DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)
Migration of Contaminated Groundwater Under Control

Facility Name: **International Business Machines Corporation (IBM)**
Facility Address: **431 Ridge Road, Dayton, NJ 08810**
Facility EPA ID#: **NJD002177210**

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EIs developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While final remedies remain the long-term objectives of the RCRA Corrective Action program, the EIs are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993 (GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated groundwater and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

EI Determination status codes should remain in the RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

Facility Information

The former IBM facility is situated on approximately 66 acres of land in Dayton, South Brunswick Township, New Jersey. The site is located in Middlesex County, northeast of Trenton, and east of Princeton. Much of the site is covered by three principal buildings, associated parking lots, and minor

support structures. The surrounding area includes a mixture of industrial, commercial, retail, and residential properties. An active drinking water supply well owned and operated by South Brunswick Township (well SB11) is located approximately 1,800 feet east and downgradient of the former IBM site.

IBM owned the property from 1954 to 1994. Between 1956 and 1985, IBM manufactured computer punch cards in centrally located Building 001. Chlorinated solvents used in IBM manufacturing operations, including tetrachloroethylene (PCE) and 1,1,1-trichloroethane (TCA), were stored in underground storage tanks (USTs) along the western side of Building 001. Building 002 was used for laboratory activity and administrative functions, and Building 003 was used for security and administration activity. After active manufacturing operations were discontinued in 1985, IBM continued to use the site exclusively for administrative and support services. Ownership of the site has changed several times since 1994. The site is currently owned by Bloomberg LP and used for office space and document storage.

To address chlorinated volatile organic compound (VOC) contamination associated with releases from USTs at the former solvent storage area, IBM installed and began operation of a groundwater extraction and air stripping treatment system in the late 1970s. On May 15, 1980, IBM entered into a formal Administrative Consent Order (ACO) with the New Jersey Department of Environmental Protection (NJDEP), which required IBM to operate the on-site treatment system for remediation of impacted groundwater. Treatment operations were initiated in early 1978 and continue to the present, except for a NJDEP-approved period of inactivity between September 1984 and October 1990. A quarterly groundwater monitoring program has also been established to monitor contaminant concentration trends and migration of the VOC plumes in shallow and deep groundwater. Based on results of the monitoring program, it is evident that active remediation and natural attenuation processes have resulted in significant reductions in VOC concentrations in both the shallow and deep groundwater aquifers.

Despite the change in site ownership, IBM retains responsibility for ongoing groundwater corrective action and monitoring at the former IBM Dayton site.

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

   _X_ If yes - check here and continue with #2 below.

   ___ If no - re-evaluate existing data, or

   ___ If data are not available, skip to #8 and enter "IN" (more information needed) status code.

Summary of Areas of Concern (AOCs) and Groundwater Impacts:

Site-Wide Groundwater

In 1977, elevated concentrations of chlorinated VOCs were identified in South Brunswick Township well SB11. This contamination was traced back to solvent releases from USTs in IBM's former solvent storage area. Treatment operations were initiated in early 1978 and continue to the present, except for a period of inactivity between September 1984 and October 1990. During the initial groundwater investigation in 1977, and to facilitate subsequent monitoring of ongoing treatment operations, IBM installed 112 groundwater monitoring wells at and downgradient of the former IBM Dayton site. The monitoring network provided broad coverage of the investigation area, and the majority of wells were sampled at least quarterly for approximately 21 years. Based on the sustained lack of VOC concentrations above New Jersey Groundwater Quality Criteria (GWQC), 52 of these wells have been abandoned with NJDEP approval since 2000 (Ref. 6).

In February 2000, IBM implemented a new program for site-wide groundwater monitoring at the IBM Dayton site. This program includes quarterly measurement of groundwater elevations at 57 wells, quarterly collection of samples for VOC analysis at 24 wells, and annual collection of samples for VOC analysis at an additional 12 wells (Ref. 5). This program continues to date, resulting in over 30 years of groundwater monitoring data for the site. In July 2008, an additional monitoring well pair (shallow well GW47s and deep well GW47d) was installed and sampled north of the site, and groundwater samples were collected from nine Geoprobe sampling locations north and east of the site, to assess the impact of temporary changes in groundwater flow direction. A vertical profiling program was also implemented at that time to determine VOC concentrations at various depths at 15 existing shallow wells and 11 existing deep wells (Ref. 7). The entire resultant volume of groundwater data was considered in development of this EI determination.

