beneficial use within a reasonable timeframe given the Facility's setting. Where aquifers either have the potential, or are currently used for water supply, EPA uses MCLs. For the groundwater under the Facility and Facility-related groundwater under DCRC, GW clean up goals are Delaware's MCLs. DE's MCLs for PCE, TCE and VC are 1 ppb each, whereas federal MCLs for PCE and TCE is 5 ppb and VC is 2 ppb.

If clean-up to MCLs is not possible, EPA seeks to prevent or minimize the further migration of a plume, prevent exposure to contaminated GW and evaluate further risk reduction. Technical Impracticability (TI) refers to a situation where achieving GW clean-up standards is not practicable using current engineered treatment solutions when feasibility, reliability, project scale/magnitude and safety is considered.

EPA has determined that restoration of GW to drinking water standards or MCLs (as promulgated in 40 C.F.R. Part 141, pursuant to Section 1412 of the Safe Drinking Water Act, 42 U.S.C. Section 300g-1 and as promulgated in 16 DE Administrative Code 4462, Delaware's *Regulations Governing Public Drinking Water Systems*, Section 6.0 at the Facility is technically impracticable for the inorganic (metals) plume for the following reasons.

(1) the aquifer beneath the Facility exhibits low permeability and low GW yield, unsuitable for treatment by either injection or GW extraction;

(2) the metals plume beneath the Undeveloped Parcel and a portion of the CS_2 Plant Area has remained stable and stationary since GW monitoring began in 2001, indicating an old plume staying on-site, moving very slowly or not at all.

(3) Excavation of potential contaminant source areas, the Landfill and Barren Areas, is not recommended because the waste is capped with geosynthetic Caps that prohibits precipitation from washing any residual contaminants into the aquifer.

(4) The Facility is located within the Delaware City Industrial Area Groundwater Management Zone (GMZ) established by DNREC in 2008. New public or domestic (potable) water supply wells are prohibited within the GMZ by DNREC (Attachment B). GW was not and is not used as a source of drinking water on- and off-Site.

EPA's CAO for on- and off-Site GW is to control exposure to hazardous constituents remaining in GW until GW meets the more stringent of EPA's and Delaware's clean-up goals of MCLs or RSLs (where MCLs are not established for a constituent).

3. Vapor Intrusion - EPA's CAOs for sites with the potential for contaminated subsurface vapor to enter habitable buildings/structures is to control human exposure and attain EPA's acceptable cancer risk range and non-cancer risk hazard quotient.

Section 8: EPA's Final Remedy

EPA's Final Remedy for the Facility applies to the Akzo Study Area (Figure 3) and the off-site groundwater plume. Figure 2 depicts the entire Akzo Facility. The Akzo Study Area excludes the Agricultural Parcel. The Agricultural Parcel is subject to a CERCLA groundwater clean-up (Delaware City PVC) and is not included in the RCRA Corrective Action investigation and clean-up. EPA's Final Remedy also includes a remedy for off-site groundwater contamination including an investigation for potential vapor intrusion.

EPA's Final Remedy for the Akzo Study Area and the off-site groundwater plume consists of:

(1) Establishment a Technical Impracticability (TI) Zone on the Akzo Study Area encompassing the groundwater plume consisting of metals. Long-term monitoring of groundwater will confirm plume stability and any contaminant trends:

a. Because of on-Site aquifer characteristics, as discussed in Section 7, that inhibit MCL attainment throughout the inorganic GW plume on-Site, EPA is requiring continued GW monitoring along with establishment of a TI Zone as the remedy that represents the best balance of the criteria EPA uses when selecting a remedy. This remedy will protect human health and the environment.

The proposed TI zone is defined as GW within the area depicted in Figure 3. The Facility will be required to submit an annual report to EPA documenting GW plume trends.

(2) Monitored natural attenuation (MNA) of the chlorinated volatile organic compound (cVOC) groundwater plume that includes a small area of the Akzo Study Area and an off-site area. MNA will document progress towards attaining compliance with EPA and Delaware's MCLs;

(3) Institutional controls for implementation of land and groundwater use restrictions.

