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RCRA POST-CLOSURE PERMIT RENEWAL APPLICATION

FORMER HALLMACK FACILITY
Harrodsburg, Kentucky

EPA ID # KYD-081-017-667

September 2022
File No.20.0150290.10

PREPARED FOR:
Kentucky Department for Environmental Protection
Division of Waste Management
Frankfort, Kentucky

Prepared By:

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September 22, 2022
File No. 20.0150290.10

Kentucky Department for Environmental Protection
Division of Waste Management
Frankfort Office Park
14 Reilly Road
Frankfort, Kentucky 40601-1190

Attention: April J. Webb, P.E.
Manager - Hazardous Waste Branch

Subject: RCRA Post-Closure Permit Renewal Application
Former Hallmack Facility
Harrodsburg, Kentucky
EPA ID # KYD-081-017-667, AI# 48471, APE 20180001

Dear Ms. Webb:

On behalf of Kidde-Fenwal, Inc. (Kidde/ "Permittee"), GZA GeoEnvironmental, Inc. (GZA) prepared this RCRA Post-Closure Permit Renewal Application ("Application") for the Former Hallmack facility ("Facility") in Harrodsburg, Kentucky, EPA ID # KYD-081-017-667. The existing Facility permit was issued on February 22, 1996, and was to expire on March 2, 2017; however, the permit renewal was postponed in July 13, 2016, January 19, 2017, and January 2, 2018 letters to UTC from the Kentucky Division of Waste Management (KDWM) to allow for a monitored natural attenuation (MNA) evaluation and was extended to July 9, 2018 in a June 25, 2018 letter to UTC; see References 1, 2, and 3.

The original Application was submitted to KDWM on July 3, 2018. A Notice of Deficiency (NOD) regarding the contents of the Application was submitted to the Permittee on August 10, 2022. A September 22, 2022 response to the NOD which provided the missing information in the original Application including the Part B facility description checklist, Part A application form checklist, Part A form and signed application addendum, Part L signatures checklist and signed cover letter, photocopy of the application check, financial requirements checklist and copies of Bonds, and a list of SWMUs and AOCs. It is the Permittee's understanding that the September 22, 2022 response letter adequately addressed KDWM's concerns. The September 22, 2022 response to the NOD and supporting information is provided in Attachment VII.

The revised Post-Closure Plan, Attachment III to the Permit Renewal Application, which describes the actions to be taken during the effective period of the renewed Permit, was based on the experience of more than 22 years of post-closure care.

As of April 3, 2020, Kidde-Fenwal, Inc. became a subsidiary of Carrier. To satisfy the financial assurance and liability requirements of the RCRA Post-Closure Permit, the Permittee will be using performance bond (# 08966128) and liability bond (#08966129), which will be updated upon approval of the new permit.

An Equal Opportunity Employer M/F/V/H

We look forward to working with you. Should you have any questions please contact the undersigned at 262-754-2560.

Sincerely,

GZA GeoEnvironmental, Inc.

Anthony Urbano
Senior Project Manager

Mark Krumenacher, P.G.
Senior Principal

cc: Donald Sorbello, Carrier
Richard Thomas, Frankfort Regional Office
Jamie Schiff - Textron

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RCRA POST-CLOSURE PERMIT RENEWAL APPLICATION

The Hazardous Waste Management Post-Closure Permit ("RCRA Permit") (No. KYD-081-017-667, issued March 2007) renewal application was prepared on behalf of Kidde-Fenwal, Inc. (Kidde/ "Permittee"), by GZA GeoEnvironmental Inc. (GZA) for the former Hallmack property ("Facility") located in Harrodsburg, Kentucky. The RCRA Permit renewal application was prepared in general accordance with the 1998 Post-Closure Rule (63 Federal Register 56709; October 22, 1998).

With written concurrence from the Kentucky Division of Waste Management (KDWM) on February 7, 2018 (via email Reference 4), the Post-Closure Permit Application was prepared to be consistent with the United States Environmental Protection Agency's (USEPA) 1998 Post-Closure Rule following the requirements of 40 CFR 270.28, in lieu of preparation of a full Part B permit application. For post-closure permits, per §270.28, the owner or operator is required to submit only the information specified in §§ 270.14(b)(1), (4), (5), (6), (11), (13), (14), (16), (18) and (19), (c), and (d), unless the Regional Administrator determines that additional information from §§ 270.14, 270.16, 270.17, 270.18, 270.20, or 270.21 is necessary; which was not requested. The RCRA Permit Renewal Application was developed based on the required information specified in the Rule.

1.0 GENERAL DESCRIPTION OF THE FACILITY [§§ 270.14(B)(1)]

The former Hallmack property (Facility) is comprised of two adjacent parcels of land located at 1010 and 1020 North College Street in Harrodsburg, Mercer County, Kentucky at the approximate location shown on Attachment I. A Facility Topographic Survey is included as Attachment II. The former operations at the Facility included the manufacturing of die cast metal bathroom accessories and other decorative household fixtures from 1968 to 1986. The Facility property has remained vacant since manufacturing ceased and the Facility closed in 1986. Following many years of remedial investigations and corrective actions, the building, exterior structures and pavement were demolished in 2004 (Reference 5).

The 1010 North College Street (southern) parcel is comprised of approximately 21 acres. The 1010 North College Street Lot supported a Groundwater Remediation System (GRS) comprised of groundwater monitoring and extraction wells, associated plumbing and two groundwater treatment buildings.

The 1020 North College Street (northern) Parcel is comprised of approximately 8 acres and includes the fenced area of three former surface impoundments previously used to store wastewater and sludge. Based on reports prepared at the time of closure of the former surface impoundments, the wastewater treatment sludge was removed from the three former surface impoundments to the top of bedrock. Upon removal of the sludge, the impoundment walls (comprised of clay soil) were subsequently graded over the bedrock surface to form a sloping plane, which was then capped with a 5 to 8 feet thick engineered composite cap in accordance with approved closure plans. The engineered composite cap is comprised of a minimum of 4-inches of topsoil, 20-inches of compacted clay, a filter fabric, 12-inch drainage layer of crushed limestone, a 36 ml Hypalon impermeable membrane, underlain by a 24-inch compacted clay liner. Thus, the existing RCRA Permit is for the storage of relatively low permeability clay soil that comprised the former surface impoundment walls and at the time of closure was believed to contain hazardous waste (§§ 261.31 Industry and Hazardous Waste No. F006) by the contained-in rule.

On August 26, 1991, a Notice of Hazardous Waste Activity was placed on the property that gives notice that the property was used for the disposal of hazardous waste (Reference 6). Kidde plans on recording an Environmental Covenant that

will prohibit certain activities to reduce human exposure to hazardous substances in soil and groundwater at the property. The Environmental Covenant will be in substantially the same form as the draft provided in Appendix A of Attachment III. The proposed Environmental Covenant will restrict the use of the property for residential activities, will prohibit the use of groundwater for drinking water or other domestic purposes, will restrict disturbance of the engineered composite cap, will restrict disturbance of soil, will prohibit actions that may cause risk of migration of hazardous substances, and will prevent the construction of any buildings on the property without approval by KYDEP and without adequate vapor intrusion protection.

Former manufacturing operations at the Facility included nickel, copper and chromium electroplating and used trichloroethylene (TCE) as a degreasing solvent prior to metal plating. The rinse water generated in the electroplating process, which was also believed to contain TCE, was treated in the wastewater treatment room and then transferred to surface impoundment No. 1. Metals within the wastewater were precipitated in the surface impoundment and the resulting sludge was transferred to surface impoundment Nos. 2 and 3 for storage. The supernatant from surface impoundment No. 1 was, for a period of time, discharged directly to a ditch present between the impoundments and the building. At a later time, the supernatant was additionally treated within a clarifier prior to discharge to the sanitary sewer. The sludge was stored in surface impoundment Nos. 2 and 3 and during the latter stages of Facility operation, the sludge was dewatered using a filter press and disposed off the Facility property as a hazardous waste (F006).

Based on historical documents for the Facility, the F006 hazardous waste was removed from the former surface impoundments in 1987 following closure plans approved by KDEP in December 1986. The December 1986 closure plan approval specified that the contaminants of concern associated with the former surface impoundments were cadmium, hexavalent chromium, nickel, and/or cyanide. The residual waste present in soil used to construct the impoundments was determined through soil sampling to be limited to those contaminants of concern at concentrations greater than background.

GZA's Former Surface Impoundment Sampling Report (Reference 7), which was submitted to KYDEP on January 6, 2017, included analytical testing of soil samples collected from below the engineered composite cap. The soil samples were analyzed for cadmium, hexavalent chromium, nickel, and cyanide, the only parameters detected at concentrations greater than background concentrations in the soil remaining in the former impoundments following removal of the plating sludge. The only parameter which exceeded US EPA's Industrial Regional Screening Level in the soil samples collected by GZA was hexavalent chromium.

The engineered composite cap prevents exposure to underlying soil to most individuals. Although unlikely, potential construction workers could be exposed to the underlying soil that contains the hexavalent chromium. A limited risk assessment included in the Former Surface Impoundment Sampling Report concluded that the hexavalent chromium concentrations detected were less than the site-specific screening value protective of potential construction workers and emergency /utility workers. To further protect occupants, institutional controls at the Facility (Appendix A of Attachment III) will limit land use and activities. GZA concluded that the test results supported a contained-out determination for the soil present beneath the engineered composite cap at the location of the former surface impoundments. In place media such as soil does not meet the definition of solid waste and the risk-based standards, supplemented by a risk assessment, demonstrate that <u>hazardous waste is not present beneath the former surface impoundment cap</u>.

Historically, two degreasers were present below-grade within the former building in concrete-lined pits. An additional degreaser and a solvent still were located above-grade on the concrete floor. Each degreaser used TCE as the degreasing solvent. Tetrachloroethylene (PCE) was also used for cleaning spray-painting equipment. The solvents were stored within the former building in 55-gallon capacity drums near degreasing and painting operations. Waste solvent was stored in 55-

gallon capacity drums on a concrete drum storage pad located outside the western wall of the former building. Additional detail concerning historical manufacturing operations is available in the Engineering Feasibility Study report (Reference 8 – Consoer Townsend Envirodyne Engineers, Inc., September 1995).

Due to the presence of TCE in the groundwater, a remediation system was installed that relied upon nine groundwater extraction wells (design approved by KDWM) to pump small amounts of groundwater for treatment using an air stripper system to reduce chlorinated Volatile Organic Compound (CVOC) concentrations, followed by disposal of the treated water at the City of Harrodsburg Publicly Owned Treatment Works (POTW).

The aquifer is comprised of karst limestone (Tanglewood Member) varying in thickness at the Facility from 30 to 60 feet, however the saturated thickness of the aquifer is less than 10 feet. The karst conduits identified at the Facility through a series of investigations are connected to Humane Spring located 3,300 feet downgradient of the Facility. A 1993 dye tracing investigation at the Facility demonstrated that groundwater can flow from the Facility, through karst conduits, and discharge from the spring within 26 hours. A 1999/2000 dye tracing investigation at the adjacent Modine property observed a similar hydraulic connection between that property and Humane Spring. The flow rate at Humane Spring is flashy and can vary from less than 100 gallons per minute (gpm) to greater than 60,000 gpm. Karst conduits make full hydraulic containment impractical.

The combined average flow rate from the groundwater recovery wells was about 4.5 gpm. The GRS was specifically designed to avoid installation of groundwater recovery wells from karst conduits identified at the property to avoid pumping, treatment and discharge of large volumes of water that contained very low to no concentrations of CVOCs, especially following precipitation events.

The GRS began operation in April 1995 and the nine groundwater extraction wells were operated between 1995 and 2008. In August 2008, three additional extraction wells were installed but only two wells were suitable for use in the GRS (in accordance with a Corrective Action Modification Design report prepared by GZA – Reference 9). KYDEP approved the Corrective Action Modification Design report on April 11, 2008 (Reference 10). The eleven extraction wells were operated until July 2016, when the GRS was shutdown to allow a Monitored Natural Attenuation (MNA) evaluation as approved by KYDEP (References 1-3). During the 21 years of GRS operation approximately 49 million gallons of groundwater was pumped from the aquifer and approximately 99 gallons of CVOCs (predominantly trichloroethene) was removed from the groundwater.

As described in Attachment IV (GZA's MNA Evaluation Report), the investigations and remedial actions performed from the late 1980s through 2005 removed the sources of the contamination from the Facility. Each of the 45 Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) considered potential primary contaminant source areas were identified, their mass reduced to the extent technically feasible, and administratively closed. In addition, approximately 25 remedial technologies were evaluated and discounted as technically not feasible.

Unrelated, off-Site sources of TCE groundwater contamination (i.e., beyond the control of the Permittee) contribute to the surface water contamination at Humane Spring and to groundwater contamination beneath the northwestern portion of the Site and between the Site and Humane Spring. The known off-Site CVOC sources at the adjacent Modine property was partially abated and the residual TCE contamination in soil, bedrock and groundwater are being evaluated. Note that the adjacent property is referenced in various reports for the former Facility as the Signet or Modine property but may be under different ownership at this time.

Greater than 20 years of groundwater remediation had only minimal impact on groundwater quality. Remaining residual CVOC contamination in the subsurface beneath the Facility and Modine in this geology cannot be feasibly and reliably

located, targeted with active remedial technologies and removed. While partial CVOC removal was achieved with the previous GRS, that increment of removal may not have been greater than that achieved through natural attenuation over that same period of time and did not necessarily result in significant risk reduction. The inability to achieve groundwater restoration with the GRS which was designed after substantial investigation and studies, was due to the hydrogeological and contaminant factors and is not due to inadequate operation or design of the GRS.

The residual CVOC concentrations in the downgradient compliance wells and Humane Spring are decreasing and the GRS shutdown did not change that trend. There is evidence that natural attenuation occurring at the Facility, we are taking this opportunity to demonstrate and recognize its contribution (Attachment IV). It is GZA's opinion that the existing groundwater remediation system should remain off and replaced with MNA because:

(1) the Facility contaminants are not causing a risk to human health;

(2) the groundwater plume is stable and decreasing;

(3) the naturally occurring groundwater chemistry conditions are amenable to support biological degradation of the groundwater plume;

(4) the TCE concentrations in the downgradient compliance wells and Humane Spring are low and decreasing over time;

(5) since the shut-down of the GRS, there was no rebound in groundwater contaminant concentrations, the predominant contaminant (TCE) decreased in many of the former groundwater recovery wells, and there is evidence that CVOCs are anaerobically biodegrading via reductive dichlorination; and

(6) a combination of physical and natural biological processes will further reduce groundwater contaminant concentrations over time (the supporting information is provided in GZA's MNA Evaluation Report, Attachment IV).

To evaluate the effectiveness of MNA, groundwater and Humane Spring surface water monitoring will be performed in accordance with the Corrective Action Monitoring Plan included as Appendix B to the Post-Closure Plan (Attachment III).

2.0 DESCRIBE SECURITY PROCEDURES AND EQUIPMENT [§§ 270.14(B)(4)]

The Facility is comprised of vacant land with a fence encompassing the area surrounding the former surface impoundments. There are no activities other than ground maintenance and groundwater monitoring planned. There are no security procedures or security equipment warranted on the property, other than the maintaining the chain link fence which enclose the former surface impoundments.

3.0 GENERAL INSPECTION SCHEDULE [§§ 270.14(B)(5)]

During routine ground maintenance between March and November, visual inspections of the engineered composite cap constructed over the former surface impoundments will be observed for signs of erosion damage, appropriate vegetative cover, and run-on/run-off control systems. When inspections reveal that repairs are necessary, the inspector will notify the Permittee and the Permittee will implement appropriate corrective action.

The surface water at Humane Spring contains low concentrations of CVOCs. At the request of KDWM, even though it is recognized that multiple sources may be impacting the spring, Kidde agreed in 2007 to post signs near the spring which warn trespassers about the surface water quality which will be inspected on a semi-annual basis and replaced if damaged or faded.

The signs state "warning, pollutants in spring water, avoid contact, do not drink, for details contact 502-564-6716".

Due to the nature of the waste material present beneath the engineered composite cap (clay soil over bedrock), leachate and landfill gas will not develop. As such, leachate collection or gas venting systems were not installed during Facility closure and therefore, they are not addressed in the inspection schedule.

4.0 JUSTIFICATION FOR ANY REQUEST FOR WAIVER OF PREPAREDNESS AND PREVENTION REQUIREMENTS

The Facility meets the applicable requirements of Part 264 Subpart C (§§ 264.30 through 264.37), Preparedness and Prevention. Due to the nature of the waste material present beneath the engineered composite cap (clay soil over bedrock) fire, explosion, or any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil, or surface water which could threaten human health, or the environment will not occur.

The property is vacant, there are no operations at the Facility that handle hazardous waste, and there are no Facility personnel present on the property, so the equipment specified by Subpart C is not necessary and have not been installed.

Similarly, as there are no operations at the Facility that handle hazardous waste and there are no Facility personnel present on the property, the requirements of §§ 264.34 communication or alarm systems and §§ 264.35 aisle spaces do not apply to the Facility.

Due to the nature of the Facility, as described above, additional arrangements with local authorities are not necessary.

5.0 FACILITY LOCATION INFORMATION [§§ 270.14(B)(11)]

The Facility is not located in a county or election district listed in Appendix VI of Part 264, thus, no further information is required to demonstrate compliance with §§ 264.18(a).

The Facility is located in an "Area of Minimal Flood Hazard" as depicted on FEMA Flood Map 21167C0140C, effective 9/17/2008.

6.0 COPY OF THE CLOSURE PLAN AND POST-CLOSURE PLAN [§§ 270.14(B)(13)]

The approved Closure Plan for the former surface impoundments was implemented prior to issuance of the Permit and is not repeated here.

The Post-Closure Plan (Attachment III) addresses the monitoring and maintenance activities associated with the area of the former surface impoundments and includes the Corrective Action Monitoring Plan to address the groundwater.

7.0 DOCUMENTATION THAT POST-CLOSURE NOTICES HAVE BEEN FILED [§§ 270.14(B)(14)]

Necessary notices were previously submitted to the appropriate authorities as part of the closure activities and were documented in Section I of the Part B Permit Application and are not repeated here.

8.0 POST-CLOSURE COST ESTIMATE AND FINANCIAL ASSURANCE [§§ 270.14(B)(16)]

The post-closure cost estimates and description of the financial assurance mechanisms are included in the Post-Closure Plan (Attachment III).

9.0 USE OF STATE-REQUIRED FINANCIAL MECHANISMS [§§ 270.14(B)(18)]

The post-closure cost estimates and description of the financial assurance mechanisms are included in the Post-Closure Plan (Attachment III).

10.0 TOPOGRAPHIC MAP [§§ 270.14(B)(19)]

A Site Survey Map, which includes topography, was prepared for the Facility by Carter Dixon Partners (CDP Engineers, Inc.) dated September 14, 2005, is included as Attachment II.

11.0 ADDITIONAL INFORMATION [§§ 270.14(C)]

The following additional information regarding groundwater is provided as required by §§ 270.14(c).

11.1 GROUNDWATER MONITORING DATA [§§ 270.14(C)(1)]

Groundwater monitoring data obtained during the interim status period was included in Section E of the Part B Permit Application and is not repeated here. Groundwater monitoring data obtained over the past 27 years during the 54 semi-annual Corrective Action Monitoring events was submitted semi-annually in reports to KDWM and is not repeated here. GZA's MNA Evaluation Report (Attachment IV) provides data to support the recommendation that the GRS be permanently abandoned, and the corrective action be MNA.

11.2 IDENTIFICATION OF UPPERMOST AQUIFER [§§ 270.14(C)(2)]

Based on a comprehensive review of existing information pertaining to the Facility and vicinity, the uppermost aquifer is described in detail in the September 2005 Conceptual Hydrogeologic Model prepared and included as Attachment V. The Conceptual Hydrogeologic Model describes the geologic and hydrogeologic setting; contaminant source and release information; contaminant distribution, transport and fate parameters; and spatial distribution of contaminants.

11.3 MAPPING AND COMPLIANCE POINTS [§§ 270.14(C)(3)]

Attachment VI contains a topographic map which delineates the waste management area, property boundary, proposed points of compliance, location of groundwater monitoring wells and the groundwater flow direction.

11.4 DESCRIPTION OF CONTAMINATION "PLUME" [§§ 270.14(C)(4)]

The nature and extent of groundwater contamination is complex and is described in the September 2005 Conceptual Hydrogeologic Model included as Attachment V and the more recent MNA Report as Attachment IV.

11.5 PROPOSED GROUNDWATER MONITORING PROGRAM [§§ 270.14(C)(5)]

The proposed groundwater monitoring program is described in the Corrective Action Monitoring Plan included in Attachment III as Appendix B.

11.6 DETERMINATION OF APPLICABLE GROUNDWATER PROGRAM [§§ 270.14(C)(7) AND (8)]

Following 30 years of corrective action; groundwater monitoring; supplemental sampling; comprehensive evaluations of conditions at the Facility and vicinity; and our understanding of the hydrogeologic conditions and contaminant sources, migration and fate; an MNA Corrective Action program was developed that recognizes the various contamination sources and designates the Facility property boundary as the "point of compliance."

The basis for this conclusion is presented in the Conceptual Hydrogeologic Model; and the data collected over approximately 30 years with the recent MNA evaluation that commenced in 2016. The Corrective Action Monitoring Plan, included as Appendix B to the Post-Closure Plan, provides a program for addressing conditions at the Facility and vicinity that are protective of human health and the environment and are consistent with the requirements of the Post-Closure Rule.

12.0 INFORMATION ON PERMITTED SOLID WASTE MANAGEMENT UNITS [§§ 270.14(D)]

The Post-Closure Permit is to address residual contaminated groundwater. The closure plans and reports for the three SWMUs identified as surface impoundment #1 (SWMU-1), surface impoundment #2 (SWMU-2) and surface impoundment #3 (SWMU-3) and Part B RCRA Permit Application includes the information required by §§ 270.14(d) and is not repeated here.

As described above, GZA's January 6, 2017 Former Surface Impoundment Sampling Report (Reference 7) included testing of soil samples below the engineered composite cap for cadmium, hexavalent chromium, nickel, and cyanide. GZA concluded that the test results supported a contained-out determination for the soil. In place media such as soil does not meet the definition of solid waste and the risk-based standards, supplemented by a risk assessment, demonstrate that hazardous waste is not present beneath the former surface impoundment cap.

13.0 REFERENCES

1. July 13, 2016 Kentucky Division of Waste Management (KDWM) letter to Elizabeth Lang at United Technologies Corporation (UTC).
2. January 19, 2017 KDWM letter to Elizabeth Lang at UTC.
3. January 2, 2018 and June 25, 2018 KDWM letters to Elizabeth Lang at UTC.
4. February 7, 2018 email from KDWM (Ashley Bandy) to GZA GeoEnvironmental Inc. (Mr. Anthony Urbano).
5. August 11, 2004, GZA GeoEnvironmental, Inc., Demolition Report, Former Hallmack Facility, Harrodsburg, Kentucky, prepared for Kidde-Fenwal, Inc.
6. August 26, 1991 Notice of Hazardous Waste Activity
7. January 6, 2017; GZA GeoEnvironmental, Inc.; Former Surface Impoundment Sampling Report; prepared for Kidde-Fenwal, Inc.
8. September 1995; Consoer Townsend Envirodyne Engineers, Inc.; Engineering Feasibility Study – Ground-water Remediation, Hallmack Facility, NuTone, Inc., Harrodsburg, KY; prepared for NuTone, Inc. (Kidde's predecessor in title to the Facility).
9. September 29, 2007 Corrective Action Modification Design Report prepared by GZA GeoEnvironmental, Inc. for Kidde-Fenwal, Inc.
10. April 11, 2008 KDWM letter to Elizabeth Lang at Kidde-Fenwal approving the September 29, 2007 Corrective Action Modification Design report.

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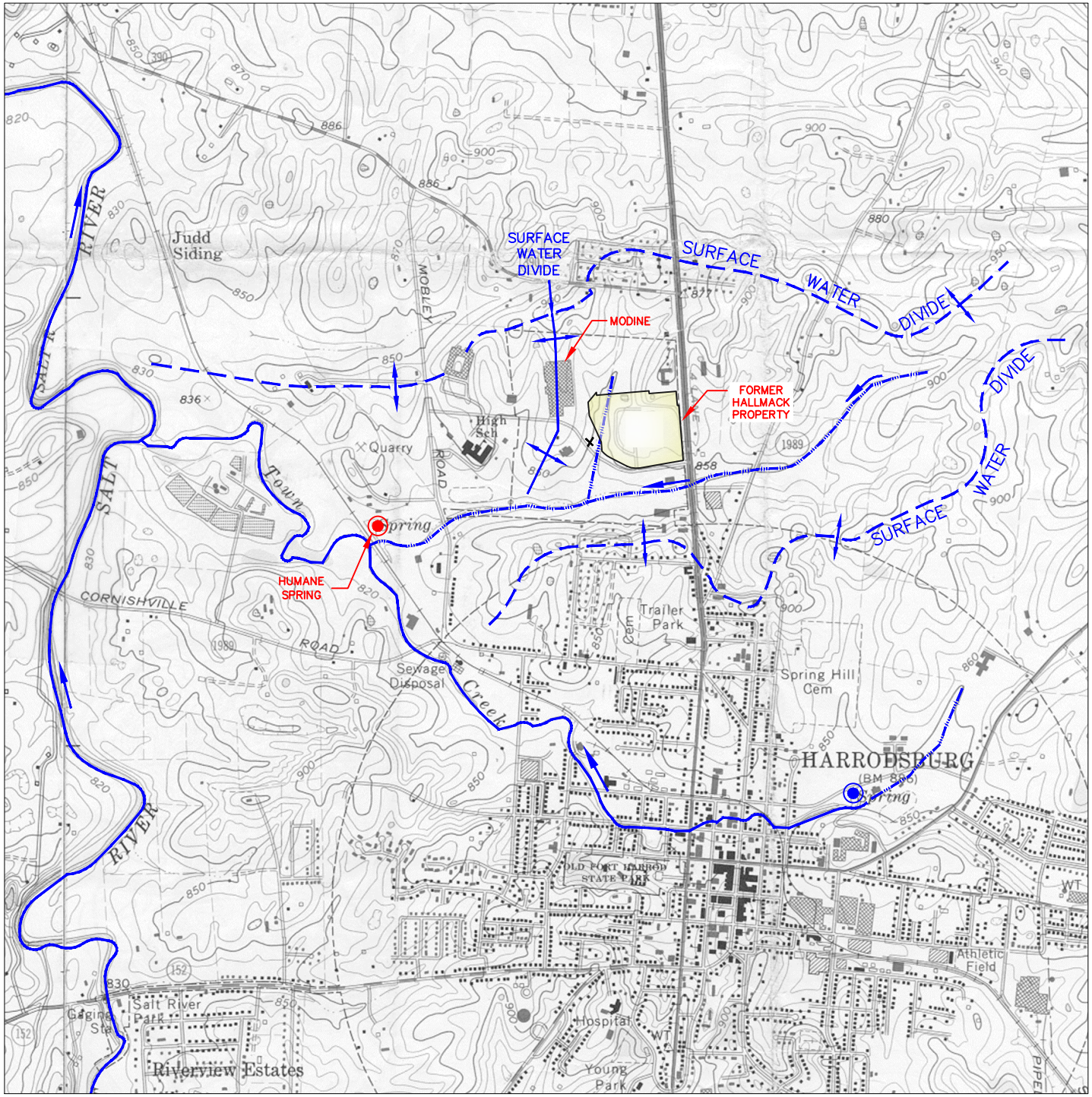
ATTACHMENT I
FACILITY LOCATION MAP



GRAPHIC SCALE IN FEET
0 500 1000 2000

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PROJ MGR: MJK
DESIGNED BY: MJK
REVIEWED BY: MAP
OPERATOR: DL
DATE: JUNE 2018

FORMER HALLMACK FACILITY
HARRODSBURG, KENTUCKY

SITE LOCATION MAP

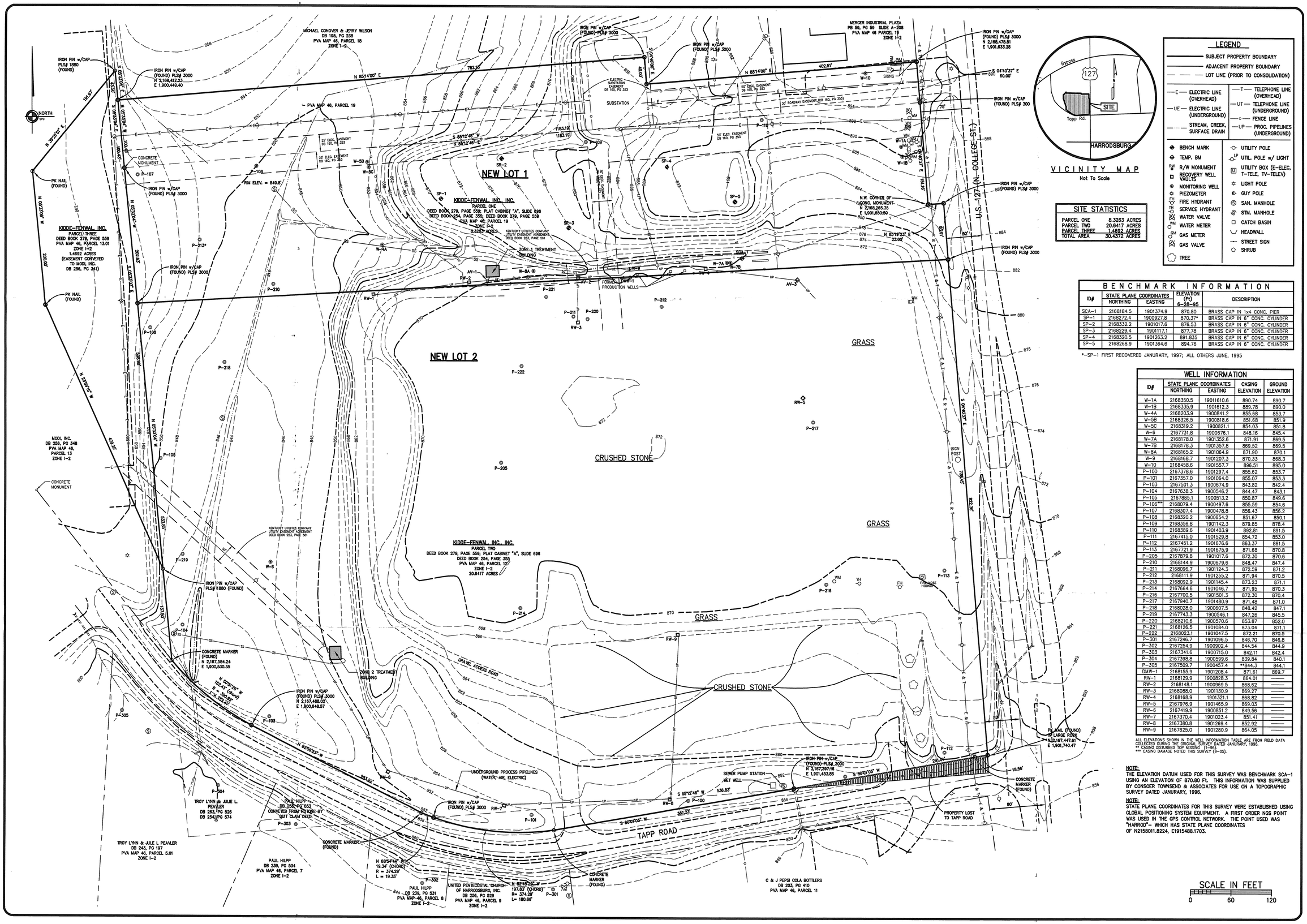
PROJECT NO.
150290.12

FIGURE NO.
1

©2005 - GZA GeoEnvironmental, Inc.

GZA-J:\ENV\150290-12.abu\FIGURES\GZA DWGS\FIG-1 SITE LOCATION MAP.dwg [FIG. 1] June 14, 2018 - 1:44pm michael.aubin

ATTACHMENT II
FACILITY TOPOGRAPHIC SURVEY



VICINITY MAP

Not To Scale

SITE STATISTICS

PARCEL ONE	8.3263 ACRES
PARCEL TWO	20.6417 ACRES
PARCEL THREE	1.4692 ACRES
TOTAL AREA	30.4372 ACRES

LEGEND

- SUBJECT PROPERTY BOUNDARY
- ADJACENT PROPERTY BOUNDARY
- LOT LINE (PRIOR TO CONSOLIDATION)
- ELECTRIC LINE (OVERHEAD)
- ELECTRIC LINE (UNDERGROUND)
- STREAM, CREEK, SURFACE DRAIN
- TELEPHONE LINE (OVERHEAD)
- TELEPHONE LINE (UNDERGROUND)
- FENCE LINE
- PROC. PIPELINES (UNDERGROUND)
- BENCH MARK
- TEMP. BM
- R/W MONUMENT
- RECOVERY WELL VAULTS
- MONITORING WELL
- PIEZOMETER
- FIRE HYDRANT
- SERVICE HYDRANT
- WATER VALVE
- WATER METER
- GAS METER
- GAS VALVE
- TREE
- UTILITY POLE
- UTIL. POLE w/ LIGHT
- UTILITY BOX (E-ELEC, T-TELE, TV-TELEV)
- LIGHT POLE
- GUY POLE
- SAN. MANHOLE
- STM. MANHOLE
- CATCH BASIN
- HEADWALL
- STREET SIGN
- SHRUB

BENCHMARK INFORMATION

ID#	STATE PLANE COORDINATES NORTHING	EASTING	ELEVATION (ft) 8-28-95	DESCRIPTION
SCA-1	2168184.5	1901374.9	870.80	BRASS CAP IN 1x4 CONC. PIER
SP-1	2168272.4	1900927.8	870.37*	BRASS CAP IN 6" CONC. CYLINDER
SP-2	2168332.2	1901017.6	876.53	BRASS CAP IN 6" CONC. CYLINDER
SP-3	2168229.4	1901117.1	877.78	BRASS CAP IN 6" CONC. CYLINDER
SP-4	2168320.5	1901263.2	891.835	BRASS CAP IN 6" CONC. CYLINDER
SP-5	2168268.9	1901364.6	894.76	BRASS CAP IN 6" CONC. CYLINDER

*-SP-1 FIRST RECOVERED JANURARY, 1997; ALL OTHERS JUNE, 1995

WELL INFORMATION

ID#	STATE PLANE COORDINATES NORTHING	EASTING	CASING ELEVATION	GROUND ELEVATION
W-1A	2168350.5	19011610.6	890.74	890.7
W-1B	2168335.9	1901612.3	889.78	890.0
W-4A	2168203.9	1900841.2	855.68	853.7
W-5B	2168326.5	1900818.6	851.68	851.9
W-5C	2168319.2	1900821.1	854.03	851.8
W-6	2167731.8	1900676.1	848.16	845.4
W-7A	2168178.0	1901352.6	871.91	869.5
W-7B	2168178.3	1901357.8	869.52	869.5
W-8A	2168165.2	1901064.9	871.90	870.1
W-9	2168168.7	1901207.3	870.33	868.3
W-10	2168458.6	1901557.7	896.51	895.0
P-100	2167378.6	1901297.4	855.62	853.7
P-101	2167357.0	1901064.0	855.07	853.3
P-103	2167501.3	1900674.9	843.82	842.4
P-104	2167638.3	1900546.2	844.47	843.1
P-105	2167885.1	1900513.2	850.87	849.6
P-106***	2168079.4	1900497.6	855.59	854.6
P-107	2168307.4	1900478.8	856.43	856.2
P-108	2168320.2	1900654.2	851.67	850.1
P-109	2168356.8	1901142.3	879.85	878.4
P-110	2168389.6	1901403.9	892.81	891.5
P-111	2167415.0	1901529.8	854.72	853.0
P-112	2167451.2	1901676.6	863.37	861.5
P-113	2167721.9	1901675.9	871.68	870.8
P-205	2167879.8	1901017.6	872.30	870.6
P-210	2168144.9	1900679.6	848.47	847.4
P-211	2168096.7	1901124.3	872.59	871.2
P-212	2168111.9	1901255.2	871.94	870.5
P-213	2168092.9	1901145.4	873.23	871.1
P-214	2167684.6	1901046.7	871.95	870.3
P-216	2167700.5	1901501.3	872.30	870.4
P-217	2167940.7	1901480.9	871.48	871.0
P-218	2168028.0	1900607.5	848.42	847.1
P-219	2167743.3	1900546.1	847.26	845.5
P-220	2168210.6	1900570.6	853.87	852.0
P-221	2168126.5	1901084.0	873.04	871.1
P-222	2168023.1	1901047.5	872.21	870.5
P-301	2167246.7	1901096.5	846.70	846.8
P-302	2167254.9	1900902.4	844.54	844.9
P-303	2167341.6	1900715.0	842.11	842.4
P-304	2167398.8	1900599.6	839.84	840.1
P-305	2167509.7	1900457.4	**844.3	844.1
DMW-1	2168155.9	1901208.4	871.61	869.7
RW-1	2168129.9	1900828.3	864.01	——
RW-2	2168148.1	1900969.5	866.62	——
RW-3	2168088.0	1901130.9	869.27	——
RW-4	2168168.9	1901321.1	868.82	——
RW-5	2167976.9	1901465.9	869.03	——
RW-6	2167419.9	1900851.2	849.56	——
RW-7	2167370.4	1901023.4	851.41	——
RW-8	2167380.8	1901268.4	852.92	——
RW-9	2167625.0	1901280.9	864.05	——

ALL ELEVATIONS SHOWN IN THE WELL INFORMATION TABLE ARE FROM FIELD DATA COLLECTED DURING THE ORIGINAL SURVEY DATED JANURARY, 1996.
** CASING DISTURBED TOP MISSING (1-96).
*** CASING DAMAGE NOTED THIS SURVEY (8-05).

NOTE:
THE ELEVATION DATUM USED FOR THIS SURVEY WAS BENCHMARK SCA-1 USING AN ELEVATION OF 870.80 FL. THIS INFORMATION WAS SUPPLIED BY CONSOER TOWNSEND & ASSOCIATES FOR USE ON A TOPOGRAPHIC SURVEY DATED JANURARY, 1996.

NOTE:
STATE PLANE COORDINATES FOR THIS SURVEY WERE ESTABLISHED USING GLOBAL POSITIONING SYSTEM EQUIPMENT. A FIRST ORDER NGS POINT WAS USED IN THE GPS CONTROL NETWORK. THE POINT USED WAS "HARROD"- WHICH HAS STATE PLANE COORDINATES OF N2158011.8224, E1915488.1703.

DRAFTING SERVICES PROVIDED BY:
3250 Blazer Parkway
Lexington, Kentucky 40509
Ph : (859)264-7500
Fax: (859)264-7501
CDP ENGINEERS, INC.
CARTER DIXON PARTNERS

REVISION:	BY:	DATE:	SCALE	:	1"=60'
			DESIGNED BY	:	CDG
			DRAWN BY	:	SPG
			CHECKED BY	:	05077
			PROJECT NO	:	SEPTEMBER 14, 2005
			DATE	:	5072-S2.dwg
			CADD DWG ID	:	

GZA GeoEnvironmental, Inc.
20900 Swenson Drive
Suite 150
Waukesha, WI 53186

TOPOGRAPHIC SITE SURVEY

FORMER HALLMACK FACILITY
HARRODSBURG, MERCER COUNTY, KENTUCKY

DRAWING
S-2

ATTACHMENT III
POST-CLOSURE PLAN

RCRA POST-CLOSURE PERMIT RENEWAL APPLICATION
FORMER HALLMACK FACILITY
HARRODSBURG, KENTUCKY
PERMIT NO. KYD-081-017-667

ATTACHMENT III
POST-CLOSURE PLAN

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APPENDICES

Appendix A Environmental Covenant
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1.0 INTRODUCTION

This Post-Closure Plan was prepared as Attachment III to the September 2022 RCRA Post-Closure Permit Renewal Application ("RCRA Permit") and will also be the Property Management Plan for the former Hallmack Facility in Harrodsburg, Kentucky (the "Facility"); permit No. KYD-081-017-667. The Post-Closure Plan includes the following elements:

1. Monitoring and maintenance activities associated with the former surface impoundments;

2. Corrective Action Monitoring Plan;

3. Facility contact information;

4. Post-closure cost estimates and financial assurance mechanisms; and

5. Draft Environmental Covenant (Appendix A)

During manufacturing operations at the Facility (1968 to 1986), up to three surface impoundments were constructed and used to store electroplating wastewater and sludge. Based on reports prepared at the time of closure of the former surface impoundments (1987 to 1989), the wastewater treatment sludge was removed from the three former surface impoundments to the top of bedrock. Upon removal of the sludge, the impoundment walls were subsequently graded over the bedrock surface to form a sloping plane, which was then capped with a 5 to 8-foot thick engineered composite cap in accordance with approved closure plans. Thus, the existing RCRA Permit was for the storage of relatively low permeability clay soil that comprised the former surface impoundment walls and at the time of closure was believed to contain hazardous waste (§§ 261.31 Industry and Hazardous Waste No. F006) by the contained-in rule.

GZA's Former Surface Impoundment Sampling Report (Reference 7 in application), which was submitted to KYDEP on January 6, 2017, included testing of soil samples below the engineered composite cap for cadmium, hexavalent chromium, nickel, and cyanide. The only parameter which exceeded US EPA's Industrial Regional Screening Level was hexavalent chromium. The engineered composite cap prevents exposure to underlying soil to most individuals. Although unlikely, potential construction workers could be exposed to the underlying soil. GZA performed a limited risk assessment and found that the hexavalent chromium concentrations detected were below the site-specific screening value that is protective of potential construction workers and emergency /utility workers. GZA concluded that the test results supported a contained-out determination for the soil present beneath the engineered composite cap at the location of the former surface impoundments. In place media such as soil does not meet the definition of solid waste and the risk-based standards, supplemented by a risk assessment, demonstrate that <u>hazardous waste is not present beneath the former surface impoundment cap.</u>

2.0 MONITORING AND MAINTENANCE OF FORMER SURFACE IMPOUNDMENTS

This Post-Closure Plan describes the monitoring and maintenance activities associated with the former surface impoundments. The activities covered by this plan were developed to address procedures established to monitor and maintain the physical condition of the former surface impoundment cover.

2.1 INSPECTIONS

During routine ground maintenance between March and November, visual inspections of the engineered composite cap constructed over the former surface impoundments will be observed for signs of erosion damage, appropriate vegetative cover, and run-on/run-off control systems. In addition, the condition of the perimeter fence will be visually inspected. When inspections reveal that repairs are necessary, the inspector will notify the Permittee and the Permittee will implement appropriate corrective action.

2.2 SECURITY CONTROL DEVICES

The Facility is comprised of vacant land with a fence encompassing the area surrounding the former surface impoundments. Hazardous waste is not present beneath the former surface impoundments. There are no activities on the Facility other than ground maintenance and groundwater monitoring planned. There are no security procedures or security equipment warranted on the property, other than the maintaining the chain link fence which enclose the former surface impoundments. It is anticipated that maintenance and repair of the fence will be minimal and additional costs have not been budgeted.

2.3 COVER SETTLEMENT, SUBSIDENCE AND DISPLACEMENT

Due to the nature of the waste material present beneath the composite cap (clay soil over bedrock), as corroborated by more than 20 years of surface monument surveying with no settlement of the cap will not be a concern. As such, additional elevation surveying will not be performed.

2.4 VEGETATIVE COVER AND EROSION DAMAGE

During routine ground maintenance between March and November, visual inspections of the composite cap constructed over the former surface impoundments will be observed for appropriate vegetative cover and signs of erosion damage. When inspections reveal erosion or vegetation that needs to be addressed, the Permittee will implement appropriate corrective action. Based on more than 23 years of maintenance limited to vegetation control, there has been no need for erosion repair or reseeding which is anticipated to remain de minimis and budgeted accordingly.

2.5 RUN-ON/RUN-OFF CONTROL

Surface drainage at the former surface impoundment cap is primarily sheet flow off the cap to the north, east and west. Sheet flow to the south and southwest enters stone trenches and a ditch reportedly designed to handle a 25-year, 24-hour storm. Design calculations and details for the ditch were submitted with the approved Closure Plan. Based on more than 23 years of observations, stone trench and ditch repair are not anticipated and remain de minimis and budgeted accordingly.

3.0 CORRECTIVE ACTION MONITORING PLAN

The groundwater Corrective Action Monitoring Plan (CAMP) contained as Appendix B was prepared to support Monitored Natural Attenuation (MNA) as the Corrective Action to address the release of hazardous constituents; chlorinated volatile organic compounds (CVOCs), into the groundwater. The foundation of the CAMP is based on the MNA Report and Conceptual Hydrogeologic Model included as Attachments IV and V.

4.0 POST-CLOSURE CONTACT

The former Hallmack Facility is closed and the property is vacant. Inquiries regarding the Facility and the closed former surface impoundments should be directed to the following individual:

Donald Sorbello
c/o Carrier Corporation
PO Box 4808, Building 7
Syracuse, New York 13221
(315) 525-4405

The Facility copy of the Post-Closure Plan will be maintained by the environmental consultant (GZA GeoEnvironmental Inc.) and is available for inspection at any time (in PDF format).

4.1 POST-CLOSURE CERTIFICATION

Within 60 days of completion of the post-closure care period, certification will be submitted to Kentucky Division of Waste Management (KDWM) indicating that the post-closure care period was performed in accordance with the specifications of the approved Post-Closure Permit and Plan. The certification will be signed by the Permittee and by an independently-registered professional engineer.

5.0 POST-CLOSURE COST ESTIMATE

The estimated costs for post-closure care at the Facility are summarized below.

Activity	Estimated Annual Cost	Estimated 10-Year Cost
MONITORING AND MAINTENANCE OF FORMER SURFACE IMPOUNDMENTS		
1. Inspections	$100	$1,000
2. Maintenance – Vegetative Cover	$100	$1,000
3. Maintenance – Erosion Damage	$100	$1,000
4. Maintenance – Run-On/Run-Off System	$100	$1,000
COMPLIANCE MONITORING		
1. Semiannual Groundwater Monitoring	$25,000	$250,000
Total Estimated Costs for 10 Year Post-Closure Care:	$25,400	$254,000

During the post-closure care period of the Facility, the Permittee shall adjust the post-closure cost estimate for inflation within thirty (30) days after the end of the Permittee's fiscal year. Based on the Facility conditions and nature of the costs estimates adjustments to the post-closure cost estimate are not anticipated to be necessary during the post-closure care period.

5.1 FINANCIAL ASSURANCE MECHANISM AND LIABILITY REQUIREMENTS FOR POST-CLOSURE

To satisfy the financial assurance and liability requirements of the RCRA Post-Closure Permit, the Permittee will be using performance bond (#08966128) and liability bond (#08966129), which will be updated upon approval of the new permit.

J:\ENV\150290-1.MAP\September20222permitrenewal\Attachment III Post Closure Plan 1 of 3.doc

APPENDIX A

DRAFT ENVIRONMENTAL COVENANT

ENVIRONMENTAL COVENANT

Kidde-Fenwal, Inc., a Delaware corporation, (hereinafter "Grantor") grants an Environmental Covenant (hereinafter "Covenant") this ___ day of _____, 2018 to the following Holder pursuant to KRS Chapter 224 Subchapter 80: Kidde-Fenwal, Inc. (hereinafter "Holder").

WHEREAS, Grantor is the owner of certain real property located on North College Street, Harrodsburg, KY 40330, which is described in Deed Book 279, Page 559 in the Mercer County Clerk's Office (hereinafter "Property"), and is more particularly described as follows:

> See Exhibit A, attached hereto and incorporated herein by reference.

WHEREAS, this instrument is an Environmental Covenant developed and executed pursuant to KRS 224.80-100 to KRS 224.80-210;

WHEREAS, a release of hazardous substances occurred and reportedly penetrated soil, bedrock and groundwater at a portion of the Property, requiring corrective action pursuant to KRS Chapter 224. Pursuant to KRS Chapter 224, Grantor has performed corrective action in accordance with applicable requirements of the Kentucky Energy and Environment Cabinet (hereinafter "Cabinet");

WHEREAS, Grantor has proposed a plan (the "Plan") to reduce human exposure to hazardous substances in soil and groundwater at the Property, including, but not limited to, maintenance of an engineered composite cap;

WHEREAS, further information concerning the activities performed may be obtained by contacting the Custodian of Records of the Kentucky Division of Waste Management at 300 Sower Blvd., Frankfort, Kentucky 40601. Records concerning this property may be found under Agency Interest: 48471.

NOW, THEREFORE, Grantor hereby grants this Environmental Covenant to the Holder, and declares that the Property shall hereinafter be bound by, held, sold, used, improved, occupied, leased, hypothecated, encumbered, and/or conveyed subject to the following requirements set forth in paragraphs 1 through 3 below:

1. DEFINITIONS

A. Grantor. "Grantor" means Kidde-Fenwal, Inc., its successors, assigns and heirs in interest.

B. Residential Use. "Residential Use" means single family or multi-family residences; child or adult care facilities; nursing home or assisted living facilities; any type of hospital or medical clinic; any type of educational purpose for children or young adults in grades kindergarten through twelfth; an outdoor playground or outdoor recreation area; outdoor agricultural activities (not including wholesale or retail storage or marketing of agricultural products); places of short-term or long-term lodging, including, but not limited to, a hotel, bed and breakfast, and motel.

C. Qualified Consultant. "Qualified Consultant" means any licensed professional engineer having a minimum of five (5) years' experience in the design of vapor protection systems.

2. USE RESTRICTIONS

A. Prohibited Uses. The Property shall not be used for a residential use.

B. Prohibited Activities.

i. Groundwater extracted from the Property shall not be used for drinking or other domestic purposes.

ii. Except as necessary to protect human health, safety, or the environment, no action shall be taken, allowed, suffered, or omitted on the Property if such action or omission is reasonably likely to create a risk of migration of metals or other hazardous substances or result in a potential hazard to human health or the environment from the metals or other hazardous substances. The restriction contained in this paragraph 2.B.ii. shall also prohibit the storage or use of chlorinated solvents at the Property.

iii. Disturbance of the cap. The approved cap placed on the portion of the Property identified as "Parcel One" on Exhibit A attached hereto, and further identified on Attachment 1 of Exhibit A, shall not be disturbed in any manner without the prior written approval of the Director, Kentucky Division of Waste Management.

iv. Soil Disturbances. Soil at the Property shall not be disturbed in any manner without the Grantor obtaining prior written approval of the Director, Kentucky Division of Waste Management.

v. Structures. Notwithstanding any provision of this covenant to the contrary, no structure, other than a structure necessary for implementation of the Plan, shall be constructed or maintained on the Property, including the construction or maintenance of a basement or other space extending below the surface of the ground (including, without limitation, parking structures), without obtaining prior written approval of the Director, Kentucky Division of Waste Management.

No enclosed buildings or other occupied structures shall be constructed without: (1) prior evaluation of the potential for vapor intrusion into any planned structure; and (2) the incorporation and maintenance of appropriate vapor intrusion mitigation measures if necessary/appropriate.

3. GENERAL PROVISIONS

A. Restrictions to Run with the Land. This Environmental Covenant runs with the land pursuant to KRS 224.80-140; is perpetual unless modified or terminated pursuant to the terms of this Covenant; and inures to the benefit of and passes with each and every portion of the Property; and binds the Grantor, all persons using the land, all persons, their heirs, successors and assigns having any right, title or interest in the Property, or any part thereof who have subordinated those interests to this Environmental Covenant, and all persons, their heirs,

successors and assigns who obtain any right, title or interest in the Property, or any part thereof after the recordation of this Environmental Covenant.

B. Conveyances of the Property. Grantor shall notify the Director of the Kentucky Division of Waste Management at least thirty (30) days in advance of any proposed grant, transfer, or conveyance of any interest in any or all of the Property. Notice shall include the name, address, and telephone number of the prospective transferee, a copy of the proposed deed or other documentation evidencing the conveyance, and a survey map that shows the boundaries of the Property being transferred.

C. Incorporation into Deeds and Leases. Each instrument hereafter conveying any interest in the Property or any portion of the Property shall contain a notice of the activity and use limitations set forth in this Environmental Covenant, and provide the recorded location of this Environmental Covenant. The notice shall be substantially in the following form:

> THE INTEREST CONVEYED HEREBY IS SUBJECT TO AN ENVIRONMENTAL COVENANT, DATED _____, 201_, RECORDED IN THE MERCER COUNTY CLERK'S OFFICE IN DEED BOOK _____, Page _____.

D. Zoning Changes. Grantor shall notify the Director, Kentucky Division of Waste Management simultaneously when any application is submitted to a local government for a building permit for the Property. Grantor shall notify the Kentucky Division of Waste Management of any proposed change in the land use for the Property.

E. Compliance Certification. Grantor shall submit an annual report to the Director of the Kentucky Division of Waste Management, on the anniversary of the date this Covenant was signed by the Grantor, detailing the Grantor's compliance, and any lack of compliance with the terms of the Covenant.

F. Right of Access. Grantor hereby grants the Cabinet, its agents, contractors and employees and any person, their agents, contractors and employees responsible for implementing the Plan the right of access to the Property at reasonable times for implementation or enforcement of this Environmental Covenant or the Plan.

G. Representations and Warranties. Grantor hereby represents and warrants to the other signatories hereto:

i. that the Grantor has the power and authority to enter into this Environmental Covenant, to grant the rights and interests herein provided, and to carry out all obligations hereunder;

ii. that the Grantor is the sole owner of the Property and holds fee simple title which is free, clear and unencumbered;

iii. that the Grantor has identified all other parties that hold any recorded interest in the Property and notified such parties, through the public notice requirements set forth in

Paragraph G.iv. of this Covenant, of the Grantor's intention to enter into this Environmental Covenant;

iv. that the Grantor has complied with all public notice requirements in KRS 224.80-110.

v. that this Environmental Covenant will not materially violate or contravene or constitute a material default under any other agreement, document or instrument to which Grantor is a party, by which Grantor may be bound or affected.

vi. that, to Grantor's actual knowledge, this Environmental Covenant will not materially violate or contravene any zoning law or other law regulating use of the Property.

vii. that this Environmental Covenant does not authorize a use of the Property that is otherwise prohibited by a recorded instrument that has priority over the Environmental Covenant.

H. Compliance Enforcement. The terms of the Environmental Covenant may be enforced by the Cabinet or any person identified in KRS 224.80-200 in accordance with applicable law. Failure to timely enforce compliance with this Environmental Covenant or the use limitations contained herein by any person shall not bar subsequent enforcement by such person and shall not be deemed a waiver of the person's right to take action to enforce any non-compliance. Nothing in this Environmental Covenant shall restrict the Cabinet from exercising any authority under applicable law.

I. Modifications/Termination. This Environmental Covenant runs with the land and is perpetual, unless modified or terminated in accordance with KRS 224.80-180 or KRS 224.80-190. The term "Amendment" as used in this Environmental Covenant, shall mean any changes to the Environmental Covenant, including the activity and use limitations set forth herein, or the elimination of one or more activity and use limitations when there is at least one limitation remaining. The term "Termination" as used in this Environmental Covenant, shall mean the elimination of all activity and use limitations set forth herein and all other obligations under this Environmental Covenant.

J. Notices. Any document or communication required to be sent to the Cabinet or the Director, Division of Waste Management, under this Covenant shall be sent to:

Director, Division of Waste Management
Department for Environmental Protection
300 Sower Blvd.
Frankfort, KY 40601

K. Severability. If any provision of this Environmental Covenant is found to be unenforceable in any respect, the validity, legality, and enforceability of the remaining provisions shall not in any way be affected or impaired.

L. Governing Law. This Environmental Covenant shall be governed by and interpreted in accordance with the laws of the Commonwealth of Kentucky.

M. Recordation. Within ten (10) business days after the date of the final required signature upon this Environmental Covenant, Grantor shall file this Environmental Covenant in the Mercer County Clerk's Office.

N. Effective Date. The effective date of this Environmental Covenant shall be the date upon which the fully executed Environmental Covenant has been recorded as a deed record for the Property with the Mercer County Clerk's Office.

O. Distribution of Environmental Covenant. The Grantor shall, within thirty (30) days of receipt from the Mercer County Clerk's Office, distribute a file and date stamped copy of the recorded Environmental Covenant to the following persons: Director, Kentucky Division of Waste Management; Judge Executive of Mercer County, each person who is in possession of the Property, each person who holds a recorded interest in the Property, and each person who signed this Environmental Covenant.

P. Cabinet and Division References. All references to the Kentucky Energy and Environment Cabinet and the Kentucky Division of Waste Management shall include successor agencies, departments, divisions or other successor entities.

The Grantor has caused this Environmental Covenant to be executed pursuant to KRS Chapter 224.80-100 to KRS 224.80-210 on this ___ day of _____, 2018.

IN TESTIMONY WHEREOF, the parties have hereunto set their hands this the day and year first above written.

KIDDE-FENWAL, INC. (Grantor/Holder)

By (Signature): _____

Printed Name: _____

Title: _____

STATE OF _____)
)
COUNTY OF _____)

The foregoing Environmental Covenant was acknowledged before me, this ___ day of _____, 2018, by _____, for and in his/her capacity as _____ on behalf of Kidde-Fenwal, Inc. (Grantor/Holder).

_____
Notary Public
My Commission Expires: _____

KENTUCKY ENERGY AND ENVIRONMENT CABINET

This Environmental Covenant is hereby approved by the Kentucky Energy and Environment Cabinet this ____ day of _____, 2018.

By: _____ _____
Jon Maybriar, Director, Date
Division of Waste Management

COMMONWEALTH OF KENTUCKY)
)
COUNTY OF _____)

The foregoing Environmental Covenant was acknowledged before me, this ___ day of _____, 2018, by Jon Maybriar for and in his capacity as Director, Kentucky Division of Waste Management.

_____
Notary Public
My Commission Expires: _____

This instrument prepared by:

_____
John R. Rhorer, Jr.
Dinsmore & Shohl LLP
250 West Main Street, Suite 1400
Lexington, KY 40507
(859) 425-1000

COMMONWEALTH OF KENTUCKY)
)
COUNTY OF MERCER)

I, _____, Clerk of the Mercer County Court, do certify that the foregoing Environmental Covenant was lodged in my office for record, and that I have recorded it, and the certificate thereon, this _____ day of _____, 2018.

_____
County Clerk

EXHIBIT A

Parcel One:
A tract or parcel of land located in Harrodsburg, Mercer County, Kentucky, and more particularly described as follows:

Being all of New Lot 1, comprising 8.3263 acres, as shown on that consolidation record plat of Hallmack Facility Division of Nutone, Inc., U.S. 127 North and Tapp Road, Harrodsburg, Mercer County, Kentucky, and dated January 22, 1996, a copy of which consolidation record plan is recorded in the Mercer County Clerk's Office at Plat Cabinet A, Slide 696.

Parcel Two:
A tract or parcel of land located in Harrodsburg, Mercer County, Kentucky, and more particularly described as follows:

Being all of New Lot 2, comprising of 20.6417 acres, as shown on that consolidation record plat of Hallmack Facility Division of Nutone, Inc., U.S. 127 North and Tapp Road, Harrodsburg, Mercer County, Kentucky, and dated January 22, 1996, a copy of which consolidation record plan is recorded in the Mercer County Clerk's Office at Plat Cabinet A, Slide 696.

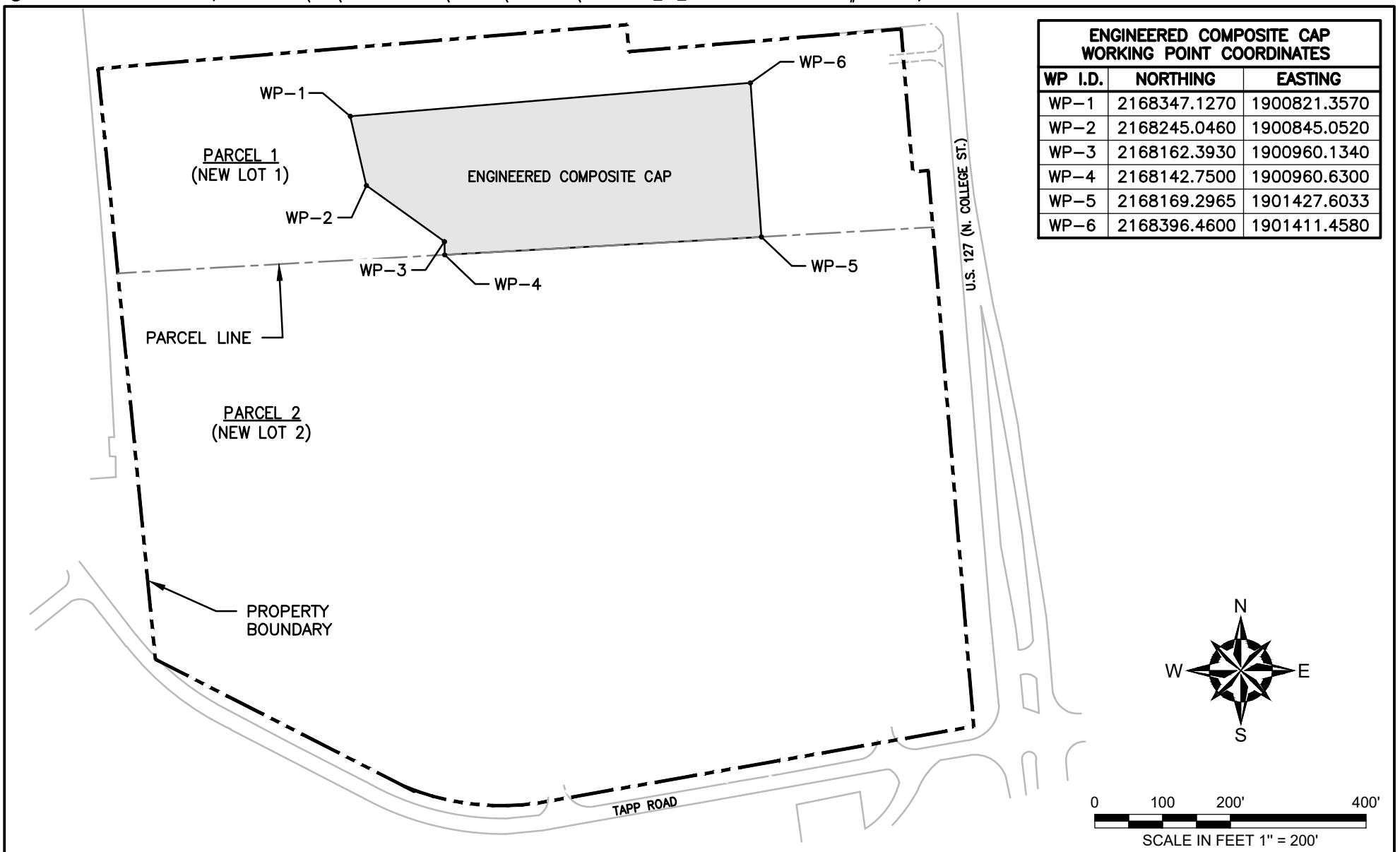
Parcel Three:
Being located near Tapp Road, in the City of Harrodsburg, County of Mercer, State of Kentucky, and bounded as follows:

Beginning at an iron pin (set) located in the line of Signet Systems and Nutone, said iron pin located N 5° 15' 00" W, a distance of 137.50 feet from a 6" x 6" x 2' concrete post (found) located in the north right-of-way of Tapp Road and being a corner to Signet Systems and Nutone; thence along a new line with Signet Systems (Deed Book 209, Page 537) for the following calls:
N 23° 41' 06" W, a distance of 429.20 feet to a PK Nail and Washer (set); N 5° 15' 00" W, a distance of 200.00 feet to a PK Nail and Washer (set); N 39° 45' 00" E a distance of 191.94 feet to an iron pin (set) located in the line of Conover; thence S 5° 15' 00" E along the line of Conover (Deed Book 195, Page 238) and Nutone (Deed Book 244, Page 630) a distance of 742.90 feet to point of beginning, containing 1.469 acres more or less. All bearings are referred to bearing of record (5° 15' 00" E) as shown in Deed Book 209, Page 541, pursuant to a survey conducted by Lindon W. Estes, RLS 1880, on December 9, 1993, of record in the Mercer County Clerk's Office in Plat Cabinet A, Slide 644.

There is excepted and less from the property conveyed from Nutone, Inc., a Delaware Corporation to Troy Lynn Peavler and Julie L. Peavler, his wife, by Deed dated 3/24/1995 of record in Deed Book 254, Page 574 in the Mercer County Clerk's Office.

Being the same property conveyed to Kidde-Fenwal, Inc., a Delaware corporation by Deed dated 7/1/2000 of record in Deed Book 279, Page 559 in the Mercer County Clerk's Office.

©2018– GZA GeoEnvironmental, Inc. GZA–J:\ENV\150290–12.ABU\FIGURES\GZA DWGS\150290–12_F1_8.5X11.DWG ATTACHMENT #1 JULY 2, 2018 MICHAEL AUBIN



ENGINEERED COMPOSITE CAP WORKING POINT COORDINATES

WP I.D.	NORTHING	EASTING
WP–1	2168347.1270	1900821.3570
WP–2	2168245.0460	1900845.0520
WP–3	2168162.3930	1900960.1340
WP–4	2168142.7500	1900960.6300
WP–5	2168169.2965	1901427.6033
WP–6	2168396.4600	1901411.4580

NO.	ISSUE/DESCRIPTION	BY	DATE

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FORMER HALLMACK FACILITY
HARRODSBURG, KENTUCKY

ATTACHMENT 1 OF EXHIBIT A
SITE PLAN

PREPARED BY:
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PREPARED FOR:
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PROJ MGR: ABU	REVIEWED BY: ABU	CHECKED BY: CKB	ATTACHMENT
DESIGNED BY: ABU	DRAWN BY: GRB	SCALE: SCALE	1
DATE: JULY 2018	PROJECT NO. 150290.12	REVISION NO. 0	

APPENDIX B

CORRECTIVE ACTION MONITORING PLAN

RCRA POST-CLOSURE PERMIT RENEWAL APPLICATION
ATTACHMENT III – POST-CLOSURE PLAN
APPENDIX B - CORRECTIVE ACTION MONITORING PLAN

1.0 CORRECTIVE ACTION PLAN

The Corrective Action Plan (CAP) is a component of the Post-Closure Plan submitted with the September 2022 RCRA Post-Closure Permit Renewal Application for the Former Hallmack facility in Harrodsburg, Kentucky ("Facility"), prepared by GZA GeoEnvironmental, Inc. (GZA) on behalf of Kidde-Fenwal, Inc. ("Permittee"). The CAP was prepared to address residual chlorinated volatile organic compounds (CVOCs) present in the groundwater.