A facility map showing site features and buildings, the location of existing and new groundwater monitoring wells (shallow and deep), abandoned wells, Geoprobe sampling locations, extraction wells, and South Brunswick Township well SB11 is provided as Figure 4 from Reference 8.

Soil-Based Investigation

In 1994, IBM entered into a remediation agreement (RA) with NJDEP pursuant to the Industrial Site Recovery Act (ISRA), provisions of which are required prior to property transfer. In accordance with the RA, IBM completed a Site Investigation (SI) and Remedial Investigation (RI) between 1994 and 1996. During the course of these efforts, 18 soil-based AOCs were identified and investigated. Table 1 describes the primary features of, and presents key sampling results and completed corrective actions for, each of the soil-based AOCs.

Table 1: Soil-Based AOCs Identified at the Former IBM Dayton Site

AOC	Description	Sampling Results and Corrective Actions
1	5,000-gallon UST U-4 used to store ethanol.	Removed in 1982. No contamination reported above New Jersey Non-Residential Direct Contact Soil Cleanup Criteria (NJ NRDCSCC).
2	Two 750-gallon USTs used to store ethanol or 1,1,1-TCA.	Removed in the late 1970s. No contamination reported above NJ NRDCSCC.
3	5,000-gallon UST U-7 used to store waste acid.	Removed in the late 1970s. Elevated cadmium levels attributed to background. No other contamination reported above NJ NRDCSCC.
4	550-gallon UST U-16 that received wastewater from the ball mill floor drain in the early 1980s.	Elevated cadmium levels attributed to background. No other contamination reported above NJ NRDCSCC.
5	5,000-gallon UST U-17 used for storage of heating oil.	No contamination reported above NJ NRDCSCC.
6	Surface impoundment and emergency fire reservoir. Previously used to aerate 1,1,1-TCA-contaminated groundwater.	No contamination reported above NJ NRDCSCC.
7	Drainage swale that accepted discharges from an IBM incinerator operated between 1969 and 1982.	Elevated cadmium levels attributed to background. No other contamination reported above NJ NRDCSCC.
8	Drainage swale that accepted stormwater runoff from Building 1.	Elevated cadmium levels attributed to background. No other contamination reported above NJ NRDCSCC.
9	Drainage swale that accepted boiler blowdown from Building 1.	De minimis benzo(a)pyrene contamination identified. No other contamination reported above NJ NRDCSCC.
10	Drainage swale that accepted runoff from the roof of Building 2. Laboratory hoods vented to the roof.	Polycyclic aromatic hydrocarbon (PAH)-contaminated soils excavated. Confirmation sampling indicated compliance with NJ NRDCSCC.
11	Drainage swale used for electrical/generator substation runoff.	No contamination reported above NJ NRDCSCC.
12	Septic system that accepted wastewater from Building 1 until 1966.	Elevated cadmium levels attributed to background. No other contamination reported above NJ NRDCSCC.
13	Dry Well A. Received discharges from a former drum storage pad in the 1970s.	No contamination reported above NJ NRDCSCC.
14	Dry Well B. Received discharges from a dye room throughout the 1970s.	No contamination reported above NJ NRDCSCC.
15	Dry Well C. Received discharges from a tinting room in the 1970s.	No contamination reported above NJ NRDCSCC.
16	Dry Well D. Accepted discharges from a plating/etching room in the 1970s.	Elevated cadmium levels attributed to background. No other contamination reported above NJ NRDCSCC.
17	Dry Well E. Used between 1966 and 1985 to receive wash water from steam cleaning operations.	Elevated cadmium levels attributed to background. No other contamination reported above NJ NRDCSCC.
18	Soil piles associated with on-site landscaping activities.	De minimis beryllium contamination identified. Elevated cadmium levels attributed to background. No other contamination reported above NJ NRDCSCC.

Source: References 1 through 4.

Based on investigation findings and confirmation sampling results, NJDEP has determined that no further action (NFA) is appropriate for each of the soil-based AOCs at the IBM Dayton site (Ref. 6). For this reason, and because groundwater is being addressed on a site-wide basis, soil-related AOCs will not be discussed further in this EI determination.