Because contaminants remain in the Landfill and Barren Areas and in GW at levels above what EPA considers acceptable for residential use, EPA's Final Remedy requires land use restrictions to restrict activities that may result in human exposure to those contaminants. EPA proposes that such restrictions be implemented and maintained through institutional controls (ICs). ICs are administrative and/or legal controls that minimize the potential for human exposure to contamination and/or protect the integrity of the remedy by limiting land or resource uses. The Final Remedy includes the following land and GW use restrictions:

a. The Akzo Study Area shall not be used for any purposes other than industrial or commercial use unless demonstrated to EPA that such use will not pose a hazard to human health or the environment and EPA provides prior written approval for such use;

b. All earth moving activities at the Facility (excluding the Agricultural Parcel), including excavation, drilling and construction will be conducted in ways that will not adversely affect or interfere with the Final Remedy, including the Capped Landfill and Barren Area engineered caps and will not adversely affect human health and the environment. An EPA-approved Soil Management Plan complying with Occupational Safety and Health Administration (OSHA) worker health and safety requirements is required as part of the Final Remedy. Earth moving activities at the Facility (excluding the Agricultural Parcel) will require prior written consent of EPA in consultation with DNREC;

c. Compliance with an approved Cap Management Plan (CMP) for the Landfill and Barren Area Caps. The CMP will be submitted for EPA review, approval and, at a minimum, must include the following: the procedures used to maintain the Caps over the contaminated soil; an inspection schedule to ensure Cap maintenance, at least annually; the maintenance requirements necessary to prevent degradation of the Caps and unacceptable exposure to the underlying soil;

d. Compliance with an EPA approved groundwater monitoring plan;

e. Compliance with DNREC's Delaware City Industrial Area Groundwater Management Zone (GMZ) requirements as shown in Figure 5; and

f. Compliance with an EPA approved vapor intrusion (VI) Assessment Plan for any occupied structures within 100 feet of the VOC plume or planned to be constructed on or within 100 feet of the VOC plume, for on- and off-Site areas of impact.

Implementation

The Final Remedy for the Facility will be implemented through an enforceable mechanism such as a Permit, Order, or an Environmental Covenant. If an Environmental Covenant is selected as the enforceable mechanism, it will be recorded in the chain of title for the Facility property pursuant to the Delaware Uniform Environmental Covenants Act (7 Del. C Chapter 79, Subchapter II).

EPA will also require a coordinate and metes and bounds survey of the Facility boundary to be included in the enforceable mechanism which implements the Final Remedy for the Facility as follows:

1. The boundary of each area with a use restriction will be defined as a polygon; and
2. The longitude and latitude of each polygon vertex will be established as follows:

    a. Decimal degrees format;
    b. At least seven decimal places;
    c. Negative sign for west longitude; and
    d. World Geodetic System (WGS) 1984 datum.

EPA, DNREC and/or their authorized agents and representatives will have access to the Facility property to inspect and evaluate the continued effectiveness of the Final Remedy and if necessary, to conduct additional remediation to ensure the protection of the public health and safety and the environment.

Section 9: Financial Assurance

The Facility will be required to demonstrate and maintain financial assurance for completion of the remedy pursuant to the standards contained in Federal regulations 40 C.F.R. § 264.145 and 40 CFR § 264.143.