As summarized in the July 2018 Monitored Natural Attenuation (MNA) Evaluation (Attachment IV), previous Facility investigations and remedial actions performed from the late 1980s through 2005 removed the sources of contamination from the Facility. Each of the 45 Solid Waste Management Units and Areas of Concern considered potential primary contaminant source areas were identified, their mass reduced to the extent technically feasible, and administratively closed. In addition, approximately 25 remedial technologies were evaluated and discounted as technically not feasible. The remedial technology selected with input and approval from the Kentucky Department for Environmental Protection to address the groundwater contamination for more than 20 years was a groundwater pumping and treatment system installed in 1995 which was augmented with additional recovery wells in 2007 and finally discontinued in 2016 to evaluate the feasibility of MNA as an appropriate corrective action for the Facility.

The primary residual contamination associated with the Facility are CVOCs in the bedrock and groundwater. Additional sources of CVOC contamination from properties beyond the control of the Permittee also contribute to the surface water contamination at downgradient Humane Spring and to groundwater contamination beneath the northwestern portion of the Facility and between the Facility and Humane Spring. The known off-Site CVOC sources at the adjacent Modine property was partially abated and the residual trichloroethene (TCE) contamination in soil, bedrock and groundwater are being evaluated. Note that the adjacent property is referenced in various reports for the former Facility as the Signet or Modine property but may be under different ownership at this time.

The foundation of the CAP is the MNA Evaluation (Attachment IV) and September 2005 Conceptual Hydrogeologic Model prepared and included as Attachment V. These reports were prepared following a comprehensive review of existing data and reports pertaining to the hydrogeologic setting, suspected and known contaminant sources, historical monitoring activities and the corrective actions. Based on the information provided in the MNA Evaluation, the Corrective Action is MNA.

The residual CVOC concentrations in the downgradient compliance wells and Humane Spring are decreasing and shutdown of the previous Groundwater Remediation System (GRS) that operated for more than 20 years did not change that trend. It is GZA's opinion that the existing groundwater remediation system should remain off and replaced with MNA for the following reasons:

1. Residual contaminants associated with the Facility are not posing a risk to human health;
2. Institutional controls at the Facility will provide secondary protection to human health by limiting land use and activities;
3. The CVOC concentrations in the groundwater are stable and decreasing;
4. Naturally occurring groundwater chemistry support biological degradation of the CVOCs in the groundwater;
5. CVOC concentrations in the downgradient compliance wells and Humane Spring are low and decreasing over time;
6. Following shutdown of the GRS, there was no rebound in groundwater contaminant concentrations and the predominant contaminant (TCE) decreased in many of the former groundwater recovery wells;
7. There is evidence that CVOCs are anaerobically biodegrading via reductive dichlorination; and
8. A combination of physical and natural biological processes will further reduce groundwater contaminant concentrations over time as summarized in Attachment IV.

1.1 CAP OBJECTIVE

The CAP provides a program for addressing groundwater at the Facility that is protective of human health and the environment and is consistent with the requirements of the 1998 Post-Closure Rule.

1.2 POINT OF COMPLIANCE

Using the flexibility allowed by the Post-Closure Rule as reflected in the existing Permit and verbally relayed by Messrs. Dale Burton and Cliff Hall to the Permittee during a meeting at the Facility on May 31, 2005, the point of compliance will remain the hydraulically downgradient southwest property boundary monitored by eight wells: P-104, P-103, P-219, P-301, P-302, P-303, P-304 and P-305.

The point of compliance reflects our understanding of the Facility hydrogeologic conditions and allows for a holistic view of the Facility recognizing that there is more than one former CVOC source area including at least one from a neighboring property; Modine.

1.3 GROUNDWATER PROTECTION STANDARDS

The Groundwater Protection Standards (GPS) at the Point of Compliance wells will be:

- Tetrachloroethene - 0.005 milligrams per liter (mg/l);
- Trichloroethene (TCE) - 0.005 mg/l;

- Cis-1,2-dichloroethene - 0.07 mg/l;
- Trans-1,2-dichloroethene - 0.1 mg/l; and
- Vinyl chloride - 0.002 mg/l.

In addition to the GPS at the Point of Compliance wells, the narrative corrective action standard "protective of human health and the environment" will apply to the releases and residual groundwater contamination at the remaining areas of the Facility per the Post-Closure Rule. Such a narrative standard is appropriate based on the eight reasons summarized in Section 1.0 above.

2.0 MONITORING PLAN

The monitoring plan is described in the following Sections.

2.1 MONITORING WELL NETWORK

Groundwater samples representative of background and the point of compliance will be collected from the following wells.

- Background Monitoring Wells: W-10 and P-106.
- Compliance Monitoring Wells: P-104, P-103, P-219, P-301, P-302, P-303, P-304 and P-305.

2.2 GROUNDWATER LEVEL MEASUREMENTS

Groundwater level measurements will be taken semi-annually from a designated reference point at the top of well casing from the following monitoring wells to facilitate a reasonable representation of groundwater flow direction: W-4A, W-6, W-7A, W-10, P-101, P-103, P-104, P-105, P-106 P-107, P-109, P-111, P-205, P-214, P-216, P-219, P-221, P-301, P-302, P-303, P-304, and P-305. Groundwater levels will be measured to the nearest 0.01-foot. The groundwater elevation data can be used to graphically present groundwater contours and directions of flow at the Facility.

2.3 GROUNDWATER SAMPLING

Groundwater monitoring wells will be sampled using low-flow sampling techniques in general accordance with the United States Environmental Protection Agency (USEPA) Region 1 July 30, 1996, Low Stress (Low Flow) SOP GW-0001; Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells using a submersible pump. Dedicated tubing will be used in each well and non-dedicated sampling equipment will be cleaned prior to sampling as described in Section 2.5.

Groundwater will be purged from the wells at a flow rate of about 0.2 to 0.5 liters per minute prior to sampling. During purging, pH, temperature, specific conductivity, dissolved oxygen (DO), turbidity and oxidation-reduction potential (ORP) of the groundwater will be measured using a flow-through cell and recorded on the groundwater sampling record. The low flow pumping rate will be measured during pumping, which will continue until the field parameters are consistent in general accordance with the USEPA guidance document. Groundwater purged from the wells will be allowed to flow onto the ground surface near the well. We note that the field screening parameters in include pH, DO, and ORP which will be used in our continuing MNA evaluation.

2.4 HUMANE SPRING SURFACE WATER SAMPLING

Humane Spring is located approximately 3,300 feet downgradient of the Facility. Surface water samples will be collected semi-annually from Humane Spring by the direct immersion of the sample containers. The sample location is within the stream directly beneath the southern edge of the building that overlies Humane Spring. At the time of sampling, the spring flow rate will be estimated using the staff gauge at the culverts near the railroad tracks. During each sampling event at Humane Spring, the condition of the posted warning signs will be observed, and signs will be maintained or replaced as necessary.

2.5 EQUIPMENT DECONTAMINATION

Dedicated sampling equipment will be used wherever possible. Sampling equipment that is not dedicated to a sampling location will be cleaned between uses. Decontamination will be accomplished by a rinse in a solution of phosphate-free detergent, followed by at least two potable water rinses. Equipment will be dried using disposable paper towels or be allowed to air-dry.

2.6 SAMPLE HANDLING

Protective disposable gloves will be utilized during groundwater and surface water sampling. A new pair of gloves will be worn at each sample location. The laboratory providing the analyses will supply the required number and type of sample containers for each sampling event that meet the appropriate performance standards for CVOCs. The samples will be placed in a cooler on ice and forwarded under chain-of-custody documentation to the analytical testing laboratory. Each sample collected for analyses will be placed in two 40-milliliter glass vials with teflon-lined septa. Sample containers will be appropriately labeled to include Facility name, sample location, date, analyses and preservatives used in the sample container.

2.7 FIELD QUALITY CONTROL

Trip blanks, field blanks and field duplicates will be used to monitor the variability of field sampling techniques and the potential for introduced contamination during sample collection and transportation. An accredited analytical laboratory will be used to perform the analyses and their Quality Assurance and Quality Control Plan will be kept on file.

2.7.1 Trip Blank

Trip blanks for CVOC analyses will be prepared by the laboratory and will accompany the sample bottles to the field and back to the laboratory. One trip blank will be included with each cooler.

2.7.2 Field Blanks

A field blank will be prepared during each sampling event by filling the appropriate sample containers with ASTM Type I organic free water (or equivalent) used for cleaning and decontamination of non-dedicated equipment used for purging and sampling. Field blanks may be analyzed for CVOCs.

One field equipment (rinsate) blank will be collected for each sampling event if decontamination of sampling equipment is required. Field equipment blanks will be collected in the field immediately following cleaning and decontamination procedures on any non-dedicated equipment used for purging or sampling by passing the ASTM Type I organic free water (or equivalent) through the non-dedicated equipment in the same procedure as a groundwater sample. Equipment blanks will be taken and analyzed when non-dedicated sampling equipment is used or when new equipment is being dedicated to a well. The equipment blank sample will be used to monitor the effectiveness of the decontamination procedure and evaluate the potential for cross-contamination between samples. Field equipment blanks may be analyzed for CVOCs.

2.7.3 Field Blank Duplicates

Field blank duplicates are utilized to monitor variability in sampling techniques, and/or the degree of heterogeneity in the groundwater. One field blind duplicate will be prepared as a split sample during each sampling event with each analyzed for CVOCs. The duplicate sample will be selected randomly prior to initiating sampling.

2.8 ANALYTICAL TESTING PARAMETERS AND METHODS

Constituents will be analyzed in accordance with SW-846 "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods." Groundwater and Humane Spring water samples will be analyzed for the CVOCs listed below in accordance with USEPA Method 8021 or 8260. The parameter listing is based on the contamination source chemicals (tetrachloroethylene and trichloroethene), their degradation daughter products, and the results of analyses performed during the initial 23 years of the RCRA Post-Closure Permit.

- Tetrachloroethene;
- Trichloroethene;

- Cis-1,2-dichloroethene;
- Trans-1,2-dichloroethene; and
- Vinyl chloride.

2.9 SAMPLING AND ANALYTICAL TESTING FREQUENCY

Groundwater and Humane Spring sampling and analytical testing will be performed semi-annually (spring and fall) during the MNA corrective action until the CVOCs concentrations in the individual eight point of compliance wells are less than the GPS for eight consecutive sampling events. Each point of compliance well will be evaluated individually and sampling of any particular well will end after it meets the compliance standard for eight sampling events.

2.10 REPORTING

The results of the sampling will be documented in an Annual Corrective Action Monitoring Plan Report by June 30th. The Report will be used to document activities performed during the reporting period and will present the groundwater monitoring, testing and field and analytical laboratory data. The report will also include the results from the MNA field parameters (pH, DO, and ORP).

ATTACHMENT IV
JULY 2018 MONITORED NATURAL ATTENUATION
EVALUATION REPORT

RCRA POST-CLOSURE PERMIT RENEWAL APPLICATION
FORMER HALLMACK FACILITY
HARRODSBURG, KENTUCKY
PERMIT NO. KYD-081-017-667

ATTACHMENT IV

MONITORED NATURAL ATTENUATION

EVALUATION REPORT

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1.00 INTRODUCTION

The former Hallmack property is located at 1010 and 1020 North College Street in Harrodsburg, Kentucky (the "Site"). A Site Locus plan is provided as Figure 1. In July of 2016 the Site groundwater remediation system (GRS) was shut down to allow the performance of a monitored natural attenuation (MNA) evaluation. Natural attenuation allows a variety of physical, chemical, or biological processes to occur in-situ without human intervention to reduce the concentration of contaminants in groundwater. These in-situ processes include biodegradation, dispersion, dilution, sorption, and volatilization. MNA is a remedial strategy that allows natural biological, chemical, and physical processes to treat the groundwater contaminants and to conduct on-going monitoring to verify that these processes are effective at reducing concentrations.

2.00 BACKGROUND

Manufacturing operations commenced on the Site in 1968 and continued until 1986 when the plant was shut down. During the operational life at the facility, both trichloroethene (TCE) and tetrachloroethene (PCE) were used. There have been no commercial or industrial activities on the Site since 1986.

The GRS was developed following extensive investigations and evaluation of remedial technologies. The 1995 Engineering Feasibility Study (EFS) included a feasibility analysis of 21 potentially applicable technologies to address the residual groundwater contamination and included the details of the existing GRS which was the selected remedial technology. The GRS began operation in April 1995 with nine groundwater extraction wells operating between 1995 and 2008.

In 2008, two groundwater extraction wells were added following the review of the previous EFS and consideration of additional remedial technologies in 2005/2006. Approximately 25 remedial technologies were discounted as technically not feasible, or in the case of MNA, not acceptable to the Kentucky Department for Environmental Protection (KDEP) and United States Environmental Protection Agency (USEPA) at that time.

The GRS was operated until July 2016. During the 21 years of GRS operation, 49 million gallons of groundwater was pumped and treated and approximately 99 gallons of chlorinated volatile organic compounds (predominantly TCE) was removed from the groundwater.

The MNA evaluation began in July 2016 following discussions with KDEP and encouragement that MNA could now be considered an acceptable remedial technology for TCE-contaminated groundwater in karst geology in Kentucky. KDEP approved the temporary GRS shutdown for the purpose of collecting data in support of evaluating an MNA remedy on July 13, 2016. Based on the favorable data obtained from the preliminary MNA evaluation, KDEP approved extensions to the GRS shutdown and continued MNA evaluation on January 19, 2017 and January 2, 2018.

The Site is underlain by shallow limestone bedrock comprised of different geologic members as depicted on Figure 2. The upper portion of the bedrock, within a few feet of ground surface, has some shale layers that have weathered to clay. These clay zones have allowed some shallow perched water zones in portions of the Site. The unsaturated bedrock from the ground surface to the aquifer contains fractures

and paleo-karst features. The groundwater table beneath the former manufacturing area is about 50 feet below grade in the Tanglewood Member. The saturated bedrock is less than 10 feet thick and is characterized by solution-enlarged karst features. The Grier Member limestone is below the Tanglewood Member and is characterized as an aquitard without karst features, vertical fractures, or voids and has a very low hydraulic conductivity.

As described in the September 2005 Conceptual Hydrologic Model, it was suspected that TCE may remain as dense non-aqueous phase liquid (DNAPL) in the bedrock matrix. However, after 30 years there has never been direct visual evidence of DNAPL at the Site.

In general, groundwater enters the Site from the northwest, north, northeast, and southeast and flows off-site to the south and southwest. A groundwater contour plan is provided as Figure 3. Groundwater flow onto the Site from the northwest includes flow from the abutting and adjacent property to the west which has a documented TCE release and groundwater contamination that testing has shown is migrating onto the Site. Note that the adjacent property is referenced in various reports for the former Hallmack Site as the Signet or Modine property (see Figure 1) but may be under different ownership at this time.

Humane Spring is located about 3,300 feet southwest and hydraulically downgradient of the Site (see location on Figure 1) and is the regional receptor of groundwater from the Site, the Modine property and the surrounding area. Humane Spring discharges from a karst feature exposed at the ground surface. A 1993 dye tracing investigation at the Site demonstrated that groundwater can flow from the Site, through karst conduits, and discharge from the spring within 26 hours. A 1999/2000 dye tracing investigation at the adjacent Modine property observed a similar hydraulic connection between that property and Humane Spring.

The Humane Spring watershed is about 1 square mile. Continuous stormwater flow as surface water within the drainage basin to Humane Spring is rare because the local drainages disappear into solution enlarged openings in the bedrock then reappears as surface water at the spring. The flow rate at Humane Spring varies from less than 100 gallons per minute (gpm) to greater than 60,000 gpm. The average flow rate from the spring is in the range of 200 to 800 gpm.

There are no downgradient potable water supply wells located between the Site and Humane Spring and none are believed to be present within the drainage basin due to the thin aquifer with little or no storage potential. There is TCE in the spring water; so to address public safety concerns, signs are posted near the spring stating “warning, pollutants in spring water, avoid contact, do not drink, for details contact 502-564-6716”.

TCE levels at Humane Spring have been lower than the Kentucky Surface Water Quality Criteria for Protection of Human Health from the Consumption of Fish Tissue of 30 parts per billion (ppb) 157 of 161 samples collected since 1991 and in each of the recent 74 samples since April 2004. As mentioned previously, the TCE levels in Humane Spring are attributable to more than one source, including the Modine property.

3.00 MNA TESTING AND RESULTS

The MNA testing program included: (1) monthly surface water samples from Humane Spring and analyses for chlorinated volatile organic compounds (CVOCs); (2) monthly flow rate data at Humane Spring; (3) semi-annual groundwater samples from the recovery wells (RW-1 to RW-9, RW-11, and RW-12) the eight compliance monitoring wells (P-103, P-104, P-219, P-301, P-302, P-303, P-304, and P-305) and the two background monitoring wells (W-10 and P-106) and analyses for CVOCs; and (4) MNA indicator parameter testing of the groundwater samples collected in March 2018. The locations of the wells are shown on Figure 3.

3.10 HUMANE SPRING

Surface water samples were collected from Humane Spring on a monthly basis from July 2016 to April 2018 and were analyzed for CVOCs. The samples were collected by immersing a 40-ml glass vial into the surface water located beneath the former pump house where the spring water exits the ground. The monthly supplemental Humane Spring analytical test results are included in Table 1. The analytical data sheets and chain of custody forms were provided in the semi-annual status reports.

The discharge rate of Humane Spring was estimated using a calibrated staff gauge, which is located near the railroad tracks about 125 feet downstream from the spring. The discharge rate for Humane Spring between July 2016 and April 2018 ranged from 20 to 6,500 gallons per minute (gpm) and is summarized in Table 1.

The predominant CVOC historically detected at Humane Spring was TCE. During the MNA evaluation period (i.e., July 2016 to April 2018) TCE was detected at concentrations of 3.2 to 11.9 parts per billion (ppb). The TCE concentrations at Humane Spring vary with time and also vary with flow rate at the spring. As an example, the highest TCE concentration was observed during the lowest spring flow rate of 20 gpm and the lowest concentration was observed during the highest spring flow rate of 6,500 gpm. The cis-1,2 dichloroethene (DCE) concentration at Humane Spring during this monitoring period ranged from 0.7 to 4.5 ppb and the PCE concentrations ranged from 0.2 to 0.6 ppb.

To compare TCE concentrations prior to the GRS shut down versus post shut down, a plot of TCE concentration at Humane Spring versus time, from 1991 to 2018, is provided in Appendix A. As illustrated on the plot, the TCE concentration ranged from 1 to 36 ppb. As described above, the TCE concentrations are generally lowest when the flow rate at Humane Spring are high and highest when the flow rate is low. The TCE concentrations varied without a consistent trend prior to 2005. However, since 2005 the TCE concentrations exhibit a general decreasing trend.

Since the shutdown of the GRS in July 2016, there has been no rebound in TCE concentrations at Humane Spring. In fact, 11 of the 22 monthly samples were collected when the flow rate at Humane Spring was low (where we historically detected higher concentrations) and the TCE concentrations were significantly lower than the low flow concentrations observed in the spring prior to GRS shut down.

3.20 POST SHUT DOWN SEMI-ANNAUL GROUNDWATER SAMPLING AND ANALYSIS

During the MNA evaluation period (July 2016 to April 2018), groundwater samples were collected from the recovery wells after three volumes of water was purged from the wells using the groundwater pump and treat system. Groundwater samples were collected from the eight Compliance Monitoring Wells and the two background wells using low flow sampling techniques. The groundwater samples were analyzed for TCE; PCE; cis-1,2-DCE; trans-1,2-DCE; and vinyl chloride. Groundwater samples from wells RW-1 to RW-4, W-10, and P-106 were also analyzed for zinc consistent with the current Compliance Monitoring/Corrective Action Plan. A summary of the historical and recent organic and inorganic test results for recovery wells and background wells during the semi-annual monitoring events are presented in Table 2. A summary of the historical and recent Compliance Monitoring Well analytical test results is presented in Table 3.

During the March 2018 groundwater sampling event water samples were analyzed for MNA indicator parameters: methane, ethane, ethene, nitrate, sulfate, dissolved iron, and dissolved manganese. The test results are summarized in Table 4.

During the low flow sampling of the compliance monitoring wells and background wells (between March 2016 and March 2018) field screening parameters included ORP, pH, specific conductance, dissolved oxygen (DO), temperature, and turbidity were measured. The data is summarized in Table 5, with field screening results observed during the March 2018 sampling of the recovery wells and Humane Spring.

Samples collected from the groundwater recovery wells had at least one CVOC detected at a concentration greater than the Groundwater Protection Standard (GPS) during the most recent (March 2018) sampling event. The total groundwater CVOC concentrations in the samples collected from the recovery wells ranged from 18 to 23,274 ppb. The recovery well with the highest groundwater CVOC concentration (23,274 ppb) was RW-12, which is located immediately south of the former building. Recovery wells RW-3, RW-9, and RW-11 had total CVOC concentrations in the range of 2,143 to 3,010 ppb. These recovery wells are located immediately north and south of the former building and within the area of the former building. The remaining seven groundwater recovery wells had CVOC concentrations of less than 224 ppb.

TCE was the predominant CVOC detected in the recovery wells with concentrations ranging from 18 to 13,500 ppb during the March 2018 sampling event. The cis-1,2 DCE concentrations in these wells ranged from 9 to 9,470 ppb. Vinyl chloride concentrations ranged from less than 1 to 189 ppb; and PCE concentrations ranged from less than 1 to 60 ppb.

TCE was detected in 4 of the 8 downgradient compliance wells at concentrations ranging from 0.5 to 6 ppb. Cis-1,2 DCE was detected in one of the downgradient compliance monitoring wells (P-301) at a concentration of 0.5 ppb. No other CVOCs were detected in the downgradient compliance wells during the March 2018 sampling event. The compliance well data was consistent with historical data.

Since the shutdown of the GRS in July 2016, two of the eight compliance monitoring wells occasionally had TCE concentrations that exceeded the GPS of 5 ppb. Specifically, P-301 had a TCE concentration as high as 7.8 ppb; and P-302 had a TCE concentration as high as 10.4 ppb.

GZA performed a statistical analysis (using CARStat) for each detected parameter (during the March 2018 sampling event) in the recovery wells, the compliance wells, and Humane Spring. Specifically, the Sen's test for trends with a 95% confidence limit was used. The analysis, provided in Appendix B, indicated a decreasing concentration trend for TCE in the samples collected at monitoring wells P-301, P-302, extraction wells RW-1 and RW-9, and Humane Spring. A decreasing concentration trend of cis-1,2-DCE at Humane Spring and extraction wells RW-2 and RW-9 was also noted in the trend analysis.

Since the shutdown of the GRS in July 2016, there was no evidence of rebound or increasing trends in the groundwater samples collected from the downgradient compliance monitoring wells, nor at Humane Spring. Some of the extraction wells exhibited evidence of a decreasing TCE trend (RW-3, RW-4, RW-5, RW-6, and RW-11) and decreasing PCE trend (RW-5) since the shutdown of the system. Some of the extraction wells exhibited evidence of an increasing cis-1,2 DCE trend (RW-3, RW-5, RW-7, RW-8, RW-11, and RW-12) and an increasing vinyl chloride trend (RW-3, RW-4, and RW-11) since the shutdown of the system. As described below, we believe this data indicates biological degradation is converting the TCE and PCE parent compounds into the breakdown products of cis-1,2 DCE and vinyl chloride. Refer to the data plots in Appendix B for recent trends.

4.00 BIODEGRADATION EVALUATION

Under anaerobic conditions chlorinated VOCs can degrade from PCE to TCE to cis-1,2-DCE to vinyl chloride to ethane and ethene to carbon dioxide and water. This process is known as reductive dechlorination. Vinyl chloride and cis-1,2-DCE can also biodegrade aerobically, when dissolved oxygen is elevated.

The primary line of evidence for chlorinated ethene biodegradation via reductive dechlorination is declining PCE and TCE levels in conjunction with production of biodegradation intermediates cis-1,2-DCE and vinyl chloride. PCE levels at the Site have always been relatively low. TCE is the predominant contaminant at the Site. The downgradient compliance wells and Humane Spring have long term statistically significant decreasing trends for TCE. The recent GRS shutdown did not alter these trends. Extraction wells RW-1 and RW-9 have long term statistically significant decreasing trends for TCE. In addition, since the GRS shutdown, TCE exhibited visual evidence of a decreasing trend at extraction wells RW-3, RW-4, RW-5, RW-6, RW-11, and recently (March 2018) at RW-12.

We note that since the GRS shutdown in July 2016 the highest TCE concentrations at the Site were observed at extraction wells RW-12 (39,200 ppb in September 2017), RW-11 (8,890 ppb in September 2016), RW-9 (1,550 ppb in March 2018), and RW-3 (4,430 ppb in March 2017). As described above these wells exhibited evidence of decreasing TCE trends.

Table 6 provides a summary of the percent of cis 1,2 DCE to TCE in the recovery wells for: the June 1995 baseline sampling event; the pre-July 2016 shutdown (September 2015 and March 2016); and post July 2016 shutdown (September 2016, March 2017, September 2017, and March 2018).

The ratio of biodegradation intermediate cis-1,2-DCE to TCE during the baseline groundwater sampling event (June 1995) was in the range of 50% to 300% at extraction wells RW-1 to RW-4. Prior to the shutdown of the GRS (September 2015 and March 2016 data) this ratio was in the range of 15% to 71%

at RW-1 to RW-4. The ratio for the other extraction wells, prior to GRS shutdown, was typically in the range of 3% to 10%. Since the GRS shutdown, this ratio increased approximately 50 to 1,200% in the extraction wells. In addition, in the most contaminated extraction well (RW-12) there is a distinct increasing cis-1,2-DCE concentration since the GRS shutdown. The increasing concentrations of TCE degradation intermediate cis-1,2-DCE as groundwater returns to natural conditions (which are more conducive to reductive dichlorination) supports MNA as a remedial strategy.

Since the GRS shutdown vinyl chloride levels have increased, or have become detected, in extraction wells RW-3, RW-4, RW-6, RW-7, RW-8, RW-9, RW-11 and RW-12. However, vinyl chloride levels have not increased in the downgradient compliance monitoring wells nor at Humane Spring. Vinyl chloride can attenuate by multiple mechanisms in the environment, including anaerobic and aerobic biodegradation and volatilization. We believe there is likely some generation of vinyl chloride (from DCE reductive dechlorination), but the vinyl chloride is attenuating downgradient of the source area.

Additional lines of evidence for biodegradation via reductive dechlorination include water geochemistry parameters that are supportive of the reductive pathway. Dissolved oxygen, nitrate, sulfate, and oxidized (typically undissolved) forms of iron and manganese are electron acceptors that are used by various environmental bacteria similar to how dechlorinating bacteria utilize PCE, TCE, cis-1,2-DCE, and vinyl chloride. Groundwater conditions that are conducive to reductive dechlorination are typically lower in dissolved oxygen, nitrate, and sulfate, and higher in dissolved iron and manganese. Dechlorinating microorganisms prefer relatively neutral pH levels, optimally between 6 and 8 standard units. Optimum dissolved oxygen levels would be less than 0.5 mg/L, with tolerated levels of less than 1 mg/L. Degradation can still occur at higher dissolved oxygen levels, because monitoring well oxygen may be higher than groundwater oxygen. Optimal oxidation reduction potential (ORP) levels would be less than 50 mV, and optimal nitrate groundwater concentrations would be less than 1 mg/L. Desirable sulfate levels would be less than 20 mg/L; however, reductive dechlorination can be observed in the field at much higher sulfate levels. Elevated concentrations of dissolved iron, manganese, and methane are also indicators of reducing conditions in groundwater. The generation of ethane or ethene is a further indication that reductive dechlorination is occurring.

During the March 2018 sampling event, the dissolved oxygen levels were less than 1 mg/L at monitoring wells W-10, P-106, and P-303; and, were in the range of 1.3 to 2.7 mg/L in the other monitoring wells. The dissolved oxygen levels were in the range of 1.3 to 6.5 mg/L in the recovery wells during this sampling event. We note that the groundwater samples were collected shortly after a large rain event, and that the rain event may have increased the dissolved oxygen levels. Specifically, we could hear cascading water sounds at some of the monitoring well locations during the water level gauging event. We also note that the monitoring wells were sampled via low flow sampling techniques, but the recovery wells were sampled using a bailer. We believe use of a bailer may increase dissolved oxygen levels. As summarized in Table 5, the low flow sampling of the monitoring wells during the previous two years exhibited dissolved oxygen levels that typically were less than 1 mg/L, and sometimes less than 0.5 mg/L.

During the March 2018 sampling event, the ORP levels were less than 50 at monitoring wells P-104, P-106, and recovery wells RW-5 and RW-11. However, as summarized in Table 5, during the previous two years, the ORP levels were typically less than 50 in all the monitoring wells, and sometimes less than -100.

As shown in Table 5, the pH levels in both the monitoring wells and recovery wells were typically in the range of 7 to 8, which is within the optimal range for reductive dechlorination.

The nitrate levels were well below 1 mg/L in most of the monitoring and recovery wells (see Table 4 for data). Only 3 of the 21 wells sampled had nitrate levels in the range of 1.3 to 2.2 mg/L. Humane Spring had a nitrate level of 3.2 mg/L, but the watershed of Humane Spring is significantly larger than the VOC plume.

The sulfate levels were typically in the range of 20 to 200 mg/L, which is above the optimal level of less than 20 mg/L. However, as described above, reductive dechlorination can be observed at many sites with elevated sulfate levels.

Some low but detected levels of methane were observed in the sampled well locations. More elevated levels of methane were observed at RW-1, RW-5, RW-12, P-103, and P-106. Detectable levels of ethane were observed at RW-3, RW-5, RW-11, RW-12, P-104, and P-106. Also, detectable levels of ethene were observed at RW-3 and RW-12. See Table 4 for a summary of the data. These data support our finding that reductive dechlorination is occurring at the site.

Dissolved iron was observed above 1 mg/L at RW-5, and dissolved manganese was observed at RW-2, RW-3, RW-4, RW-5, and RW-12 either above or very close to 1 mg/L (see Table 4 for data). The elevated levels of dissolved iron and manganese represent depleted levels of oxidized iron and manganese, conditions which are supportive of reductive dechlorination, suggesting that anaerobic degradation of PCE, TCE, cis-1,2-DCE, and vinyl chloride are likely.

In summary, the decreasing TCE concentrations, the generation of biodegradation intermediates cis 1,2 DCE and vinyl chloride, and the favorable groundwater geochemistry at the Site indicates that reductive dechlorination is occurring.

5.00 CONCLUSIONS

The investigations and remedial actions performed from the late 1980s through 2005 removed the sources of the contamination from the Site. Each of the 45 Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) considered potential primary contaminant source areas were identified, their mass reduced to the extent technically feasible, and administratively closed. In addition, approximately 25 remedial technologies were evaluated and discounted as technically not feasible.

Unrelated, off-Site sources of TCE groundwater contamination (i.e., beyond the control of the Permittee) contribute to the surface water contamination at Humane Spring and to groundwater contamination beneath the northwestern portion of the Site and between the Site and Humane Spring. The known off-Site CVOC sources at the adjacent Modine property was partially abated and the residual TCE contamination in soil, bedrock and groundwater are being evaluated.

Greater than 20 years of groundwater remediation had only minimal impact on groundwater quality. Remaining residual CVOC contamination in the subsurface beneath the Site and Modine in this geology cannot be feasibly and reliably located, targeted with active remedial technologies and removed. While

some CVOC removal was achieved with the GRS the increment of removal may not have been greater than that achieved through natural attenuation over that same period of time and did not necessarily result in significant risk reduction.

The inability to achieve groundwater restoration with the GRS which was designed after substantial investigation and studies, was due to the hydrogeological and contaminant factors and is not due to inadequate operation or design of the GRS.

The residual CVOC concentrations in the downgradient compliance wells and Humane Spring are decreasing and the GRS shutdown did not change that trend. There was some evidence that natural attenuation was occurring at the Site, we are taking this opportunity to demonstrate and recognize its contribution. It is GZA's opinion that the existing groundwater remediation system should remain off and replaced with MNA as supported by the following:

1. The site contaminants (PCE, TCE, cis-1,2-DCE, and vinyl chloride) are not causing a risk to human health.
2. The groundwater plume is stable and decreasing.
3. The groundwater remediation system operated for over 21 years, treated approximately 49 million gallons of groundwater, but only removed about 99 gallons of chlorinated VOCs from the groundwater, a rate that may be less than that removed by natural attenuation.
4. The groundwater discharge rate to Humane Spring via the karst conduits is flashy and can vary from 20 gallons per minute (gpm) to over 10,000 gpm, making full hydraulic containment impractical.
5. Since the shutdown of the groundwater remediation system over 20 months ago:
    - there has been no rebound in CVOC concentrations in the groundwater;
    - the predominant contaminant (TCE) concentrations decreased in 6 of the 11 groundwater recovery wells; and,
    - there is evidence that the chlorinated VOCs are anaerobically biodegrading via reductive dechlorination.
6. The naturally occurring groundwater geochemistry conditions are generally amenable to support further biological degradation of the groundwater plume.
7. The TCE concentrations in the downgradient compliance wells (over the past four years) have been relatively low (less than 16 ppb).
8. Since the shutdown of the GRS the TCE concentrations at Humane Spring remained low, varying from 3 to 12 ppb; and, the cis 1,2 DCE concentrations varied from 1 to 4 ppb.
9. The downgradient compliance wells (P-301 and P-302) have statistically significant decreasing trends for TCE; and, Humane Spring has statistically significant decreasing trends for both TCE and cis-1,2-DCE. The recent shutdown of the GRS did not alter these trends.
10. A combination of physical (dispersion, dilution, sorption and volatilization) and biological processes will further reduce groundwater contaminant concentrations over time.

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TABLES

TABLE 1
SUPPLEMENTAL CVOC DATA AND FLOW RATE FROM HUMANE SPRING
(Since July 2016)
Former Hallmack Facility
Harrodsburg, Kentucky

			Volatile Organic Compounds (ug/L)				
Location	**Date**	**Flow Rate[1] (gpm)**	**(TCE)**	**cis-1,2 DCE**	**trans 1,2 DCE**	**Vinyl Chloride**	**PCE**
Humane Spring	7/19/2016	180	7.3	3.3	<1	<1	0.43
	8/18/2016	1,200	3.3	2.4	<1	<1	<1
	9/19/2016	560	4.6	1.6	<1	<1	<1
	10/19/2016	30	7.9	2.9	<1	<1	0.31
	11/16/2016	20	11.9	3.8	<1	<1	0.42
	12/13/2016	250	10.2	2.3	<1	<1	0.34
	1/24/2017	4,500	3.5	0.7	<1	<1	<1
	2/23/2017	60	10	4.5	<1	<1	0.23
	3/26/2017	700	6.6	2.1	<1	<1	0.4
	4/25/2017	70	8.3	2.6	<1	<1	0.5
	5/27/2017	1,700	4.3	1.7	<1	<1	0.3
	6/30/2017	50	9.5	3.6	<1	<1	0.4
	7/20/2017	30	6.1	2.8	<1	<1	0.3
	8/30/2017	100	5.1	2.2	<1	<1	<1
	9/17/2017	150	8.0	3.0	<1	<1	0.3
	10/19/2017	150	9.2	3	<1	<1	0.56
	11/29/2017	70	9.9	2.5	<1	<1	0.48
	12/7/2017	130	7.7	2.2	<1	<1	0.37
	1/22/2018	700	7.5	1.7	<1	<1	0.59
	2/27/2018	1,100	5.3	1.8	<1	<1	<1
	3/26/2018	6,500	3.2	1.2	<1	<1	<1
	4/26/2018	1,200	6.0	1.6	<1	<1	0.39

Notes: (1) Flow rate at humane spring in gallons per minute (gpm)

TABLE 2
RECOVERY WELL, BACKGROUND WELL AND HUMANE SPRING CVOC AND ZINE CONCENTRATIONS (ug/l)
SINCE GROUNDWATER REMEDIATION SYSTEM START-UP IN APRIL 1995

Former Hallmack Facililty
Harrodsburg, Kentucky

RW-1	GPS	6/95	10/95	3/96	10/96	4/97	10/97	3/98	9/98	3/99	9/99	3/00	9/00	3/01	9/01	3/02	9/02	3/03	9/03	3/04	9/04	3/05	9/05	3/06	10/06	3/07	9/07	3/08	9/08
Trichloroethene (TCE)	5	124	<5	42	151	162	89	78	72	63	52	60	75	4.1	40	33	41	38	37	34	34	65	25	28	36	30	28	34	27
Tetrachloroethene (PCE)	5	<5	<5	<1	<5	5	<1	3.2	2.3	2.5	1.3	3.7	2.8	<1	1.2	<1	1	2.5	1	1.3	2.1	3.7	1	1	4	1.5	<1	1.8	1
cis-1,2-Dichloroethene	70	75	<5	29	61	60	21	25	21	22	13	11	15	1.2	15	13	15	14	14	13	13	12	11	13	12	11	13	14	9.2
trans-1,2-Dichloroethene	100	<5	<5	<1	<5	<5	183	<1	1.2	<1	1.8	<1	<2.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	0.5
Vinyl Chloride	2	<5	<5	<2	<10	<10	<1	<1	<1	<1	<1	<1	<2.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total CVOCs		199	0	71	212	227	415	106	96.5	87.5	68.1	74.7	92.8	5.3	56.2	46	57	55	52	48	49	81	37	44	52	43	41	50	37.7
Total Zinc		60	210	190	160	100	<100	214	97	31	116	119	193	260	218	261	267	65	103	51	96	911	98	210	66	110	<40	<20	140
RW-2	**GPS**	**6/95**	**10/95**	**3/96**	**10/96**	**4/97**	**10/97**	**3/98**	**9/98**	**3/99**	**9/99**	**3/00**	**9/00**	**3/01**	**9/01**	**3/02**	**9/02**	**3/03**	**9/03**	**3/04**	**9/04**	**3/05**	**9/05**	**3/06**	**10/06**	**3/07**	**9/07**	**3/08**	**9/08**
Trichloroethene (TCE)	5	46	75	623	164	170	45	230	100	67	48	450	460	110	40	110	69	42	130	58	250	200	920	500	790	780	878	591	267
Tetrachloroethene (PCE)	5	<5	<5	15	9	14	<1	7.4	9.3	3.4	1.5	12	12	2.6	2.6	5.4	3.1	2.1	7.4	3.9	16	14	160	97	78	58	66	45	18.5
cis-1,2-Dichloroethene	70	109	63	272	204	208	81	180	170	91	69	130	250	110	100	150	190	65	95	31	190	100	74	330	580	580	638	398	111
trans-1,2-Dichloroethene	100	<5	<5	3.7	<5	<5	191	<5	2.3	<2	<1	5.7	10	1.9	1.3	<2	<2	<1	<1	1.6	4	<2.5	<10	<5	8	<10	13	4	<5
Vinyl Chloride	2	<5	<5	<2	<10	<10	338	<5	<2	<2	<1	<1	<5	<1	<1	<2	<2	<1	<1	<1	<2	<2.5	<10	<5	<5	<10	<10	5	<2
Total CVOCs		155	138	926	377	392	742	417.4	281.6	161.4	118.5	600.8	732	224.5	143.9	265.4	262	109	232	95	460	314	1,166	927	1,456	1,418	1,595	1,043	397
Total Zinc		90	340	170	<20	100	<100	110	111	38	51	112	111	116	161	364	715	144	231	638	403	762	76	180	360	210	711	206	200
RW-3	**GPS**	**6/95**	**10/95**	**3/96**	**10/96**	**4/97**	**10/97**	**3/98**	**9/98**	**3/99**	**9/99**	**3/00**	**9/00**	**3/01**	**9/01**	**3/02**	**9/02**	**3/03**	**9/03**	**3/04**	**9/04**	**3/05**	**9/05**	**3/06**	**10/06**	**3/07**	**9/07**	**3/08**	**9/08**
Trichloroethene (TCE)	5	2,261	1,044	303	2,070	775	1,930	990	1,000	140	3,900	2,800	1,500	1,500	1,300	720	580	350	700	2,400	3,100	5,700	4,800	4,700	5,800	7,900	8,120	1,550	4,350
Tetrachloroethene (PCE)	5	42	13	2.7	22	21	<1	39	15	<4	20	<50	<20	<20	28	<5	8.3	5.5	6.2	23	100	<50	<50	<50	<50	<100	<100	5	6.8
cis-1,2-Dichloroethene	70	1,075	382	217	920	629	489	670	350	34	1,300	430	340	810	950	280	400	180	220	790	1,100	2,000	1,900	1,500	2,200	2,700	2,840	310	1,710
trans-1,2-Dichloroethene	100	<5	<5	1	<5	<5	542	<20	<10	<4	5.4	<50	<20	<20	<10	<5	<5	<2.5	<5	10	<20	<50	<25	<50	<50	<100	<100	<20	11
Vinyl Chloride	2	<5	<5	<2	<10	<10	108	<20	<10	<4	<2	<50	<20	<20	<10	<5	<5	<2.5	<5	16	<20	<50	<25	<50	<50	<100	<100	<20	<20
Total CVOCs		3,397	1,439	536	3,024	1,425	4,553	1,699	1,365	174	5,264	3,230	1,840	2,310	2,278	1,000	988	536	926	3,250	4,300	7,700	6,758	6,200	8,052	10,600	10,960	1,865	6,078
Total Zinc		3,560	240	1,300	800	1,200	400	386	616	581	345	339	673	596	400	398	173	309	223	266	288	232	238	170	340	300	187	139	209
RW-4	**GPS**	**6/95**	**10/95**	**3/96**	**10/96**	**4/97**	**10/97**	**3/98**	**9/98**	**3/99**	**9/99**	**3/00**	**9/00**	**3/01**	**9/01**	**3/02**	**9/02**	**3/03**	**9/03**	**3/04**	**9/04**	**3/05**	**9/05**	**3/06**	**10/06**	**3/07**	**9/07**	**3/08**	**9/08**
Trichloroethene (TCE)	5	309	225	41	718	593	230	300	<5	270	270	250	210	260	340	160	190	380	110	130	170	210	150	83	130	96	76	256	213
Tetrachloroethene (PCE)	5	8	<5	9	6	7	<1	<20	<5	9.2	3.9	9.4	7.5	7.5	9.4	<2	3.1	8.8	4.2	4.2	14	8.3	11	6	10	10	5	42	25
cis-1,2-Dichloroethene	70	919	186	64	211	211	308	510	<5	190	150	200	250	310	290	230	90	620	72	120	9.3	6.8	62	53	71	35	13	598	797
trans-1,2-Dichloroethene	100	<5	<5	1	<5	<5	405	<20	<5	<5	<2	2.4	5	<5	3.9	<2	<2	<5	<1	3.1	2.3	<2.5	2	2	2	<2.5	1.7	5	7
Vinyl Chloride	2	<5	5	<2	<10	<10	97	<20	<5	<5	<2	<2	5.2	<5	<2.5	<2	<2	<5	<1	1.4	<2	<2.5	<2	<1	<1	<2.5	<1	16	<10
Total CVOCs		1,236	416	115	935	811	1,093	810	<5	469.2	424	461.8	477.7	577.5	643.3	390	283	1,009	186	259	196	225	225	144	213	141	96	917	1,042
Total Zinc		380	20	290	60	400	100	141	211	450	76	327	282	88	156	98	200	107	240	462	224	147	152	42	130	220	234	147	37
RW-5	**GPS**	**6/95**	**10/95**	**3/96**	**10/96**	**4/97**	**10/97**	**3/98**	**9/98**	**3/99**	**9/99**	**3/00**	**9/00**	**3/01**	**9/01**	**3/02**	**9/02**	**3/03**	**9/03**	**3/04**	**9/04**	**3/05**	**9/05**	**3/06**	**10/06**	**3/07**	**9/07**	**3/08**	**9/08**
Trichloroethene (TCE)	5	<5	<5	23	58	76	16	39	50	56	66	75	27	43	34	40	81	50	98	89	62	75	43	50	41	52	82	73	53
Tetrachloroethene (PCE)	5	<5	<5	15	9	17	2	18	8.9	17	6.8	19	7.1	11	3	10	6.9	8.9	12	17	29	18	34	41	22	55	16	38	11
cis-1,2-Dichloroethene	70	<5	<5	12	25	40	10	32	26	23	30	20	12	32	29	26	60	28	9.9	33	8.2	<1	12	4	13	6	8	18	3
trans-1,2-Dichloroethene	100	<5	<5	<1	<5	<5	44	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2.3	1.5	<1	2	<1	1	1	1.8	2.6	2.8	0.8
Vinyl Chloride	2	<5	<5	<2	<10	<10	<1	<1	<1	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total CVOCs		0	0	50	92	133	72	89	84.9	96	103	114	46.1	86	66	76	148	87	122	141	99	139	89	96	77	115	109	132	68
RW-6	**GPS**	**6/95**	**10/95**	**3/96**	**10/96**	**4/97**	**10/97**	**3/98**	**9/98**	**3/99**	**9/99**	**3/00**	**9/00**	**3/01**	**9/01**	**3/02**	**9/02**	**3/03**	**9/03**	**3/04**	**9/04**	**3/05**	**9/05**	**3/06**	**10/06**	**3/07**	**9/07**	**3/08**	**9/08**
Trichloroethene (TCE)	5	6	<5	8.2	<5	<5	<1	7.2	6.8	2.6	3.3	19	4.5	6.4	3.5	<1	2.7	9.1	46	7.8	8.3	4.8	4.4	7.8	7.3	560	97	3.7	2,250
Tetrachloroethene (PCE)	5	<5	<5	<1	<5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<	2.9
cis-1,2-Dichloroethene	70	<5	<5	<1	<5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	19	2.5	<1	126
trans-1,2-Dichloroethene	100	<5	<5	<1	<5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.7
Vinyl Chloride	2	<5	<5	<2	<10	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.4
Total CVOCs		6	0	8	0	0	0	7.2	6.8	2.6	3.3	19	4.5	6.4	3.5	0	2.7	9.1	46	7.8	8.3	4.8	4.4	7.8	7.3	579	100	3.7	2,380

Notes: (1) Total Zinc Results/ Dissolved zinc results
(2) Highlighted values indicate exceedance of GPS.

TABLE 2
RECOVERY WELL, BACKGROUND WELL AND HUMANE SPRING CVOC AND ZINE CONCENTRATIONS (ug/l)
SINCE GROUNDWATER REMEDIATION SYSTEM START-UP IN APRIL 1995

Former Hallmack Facililty
Harrodsburg, Kentucky

RW-7	GPS	6/95	10/95	3/96	10/96	4/97	10/97	3/98	9/98	3/99	9/99	3/00	9/00	3/01	9/01	3/02	9/02	3/03	9/03	3/04	9/04	3/05	9/05	3/06	10/06	3/07	9/07	3/08	9/08
Trichloroethene (TCE)	5	883	176	665	2,360	872	190	120	240	160	240	310	1,300	160	200	680	340	79	590	280	210	240	220	210	99	450	61	161	410
Tetrachloroethene (PCE)	5	<5	<5	<1	<5	<5	<1	<1	<2	<1	<2.5	<2.5	<10	<5	<1	<5	<2	<1	<1	<5	<2	<5	<2	<2	<3	<1	<1	<1	<5
cis-1,2-Dichloroethene	70	<5	<5	54	118	7	<1	7.8	13	<1	<2.5	<2.5	<10	<5	1.8	<5	2.1	<1	<1	<5	<2	<5	4.5	2	<3	3.7	1	2.8	8.6
trans-1,2-Dichloroethene	100	<5	<5	<1	<5	<5	20	<1	<2	<1	<2.5	<2.5	<10	<5	<1	<5	<2	<1	<1	<5	<2	<5	<2	<2	<3	<1	<1	<1	<5
Vinyl Chloride	2	<5	<5	<2	<10	<10	<1	<1	<2	<1	<2.5	<2.5	<10	<5	<1	<5	<2	<1	<1	<5	<2	<5	<2	<2	<3	<1	<1	<1	<5
Total CVOCs		883	176	719	2,478	879	210	127.8	253	160	240	310	1,300	160	202	680	342	79	590	280	210	240	225	222	99	454	62	164	419
RW-8	**GPS**	**6/95**	**10/95**	**3/96**	**10/96**	**4/97**	**10/97**	**3/98**	**9/98**	**3/99**	**9/99**	**3/00**	**9/00**	**3/01**	**9/01**	**3/02**	**9/02**	**3/03**	**9/03**	**3/04**	**9/04**	**3/05**	**9/05**	**3/06**	**10/06**	**3/07**	**9/07**	**3/08**	**9/08**
Trichloroethene (TCE)	5	98	82	18	14	465	532	67	24	11	22	15	16	7.2	15	12	10	14	8.5	8.5	1,700	9.6	22	81	43	67	101	7.6	16
Tetrachloroethene (PCE)	5	<5	<5	<1	<5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<20	<2	<1	<1	<1	<1	<1	<1	0.4
cis-1,2-Dichloroethene	70	<5	<5	2.8	14	31	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	90	<2	<1	3	1.5	2.3	3.4	<1	1.2
trans-1,2-Dichloroethene	100	<5	<5	<1	<5	<5	34	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<20	<2	<1	<1	<1	<1	<2	<1	<1
Vinyl Chloride	2	<5	<5	<2	<10	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<20	<2	<1	<1	<1	<1	<2	<1	<1
Total CVOCs		98	82	21	28	496	566	67	24	11	22	15	16	7.2	15	12	10	14	8.5	8.5	1,790	9.6	22	84	45	69	104	7.6	17.6
RW-9	**GPS**	**6/95**	**10/95**	**3/96**	**10/96**	**4/97**	**10/97**	**3/98**	**9/98**	**3/99**	**9/99**	**3/00**	**9/00**	**3/01**	**9/01**	**3/02**	**9/02**	**3/03**	**9/03**	**3/04**	**9/04**	**3/05**	**9/05**	**3/06**	**10/06**	**3/07**	**9/07**	**3/08**	**9/08**
Trichloroethene (TCE)	5	11,050	16,110	14,600	14,200	14,700	14,800	13,000	12,000	21,000	11,000	14,000	4,200	43,000	460	16,000	42,000	13,000	30,000	36,000	40,000	14,000	70,000	56,000	28,000	64,000	30,400	6,530	23,200
Tetrachloroethene (PCE)	5	<5	<5	<25	<5	<5	<1	<100	<200	<40	<250	<400	<25	<100	<10	9.2	<200	<100	<500	<500	<200	<250	<500	<200	<500	<500	<500	<100	34
cis-1,2-Dichloroethene	70	710	680	703	779	972	472	2,100	640	1,100	490	440	250	1,500	25	730	2,300	730	2,300	1,900	1,300	<250	2,800	2,200	1,400	2,400	1,090	196	1,060
trans-1,2-Dichloroethene	100	<5	<5	<25	<5	5	379	<100	<200	<40	<250	<400	<25	<100	<10	<5	<200	<100	<500	<500	<200	<250	<500	<200	<500	<500	<500	<100	<100
Vinyl Chloride	2	<5	<5	<50	<10	<5	115	<100	<200	<40	<250	<400	<25	<100	<10	<5	<200	<100	<500	<500	<200	<250	<500	<200	<500	<500	<500	<100	<100
Total CVOCs		11,760	16,790	15,303	14,984	15,682	15,959	15,100	12,640	22,100	11,490	14,440	4,450	44,500	485	16,739	44,300	13,730	32,300	37,900	41,300	14,000	72,800	58,200	29,400	66,400	31,490	6,726	24,294
RW-11	**GPS**																												**9/08**
Trichloroethene (TCE)	5																												48,200
Tetrachloroethene (PCE)	5																												361
cis-1,2-Dichloroethene	70																												2,020
trans-1,2-Dichloroethene	100																												<1000
Vinyl Chloride	2																												<1000
Total CVOCs																													50,581
RW-12	**GPS**																												**9/08**
Trichloroethene (TCE)	5																												19,000
Tetrachloroethene (PCE)	5																												28
cis-1,2-Dichloroethene	70																												826
trans-1,2-Dichloroethene	100																												<100
Vinyl Chloride	2																												<100
Total CVOCs																													19,854
Humane Spring	**GPS**	**6/95**	**10/95**	**3/96**	**10/96**	**4/97**	**10/97**	**3/98**	**9/98**	**3/99**	**9/99**	**3/00**	**9/00**	**3/01**	**9/01**	**3/02**	**9/02**	**3/03**	**9/03**	**3/04**	**9/04**	**3/05**	**9/05**	**3/06**	**9/06**	**3/07**	**9/07**	**3/08**	**9/08**
Trichloroethene (TCE)	5	14	10	10.8	28	14	UN	9.3	4.4	16	16	9.1	10	6.4	24	4.1	15	7.5	15	35	12	8.0	18.0	8.1	8.0	16	18	9.1	12.4
Tetrachloroethene (PCE)	5	6	<5	<1	<5	<5	UN	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.6	<1	<1	<1	<1	<1	<1	<1	0.3	0.5
cis-1,2-Dichloroethene	70	20	14	7.3	19	16	UN	9	3.8	9.3	18	3.5	2.4	5.7	16	3.5	7.6	3.6	5.4	6	3.9	3.9	15	2.6	3.2	4.2	8.9	2.8	9.3
trans-1,2-Dichloroethene	100	<5	<5	<1	<5	<5	UN	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Vinyl Chloride	2	<5	<5	<2	<10	<10	UN	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total CVOCs		40	24	18.1	47	30	0	18.3	8.2	25.3	34	12.6	12.4	12.1	40	7.6	22.6	11.1	20.4	41.6	15.9	11.9	33	10.7	11.2	20.2	26.9	12.2	22.2
P-106	**GPS**	**6/95**	**10/95**	**3/96**	**10/96**	**4/97**	**10/97**	**3/98**	**9/98**	**3/99**	**9/99**	**3/00**	**9/00**	**3/01**	**9/01**	**3/02**	**9/02**	**3/03**	**9/03**	**3/04**	**9/04**	**3/05**	**9/05**	**3/06**	**9/06**	**3/07**	**9/07**	**3/08**	**9/08**
Trichloroethene (TCE)	5	26									23															6.6	7.9	1.7	13.6
Tetrachloroethene (PCE)	5	<5									<1															<1	<1	<1	<1
cis-1,2-Dichloroethene	70	<5									<1															<1	<1	<1	<1
trans-1,2-Dichloroethene	100										<1															<1	<1	<1	<1
Vinyl Chloride	2	<10									<1															<1	<1	<1	<1
Total CVOCs		26									23															6.6	7.9	1.7	13.6
Total Zinc																										<10	<20	<20	<20
W-10	**GPS**	**6/95**	**10/95**	**3/96**	**10/96**	**4/97**	**10/97**	**3/98**	**9/98**	**3/99**	**9/99**	**3/00**	**9/00**	**3/01**	**9/01**	**3/02**	**9/02**	**3/03**	**9/03**	**3/04**	**9/04**	**3/05**	**9/05**	**3/06**	**9/06**	**6/07**	**9/07**	**3/08**	**9/08**
Trichloroethene (TCE)	5																									<1	<1	0.4	<1
Tetrachloroethene (PCE)	5																									<1	<1	<1	<1
cis-1,2-Dichloroethene	70																									<1	<1	<1	<1
trans-1,2-Dichloroethene	100																									<1	<1	<1	<1
Vinyl Chloride	2																									<1	<1	<1	<1
Total CVOCs																										<1	<1	0.4	<1
Total Zinc		30	40	40	<20	<20	<100	47	9	14	>5	8	9	12	<5	<5	109	18	11	25	<10	14	15	10	14	430	<40	<20	<20

Notes: (1) Total Zinc Results/ Dissolved zinc results
(2) Highlighted values indicate exceedance of GPS.

TABLE 2
RECOVERY WELL, BACKGROUND WELL AND HUMANE SPRING CVOC AND ZINE CONCENTRATIONS (ug/l)
SINCE GROUNDWATER REMEDIATION SYSTEM START-UP IN APRIL 1995

Former Hallmack Facililty
Harrodsburg, Kentucky

RW-1	GPS	3/09	9/09	3/10	9/10	3/11	9/11	3/12	9/12	3/13	9/13	3/14	9/14	3/15	9/15	3/16	9/16	3/17	9/17	3/18
Trichloroethene (TCE)	5	35	28	24	26	68	40.5	58	21.5	28	27	36	20	20	23	46	21	56	42	17
Tetrachloroethene (PCE)	5	1.4	1.1	0.9	1	2	4.9	3.2	1.0	2.1	1.4	2.1	0.71	0.87	0.76	3.0	1.2	2.8	1.9	1.2
cis-1,2-Dichloroethene	70	8.8	8.7	9.6	11	29	5.3	6.8	7.8	16.2	8.1	13	14	16	13	16	20	34	28	13
trans-1,2-Dichloroethene	100	0.6	<1	0.5	0.5	0.9	<1	<1	0.4	0.4	0.3	0.4	1	0.47	0.55	0.67	0.71	0.77	0.63	0.4
Vinyl Chloride	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.29	<1	<1	<1	0.51	<1	0.54
Total CVOCs		46	38	35	38	100	50.7	68	30.7	47	37	51	36	37	37	65	42	94	72	32
Total Zinc		82	54	266	84	201	73.7	158	48	73	43	213	315	192	142	112	171	104	34	498/113[1]
RW-2	**GPS**	**3/09**	**9/09**	**3/10**	**9/10**	**3/11**	**9/11**	**3/12**	**9/12**	**3/13**	**9/13**	**3/14**	**9/14**	**3/15**	**9/15**	**3/16**	**9/16**	**3/17**	**9/17**	**3/18**
Trichloroethene (TCE)	5	236	297	371	168	43	87.6	150	88	97	79	113	64	35	71	206	112	10	57	63
Tetrachloroethene (PCE)	5	25	27	38	24	4	10.8	13.8	11.4	10.7	5.8	11.3	5.1	3.4	5.2	21	15	1.4	3.3	7.9
cis-1,2-Dichloroethene	70	120	210	281	64	54	45.6	66	44	75	23	45	24	27	25	146	9.3	59	36	46
trans-1,2-Dichloroethene	100	<5	<5	2.6	1	1.1	0.8	1.4	1.5	1.1	1.0	0.9	2.5	0.91	1.2	3.5	1.6	0.49	0.7	1.3
Vinyl Chloride	2	<5	<5	<5	<2	0.5	<1	0.25	<1	<1	<1	<1	<1	0.27	<1	<1	<1	1.8	1	1.9
Total CVOCs		381	534	693	257	103	145	231	145	183	109	170	95	70	103	377	138	73	98	120
Total Zinc		140	209	307	155	441	269	138	36	359	141	263	162	98	329	45	200	191	75	466/92.1[1]
RW-3	**GPS**	**3/09**	**9/09**	**3/10**	**9/10**	**3/11**	**9/11**	**3/12**	**9/12**	**3/13**	**9/13**	**3/14**	**9/14**	**3/15**	**9/15**	**3/16**	**9/16**	**3/17**	**9/17**	**3/18**
Trichloroethene (TCE)	5	6,150	7,520	6,820	3,090	2,830	2,020	4,340	4,620	4,610	2,570	12,800	8,280	12,900	3,510	5,480	3,380	4,430	1,060	1,740
Tetrachloroethene (PCE)	5	<100	<100	<100	<50	14	22.7	21.4	<50	<50	<50	154	44	108	16.7	32.1	<50	<11	<11	6.6
cis-1,2-Dichloroethene	70	1,880	2,330	2,080	1,900	1,300	864	1,890	2,270	1,880	1,490	1,010	1,660	632	1,310	985	3,210	3,940	2,660	981
trans-1,2-Dichloroethene	100	<100	<100	<100	<50	<50	<50	23	<50	<50	<50	8.1	<1	6.7	11	<50	<50	15	<11	6.8
Vinyl Chloride	2	<100	<100	<100	<50	<50	<50	13	<50	<50	<50	<1	<1	<6	<6	<50	28.5	217	477	62.7
Total CVOCs		8,030	9,850	8,900	4,990	4,144	2,907	6,287	6,890	6,490	4,060	13,972	9,984	13,647	4,848	6,497	6,619	8,602	4,197	2,797
Total Zinc		168	243	185	103	187	111	123	129	289	87	87	154	78	141	107	1,360	958	1,410	774/220[1]
RW-4	**GPS**	**3/09**	**9/09**	**3/10**	**9/10**	**3/11**	**9/11**	**3/12**	**9/12**	**3/13**	**9/13**	**3/14**	**9/14**	**3/15**	**9/15**	**3/16**	**9/16**	**3/17**	**9/17**	**3/18**
Trichloroethene (TCE)	5	639	193	136	217	283	161	366	573	304	143	353	159	224	199	160	49	90	32	101
Tetrachloroethene (PCE)	5	135	21	18	20	38	28.1	51	123	57	19	50	20	35	21	29	13	12.6	6.1	29.7
cis-1,2-Dichloroethene	70	334	44	80	294	283	120	331	577	189	100	100	309	68	29	29	211	232	147	87
trans-1,2-Dichloroethene	100	8.2	4.7	3	3	4.1	2	4.8	8.8	2	1.8	3	2.3	2	2.5	2.4	3.0	2.1	1.1	2.2
Vinyl Chloride	2	<10	<2	<2	<2	<5	<5	<5	<5	<5	<1	<2	13	<1	<1	<1	0.8	9.9	74.5	1.4
Total CVOCs		1,116	263	237	534	608	311	753	1,282	552	264	506	503	330	251	221	277	346	261	221
Total Zinc		39	62	175	91	103	96	100	91	91	79	178	201	354	194	137	4,530	1,030	733	2880/204[1]
RW-5	**GPS**	**3/09**	**9/09**	**3/10**	**9/10**	**3/11**	**9/11**	**3/12**	**9/12**	**3/13**	**9/13**	**3/14**	**9/14**	**3/15**	**9/15**	**3/16**	**9/16**	**3/17**	**9/17**	**3/18**
Trichloroethene (TCE)	5	29	92	81	106	73	49.4	50.9	46.5	51	53	70	83	69	38	74	9.6	43	17	42
Tetrachloroethene (PCE)	5	44	10.3	17	15	15	22.1	27.7	28.6	26	18	44	14	44	20	29	4.7	9.9	6.2	12.9
cis-1,2-Dichloroethene	70	1.8	11.2	12	20	19	13.8	4.1	4.3	13.4	6.2	6.3	4.9	8.5	1.8	4.6	49	18	11	15
trans-1,2-Dichloroethene	100	0.8	2.6	2.6	3	2	1.2	1.8	1.8	2	1.7	2.6	1.2	2.1	1.3	3.0	0.9	1.4	0.7	1.8
Vinyl Chloride	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.7	<1	0.64
Total CVOCs		75	116	113	144	109	85	85	81	93	79	123	103	123	61	121	64	74	35	72
RW-6	**GPS**	**3/09**	**9/09**	**3/10**	**9/10**	**3/11**	**9/11**	**3/12**	**9/12**	**3/13**	**9/13**	**3/14**	**9/14**	**3/15**	**9/15**	**3/16**	**9/16**	**3/17**	**9/17**	**3/18**
Trichloroethene (TCE)	5	33	3.1	108.0	40	4.8	4.0	60.5	3,300	24	5,640	1,210	7,380	1,900	3,070	9,710	1,390	271	60	9
Tetrachloroethene (PCE)	5	<1	<1	<1	<1	<1	<1	0.3	9.2	<1	21	<5	31	7	7.9	<50	8.4	1.3	0.9	<1
cis-1,2-Dichloroethene	70	0.6	<1	12	0.6	<1	<1	2.1	238	0.81	410	67	418	149	314	314	96	163	41.7	8.7
trans-1,2-Dichloroethene	100	<1	<1	<1	<1	<1	<1	<1	1.8	<1	1.8	<7	<1	<4	<4	<50	0.62	<1.1	0.32	<1
Vinyl Chloride	2	<1	<1	<1	<1	<1	<1	<1	0.7	<1	0.5	<7	<1	<5	<5	<50	<1	36	34	<1
Total CVOCs		34	3.1	120.0	41.0	4.8	4.0	63.0	3,550	25	6,073	1,277	7,829	2,056	3,392	10,024	1,495	471	137	18

Notes: (1) Total Zinc Results/ Dissolved zinc results
(2) Highlighted values indicate exceedance of GPS.