References:

1. Memorandum from Yang Cao, NJDEP, to Bruce Venner, NJDEP, re: IBM Case Transfer. Dated January 12, 1995.
2. Memorandum from Andrew Marinucci, NJDEP, to Carol Graubart, NJDEP, re: RI Report. Dated October 19, 1995.
3. Memorandum from Andrew Marinucci, NJDEP, to Carol Graubart, NJDEP, re: RI Report. Dated January 26, 1996.
4. Letter from Carol Graubart, NJDEP, to Karen Majchrzak, IBM, re: SI Summary Report and RI Summary Report. Dated March 15, 1996.
5. 2005 Annual Report on Groundwater Remediation System Performance and Status of the Groundwater Monitoring Program. Prepared by Groundwater Sciences Corporation. Dated May 2006; Amended April 2008.
6. Hydrogeologic Conceptual Site Model for the Former IBM Facility. Prepared by TRC Environmental Corporation. Dated April 30, 2008.
7. Letter from Mitchell Meyers, IBM, to Barry Tornick, EPA Region 2, re: Addendum to IBM's August 2007 Draft Documentation of Environmental Indicator Determination. Dated August 26, 2008.
8. E-mail from Keith Gagnon, TRC Environmental Corporation, to Barry Tornick and Sameh Abdellatif, EPA Region 2, re: IBM EI – Dayton, NJ. Dated August 29, 2008.

2. Is **groundwater** known or reasonably suspected to be "**contaminated**"[1] above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

   _X_ If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

   ___ If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

   ___ If unknown - skip to #8 and enter "IN" status code.

Rationale:

Hydrogeological Background

Two important water supply aquifers are present in the vicinity of the former IBM Dayton site. The shallow sand unit beneath the former IBM site is formally referred to as the Old Bridge Sand Member of the Magothy Formation and consists of coarse-grained sand and gravel. This unit ranges from 30 to 65 feet thick in the site vicinity. The shallow aquifer water table is encountered within the Old Bridge Sand at approximately 25 feet below ground surface (bgs). The deeper sand unit is designated as the Farrington Sand and consists of fine and coarse sand. This unit ranges from 25 to 60 feet thick in the site vicinity (Ref. 4).

The shallow and deep aquifer units are separated by the Woodbridge Clay Member of the Magothy Formation, which ranges in thickness from several inches to a few feet thick in the area. Although the clay layer is generally consistent across the area, there are a few locations where it is absent. Available well logs indicate that the clay layer is present in the former source area, as observed at well GW06; across the northern portion of the site in the area of well cluster GW18, existing well OOD, and former wells DDD and KKD; and off site to the east at wells BBD and JJD. These well logs also indicate that the clay layer is not present in the vicinity of well SB11, further east of the site where VOC contamination was first identified in groundwater. Where present, this clay layer acts as a leaky aquitard, impeding vertical groundwater flow. However, a vertical downward gradient is present in the Old Bridge unit, which recharges the deeper Farrington Sand Aquifer in the vicinity of the former IBM Dayton site. Weathered, red shale bedrock of the Passaic Formation is located beneath the deep aquifer at depths greater than 110 feet bgs (Refs. 2 and 4).

Groundwater Quality

The primary VOC contaminants at the former IBM Dayton site have historically included PCE, 1,1,1-TCA, 1,1-dichloroethane (DCA), and 1,1-dichloroethylene (DCE). Lesser concentrations of trichloroethylene (TCE) are also present in both the shallow and deep aquifers. In a letter to the facility dated January 19, 2000 (Ref. 1), NJDEP indicated that contamination across the study area is well characterized by the extensive set of groundwater data collected over the past 21 years. Because NJDEP

[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

requires ongoing groundwater monitoring only for VOCs, no other constituents (e.g., semi-volatile organic compounds, metals) will be considered further in this EI determination.

The most recent groundwater sampling event was conducted in July 2008. Because it was conducted independent of the formal groundwater monitoring program, this round did not include sampling of all 36 wells in that program. Nevertheless, the July 2008 sampling event did include collection of samples from 16 shallow monitoring wells, 12 deep monitoring wells, and nine Geoprobe locations. As such, data from this round is considered sufficiently comprehensive for use in development of this EI determination. The results of this sampling round were reported in Reference 5, with the highest GWQC exceedances listed in Table 2 by affected aquifer and location (i.e., on or off site).