Section 10: Public Participation

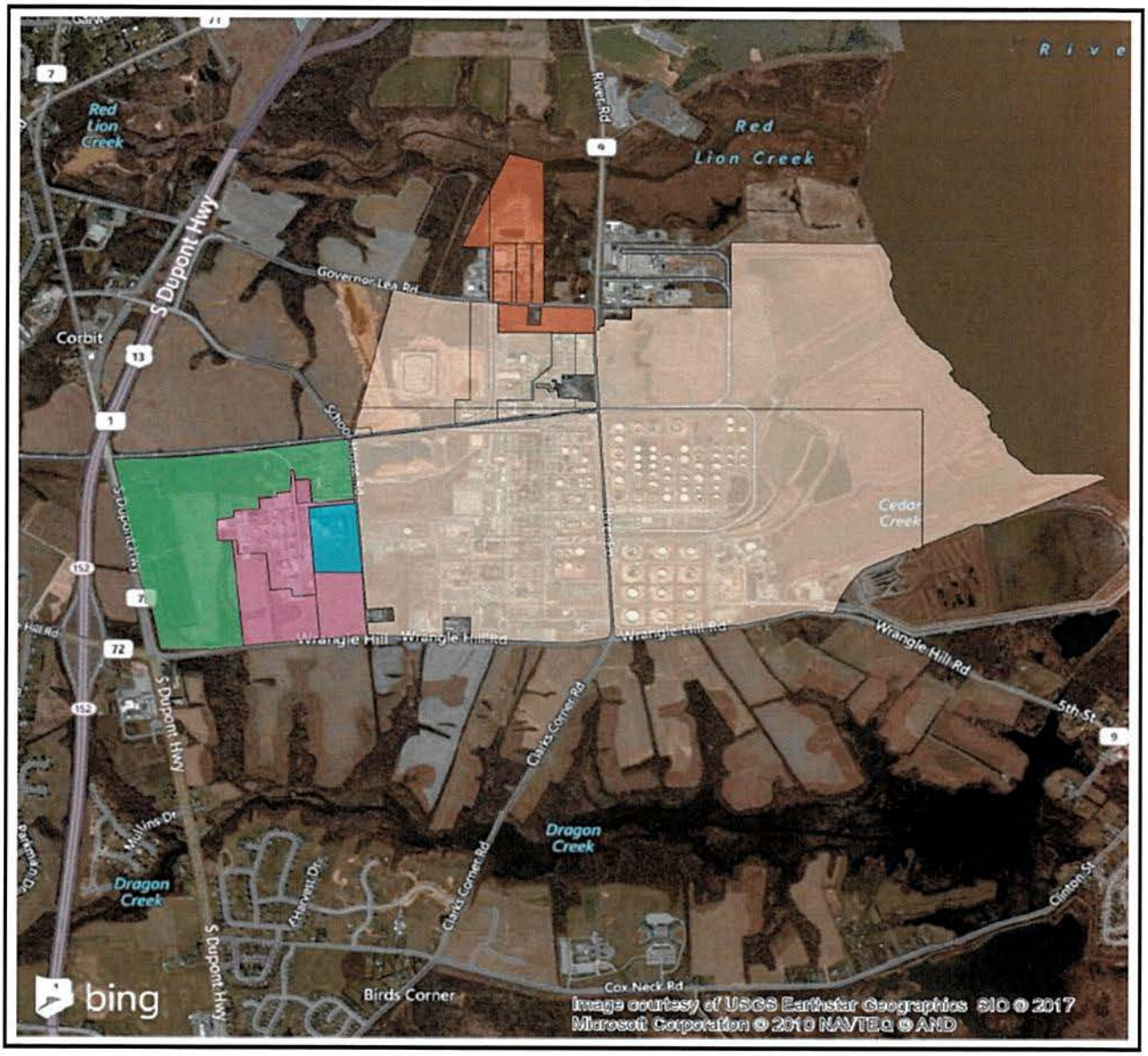
EPA announced the 30-day public comment period (June 8 to July 7, 2017) on the proposed remedy in the Middletown Transcript weekly newspaper. EPA received comments from DNREC within the 30-day comment period and from DCRC and Akzo after the public comment closed. The comments and EPA's responses are presented in Attachment A of the FDRTC.

Section 11: Declaration

Based on the Administrative Record compiled for the corrective action for on- and off-site areas of the Facility, I have determined that the Final Remedy selected in this Final Decision and Response to Comments is protective of human health and the environment.