TABLE 2
RECOVERY WELL, BACKGROUND WELL AND HUMANE SPRING CVOC AND ZINE CONCENTRATIONS (ug/l)
SINCE GROUNDWATER REMEDIATION SYSTEM START-UP IN APRIL 1995

Former Hallmack Facililty
Harrodsburg, Kentucky

RW-7	GPS	3/09	9/09	3/10	9/10	3/11	9/11	3/12	9/12	3/13	9/13	3/14	9/14	3/15	9/15	3/16	9/16	3/17	9/17	3/18
Trichloroethene (TCE)	5	198	260	329	81	182	93.4	177	94.7	93	84	183	193	240	325	215	50.6	272	116	208
Tetrachloroethene (PCE)	5	<5	<5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2
cis-1,2-Dichloroethene	70	2.1	3.7	2.8	1.4	1.6	0.7	2.4	3.1	0.89	2.5	2.6	2.9	1.9	9.4	1.4	0.89	52	141	13.2
trans-1,2-Dichloroethene	100	<5	<5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.32	0.91	<2
Vinyl Chloride	2	<5	<5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	4.5	107	3
Total CVOCs		200	264	332	82	184	94	179	98	94	86	186	196	242	334	216	51	329	365	224
RW-8	**GPS**	**3/09**	**9/09**	**3/10**	**9/10**	**3/11**	**9/11**	**3/12**	**9/12**	**3/13**	**9/13**	**3/14**	**9/14**	**3/15**	**9/15**	**3/16**	**9/16**	**3/17**	**9/17**	**3/18**
Trichloroethene (TCE)	5	17.4	3.4	14.6	13.6	1,280	36.7	67.6	15.5	30.0	20	12	10	19	22	13	24	29	111	21
Tetrachloroethene (PCE)	5	<1	<1	<1	<1	1.4	<1	0.4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
cis-1,2-Dichloroethene	70	0.3	<1	<1	0.5	66	2.1	2.8	0.46	<1	1.2	0.4	<1	0.55	3.9	<1	5.6	2.1	36.7	34.4
trans-1,2-Dichloroethene	100	<1	<1	<1	<1	0.4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.8	0.6	0.9
Vinyl Chloride	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	5.1	1.7
Total CVOCs		17.7	3.4	14.6	14.1	1,348	39	71	16	30	21	12	10	20	26	13	29	32	153	57.6
RW-9	**GPS**	**3/09**	**9/09**	**3/10**	**9/10**	**3/11**	**9/11**	**3/12**	**9/12**	**3/13**	**9/13**	**3/14**	**9/14**	**3/15**	**9/15**	**3/16**	**9/16**	**3/17**	**9/17**	**3/18**
Trichloroethene (TCE)	5	3,700	4,900	13,500	34,100	6,990	670	1,140	1,520	268	189	212	389	279	663	536	197	457	663	1,550
Tetrachloroethene (PCE)	5	<50	<50	<50	<200	<100	2.6	2.6	<20	<5	0.5	0.5	<1	<1	<2	<10	<2	0.6	<5	3.2
cis-1,2-Dichloroethene	70	305	380	791	1,330	255	53.3	218.0	326.0	64	56	69	102	69	211	133	37	170	337	573
trans-1,2-Dichloroethene	100	<50	<50	<50	<200	<100	<10	<10	<20	<5	0.4	0.7	<1	1.2	2.5	<10	<2	1.7	2.6	6.5
Vinyl Chloride	2	<50	<50	<50	<200	<100	<10	<10	<20	<5	<1	<1	<1	<1	<1	<10	<2	4.6	4.9	10.6
Total CVOCs		4,005	5,280	14,291	35,430	7,245	726	1,361	1,846	332	246	282	491	349	877	669	234	634	1,008	2,143
RW-11	**GPS**	**3/09**	**9/09**	**3/10**	**9/10**	**3/11**	**9/11**	**3/12**	**9/12**	**3/13**	**9/13**	**3/14**	**9/14**	**3/15**	**9/15**	**3/16**	**9/16**	**3/17**	**9/17**	**3/18**
Trichloroethene (TCE)	5	20,600	48,800	19,200	2,670	1,640	1,620	3,430	9,750	987	28,400	25,600	27,100	7,150	54,800	16,400	8,890	7,910	3,190	217
Tetrachloroethene (PCE)	5	164	610	340	23	21	26.8	41.3	112.0	16.0	299	291	280	86	297	171	115	74	30	<25
cis-1,2-Dichloroethene	70	974	2,030	1,560	200	67	947	471	792	88	1,190	956	1,340	300	1,510	822	345	1,240	9,080	2,590
trans-1,2-Dichloroethene	100	<500	<500	<250	<50	<20	<20	<20	<100	<20	10	<69	<86	<21	<21	<100	<100	<100	<100	14
Vinyl Chloride	2	<500	<500	95	<50	<20	<20	<20	<100	<20	<10	<65	<81	<25	<25	<100	<100	<100	1,190	189
Total CVOCs		21,738	51,440	21,195	2,893	1,728	2,594	3,942	10,654	1,091	29,899	26,847	28,720	7,536	56,607	17,393	9,350	9,224	13,490	3,010
RW-12	**GPS**	**3/09**	**9/09**	**3/10**	**9/10**	**3/11**	**9/11**	**3/12**	**9/12**	**3/13**	**9/13**	**3/14**	**9/14**	**3/15**	**9/15**	**3/16**	**9/16**	**3/17**	**9/17**	**3/18**
Trichloroethene (TCE)	5	2,970	15,600	4,740	10,300	28,000	17,800	42,500	34,500	39,400	29,400	32,900	23,600	19,200	33,500	31,000	25,000	27,200	39,200	13,500
Tetrachloroethene (PCE)	5	<50	20	<50	<50	68	<500	203	200	<500	1,120	166	103	84	160	182	<500	122	186	59.6
cis-1,2-Dichloroethene	70	254	746	315	666	1,100	1,070	1,600	1,720	1,500	<500	1,240	953	862	1,210	1,030	1,280	5,560	4,270	9,470
trans-1,2-Dichloroethene	100	<50	<50	<50	<50	<200	<500	<500	<500	<500	<500	<170	<86	<52	<52	<500	<500	<500	<500	58.3
Vinyl Chloride	2	<50	<50	<50	<50	<200	<500	<500	<500	<500	<500	<160	<81	<63	<63	<500	<500	<500	<500	186
Total CVOCs		3,224	16,366	5,055	10,966	29,168	18,870	44,303	36,420	40,900	30,520	34,306	24,656	20,146	34,870	32,212	26,280	32,882	43,656	23,274
Humane Spring	**GPS**	**3/09**	**9/09**	**3/10**	**9/10**	**3/11**	**9/11**	**3/12**	**9/12**	**3/13**	**9/13**	**3/14**	**9/14**	**3/15**	**9/15**	**3/16**	**09/19/16**	**3/17**	**9/17**	**3/18**
Trichloroethene (TCE)	5	8	10.1	9.4	16	8.8	6.5	10.7	9.6	5.0	5.9	7.6	6.1	10	8.1	6.8	4.6	6.6	8.0	3.2
Tetrachloroethene (PCE)	5	0.3	<1	<1	<1	0.3	<1	0.5	<1	<1	<1	0.5	0.36	0.55	<1	0.47	<1	0.4	0.3	<1
cis-1,2-Dichloroethene	70	2.5	4.1	2.8	9.9	3.6	1.9	2.7	4.7	1.3	3.6	2.6	3.5	2.8	2.8	2.5	1.6	2.1	3.0	1.2
trans-1,2-Dichloroethene	100	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Vinyl Chloride	2	<1	<1	<1	<1	<1	<1	0.3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total CVOCs		10.8	14.2	12.2	25.9	12	8	14	14.3	6.3	9.5	10.7	10	13	11	9.8	6.2	9.1	11.3	4.4
P-106	**GPS**	**3/09**	**9/09**	**3/10**	**9/10**	**3/11**	**9/11**	**3/12**	**9/12**	**3/13**	**9/13**	**3/14**	**9/14**	**3/15**	**9/15**	**3/16**	**9/16**	**3/17**	**9/17**	**3/18**
Trichloroethene (TCE)	5	4	7.8	3.3	10.2	6.8	3.1	6.2	8.6	2.1	0.6	1.7	19	6	12	6.5	1.9	1.1	7.8	1.5
Tetrachloroethene (PCE)	5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
cis-1,2-Dichloroethene	70	<1	0.3	<1	<1	<1	<1	<1	<1	<1	0.3	<1	<1	<1	<1	<1	<1	<1	<1	<1
trans-1,2-Dichloroethene	100	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Vinyl Chloride	2	<1	0.47	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total CVOCs		4	8.6	3.3	10.2	6.8	3.1	6.2	8.6	2.1	0.9	1.7	19	6	12	6.5	1.9	1.1	7.8	1.5
Total Zinc		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20/<20[1]
W-10	**GPS**	**3/09**	**9/09**	**3/10**	**9/10**	**3/11**	**9/11**	**3/12**	**9/12**	**3/13**	**9/13**	**3/14**	**9/14**	**3/15**	**9/15**	**3/16**	**9/16**	**3/17**	**9/17**	**3/18**
Trichloroethene (TCE)	5	<1	<1	0.27	0.34	0.28	<1	0.68	<1	<1	0.30	<1	<1	0.24	<1	<1	<1	<1	<1	<1
Tetrachloroethene (PCE)	5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
cis-1,2-Dichloroethene	70	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
trans-1,2-Dichloroethene	100	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Vinyl Chloride	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total CVOCs		<1	<1	0.3	0.3	0.3	<1	0.7	<1	<1	0.3	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Zinc		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20/<20[1]

Notes: (1) Total Zinc Results/ Dissolved zinc results
(2) Highlighted values indicate exceedance of GPS.

TABLE 3
COMPLIANCE MONITORING WELL CVOC DATA

Former Hallmack Facility
Harrodsburg, Kentucky

		Volatile Organic Compounds (ug/L)				
Well ID	**Date**	**(TCE)**	**cis-1,2 DCE**	**trans 1,2 DCE**	**Vinyl Chloride**	**PCE**
	GPS	5	70	100	2	5
P-103	10/16/1987	5.3				<3.9
	10/22/1987	115.3				0.53
	11/18/1987	1				<0.5
	12/8/1987	2.3				<0.5
	1/5/1988	<0.5				<0.5
	2/6/1988	<0.5				<0.5
	4/26/1988	45.9				<0.5
	6/14/1988	<0.5				<0.5
	7/21/1988	<0.5				<0.5
	8/16/1988	1				<0.5
	12/18/1992	<5	<5		<10	<10
	12/28/1992	<5	<5		<10	<5
	9/21/1993	<5	<5		<10	<5
	3/29/1995	<5	<5		<5	<5
	8/17/1999	<1.0	<1.0	<1.0	<1.0	<1.0
	7/27/2005	<1	5.2	<1	<1	24
	3/31/2007	<1	<1	<1	<1	<1
	9/11/2007	2.2	<1	<1	<1	<1
	3/28/2008	<1	<1	<1	<1	<1
	9/17/2008	13	0.4	<1	<1	<1
	3/29/2009	2.8	<1	<1	<1	<1
	9/20/2009	3.2	<1	<1	<1	<1
	3/28/2010	0.66	<1	<1	<1	<1
	9/19/2010	1.9	<1	<1	<1	<1
	3/28/2011	0.4	<1	<1	<1	<1
	9/28/2011	0.5	<1	<1	<1	<1
	3/27/2012	0.4	<1	<1	<1	<1
	9/25/2012	<1	<1	<1	<1	<1
	3/26/2013	3.4	<1	<1	<1	<1
	9/16/2013	<1	<1	<1	<1	<1
	3/25/2014	1.5	<1	<1	<1	<1
	9/28/2014	0.76	<1	<1	<1	<1
	3/30/2015	1.3	<1	<1	<1	<1
	9/27/2015	0.4	<1	<1	<1	<1
	3/21/2016	0.8	<1	<1	<1	<1
	9/19/2016	0.96	<1	<1	<1	<1
	3/26/2017	<1	<1	<1	<1	<1
	9/17/2017	1.0	<1	<1	<1	<1
	3/25/2018	3.2	<1	<1	<1	<1
P-104	10/16/1987	7.3				<3.9
	10/22/1987	25.3				0.6
	11/18/1987	34.3				<0.5
	3/1/1988	1.9				<0.5
	3/8/1988	2.1				<0.5
	3/22/1988	88.9				<0.5
	4/16/1988	123				<0.5
	6/1/1988	2				<0.5
	7/12/1988	6				<0.5
	8/16/1988	4				<0.5

TABLE 3
COMPLIANCE MONITORING WELL CVOC DATA

Former Hallmack Facility
Harrodsburg, Kentucky

		Volatile Organic Compounds (ug/L)				
Well ID	**Date**	**(TCE)**	**cis-1,2 DCE**	**trans 1,2 DCE**	**Vinyl Chloride**	**PCE**
	GPS	5	70	100	2	5
P-104	9/20/1988	6				
cont'd	10/4/1988	4				<0.5
	12/28/1992	<5	<5		<10	<5
	9/21/1993	<5	<5		<10	<5
	8/17/1999	1.5	<1.0	<1.0	<1.0	<1.0
	7/27/2005	<1	1.1	<1	<1	6.4
	3/31/2007	<1	<1	<1	<1	<1
	9/12/2007	0.4	<1	<1	<1	<1
	3/28/2008	<1	<1	<1	<1	<1
	9/17/2008	1.9	<1	<1	<1	<1
	3/29/2009	1.1	<1	<1	<1	<1
	9/20/2009	0.7	<1	<1	3.5	<1
	3/28/2010	<1	<1	<1	<1	<1
	9/19/2010	0.9	<1	<1	<1	<1
	3/28/2011	0.7	<1	<1	<1	<1
	9/28/2011	0.35	<1	<1	<1	<1
	3/27/2012	0.9	<1	<1	<1	<1
	9/25/2012	0.9	<1	<1	<1	<1
	3/25/2013	<1	<1	<1	<1	<1
	9/15/2013	<1	<1	<1	<1	<1
	3/24/2014	0.34	<1	<1	<1	<1
	9/28/2014	0.45	<1	<1	<1	<1
	3/30/2015	0.35	<1	<1	<1	<1
	9/27/2015	0.74	<1	<1	<1	<1
	3/21/2016	<1	<1	<1	<1	<1
	9/19/2016	<1	<1	<1	<1	<1
	3/26/2017	<1	<1	<1	<1	<1
	9/17/2017	<1	<1	<1	<1	<1
	3/25/2018	<1	<1	<1	<1	<1

TABLE 3
COMPLIANCE MONITORING WELL CVOC DATA

Former Hallmack Facility
Harrodsburg, Kentucky

		Volatile Organic Compounds (ug/L)				
Well ID	**Date**	**(TCE)**	**cis-1,2 DCE**	**trans 1,2 DCE**	**Vinyl Chloride**	**PCE**
	GPS	5	70	100	2	5
P-219	11/10/1988	2.4				<0.5
	11/15/1988	<0.5				<0.5
	11/30/1988	<0.5				<0.5
	4/7/1989	3				<0.5
	4/18/1989	0.7				<0.5
	12/28/1992	<5	<5		<10	<5
	9/21/1993	<5	<5		<10	<5
	7/27/2005	<1	<1	<1	<1	12
	3/31/2007	1.5	<1	<1	<1	<1
	9/12/2007	0.5	<1	<1	<1	<1
	3/28/2008	<1	<1	<1	<1	<1
	9/17/2008	1.6	<1	<1	<1	<1
	3/29/2009	1.1	<1	<1	<1	<1
	9/21/2009	0.44	<1	<1	<1	<1
	3/28/2010	0.32	<1	<1	<1	<1
	3/28/2011	<1	<1	<1	<1	<1
	9/28/2011	0.38	<1	<1	<1	<1
	3/26/2012	0.5	<1	<1	<1	<1
	9/24/2012	<1	<1	<1	<1	<1
	3/25/2012	<1	<1	<1	<1	<1
	9/15/2013	0.53	<1	<1	<1	<1
	3/24/2014	0.37	<1	<1	<1	<1
	9/28/2014	0.55	<1	<1	<1	<1
	3/30/2015	<1	<1	<1	<1	<1
	9/27/2015	0.43	<1	<1	<1	<1
	3/21/2016	<1	<1	<1	<1	<1
	9/19/2016	0.29	<1	<1	<1	<1
	3/26/2017	<1	<1	<1	<1	<1
	9/17/2017	0.44	<1	<1	<1	<1
	3/25/2018	<1	<1	<1	<1	<1
P-301	11/29/1988	55.8				<0.5
	1/5/1989	46.7				<0.5
	1/10/1989	85.9				<0.5
	4/4/1989	48.7				<0.5
	9/6/1989	72				<0.5
	9/12/1989	68				<0.5
	11/8/1990	41				<0.5
	4/2/1991	61				<10
	12/30/1992	43	<5		<10	<5
	9/22/1993	<5	<5		<10	<5
	3/29/1995	12	<5		<5	<5
	8/17/1999	8.6	<1.0	<1.0	<1.0	<1.0
	7/28/2005	19	<1	<1	<1	<1
	3/31/2007	9.4	3	<1	<1	<1
	9/11/2007	6.5	<1	<1	<1	<1
	3/28/2008	17.8	0.6	<1	<1	<1
	9/16/2008	5.5	0.3	<1	<1	<1
	3/29/2009	8.3	0.3	<1	<1	<1
	9/20/2009	20	<1	<1	<1	<1

TABLE 3
COMPLIANCE MONITORING WELL CVOC DATA

Former Hallmack Facility
Harrodsburg, Kentucky

		Volatile Organic Compounds (ug/L)				
Well ID	**Date**	**(TCE)**	**cis-1,2 DCE**	**trans 1,2 DCE**	**Vinyl Chloride**	**PCE**
	GPS	5	70	100	2	5
P-301	3/28/2010	27.6	0.55	<1	<1	<1
cont'd	9/19/2010	10.7	0.63	<1	<1	<1
	3/27/2011	9	<1	<1	<1	<1
	9/27/2011	5.7	<1	<1	<1	<1
	3/26/2012	6	0.4	<1	<1	<1
	9/24/2012	34	<1	<1	<1	<1
	3/25/2013	3.7	0.27	<1	<1	<1
	9/15/2013	3.7	0.51	<1	<1	<1
	3/24/2014	4.9	0.44	<1	<1	<1
	9/28/2014	10.3	<1	<1	<1	<1
	3/30/2015	12.7	0.35	<1	<1	<1
	9/27/2015	7.4	<1	<1	<1	<1
	3/21/2016	3.0	<1	<1	<1	<1
	9/19/2016	0.9	0.39	<1	<1	<1
	3/26/2017	6.9	1.2	<1	<1	<1
	9/18/2017	7.8	0.47	<1	<1	<1
	3/25/2018	6.0	0.51	<1	<1	<1
P-302	11/22/1988	60.8				60.8
	11/29/1988	14.4				<0.5
	1/5/1989	18.7				<0.5
	1/10/1989	46.4				<0.5
	9/6/1989	54				<0.5
	11/8/1990	72				<0.5
	4/2/1991	27				<10
	12/30/1992	31	<5		<10	<5
	9/22/1993	18	<5		<10	<5
	3/29/1995	35	<5		5	<5
	8/17/1999	5.6	1.5	<1.0	<1.0	<1.0
	7/28/2005	5.2	1.8	<1	<1	<1
	3/31/2007	19	<1	<1	<1	<1
	9/11/2007	6.2	1.1	<1	<1	<1
	3/28/2008	3.2	0.4	<1	<1	<1
	9/16/2008	4.2	1	<1	<1	<1
	3/29/2009	9.6	0.4	<1	<1	<1
	9/20/2009	2.4	0.51	<1	<1	<1
	3/28/2010	18.9	<1	<1	<1	<1
	9/19/2010	6	0.45	<1	<1	<1
	3/27/2011	7.6	0.39	<1	<1	<1
	9/27/2011	3	0.4	<1	<1	<1
	3/26/2012	8.6	0.3	<1	<1	<1

TABLE 3
COMPLIANCE MONITORING WELL CVOC DATA

Former Hallmack Facility
Harrodsburg, Kentucky

		Volatile Organic Compounds (ug/L)				
Well ID	**Date**	**(TCE)**	**cis-1,2 DCE**	**trans 1,2 DCE**	**Vinyl Chloride**	**PCE**
	GPS	5	70	100	2	5
P-302	9/24/2012	13.7	<1	<1	<1	<1
cont'd	3/25/2013	2.8	0.49	<1	<1	<1
	9/15/2013	9.9	0.43	<1	<1	<1
	3/24/2014	3.1	0.46	<1	<1	<1
	9/28/2014	15.3	<1	<1	<1	<1
	3/30/2015	6.6	0.40	<1	<1	<1
	9/27/2015	6.1	0.58	<1	<1	<1
	3/21/2016	9.6	0.36	<1	<1	<1
	9/19/2016	4.9	0.37	<1	<1	<1
	3/26/2017	10.4	0.29	<1	<1	<1
	9/18/2017	1.4	0.96	<1	<1	<1
	3/25/2018	1.6	<1	<1	<1	<1
P-303	11/22/1988	<0.5				<0.5
	11/29/1988	0.8				<0.5
	1/5/1989	0.9				<0.5
	1/10/1989	0.7				<0.5
	4/11/1989	1.5				<0.5
	9/6/1989	0.7				<0.5
	11/8/1990	<0.5				<0.5
	12/29/1992	<5	<5		<10	<5
	9/21/1993	<5	<5		<10	<5
	8/17/1999	<1.0	<1.0	<1.0	<1.0	<1.0
	3/31/2007	<1	<1	<1	<1	<1
	9/11/2007	0.7	<1	<1	<1	<1
	3/28/2008	<1	<1	<1	<1	<1
	9/16/2008	1.3	<1	<1	<1	<1
	3/29/2009	0.6	<1	<1	<1	<1
	9/20/2009	0.39	<1	<1	<1	<1
	3/28/2010	0.33	<1	<1	<1	<1
	9/19/2010	0.44	<1	<1	<1	<1
	3/27/2011	<1	<1	<1	<1	<1
	9/27/2011	<1	<1	<1	<1	<1
	3/26/2012	0.5	<1	<1	<1	<1
	9/24/2012	<1	<1	<1	<1	<1
	3/25/2013	<1	<1	<1	<1	<1
	9/15/2013	0.35	<1	<1	<1	<1
	3/24/2014	0.31	<1	<1	<1	<1
	9/28/2014	<1	<1	<1	<1	<1
	3/30/2015	<1	<1	<1	<1	<1
	9/27/2015	<1	<1	<1	<1	<1
	3/21/2016	<1	<1	<1	<1	<1
	9/19/2016	<1	<1	<1	<1	<1
	3/26/2017	<1	<1	<1	<1	<1
	9/18/2017	<1	<1	<1	<1	<1
	3/25/2018	<1	<1	<1	<1	<1
P-304	11/22/1988	1.8				<0.5
	11/29/1988	0.9				<0.5
	1/5/1989	<0.5				<0.5
	2/28/1989	1				<0.5
	4/11/1989	1.3				<0.5

TABLE 3
COMPLIANCE MONITORING WELL CVOC DATA

Former Hallmack Facility
Harrodsburg, Kentucky

		Volatile Organic Compounds (ug/L)				
Well ID	**Date**	**(TCE)**	**cis-1,2 DCE**	**trans 1,2 DCE**	**Vinyl Chloride**	**PCE**
	GPS	5	70	100	2	5
P-304	4/18/1989	1.3				<0.5
cont'd	9/6/1989	1.6				<0.5
	11/8/1990	<0.5				<0.5
	12/29/1992	<5	<5		<10	<5
	9/21/1993	<5	<5		<10	<5
	8/17/1999	<1.0	<1.0	<1.0	<1.0	<1.0
	7/28/2005	<1	<1	<1	<1	<1
	3/31/2007	<1	<1	<1	<1	<1
	9/11/2007	<1	<1	<1	<1	<1
	3/28/2008	<1	<1	<1	<1	<1
	9/16/2008	1	<1	<1	<1	<1
	3/29/2009	1.5	<1	<1	<1	<1
	9/21/2009	0.5	<1	<1	<1	<1
	3/28/2010	0.25	<1	<1	<1	<1
	9/19/2010	0.41	<1	<1	<1	<1
	3/27/2011	<1	<1	<1	<1	<1
	9/27/2011	<1	<1	<1	<1	<1
	3/26/2012	0.4	<1	<1	<1	<1
	9/24/2012	<1	<1	<1	<1	<1
	3/25/2013	<1	<1	<1	<1	<1
	9/15/2013	<1	<1	<1	<1	<1
	3/24/2014	0.41	<1	<1	<1	<1
	9/28/2014	<1	<1	<1	<1	<1
	3/30/2015	<1	<1	<1	<1	<1
	9/27/2015	<1	<1	<1	<1	<1
	3/21/2016	<1	<1	<1	<1	<1
	9/19/2016	<1	<1	<1	<1	<1
	3/26/2017	<1	<1	<1	<1	<1
	9/17/2017	<1	<1	<1	<1	<1
	3/25/2018	<1	<1	<1	<1	<1
P-305	11/22/1988	<0.5				<0.5
	11/29/1988	4.3				<0.5
	1/5/1989	1.8				<0.5
	2/28/1989	3.3				<0.5
	4/11/1989	2.7				<0.5
	9/6/1989	1.6				<0.5
	7/28/2005	18	4.2	<1	<1	<1
	3/31/2007	NA	NA	NA	NA	NA
	9/11/2007	20	2.6	<1	<1	0.4
	3/28/2008	0.4	<1	<1	<1	<1
	9/16/2008	5.7	4.3	<1	<1	<1
	3/29/2009	1.7	<1	<1	<1	<1
	9/20/2009	0.93	<1	<1	<1	<1
	3/28/2010	1.8	<1	<1	<1	<1

TABLE 3
COMPLIANCE MONITORING WELL CVOC DATA

Former Hallmack Facility
Harrodsburg, Kentucky

		Volatile Organic Compounds (ug/L)				
Well ID	**Date**	**(TCE)**	**cis-1,2 DCE**	**trans 1,2 DCE**	**Vinyl Chloride**	**PCE**
	GPS	5	70	100	2	5
P-305	9/19/2010	4.0	0.58	<1	<1	<1
Cont'd	3/27/2011	0.5	<1	<1	<1	<1
	9/27/2011	0.47	<1	<1	<1	<1
	3/26/2012	1.1	<1	<1	<1	<1
	9/24/2012	1.7	<1	<1	<1	<1
	3/25/2013	<1	<1	<1	<1	<1
	9/15/2013	2.1	<1	<1	<1	<1
	3/24/2014	0.90	<1	<1	<1	<1
	9/28/2014	2.00	<1	<1	<1	<1
	3/30/2015	0.28	0.71	<1	<1	<1
	9/27/2015	0.38	0.82	<1	<1	<1
	3/21/2016	<1	<1	<1	<1	<1
	9/18/2016	0.6	0.35	<1	<1	<1
	3/26/2017	<1	<1	<1	<1	<1
	9/17/2017	<1	<1	<1	<1	<1
	3/25/2018	0.50	<1	<1	<1	<1

TABLE 4
GROUNDWATER MNA INDICATOR PARAMETER RESULTS

Former Hallmack Facility
Harrodsburg, Kentucky

Well ID	Date	Methane (ug/l)	Ethane (ug/l)	Ethene (ug/l)	Nitrate (mg/l)	Sulfate (mg/l)	Dissolved Iron (mg/l)	Dissolved Manganese (mg/l)
RW-1+A10:G23	3/26/2018	11.3	<1	<1	<0.1[1]	97	<300	85
RW-2	3/26/2018	0.7	<1	<1	1.3[1]	139	<300	2,260
RW-2*	3/26/2018	4.4	<1	<1	0.7[1]	139	<300	1,310
RW-3	3/26/2018	1.5	0.57	20	0.16	113	<300	897
RW-4	3/26/2018	0.3	<1	<1	0.2[1]	151	434	1,170
RW-5	3/26/2018	27.1	0.34	<1	0.31	148	2,600	874
RW-6	3/27/2018	0.23	<1	<1	0.76	25.4	<300	54.5
RW-7	3/27/2018	2.2	<1	<1	0.9	25.5	<300	192
RW-8	3/26/2018	1.5	<1	<1	0.27[1]	35.9	<300	82.8
RW-9	3/26/2018	0.66	<1	<1	0.28[1]	144	<300	153
RW-11	3/26/2018	0.95	0.93	<1	<0.1[1]	95.4	378	269
RW-12	3/26/2018	12.0	4.4	4.5	<0.5[1]	213	<300	2,290
W-10	3/25/2018	6.6	<1	<1	<1.0[1]	482	<300	85.7
P-103	3/25/2018	24.9	<1	<1	0.65	38.6	<300	35.6
P-104	3/25/2018	3.6	4.5	<1	0.71	38.6	<300	<15
P-106	3/26/2018	13.0	0.86	<1	0.2	46.3	<300	<15
P-219	3/25/2018	3.9	<1	<1	0.22	27.8	<300	<15
P-301	3/25/2018	0.32	<1	<1	1.6[2]	35.6	<300	<15
P-302	3/25/2018	6.2	<1	<1	0.22	20.3	<300	<15
P-303	3/25/2018	1.5	<1	<1	0.92[2]	102	<300	<15
P-304	3/25/2018	0.21	<1	<1	0.87	31.1	<300	<15
P-305	3/25/2018	0.83	<1	<1	2.2	57.3	<300	22.2
Humane Spring	3/26/2018	1.6	<1	<1	3.2[1]	28.5	<300	<15

Notes (1) Samples analyzed slightly (2 to 10 hours) outside the laboratory hold time of 48 hours
(2) Samples analyzed 14 to 16 days outside laboratory hold time of 48 hours due to sulfate interference and laboratory calibration issues.
(3) * Indicates blind duplicate test results

TABLE 5
FIELD SCREENING PARAMETER RESULTS

Former Hallmack Facility
Harrodsburg, Kentucky

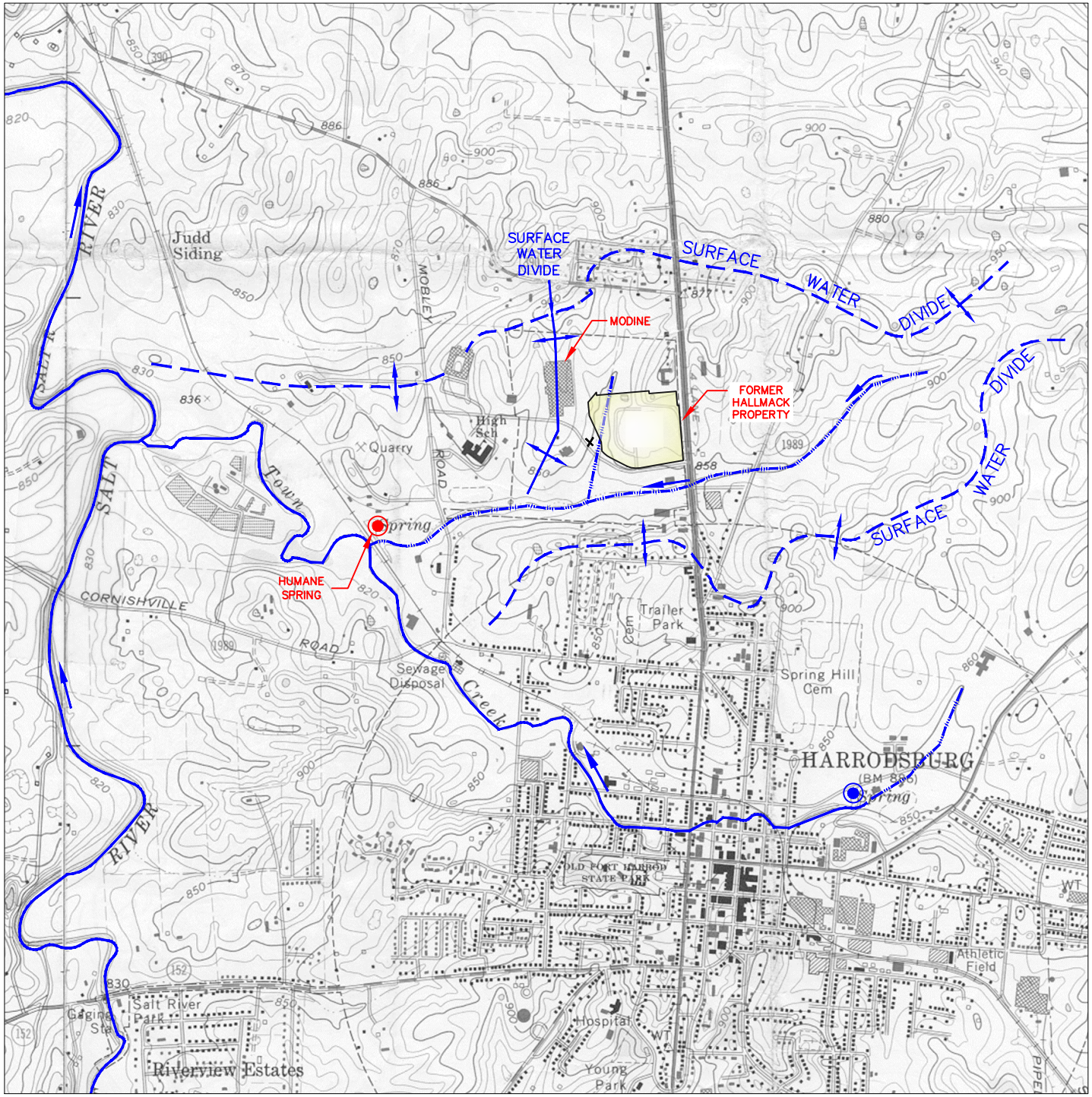
		Field Screening Parameters					
Well ID	**Date**	**ORP (mvolts)**	**pH (s.u.)**	**Spec. Cond. (µS/cm)**	**DO (mg/L)**	**Temperature (°C)**	**Turbidity (ntu)**
W-10	3/21/2016	-66	7.91	2,110	0.96	16.0	3
	9/19/2016	25	7.01	3,731	1.13	13.7	2
	3/26/2017	10	6.59	1,430	0.39	15.9	2
	9/17/2017	12	6.96	2,032	0.9	13.0	2
	3/25/2018	70	7.92	1,488	0.22	15.9	2
P-103	3/21/2016	-201	7.28	690	1.33	13.5	6
	9/19/2016	-190	7.1	709	1.00	13.1	5
	3/26/2017	25	7.47	570	0.36	13.7	2
	9/17/2017	-38	7.15	1,992	0.78	10.0	3
	3/25/2018	86	7.8	473	1.70	13.2	5
P-104	3/21/2016	-283	7.25	2,120	0.89	12.6	4
	9/19/2016	-146	7.29	2,380	0.92	13.0	4
	3/26/2017	-173	7.30	1,182	0.26	13.7	4
	9/17/2017	-216	7.32	2,221	0.82	12.3	5
	3/25/2018	37	7.74	4.04	1.7	12.3	3
P-106	3/21/2016	-108	7.98	740	1.24	15.2	6
	9/19/2016	-1	7.14	1,240	1.10	12.7	4
	3/26/2017	-142	7.14	5,532	0.72	14.7	3
	9/17/2017	-100	7.33	2,453	0.52	11.4	2
	3/25/2018	-9	7.74	567	0.53	13.7	4
P-219	3/21/2016	45	7.03	595	1.23	13.8	4
	9/19/2016	67	7.05	1,297	0.93	11.5	5
	3/26/2017	21	7.12	510	0.6	14.5	3
	9/17/2017	72	7.21	1,259	0.86	12.7	3
	3/25/2018	138	7.77	303	2.22	12.2	1
P-301	3/21/2016	-48	7.15	596	1.16	14.9	1
	9/19/2016	-4	7.2	1,112	1.11	11.3	0
	3/26/2017	56	7.16	492	0.66	14.7	2
	9/18/2017	32	7.37	1,151	0.84	9.6	2
	3/25/2018	232	7.61	545	1.27	14.3	2
P-302	3/21/2016	-39	7.53	748	1.31	15.1	4
	9/19/2016	74	7.70	1,817	1.00	11.5	5
	3/26/2017	55	6.97	701	0.82	15.0	3
	9/18/2017	32	7.31	1,413	0.72	10.4	3
	3/25/2018	243	7.76	420	2.2	15.2	1
P-303	3/21/2016	-41	7.53	740	0.67	14.7	1
	9/19/2016	73	7.00	1,501	0.78	12.0	2
	3/26/2017	61	7.14	7.76	0.71	15.1	5
	9/18/2017	37	7.08	879	0.65	10.2	5
	3/25/2018	210	7.65	582	0.66	15.1	4
P-304	3/21/2016	-30	7.47	720	0.71	14.7	5
	9/19/2016	75	7.77	1,560	1.33	12.7	2
	3/26/2017	62	7.09	557	0.72	15.5	2
	9/17/2017	36	7.01	1,466	0.56	9.3	1
	3/25/2018	229	7.43	541	2.29	13.6	5
P-305	3/21/2016	-82	7.90	800	0.80	15.5	6
	9/18/2016	61	7.49	1,817	0.77	14.7	5
	3/26/2017	50	7.14	703	1.10	15.2	3
	9/17/2017	-53	7.31	1,540	0.99	10.1	5
	3/25/2018	151	7.55	537	2.7	13.3	1
RW-1	3/26/2018	90	7.6	741	1.8	14.1	5.1
RW-2	3/26/2018	206	7.7	890	3.6	15.3	6.1
RW-3	3/26/2018	169	8.7	696	2.5	13.4	8.8
RW-4	3/26/2018	290	7.8	697	3.6	14.2	21
RW-5	3/26/2018	9	8	745	1.9	13.6	37
RW-6	3/27/2018	154	8.3	497	6.5	13.4	10
RW-7	3/27/2018	191	7.8	556	4.8	14	7
RW-8	3/26/2018	183	7.7	443	3.9	14.5	24
RW-9	3/26/2018	187	7.8	773	3.6	14.6	15
RW-11	3/26/2018	46	7.8	652	1.8	15.7	85
RW-12	3/26/2018	195	7.6	1066	1.3	14.9	42
Humane Spring	3/26/2018	180	7.9	594	5.6	13.6	0.3

TABLE 6
GROUNDWATER PERCENT of CIS-1,2 DICHLOROETHENE to TRICHLOROETHENE RATIO

Former Hallmack Facility
Harrodsburg, Kentucky

	1995 Baseline	Pre July 2016 Shutdown		Post July 2016 Shutdown			
	Jun-95	Sep-15	Mar-16	Sep-16	Mar-17	Sep-17	Mar-18
Well ID	CIS-1,2 DCE/TCE RATIO IN %						
RW-1	60	56	35	95	61	67	76
RW-2	237	35	71	8	590	63	73
RW-3	47	37	18	95	89	251	56
RW-4	297	15	18	431	258	459	86
RW-5	NA	5	6	510	42	65	36
RW-6	NA	10	3	7	60	70	97
RW-7	<1	3	1	2	19	122	6
RW-8	<4	18	<8	23	7	33	164
RW-9	6	32	25	19	37	51	37
RW-11	NA	3	5	4	16	285	1,194
RW-12	NA	4	3	5	20	11	70

FIGURES



GRAPHIC SCALE IN FEET
0 500 1000 2000

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PROJ MGR: MJK
DESIGNED BY: MJK
REVIEWED BY: MAP
OPERATOR: DL
DATE: JUNE 2018

FORMER HALLMACK FACILITY
HARRODSBURG, KENTUCKY

SITE LOCATION MAP

PROJECT NO.
150290.12

FIGURE NO.
1

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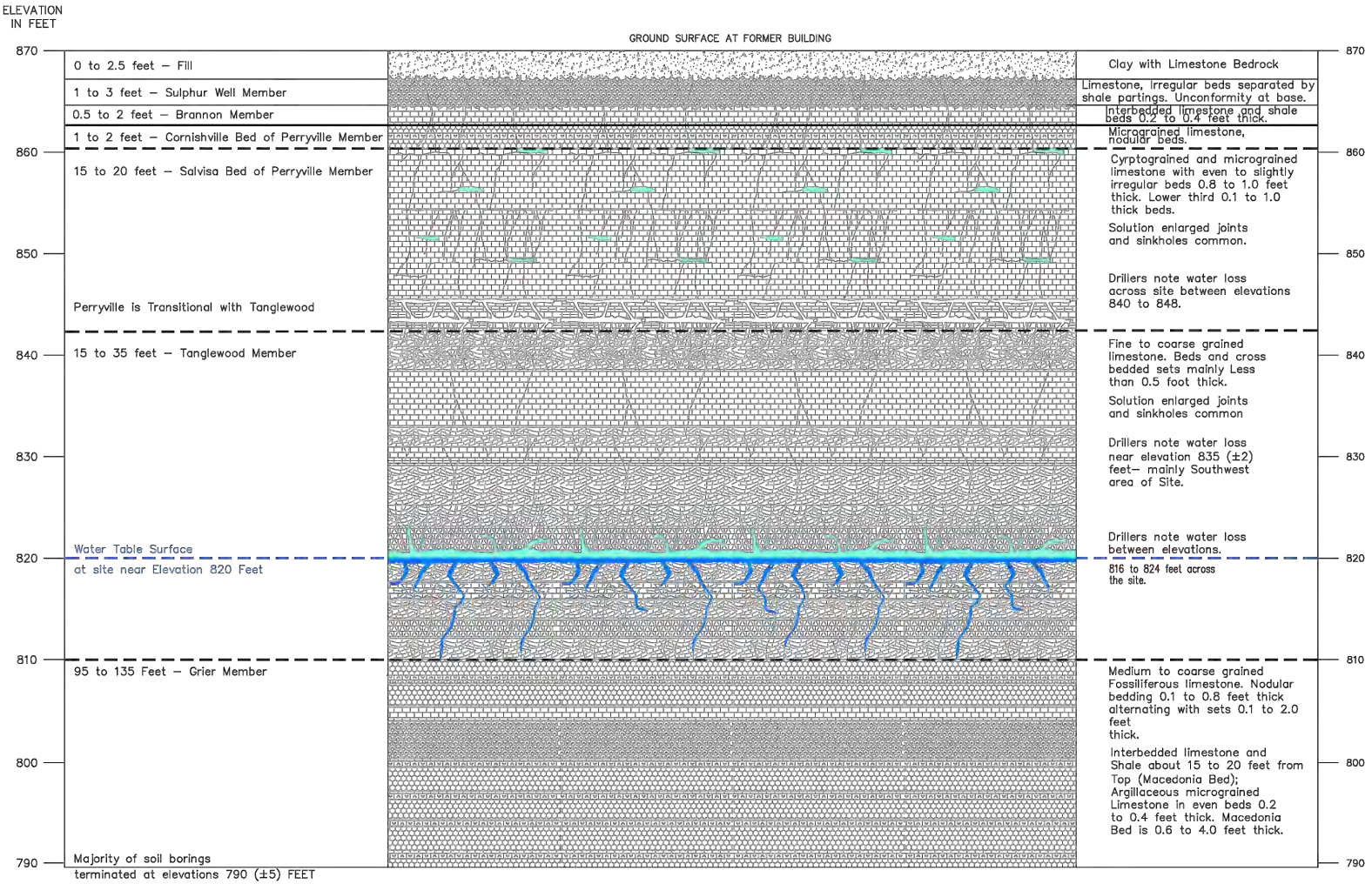
GZA-J:\ENV\150290-12.abu\FIGURES\GZA DWGS\FIG-1 SITE LOCATION MAP.dwg [FIG. 1] June 14, 2018 - 1:44pm michael.aubin

©2018– GZA GeoEnvironmental, Inc. GZA–J:\ENV\150290–16.ABU\FIGURES\150290–16_GEOLOGIC PROFILE.DWG FIGURE–2 MAY 24, 2018 CARL BERGDEN



N□□□□□

1. Lithologic description from Kentucky Geologic Survey; 1985, Stratigraphy along and adjacent to the Bluegrass Parkway and 1972 Geologic Quadrangle Map, Harrodsburg Quadrangle, Kentucky.
2. Lithologic thicknesses are based on observations at site and vicinity.
3. Fractures and voids depicted are from boring logs of wells installed for Hallmack.

□□□□ND□

- Clay Fill with pieces of Limestone
- Cross bedded Limestone
- Fossiliferous Limestone
- Fossiliferous Limestone – Irregular Beds
- Irregular Bedded Limestone
- Laminar Bedded Limestone
- Argillaceous Limestone

NO.	ISSUE/DESCRIPTION	BY	DATE

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NOTES:

1. THE BASE PLAN WAS DEVELOPED FROM AN AUTOCAD DRAWING PROVIDED BY CDP ENGINEERS, INC. ENTITLED "SITE SURVEY MAP," DATED JANUARY 22, 1996, ORIGINAL SCALE 1"=50'.
2. WATER LEVEL READINGS HAVE BEEN MADE IN THE MONITORING WELLS AND UNDER CONDITIONS STATED ON THE LOGS. THIS DATA HAS BEEN REVIEWED AND INTERPRETATIONS MADE IN THE TEXT OF THE REPORT. HOWEVER, IT MUST BE STATED THAT FLUCTUATIONS IN THE LEVEL OF THE GROUNDWATER MAY OCCUR DUE TO VARIATIONS IN RAIN FALL, PUMPING RATES, TEMPERATURE AND OTHER FACTORS DIFFERENT FROM PRESENT AT THE TIME MEASUREMENTS WERE MADE.
3. GROUNDWATER CONTOURS ARE BASED ON WIDELY SPACED EXPLORATIONS AND MAY NOT REFLECT ACTUAL SUBSURFACE CONDITIONS.
4. THE GROUNDWATER REMEDIATION (PUMPING) SYSTEM WAS TEMPORARILY SHUTDOWN ON JULY 21, 2016.

LEGEND:

- SUBJECT PROPERTY BOUNDARY
- ADJACENT PROPERTY BOUNDARY
- E — ELECTRIC LINE (OVERHEAD)
- UE — ELECTRIC LINE (UNDERGROUND)
- STREAM, CREEK, SURFACE DRAIN
- BENCH MARK
- RECOVERY WELL VAULTS
- R/W MONUMENT
- MONITORING WELL
- PIEZOMETER
- FIRE HYDRANT
- WATER VALVE
- WATER METER
- GAS METER
- GAS VALVE
- SHRUB
- TREE
- T — TELEPHONE LINE (OVERHEAD)
- UT — TELEPHONE LINE (UNDERGROUND)
- FENCE LINE
- UP — PROC. PIPELINES (UNDERGROUND)
- UTILITY POLE
- UTIL. POLE w/ LIGHT
- UTILITY BOX (E-ELEC, T-TELE, TV-TELEV)
- LIGHT POLE
- GUY POLE
- SAN. MANHOLE
- STM. MANHOLE
- CATCH BASIN
- HEADWALL
- STREET SIGN
- WELL INSTALLED IN JUNE 2007
- CLOSED IMPOUNDMENTS
- 820.86 — GROUNDWATER ELEVATION (IN FEET) RECORDED ON 9/17/2017
- GROUNDWATER CONTOUR (IN FEET) RECORDED ON 9/17/2017

SCALE IN FEET
0' 50' 100' 200'

GZA GeoEnvironmental, Inc.

REV#	DESCRIPTION	BY	DATE

PROJ. MGR. ABU
CHK'D BY: ABU
REV'D BY: MAP
DRAWN BY: CRB
SCALE: 1"=50'
DATE: 5/24/2018

FORMER HALLMACK FACILITY
HARRODSBURG, KENTUCKY

GROUNDWATER CONTOUR PLAN 09/17/2017

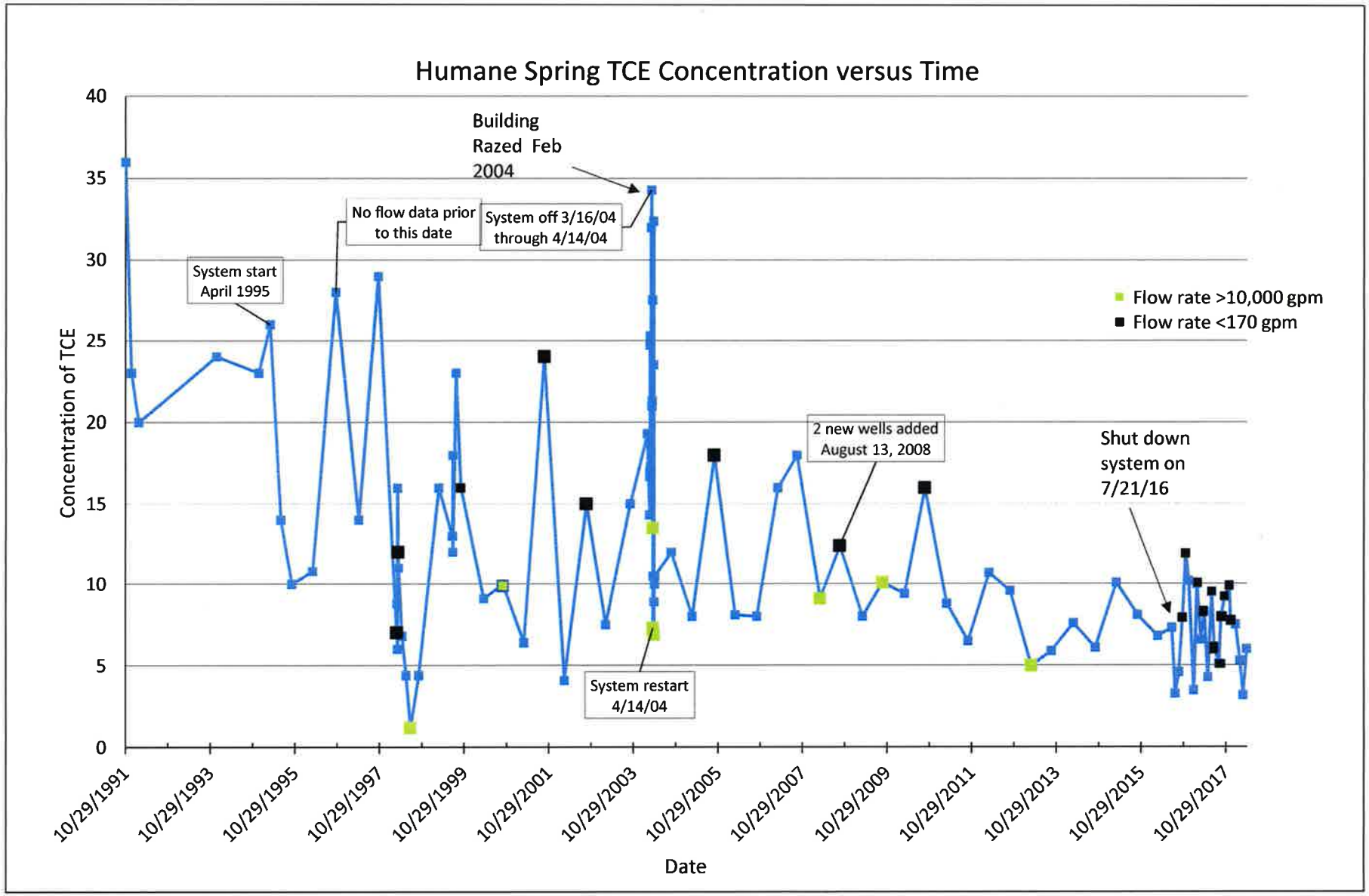
PROJECT NO.
150290.16

FIGURE NO.
3

© 2018 GZA GeoEnvironmental, Inc. GZA DRAWING PATH – J:\CNN\150290-16.cnn\FIGURES\150290-16_GWC.dwg [09-17-2017] FIGURE-3] Last Modified: May 24, 2018 – 9:57am Plotted on: May 24, 2018 – 9:58am by cardwright

APPENDIX A

PLOT OF TCE CONCENTRATION AT HUMANE SPRING

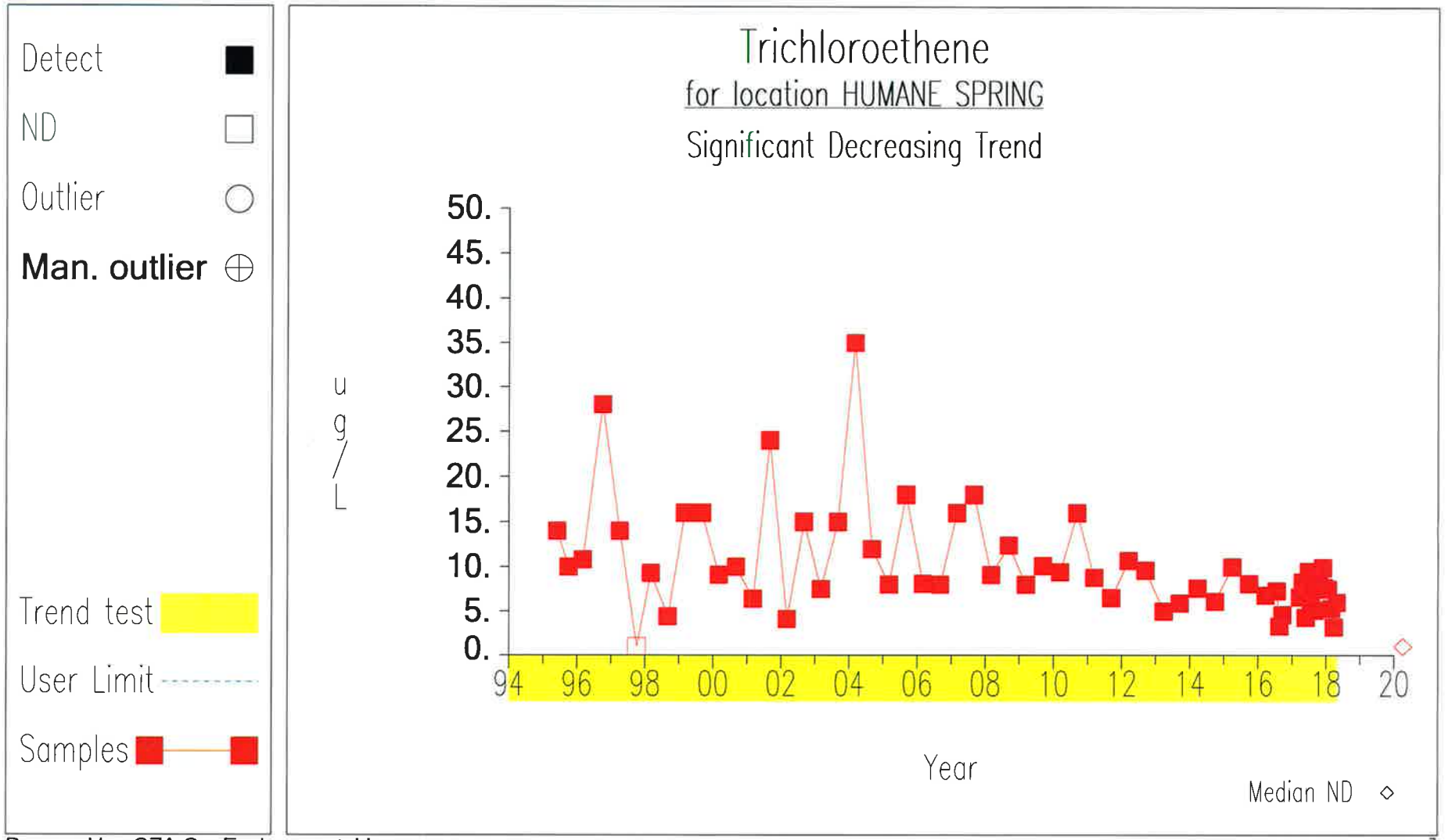

Humane Spring TCE Concentration versus Time
Concentration of TCE
Date
40
35
30
25
20
15
10
5
0
10/29/1991
10/29/1993
10/29/1995
10/29/1997
10/29/1999
10/29/2001
10/29/2003
10/29/2005
10/29/2007
10/29/2009
10/29/2011
10/29/2013
10/29/2015
10/29/2017
Building Razed Feb 2004
No flow data prior to this date
System off 3/16/04 through 4/14/04
System start April 1995
2 new wells added August 13, 2008
Shut down system on 7/21/16
System restart 4/14/04
Flow rate >10,000 gpm
Flow rate <170 gpm

APPENDIX B

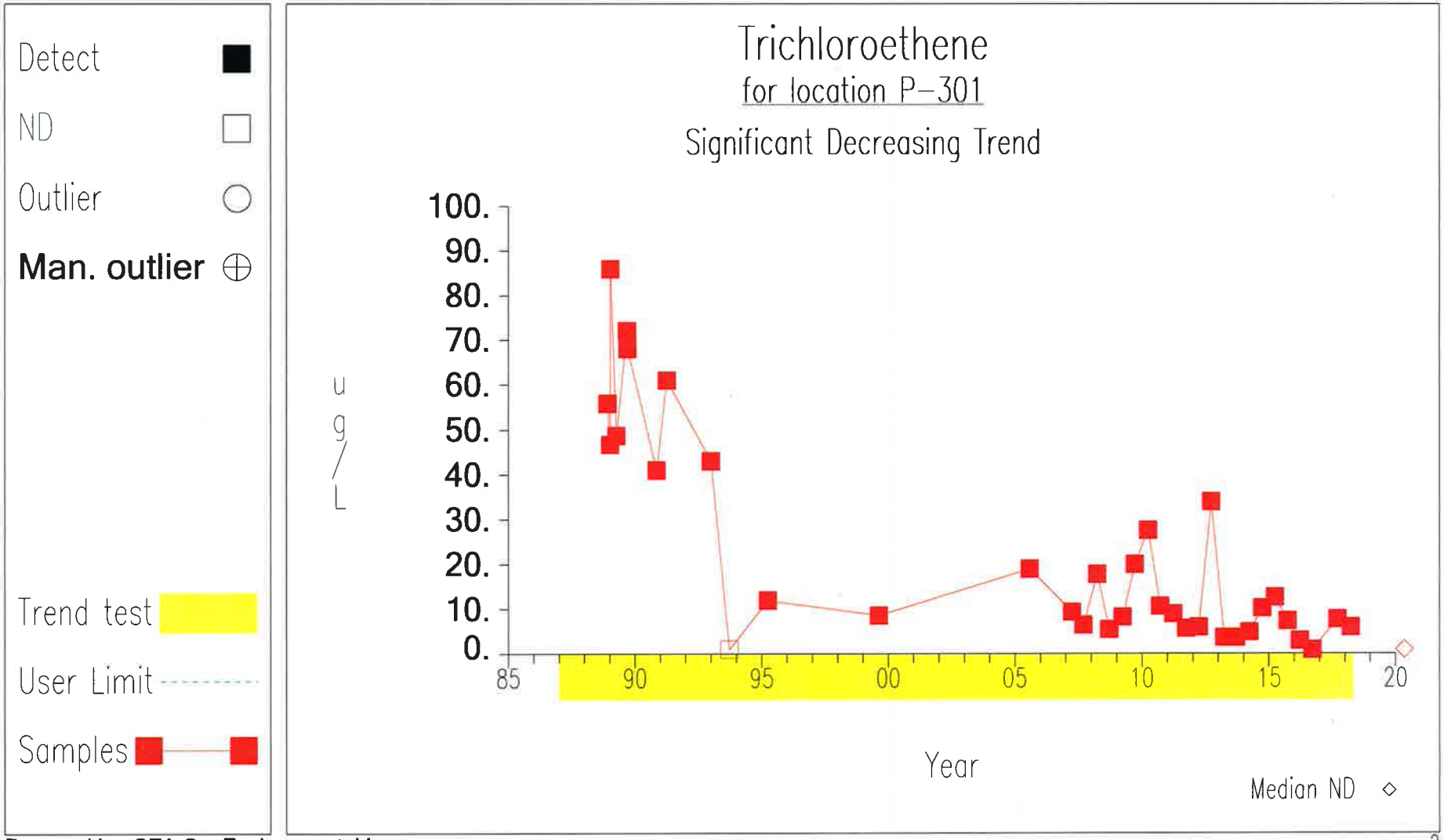
STATISTICAL ANALYSIS FOR TRENDS

Analysis prepared on: 5/14/2018

Time Series

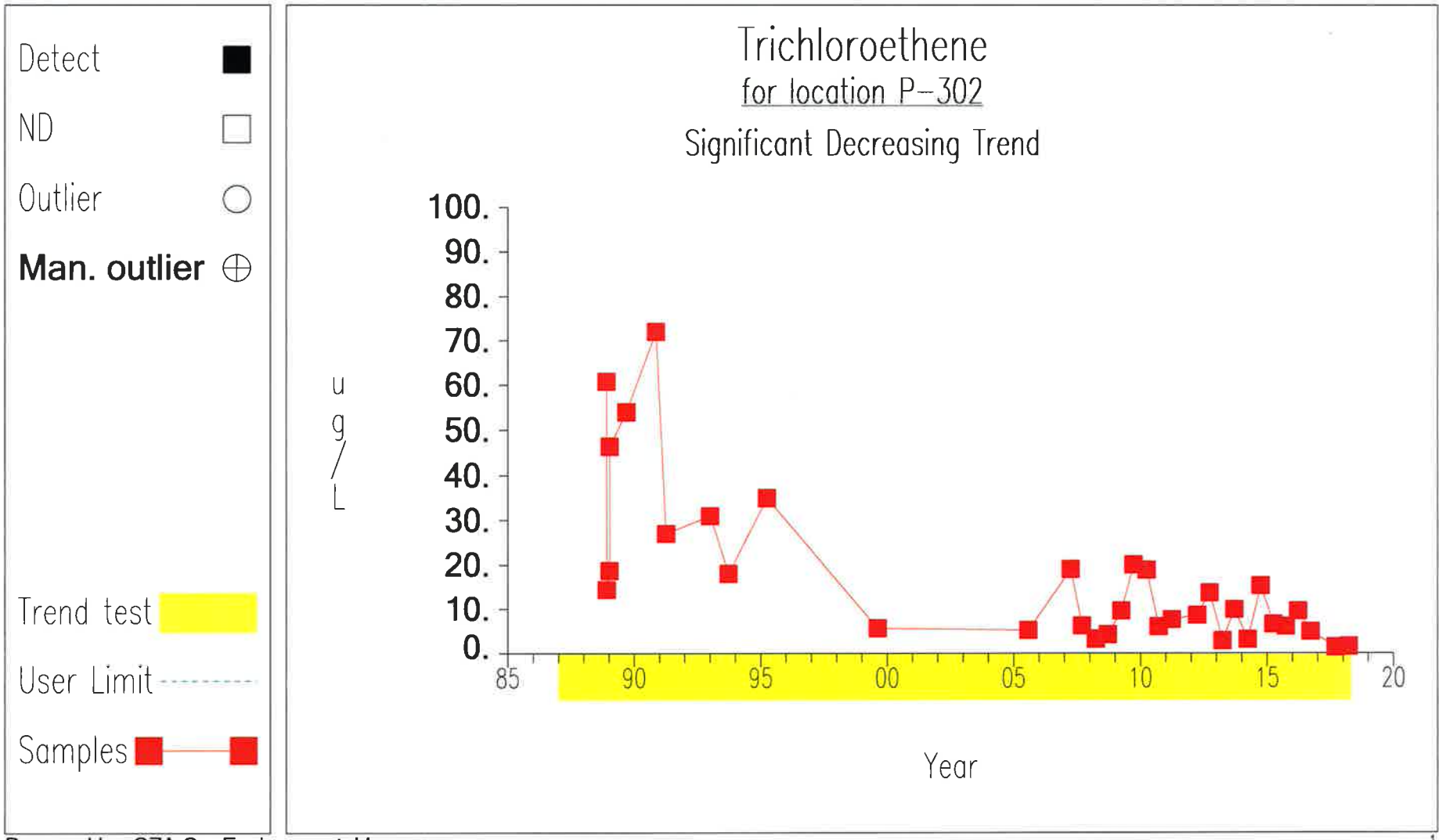


Time Series

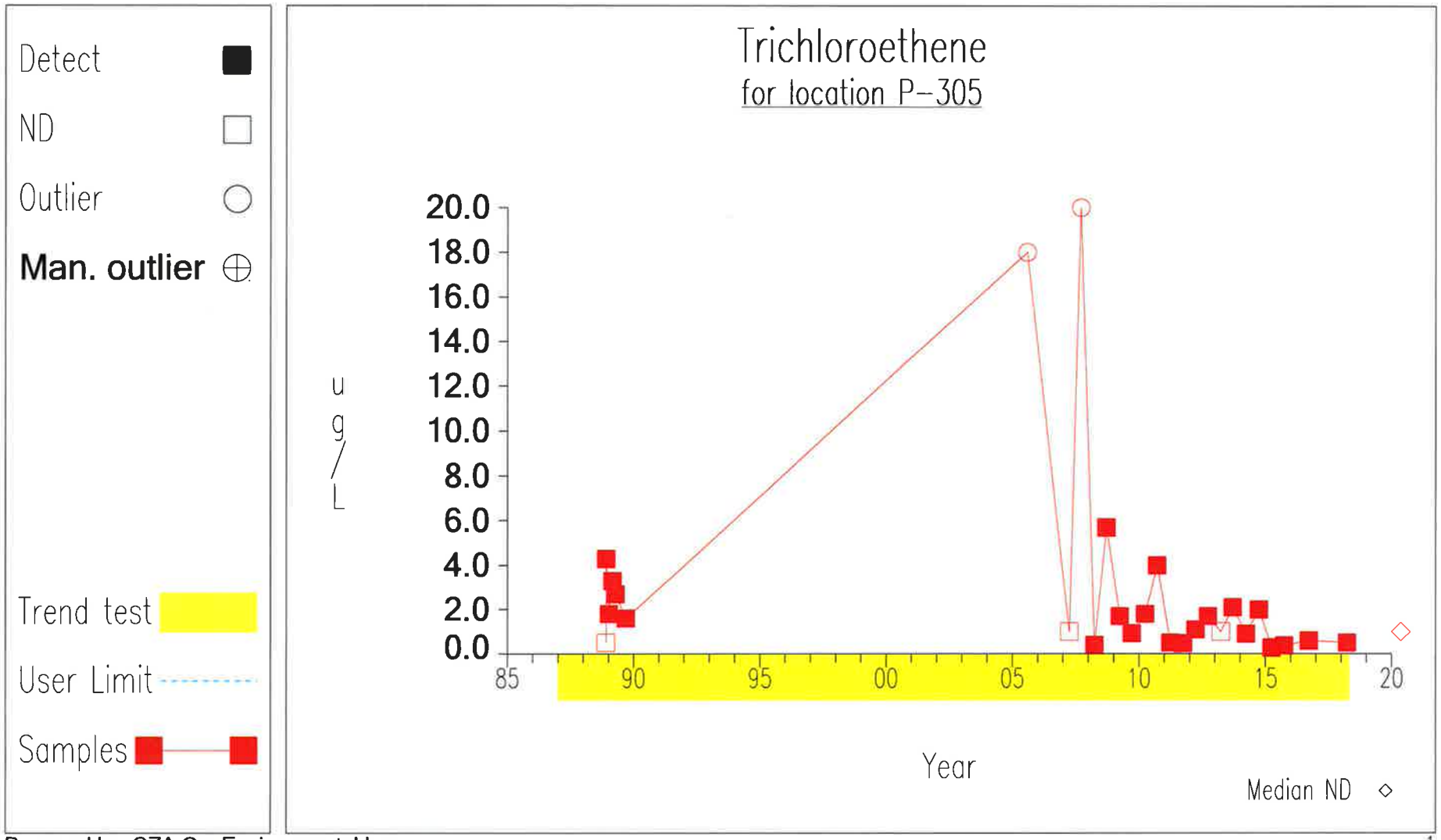


Prepared by: GZA GeoEnvironmental Inc.