Table 2: Maximum Contaminant Concentrations Detected in July 2008

Constituent	NJ GWQS (µg/L)	On-Site Maximum		Off-Site Maximum	
		Concentration (µg/L)	Well	Concentration (µg/L)	Well
Shallow Aquifer					
PCE	1	170	GW06	3.1	TW-2
1,1,1-TCA	30	250	GW06	NE	---
TCE	1	4.3	GW06	NE	---
1,1-DCA	50	280	GW06	NE	---
1,1-DCE	1	470	GW06	2.3	TW-2
Deep Aquifer					
PCE	1	29	GW18B	120	JJD
1,1,1-TCA	30	NE	---	210	FFD
TCE	1	1.2	GW18B	4.2	JJD
1,1-DCE	1	27	GW18B	100	JJD

NE: Constituent concentration measured in July 2008 did not exceed applicable NJ GWQS.
Source: Reference 5

As indicated in the table, the highest on-site VOC concentrations in the shallow aquifer are centered around monitoring well GW-06 in the historical source area (i.e., the former solvent storage area west of Building 001). Figure 4 from Reference 5 shows that PCE impacts in this immediate area extended through the entire thickness of the shallow aquifer in July 2008. Shallow groundwater contamination is also present at lesser concentrations along the northern edge of the site and extending off site to the northeast and east along Ridge Road and Helen Drive. Low level PCE and 1,1-DCE exceedances were identified at well BBS, well CCS, and Geoprobe locations TW2 and TW3. The area of VOC contamination above GWQC in the shallow aquifer is bounded by well GW47s to the north; Geoprobe locations TW4 and TW5 to the east; well GW22 to the south; and well GW03 to the west. Each of these sampling locations reported VOC concentrations as nondetect or below GWQC during the July 2008 sampling event (Ref. 5).

In July 2008, VOC exceedances were reported in the deep aquifer along the entire length of the northern site perimeter, and extending off site to the northeast and east. The highest VOC concentrations were reported at wells JJD and FFD, both situated east of the site along Ridge Road. The extent of VOC contamination above GQWC in this aquifer is bounded by well GW47d to the north; EED to the east; and GW01, GW21, and GW38 to the south. Again, each of these wells reported VOC concentrations as nondetected or below GWQC during the July 2008 sampling event (Ref. 5). Furthermore, due to extensive pumping of well SB11, deep aquifer contamination migrating along Ridge Road east of the site is expected to be captured before reaching well TWP2, as has historically been the case (Ref. 3).

References:

1. Letter from Carol Graubart, NJDEP, to Mitchell Meyers, IBM, re: Proposed Changes to Groundwater Monitoring Program. Dated January 19, 2000.
2. Memorandum from Laurie Whitesell, NJDEP, to Thomas Grzymski, NJDEP, re: IBM Corporation (Site Summary and Groundwater Data). Dated August 18, 2005.
3. 2005 Annual Report on Groundwater Remediation System Performance and Status of the Groundwater Monitoring Program. Prepared by Groundwater Sciences Corporation. Dated May 2006; Amended April 2008.
4. Hydrogeologic Conceptual Site Model for the Former IBM Facility. Prepared by TRC Environmental Corporation. Dated April 30, 2008.
5. Letter from Mitchell Meyers, IBM, to Barry Tornick, EPA Region 2, re: Addendum to IBM's August 2007 Draft Documentation of Environmental Indicator Determination. Dated August 26, 2008.

3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater"[2] as defined by the monitoring locations designated at the time of this determination)?

   X If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"[2].

   ___ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"[2]) - skip to #8 and enter "NO" status code, after providing an explanation.

   ___ If unknown - skip to #8 and enter "IN" status code.

Rationale:

Groundwater Extraction and Treatment History

As stated previously, elevated levels of chlorinated VOCs were detected in South Brunswick Township supply well SB-11 in 1977. Investigation of the former IBM property and off-site areas indicated the presence of dense, non-aqueous phase liquids (DNAPLs) and dissolved-phase contamination in shallow and deep groundwater. This contamination is believed to be associated with leakage from USTs and transfer lines formerly present at the southwestern corner of Building 001 (Ref. 3). Based on this determination, IBM removed the leaking USTs, excavated surrounding soil that had been impacted by the release, and installed a Phase I groundwater extraction and treatment system in 1978. This system was operational from 1978 to 1984 and resulted in decreasing contaminant concentrations levels in both the shallow Old Bridge aquifer and the deep Farrington aquifer. In September 1984, the system was shut down with NJDEP approval due to diminishing effectiveness in achieving further reduction in contaminant concentrations. A second phase of on-site groundwater treatment was initiated in October 1990, after groundwater quality in the shallow aquifer began to show rebounding contaminant concentrations. The Phase II system consists of four on-site extraction wells (GWI-8, GWI-9R, GW32R, and GW33R), treatment in an air stripping unit, and discharge to groundwater via an on-site spray irrigation field under New Jersey Pollutant Discharge Elimination System (NJPDES) permit number NJ0000426 (Ref. 4). As indicated in References 4 and 5, groundwater is extracted from these wells at an average combined flow rate of approximately 45 gallons per minute (gpm). Operation of this groundwater recovery and treatment system continues to date.

South Brunswick Township well SB11, and wells further downgradient, are used by the Township and the Elizabeth Water Company to provide potable water to local residents. To address VOC contamination identified in the well, IBM constructed a water treatment system at this well in 1984; South Brunswick Township took over operation of the treatment system in May 1985 (Ref. 1). The well SB11 treatment facility consists of an air stripping tower and a carbon adsorption unit that treats extracted groundwater at

[2] "Existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

a rate of approximately 1,100 gpm. This facility is used to treat extracted groundwater from well SB11 prior to its use as a component of the public water supply, and the effluent drinking water supply is monitored quarterly for VOC content under supervision by the NJDEP Bureau of Safe Drinking Water. Post-treatment water samples routinely report nondetected VOC concentrations and would be shut down if sampling revealed contamination levels above applicable drinking water criteria (Ref. 2). Well SB11 was taken off-line temporarily in 2005 so that South Brunswick Township could expand the treatment train to include a system for removal of naturally occurring radium from the extracted groundwater (Ref. 4). Pumping from well SB11 resumed on July 3, 2008 (Ref. 7).

Influence of Extraction on Groundwater Flow

Groundwater flow in both the shallow and deep aquifers is strongly influenced by groundwater extraction operations at and around the former IBM Dayton site. As shown on Figure 3-1 from Reference 4, shallow groundwater is clearly pulled inward toward the four on-site extraction wells in the central and eastern portion of the former IBM property (including in the original source area).

Pumping from South Brunswick water supply well SB11, located approximately 1,800 feet east of the former IBM property, exerts even greater influence over flow direction in both the shallow and deep aquifers due to a much higher extraction rate. When well SB11 is in active use, groundwater in the shallow and deep aquifers throughout the study area (across the former IBM Dayton site and off site to the east) is pulled toward well SB11, and a radially inward flow pattern around this well is indicated by groundwater elevation data. As stated previously, this well was taken off line in 2005 to allow South Brunswick Township to install a treatment system for removal of naturally occurring radium in the water supply. As a result, a slight shift toward a more northerly flow direction was observed in both aquifers. Water level measurements also indicated development of a groundwater divide across the center of the former IBM property, with flow beneath the western portion of the site moving to the west-southwest.

Pumping of well SB11 resumed on July 3, 2008, and an immediate drawdown in water levels was observed in shallow wells BBS and FFS, and in deep wells BBD, FFD, OOD, and SB09. As shown on Figures 2 and 3 from Reference 6, by the end of July 2008, groundwater flow in both units shifted back to an easterly direction toward well SB11 across much of the study area. Because only a short period of time had elapsed between pumping startup and groundwater elevation measurement, the influence of pumping at well SB11 was not yet observed in the westernmost portion of the study area, and both aquifers continue to exhibit divided groundwater flow. However, an assessment of historic groundwater flow patterns observed when well SB11 was in active operation suggests that the influence of pumping at well SB11 will eventually be felt across the entire study area (Ref. 6).

Hydraulic Control in the Shallow Aquifer

Figure 2 from Reference 7 shows shallow groundwater flow direction as radially inward toward the on-site recovery wells. Although the area of influence for these wells is limited, VOC contamination in the source area around well GW06 (the former solvent storage area west of Building 001) is being adequately contained by on-site pumping at well GW32R.