Date: 11.21.18

John A. Armstead, Director
Land and Chemicals Division
US EPA, Region III



0 0.25 0.5 0.75 1 Miles

N
W E
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Figure 1
Akzo and Adjacent Properties

- Akzo Nobel
- PBF Delaware City Refinery
- Bilcare Research, Inc
- Formosa Plastics Corp
- Standard Chlorine of Delaware, Inc

Akzo Facility

Legend

- Capped Landfill
- Barren Area
- Akzo
- Agricultural Parcel
- Undeveloped Parcel
- Carbon Disulfide Plant Parcel
- Roads

0 125 250 500 750 1,000 Meters

N W E S

Figure 2

*Boundaries defined by Delaware tax parcel data.
EPA Region 3, LCD GIS Team: J.Anstotz & J.Hennessy

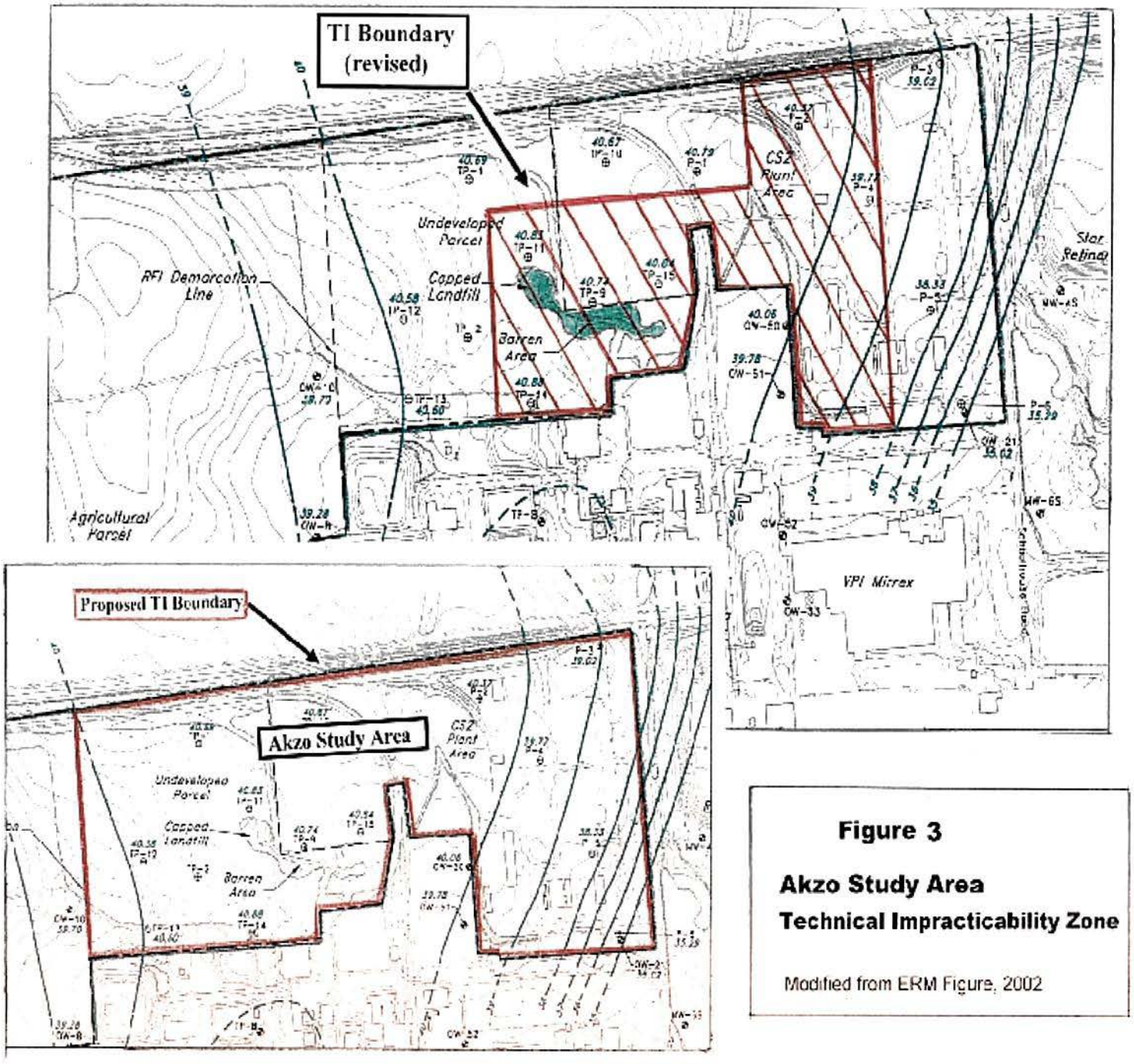


Figure 3

Akzo Study Area

Technical Impracticability Zone

Modified from ERM Figure, 2002

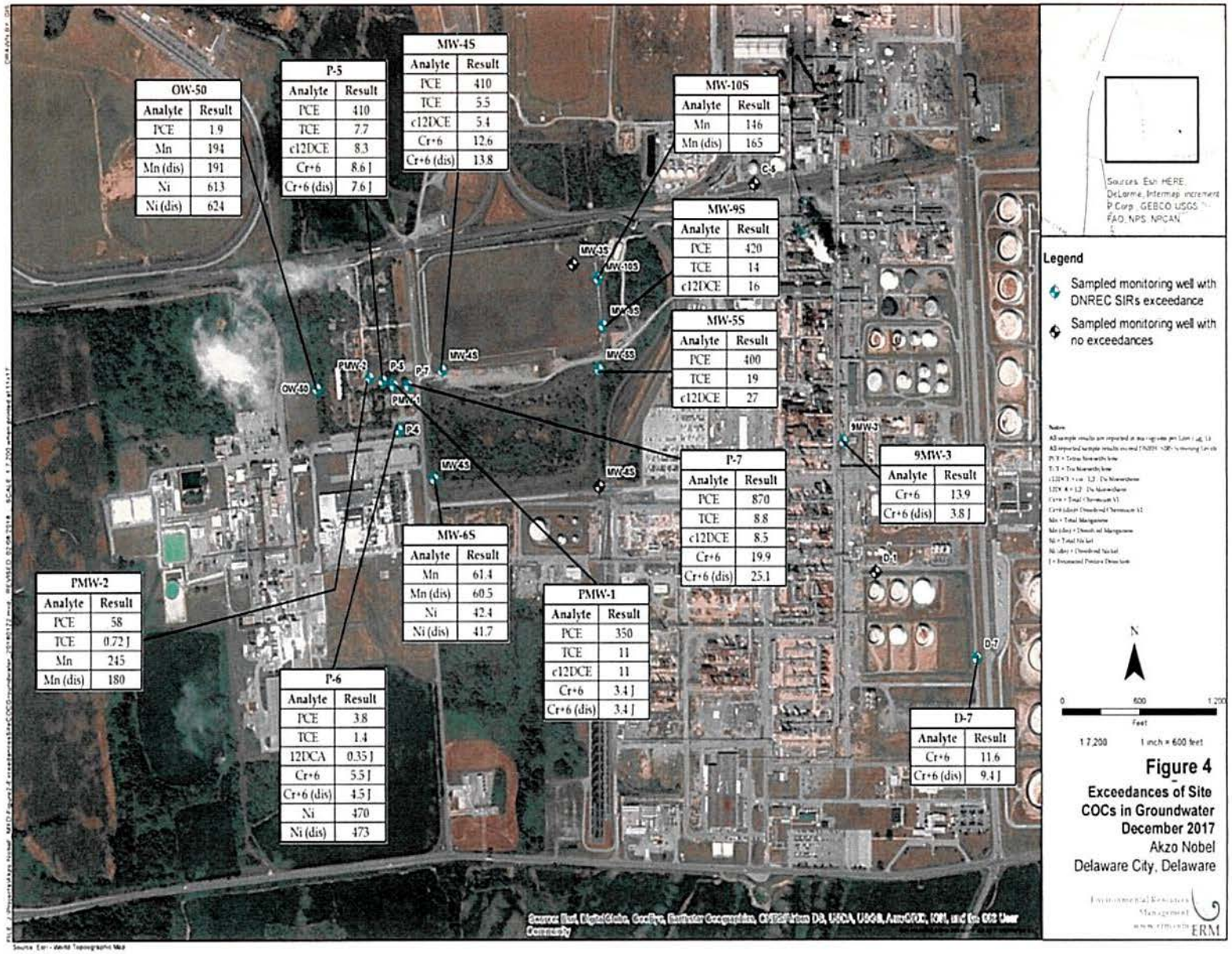
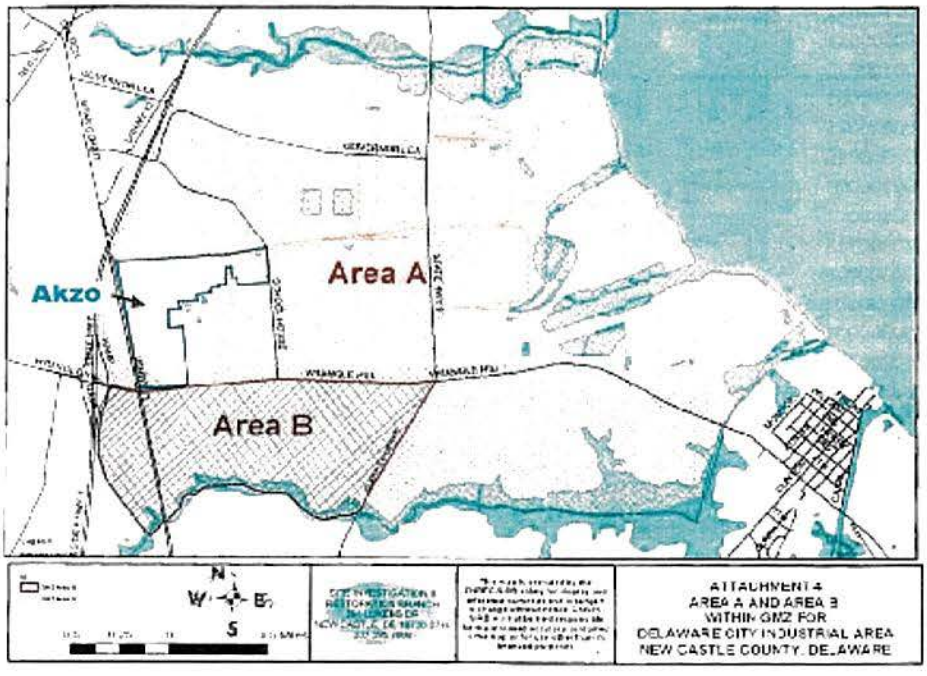