Time Series

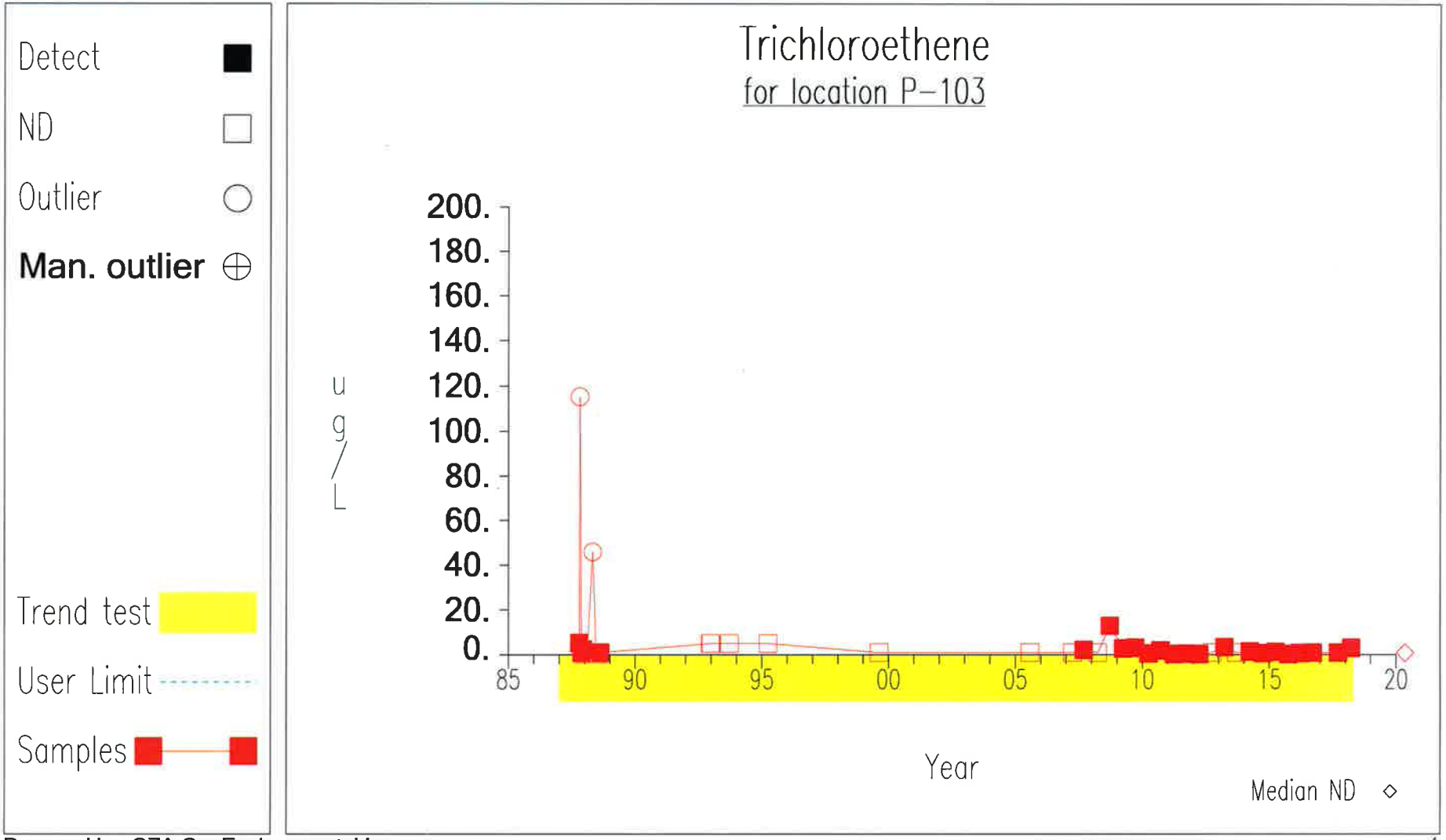

Detect
ND
Outlier
Man. outlier
Trend test
User Limit
Samples
Trichloroethene
for location P-302
Significant Decreasing Trend
ug/L
100.
90.
80.
70.
60.
50.
40.
30.
20.
10.
0.
85
90
95
00
05
10
15
20
Year

Time Series



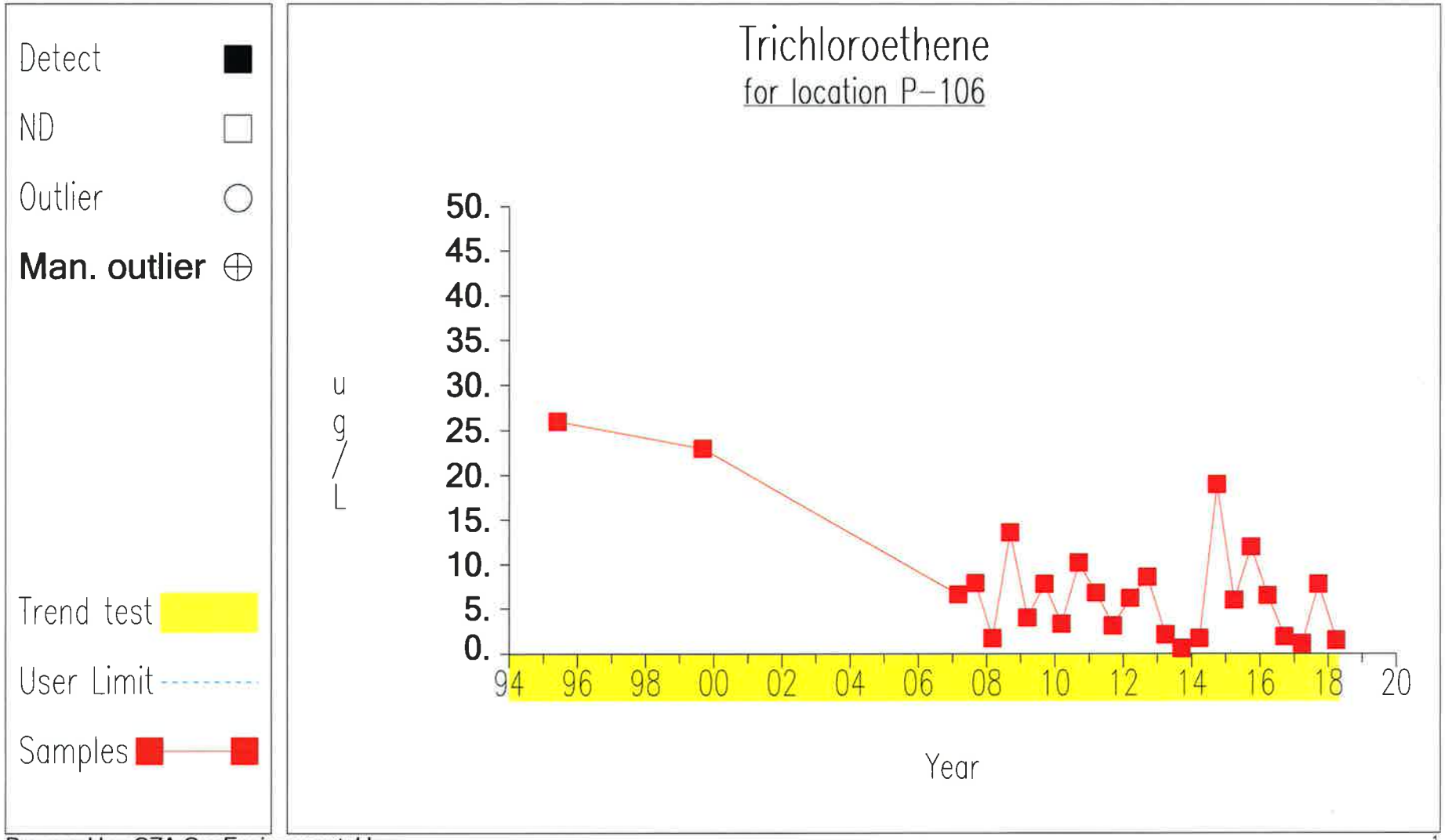
Prepared by: GZA GeoEnvironmental Inc.

Time Series



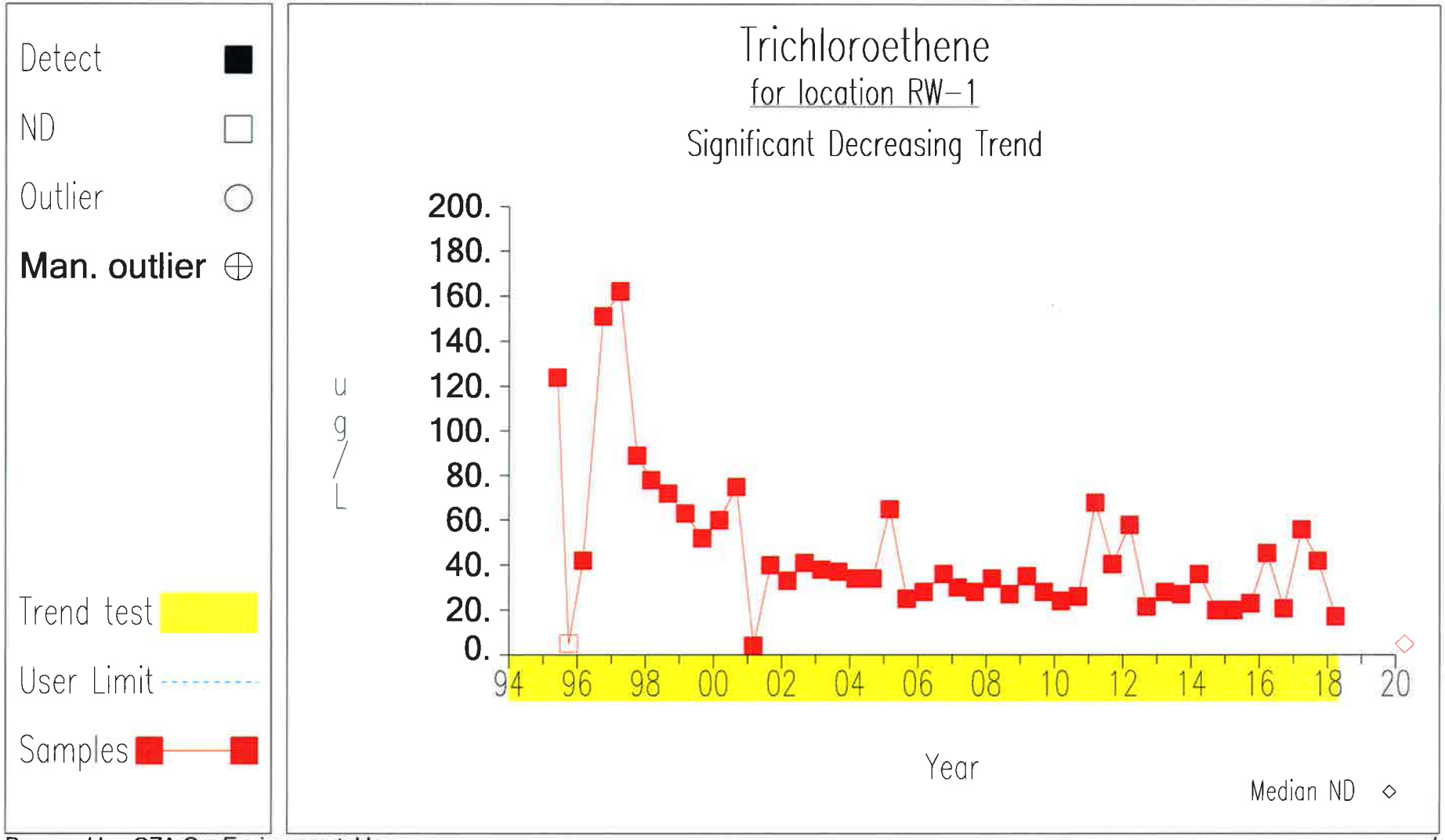
Prepared by: GZA GeoEnvironmental Inc.

Time Series

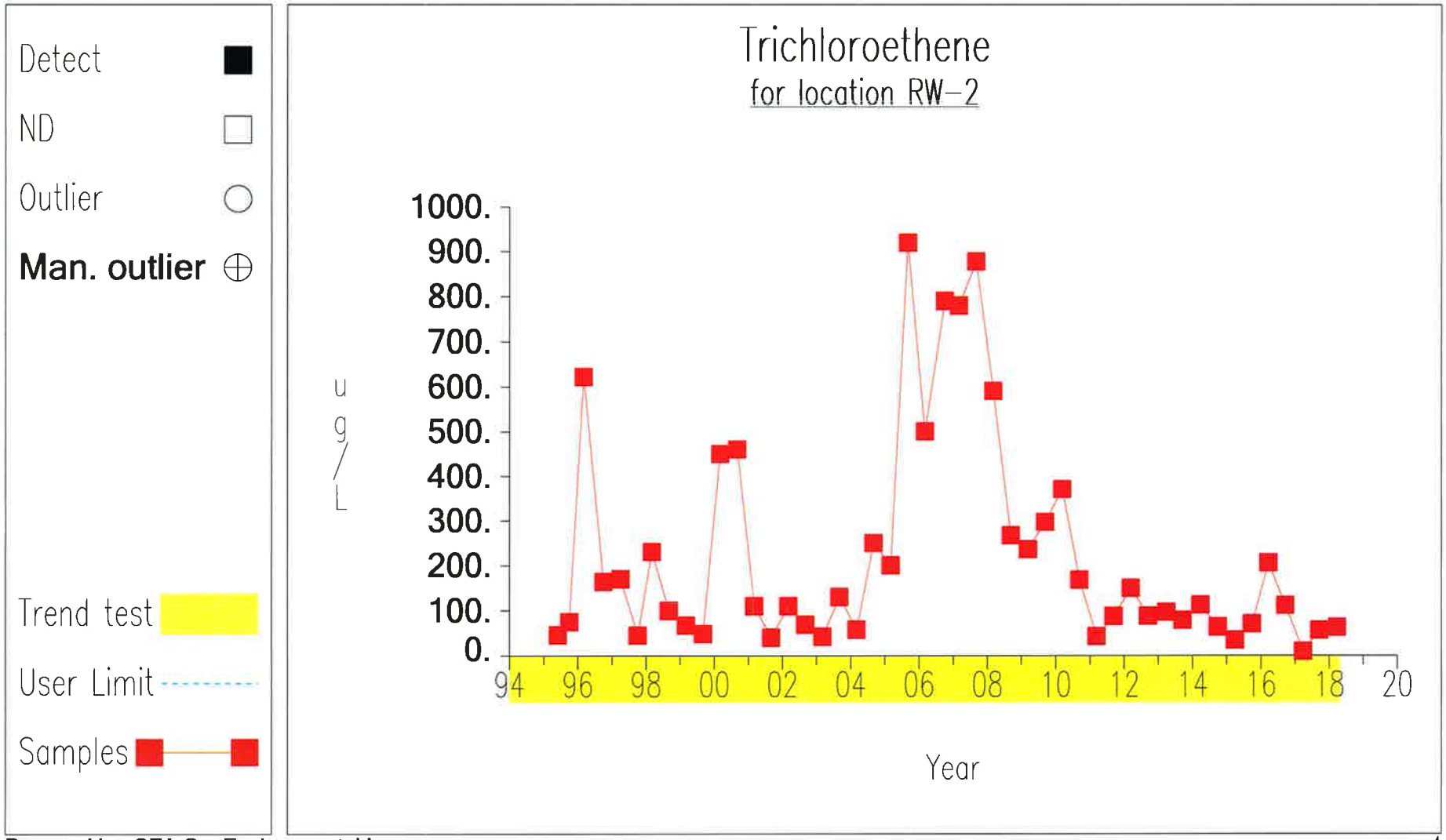


Prepared by: GZA GeoEnvironmental Inc.

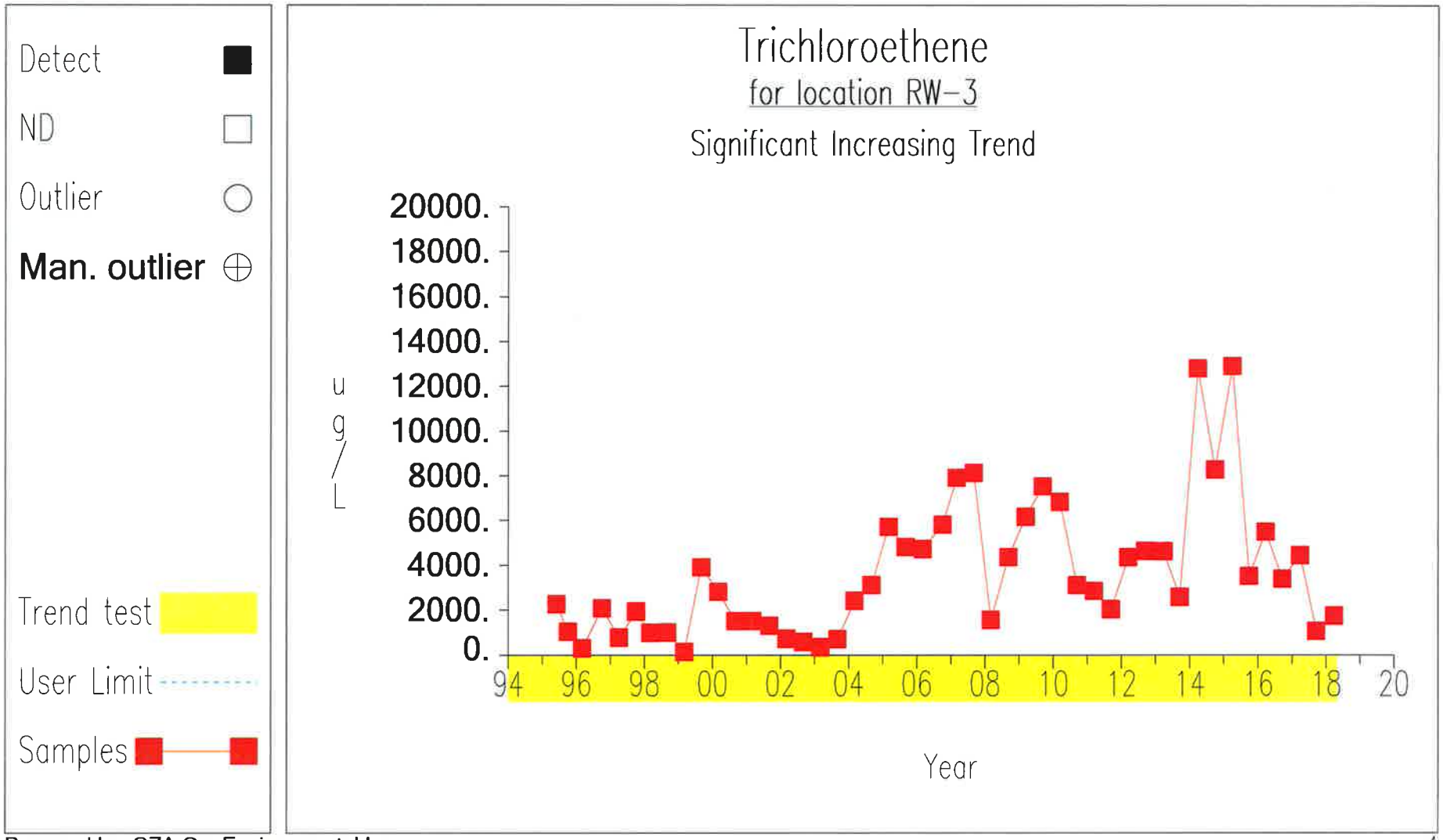
Time Series


Detect
ND
Outlier
Man. outlier
Trend test
User Limit
Samples
Trichloroethene
for location RW-1
Significant Decreasing Trend
ug/L
200.
180.
160.
140.
120.
100.
80.
60.
40.
20.
0.
94
96
98
00
02
04
06
08
10
12
14
16
18
20
Year
Median ND

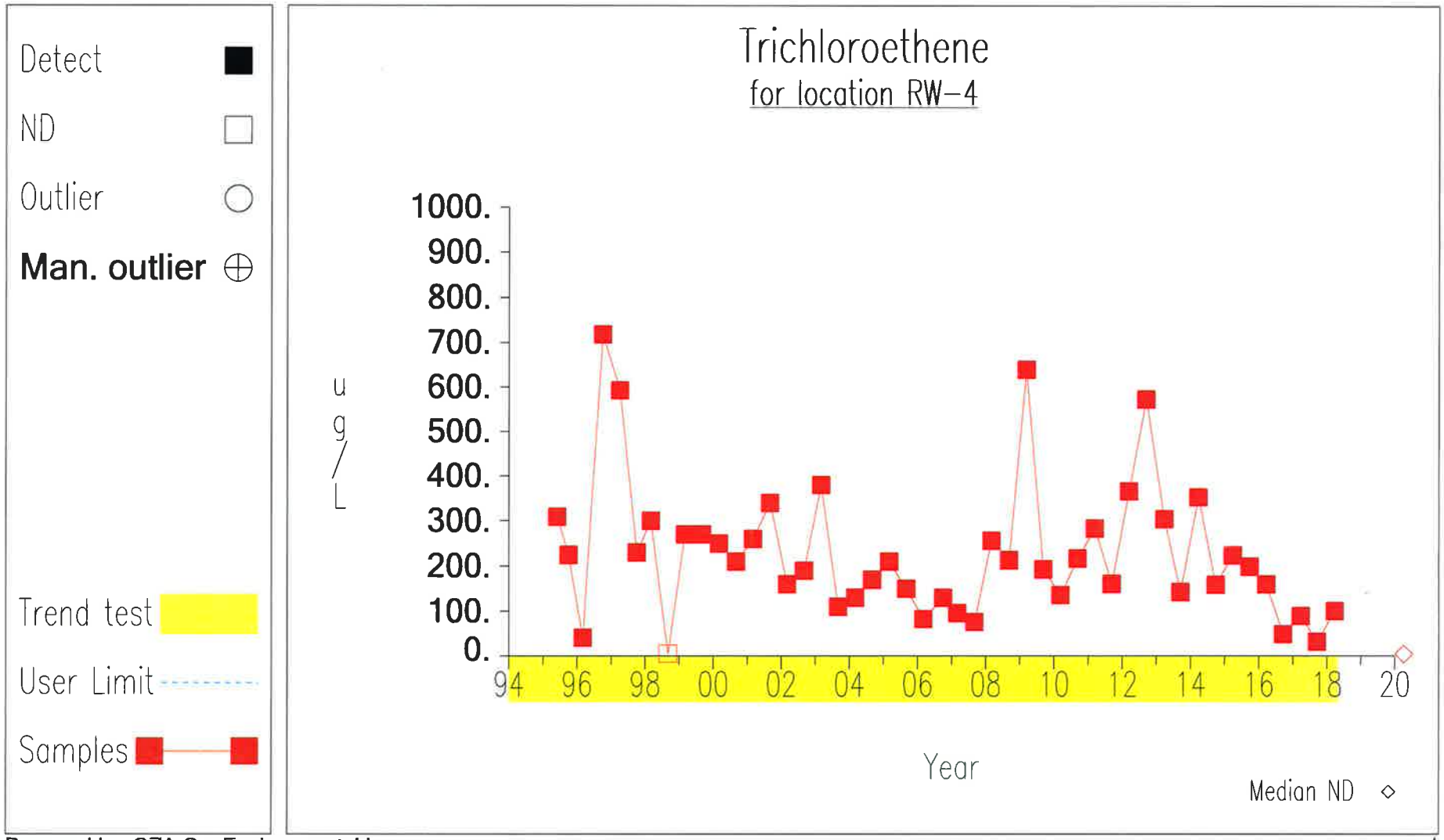
Time Series


Detect
ND
Outlier
Man. outlier
Trend test
User Limit
Samples
Trichloroethene
for location RW-2
1000.
900.
800.
700.
600.
500.
400.
300.
200.
100.
0.
ug/L
94
96
98
00
02
04
06
08
10
12
14
16
18
20
Year

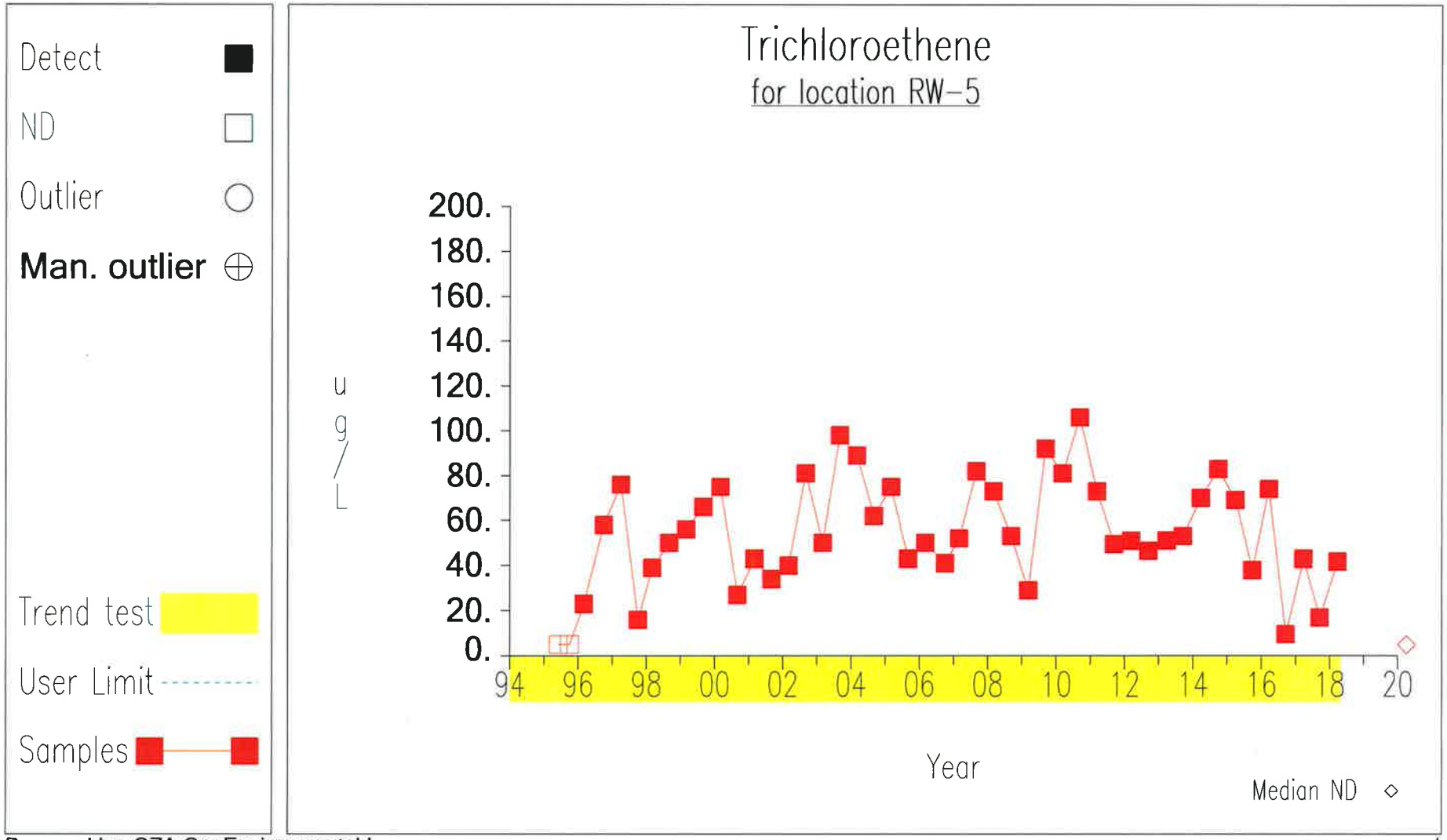
Time Series


Detect
ND
Outlier
Man. outlier
Trend test
User Limit
Samples
Trichloroethene
for location RW-3
Significant Increasing Trend
ug/L
20000.
18000.
16000.
14000.
12000.
10000.
8000.
6000.
4000.
2000.
0.
94
96
98
00
02
04
06
08
10
12
14
16
18
20
Year

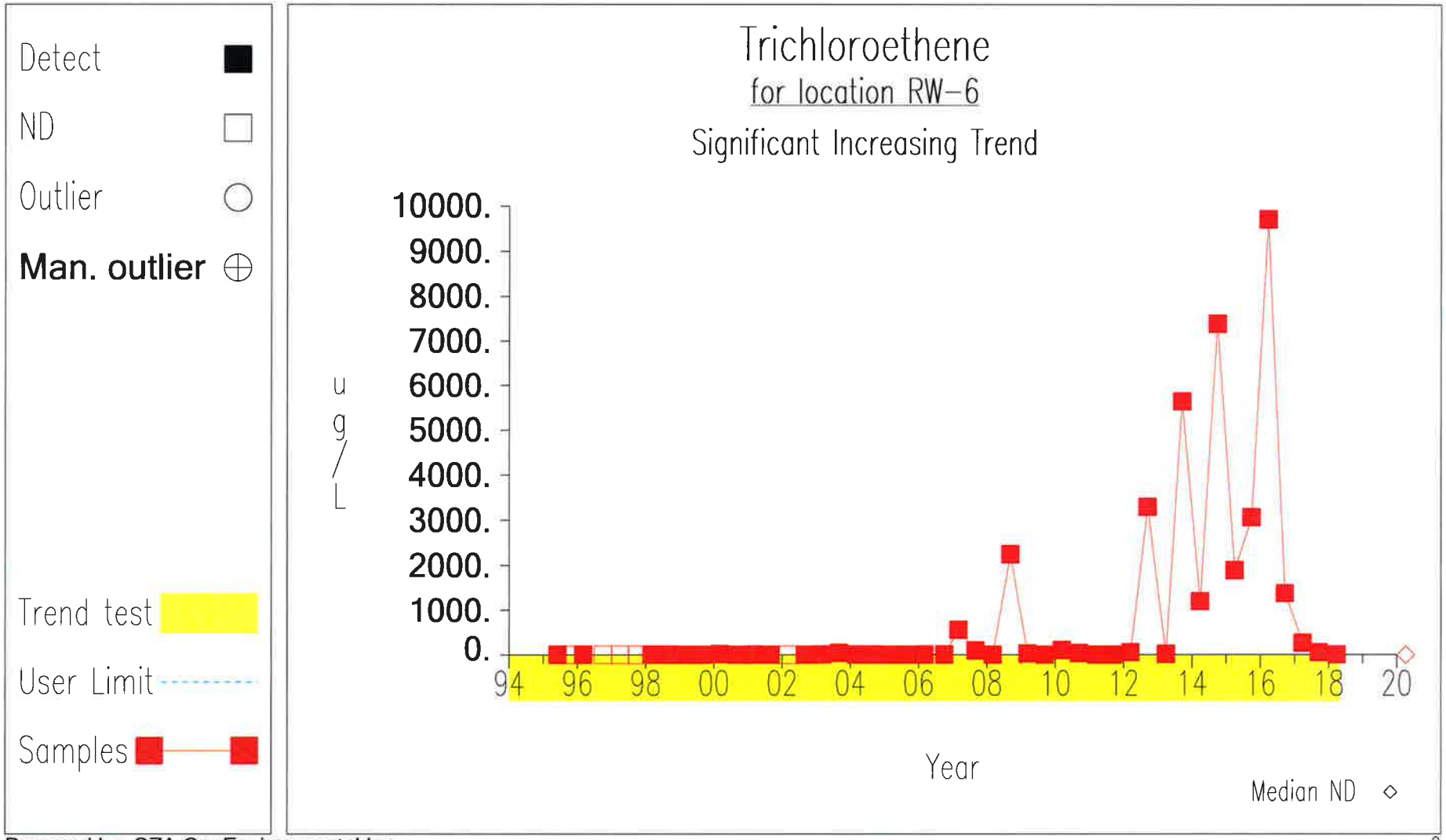
Time Series


Detect
ND
Outlier
Man. outlier
Trend test
User Limit
Samples
Trichloroethene
for location RW-4
1000.
900.
800.
700.
600.
500.
400.
300.
200.
100.
0.
u g / L
94
96
98
00
02
04
06
08
10
12
14
16
18
20
Year
Median ND

Time Series

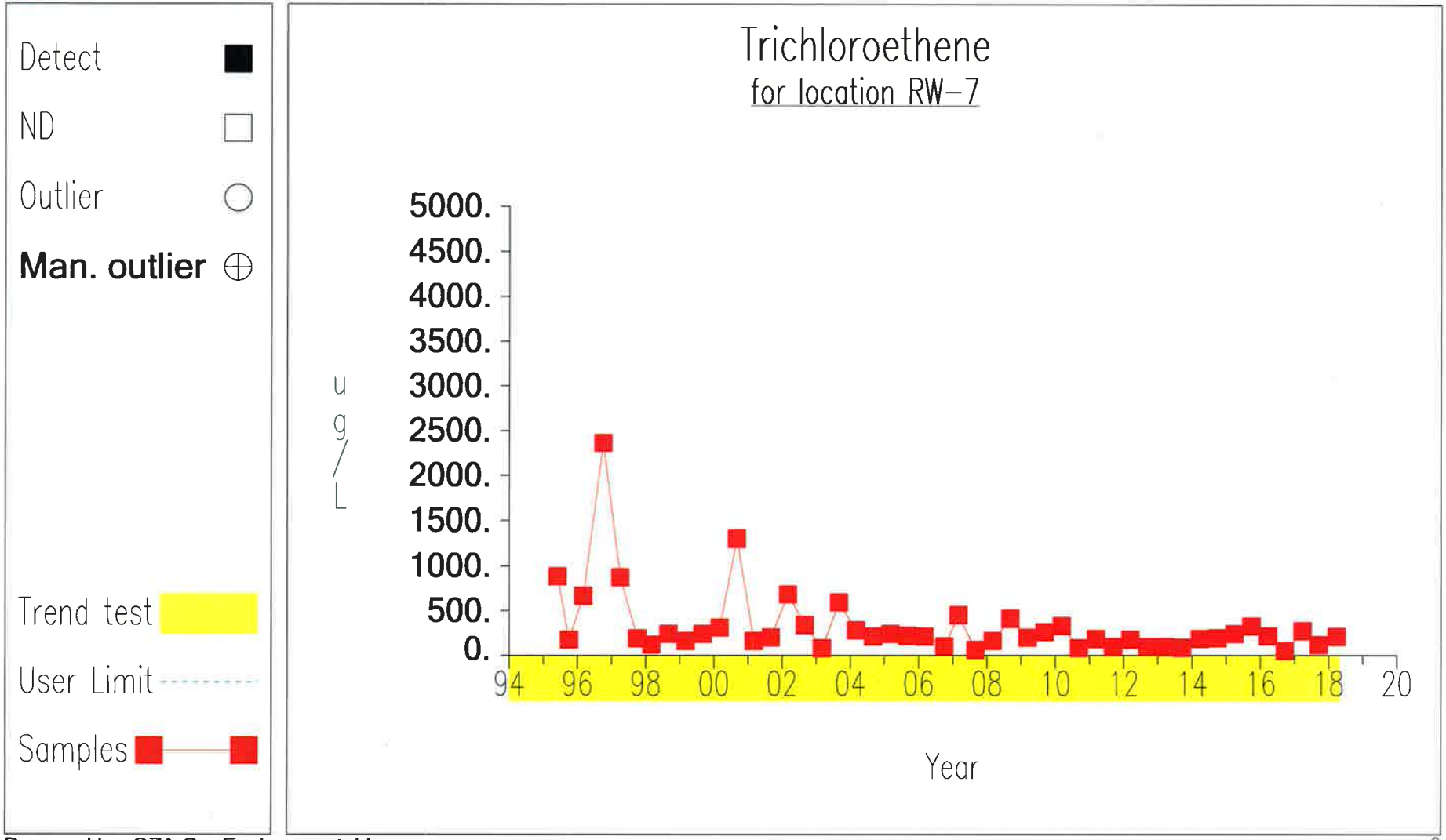

Detect
ND
Outlier
Man. outlier
Trend test
User Limit
Samples
Trichloroethene
for location RW-5
u g / L
200.
180.
160.
140.
120.
100.
80.
60.
40.
20.
0.
94
96
98
00
02
04
06
08
10
12
14
16
18
20
Year
Median ND

Time Series

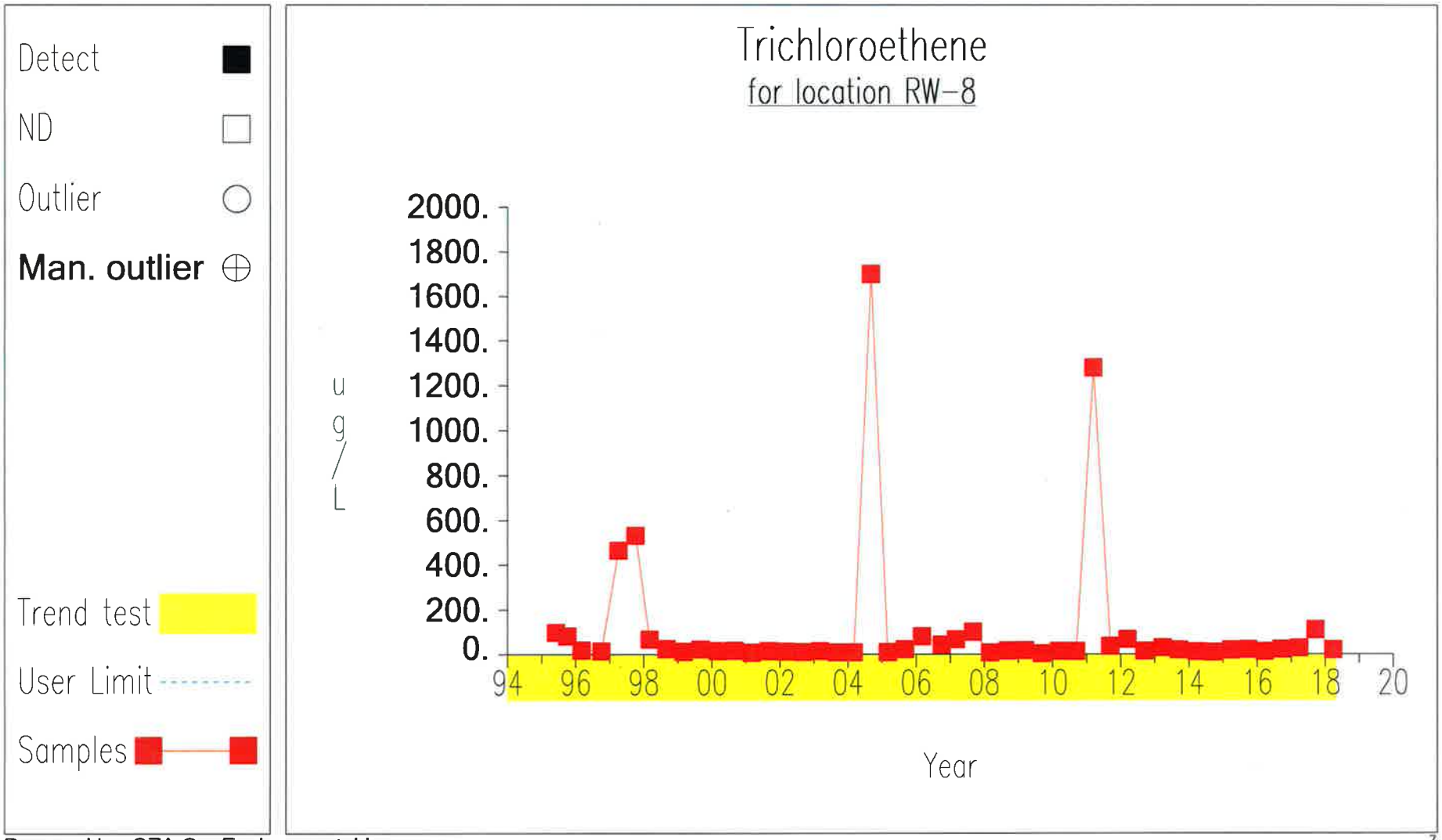


Prepared by: GZA GeoEnvironmental Inc.

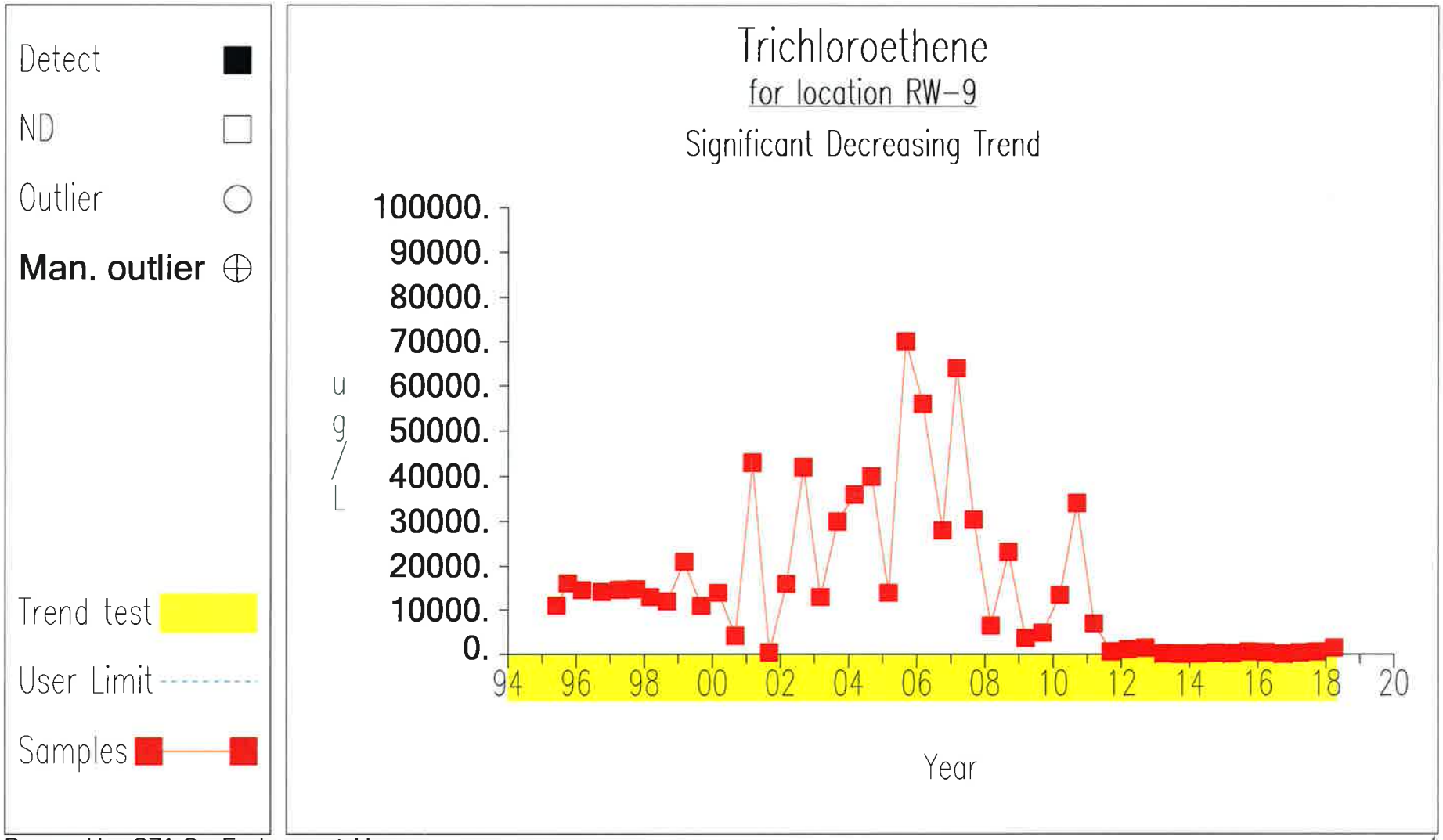
Time Series


Detect
ND
Outlier
Man. outlier
Trend test
User Limit
Samples
Trichloroethene
for location RW-7
5000.
4500.
4000.
3500.
3000.
2500.
2000.
1500.
1000.
500.
0.
ug/L
94
96
98
00
02
04
06
08
10
12
14
16
18
20
Year

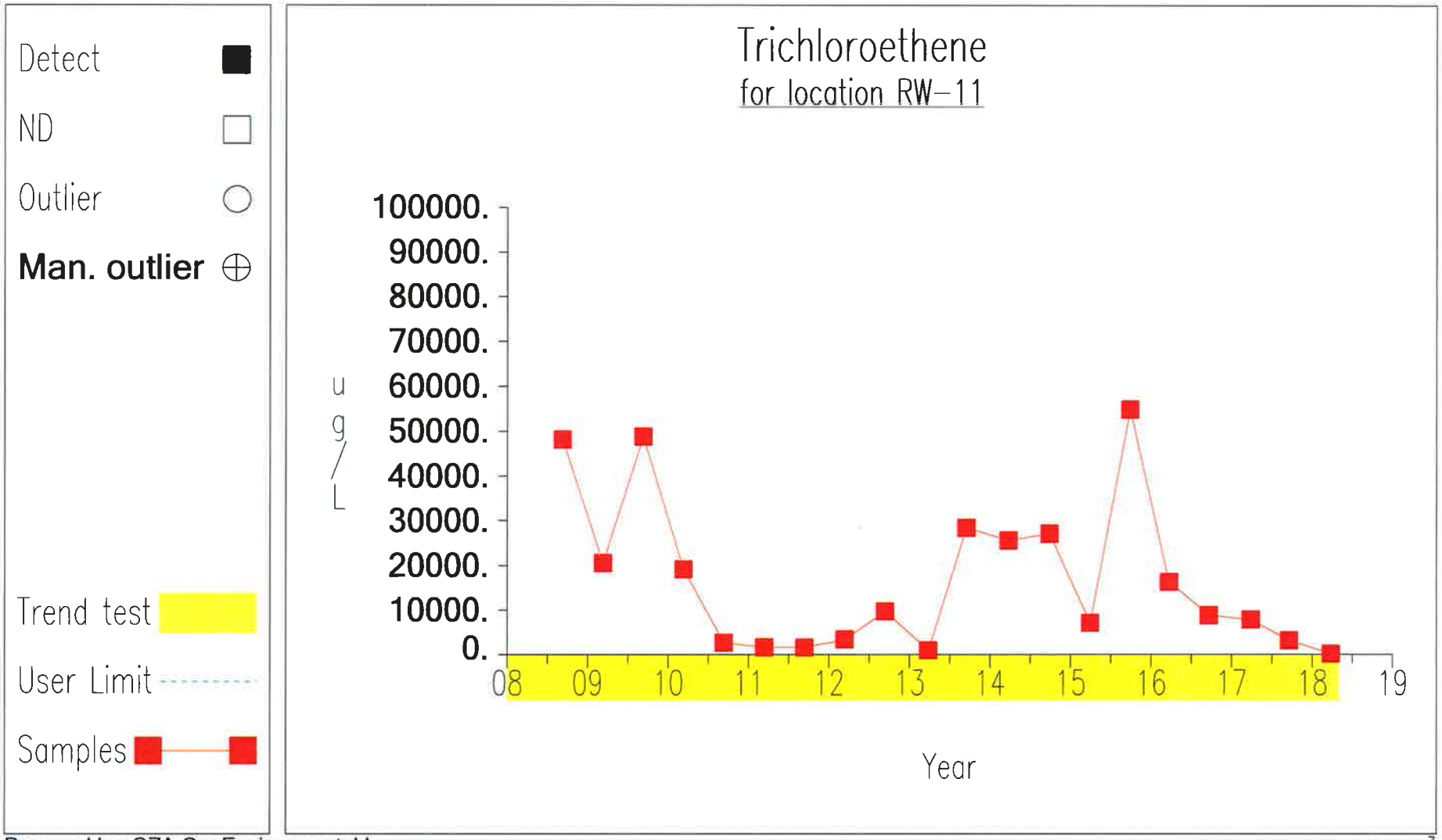
Time Series


Detect
ND
Outlier
Man. outlier
Trend test
User Limit
Samples
Trichloroethene
for location RW-8
ug/L
2000.
1800.
1600.
1400.
1200.
1000.
800.
600.
400.
200.
0.
94
96
98
00
02
04
06
08
10
12
14
16
18
20
Year

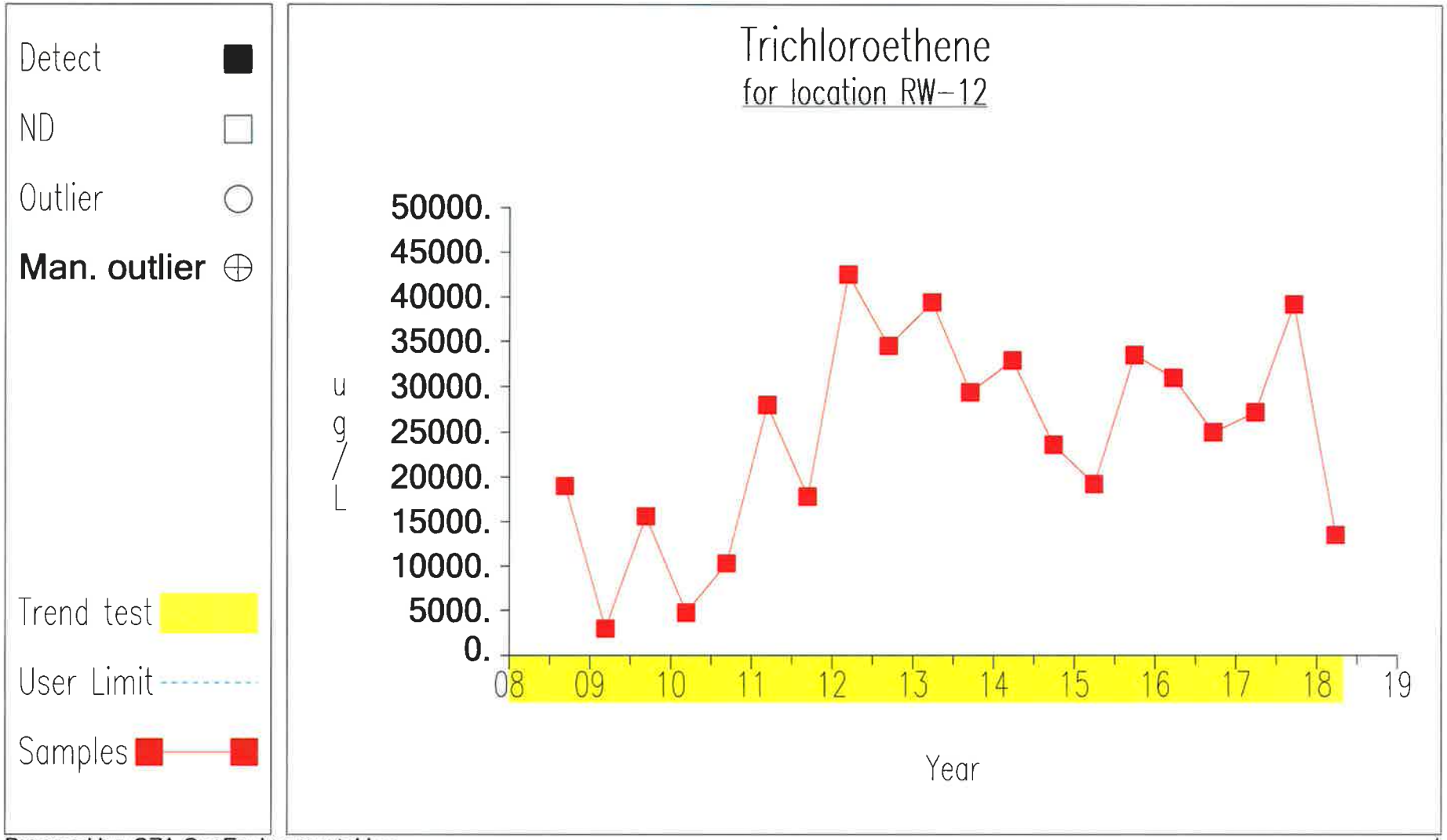
Time Series


Detect
ND
Outlier
Man. outlier
Trend test
User Limit
Samples
Trichloroethene
for location RW-9
Significant Decreasing Trend
100000.
90000.
80000.
70000.
60000.
50000.
40000.
30000.
20000.
10000.
0.
ug/L
94
96
98
00
02
04
06
08
10
12
14
16
18
20
Year

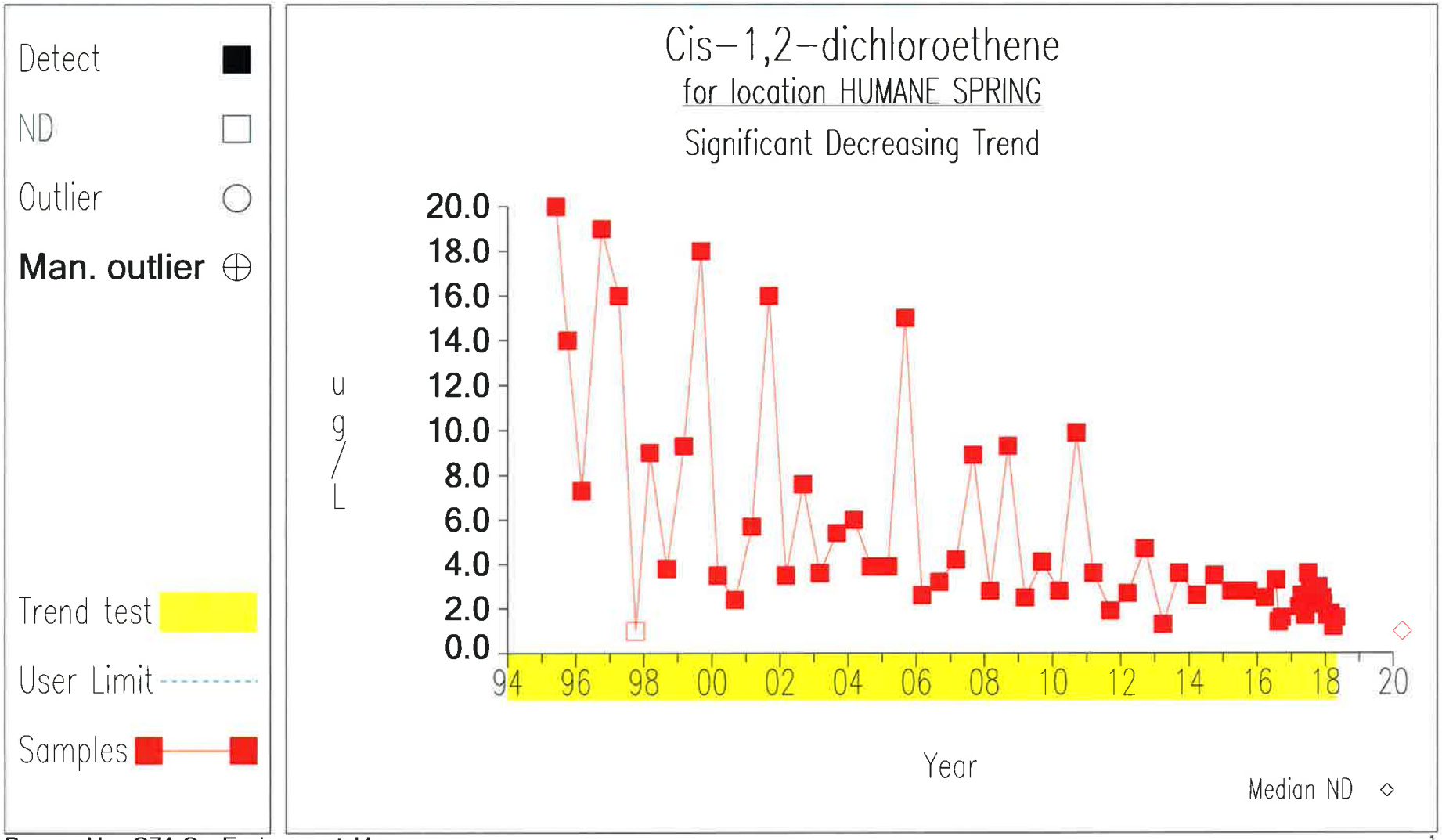
Time Series


Detect
ND
Outlier
Man. outlier
Trend test
User Limit
Samples
Trichloroethene
for location RW-11
100000.
90000.
80000.
70000.
60000.
50000.
40000.
30000.
20000.
10000.
0.
ug/L
08
09
10
11
12
13
14
15
16
17
18
19
Year

Time Series

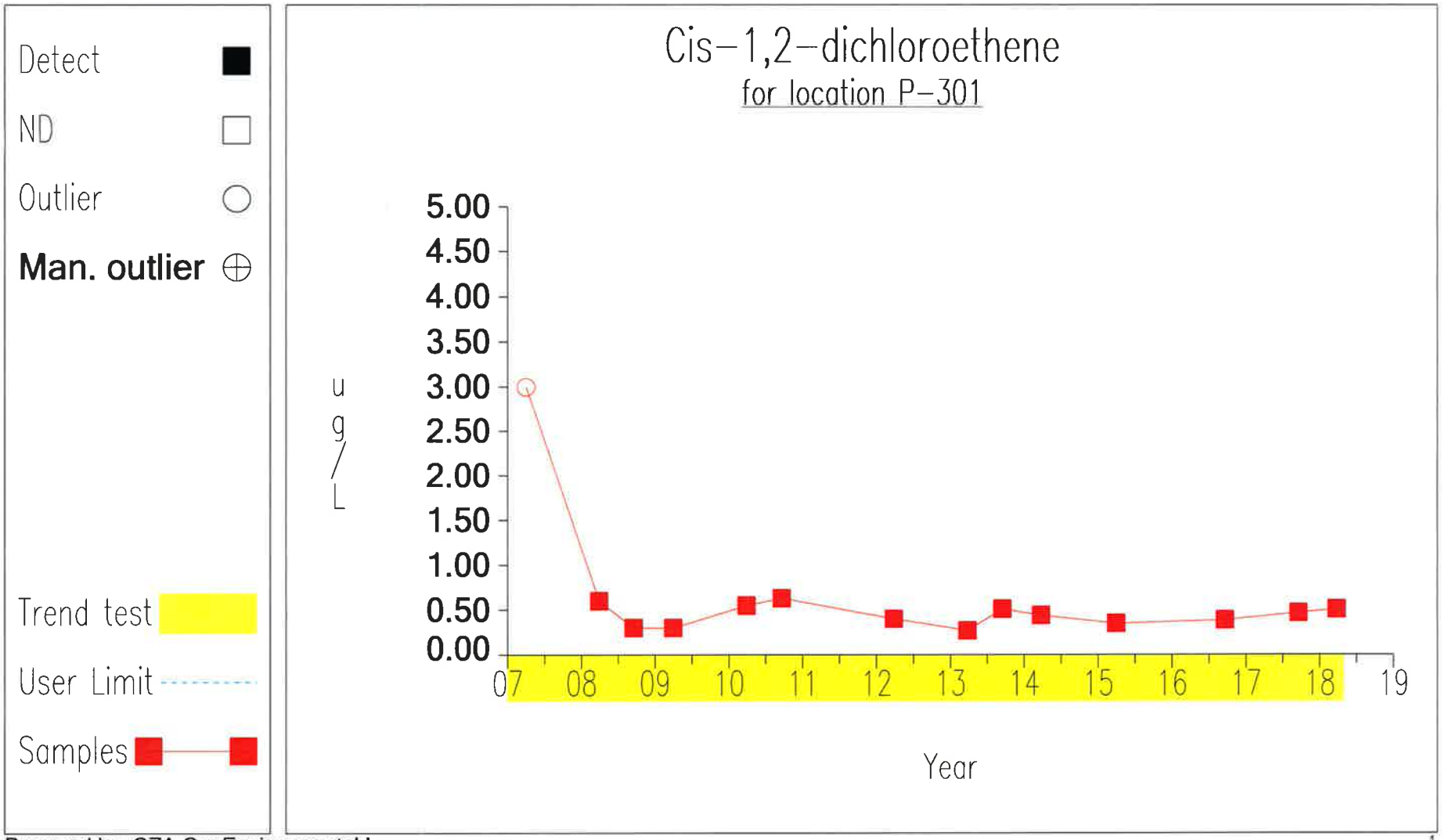

Detect
ND
Outlier
Man. outlier
Trend test
User Limit
Samples
Trichloroethene
for location RW-12
50000.
45000.
40000.
35000.
30000.
25000.
20000.
15000.
10000.
5000.
0.
ug/L
08
09
10
11
12
13
14
15
16
17
18
19
Year

Time Series

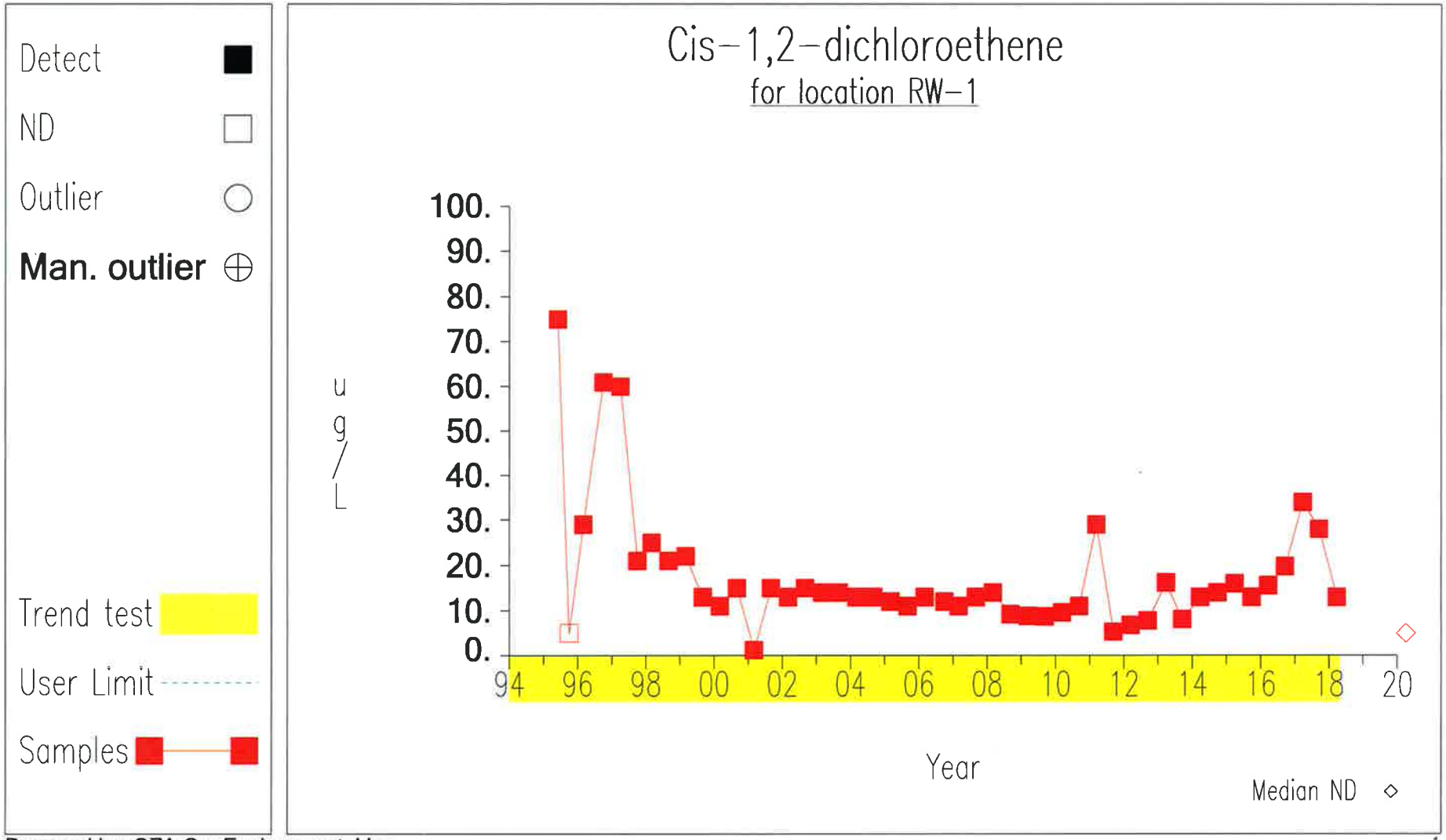


Prepared by: GZA GeoEnvironmental Inc.