Figure 2 from Reference 7 also indicates the presence of a groundwater divide in the shallow aquifer. The divide runs north-south across the center of the site in early August 2008, with wells GW06 and GW12 roughly defining the line of divergent flow. Shallow groundwater east of this line, including impacted groundwater on site and off site to the north and east (as shown on Figure 4 from Reference 8), is pulled toward and contained by groundwater extraction from well SB11. Shallow groundwater west of the dividing line flows to the west-southwest, except in the immediate vicinity of well GW06 where flow

is more strongly influenced by pumping at well GW32R. Although the tail end of the VOC plume in shallow groundwater is situated west of well GW12 (as shown on Figure 4 from Reference 8), exceedances were not reported in downgradient well GW03 during the July 2008 groundwater sampling event, and VOC contamination is not migrating off site to the west.

The groundwater divide in the shallow aquifer is expected to dissipate with continued pumping of South Brunswick Township well SB11 and expansion of the well's area of influence (Ref. 6). As this occurs, groundwater flow patterns in the shallow aquifer will return to the patterns observed prior to shutdown of well SB11 in 2005. Accordingly, any contamination currently moving westward in the shallow aquifer will eventually be pulled back east toward well SB11 for capture and extraction. Based on this information, it appears that VOC contamination in the shallow aquifer is being adequately controlled and not migrating beyond the existing area of impact.

Hydraulic Control in the Deep Aquifer

Groundwater flow in the deep Farrington aquifer exhibits a pattern of divergent flow similar to that indicated in the shallow aquifer. Figure 3 from Reference 7 shows deep groundwater flow radially inward toward South Brunswick Township well SB11 across all portions of the study area except beneath the undeveloped western and unimproved southern portions of the former IBM property. Thus, only the tail end of the VOC plume along the northern property line falls outside the current influence of well SB11. Although IBM has taken responsibility for monitoring VOC contamination in the deep aquifer, the pattern of VOC concentrations along the northwest corner of the former IBM property is suggestive of an upgradient, off-site contaminant source. In 1980, South Brunswick Township identified an automobile junkyard north of the site as a potential source of observed contamination in the deep Farrington aquifer (Ref. 4). Consequently, any contamination temporarily migrating westward in the deep aquifer is not expect to move into as-yet-unimpacted areas.

The groundwater divide in the deep aquifer is also expected to dissipate with continued pumping of South Brunswick Township well SB11 and expansion of the well's area of influence (Ref. 6). As this occurs, groundwater flow patterns in the deep aquifer will return to the patterns observed prior to shutdown of well SB11 in 2005, and contamination will eventually be pulled back east toward well SB11 for capture and extraction. Based on this information, it appears that VOC contamination in the deep aquifer is also being adequately controlled and not migrating beyond the existing area of impact.

References:

1. Memorandum from Yang Cao, NJDEP, to Bruce Venner, NJDEP, re: IBM Case Transfer. Dated January 12, 1995.
2. E-mail from Dhruva Kanjarpane, NJDEP, to Barry Tornick, USEPA, re: Requested Summaries of the EI Status of the New Government Performance Results Act Facilities (IBM Dayton). Dated June 22, 2005.
3. Memorandum from Laurie Whitesell, NJDEP, to Thomas Grzymski, NJDEP, re: IBM Corporation (Site Summary and Groundwater Data). Dated August 18, 2005.
4. 2005 Annual Report on Groundwater Remediation System Performance and Status of the Groundwater Monitoring Program. Prepared by Groundwater Sciences Corporation. Dated May 2006; Amended April 2008.
5. 2006 Annual Report on Groundwater Remediation System Performance and Status of the Groundwater Monitoring Program. Prepared by Groundwater Sciences Corporation. Dated May 2007; Amended April 2008.

6. Hydrogeologic Conceptual Site Model for the Former IBM Facility. Prepared by TRC Environmental Corporation. Dated April 30, 2008.
7. Letter from Mitchell Meyers, IBM, to Barry Tornick, EPA Region 2, re: Addendum to IBM's August 2007 Draft Documentation of Environmental Indicator Determination. Dated August 26, 2008.
8. E-mail from Keith Gagnon, TRC Environmental Corporation, to Barry Tornick and Sameh Abdellatif, EPA Region 2, re: IBM EI – Dayton, NJ. Dated August 29, 2008.

4. Does "contaminated" groundwater **discharge** into **surface water** bodies?

___ If yes - continue after identifying potentially affected surface water bodies.

_X_ If no - skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies.