Figure 4
Exceedances of Site COCs in Groundwater
December 2017
Akzo Nobel
Delaware City, Delaware

Figure 5

Memorandum of Agreement (MOA) for the Delaware City Industrial Area, New Castle County, Delaware, signed by DNREC Divisions of Air & Waste Management (DAWM) and Water Resources (DWR) in 2008. Now, therefore, it is agreed by DAWM & DWR as follows:

1. A Groundwater Management Zone (GMZ) shall be established to include the listed sites and surrounding areas as defined both in the text and on the attached maps (1,2,3 and 4).
2. No new public or domestic (potable) water supply wells will be allowed or permitted within the GMZ **Area A** (Attachment 4).
3. No new public or domestic (potable) water supply wells will be allowed in the unconfined Columbia aquifer and any underlying aquifer unit hydraulically connected to the Columbia aquifer within the GMZ **Area B** (Attachment 4). Potable wells in the GMZ Area B may be allowed or permitted provided: (i) they are drilled into a confined aquifer, (ii) they are constructed to prevent the vertical movement of potential contaminants, (iii) that contaminated groundwater, if encountered, will be sufficiently treated to applicable potable use standards; and (iv) a joint review and approval is completed by both DWR and DAWM.
4. Non-potable wells, such as, but not limited to, industrial, monitoring, observation, and contaminant recovery wells, may be installed in GMZ areas A and B following joint review and approval by DWR and DAWM.
5. Permits for wells in GMZ Area B may only be issued by DWR following joint reviews and approvals by both DWR and DAWM.