Time Series

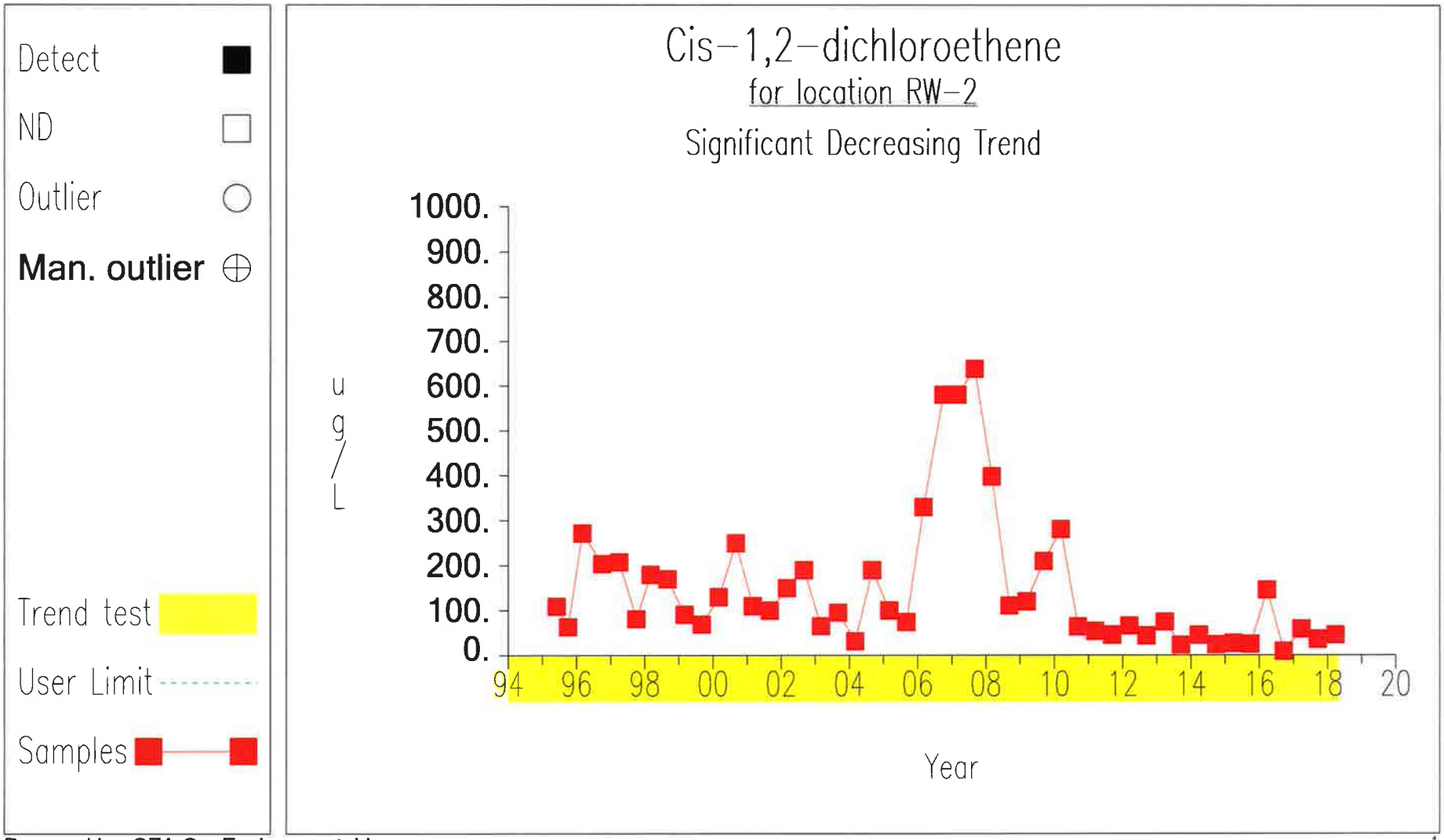

Detect
ND
Outlier
Man. outlier
Trend test
User Limit
Samples
Cis-1,2-dichloroethene
for location P-301
ug/L
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
07
08
09
10
11
12
13
14
15
16
17
18
19
Year

Time Series



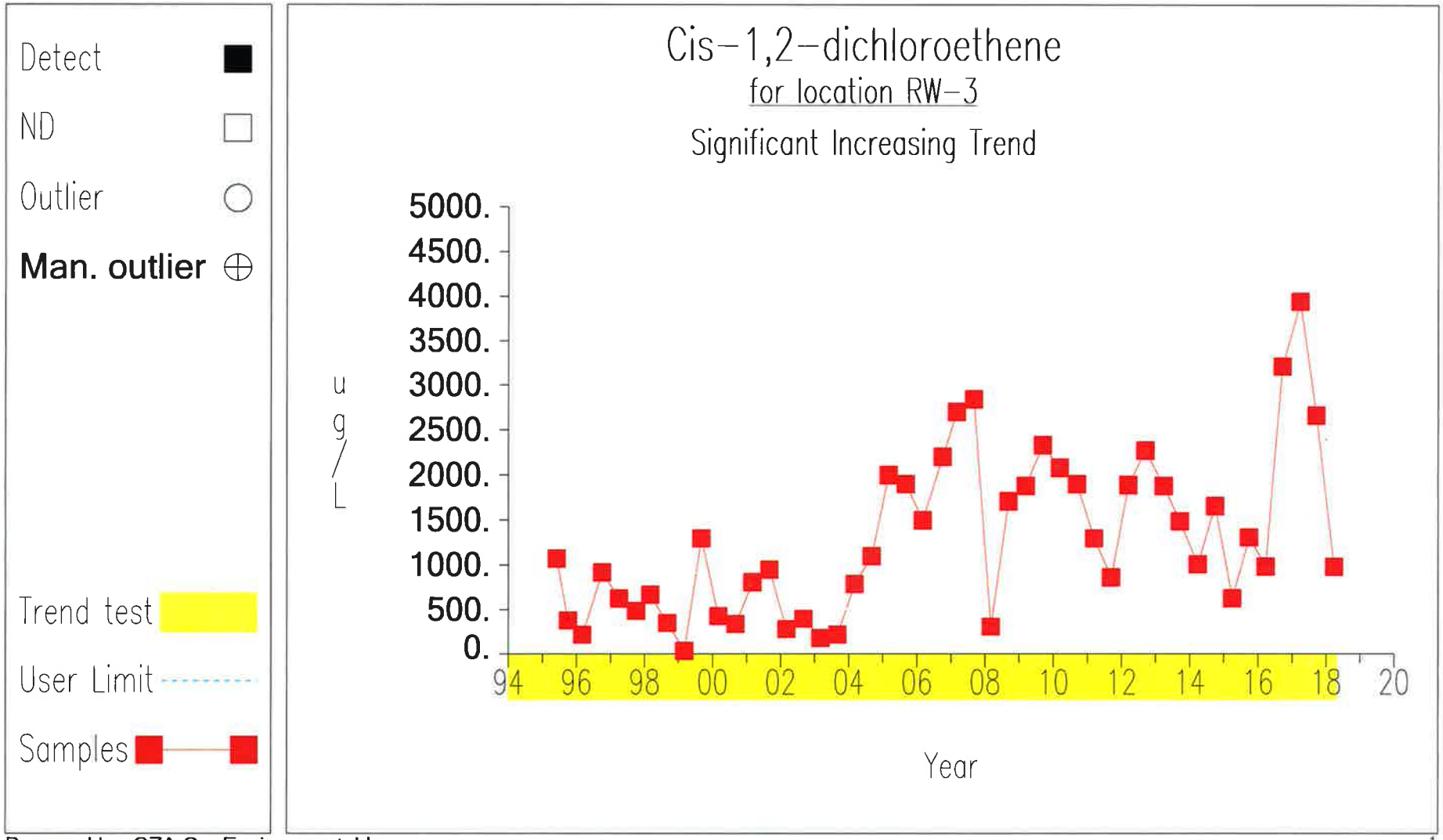
Prepared by: GZA GeoEnvironmental Inc.

Time Series



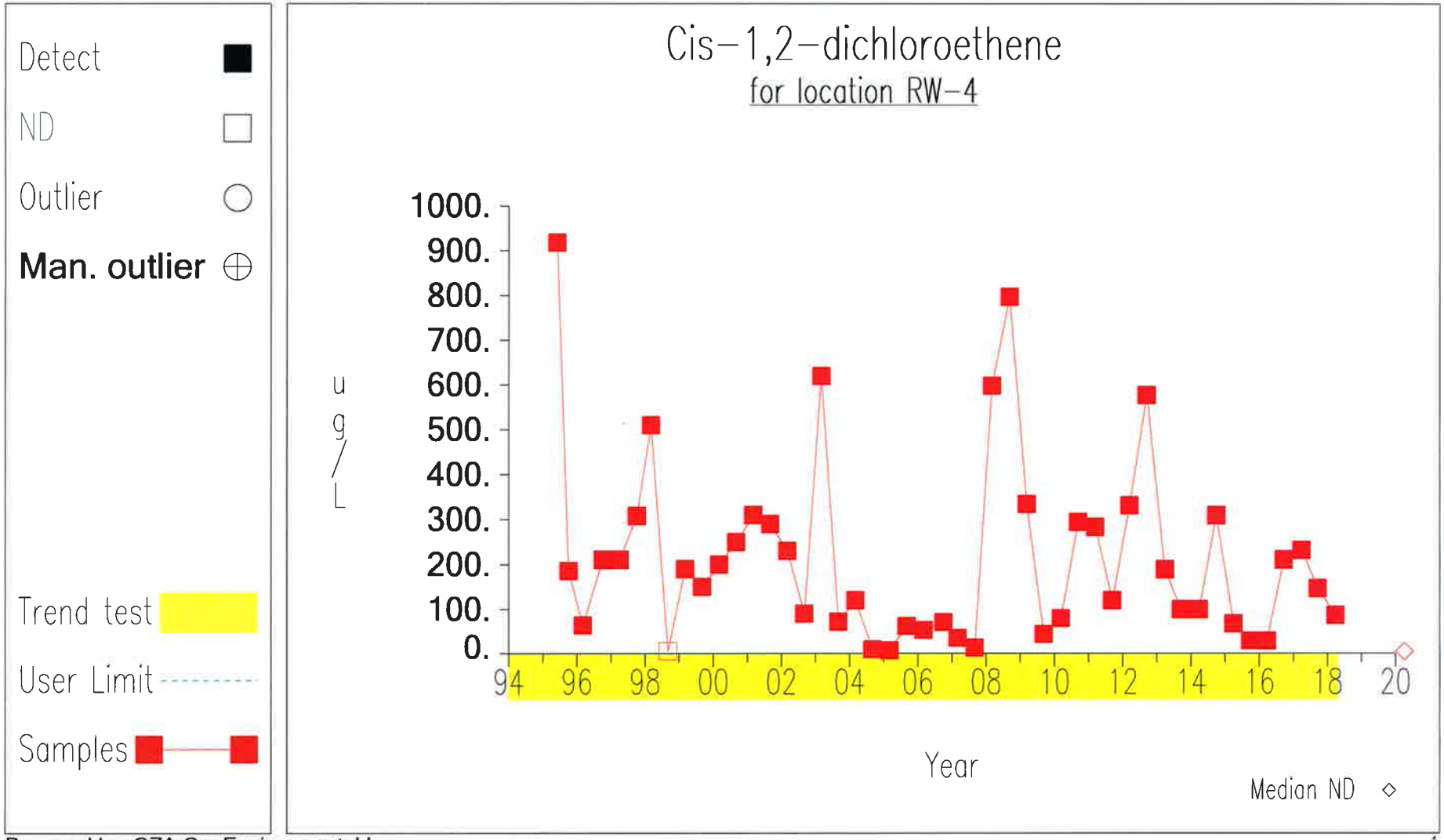
Prepared by: GZA GeoEnvironmental Inc.

Time Series



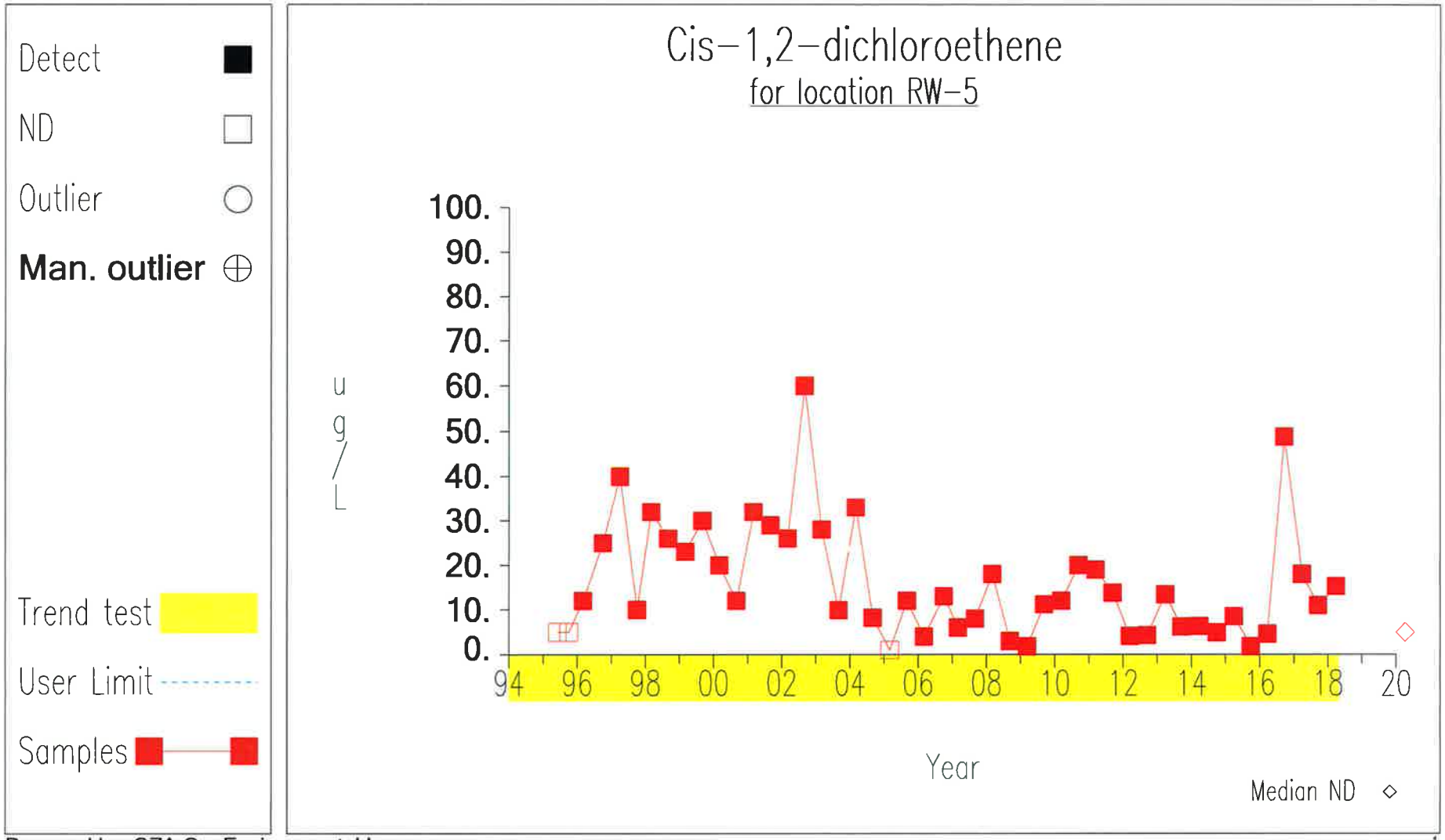
Prepared by: GZA GeoEnvironmental Inc.

Time Series



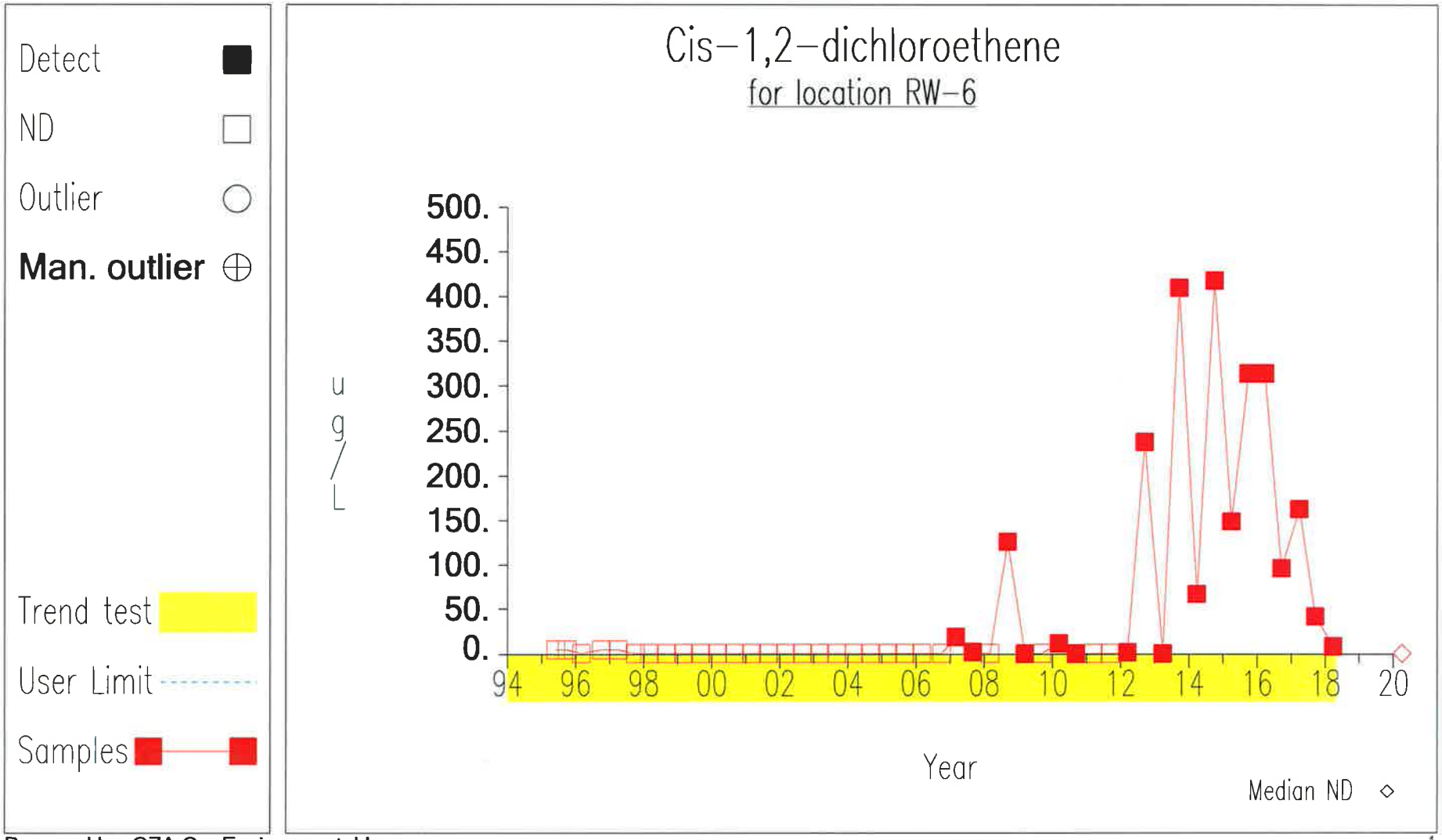
Prepared by: GZA GeoEnvironmental Inc.

Time Series



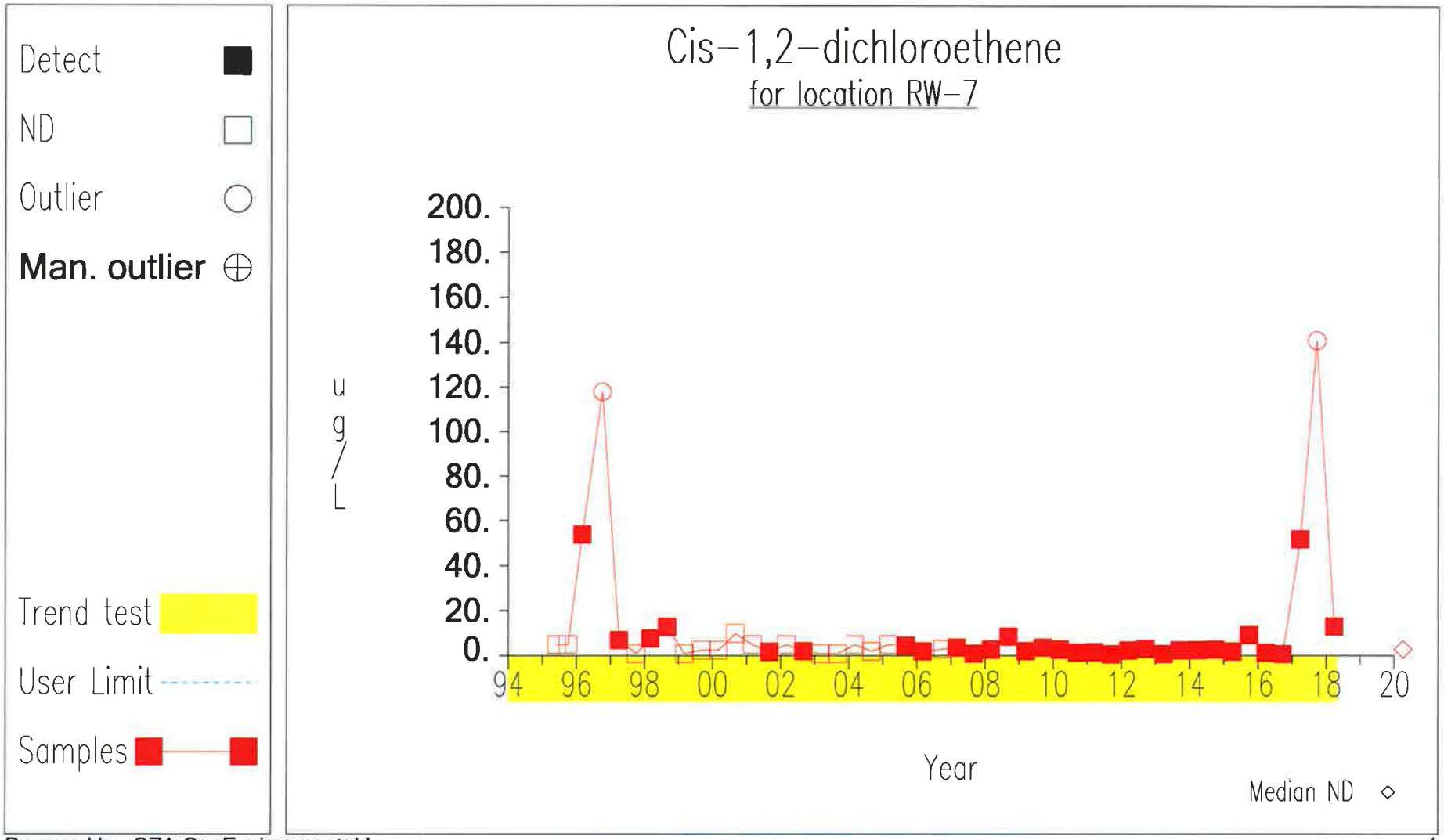
Prepared by: GZA GeoEnvironmental Inc.

Time Series



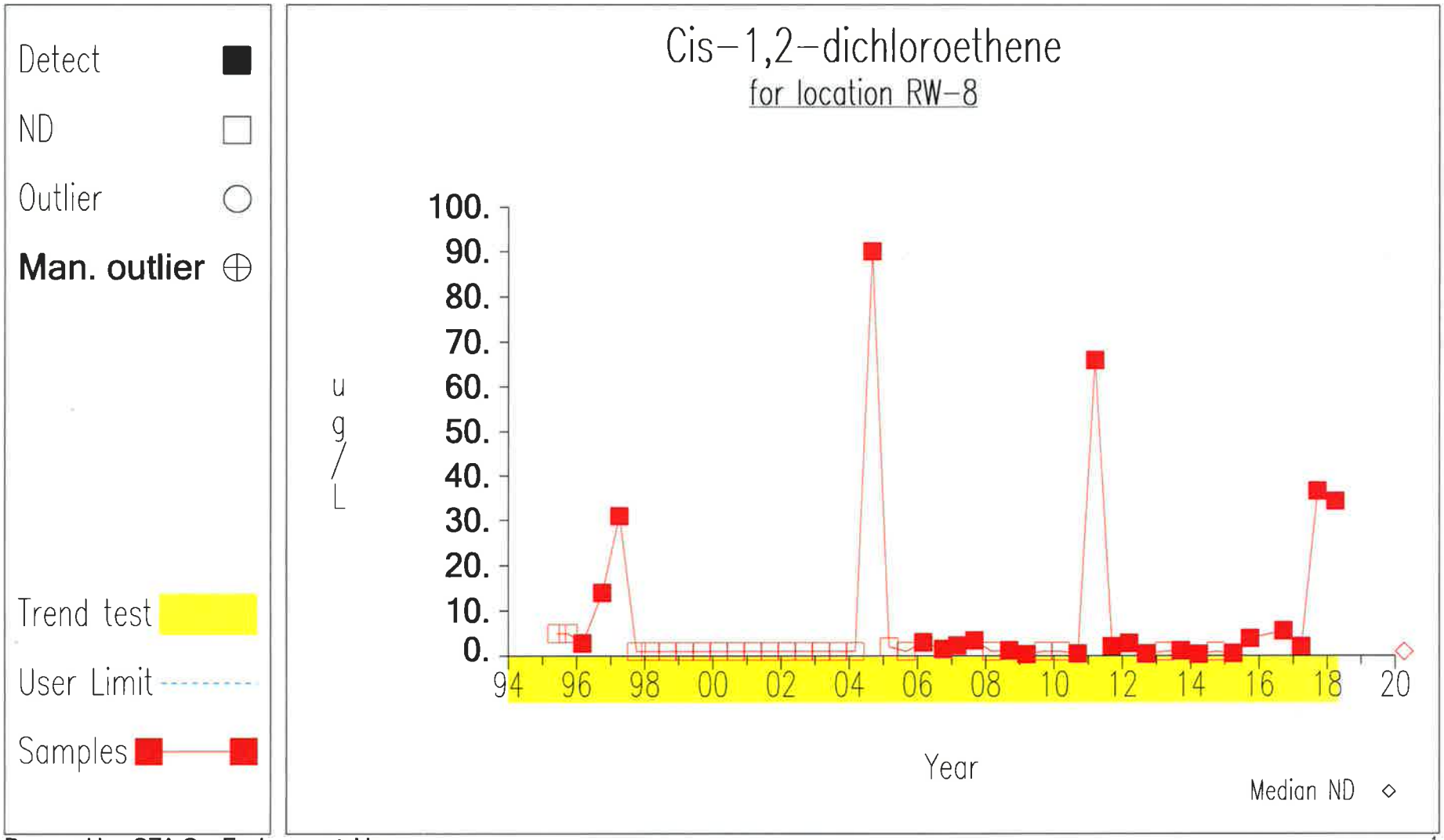
Prepared by: GZA GeoEnvironmental Inc.

Time Series



Prepared by: GZA GeoEnvironmental Inc.

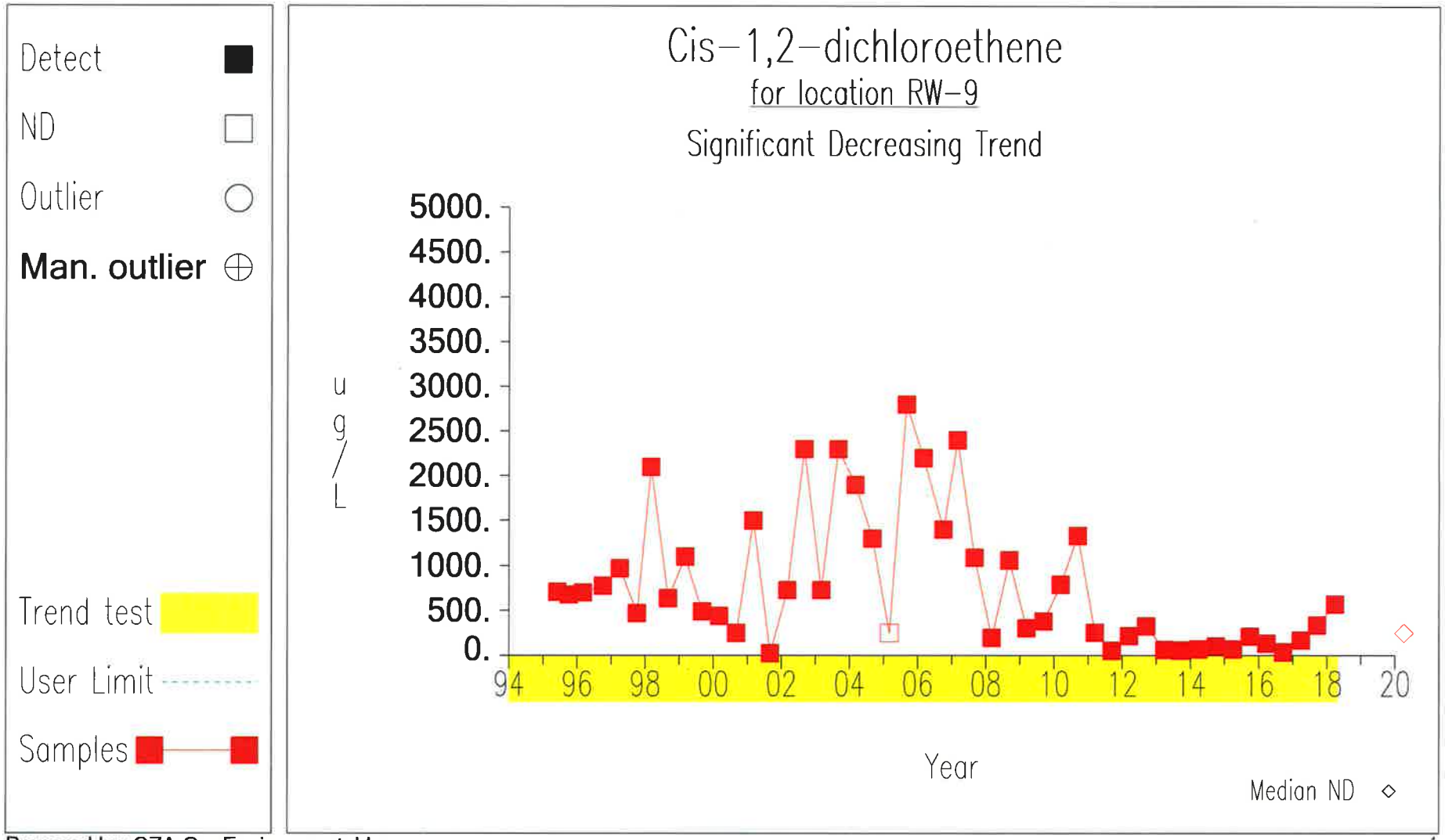
Time Series



Prepared by: GZA GeoEnvironmental Inc.

Analysis prepared on: 5/14/2018

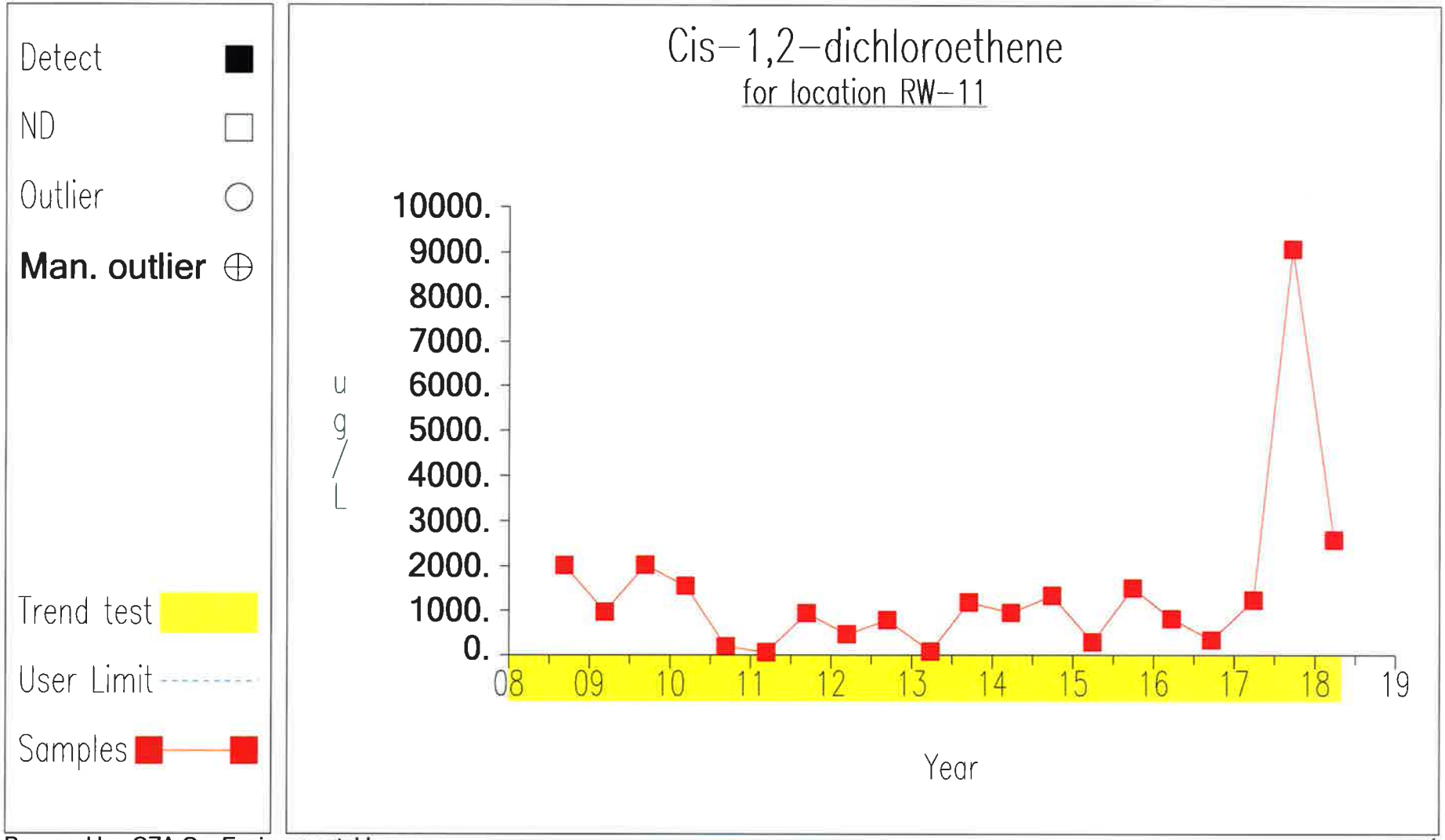
Time Series



Prepared by: GZA GeoEnvironmental Inc.

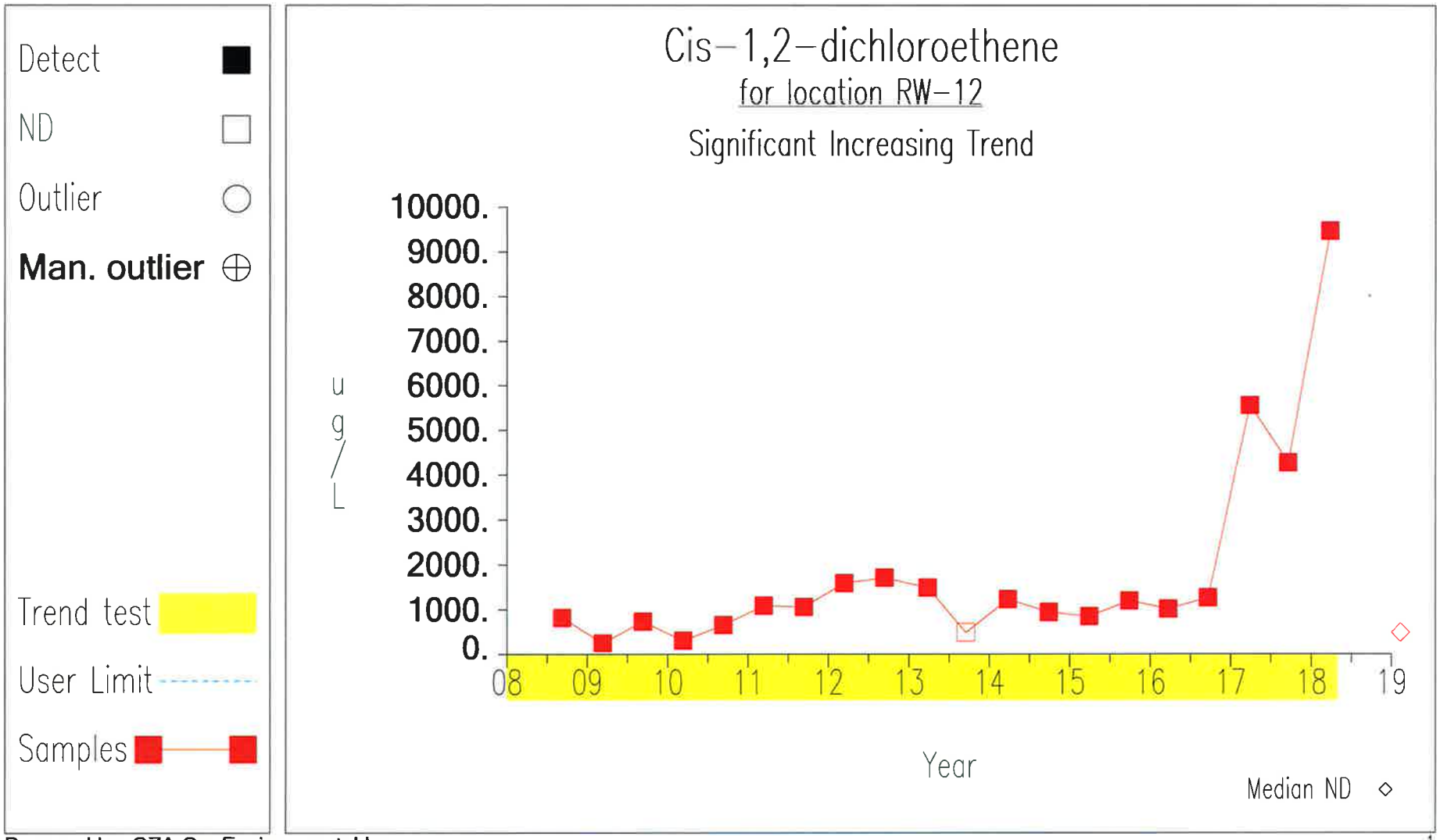
Analysis prepared on: 5/14/2018

Time Series



Prepared by: GZA GeoEnvironmental Inc.

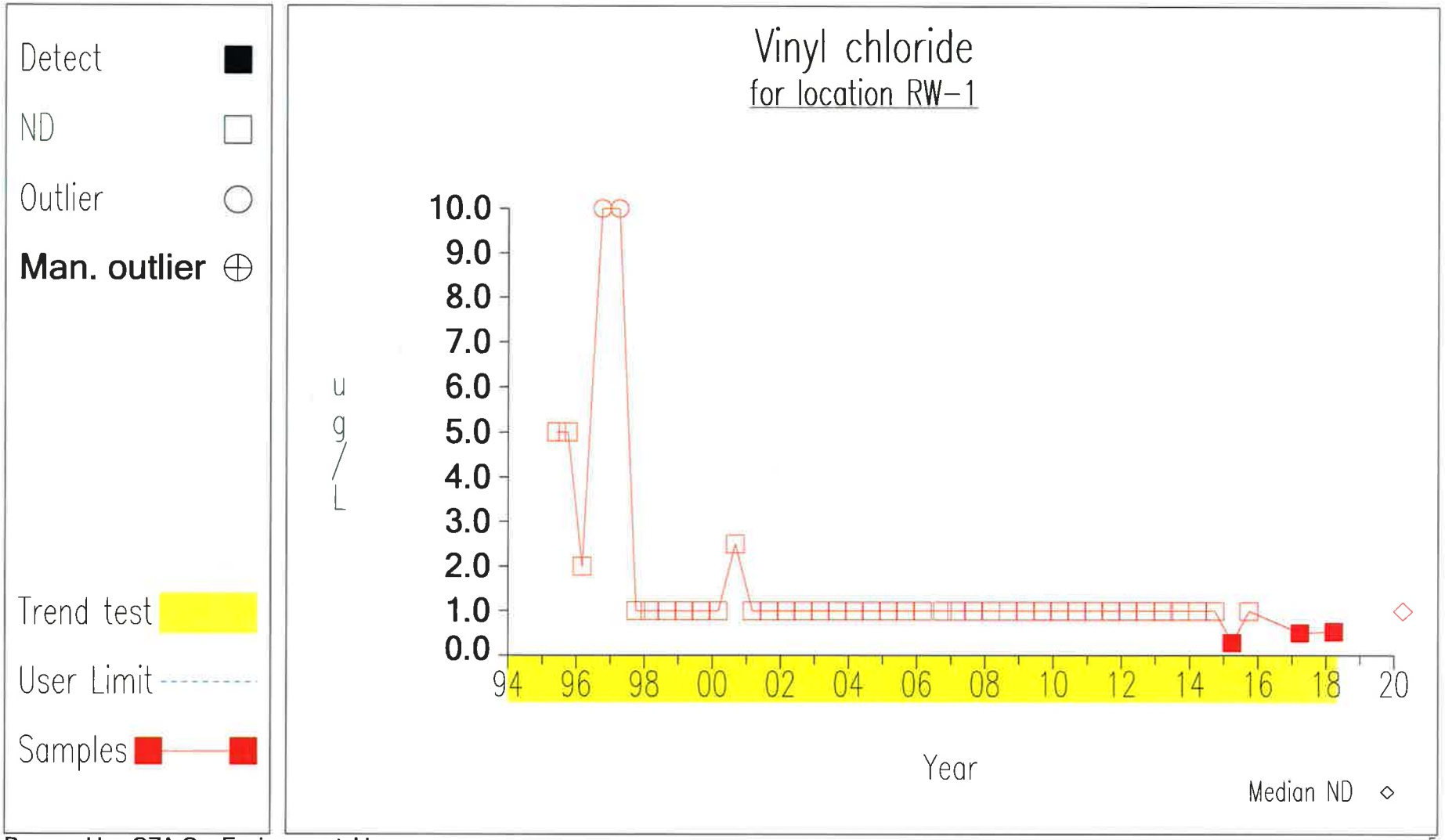
Time Series



Prepared by: GZA GeoEnvironmental Inc.

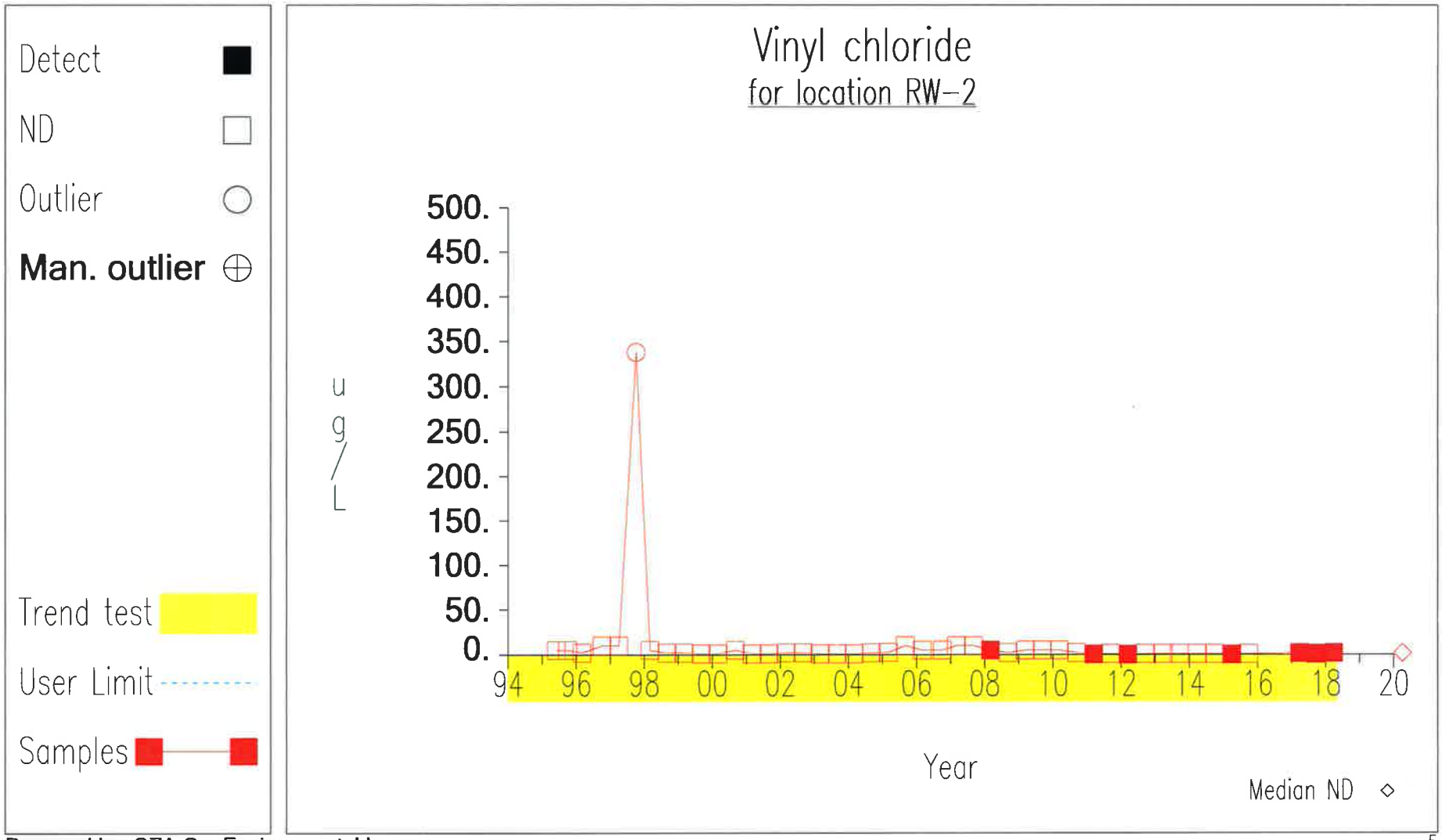
Analysis prepared on: 5/14/2018

Time Series

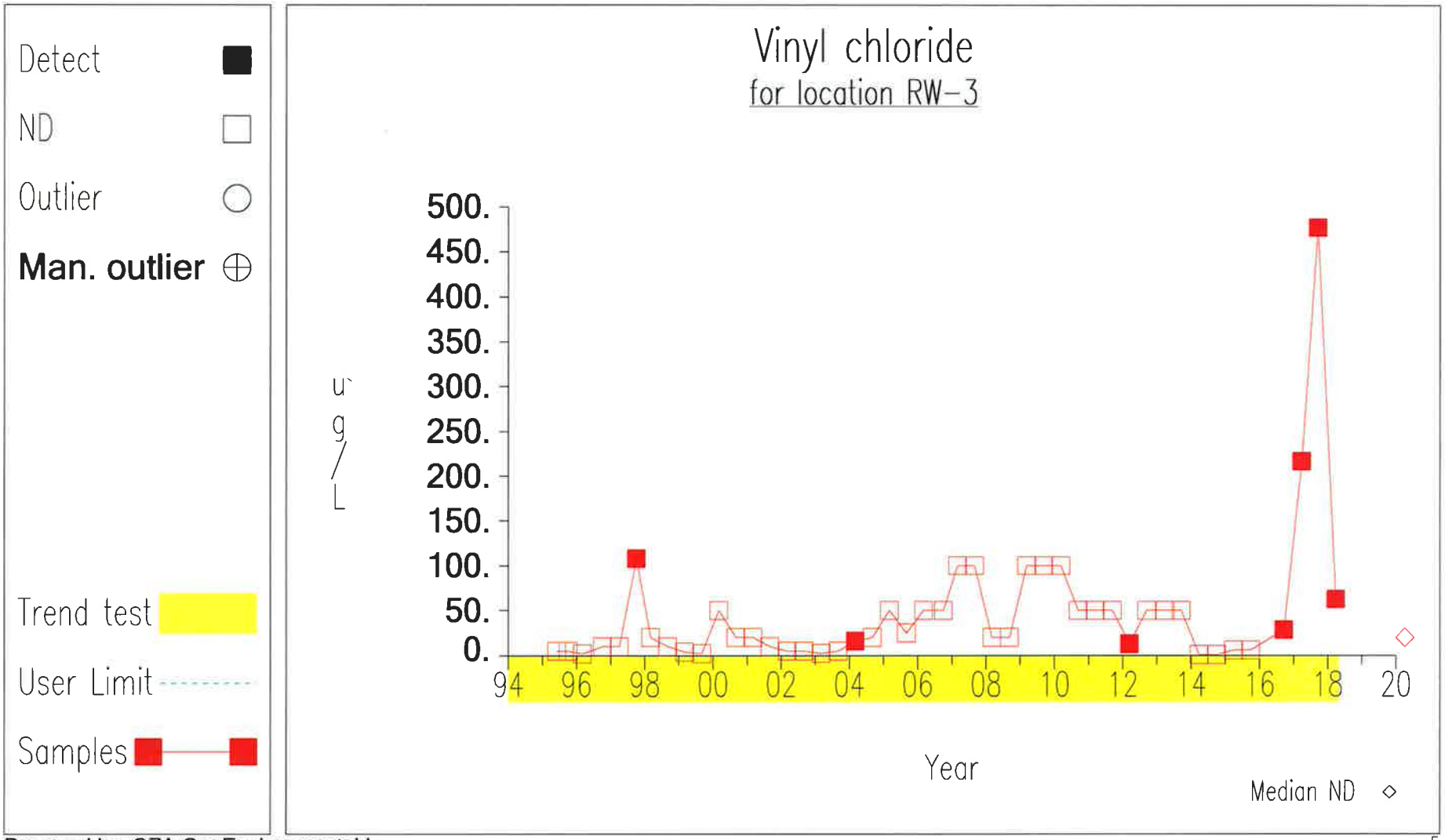


Prepared by: GZA GeoEnvironmental Inc.

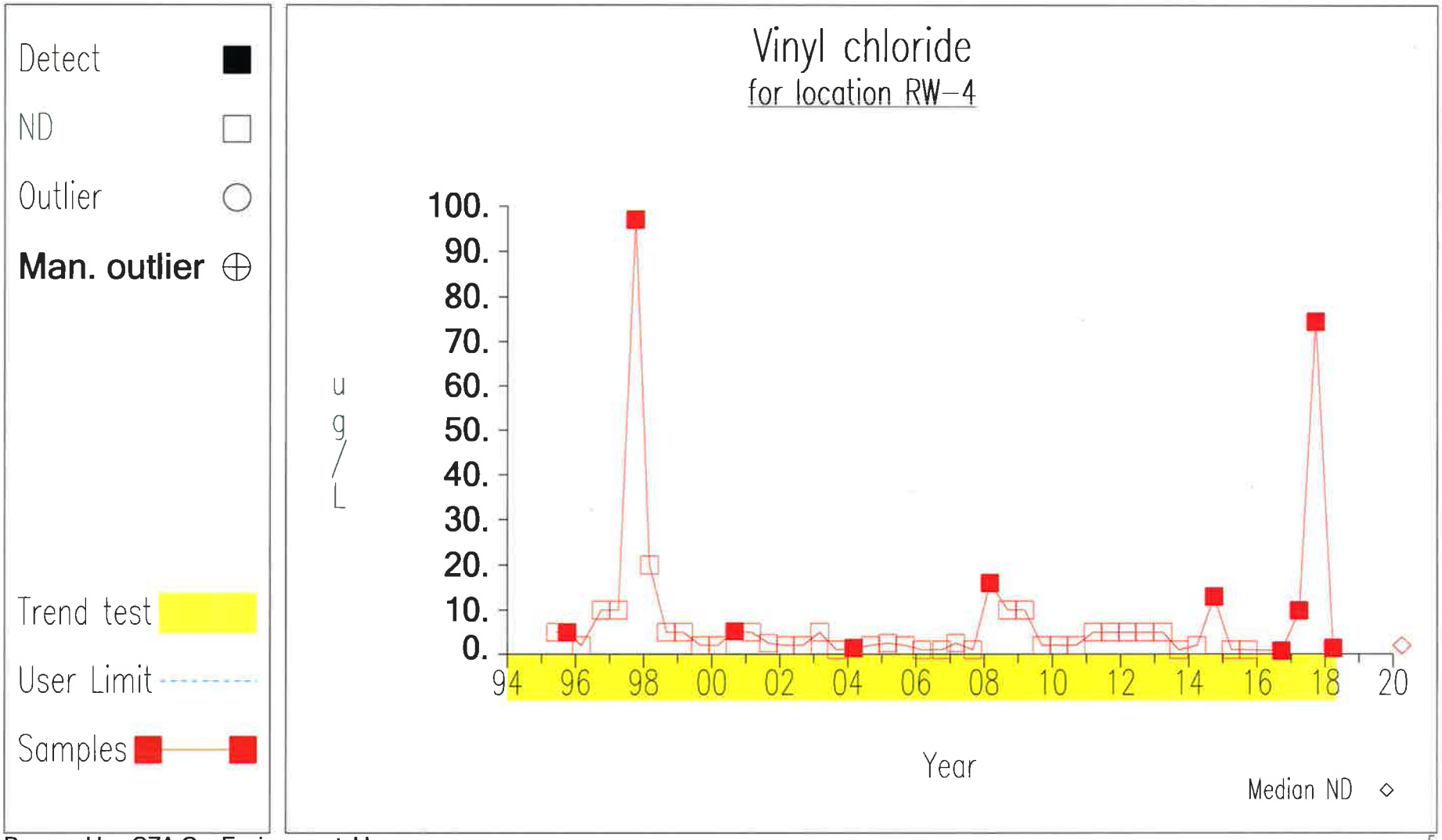
Time Series


Detect
ND
Outlier
Man. outlier
Trend test
User Limit
Samples
Vinyl chloride
for location RW-2
ug/L
500.
450.
400.
350.
300.
250.
200.
150.
100.
50.
0.
94
96
98
00
02
04
06
08
10
12
14
16
18
20
Year
Median ND

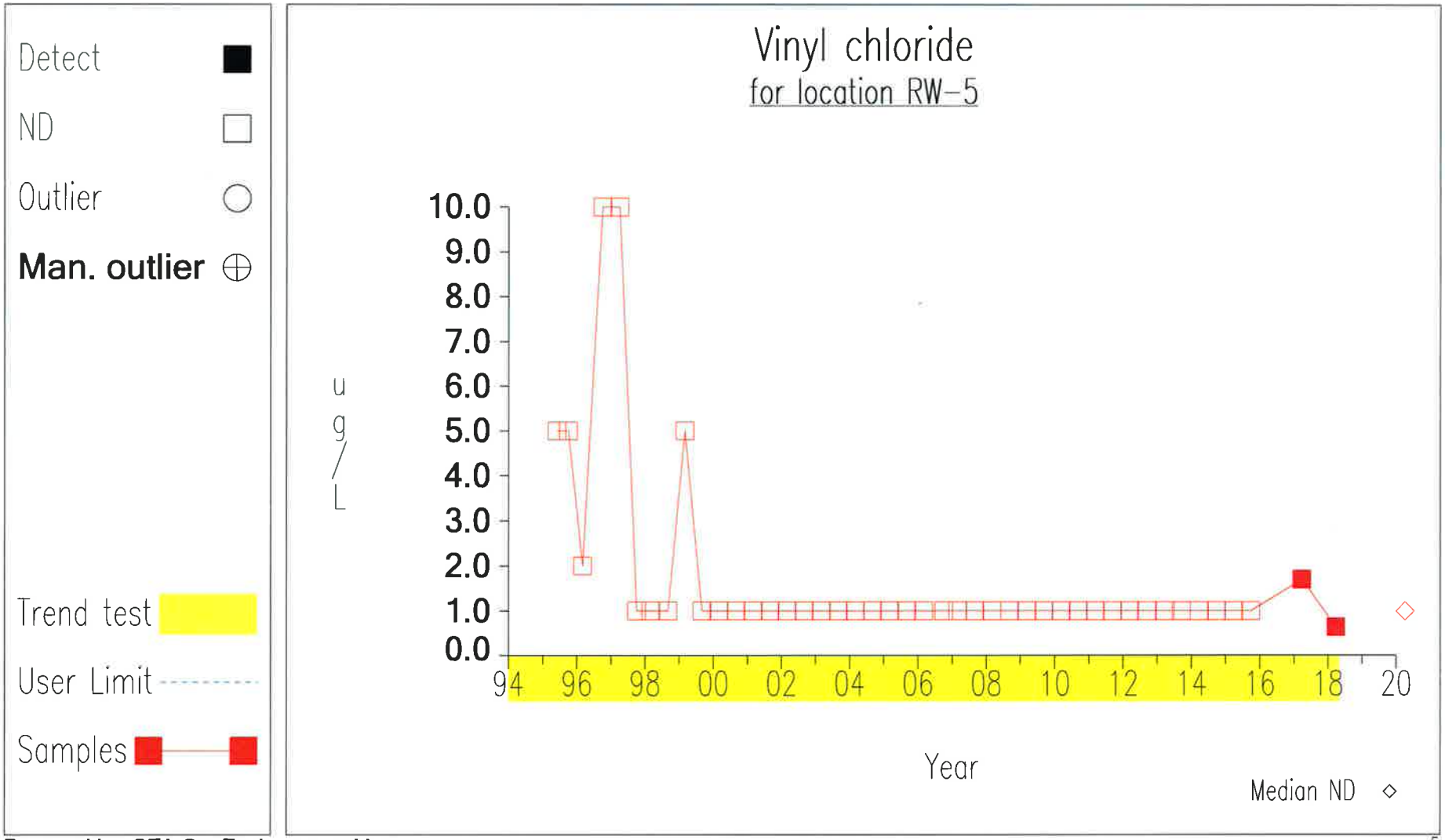
Time Series


Detect
ND
Outlier
Man. outlier
Trend test
User Limit
Samples
Vinyl chloride
for location RW-3
ug/L
500.
450.
400.
350.
300.
250.
200.
150.
100.
50.
0.
94
96
98
00
02
04
06
08
10
12
14
16
18
20
Year
Median ND

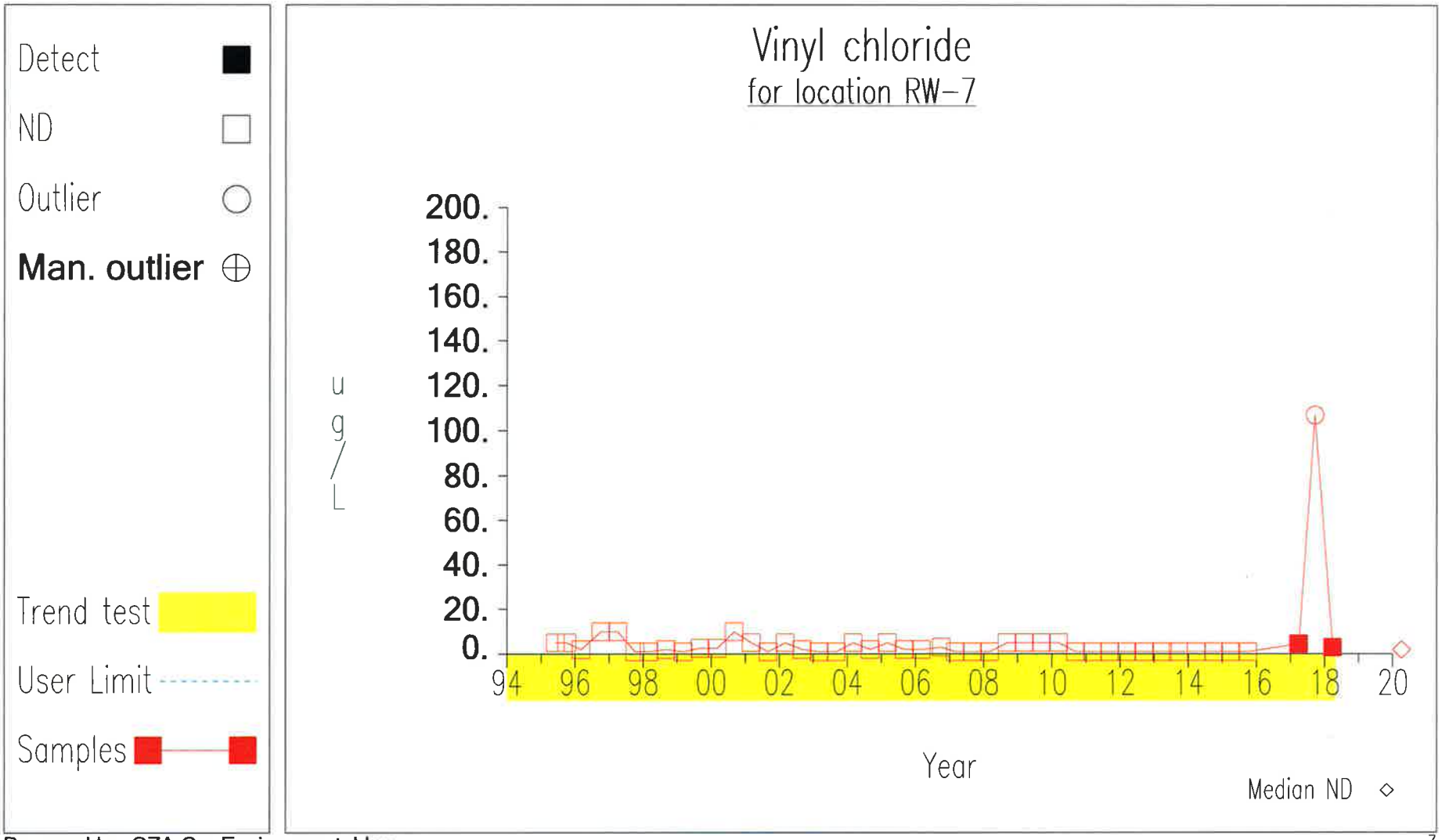
Time Series


Detect
ND
Outlier
Man. outlier
Trend test
User Limit
Samples
Vinyl chloride
for location RW-4
ug/L
100.
90.
80.
70.
60.
50.
40.
30.
20.
10.
0.
94
96
98
00
02
04
06
08
10
12
14
16
18
20
Year
Median ND

Time Series


Detect
ND
Outlier
Man. outlier
Trend test
User Limit
Samples
Vinyl chloride
for location RW-5
ug/L
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
94
96
98
00
02
04
06
08
10
12
14
16
18
20
Year
Median ND

Time Series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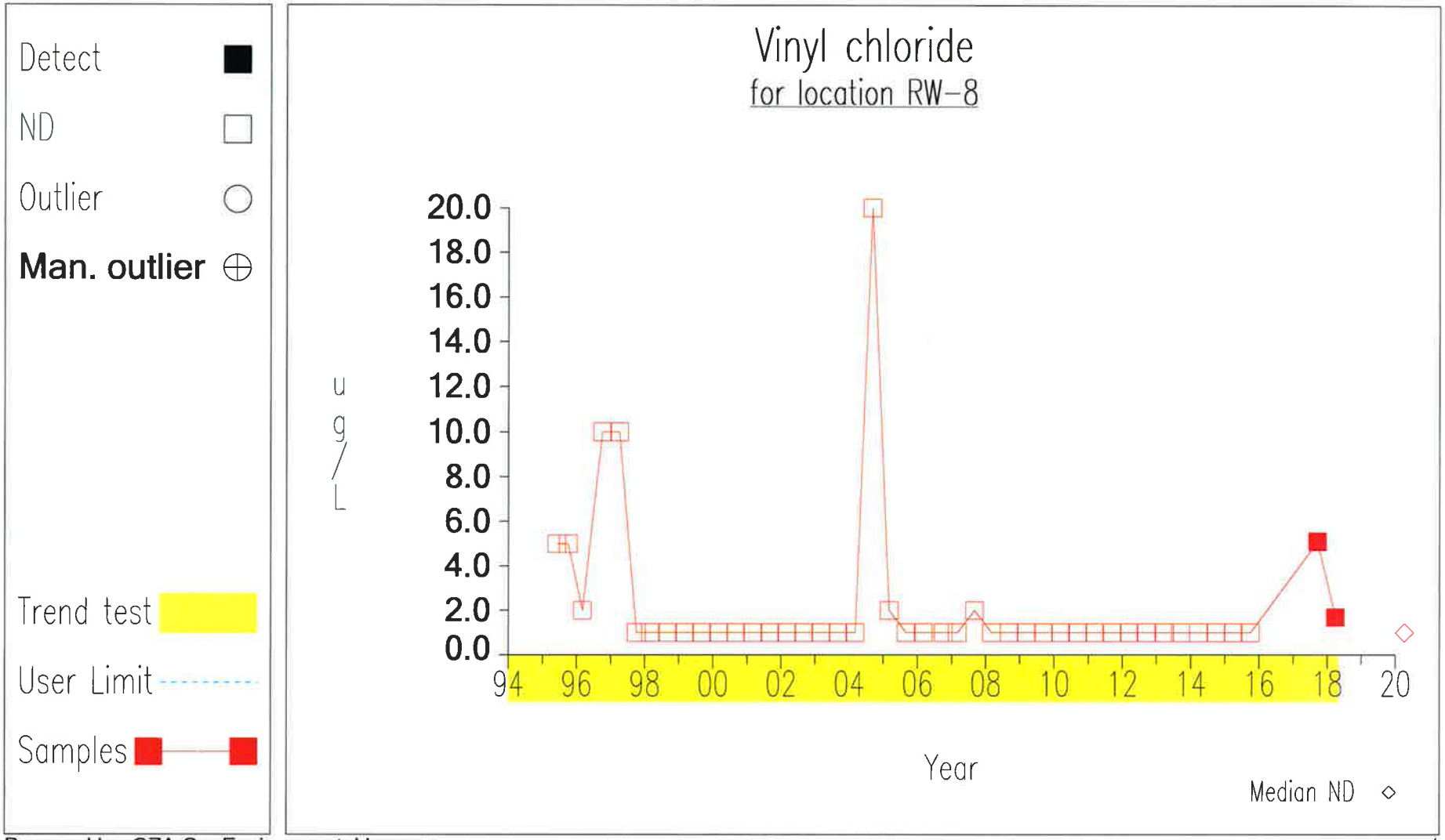