___ If unknown - skip to #8 and enter "IN" status code.

Rationale:

No surface water bodies are present within the boundaries of the former IBM Dayton site. However, several water bodies are present in the surrounding area, including an unnamed tributary of Lawrence Brook, one-quarter mile to the west; Devil's Brook and associated marshlands, one-half mile to the south; Deans Pond, one mile to the north-northwest; Davidsons Mill Pond, two miles to the north-northeast; and Pigeon Swamp, two miles to the east.

As stated in the response to Question 2, both shallow and deep groundwater beneath the former IBM Dayton site historically flowed eastward under the influence of pumping at South Brunswick Township well SB11. Temporary shutdown of this well between 2005 and July 2008 resulted in development of additional groundwater flow components to the northeast and west-southwest in each aquifer. Pumping has resumed, and groundwater flow is gradually returning to that observed prior to shutdown. However, under current conditions, the potential for groundwater flow to the west and northeast, and potential discharges to the Lawrence Brook tributary and Davidsons Mill Pond, must be evaluated in this EI determination. Conversely, groundwater flow toward Devil's Brook (south) and Deans Pond (north-northwest) has not been observed. Furthermore, with well SB11 located less than one-half mile east of the site, and groundwater flowing inward toward this well from all directions, groundwater beneath the former IBM Dayton site is not expected to reach Pigeon Swamp (two miles to the east). Thus, these three surface water bodies are eliminated from further consideration in this EI determination

As discussed in the response to Question 2, groundwater contamination has been delineated by "clean" sampling locations (i.e., wells and Geoprobe sampling points reporting VOC concentrations as nondetected or below GWQC). In July 2008, VOC contamination above GWQC in the shallow aquifer was bounded to the west by on-site well GW03 and to the northeast by well GW47s (located approximately one-quarter mile outside the site's northeastern corner). VOC exceedances in the deep aquifer were bounded by on-site well GW01 to the southwest and off-site well GW47d approximately one-quarter mile to the northeast. Based on these findings, it is evident that impacted groundwater at the former IBM Dayton site does not extend far enough off site in either aquifer to threaten the Lawrence Brook tributary or Davidsons Mill Pond.

Thus, despite proximity to several water bodies, impacted groundwater from the former IBM Dayton site is not expected to discharge to surface water under current conditions.

Reference:

1. Letter from Mitchell Meyers, IBM, to Barry Tornick, EPA Region 2, re: Addendum to IBM's August 2007 Draft Documentation of Environmental Indicator Determination. Dated August 26, 2008.

5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentration[3] of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or ecosystems at these concentrations)?

___ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration[3] of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgment/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or ecosystem.

___ If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration[3] of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations[3] greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

___ If unknown - enter "IN" status code in #8.

Rationale:

This section is not applicable; see the response to Question 4.

[3] As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

6. Can the **discharge** of "contaminated" groundwater into surface water be shown to be "**currently acceptable**" (i.e., not cause impacts to surface water, sediments or ecosystems that should not be allowed to continue until a final remedy decision can be made and implemented[4])?

___ If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and ecosystems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment[5], appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialist, including an ecologist) adequately protective of receiving surface water, sediments, and ecosystems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

___ If no - (the discharge of "contaminated" groundwater can not be shown to be "**currently acceptable**") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or ecosystem.

___ If unknown - skip to 8 and enter "IN" status code.

Rationale:

This section is not applicable; see the response to Question 4.

[4] Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, an appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

[5] The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field, and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments, or eco-systems.

7. Will groundwater **monitoring**/measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

   _X_ If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

   ___ If no - enter "NO" status code in #8.

   ___ If unknown - enter "IN" status code in #8.

Rationale:

As stated previously, the current groundwater monitoring program for the former IBM Dayton site was implemented in February 2000. Specific program components and associated wells are indicated in Table 3.