Attachment A

Response to Comments

I. Comments received by Delaware Department of Natural Resources and Environmental Control (DNREC), Solid and Hazardous Waste Management Section are shown in blue and EPA's responses are in black.

1. Section 3.3, Subsection1, Paragraph 2 – There is a groundwater divide that runs east-west in the eastern part of the site. The PCE plume in this area generally extends to the northeast, but water to the south flows south-east. Further discussion is needed to clarify the number and direction of the groundwater divides.
EPA Response: EPA has not modified this paragraph for the following reasons. A groundwater (GW) high point or mound on the DE City PVC property, south of the Facility, creates a GW divide under the Undeveloped Parcel, such that GW flows east from the Barren Area towards the CS2 Plant Area, under Schoolhouse Road onto the DCRC property. West of the divide, GW flows towards the Agricultural Parcel. After reviewing GW elevations and the elevation maps from Akzo's Phase II RFI and Akzo's GW Reports from 2001 – 2018, it appears that the GW divide was not static, but shifted around. Because the GW high points were not static, neither are/were the GW flow directions. The Statement of Basis (SB) is a condensed summary of the data, providing as much detail as necessary for public understanding of the proposed remedy.

2. Section 3.3, Subsection 3, Table 1 – Delaware State [Drinking Water] Maximum Contaminant Levels (MCLs) is 1 part per billion for PCE, TCE and vinyl chloride. Please update the table to reflect this.
EPA Response: Table 1 in the FDRTC was revised to show Delaware's MCLs for the three chlorinated volatile organic compounds, PCE, TCE and vinyl chloride.

3. Section 3.3, Subsection Paragraph 3 – This paragraph could be misinterpreted as describing four plumes, not two. Please give a more specific description of the inorganics plume.
EPA Response: EPA disagrees. The paragraph begins with, 'Table 1 shows that two distinct plumes exist under the Akzo Study Area…' and continues with a discussion of the two different source areas and locations of the two plumes. EPA added 'nickel' to the description of the dissolved manganese and hexavalent chromium plume to the inorganics plume discussion in paragraph 3.

4. Section 5, Paragraph 1, final sentence – There is a building in use on the Delaware City Refining Company (DCRC) property. The building is used as a storage shed for the fire-fighting equipment and is occasionally occupied by the DCRC Fire Inspector. A discussion regarding potential vapor intrusion issues on DCRC property should be included.
EPA Response: DCRC confirmed that the building is currently unoccupied. As part of the Final Remedy, EPA is requiring compliance with an EPA-approved VI Assessment Plan for any occupied

structures within 100 feet of the cVOC plume or planned to be constructed on or within 100 feet of the VOC plume, on- and off-Site of the Facility. The equipment storage shed noted in the comment is not located in or near the cVOC plume path. A list of DCRC buildings used by workers, located down-gradient of the cVOC plume was provided to Akzo by DCRC for further investigation for vapor intrusion potential by Akzo. The off-site investigation will continue as part of the Final Remedy, and any mitigation of indoor vapor, if needed, will also be part of the Final Remedy.

5. Section 7, Subsection 3, final sentence – Has there been any air quality testing performed within the Fire Inspector's building on DCRC property? If not, this sentence needs to be changed to reflect this.
EPA Response: Indoor air quality testing within the Fire Inspector's building is not necessary. See the response to 4, above.

6. Section 8, Subsection 2, Letter d – Will the Groundwater Monitoring Plan also require DNREC approval? Please update this item to reflect this change.
EPA Response: EPA will send the draft GW Monitoring Plan to DNREC for review and comment. EPA will approve the Plan only with DNREC concurrence.