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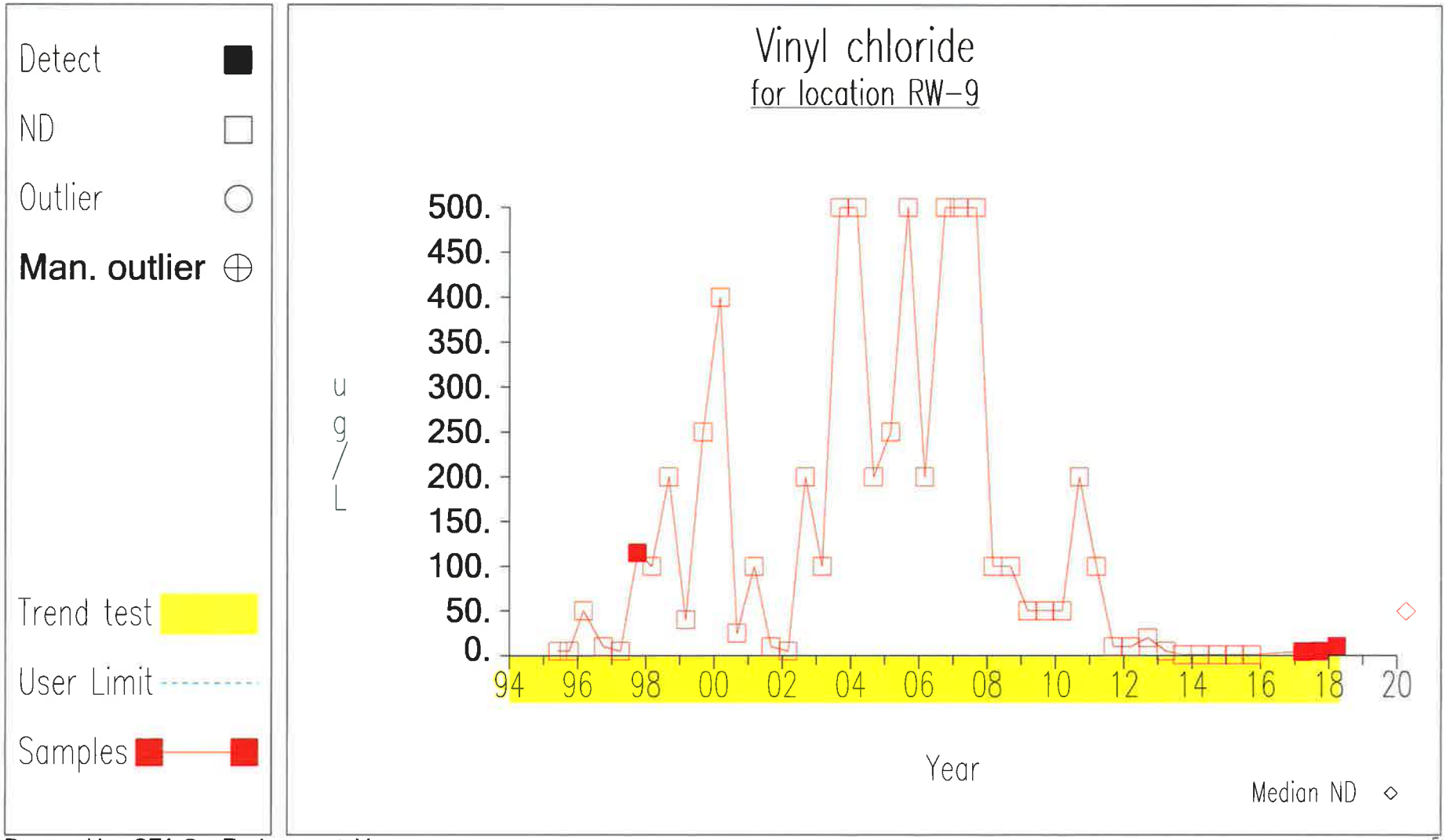
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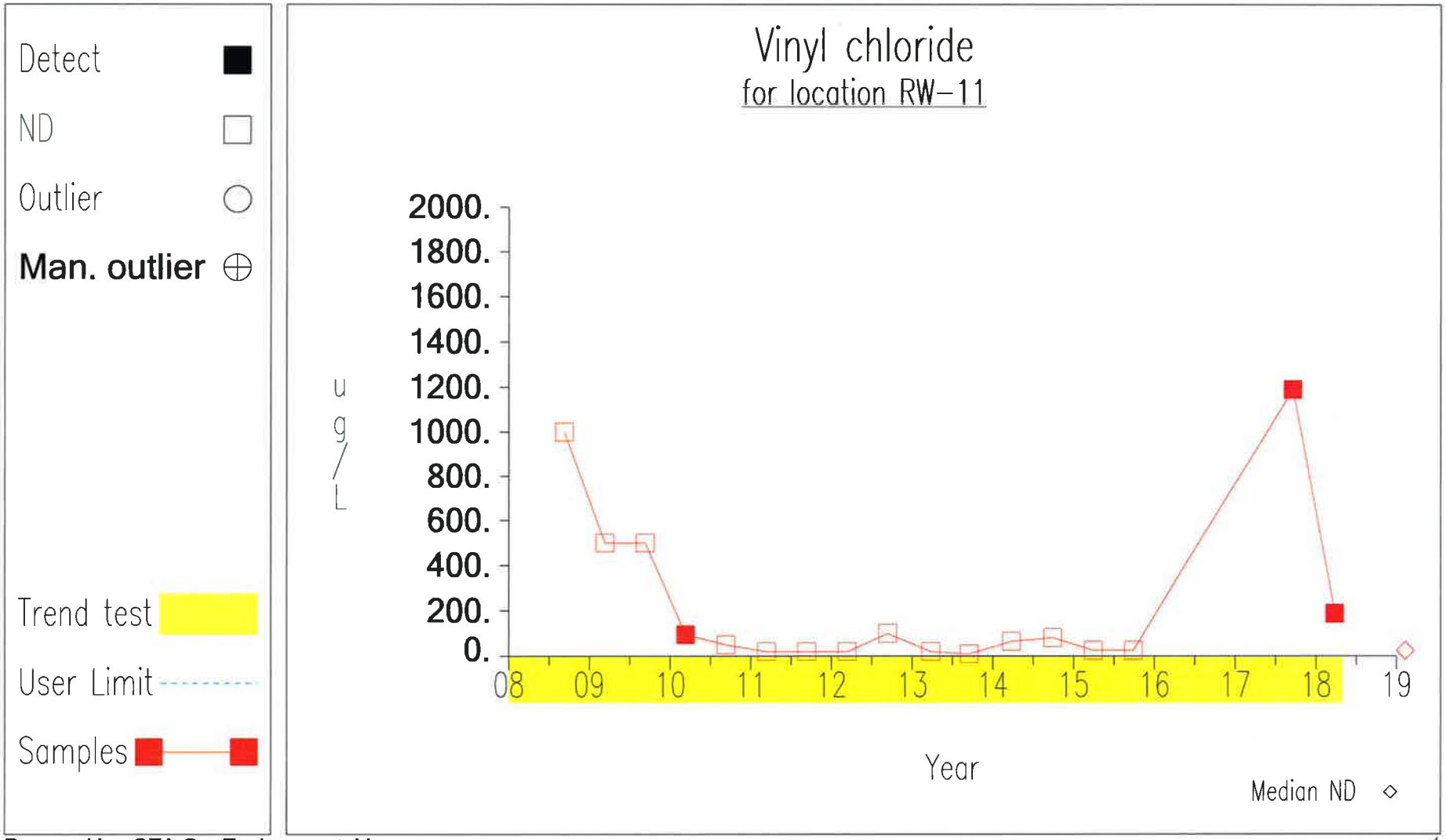
Year
Median ND

Time Series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Year
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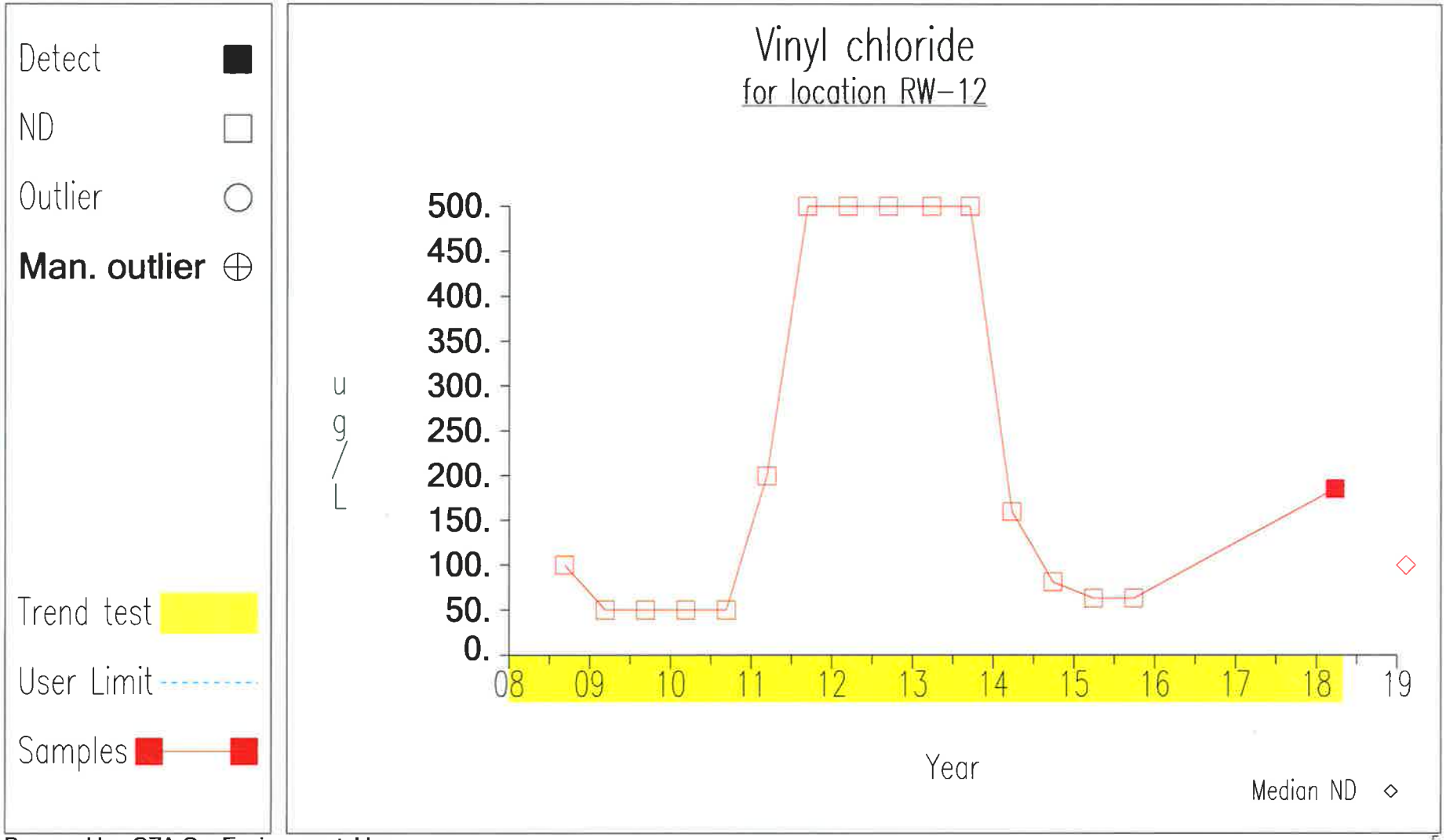
Time Series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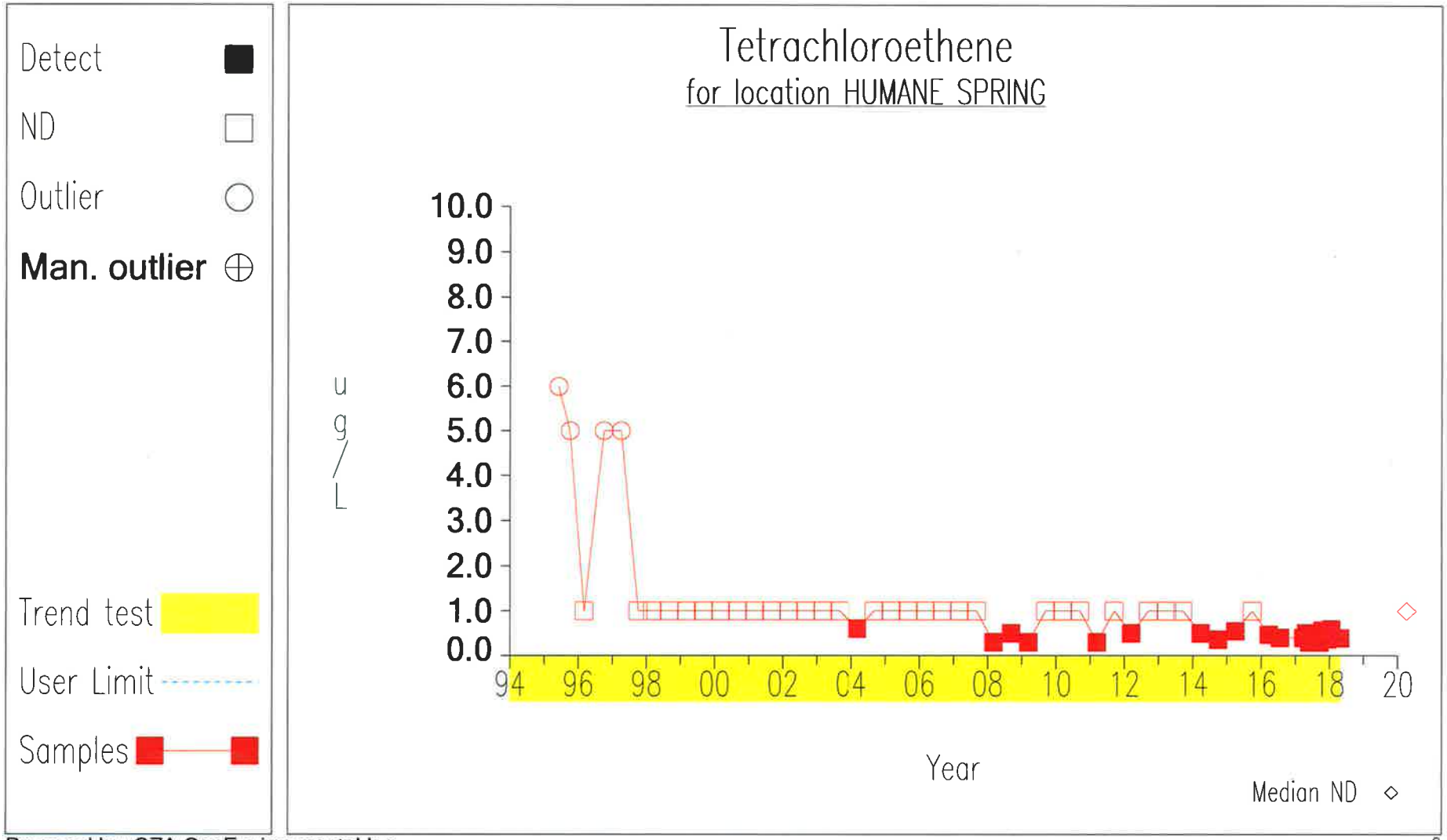

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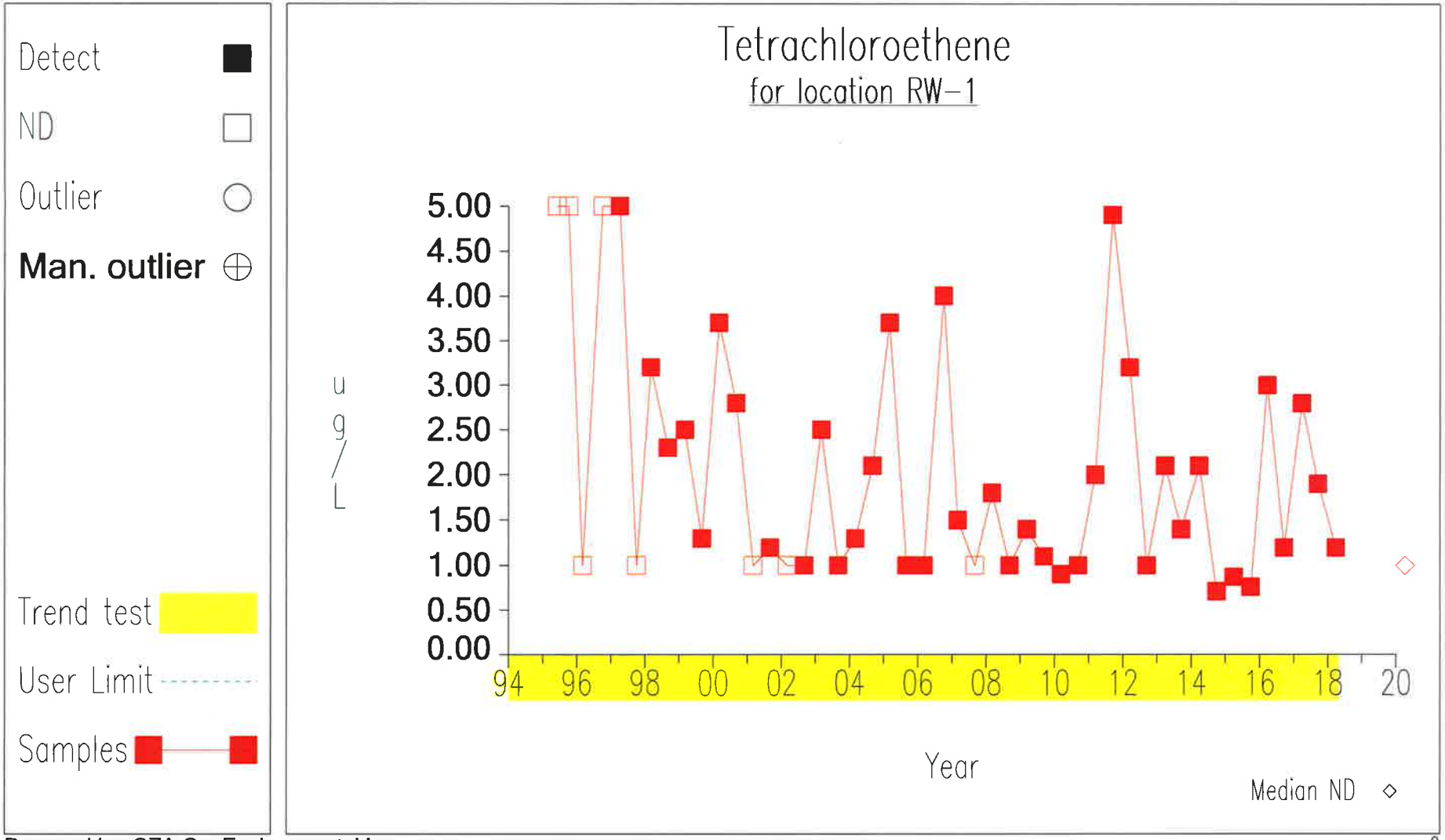
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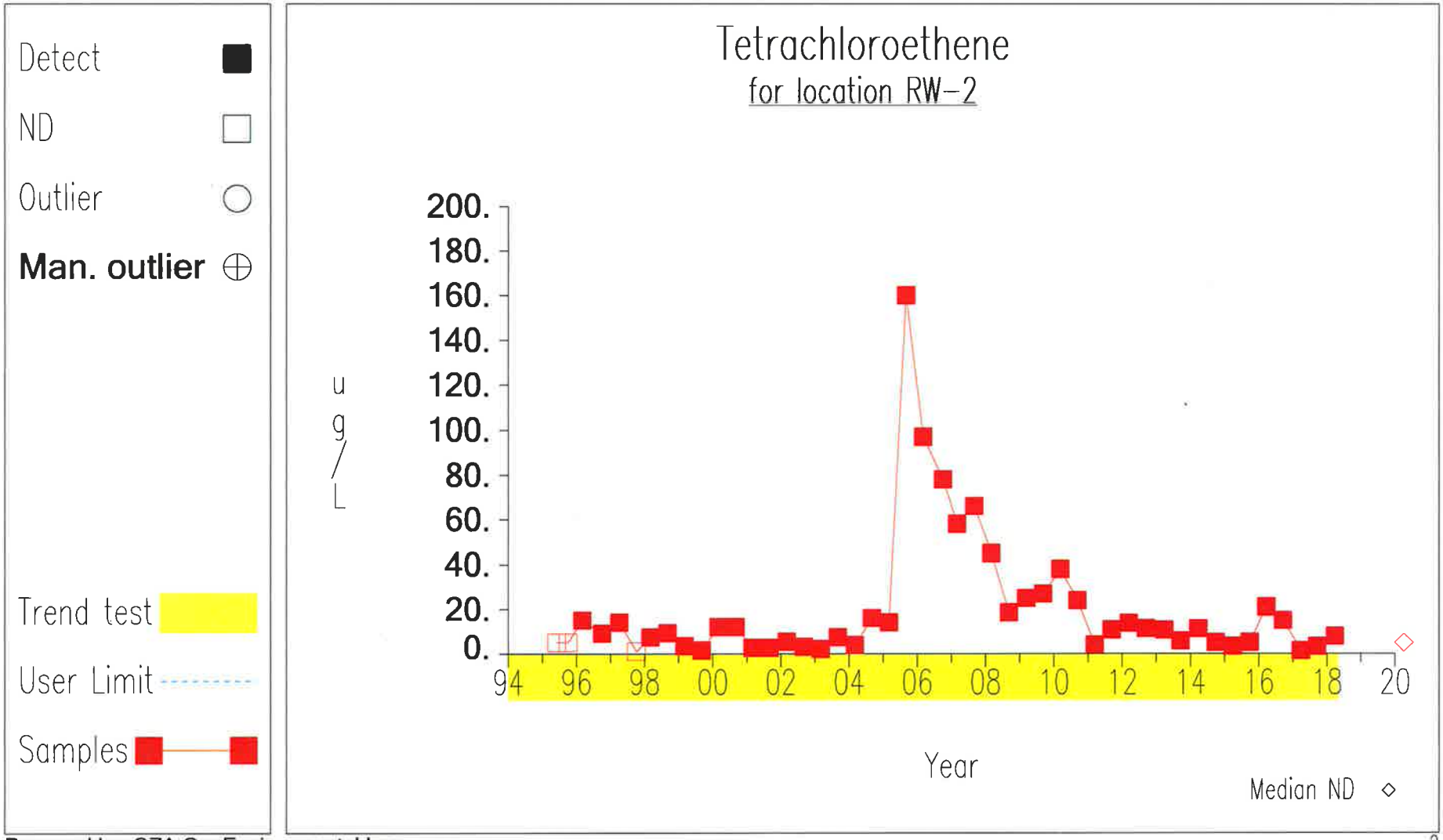
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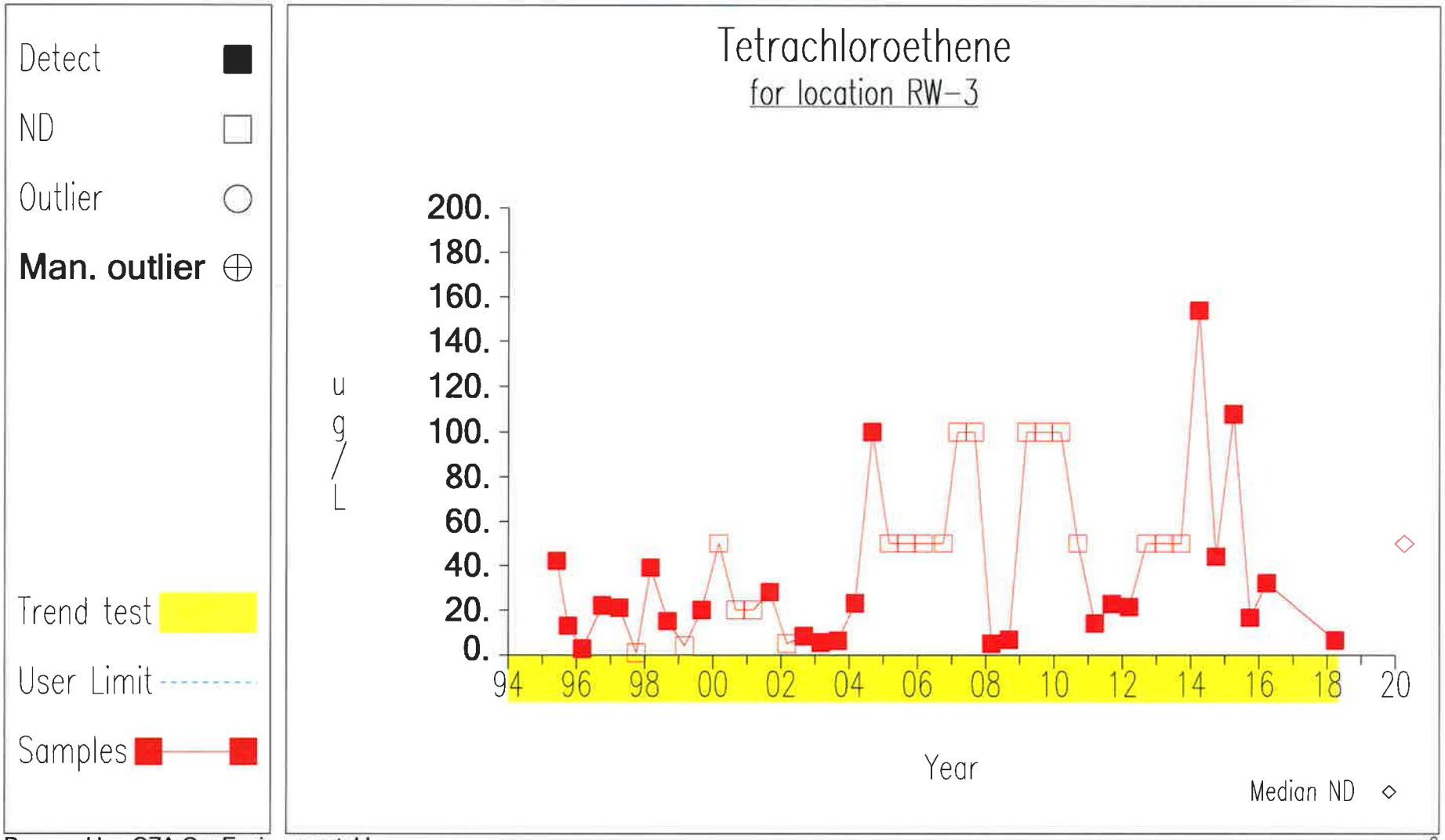

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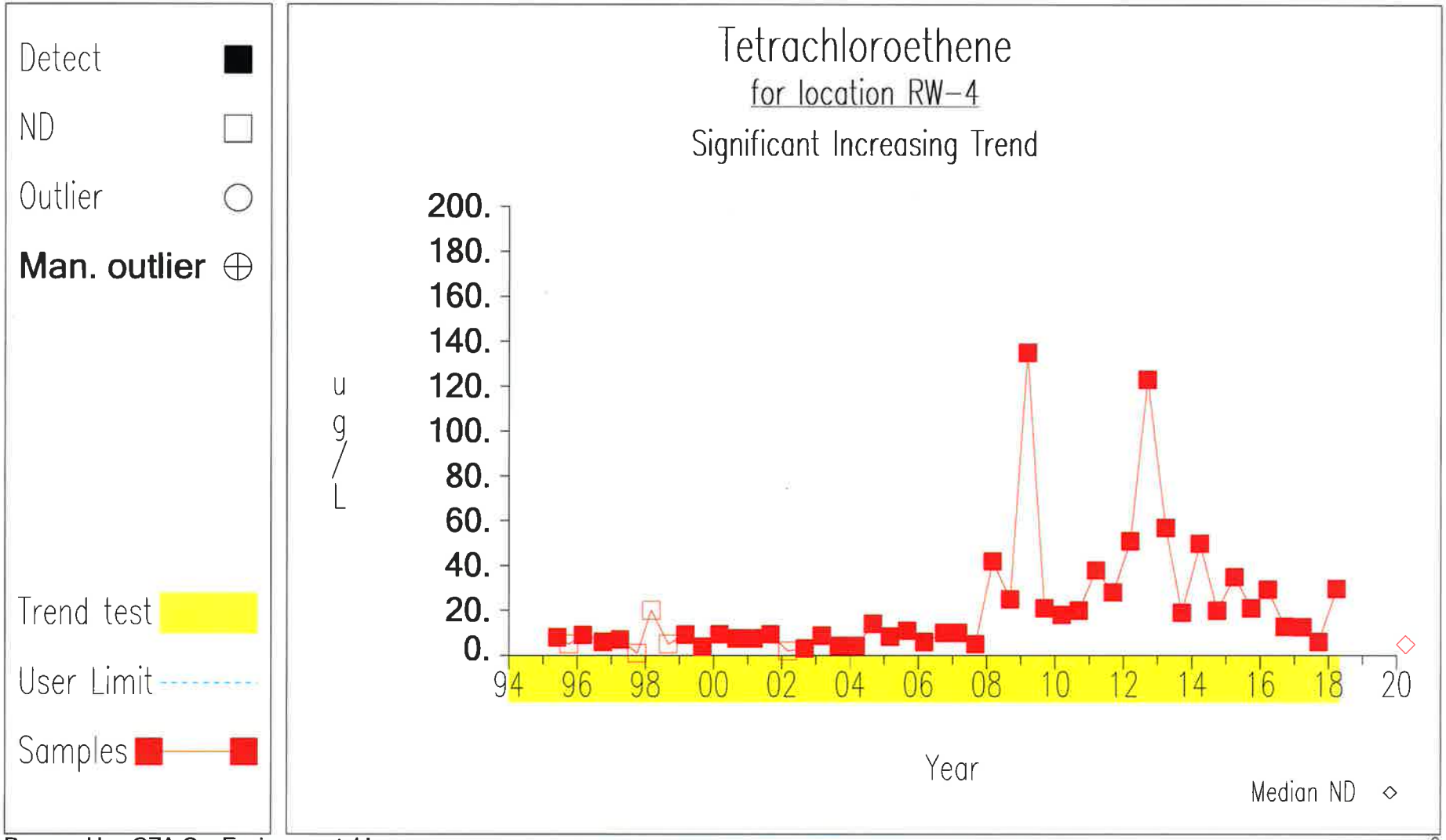
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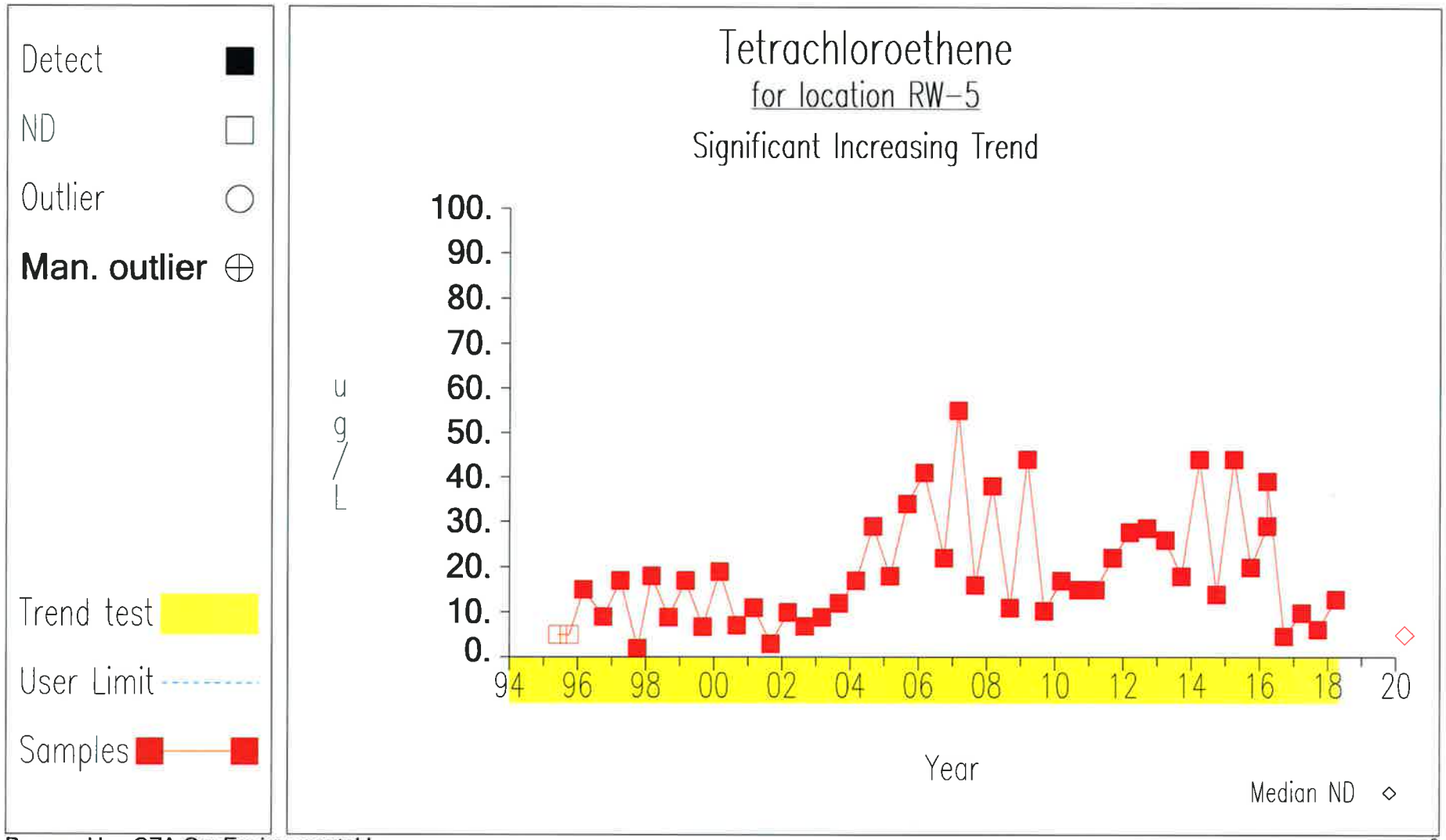
Analysis prepared on: 5/14/2018

Time Series



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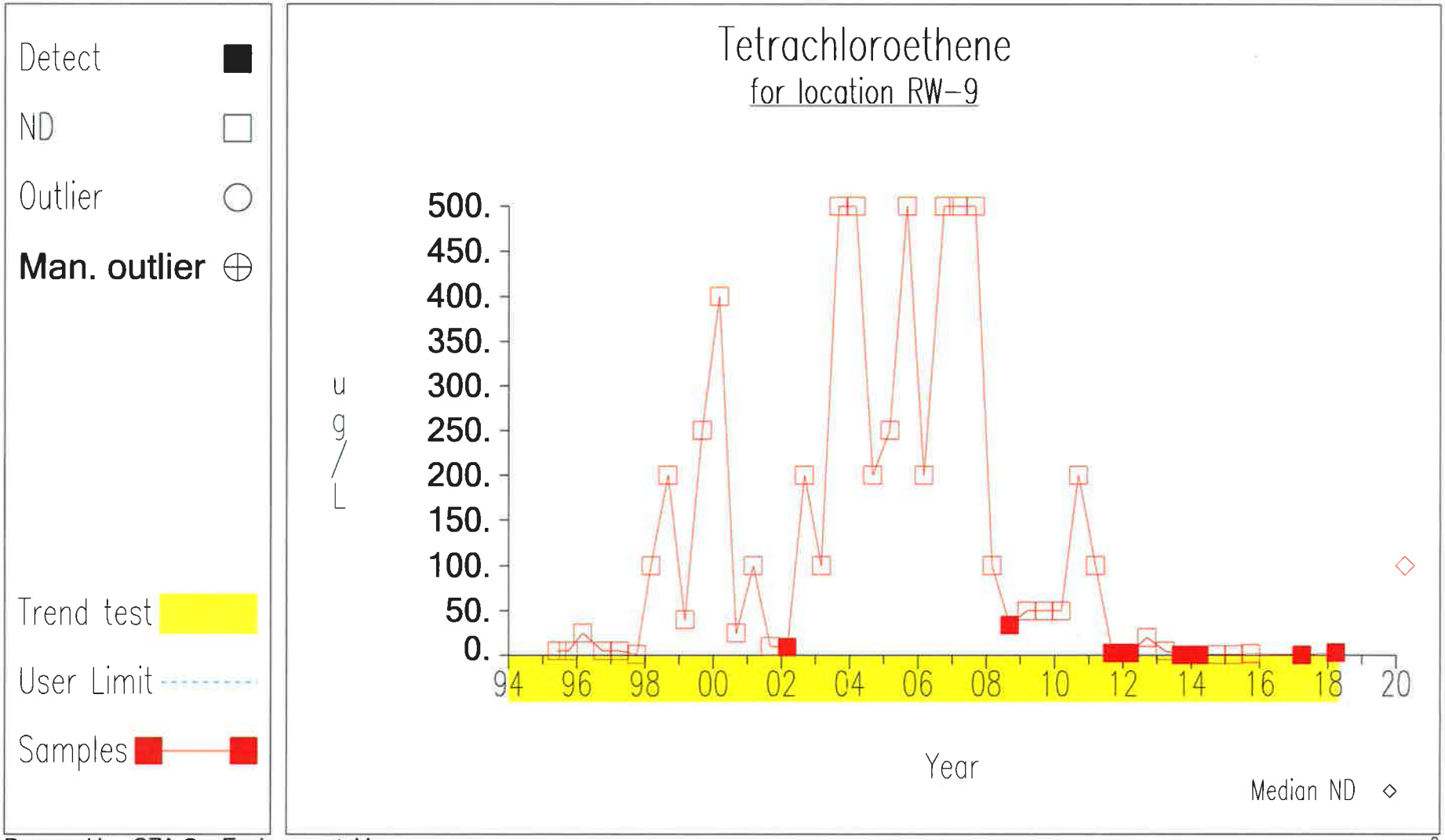
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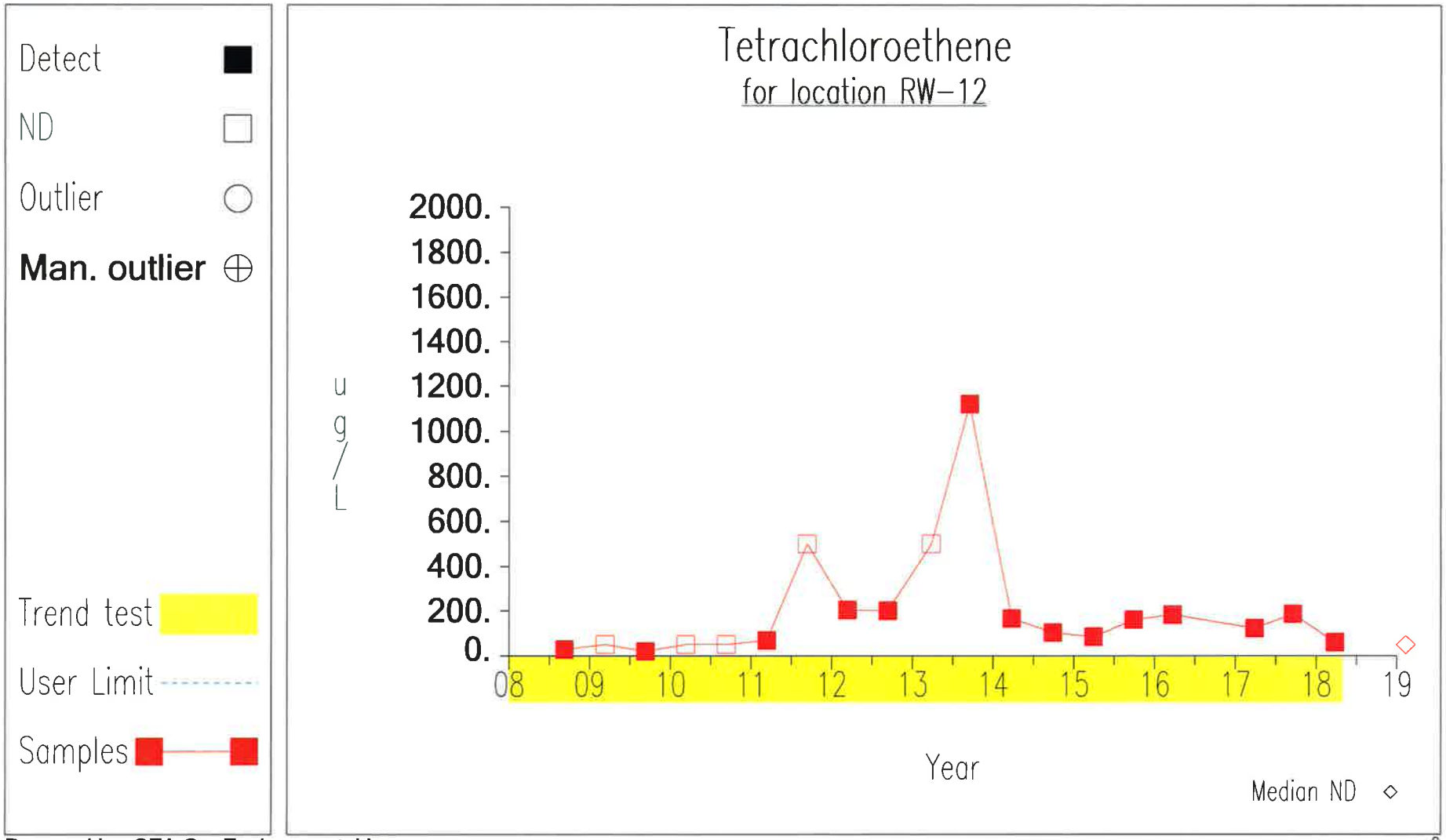

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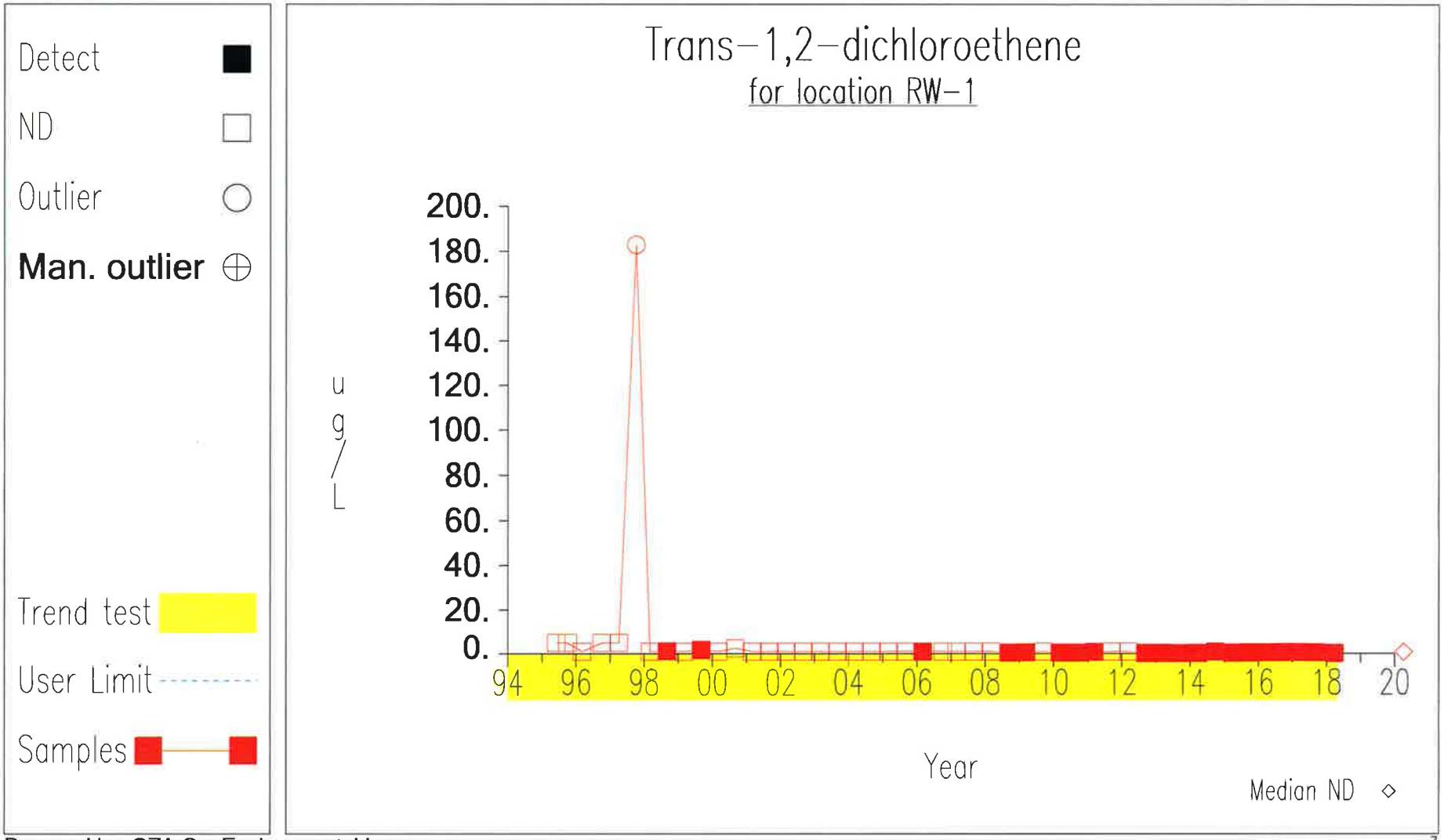
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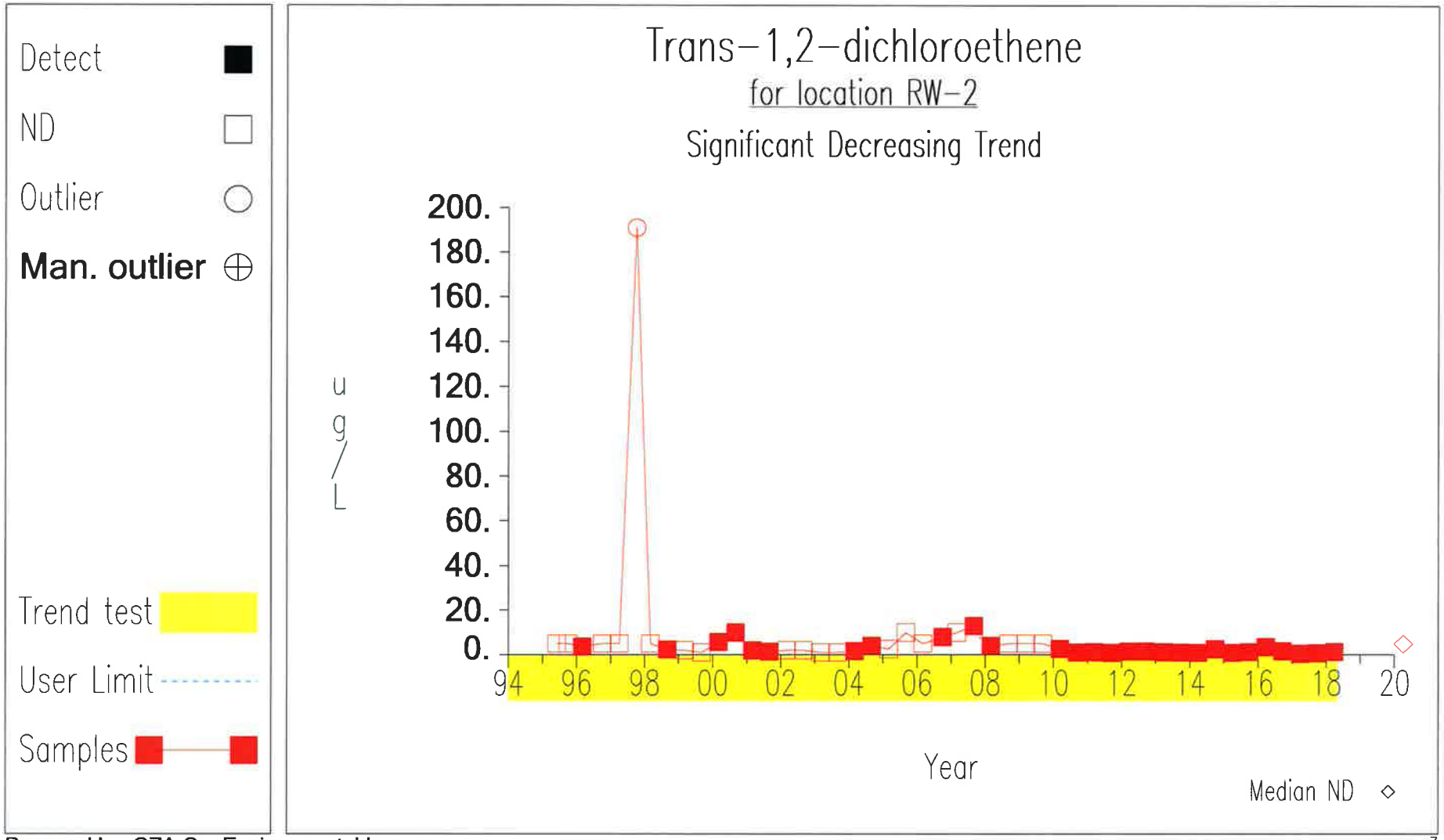
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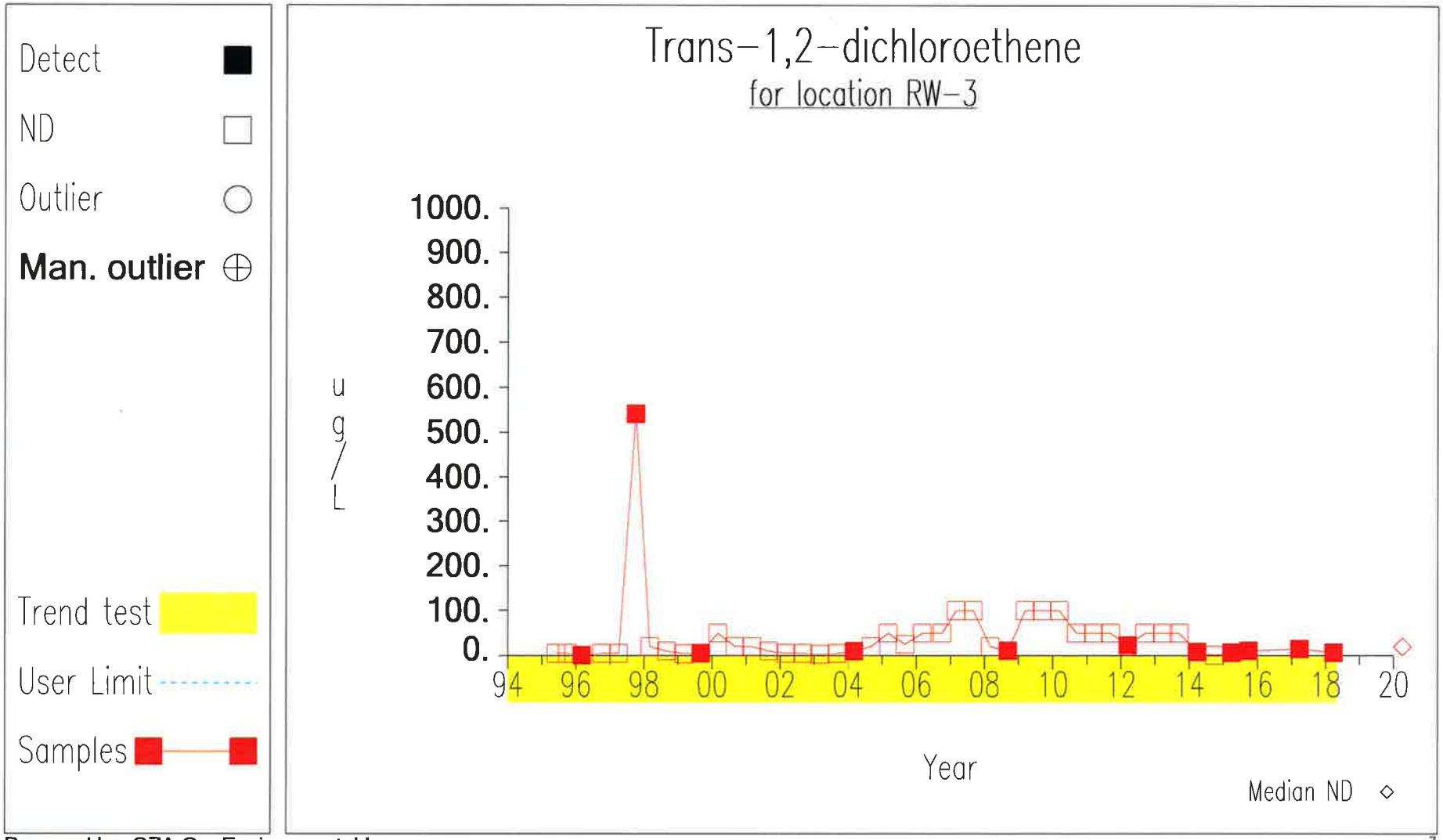
Year
Median ND

Analysis prepared on: 5/14/2018

Time Series



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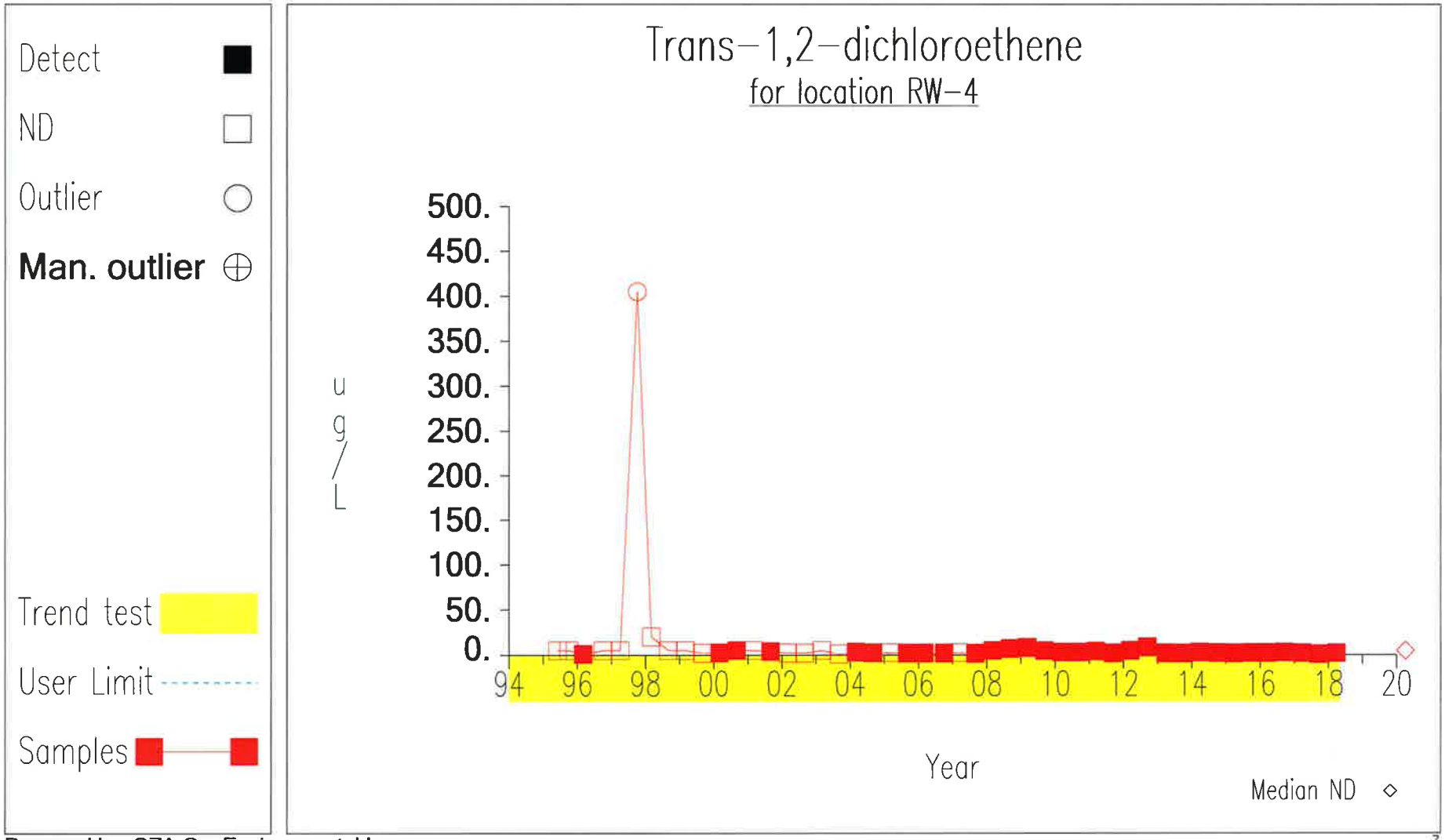

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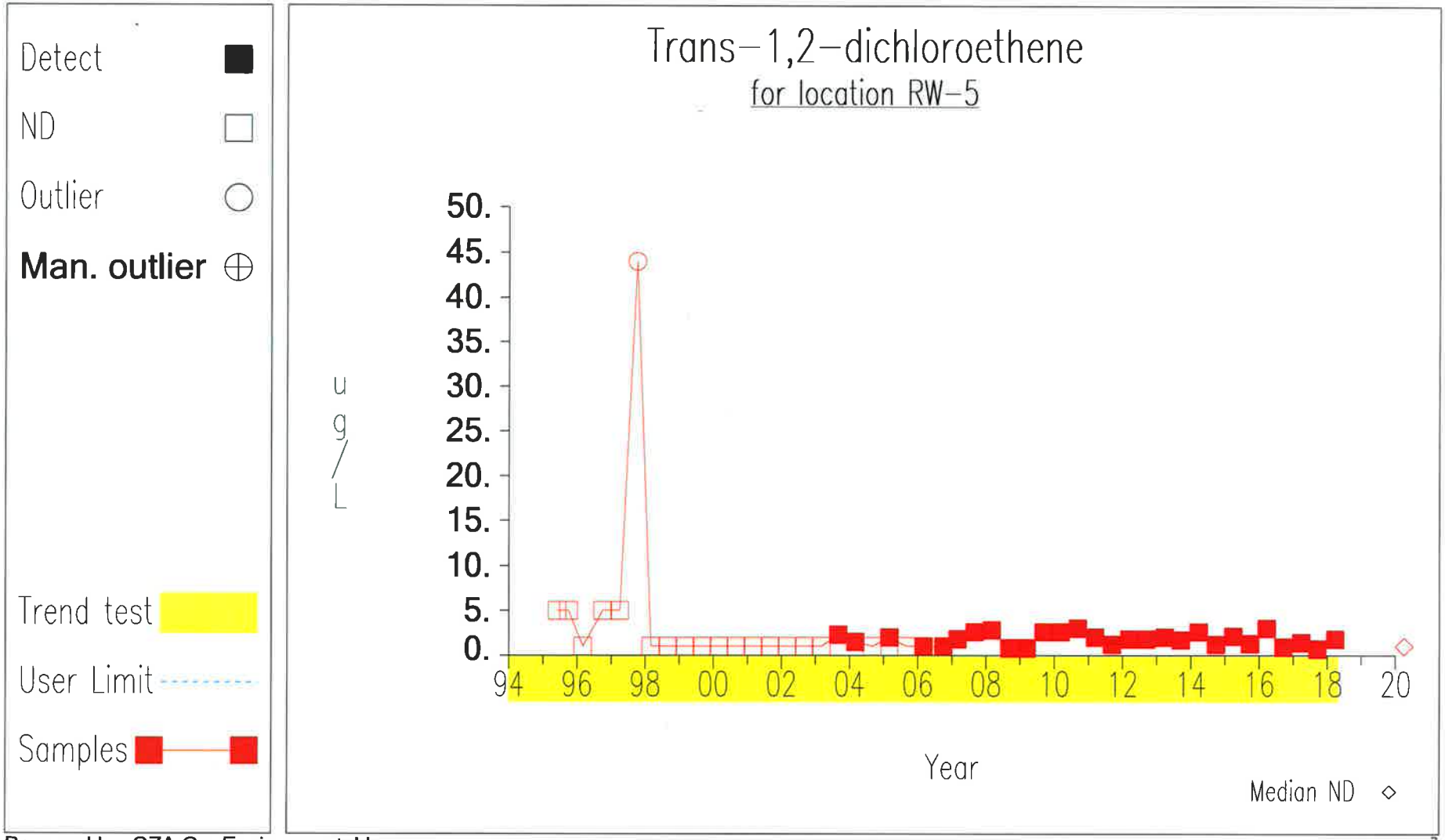

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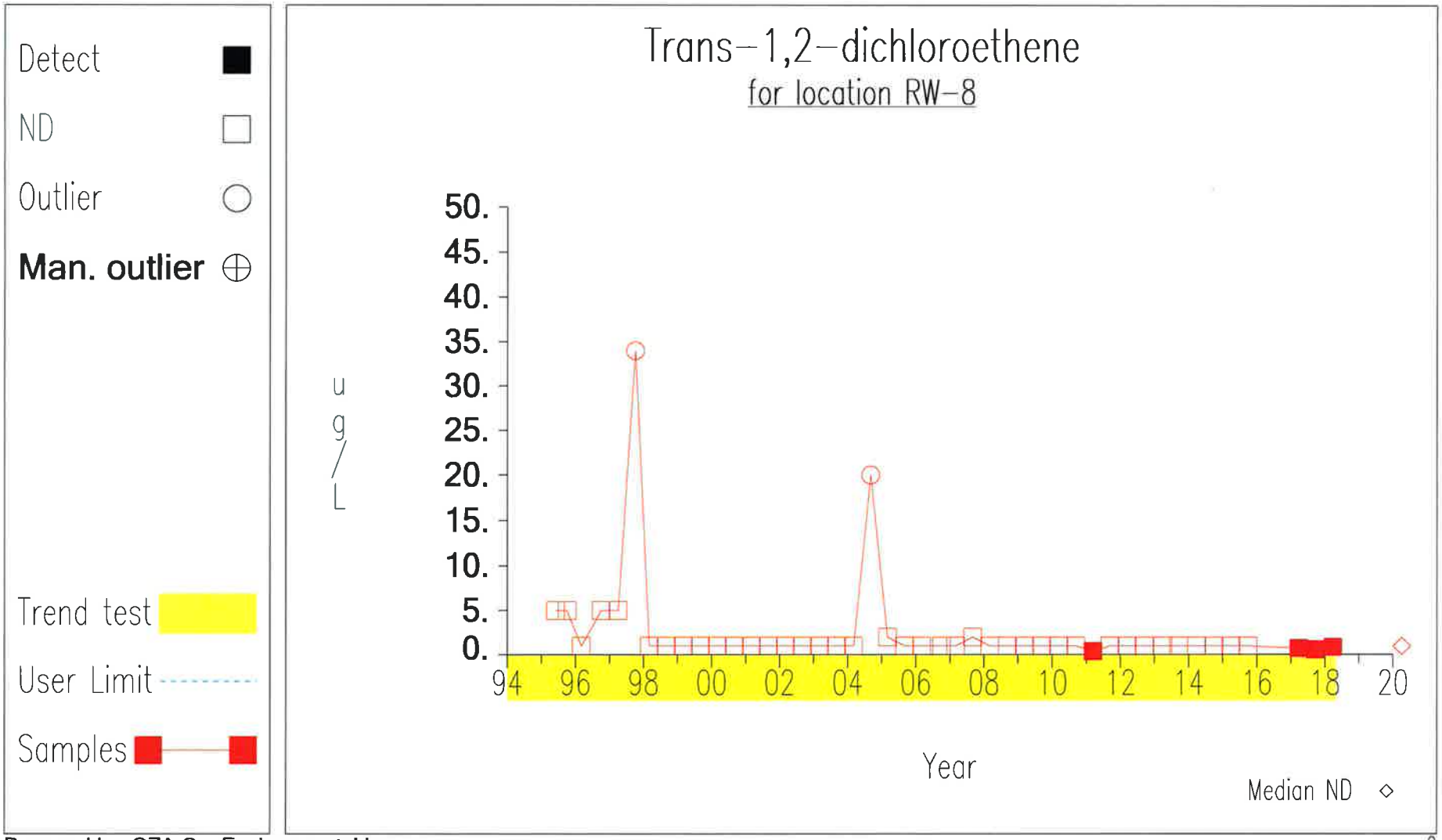

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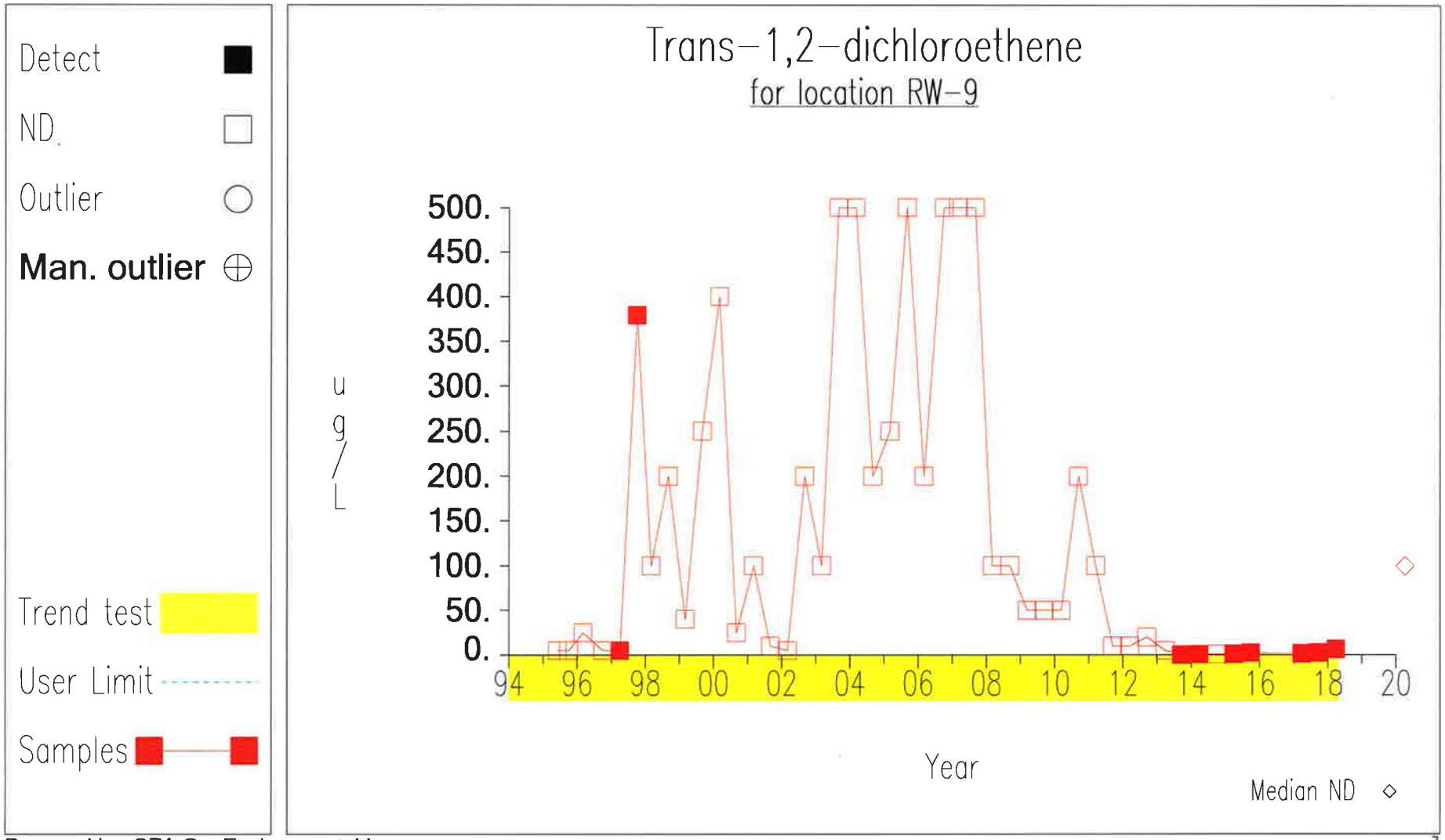
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Year
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Analysis prepared on: 5/14/2018