Table 3: Ongoing IBM Groundwater Monitoring Program

Task	Frequency	Wells Included
Groundwater Elevation Measurement	Quarterly	• Shallow Wells (37): BBS, CCS, FFS, GW03, GW06, GW09, GW12, GW14, GW19, GW22, GW23, GW25, GW29, GW31, GW32R, GW33R, GW34, GW43D, GW43I, GW43S, GW44D, GW44I, GW44S, GW45D, GW45I, GW46D, GW46I, GW46S, GWI-2, GWI-4, GWI-6, GWI-8, GWI-9R, SB01, SB15, SB22, and SB23 • Deep Wells (20): BBD, EED, FFD, GW01, GW05, GW07, GW18A, GW18B, GW18E, GW21, GW35, GW36, GW38, HHD, JJD, OOD, SB07, SB09, SB21, and TWP2
Sample Collection	Quarterly	• Shallow Wells (15): BBS, CCS, FFS, GW06, GW19, GW25, GW31, GW32R, GW33R, GW46D, GW46I, GW46S, GWI-8, GWI-9R, and SB23 • Deep Wells (9): BBD, FFD, GW18A, GW18B, GW18E, GW35, GW36, JJD, and SB07
Sample Collection	Annually (in May)	• Shallow Wells (6): GW09, GW43D, GW43I, GW43S, GWI-2, and GWI-4 • Deep Wells (6): EED, GW05, GW07, HHD, OOD, and TWP2

Source: Reference 2

An additional monitoring well pair (shallow well GW47s and deep well GW47d) was installed and sampled in July 2008. These wells will be added to the quarterly groundwater monitoring program, presumably beginning with the November 2008 sampling round (Ref. 2). All samples collected as part of the ongoing monitoring program are sent for VOC analysis using SW-846 Method 8021B. In addition, pH and specific conductance are measured in the field as part of the sampling effort (Ref. 1).

In accordance with the ACO that IBM entered into with NJDEP on May 15, 1980, and its subsequent amendments, IBM intends to continue on-site groundwater recovery and treatment operations, quarterly

and annual groundwater sampling and analysis for VOCs, and monitoring of groundwater elevations across the study area. In addition, IBM will maintain communication with South Brunswick Township regarding operation of well SB11 to ensure control over the existing VOC plume in shallow and deep groundwater beneath the site. IBM will keep EPA apprised of variation in the distribution of VOCs in groundwater, unexpected changes in groundwater flow direction, and significant modifications in the operational status of well SB11 (Ref. 2).

References:

1. 2006 Annual Report on Groundwater Remediation System Performance and Status of the Groundwater Monitoring Program. Prepared by Groundwater Sciences Corporation. Dated May 2007; Amended April 2008.
2. Letter from Mitchell Meyers, IBM, to Barry Tornick, EPA Region 2, re: Addendum to IBM's August 2007 Draft Documentation of Environmental Indicator Determination. Dated August 26, 2008.

8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

_X_ YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the former IBM Dayton site, EPA ID# NJR000061697, located at 431 Ridge Road in Dayton, South Brunswick Township, Middlesex County, New Jersey. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater." This determination will be reevaluated when the Agency becomes aware of significant changes at the facility.

___ NO - Unacceptable migration of contaminated groundwater is observed or expected.

___ IN - More information is needed to make a determination.

Completed by: _____ Date:_____
Michele Benchouk
Environmental Consultant
Booz Allen Hamilton

Reviewed by: _____ Date:_____
Lucas Kingston
Environmental Consultant
Booz Allen Hamilton

Also reviewed by: _____ Date:_____
Sameh Abdellatif, RPM
RCRA Programs Branch
EPA Region 2

_____ Date:_____
Barry Tornick, New Jersey Section Chief
RCRA Programs Branch
EPA Region 2

Approved by: Original signed by: _____ Date: September 26, 2008
Adolph Everett, Chief
RCRA Programs Branch
EPA Region 2

Locations where references may be found:

References reviewed to prepare this EI determination are identified after each response. Reference materials are available at U.S. EPA, Region 2.

Contact telephone numbers and e-mail:
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Attachments

The following attachment has been provided to support this EI determination.

Attachment 1 - Summary of Media Impacts Table

Attachment 1: Summary of Media Impacts Table

Former IBM Corporation Dayton Facility
NJR000061697

AEC or SWMU	GW	AIR (Indoors)	SURF SOIL	SURF WATER	SED	SUB SURF SOIL	AIR (Outdoors)	CORRECTIVE ACTION MEASURE	KEY CONTAMINANTS
Groundwater	Yes	No	No	No	No	No	No	• On-site recovery, treatment, and discharge via spray irrigation • Off-site air stripping and carbon adsorption treatment of groundwater extracted from well SB11 by South Brunswick Township	Chlorinated VOCs