7. Section 8, Subsection 2, Letter f – Will the Vapor Intrusion Assessment Plan also require DNREC approval? Please update this item to reflect this change.
EPA Response: EPA will send the draft VI Assessment Plan to DNREC for review and comment. EPA will approve the Plan only with DNREC concurrence.

8. Section 8, Subsection 2, Letter f – The Vapor Intrusion Assessment Plan needs to include off-site areas such as the Fire Inspector's building on DCRC property. Please update this item to reflect this.
EPA Response: The VI Assessment Plan will require an assessment of all buildings on DCRC that are located within 100 feet of the VOC plume or planned to be constructed on or within 100 feet of the VOC plume, on- and off-Site of the Facility, consistent with EPA's OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air, dated June 2015.

9. Figure 3 – If available, please include a map that shows the full extent of the PCE plume, including the areas off Akzo's property.
EPA Response: There are underground utilities and potential hazards at DCRC and because of the risks posed by installing more monitoring wells, a current PCE plume map is not available for the DCRC property. However, the off-site vapor intrusion investigation will assess any impacts posed by the cVOC plume.

10. DNREC-SHWMS is still not fully convinced that this SB fully describes the remedy. For example, the remediation of the off-site plume on DCRC property is not well-described.
EPA Response: See EPA's response to 9, above. Also, cVOC levels are decreasing over time.

11. EPA has issued guidance on how to demonstrate the likely efficacy and the appropriateness of Monitored Natural Attenuation for chlorinated solvents in groundwater (see EPA/600/R-98/128 and EPA OSWER Directive 9200.4-17). Facilities have been expected to employ this guidance in evaluating their sites. It is DNREC's position that use of the guidance to demonstrate the appropriateness of an approach that doesn't involve active remediation would be advisable and consistent with what is expected of other facilities.
EPA Response: EPA issued the Monitored Natural Attenuation (MNA) guidance in 1998. Since 1998, the use of MNA to remediate groundwater has continued to evolve, dependent on site specific conditions and risk. The levels of PCE on- and off-site are much lower now than when monitoring began in 2001. Active remediation was not as effective as hoped. Further attempts at active remediation are not indicated due to the aquifer characteristics as discussed in Section 7, point 2.

12. Was there a document that compared all remedies against one another? If so, a citation to that document would be helpful. The case for TI seems like it needs more support from previous data.
EPA Response: Potential remedies were compared in the Final Corrective Measures Study (ERM, May 2010). Section 6 in this FDRTC discusses the CMS. The CMS is listed in the Administrative Record Index in Attachment A of the Statement of Basis.

II. EPA received a letter from the Delaware City Refining Company (DCRC), dated May 21, 2018 concerning the information in the Akzo Statement of Basis and a 2017 Akzo Groundwater Report that EPA had sent to DCRC. EPA received DCRC's comments after the public comment period closed. EPA responded to DCRC in an e-mail dated July 6, 2018. DCRC major concerns are:

(1) the impact of the migrating contaminant plume to the health and safety of DCRC employees and contractors, as well as the implications of such plume for subsurface conditions and environmental compliance at the Refinery;
(2) the scope of the groundwater evaluation is not sufficiently comprehensive;
(3) potential for vapor intrusion by cVOCs into existing structures, and;
(4) the work undertaken by the Agency with respect to the subsurface contamination related to the Akzo Site will fully consider and account for on-going investigation and remediation activities undertaken by Motiva under DNREC's oversight.

EPA's e-mail response acknowledged DCRC's concerns and requested that DCRC provide a contact so that EPA and Akzo could coordinate further groundwater and vapor intrusion investigations on the DCRC property. EPA also proposed a meeting with DCRC, Motiva and Akzo regarding the investigations. The result of DCRC's letter and subsequent communications is that Akzo and DCRC are in direct contact and working on next steps regarding the vapor intrusion assessment on DCRC property.

III. Akzo sent comments to EPA on the Statement of Basis after the public comment period closed, providing updated information on the Facility's ownership, estimated costs of Remedy implementation and corrections to minor factual errors, such as parcel acreage, GW Report dates and other corrections. EPA incorporated these comments in this FDRTC.