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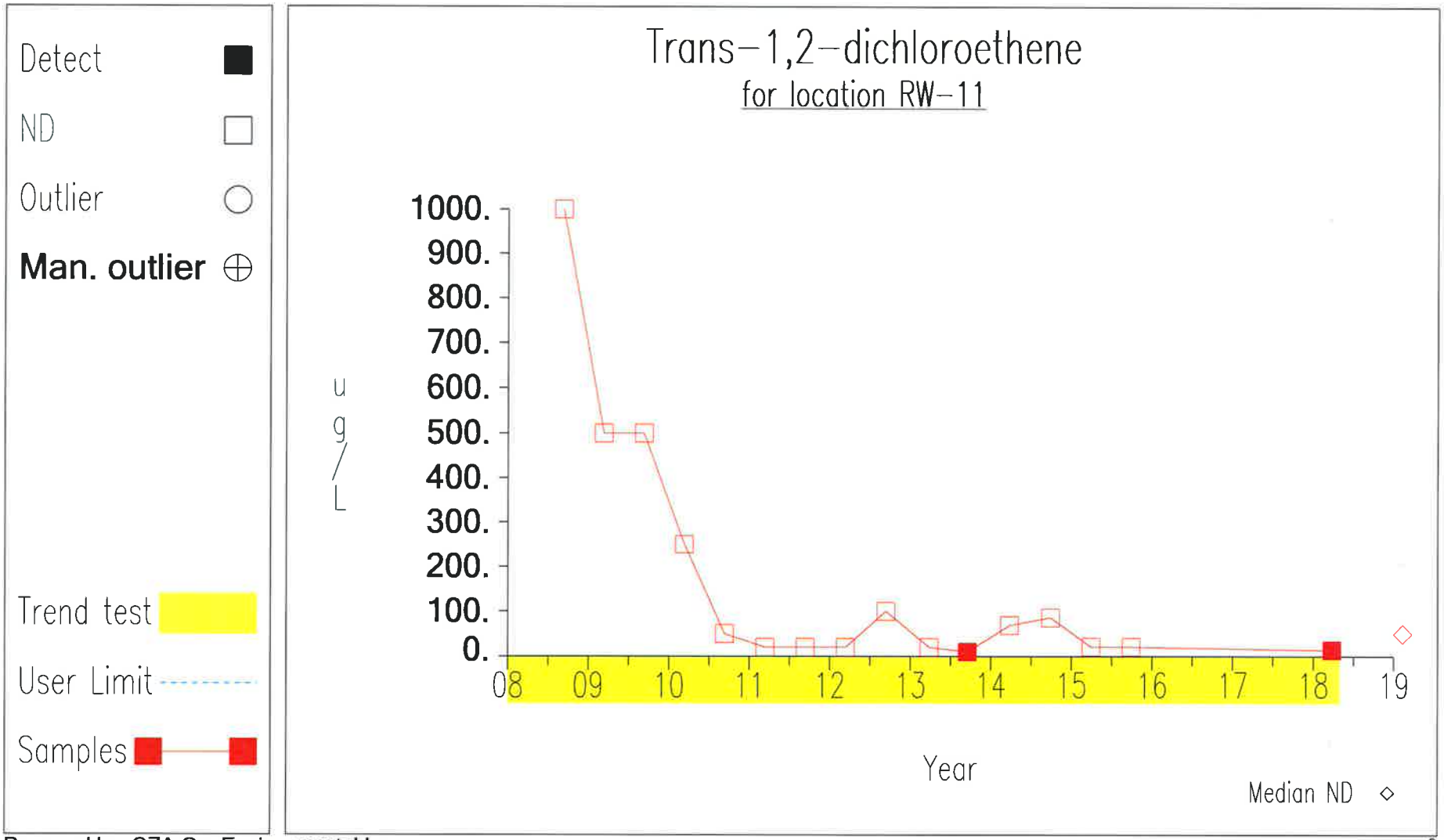

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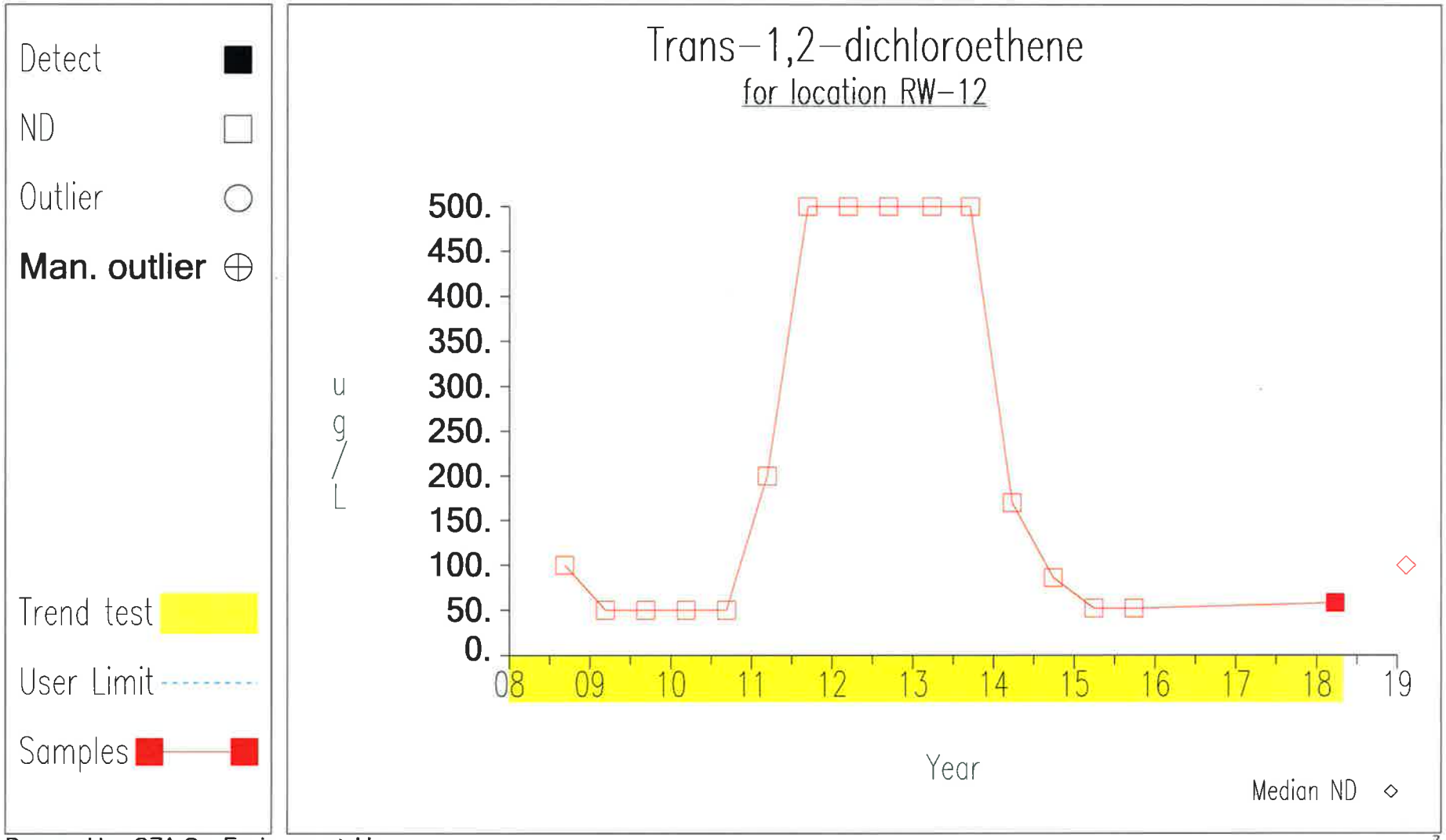

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Analysis prepared on: 5/14/2018

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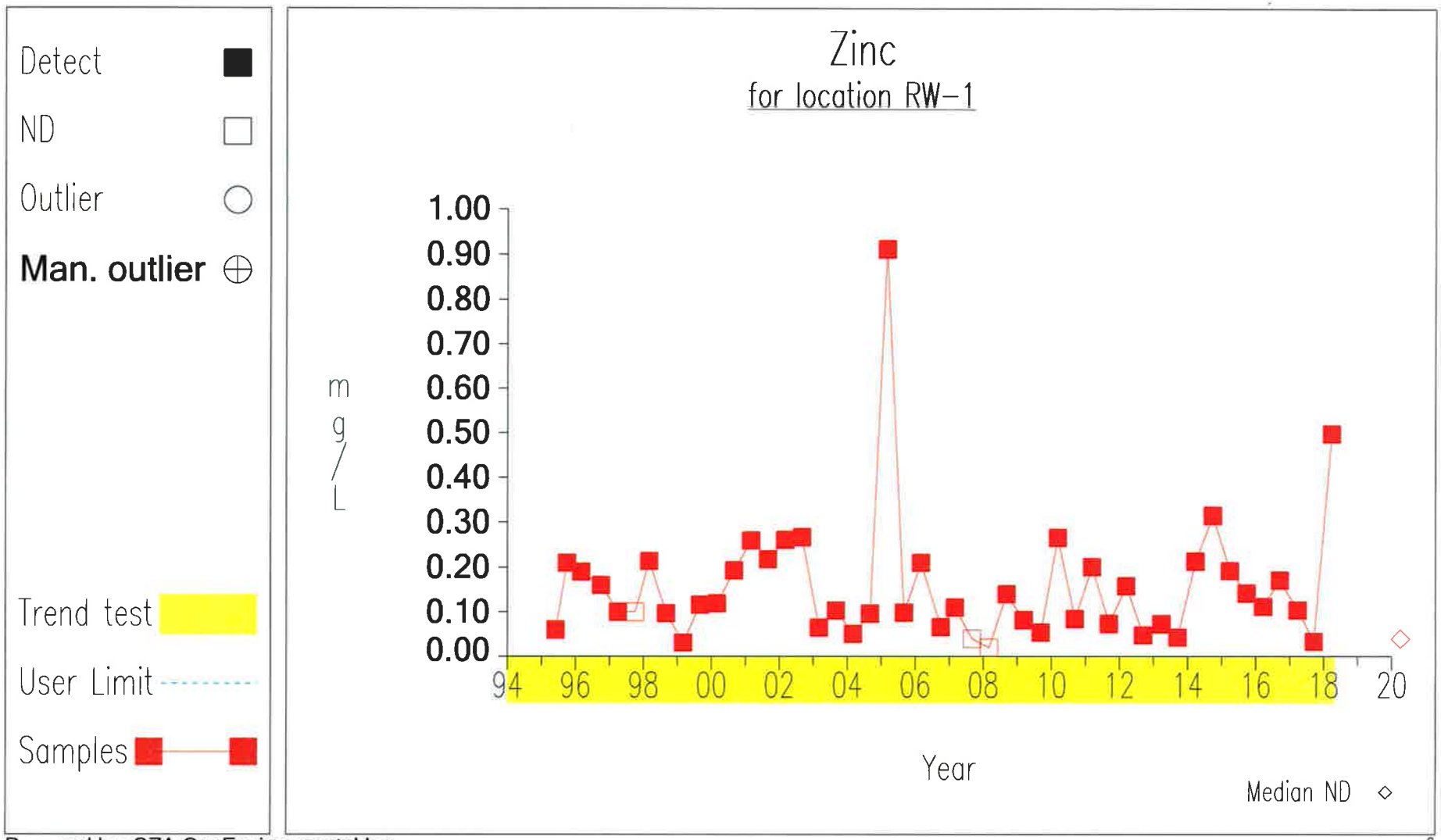

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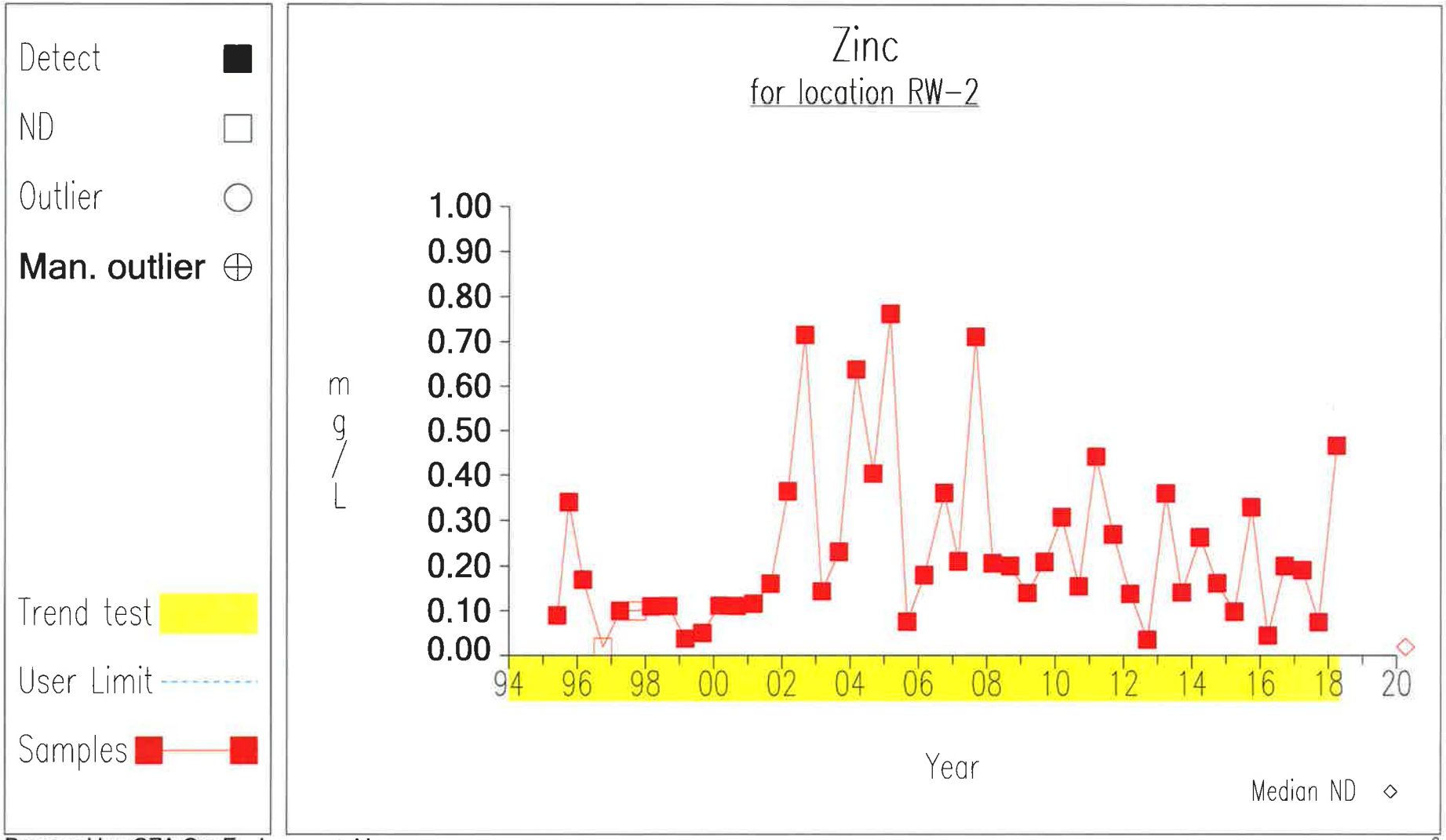
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Year
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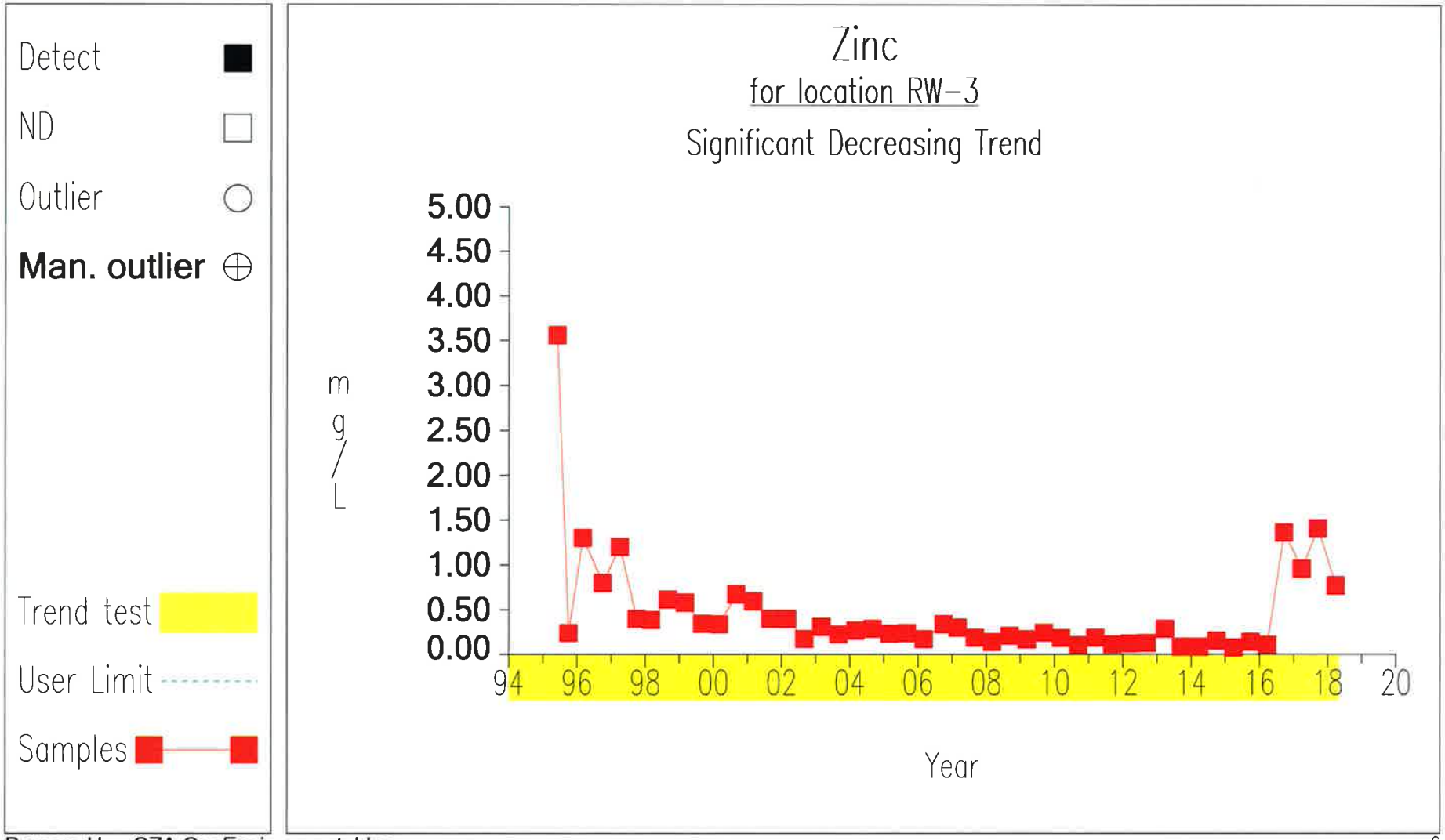
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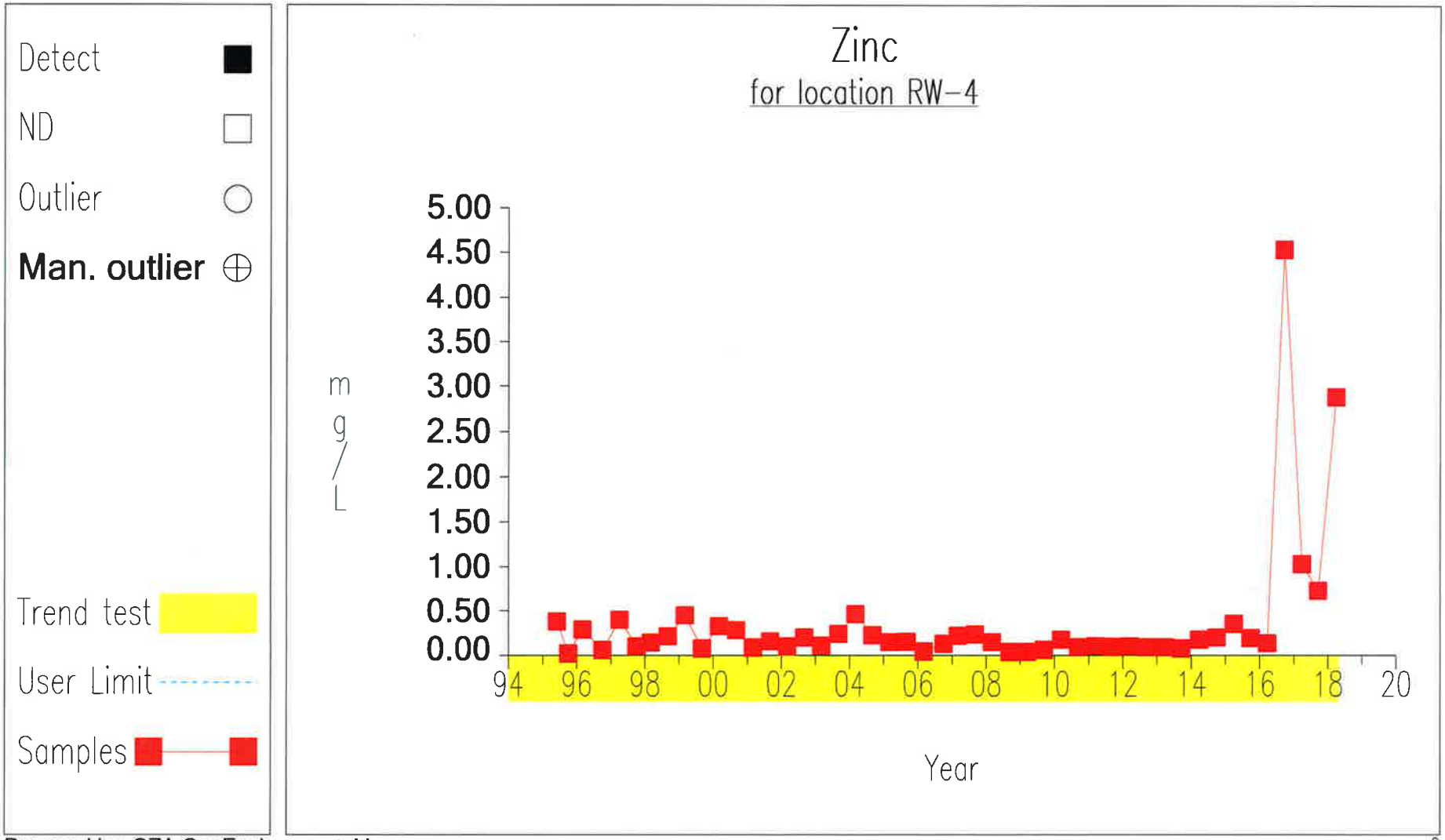
Time Series



Prepared by: GZA GeoEnvironmental Inc.

ATTACHMENT V
SEPTEMBER 2005 CONCEPTUAL HYDROGEOLOGIC MODEL

RCRA POST-CLOSURE PERMIT RENEWAL APPLICATION
FORMER HALLMACK FACILITY
HARRODSBURG, KENTUCKY
PERMIT NO. KYD-081-017-667

ATTACHMENT V
SEPTEMBER 2005 CONCEPTUAL HYDROGEOLOGIC MODEL

RCRA POST-CLOSURE PERMIT RENEWAL APPLICATION
FORMER HALLMACK FACILITY
HARRODSBURG, KENTUCKY
PERMIT NO. KYD-081-017-667

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ATTACHMENT V
CONCEPTUAL HYDROGEOLOGIC MODEL

RCRA POST-CLOSURE PERMIT RENEWAL APPLICATION
FORMER HALLMACK FACILITY
HARRODSBURG, KENTUCKY
PERMIT NO. KYD-081-017-667

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Appendix A Groundwater Flow Maps
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Appendix D 2000 Dye Tracing Investigation Report

1.0 INTRODUCTION

The Conceptual Hydrogeologic Model (the "Model") was prepared by GZA GeoEnvironmental, Inc. for the Former Hallmack facility in Harrodsburg, Mercer County, Kentucky (the "Facility"). The Facility location is shown on the Site Location Plan, Figure No. 1 and the Site and Vicinity Plan, Figure No. 2. The layout of the Facility property based on a recent survey is provided as Figure No. 3. The Model was prepared to document a reasonable interpretation of the geologic and hydrogeologic characteristics of the Facility and vicinity to guide efforts to address groundwater contamination from a variety of known and suspected sources at and off the Facility property.

The Model was based on a review effort that spanned several years and included: (1) a review of approximately 10 years of groundwater remediation system performance monitoring data and a review of prior studies of the Facility, Humane Spring and neighboring properties; (2) a review of the results of investigation and closure activities at more than 40 RCRA solid waste management units; (3) a supplemental potential contaminant source area investigation; (4) an investigation of perched water; (5) supplemental groundwater aquifer sampling; (6) review of regional geologic reports and supplemental geological characterization with the assistance of outside experts; (7) supplemental surface water sampling at Humane Spring; and (8) a rigorous evaluation of historical Humane Spring water quality data.

2.0 GEOLOGIC AND HYDROGEOLOGIC SETTING

The hydraulic conductivity of the intact limestone underlying the Facility is negligible. The hydraulic conductivity of the non-karst fractures varies from low to high. These fractures transmit groundwater to the karst conduits. The hydraulic conductivity of the karst conduits is very high, with flow in these features strongly influencing groundwater migration patterns.

2.1 REGIONAL AND FACILITY GEOLOGY

Facility geology is described in the following paragraphs and is summarized on the Site-specific Geologic Profile included as Figure No. 5.[1] This profile is based on the boring logs completed during Facility investigations, bedrock outcrop and road cut observations at and near the Facility, published geologic reports and additional interpretive assistance from Dr. Frank Ettensohn, Chairman of the Department of Geological Sciences at the University of Kentucky in Lexington and an expert on the bedrock geology of the Facility area.

[1] Note that the geologic description and profile may differ from previous reports for the Facility because earlier investigators relied on and reported general regional geologic descriptions and not Facility-specific observations.

The geology at the Facility and vicinity consists of less than 10 feet of clay soil overlying limestone bedrock. The limestone beneath the Facility is the Middle Ordovician Age Lexington Limestone Series. It is divided into several Members based on changes in lithology.

Beneath the clay soil in the area of the former surface impoundments and building is about 1 to 3 feet of the Sulphur Well Member, which is bryozoan (fossil)-rich and irregularly bedded limestone. The Sulphur Well is underlain by the Brannon Member. The Brannon is characterized as 2- to 5-inch thick layers of interbedded micrograined limestone and shale. At the Facility, the Brannon ranges in thickness from 0.5 to 3 feet. There is an unconformity at the base of the Sulphur Well meaning that the surface of the underlying Brannon Member was exposed in the area of the Facility and subjected to erosion prior to deposition of the Sulphur Well. As a result, the thickness of the Brannon varies and may not be present in all areas of the Facility and vicinity.[2] During the erosional period experienced by the Brannon, its shale layers weathered to soft, plastic clay. As discussed later in this report, these clay layers play a key role in the migration of perched water and the persistence of trichloroethylene (TCE) contamination at the Facility.

Underlying the Brannon is the Perryville Member, which is divided into the Cornishville Bed and the Salvisa Bed. The Cornishville Bed consists of 1 to 2 feet of gray, microcrystalline limestone. The underlying Salvisa Bed is light gray, almost white, and is cryptocrystalline limestone in 0.8- to 1-foot thick beds. The Salvisa Bed ranges from 15 to 20 feet thick at the Facility. The lower third has 0.1- to 1-foot thick beds and contains solution-enlarged joints.[3]

Underlying the Perryville Member is the Tanglewood Limestone Member, which is fine- to coarse-grained, is about 30 feet thick at the Facility (present between elevations of 840 and 810 feet) and is characterized by solution-enlarged joints (karst features). Vertical fractures, voids, “broken zones” and water loss were logged during drilling across the Facility within the Tanglewood, especially near the groundwater table (which at the Facility is approximately at elevation 821 feet), and within the upper 10 feet of that formation presumably representing a paleo-groundwater table surface (see Figure No. 5). Humane Spring discharges from the karst features near the base of the Tanglewood.

The medium- to coarse-grained Grier Limestone Member is present beneath the Tanglewood. The Grier is not characterized by karst features, vertical fractures, voids, or broken zones and has a low hydraulic conductivity.

---

[2] The Brannon was identified at the Facility in the degreaser pit excavations.

[3] While installing wells at the Facility, drillers noted a loss of drilling fluids (water) generally between elevations of 848 to 840 feet above mean sea level while drilling through the lower portion of the Salvisa Bed and the upper portion of the underlying Tanglewood Limestone Member.

2.2 REGIONAL AND FACILITY HYDROLOGY

2.2.1 Humane Spring Watershed

The Facility is located in the Humane Spring drainage basin, as depicted on Figure No. 1. This basin comprises an area of approximately 1 square mile. The 30-acre former Hallmack Facility comprises about five percent of the Humane Spring recharge area. A rapid subsurface hydraulic connection between portions of the Facility and Humane Spring was confirmed by a 1993 dye trace study (the "1993 Dye Study") conducted at the Facility.[4]

Average annual precipitation for the area is about 46 inches. Based on precipitation measurements and discharge rates measured during the 1993 Dye Study, approximately 34 percent of the total precipitation that falls within the Humane Spring recharge basin (i.e., 16 inches per year) enters the groundwater and eventually discharges at Humane Spring and on average, Humane Spring discharges at an average annual rate of approximately 500 gallons per minute (gpm). This helps demonstrate that Humane Spring is the discharge point for groundwater that passes beneath the Facility.

2.2.2 Facility Surface Water Flow

The Facility is connected to Humane Spring by both surface and groundwater flow. Storm water from the northern and western portions of the Facility may travel over land to South Creek, located near the western boundary of the Facility between Hallmack and Modine. It also flows over land to a drainage ditch (sometimes referred to as the "West Ditch") located between the former building and the former surface impoundments. Water in West Ditch flows west to South Creek, which flows south, beneath Tapp Road and adjoining warehouse buildings to what is referred to as Tapp Road Creek, then west to the stream formed by Humane Spring which joins Town Creek approximately 100 yards downstream of Humane Spring's surface discharge point. Town Creek discharges into the Salt River. Each of these ditches and creeks between the Facility and Humane Spring

[4] See, Final Report, 1993 Dye Tracing Investigation, NuTone Facility Harrodsburg, Kentucky, prepared by Ozark Underground Laboratory for CTA (November 18, 1993). The objective of the investigation was to help characterize groundwater movement along preferential flow routes, determine if groundwater from the Facility followed preferential flow routes that discharged at Humane Spring or other Springs, and determine if flow to Humane Spring is intercepted by existing monitoring wells and piezometers. Results of the groundwater tracing indicated that the Facility is underlain by a karst aquifer capable of relatively rapid groundwater movement, indicating integrated fracture and solutionally-enlarged openings in the bedrock. The report also concluded that the recharge area for Humane Spring is essentially coincident with the topographic basin for Tapp Road Creek. See also Work Plan for Groundwater Tracing Study NuTone, Inc. Facility, Harrodsburg, Kentucky, prepared for CTA by Ozark Underground Laboratory (October 9, 1992).

are intermittent, losing streams that can lose water to infiltration into the subsurface anywhere along their length. In fact, continuous storm water flow from the Facility to Humane Spring is rare. During the 1993 Dye Study, surface water was not observed to flow the entire route to Humane Spring.

2.2.3 Facility Groundwater Flow and Elevation

In general, groundwater enters the Facility from the northwest, north, northeast and southeast and flows off-site to the south and southwest. Notably, groundwater flow onto the Hallmack Facility from the west and northwest include flows from the adjacent Modine property.[5] This flow was previously reported by investigators for Hallmack and Signet and confirmed by a dye trace study conducted by Modine in 1999/2000 ("Modine Dye Study"). Groundwater elevation contour maps prepared for Hallmack and Modine are presented in Appendix A.

The unconfined aquifer in the limestone bedrock extends to a depth of approximately 60 feet below ground surface (bgs) at the Facility. The groundwater table is at a depth of about 50 feet when measured in the areas of the former building. A 1993 GRS pumping test report concluded that the aquifer is likely to be as thin as 10 feet (consistent with the geologic profile presented in Figure No. 5) and that the aquifer does not store a large volume of water. The report also found that the deeper bedrock at the Facility (Grier Member) is not hydraulically connected to the shallow water-bearing bedrock.[6] The karst features of the Facility bedrock are dominated by a thin, less than 10-foot thick, solution-enlarged system of conduits located at and just below the groundwater table surface.

2.2.4 Groundwater Flow Regimes

At the Facility, groundwater flows in three distinct systems. First, perched water in the soil and shallow bedrock. The source of this perched water is precipitation that flows vertically and horizontally through fractures and bedding planes as it migrates to the aquifer. Within the aquifer, groundwater migrates rapidly through karst conduits, solution-enlarged joints and bedding planes. The 1993 Dye Study demonstrated that groundwater can flow from the Facility through this system to Humane Spring, approximately 3,000 feet southwest of the Facility, within 26

[5] Groundwater flows at the Facility and at Signet were determined by groundwater investigations completed by Stokley-Cheeks & Associates, Inc. (SCA) for Hallmack, and by Dames & Moore, ERM and Scott R. Smith Environmental Management Consultants, Inc. for Signet. Maps prepared for Signet in 1993 and 1998, based on groundwater elevations in wells installed at Signet, show groundwater flow from Signet onto Hallmack in the northwestern area of the Hallmack property, and are consistent with SCA's findings.

[6] See Aquifer Pump Test Report, Hallmack Facility, Harrodsburg, Kentucky, prepared by CTA (December 21, 1993). The aquifer-pumping test also indicated that there is a high level of connectivity between many of the wells at the Facility.

hours. Third, groundwater flows very slowly through the low hydraulic conductivity fractures of the bedrock.

The overburden (clay or granular fill) is relatively thin, varying from a few inches to approximately 10 feet in depth at the Facility. Beneath the overburden soil, precipitation infiltrating as groundwater encounters an epikarst layer consisting of fractured and weathered limestone and clay layers. The water travels slowly through the rock and along bedding planes until it strikes vertical fractures. The water then moves rapidly downward and horizontally through these epikarst fractures and bedding planes, following a tortuous path, eventually reaching the depth of the water table which corresponds with the solution-enlarged karst conduits. Once the water enters a karst conduit, it flows rapidly to Humane Spring.

Groundwater flow direction and rate are variable over localized areas of the Facility, as dictated by the local fracture and conduit pattern. This is evidenced, for example, by the differences in groundwater elevations and TCE concentrations in closely situated surface wells.[7] It is also evidenced by the results of the 1993 Dye Study.

Fluorescein dye released at the ground surface on the northern portion of the Facility appeared at Humane Spring approximately 31 hours after release. It was generally accepted that the dye reached Humane Spring via fast flowing subsurface groundwater conduits; however, investigators at the time did not necessarily consider surface water flow.[8] This dye appeared in wells P-104 and P-219 within 48 hours of release,[9] and in wells P-211 and P-212 within four days. Ultimately, this dye was detected in 11 other on-site wells, but only several weeks later.[10] The locations of the dye release trenches, the wells sampled during the test and a summary of results are shown on Figure No. 6.

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[7] Compare, for example, the groundwater elevations presented on Figure No. 3 for piezometers P-100 and P-101 with the elevations of the adjacent recovery wells RW-8 and RW-7.

[8] Data reported on the timing of dye appearance in surface water on and off the Facility indicates that the dye may have first reached Humane Spring due in part to surface water flow. The dye detected in wells P-104 and P-219 located near South Creek may also have migrated that distance via surface water flow.

[9] Note that frequent (hourly) sampling was only completed at Humane Spring and not in wells. Therefore, there is insufficient data to compare the timing of dye appearance in the wells (first sampled 48 hours after release), especially wells P-104 and P-219, to the timing of dye appearance at Humane Spring.

[10] Each well where dye was detected was an open-bedrock well constructed with a steel casing set at the soil/bedrock interface (depth generally less than 10 feet below grade). Dye was not detected in wells constructed with casings sealed into the bedrock to depths near the groundwater table surface. This suggests that where dye was detected in the groundwater that the open boreholes provided a vertical migration conduit for the dye to reach the groundwater.

In contrast, Rhodamine dye (released at the ground surface approximately 200 feet east from where the Fluorescein dye was released) was detected in only two wells. This dye was first detected three weeks after release in P-205, located about 560 feet from the dye release location. Almost two months later, the dye was first detected in a second well (P-212), which is located adjacent to the northern side of the former building, but only about 250 feet from the dye release location. Although this dye took weeks to travel a few hundred feet to on-site wells, it appeared nearly 3,000 feet away at Humane Spring within about 23 hours following release. The results of this dye test provide no specific information on the route of transport from the dye release location to Humane Spring, but strongly suggest that groundwater migration at the Facility occurs both in open fractures and via irregular and unconnected joints and fractures.

2.2.5 Location of Principal Conduits

Because of the importance of conduit flow to Facility hydrology and containment strategies, the principal conduits at the Facility were identified to the extent practical by a 1993 natural potential ("NP") survey.[11] These potential karst conduits are depicted on Figure No. 6 based on the Geophysics Group's interpretation of the NP anomalies.

Interpretation of the NP survey results delineated one continuous potential karst conduit which trends west from the western area of the former surface impoundments, then south along the east side of South Creek (referred to as "Nutone Creek" in the NP report), then encompassing the area on both sides of South Creek to the southwestern property boundary.[12] The 1993 Dye Study concluded that it was by this karst conduit that groundwater from the Facility could reach Humane Spring in 31 hours or less. Wells W-5C, P-210, P-104 and P-219 were installed within this presumed karst conduit.[13]

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[11] Results of Natural-Potential Survey at the Hallmack Facility, Harrodsburg, Kentucky, prepared by The Geophysics Group for CTA (August 27, 1993). The purpose of the NP study was to locate karst conduits likely to carry groundwater and possible contaminants between the endpoints of dye tracing tests. Six relatively positive NP anomalies, or sets of anomalies, typical of karst conduit expressions, were mapped oriented in a southwesterly to south-southwesterly direction. The largest system of karst conduits extended roughly parallel to and east of South Creek in the western area of the Facility. Another prominent anomaly was observed between the former surface impoundment No. 1 and the former building. Each of the deduced conduits were interpreted to be within 50 feet of the ground surface.

[12] The NP survey was repeated over the western NP anomaly following the addition of water into the Fluorescein dye injection trench. The NP response was enhanced by about 30 percent after the water was injected into the trench, confirming the likelihood that the western NP anomaly is a principal karst conduit.

[13] A portion of the NP anomaly described above also corresponds with a 520-foot long area of shallow (less than 1 foot) metals-contaminated soil (i.e., AOC-West) that was present on the eastern side of the drainage (South Creek/NuTone Creek) at the time of the NP survey. The metals-contaminated soil, discovered and remediated in 1998, may have had some effect on the electrical readings made during the NP survey; however, review of boring log information for wells installed in the area consistently indicate the presence of karst features in that area of the Facility (i.e, voids, water loss, etc.).

Interpretation of the NP survey data also indicated shorter, southwest-trending karst conduits that did not extend across the Facility. One of the shorter conduits was interpreted to extend from the eastern edge of former surface impoundment No. 1, southwest past the western (Fluorescein) dye release trench, terminating between wells W-9 and P-212. A pair of southwest-trending karst conduits were interpreted to be present southwest of the former building between what was a gravel access road and Tapp Road. The NP survey data suggests that recovery well RW-6 was installed within one of these apparent karst conduits and well P-302 is present immediately across Tapp Road from another; however, both of these apparent conduits appear to be minor in nature. Refer to Figure No. 6 for locations of other possible karst conduits. No karst conduits identified by the NP survey can explain the rapid transport of Rhodamine dye from the northeastern portion of the Facility to Humane Spring.

3.0 CONTAMINANT SOURCE AND RELEASE INFORMATION

3.1 LOCATION, NATURE AND HISTORY OF PREVIOUS CONTAMINANT RELEASES OR SOURCES

The potential sources of volatile organic compound (VOC) groundwater contamination at the Facility have been studied. While the total volume of these VOC releases is unknown, it is likely that they occurred (to greater or lesser degrees) at several areas of the Facility, over an extended period of time (i.e., as long as 18 years). There is no information suggesting acute release events. Rather, the circumstances suggest slow, gradual seepage to the bedrock and aquifer from the surface impoundments (Solid Waste Management Units [SWMU] 1, 2 and 3), drum storage pad (DSA) (SWMU-27B), degreasers located in concrete-lined pits within the bedrock (SWMU-18 and -19) and miscellaneous incidental solvent handling locations around the Facility. It is also reasonably certain that no new VOC releases have occurred following plant shutdown in 1986.

3.2 PRIMARY RELEASE AND SOURCE AREAS HAVE BEEN IDENTIFIED AND REMEDIATED TO THE EXTENT PRACTICABLE

3.2.1 Surface Impoundments and Drum Storage Area

A source of TCE to the subsurface, the former surface impoundments, were emptied of their contents and excavated to the top of bedrock and covered with

an impermeable RCRA Subtitle C landfill cap.[14] Removal of sludge from the surface impoundments eliminated these impoundments as a source of TCE into the subsurface. Similarly, the DSA concrete pad and surrounding soil (contaminated with TCE) were excavated to bedrock and closed in 1996.[15] Accordingly, these areas are no longer considered ongoing TCE sources to the aquifer.

3.2.2 Supplemental Potential Source Area Investigation

GZA re-evaluated each SWMU and Area of Concern (AOC) historically identified at the Facility and administratively closed prior to GZA's involvement. Based on our understanding of historical operations, other areas of the Facility not identified as SWMUs or AOCs were also evaluated. The purpose of the work was to identify potential VOC sources to the bedrock. Notwithstanding prior determinations, we found reason to believe that additional evaluation was justified at several of the identified areas. A listing of each area evaluated is summarized in Table B-1 provided in Appendix B.

Thereafter, GZA completed a subsurface investigation of the identified suspect areas. This work included the excavation of 43 shallow test pits (16 within the building). Several of the suspect areas overlapped and were evaluated concurrently. Other suspect areas were widespread and required multiple sampling locations. Sampling locations are shown on Figure No. 4. A summary of the investigation is provided in Appendix B.

Based on the results of this investigation, GZA identified that the two degreaser pits (SWMUs-18 and -19) constituted additional likely residual TCE source areas. The concrete degreaser pit linings and surrounding fill soil were subsequently removed to the degree possible. Accordingly, the degreaser pit areas are not considered ongoing TCE source areas.

Based on the investigation and remediation work completed to date, all primary source areas have been identified and remediated to the extent practicable. Additional actions pertaining to TCE source areas in soil at the Facility are not needed.

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[14] See EFS at pp. 10-11 for additional details concerning closure of the former surface impoundments.

[15] During December 1995 and January 1996, NuTone caused the DSA concrete pad to be excavated and disposed in accordance with a Drum Storage Area RCRA Closure Plan (August 23, 1995) approved by KDEP on December 19, 1995. NuTone submitted the Closure Certification to KDEP on March 21, 1996, and KDEP approved Closure status for the DSA on August 18, 1997. During October 1997, CTE excavated and disposed of the remaining contaminated soil surrounding the concrete pad in the vicinity of the DSA (SWMU 27B) in accordance with its RCRA Facility Investigation/Corrective Measures Study RFI/CMS Work Plan (August 27, 1997). KDEP approved closure of SWMU by permit amendment in 2004.

3.2.3 Location of Residual Subsurface Sources

Although the primary TCE sources were removed and the immediately affected source areas were remediated to the extent feasible, residual TCE remains within approximately 50 to 60 feet of unsaturated and saturated bedrock. For purposes of this discussion we define a primary source as a man-made vessel or structure (degreaser, tank, drum, etc.) where TCE was contained and subsequently leaked or otherwise escaped into the environment. We believe that TCE was released directly to the bedrock from more than one source area; specifically, two degreasers installed in concrete-lined pits excavated into the bedrock and the outdoor concrete pad used to store drums. Some unknown volume of TCE remains as dense non-aqueous phase liquid (DNAPL) in the bedrock matrix and in thin layers and surface coatings along the surface of an unknown number of irregular horizontal joints, bedding planes and vertical fractures. We consider this residual TCE in the bedrock as a "residual" or "passive" TCE source or sources. TCE was also released in dissolved phase and is dissolving further from existing DNAPL in the bedrock. It is in this form that TCE is most readily identified, both in the massive rock and the rock fractures.

Both DNAPL and dissolved phase chlorinated VOCs (CVOCs) are ongoing passive sources of contamination. TCE as a DNAPL has a low solubility but is slowly being removed from fractures as it is dissolved into the groundwater. At the same time, dissolved TCE is entering the primary porosity of the bedrock through the process of matrix diffusion whereby the residual or passive sources of CVOCs in the dense bedrock matrix will continue for decades, after the DNAPL sources are depleted. Discussions of processes pertaining to residual and passive CVOC transport mechanisms are provided in the following Section.

4.0 CONTAMINANT DISTRIBUTION, TRANSPORT AND FATE PARAMETERS

Discussions pertaining to contaminant distribution, transport and fate are provided in the following Sections.

4.1 CONTAMINANT TRANSPORT MECHANISMS AND PATHWAYS

To understand the nature of the groundwater restoration issues presented at the Facility, it is helpful to understand the processes by which TCE was released and subsequently transported through the subsurface, and the time period over which this migration has occurred. Based on our understanding of Facility history and operations, we ascertain that TCE was released as a free product (DNAPL) and as a dissolved phased liquid, in water. DNAPL releases likely occurred within the degreaser pits, the DSA and possibly elsewhere from undocumented locations. Dissolved phase TCE was likely released inside the building in the former plating line area, through the base of the former surface

impoundments and to the West Ditch adjacent to the former surface impoundments after clarification (during the period of time prior to discharge to the sanitary sewer). TCE as DNAPL and dissolved-phase TCE in wastewater and subsequently in the perched water migrated primarily through joints created by bedding planes, fractures and faults by processes of advection and dispersion. Advection is the bulk motion of the groundwater and dispersion is the process of mechanical mixing of groundwater. TCE in the massive non-fractured bedrock matrix migrates slowly with the groundwater, as well as via diffusion under its concentration gradient. Diffusion is a critical process of CVOC migration in the subsurface and is discussed in greater detail below.

In general, the bedrock at the Facility consists of solid rock cut by a network of horizontal, vertical and angled joints. Groundwater flows unevenly through an intricate network of paths formed by the joint intersections. However, groundwater does not move along all of the joints. For various reasons, no driving force exists in a number of the joints. For instance, groundwater does not flow freely in joints that are "dead-ends." Moreover, groundwater flows only in small parts, i.e. flow channels, of the joints that form the active flow routes. Thus, groundwater flows primarily along a small portion of inter-connected joints (the "water-bearing joints"), while most of the joints and other bedrock volumes with low joint density (the "bedrock matrix" or "matrix blocks") contain essentially immobile groundwater. The hydraulic characteristics of the bedrock are mainly defined by the properties of the joint network, i.e. the permeability, density, size and orientation distributions of the joints.

In the fractured bedrock, there is a significant volume of groundwater located in the matrix blocks, whereas most of the moving groundwater is in the interconnected and groundwater-bearing joints. The transport of CVOCs in the relatively immobile groundwater is dominated by molecular diffusion. Mass transport in the bedrock is accompanied by the diffusion of CVOC particles from the groundwater-bearing joints to the matrix blocks and vice versa, i.e. the matrix blocks act as residual sources (and/or sinks) that feed (and/or drain) the groundwater-bearing joints. This diffusion process acts as a dynamic storage mechanism for the mass of CVOCs in the system (bedrock and groundwater) and constitutes a process that can be effective in transferring mass from (and/or to) the moving groundwater into (and/or from) the matrix blocks and, thus, in retarding transport process through the system. Matrix diffusion is a slow and transient process, which can rarely be assumed to have reached a steady state and, therefore, it may have an effect on the transport phenomenon of the modeled volume for a long time.

In its simplest form, diffusion is the transport of a material or chemical by molecular motion. If molecules of a chemical are present in an apparently motionless fluid, they will exhibit microscopic erratic motions due to being randomly struck by other molecules in the fluid. Individual particles or molecules will follow paths sometimes known as "random walks." In such processes, a chemical initially concentrated in one area will disperse. That

is, there will be a net transport of that chemical from regions of high concentration to regions of low concentration.

4.1.1 Horizontal and Vertical Migration Within the Unsaturated Zone

Dissolved phase TCE was in the plating wastewater which was released from the former plating line area and the former surface impoundments and entered the Sulphur Well member and then the Brannon. Within the Brannon (i.e., about 2 to 8 feet bgs), some portion of the dissolved TCE and DNAPL would have been absorbed by weathered shale (the shale was observed within the former degreaser pit excavations to have weathered into clay) layers, but the majority of the TCE-containing water would have spread horizontally along the clay layers and bedding planes within the Brannon and across the Facility. Previously uncontaminated perched water (i.e., vadose zone water) coming into contact with TCE-contaminated soil, bedrock, or concrete, would itself become contaminated increasing the volume of contaminated groundwater. This contaminated groundwater would spread horizontally along the Brannon until it either reached a vertical crack or fissure, or reached the edge of the Brannon as present on the Facility. At either a crack or the edge of the formation, the TCE-containing water would then infiltrate vertically into the underlying Perryville Member, then the Tanglewood Member. Similarly, depending on the mass, a release of free-phase TCE (i.e., as DNAPL) to the surface of the Facility in or in the vicinity of the building (i.e., from the DSA, one of the degreasers, or in connection with any other solvent handling processes) could have penetrated the concrete and surficial soil and descend vertically to the Brannon. There again, depending on the mass of the release, free-phase TCE could also have migrated horizontally along the Brannon's bedding planes and clay layers until it reached an edge or fracture that would allow it to migrate vertically to the underlying bedrock. The multi-directional horizontal spread of TCE would have been exacerbated by the relatively horizontal bedding planes at the Facility (minimal dip) and the minimal horizontal hydraulic gradient within the Brannon at the Facility. Further evidence of this horizontal migration within the vadose zone is provided by the extensive dye study performed in 1993.

Because of the existence of the Brannon, the contaminant distribution characteristics of this Facility are different than those facilities situated on more uniformly permeable geology. In more permeable geology, the majority of the TCE-contaminated water (and/or DNAPL) could be expected to migrate vertically toward the aquifer, resulting in a narrower subsurface residual source area, and a definable plume in the groundwater. In contrast, at the Facility, the geology caused releases at relatively confined surface locations to be spread widely at the uppermost layers of the bedrock, increasing the areal distribution of TCE in the unsaturated portion of the bedrock beneath the Facility.

Not all the TCE released necessarily reached the saturated portions of the aquifer. As the TCE (DNAPL and dissolved phase) migrated along the vertical and horizontal pathways through the unsaturated rock, TCE absorbed onto the rock surface and into the rock matrix, leaving behind a TCE coating or smear extending from the top of the unsaturated bedrock to the base of the saturated bedrock. In addition, TCE as DNAPL flowing through these fractures could displace water in low portions of a fracture and accumulate, forming pools. While it is possible that large pools may have formed in this way, it is more likely that there are an immeasurable number of small pools present throughout the bedrock. These pools become residual secondary source areas. As groundwater passes over these DNAPL accumulations, TCE is dissolved into the groundwater.

Where fractures are absent or terminate, TCE also moves through the rock by diffusion, as described above. During this process, TCE (DNAPL and dissolved phases) migrates under a chemical gradient from areas of high TCE concentration to areas of low concentration. At Hallmack, after the primary TCE sources were mitigated (i.e., cutting off the source and reducing the concentration in subsequent groundwater flows), the same process of diffusion subsequently causes the rock matrix to release TCE back into the groundwater.

4.1.2 Horizontal and Vertical Migration Within the Saturated Zone

By the same processes, TCE would similarly become lodged within fractures, pools and the rock matrix within the saturated zone. However, once below the groundwater table, a portion of the aqueous phase TCE migrates quickly to Humane Spring with groundwater flow through karst conduits and solution-enlarged joints. Consequently, the lateral extent of groundwater contamination has been well established, the leading edge of the plume is not expanding. As in fractures elsewhere in the rock column, TCE DNAPL could also form pools at low-lying areas at the interface between the base of the Tanglewood and the top of the relatively impervious Grier Foundation. We note, however, that extensive testing at Humane Spring has shown no evidence of flushing of DNAPL during storm events.

Accordingly, after perhaps as many as 40 years of gradual migration, the residual TCE is believed to be widely spread in small quantities throughout the bedrock beneath most of the former building. With each precipitation event, surface water migrating through the overburden and bedrock enter the same fractures as the original TCE releases. As this water passes over the small DNAPL pools and TCE absorbed into the rock matrix, small quantities of TCE are dissolved, which are then transported to the aquifer and, presumably, Humane Spring.

4.2 DNAPL

Although DNAPL has not been directly observed at the Facility, we can infer that DNAPL exists at the Facility based on several other lines of indirect evidence.[16] First, there were several likely free-phase TCE sources at the Facility. Free-phase TCE was managed at the DSA and the degreasers and any releases from those areas to the subsurface would likely have been free-phase material. Halogenated solvents (in smaller quantities) were also used in other parts of the Facility for a variety of tasks.

Second, the TCE concentration in recovery wells RW-3 and RW-9 have been detected at 2 to 42 milligrams per liter (mg/L) since 2002. These concentrations are greater than 1 percent of the pure phase solubility for TCE, which is on the order of 1,000 to 1,500 mg/L.

Third, contaminant concentrations at Humane Spring are consistent with releases associated with recharge events and groundwater flow through presumed DNAPL pools. Storm events can result in groundwater discharge at Humane Spring close to 1,000 times the average discharge rate. Yet, through such events, contaminant concentrations measured at Humane Spring remain fairly constant, with minimal dilutional effect from the significantly increased groundwater flow (i.e., the total mass of TCE discharged at Humane Spring generally increases linearly with increases in discharges resulting from aquifer recharge events). Plots of TCE and cis-1,2-dichloroethylene (cis-1,2-DCE) versus discharge rates are attached to Table 2. As shown on the Plots, the TCE and cis-1,2-DCE concentrations at Humane Spring do not decrease linearly with increases in discharge rates, indicating that there may be a source of TCE to the groundwater in the form of DNAPL below the groundwater table. A detailed evaluation of Humane Spring water quality is provided in Appendix C.

4.3 EXTENT OF RESIDUAL AND FREE-PHASE DNAPL

Based on inferred existence of DNAPL at the Facility, and our conceptual model of the transport of DNAPL through the unsaturated and saturated zones of the bedrock, we can also conclude that DNAPL may be present (i) vertically throughout the rock column from the top of the unsaturated zone near former source areas to the bottom of the aquifer; and (ii) horizontally in each direction from the former source areas. As noted above, the horizontal extent of the zone has been exacerbated by the spreading effect of the Brannon Member, where present, and other low permeability horizons. The absence of vertical migration below the Grier Formation was confirmed by a 1993 deep well investigation in the vicinity of the impoundments.[17]

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[16] See generally, *DNAPL Facility Characterization*, United States Environmental Protection Agency (September 1994) OSWER Pub. 9355.4-16FS/EPA/540/F-94/049 PB94-963317.

[17] See "Investigation of Deep Ground Water at Hallmack Harrodsburg, Kentucky" (December 21, 1993), prepared by CTA for NuTone and submitted to the KDEP. The objective of the investigation was to determine the hydrogeologic properties of the deeper rock units at the Facility and to determine if these units have been impacted by Facility-related

DNAPL distribution is not likely to be uniform, but erratic, coincident with the secondary porosity in the bedrock. As a result, it is also impossible to determine or characterize the relative quantities of DNAPL within the unsaturated and saturated zones across the Facility. Indeed, given the geology, it is likely that the allocation between the saturated and unsaturated zones varies widely across the Facility, again, coincident with erratic secondary porosity and exacerbated by the wide horizontal spread occasioned by the effect of the Brannon Member and other low permeability horizons.

The extent of the DNAPL has also been exacerbated by the passage of time. It is reasonable to assume that DNAPL first entered the subsurface at or about the time manufacturing operations commenced at the Facility in 1968; and depending on the mass of the releases, continued to migrate for 18 years until the termination of operations in 1986. While the configuration of DNAPL has been stable for years, dissolved phase migration by both advection and diffusion has been ongoing for as many as 37 years.

5.0 CURRENT SPATIAL DISTRIBUTION OF CONTAMINANTS

Routine sampling required by the RCRA Permit provides contaminant concentration information in the immediate area of the former surface impoundments, along the southern (downgradient) property boundary and at Humane Spring. In order to more fully evaluate changes in groundwater quality since startup of the GRS, GZA undertook a program of supplemental aquifer sampling in August 1999 and July 2005, from several on- and off-site wells not ordinarily sampled under the RCRA Permit. The following paragraphs describe the results of that sampling and the related trends. Because of the impact on contaminant levels at Hallmack and Humane Spring from the adjacent Signet property, we also present our understanding of the investigation and remediation of TCE releases at that facility. A summary of groundwater VOC analytical data collected for the Facility is provided in Table 1. Included on Table 1 are plots of TCE concentrations versus time for the majority of the wells. These plots are also shown on Figure No. 7.

5.1 CONTAMINANT DISTRIBUTION

In general, the 1999 and 2005 analytical data is consistent with previous analytical results from 1994 or 1995, which is when the majority of wells were last sampled. Samples from the 11 wells that contained no detectable concentrations of TCE in the early years were again less than the detection limits. Concentrations in the other wells were similar to concentrations identified in 1995. One well, P-220, located immediately north of the former building and adjacent to recovery well RW-3, detected an increase in TCE

compounds. The investigation concluded that groundwater contamination was limited to the shallow groundwater within the karstic limestone.

concentration from 12,620 parts per billion (ppb) in 1995 to 25,000 ppb in 1999 (this well was not sampled in 2005).

5.1.1 Western and Southwestern Areas of the Facility

This is the location of the prime karst conduit identified by the NP survey. During well gauging, it also appears as a groundwater sink, typically having the lowest water levels on the property. There is an array of nine on- and off-site wells present at a spacing of 30 feet to 120 feet along the southwestern area of the Facility (from north to south, P-105, SS-4, P-219, P-104, P-305, P-103, P-304, P-303 and RW-6) (Figure No. 3). TCE-contaminated groundwater has not been detected in well SS-4 since installation in 1990, in the on-site P-100 and P-200 series wells since 1988, or in the off-site P-300 series wells since 1990.

Wells W-5C, P-210, P-104 and P-219 were installed within the primary karst conduit present at the Facility. Prior to the closure of the former surface impoundments, these wells contained TCE in concentrations ranging from 2.4 ppb to 282 ppb, however, TCE has not been detected in these wells in concentrations greater than the Groundwater Protection Standards (GPS) subsequent to the closure of the former surface impoundments. Similarly, TCE concentrations in well P-102 decreased from more than 200 ppb to less than 15 ppb following closure of the former surface impoundments. TCE concentrations in well RW-6 (which replaced P-102) have been generally less than 10 ppb since installation in 1995. These data indicate that the former surface impoundment closure was effective in removing an active source of VOC contaminants.

5.1.2 Southern Property Boundary

An array of nine on- and off-site wells is located generally in a straight line along the southern property boundary (see Figure No. 3). TCE was detected in six of these nine wells, three on-site wells[18] (RW-7, RW-8 and P-101) and three off-site wells (P-301, P-302, and P-305). The TCE concentrations in wells P-301 and P-302 show a decreasing trend following closure of the former surface impoundments in 1988. Groundwater quality in well P-305 may be affected by TCE releases from the Signet property. The analytical data and data plots versus time are included in Table 1 and Figure No. 7.

[18] Well P-100 may also exceed the standard, however, it is damaged and has not been sampled since 1993. The last sample detected TCE at 102 ppb.

5.1.3 Groundwater in the Vicinity of the Building

There are several monitoring wells and recovery wells (RW-1, RW-2, RW-4, RW-5, P-222, P-205 and P-214, to name a few) in the vicinity of the former building (see Figure No. 3 and Table 1). Review of the analytical data indicates similar decreasing trends in concentrations in groundwater from most of the wells, again seemingly attributed to closure of the former surface impoundments in 1988. Conversely, data from recovery wells RW-3 and RW-9, also located in proximity to the building, possibly indicate an increasing trend. The analytical data and data plots versus time are included in Table 1 and Figure No. 7.

5.1.4 Northwestern Area

Wells W-5C, P-210, P-218 and P-105, which form a line dividing these far northwestern wells (and Signet) from the remainder of the Facility, experienced a significant decrease in TCE concentrations to non-detect levels (<5 ppb) following closure of the former surface impoundments. In contrast, a subset of wells located in the northwestern area of the Facility (i.e., P-106, P-107, P-108 and P-213) did not decrease to non-detect levels (<5 ppb) following closure of the former surface impoundments in 1988, and TCE concentrations in P-106, P-107, P-108 and P-213 still exceed the GPS for TCE. This suggests that at least a portion of the source of the TCE found in the northwestern wells was not the former surface impoundments or, in light of groundwater flow direction, possibly any other on-site source. Indeed, historical groundwater elevation maps (Appendix A) and the 1999/2000 Dye Trace Study (Appendix D) indicate that that contaminated groundwater in these wells is likely migrating onto the Facility from the adjacent Signet property.

5.1.5 Recovery Well Data

The most repeated sampling is of the nine recovery wells. Our review of these data reveal that the annual CVOC removal has remained fairly consistent at a rate of about 28 pounds or 2.5 gallons per year and that the highest concentration of CVOCs is on the southern side of the former building, away from manufacturing areas. Based on these observations, we conclude:

- The distribution of DNAPL in the bedrock beneath the area of the former building is not known.

- The mass of DNAPL beneath the former building area remains after almost ten years of active groundwater remediation.

- Small, seemingly inconsequential, routine releases of TCE over the 18-year operating history of the Facility could have resulted in a total mass of DNAPL that will continue to reside in the bedrock for additional decades. Observed concentrations over nearly ten years in extracted groundwater indicate this is, in fact, the case.

5.2 CONTAMINANT DISTRIBUTION AT ADJACENT SIGNET PROPERTY

Unabated historical TCE releases by others at and from the adjacent Signet property also appear to be likely sources of groundwater contamination at the Facility and at Humane Spring. Historically, Signet reportedly used more than 15,000 gallons of TCE per year.[19] Investigations by others at the Signet property have identified both petroleum-contaminated soil and two areas of TCE-contaminated soil in the western part of that property.[20] Signet installed three groundwater-monitoring wells (SS-6, SS-7 and SS-8) in the western area of its property in 1993, and two additional groundwater-monitoring wells (SS-9 and SS-10) in the southwestern area of their property in 1998 (see Figure No. 2 [showing approximate Signet release areas and well locations]). Corrective action in 1997 (under the direction of the Kentucky Department of Environmental Protection [KDEP] Division of Waste Management, State Superfund Section) included excavation of petroleum- and TCE-contaminated soil and installation of a soil vapor extraction system.[21] Prior to excavation of the TCE-contaminated soil, TCE concentrations in shallow groundwater within the clay soil were detected as high as 130,000 ppb (approximately 10% of solubility, an indication DNAPL was released). December 1998 sampling and analytical testing indicated that combined TCE and 1,2-DCE concentrations in the groundwater on Signet's western and southwestern property boundaries generally range from 500 to 1,100 ppb.

TCE contamination is also present on the eastern portion of the Signet property. Five groundwater-monitoring wells (SS-1 through SS-5) were installed by Signet on the eastern portion of their property in September 1990, to further investigate the groundwater quality relating to Hallmack's reported TCE contamination. TCE and/or 1,2-DCE were detected in groundwater samples collected from two wells (SS-1 and SS-2) on the eastern area of the Signet property in 1990. Notwithstanding groundwater elevations suggesting that, in fact, groundwater flowed from Signet onto the Hallmack property, this contamination was attributed by Signet to Hallmack on the theory that a groundwater mounding effect caused by the former surface impoundments in turn caused Hallmack groundwater to flow off-Facility to the north, then west onto Signet's property, then southeast back onto the Hallmack property. That theory is not supported by groundwater

[19] See EFS at p. 16.

[20] Other than the 1999/2000 Dye Trace Study, this discussion is based on data obtained from KDEP files prior to 2000.

[21] See generally, KDEP State Superfund Section File for "Signet Systems," ID. No. RR # 05571.

flow patterns reported for the Signet property and flow patterns developed following closure of the former surface impoundments. That hypothesis is also refuted by the results of a 1994 soil sampling program conducted in the area north and west of the former surface impoundments, which confirmed that the soil quality in this area was consistent with background soil data.[22]

5.2.1 Signet Dye Study

In December 1999, in connection with the groundwater investigations ongoing at Signet in response to the TCE release on the western portion of its property, Signet commenced a dye trace study involving direct injection of dye into cased monitoring wells installed in the western portion of its property (SS-8), and east of the Signet building (SS-3) on property that was historically owned by Signet.[23] Dye injection locations (wells SS-3 and SS-8) are shown on Figure No. 2. To evaluate the potential for contamination originating at Signet to migrate onto the Hallmack property, GZA arranged for the placement and monitoring of dye receptor packs in (i) seven on-site wells (RW-1, P-105, P-106, P-107, P210, P-213 and P-218); (ii) two off-site wells (P-306 and P-307); and (iii) Humane Spring.[24]

GZA has not had the opportunity to review the results of monitoring conducted by Signet's consultant; however, our contemporaneous monitoring of Signet's dye confirmed a direct and rapid connection between the western portion of the Signet property (i.e., its documented petroleum and TCE contamination source areas) and Humane Spring. As expected, due to the dye injection procedures, our monitoring did not detect evidence of a connection between Signet's western source area and the Hallmack property. We believe that Fluorescein dye was not detected in the groundwater in the Hallmack wells because of the injection procedures utilized by Signet's consultant. The dye was injected at or near *the groundwater table surface* in well SS-8 (i.e., approximately 50 feet bgs), located on the western side of a generally north-south trending surface water and groundwater divide present through the central portion of the Signet property. Results may have been different had the dye been released to the ground surface

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[22] See Final Report of Sampling and Analysis Along the Conover/Wilson Property Line (July 11, 1994), prepared by CTA for NuTone, Inc.

[23] On January 12, 2000, K2 GeoEnvironmental (K2) of Nashville, Tennessee injected Uranine (Fluorescein) green dye in well SS-8, located west of the Signet building and Rhodamine WT red dye in well SS-3, located east of the Signet building on what is now the Hallmack property, but formerly belonged to Signet. Both wells are constructed with PVC casing and 10-foot well screens. NuTone acquired the triangular parcel of the historical Signet property from Signet in 1991, in connection with the settlement of litigation involving the contamination identified in wells SS-1 and SS-2. Signet retains a repurchase option on this parcel.

[24] Monitoring and analysis of the results of the Signet dye release on the Hallmack property was conducted for GZA by Crawford and Associates, Inc. ("C&A') from Bowling Green, Kentucky. C&A was present during the dye injection and placed, collected and analyzed the dye receptors during the period of December 30, 1999, through February 25, 2000.

and allowed to follow a migration route to the groundwater table surface similar to that followed by the TCE release(s) that were at or near the ground surface. Similarly, as expected, our monitoring did confirm a hydraulic connection between the eastern injection point and both (i) Humane Spring and (ii) three on-site wells (i.e., wells P-107, P-210 and P-213). Thus, the dye study supports the predicted groundwater flow from the historical Signet property onto the Hallmack property, consistent with the data provided in Appendix A.

Details and results of the dye tracing study are provided in the March 23, 2000, Dye Tracing Report by Crawford and Associates, Inc. (now the Center for Cave and Karst Studies at Western Kentucky University), which is provided in Appendix D.

5.3 HUMANE SPRING CONTAMINANT DISTRIBUTION

Based on water samples collected from Humane Spring during the period of 1991 through 2004, the range of total CVOC concentrations in Humane Spring is 5 to 43 ppb, averaging 21 ppb. The highest observed TCE concentration was 37 ppb. The average TCE concentration over 90 samples analyzed was 12.6 ppb, less than the applicable standard (Kentucky Surface Water Quality Criteria for Protection of Human Health from the Consumption of Fish Tissue for TCE) of 30 ppb.[25] The average range has not meaningfully changed since the startup of the GRS. Also, as determined through supplemental sampling at Humane Spring in 2004, the average range in CVOC concentrations is apparently not influenced by operation (including shutdown) of the GRS at the Facility. The 2004 study is described and the results summarized in Appendix C. Humane Spring sampling data is provided in Table 3.

Historical testing by others has shown that petroleum VOCs (PVOC) (i.e., benzene, toluene and xylene) were present in the water at Humane Spring at concentrations of 1.0 to 3.0 ppb in 1991 and 1994. We are aware of no analysis for the period between 1994 and 1998, that would have detected these PVOCs at these concentrations.[26] Sampling at Humane Spring conducted by GZA in 1998 detected PVOCs typically at concentrations less than 1.0 ppb.[27] To our knowledge, Humane Spring has not been analyzed for other potential contaminants (unrelated to the Facility) which are often found in urban

[25] See 401 KAR 5:031 Section 6, Table 1 (eff. Sept. 8, 2004). There is no equivalent standard for 1,2-DCE, however, the toxicological effects of 1,2-DCE on freshwater aquatic systems are, in general, less than that for TCE. The USEPA Maximum Contaminant Levels for drinking water are not directly applicable standards for the water in Humane Spring, as it is not used as a potable water source.

[26] Water samples collected from Humane Spring since 1994 were only analyzed for CVOCs, or the PVOC detection limit was generally about 5.0 ppb, so the relatively trace concentrations of PVOCs were not subsequently detected.

[27] PVOCs detected included: benzene, toluene, ethylbenzene, m&p-xylene, o-xylene, styrene, methyl-tert-butyl ether, isopropylbenzene, 1,3,5-trimethylbenzene and 1,2,4-trimethylbenzene. Concentrations detected were less than the method detection limit of the majority of previous water analyses.

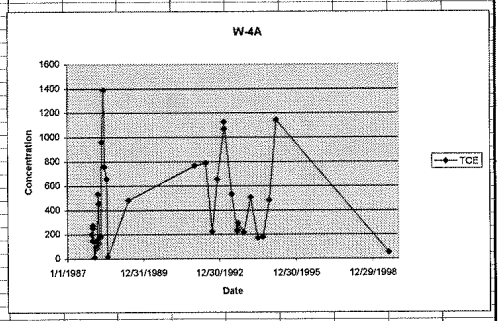
watersheds (coliform, pesticides, etc.). The supplemental analytical results for samples collected at Humane Spring in 1998 are included in Appendix C.

A review of over 100 analyses of groundwater and perched groundwater collected at the Facility, which included analyses for PVOCs, did not indicate the presence of any petroleum contamination in the Facility groundwater. Similarly, petroleum contamination has not been detected in soil samples collected from the Facility. The reported petroleum-contaminated soil and groundwater detected at the Signet property may be contributing to the petroleum contamination detected at Humane Spring, or these may be the result of the urban nature of portions of the watershed.

TABLES

TABLE 1
VOC ANALYTICAL RESULTS FOR GROUNDWATER
1987 - 2005
Former Hallmack Facility
Harrodsburg, Kentucky

Area of Site	Well ID	Date		TCE	C-1,2-DCE	T-1,2-DCE	Vinyl Chloride	1,1-DCA	1,1-DCE	1,1,1-TCA	PCE	1,1,2-TCA
Groundwater Protection Standard =>				5	70	100	2	5	7	200	5	
				ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
NE Near Lagoons	W-1A	5/14/1987		<2								
		8/25/1987		<5							<5	
		11/18/1987		0.96							<0.5	
		12/8/1987		<0.5							<0.5	
		12/17/1987		<0.5							<0.5	
		12/22/1987		<0.5							<0.5	
		12/29/1987		<0.5							<0.5	
		1/5/1988		<0.5							<0.5	
		1/23/1988		<0.5							<0.5	
		1/30/1988		<0.5							<0.5	
		2/6/1988		<0.5							<0.5	
		2/16/1988		<0.5							<0.5	
		2/23/1988		<0.5							<0.5	
		3/1/1988		<0.5							<0.5	
		3/8/1988		<0.5							<0.5	
		3/22/1988		0.5							<0.5	
		3/29/1988		<0.5							<0.5	
		4/3/1988		<0.5							<0.5	
		4/16/1988		<0.5							<0.5	
		4/19/1988		<0.5							<0.5	
		4/26/1988		<0.5							<0.5	
		5/3/1988		<0.5							<0.5	
		5/10/1988		<0.5							<0.5	
		5/17/1988		0.8							<0.5	
		5/25/1988		<0.5							<0.5	
		6/1/1988		<0.5							<0.5	
		6/7/1988		<0.5							<0.5	
		6/14/1988		<0.5							<0.5	
		6/21/1988		<0.5							<0.5	
		6/30/1988		<0.5							<0.5	
		7/7/1988		<0.5							<0.5	
		7/12/1988		<0.5							<0.5	
		7/21/1988		<0.5							<0.5	
		7/26/1988		<0.5							<0.5	
		8/2/1988		<0.5							<0.5	
		8/9/1988		<0.5							<0.5	
		8/16/1988		<0.5							<0.5	
		11/15/1988		<0.5							<0.5	
		12/20/1988		2.2							<0.5	
		1/10/1989		<0.5							<0.5	
		1/17/1989		<0.5							<0.5	
		1/24/1989		<0.5							<0.5	
		1/31/1989		<0.5							<0.5	
		3/10/1989									3	
		4/7/1989		<0.5							<0.5	
		6/8/1989		<0.5							<0.5	
		6/13/1989		<0.5	<0.5						<0.5	
		1/31/1990		<0.5							<0.5	
		3/22/1990		<1.0							<1.0	
		4/2/1990		<10							<10	
		4/2/1991		<10							<10	
NE Near Lagoons	W-1B	1/15/1992		16	15		<10	<5	<5	<5	<5	<5
		12/15/1992		<5	<5		<10	<5	<5	<5	<5	<5
		9/20/1993		<5	<5		<10	<5	<5	<5	<5	<5
SW of Lagoons	W-4A	8/25/1987		13,000							760	
		11/18/1987		6779							324	
		12/8/1987		180.1							11.3	
		12/17/1987		######							<0.5	
		12/22/1987		202.3							13.6	
		12/29/1987		146							9.3	
		1/7/1988		249							17.2	
		1/7/1988	bttm	273							14.6	
		1/30/1988		9.9							<0.5	
		2/23/1988		96.4							5.2	
		3/1/1988		147							6.7	
		3/8/1988		87.8							3.6	
		3/22/1988		530							<0.5	
		3/29/1988		451							17.5	
		4/3/1988		129							7.7	
		4/19/1988		171							<0.5	
		5/3/1988		185							<0.5	
		5/10/1988		958							59	
		6/14/1988		1386							74	
		6/21/1988		755							47	
		7/26/1988		655							52.5	
		8/9/1988		15							1.4	
		6/8/1989		481							26	
		1/15/1992		762	170		<10	<5	<4	10	29	<5
		6/23/1992		786	533		<10	<5	<5	13	25	<5
		9/23/1992		223	558		<10	<5	<5	7	11	<5
		12/7/1992		651	334		<10	<5	<5	9	19	<5
		3/12/1993		1,067	376		<10	<5	<5	12	23	<5
		3/12/1993	Dup	1,124	381		<10	<5	<5	13	25	<5
		6/29/1993		530	254		10	<5	<5	7	15	<5
		9/14/1993		225	102		<10	<5	<5	<5	5	<5
		9/14/1993	Dup	235	107		<10	<5	<5	<5	5	<5
		9/23/1993		292	119		<10	<5	<5	<5	8	<5
		12/20/1993		215	268		19	<5	<5	<5	<5	<5
		3/29/1994		503	115		<10	<5	<5	<5	8	<5
		7/6/1994		169	120		<10	<5	<5	<5	<5	<5
		9/20/1994		177	116		<10	<5	<5	<5	<5	<5
		12/20/1994		481	148		<10	<5	<5	<5	8	<5
		3/29/1995		1,140	141		<5		<5	11	24	
		8/17/1999		51	11	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	<1.0



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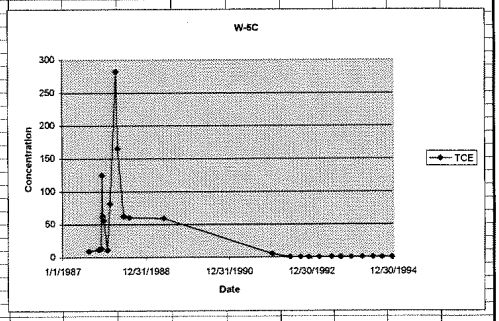
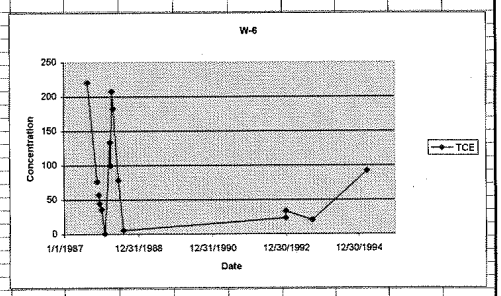
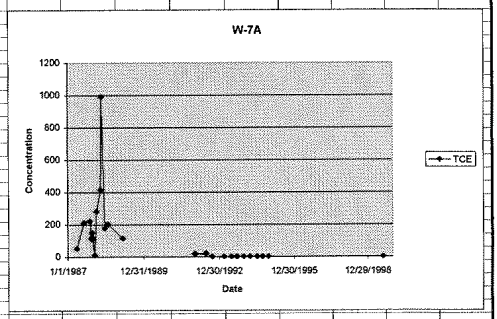
1987 - 2005
Former Hallmack Facility
Harrodsburg, Kentucky

Area of Site	Well ID	Date	TCE	C-1,2-DCE	T-1,2-DCE	Vinyl Chloride	1,1-DCA	1,1-DCE	1,1,1-TCA	PCE	1,1,2-TCA
		Groundwater Protection Standard =>	5	70	100	2	5	7	200	5	
			ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
NW of Lagoons	W-5C	8/25/1987	9							<5	
		11/18/1987	11.3							<0.5	
		12/8/1987	13							<0.5	
		12/17/1987	124.6							<0.5	
		12/22/1987	61.8							<0.5	
		12/29/1987	55.8							<0.5	
		1/30/1988	10.9							<0.5	
		2/23/1988	81.5							3.3	
		4/19/1988	282							<0.5	
		5/3/1988	165							0.5	
		6/21/1988	62							<0.5	
		8/9/1988	60							<0.5	
		6/8/1989	59							<0.5	
		1/16/1992	5	10		<10	<5	<5	<5	<5	<5
		6/23/1992	<5	31		<10	<5	<5	<5	<5	<5
		9/23/1992	<5	<5		<10	<5	<5	<5	<5	<5
		12/7/1992	<5	<5		<10	<5	<5	<5	<5	<5
		3/12/1993	<5	6		<10	<5	<5	<5	<5	<5
		6/29/1993	<5	<5		<10	<5	<5	<5	<5	<5
		9/14/1993	<5	<5		<10	<5	<5	<5	<5	<5
		9/21/1993	<5	<5		<10	<5	<5	<5	<5	<5
		12/20/1993	<5	<5		<10	<5	<5	<5	<5	<5
		3/29/1994	<5	<5		<10	<5	<5	<5	<5	<5
		7/6/1994	<5	<5		<10	<5	<5	<5	<5	<5
		9/20/1994	<5	<5		<10	<5	<5	<5	<5	<5
		12/20/1994	<5	<5		<10	<5	<5	<5	<5	<5
Western Area of Site	W-6	8/25/1987	220							<7	
		11/25/1987	76.1							<0.5	
		12/8/1987									
		12/9/1987	56.9							<0.5	
		12/17/1987	44.4							<0.5	
		1/5/1988	35.4							<0.5	
		2/6/1988	<0.5							<0.5	
		3/29/1988	133							<0.5	
		4/3/1988	99.1								
		4/19/1988	207							0.7	
		5/3/1988	182							0.6	
		6/21/1988	78							<0.5	
		8/9/1988	5.3							<0.5	
		12/28/1992	23	28		<10	<5	<5	<5	<10	<5
		12/28/1992 Dup	33	6		<10	<5	<5	<5	<10	<5
		9/23/1993	20	16		<10	<5	<5	<5	<5	<5
		3/29/1995	92	17		<5		<5	<5	<5	
SE of Lagoons	W-7A	5/14/1987	52								
		8/25/1987	210							7	
		11/18/1987	219.5							<0.5	
		12/9/1987	111.3							2.5	
		12/17/1987	148.7							3.3	
		12/22/1987	122.5							2.3	
		12/29/1987	107.4							1.9	
		1/30/1988	10.9							<0.5	
		2/23/1988	280							33.3	
		4/19/1988	415							32	
		5/3/1988	990							<5	
		6/21/1988	178							7	
		8/9/1988	202							9	
		3/10/1989	115								
		6/8/1989								6	
		1/16/1992	18	227		<10	<5	<5	<5	<5	<5
		1/16/1992 Dup	17	224		<10	<5	<5	<5	<5	<5
		6/23/1992	21	585		60	<5	<5	<5	<5	<5
		9/23/1992	<5	179		54	<5	<5	<5	<5	<5
		3/12/1993	<5	189		37	<5	<5	<5	<5	<5
		6/29/1993	<5	67		95	<5	<5	<5	<5	<5
		9/14/1993	<5	16		<5	<5	<5	<5	<5	<5
		9/23/1993	<5	25		13	<5	<5	<5	<5	<5
		12/20/1993	<5	23		<10	<5	<5	<5	<5	<5
		3/29/1994	<5	13		<10	<5	<5	<5	<5	<5
		7/6/1994	<5	12		<10	<5	<5	<5	<5	<5
		9/20/1994	<5	<5		<10	<5	<5	<5	<5	<5
		12/20/1994	<5	6		<10	<5	<5	<5	<5	<5
		8/17/1999	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
South of Lagoons	W-8A	5/14/1987	372								
		8/25/1987	990							54	
		11/18/1987	1,729							44.89	
		12/8/1987	3,181							18.6	
		12/17/1987	1,476							5.8	
		12/22/1987	2,622							7.1	
		12/29/1987	262.9							7.2	
		1/5/1988	948							<0.5	
		2/6/1988	<0.5							<0.5	
		4/19/1988	715							35.2	
		5/3/1988	215							<5	
		7/7/1988	435							13	
		8/9/1988	446							17	
		6/13/1989	30	11						0.9	
		1/16/1992	492	253		<10	<5	<5	<5	<5	<5
		6/23/1992	115	349		<10	<5	<5	<5	<5	<5
		6/23/1992	137	321		<10	<5	<5	<5	<5	<5
		9/23/1992	45	159		21	<5	<5	<5	<5	<5
		9/23/1992 Dup	71	113		<10	<5	<5	<5	<5	<5
		12/7/1992	52	114		<10	<5	<5	<5	<5	<5
		12/7/1992 Dup	52	111		<10	<5	<5	<5	<5	<5
		3/12/1993	67	137		24	<5	<5	<5	<5	<5
		6/29/1993	24	65		77	<5	<5	<5	<5	<5
		9/14/1993	52	46		<10	<5	<5	<5	<5	<5
		9/23/1993	82	52		<10	<5	<5	<5	<5	<5
		12/20/1993	49	74		28	<5	<5	<5	<5	<5
		3/29/1994	63	80		13	<5	<5	<5	<5	<5
		3/29/1994 Dup	95	81		<10	<5	<5	<5	<5	<5
		7/6/1994	34	61		25	<5	<5	<5	<5	<5
		9/20/1994	42	70		<10	<5	<5	<5	<5	<5
		12/20/1994	202	100		<10	<5	<5	<5	<5	<5
		3/29/1995	165	80		<5		<5	7	10	
		8/17/1999	170	600	4.8	43	<2.0	<2.0	<2.0	12	<2.0







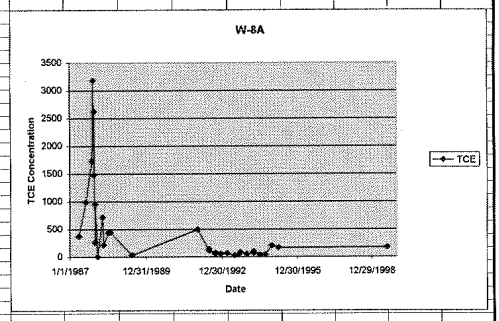
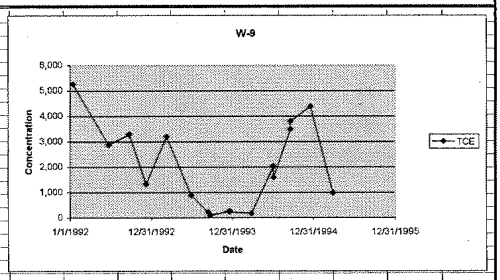
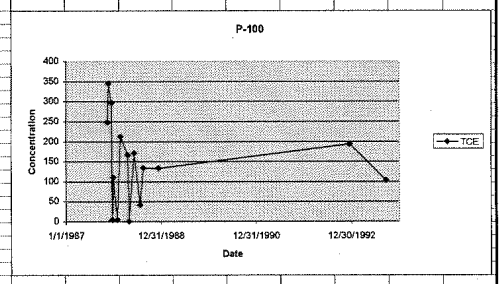
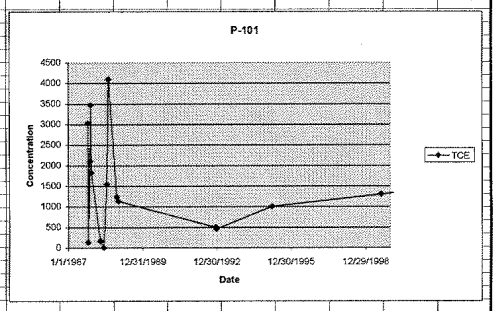


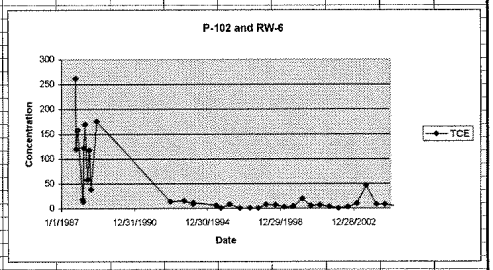
TABLE 1
VOC ANALYTICAL RESULTS FOR GROUNDWATER
1987 - 2005
Former Hallmack Facility
Harrodsburg, Kentucky

Area of Site	Well ID	Date	TCE	C-1,2-DCE	T-1,2-DCE	Vinyl Chloride	1,1-DCA	1,1-DCE	1,1,1-TCA	PCE	1,1,2-TCA
Groundwater Protection Standard =>			5	70	100	2	5	7	200	5	
			ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
South of Lagoons	W-9	1/16/1992	5,254	5,760		19	<5	9	<5	281	<5
		6/23/1992	2,865	15612		286	<5	12	<5	148	<5
		9/23/1992	3,290	9920		145	<5	13	<5	121	<5
		12/7/1992	1,319	5106		300	<5	<5	<5	62	<5
		3/12/1993	3,196	7481		58	<5	6	<5	92	<5
		6/29/1993	881	2606		349	<5	<5	<5	37	<5
		9/14/1993	219	708		100	<5	<5	<5	<5	<5
		9/23/1993	97	659		153	<5	<5	<5	<5	<5
		12/20/1993	258	989		192	<5	<5	<5	10	<5
		12/20/1993 Dup	231	996		247	<5	<5	<5	10	<5
		3/29/1994	170	1331		122	<5	<5	<5	<5	<5
		7/6/1994	2,029	2556		143	<5	<5	<5	35	<5
		7/6/1994 Dup	1,583	2785		127	<5	<5	<5	31	<5
		9/20/1994	3,478	4433		34	<5	<5	<5	84	<5
		9/20/1994 Dup	3,795	4637		47	<5	<5	<5	95	<5
		12/20/1994	4,379	3673		210	<5	7	<5	270	<5
		3/29/1995	980	2538		119		<5	<5	83	
NE Corner of Site	W-10	6/23/1992	<5	<5		<10	<5	<5	<5	<5	<5
		9/23/1992	<5	<5		<10	<5	<5	<5	<5	<5
		12/7/1992	<5	<5		<10	<5	<5	<5	<5	<5
		3/12/1993	<5	<5		<10	<5	<5	<5	<5	<5
		6/29/1993	<5	<5		<10	<5	<5	<5	<5	<5
		6/29/1993 Dup	<5	<5		<10	<5	<5	<5	<5	<5
		9/14/1993	<5	<5		<10	<5	<5	<5	<5	<5
		9/20/1993	<5	<5		<10	<5	<5	<5	<5	<5
		12/20/1993	<5	<5		<10	<5	<5	<5	<5	<5
		3/29/1994	<5	<5		<10	<5	<5	<5	<5	<5
		7/6/1994	<5	<5		<10	<5	<5	<5	<5	<5
		9/20/1994	6	<5		<10	<5	<5	<5	<5	<5
		12/20/1994	<5	<5		<10	<5	<5	<5	<5	<5
		3/29/1995	<5	<5		<5		<5	<5	<5	
		6/29/1995	<5	<5		<5	<5	<5	<5	6	
		10/2/1995	<5	<5		<5	<5	<5	<5	<5	
		3/28/1996	<1	<1		<2	<1	<1	<1	<1	
		10/15/1997	<1	<1		<1	<1	<1	<1	<1	<1
		8/17/1999	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
S-SE Along Southern Border - Near RW-8	P100	11/17/1987	247.6							2.2	
		11/25/1987	343.8							4.3	
		12/17/1987	296.2							3.2	
		12/22/1987	3.2							3.2	
		12/29/1987	109.6							1.1	
		1/30/1988	3.9							<0.5	
		2/23/1988	212							0.8	
		4/19/1988	166							2.1	
		4/26/1988	<0.5							<0.5	
		6/7/1988	171							2	
		7/21/1988	41							0.7	
		8/16/1988	134							2.7	
		12/14/1988	133							1.6	
		12/17/1992	193	<5		<10	<5	<5	<5	<10	<5
		9/23/1993	102	<5		<10	<5	<5	<5	<5	<5
Southern Border Near RW-7	P101	10/16/1987	3028							<3.9	
		10/22/1987	128.5							<0.5	
		11/17/1987	2,091.4							<0.5	
		11/25/1987	3,469.1							<0.5	
		12/8/1987	1,819.3							<0.5	
		4/19/1988	160							1.9	
		6/7/1988	0.6							<0.5	
		7/21/1988	1541							7.5	
		8/16/1988	4,091							<0.5	
		12/14/1988	1,239							<0.5	
		1/5/1989	1,133							<0.5	
		12/18/1992	496	<5		<10	<5	<5	<5	<10	<5
		12/28/1992	460	<25		<50	<25	<25	<25	<25	<25
		3/29/1995	1,000	16		<5		<5	<5	<5	
		8/17/1999	1,300	<25	<25	<25	<25	<25	<25	<25	<25
		7/29/2005	1,700	17	<1.0	<1.0	<1.0	<1.0	<1.0	4.7	<1.0
Southern Border Replaced by RW-6	P102	10/16/1987	261.5							4.23	
		10/22/1987	119.4							<0.5	
		11/25/1987	156.9							<0.5	
		3/1/1988	18							<0.5	
		3/8/1988	13.4							<0.5	
		3/22/1988	121							<0.5	
		4/19/1988	169							2.2	
		6/1/1988	58							<0.5	
		7/12/1988	117							<0.5	
		8/16/1988	38							<0.5	
		12/14/1988	175							<0.5	
		12/28/1992	13	<5		<10	<5	<5	<5	<5	<5
		9/22/1993	15	<5		<10	<5	<5	<5	<5	<5
		3/30/1994	8.59	<5		<10		<5		<5	
		3/30/1994 Dup	11.6	<5		<10		<5		<5	
SW Area of Site	P103	10/16/1987	5.3							<3.9	
		10/22/1987	115.3							0.53	
		11/18/1987	0.9821							<0.5	
		12/8/1987	2.3							<0.5	
		1/5/1988	<0.5							<0.5	
		2/6/1988	<0.5							<0.5	
		4/26/1988	45.9							<0.5	
		6/14/1988	<0.5							<0.5	
		7/21/1988	<0.5							<0.5	
		8/16/1988	1							<0.5	
		12/18/1992	<5	<5		<10	<5	<5	<5	<10	<5
		12/28/1992	<5	<5		<10	<5	<5	<5	<5	<5
		9/21/1993	<5	<5		<10	<5	<5	<5	<5	<5
		3/29/1995	<5	<5		<5		<5	<5	<5	
		8/17/1999	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
		7/27/2005	<1.0	5.2	<1.0	<1.0	<1.0	<1.0	<1.0	24	<1.0









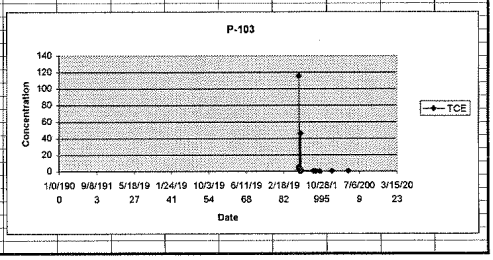
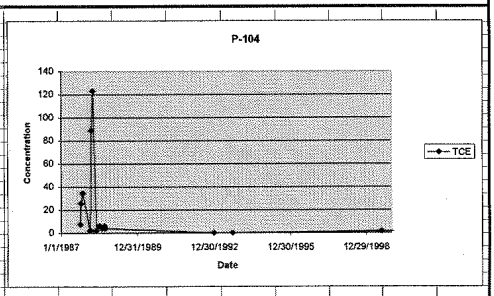
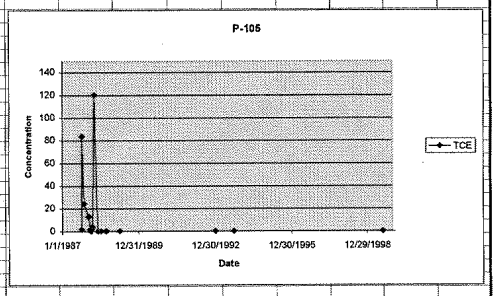
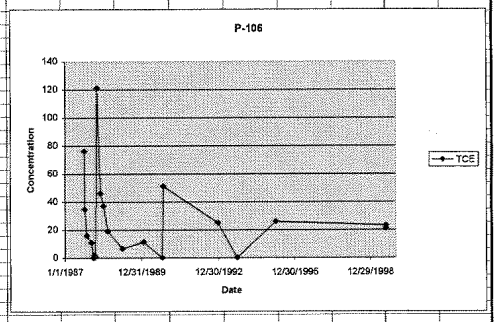


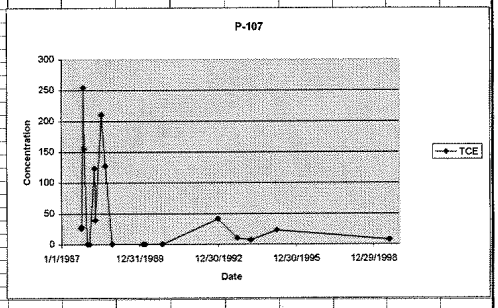
TABLE 1
VOC ANALYTICAL RESULTS FOR GROUNDWATER
1987 - 2005
Former Hallmack Facility
Harrodsburg, Kentucky

Area of Site	Well ID	Date	TCE	C-1,2-DCE	T-1,2-DCE	Vinyl Chloride	1,1-DCA	1,1-DCE	1,1,1-TCA	PCE	1,1,2-TCA
		Groundwater Protection Standard =>	5	70	100	2	5	7	200	5	
			ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
SW Area of Site	P104	10/16/1987	7.3							<3.9	
		10/22/1987	25.3							0.56	
		11/18/1987	34.3							<0.5	
		3/1/1988	1.9							<0.5	
		3/8/1988	2.1							<0.5	
		3/22/1988	88.9							<0.5	
		4/16/1988	123							<0.5	
		6/1/1988	2							<0.5	
		7/12/1988	6							<0.5	
		8/16/1988	4							<0.5	
		9/20/1988	6								
		10/4/1988	4							<0.5	
		12/28/1992	<5	<5		<10	<5	<5	<5	<5	<5
		9/21/1993	<5	<5		<10	<5	<5	<5	<5	<5
		8/17/1999	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
		7/27/2005	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	6.4	<1.0
W- Central Boundary	P105	10/16/1987	1.5							<3.9	
		10/22/1987	83.5							<0.5	
		11/18/1987	24.07							<0.5	
		1/23/1988	12.7							<0.5	
		2/16/1988	1.46							<0.5	
		2/23/1988	<0.5								
		3/1/1988	<0.5							<0.5	
		3/8/1988	2							<0.5	
		3/22/1988	3.8							<0.5	
		4/16/1988	120							<0.5	
		6/1/1988	<0.5							<0.5	
		7/12/1988	<0.5							<0.5	
		9/20/1988	<0.5								
		10/4/1988	<0.5							<0.5	
		4/7/1989	<0.5							<0.5	
		12/30/1992	<5	<5		<10	<5	<5	<5	<5	<5
		9/21/1993	<5	<5		<10	<5	<5	<5	<5	<5
		8/17/1999	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
		7/27/2005	<1.0	1.6	<1.0	<1.0	<1.0	<1.0	<1.0	11	<1.0
West Central Boundary North of P-105	P106	10/16/1987	76							<3.9	
		10/22/1987	34.5							<0.5	
		11/17/1987	16							<0.5	
		1/23/1988	10.9							<0.5	
		2/16/1988	<0.5							<0.5	
		3/1/1988	<0.5							<0.5	
		3/8/1988	2							<0.5	
		3/22/1988	0.8							<0.5	
		4/16/1988	121							<0.5	
		6/1/1988	46							<0.5	
		7/12/1988	37							<0.5	
		9/14/1988	19							<0.5	
		4/7/1989	6.7							0.6	
		1/31/1990	11.4							<0.5	
		10/25/1990	<1								
		11/14/1990	51								
		12/29/1992	25	<5		<10	<5	<5	<5	<5	<5
		9/22/1993	<5	<5		<10	<5	<5	<5	<5	<5
		3/29/1995	26	<5		<5		<5	<5	<5	
		8/17/1999	23	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
		8/17/1999 Dup	21	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
NW Corner of Site	P107	10/16/1987	25.7							<3.9	
		10/22/1987	27.8							<0.5	
		11/17/1987	253.9							<0.5	
		11/25/1987	154.9							<0.5	
		1/5/1988	<0.5							<0.5	
		2/6/1988	<0.5							<0.5	
		4/16/1988	123							<0.5	
		4/26/1988	39							<0.5	
		7/26/1988	210							<0.5	
		9/14/1988	127							<0.5	
		12/14/1988	<0.5							<0.5	
		12/20/1988	<0.5							<0.5	
		2/19/1990	<0.5							<0.5	
		3/22/1990	<0.5							<1	
		11/6/1990	<0.5								
		11/15/1990	<0.5							<1	
		12/29/1992	41	<5		<10	<5	<5	<5	<5	<5
		9/22/1993	10	<5		<10	<5	<5	<5	<5	<5
		3/31/1994	7.08	<5		<10		<5		<5	
		3/29/1995	23	<5		<5		<5	<5	<5	
		8/17/1999	7.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0









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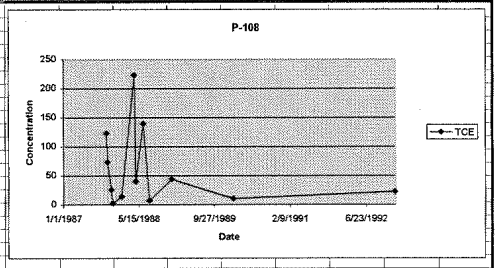
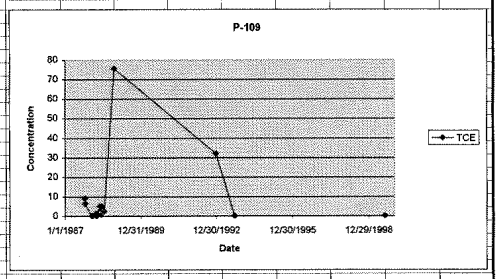
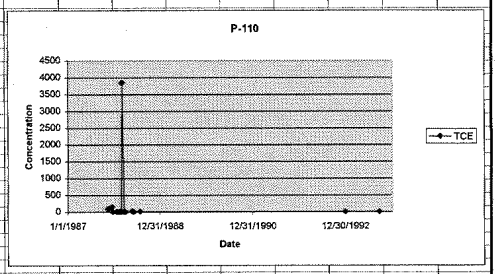
VOC ANALYTICAL RESULTS FOR GROUNDWATER
1987 - 2005
Former Hallmack Facility
Harrodsburg, Kentucky

Area of Site	Well ID	Date	TCE	C-1,2-DCE	T-1,2-DCE	Vinyl Chloride	1,1-DCA	1,1-DCE	1,1,1-TCA	PCE	1,1,2-TCA
Groundwater Protection Standard =>			5	70	100	2	5	7	200	5	
			ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
NW Corner of Site	P108	10/16/1987	122.8							<3.9	
		10/22/1987	73.4							0.55	
		11/17/1987	25.6							<0.5	
		11/25/1987	2.4							<0.5	
		1/23/1988	13.9							<0.5	
		4/16/1988	223							<0.5	
		4/26/1988	40							<0.5	
		6/14/1988	139							<0.5	
		7/26/1988	7							<0.5	
		12/20/1988	43.9							<0.5	
		1/31/1990	10							<0.5	
		12/29/1992	22	<5		<10	<5	<5	<5	<5	<5
N-Central Boundary	P109	10/16/1987	9.2							<3.9	
		10/22/1987	6.5							<0.5	
		1/23/1988	<0.5							<0.5	
		1/30/1988	<0.5							<0.5	
		2/6/1988	<0.5							<0.5	
		3/29/1988	1.4							<0.5	
		4/3/1988	<0.5							<0.5	
		5/25/1988	5							<0.5	
		6/7/1988	0.7							<0.5	
		6/14/1988	5							<0.5	
		7/26/1988	2.5							<0.5	
		12/20/1988	75.6							<0.5	
		12/30/1992	32	50		<10	<5	<5	<5	<5	<5
		9/23/1993	<5	9		<10	<5	<5	<5	<5	<5
		8/17/1999	<1.0	1.2	<1.0	4.4	<1.0	<1.0	<1.0	<1.0	<1.0
		8/17/1999 Dup	<1.0	1.2	<1.0	4.4	<1.0	<1.0	<1.0	<1.0	<1.0
NE Area of Site	P110	11/17/1987	92.8							4.3	
		12/17/1987	147							0.6	
		12/22/1987	<0.5							<0.5	
		1/23/1988	1.9							<0.5	
		2/16/1988	<0.5							<0.5	
		3/1/1988	6							<0.5	
		3/8/1988	3,840							2.6	
		3/22/1988	<0.5							<0.5	
		3/29/1988	1.2							<0.5	
		4/3/1988	<0.5							<0.5	
		5/25/1988	16.6							1.5	
		6/7/1988	2							<0.5	
		7/26/1988	9.6							1.1	
		12/30/1992	<5	<5		<10	<5	<5	<5	<5	<5
		9/21/1993	<5	<5		<10	<5	<5	<5	<5	<5
SE Corner of Site	P111	11/18/1987	10.2							<0.5	
		11/25/1987	2.8							<0.5	
		12/17/1987	1.2							<0.5	
		1/5/1988	30.9							<0.5	
		2/6/1988	<0.5							<0.5	
		3/1/1988	0.77							<0.5	
		3/8/1988	19.3							<0.5	
		3/22/1988	<0.5							<0.5	
		5/10/1988	1.3							<0.5	
		6/7/1988	<0.5							<0.5	
		6/30/1988	<0.5							<0.5	
		7/21/1988	0.9							<0.5	
		8/2/1988	<0.5							<0.5	
		12/6/1988	<0.5							<0.5	
		12/14/1988	<0.5							<0.5	
		12/17/1992	<5	<5		<10	<5	<5	<5	<10	<5
		9/21/1993	<5	<5		<10	<5	<5	<5	<5	<5
		8/17/1999	2.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
		7/28/2005	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SE Corner of Site	P112	1/16/1988	<0.5							<0.5	
		1/23/1988	<0.5							<0.5	
		1/30/1988	<0.5							<0.5	
		2/6/1988	<0.5							<0.5	
		4/26/1988	<0.5							<0.5	
		5/10/1988	<0.5							<0.5	
		6/30/1988	<0.5							<0.5	
		8/2/1988	<0.5							<0.5	
		12/6/1988	2.9							<0.5	
		12/20/1988	<0.5							<0.5	
		4/4/1989	0.5							<0.5	
		12/30/1992	<5	<5		<10	<5	<5	<5	<5	<5
		9/20/1993	<5	<5		<10	<5	<5	<5	<5	<5
SE Area of Site Along East Boundary	P113	1/23/1988	<0.5							<0.5	
		1/30/1988	<0.5							<0.5	
		2/6/1988	<0.5							<0.5	
		2/23/1988	<0.5							<0.5	
		4/26/1988	<0.5							<0.5	
		5/10/1988	1.8							<0.5	
		6/30/1988	<0.5							<0.5	
		8/2/1988	<0.5							<0.5	
		12/6/1988	2							<0.5	
		12/20/1988	<0.5							<0.5	
		4/4/1989	5.5							<0.5	
		12/30/1992	<5	<5		<5	<5	<5	<5	<5	<5







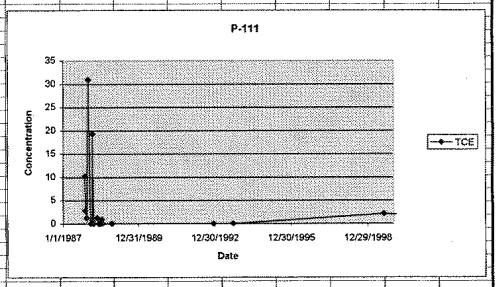
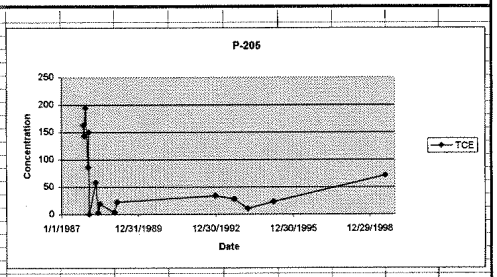
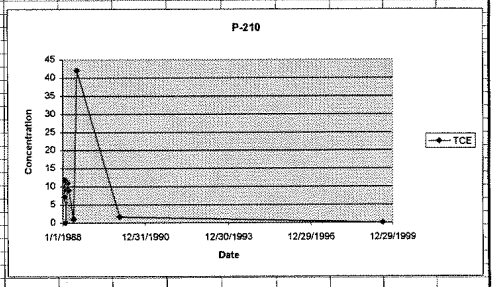
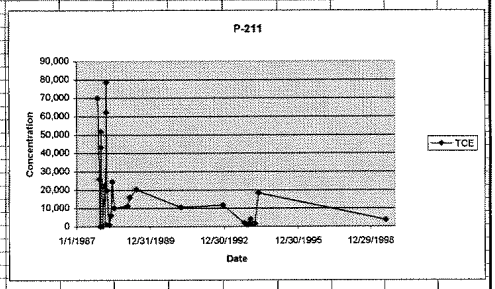


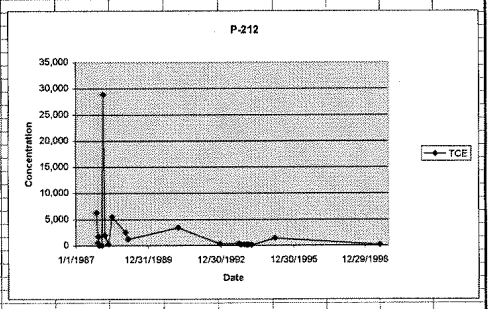
TABLE 1
VOC ANALYTICAL RESULTS FOR GROUNDWATER
1987 - 2005
Former Hallmack Facility
Harrodsburg, Kentucky

Area of Site	Well ID	Date	TCE	C-1,2-DCE	T-1,2-DCE	Vinyl Chloride	1,1-DCA	1,1-DCE	1,1,1-TCA	PCE	1,1,2-TCA
		Groundwater Protection Standard =>	5	70	100	2	5	7	200	5	
			ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
West Side of Bldg	P205	11/17/1987	162.7							<0.5	
		11/25/1987	142.6							1.5	
		12/17/1987	193.7							2.3	
		1/23/1988	85.6							1.9	
		1/30/1988	150.2							<0.5	
		2/6/1988	<0.5							<0.5	
		5/10/1988	58							3	
		6/14/1988	3							<0.5	
		7/7/1988	19							0.7	
		1/31/1989	3.6							<0.5	
		3/10/1989	22							0.7	
		12/30/1992	34	19		<10	<5	<5	<5	<5	<5
		9/22/1993	28	9		<10	<5	<5	<5	<5	<5
		3/30/1994	10.5	7.3		<10		<5		<5	
		3/29/1995	23	9		<5		<5	<5	<5	
		8/17/1999	71	19	<2.0	3.9	<2.0	<2.0	<2.0	<2.0	<2.0
NW Area of Site	P210	1/23/1988	7.1							<0.5	
		1/30/1988	11.8							<0.5	
		2/6/1988	<0.5							<0.5	
		3/1/1988	9.1							<0.5	
		3/8/1988	10.9							<0.5	
		3/22/1988	8.9							<0.5	
		5/25/1988	1							<0.5	
		7/12/1988	42							<0.5	
		1/31/1990	1.6							<0.5	
		8/17/1999	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
NW Corner of Bldg	P211	11/17/1987	######							<0.5	
		12/17/1987	25,850							<0.5	
		12/22/1987	<0.5							<0.5	
		12/29/1987	105							0.86	
		1/7/1988	43,085							<0.5	
		1/7/1988 bttm	51,495							<0.5	
		1/30/1988	181							8.4	
		2/23/1988	22,100							<0.5	
		3/8/1988	1,240							1.7	
		3/22/1988	62,197							<0.5	
		3/29/1988	76,505							10.7	
		4/3/1988	19,606							<0.5	
		5/3/1988	955							10	
		6/1/1988	5,895							<0.5	
		6/21/1988	24,500							2	
		7/21/1988	10,138							<0.5	
		1/31/1989	11,069							16	
		3/10/1989	15,722							6.6	
		6/13/1989	20,359	4207						12	
		4/3/1991	10,423							<10	
		12/16/1992	11,700	4060		48	102	90	152	<10	<5
		10/28/1993	1,852	542		<10	12	<5	7	<5	<5
		12/2/1993	882	410		<10	<5	<5	<5	<5	<5
		12/22/1993	1,109	440		<10	9	<5	<5	<5	<5
		1/27/1994	3,906	569		<10	8	<5	6	<5	<5
		2/15/1994	1,546	583		<10	9	<5	<5	<5	<5
		3/31/1994	1,190	487.75		3.25		4.58		4.25	
		5/20/1994	18,300	3914		<10	108	52	160	<5	<5
		8/17/1999	3,600	1200	<50	<50	<50	<50	<50	<50	<50
N Side of Bldg	P212	11/17/1987	6,253.1							1.2	
		12/8/1987	480.6							<0.5	
		12/17/1987	1,709.1							<0.5	
		12/22/1987	<0.5							<0.5	
		1/5/1988	33							<0.5	
		2/6/1988	<0.5							<0.5	
		3/1/1988	28,800								
		3/22/1988	1,944							6.2	
		5/17/1988	269							7.8	
		7/7/1988	5,475							47	
		1/31/1989	2,545							12	
		3/10/1989	1,214							7	
		4/3/1991	3,399							<10	
		12/16/1992	343	2118		1243	6	7	<5	<10	<5
		9/23/1993	303	621		17	<5	<5	<5	<5	<5
		10/28/1993	131	118		<10	<5	<5	<5	<5	<5
		12/20/1993	122	127		27	<5	<5	<5	<5	<5
		12/22/1993	138	120		<10	<5	<5	<5	<5	<5
		1/27/1994	74	85		<10	<5	<5	<5	<5	<5
		2/15/1994	100	104		20	<5	<5	<5	<5	<5
		3/30/1994	79	111.05		10.6		<5		4.21	
		3/29/1995	1,360	1378		21		<5	5	67	
		8/17/1999	150	130	<5.0	5.1	<5.0	<5.0	<5.0	<5.0	<5.0
NW Area of Site	P213	1/23/1988	5.7							<0.5	
		1/30/1988	10.4							<0.5	
		2/6/1988	<0.5							<0.5	
		2/16/1988	1.18							<0.5	
		3/1/1988	1.4							<0.5	
		3/8/1988	4.3							<0.5	
		3/22/1988	7.9							<0.5	
		5/17/1988	5							<0.5	
		7/7/1988	18							<0.5	
		12/20/1988	25.4							<0.5	
		4/7/1989	4							<0.5	
		1/31/1990	4.8							<0.5	
		10/25/1990	<1								
		11/14/1990	35.2							<1	
		12/29/1992	19	<5		<10	<5	<5	<5	<5	<5
		9/22/1993	7	<5		<10	<5	<5	<5	<5	<5









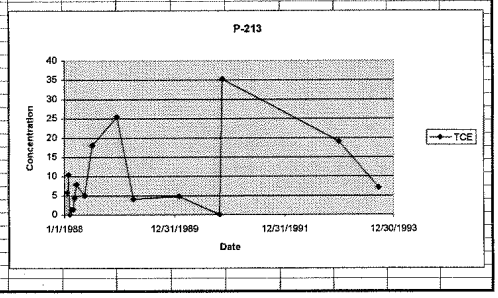
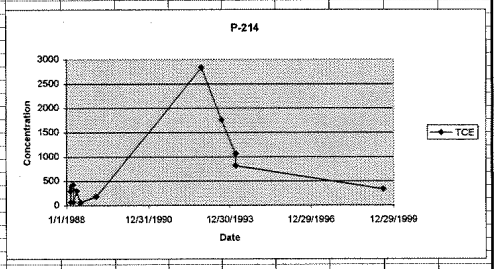
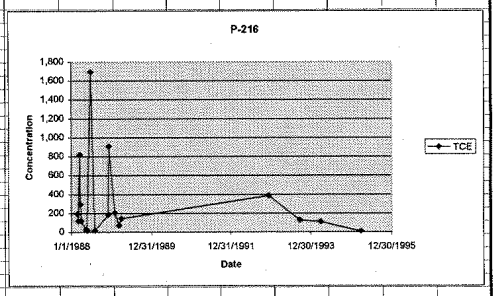
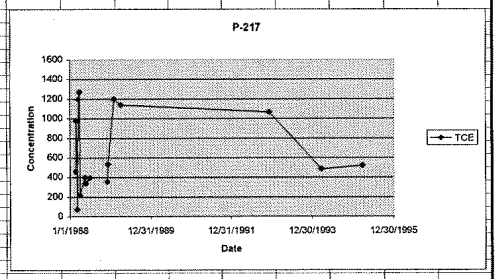


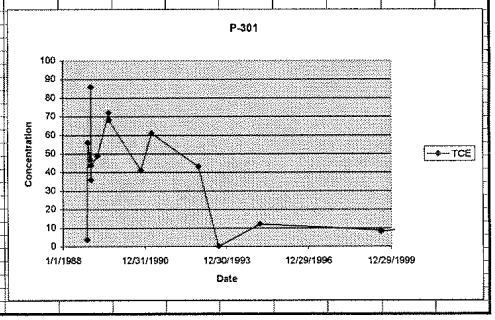
TABLE 1
VOC ANALYTICAL RESULTS FOR GROUNDWATER
1987 - 2005
Former Hallmack Facility
Harrodsburg, Kentucky

Area of Site	Well ID	Date		TCE	C-1,2-DCE	T-1,2-DCE	Vinyl Chloride	1,1-DCA	1,1-DCE	1,1,1-TCA	PCE	1,1,2-TCA
		Groundwater Protection Standard =>		5	70	100	2	5	7	200	5	
				ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
SW Corner of Bldg	P214	2/23/1988		292								
		3/1/1988		64							<0.5	
		3/8/1988		377							3.1	
		3/22/1988		330							<0.5	
		3/29/1988		418							4.2	
		4/3/1988		67.4							<0.5	
		5/17/1988		290							4.7	
		7/7/1988		51							0.7	
		1/31/1989		180							3	
		12/28/1992		2,827	715		<10	<5	<5	<5	<5	<5
		9/23/1993		1,760	401		<10	<5	<5	<5	<5	<5
		3/30/1994		1,060	151.25		0.82		1.1		<5	
		3/29/1994		816	182		<5		<5	<5	<5	
		8/17/1999		330	150	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Replaced by RW-9	P215	9/6/1989		893							21	
South Side of Bldg		9/12/1989		918							21.9	
		12/17/1992		168	27		<10	<5	<5	<5	<10	<5
		9/23/1993		1,807	130		<10	<5	<5	<5	<5	<5
		1/27/1994		33,038	1206		<10	<5	5	<5	<5	<5
		2/17/1994		228	13		<10	<5	<5	<5	<5	<5
		3/30/1994		1,630	81.27		<10		0.63		2.49	
		5/20/1994		259	22		<10	<5	<5	<5	<5	<5
SE Corner of Bldg	P216	3/1/1988		193							3	
		3/8/1988		113.8							1.1	
		3/22/1988		817							<0.5	
		3/29/1988		295							3.2	
		4/3/1988		120							<0.5	
		5/17/1988		24							0.7	
		5/25/1988		15.5							<0.5	
		6/30/1988		1,690							36.4	
		8/2/1988		15.6							<0.5	
		11/30/1988		184.4							3.2	
		12/6/1988		905.6							14.9	
		1/31/1989		203							5	
		3/10/1989		69							3	
		4/4/1989		143							2	
		12/16/1992		383	6		<10	<5	<5	<5	<5	<5
		9/23/1993		127	17		<10	<5	<5	<5	<5	<5
		3/30/1994		108	1.44		<10		<5		2.95	
		3/29/1995		8	<5		<5		<5	<5	<5	
East Side of Bldg	P217	2/23/1988		458							<0.5	
Near RW-5		3/1/1988		977							101	
		3/8/1988		72							22.5	
		3/22/1988		1,195							<0.5	
		3/29/1988		1,270							11.7	
		4/3/1988		217							4.4	
		5/17/1988		398							11.7	
		5/25/1988		336							10.7	
		6/30/1988		395							9.9	
		8/2/1988	###								49	
		11/30/1988		353.1							9.8	
		12/6/1988		531.2							22.3	
		1/31/1989		1,196.7							32	
		4/4/1989		1,139							41	
		12/14/1992		1,065	146		<10	<5	<5	<5	21	<5
		3/30/1994		482	113.19		<10		<5		35.4	
		3/29/1995		520	127		<5		<5	<5	35	
NW Area of Site	P218	2/23/1988		184							2.5	
		11/10/1988		<0.5							<0.5	
		11/15/1988		0.7							<0.5	
		11/30/1988		0.9							<0.5	
		4/7/1989		<0.5							<0.5	
		4/18/1989		0.6							<0.5	
		12/29/1992		<5	<5		<10	<5	<5	<5	<5	<5
		9/21/1993		<5	<5		<10	<5	<5	<5	<5	<5
SW Area of Site	P219	11/10/1988		2.4							<0.5	
		11/15/1988		<0.5							<0.5	
		11/30/1988		<0.5							<0.5	
		4/7/1989		3							<0.5	
		4/18/1989		0.7							<0.5	
		12/28/1992		<5	<5		<10	<5	<5	<5	<5	<5
		9/21/1993		<5	<5		<10	<5	<5	<5	<5	<5
		7/24/2005		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	12	<1.0
N Side of Bldg	P220	9/23/1993		3,790	666		<10	15	8	21	<5	<5
		12/22/1993		3,477	1498		<10	<5	<5	7		<5
		3/30/1994		3,770	1967		<10		10.6		1.92	
		5/20/1994		8,500	5423		23	57	17	69	<5	<5
		3/29/1995		12,620	2221		7		24	93	6	
		8/17/1999		25,000	3100	<100	<100	<100	<100	<100	<100	<100
NW of Bldg	P221	9/23/1993		596	524		<10	<5	<5	<5	<5	<5
		3/30/1994		199	111.47		0.81		<5		5.52	
NW of Bldg	P222	9/23/1993		21	61		<10	<5	<5	<5	<5	<5
		3/30/1994		460	161.85		<10		<5		3.54	
South of Site	P301	11/22/1988		3.8							3.8	
Across Tapp Road		11/29/1988		55.8							<0.5	
		1/5/1989		46.7							<0.5	
		1/10/1989	top	35.9							<0.5	
		1/10/1989	mid	85.9							<0.5	
		1/10/1989	bttm	43.7							<0.5	
		4/4/1989		48.7							<0.5	
		9/6/1989		72							<0.5	
		9/12/1989		68							<0.5	
		11/8/1990		41							<0.5	
		4/2/1991		61							<10	
		12/30/1992		43	<5		<10	<5	<5	<5	<5	<5
		9/22/1993		<5	<5		<10	<5	<5	<5	<5	<5
		3/29/1995		12	<5		<5		<5	<5	<5	
		8/17/1999		8.6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
		8/17/1999	Dup	7.9	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
		7/28/2005		19	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
		7/28/2005	Dup	20	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0









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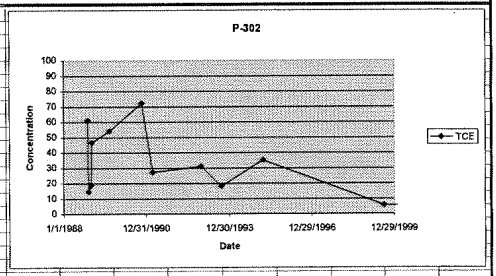
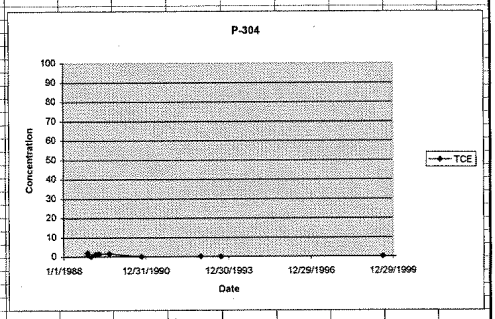
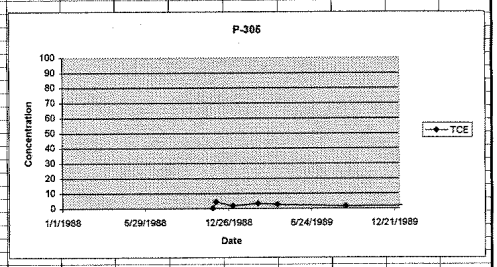
1987 - 2005
Former Hallmack Facility
Harrodsburg, Kentucky

Area of Site	Well ID	Date	TCE	C-1,2-DCE	T-1,2-DCE	Vinyl Chloride	1,1-DCA	1,1-DCE	1,1,1-TCA	PCE	1,1,2-TCA
Groundwater Protection Standard =>			5	70	100	2	5	7	200	5	
			ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
South of Site	P302	11/22/1988	60.8							60.8	
Across Tapp Road		11/29/1988	14.4							<0.5	
		1/5/1989	18.7							<0.5	
		1/10/1989	46.4							<0.5	
		9/6/1989	54							<0.5	
		11/8/1990	72							<0.5	
		4/2/1991	27							<10	
		12/30/1992	31	<5		<10	<5	<5	<5	<5	<5
		9/22/1993	18	<5		<10	<5	<5	<5	<5	<5
		3/29/1995	35	<5		5		<5	<5	<5	
		8/17/1999	5.6	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
		7/28/2005	5.2	1.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
South of Site	P303	11/22/1988	<0.5							<0.5	
Across Tapp Road		11/29/1988	0.8							<0.5	
		1/5/1989	0.9							<0.5	
		1/10/1989	0.7							<0.5	
		4/11/1989	1.5							<0.5	
		9/6/1989	0.7							<0.5	
		11/8/1990	<0.5							<0.5	
		12/29/1992	<5	<5		<10	<5	<5	<5	<5	<5
		9/21/1993	<5	<5		<10	<5	<5	<5	<5	<5
		8/17/1999	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
South of Site	P304	11/22/1988	1.8							<0.5	
Across Tapp Road		11/29/1988	0.9							<0.5	
		1/5/1989	<0.5							<0.5	
		2/28/1989	1							<0.5	
		4/11/1989	1.3							<0.5	
		4/18/1989	1.3							<0.5	
		9/6/1989	1.6							<0.5	
		11/8/1990	<0.5							<0.5	
		12/29/1992	<5	<5		<10	<5	<5	<5	<5	<5
		9/21/1993	<5	<5		<10	<5	<5	<5	<5	<5
		8/17/1999	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
		7/28/2005	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
		7/28/2005 Dup	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
South of Site	P305	11/22/1988	<0.5							<0.5	
Across Tapp Road		11/29/1988	4.3							<0.5	
		1/5/1989	1.8							<0.5	
		2/28/1989	3.3							<0.5	
		4/11/1989	2.7							<0.5	
		9/6/1989	1.6							<0.5	
		7/28/2005	18	4.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
South of Tapp Road	P306	11/29/1988	40.3							<0.5	
West of National Guard		12/14/1988	1.1							<0.5	
		2/28/1989	40.6							<0.5	
		4/11/1989	37							<0.5	
		4/18/1989	35							<0.5	
		9/22/1993	9	32		21	<5	<5	<5	<5	<5
South of Tapp Road	P307	11/29/1988	<0.5							<0.5	
West of National Guard		12/14/1988	41.5							<0.5	
		2/28/1989	0.7							<0.5	
		4/11/1989	<0.5							<0.5	
		4/18/1989	0.7							<0.5	
		9/22/1993	<5	<5		<10	<5	<5	<5	<5	<5
South of Tapp Road	P308	12/20/1988	<0.5							<0.5	
SW of National Guard											
South of Tapp Road	P309	8/23/1988	<0.5							<0.5	
South of P301		8/30/1988	<0.5							<0.5	
		9/7/1988	0.7							<0.5	
		9/13/1988	<0.5							<0.5	
		9/20/1988	<0.5							<0.5	
		9/22/1993	<5	<5		<10	<5	<5	<5	<5	<5
		8/17/1999	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
South of Tapp Road	P310	8/23/1988	0.5							0.7	
South of P309		8/30/1988	<0.5							0.9	
		9/7/1988	<0.5							0.9	
		9/13/1988	1							2	
		9/20/1988	<0.5							<0.5	
South of Tapp Road	P317	8/23/1988	<0.5							<0.5	
400 Feet West of P310		8/30/1988	<0.5							<0.5	
		9/7/1988	<0.5							<0.5	
		9/13/1988	<0.5							<0.5	
		9/20/1988	<0.5							<0.5	
		11/10/1988	<0.5							<0.5	
South of Tapp Road	P327	9/14/1988	<0.5							<0.5	
500 Feet West of P317		9/20/1988	<0.5							<0.5	
S of National Guard		9/27/1988	<0.5							<0.5	
		10/4/1988	<0.5							<0.5	
		10/25/1988	<0.5							<0.5	
		11/1/1988	<0.5							<0.5	
		4/25/1989	<0.5							<0.5	







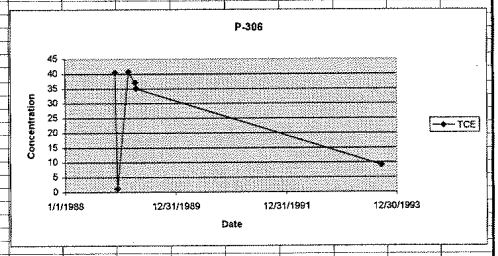
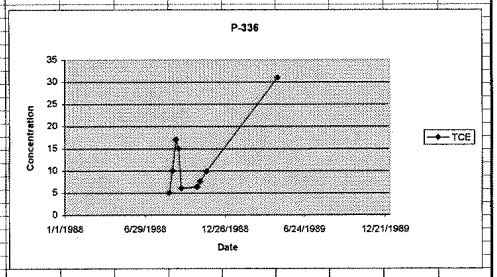
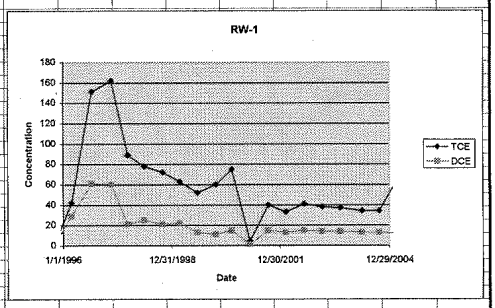
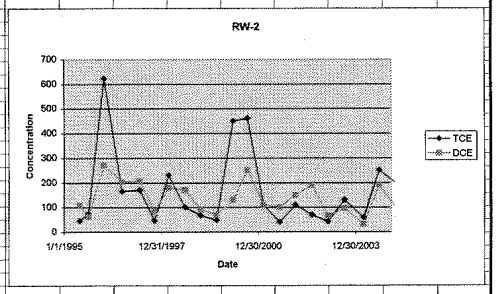


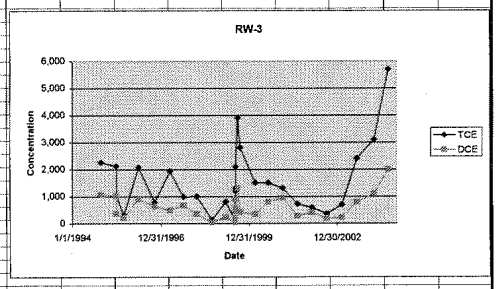
TABLE 1
VOC ANALYTICAL RESULTS FOR GROUNDWATER
1987 - 2005
Former Hallmack Facility
Harrodsburg, Kentucky

Area of Site	Well ID	Date		TCE	C-1,2-DCE	T-1,2-DCE	Vinyl Chloride	1,1-DCA	1,1-DCE	1,1,1-TCA	PCE	1,1,2-TCA
Groundwater Protection Standard =>				5	70	100	2	5	7	200	5	
				ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
SW of National Guard	P331	9/14/1988		<0.5							<0.5	
		9/20/1988		<0.5							<0.5	
		9/27/1988		<0.5							<0.5	
		10/4/1988		<0.5							<0.5	
		10/25/1988		<0.5							<0.5	
		11/1/1988		<0.5							<0.5	
		4/25/1989		<0.5							<0.5	
SW of National Guard	P335	9/14/1988		<0.5							<0.5	
		9/20/1988		<0.5							<0.5	
		9/27/1988		<0.5							<0.5	
		10/4/1988		<0.5							<0.5	
		10/25/1988		<0.5							<0.5	
		11/1/1988		<0.5							<0.5	
		4/25/1989		<0.5							<0.5	
SW of National Guard	P336	8/23/1988		5							<0.5	
		8/30/1988		10							<0.5	
		9/7/1988		17							<0.5	
		9/13/1988		15							<0.5	
		9/20/1988		6							<0.5	
		10/25/1988		6.3							<0.5	
		11/1/1988		7.5							<0.5	
		11/15/1988		9.8							<0.5	
		4/25/1989		31							<0.5	
SW of National Guard	P339	9/14/1988		11							<0.5	
		9/20/1988		16							<0.5	
		9/27/1988		7							<0.5	
		10/4/1988		13							<0.5	
		11/10/1988		3.8							<0.5	
		11/15/1988		7.6							<0.5	
		4/25/1989		4							<0.5	
North of Bldg	DMW-1	9/20/1993		<5	<5		<10	<5	<5	<5	<5	<5
		9/23/1993		<5	<5		<10	<5	<5	<5	<5	<5
SW of Lagoons	RW-1	6/29/1995		124	75	<5	<5	<5	<5	<5	<5	
		10/2/1995		<5	<5	<5	<5	<5	<5	<5	<5	
		3/28/1996		42	29	<1	<2	<1	<1	<1	<1	
		10/15/1996		151	61	<5	<10	<5	<5	<5	<5	
		4/30/1997		162	60	<5	<10	<5	<5	<5	5	
		10/15/1997		89	21	183	<1	42	42	38	<1	<1
		3/26/1998		78	25	<1	<1	<1	<1	<1	3.2	
		9/30/1998		72	21	1.2	<1	<1	<1	<1	2.3	
		3/23/1999		63	22	<1	<1	<1	<1	<1	2.5	
		9/17/1999		52	13	1.8	<1	<1	<1	<1	1.3	
		3/22/2000		60	11	<1	<1	<1	<1	<1	3.7	
		9/1/2000		75	15	<2.5	<2.5	<2.5	<2.5	<2.5	2.8	
		3/1/2001		4.1	1.2	<1	<1	<1	<1	<1	<1	
		9/1/2001		40	15	<1	<1	<1	<1	<1	1.2	
		3/1/2002		33	13	<1	<1	<1	<1	<1	<1	
		9/1/2002		41	15	<1	<1	<1	<1	<1	1	
		3/1/2003		38	14	<1	<1	<1	<1	<1	2.5	
		9/1/2003		37	14	<1	<1	<1	<1	<1	1	
		3/31/2004		34	13	<1	<1	<1	<1	<1	1.3	
		9/20/2004		34	13	<1	<1	<1	<1	<1	2.1	
		3/21/2005		65	12	<1	<1	<1	<1	<1	3.7	
South of Lagoons	RW-2	6/29/1995		46	109	<5	<5	<5	<5	<5	<5	
		10/2/1995		75	63	<5	<5	<5	<5	<5	<5	
		3/28/1996		623	272	3.7	<2	4.5	1.4	6.1	15	
		10/15/1996		164	204	<5	<10	<5	<5	<5	9	
		4/30/1997		170	208	<5	<10	<5	<5	<5	14	
		10/15/1997		45	81	191	336	46	41	<1	<1	<1
		3/26/1998		230	180	<5	<5	<5	<5	<5	7.4	
		9/30/1998		100	170	2.3	<2	<2	<2	<2	9.3	
		3/23/1999		67	91	<2	<2	<2	<2	<2	3.4	
		9/17/1999		48	69	<1	<1	<1	<1	<1	1.5	
		3/22/2000		450	130	5.7	<1	1	<1	2.1	12	
		9/1/2000		460	250	10	<5	<5	<5	<15	12	
		3/1/2001		110	110	1.9	<1	<1	<1	<1	2.6	
		9/1/2001		40	100	1.3	<1	<1	<1	<1	2.6	
		3/1/2002		110	150	<2	<2	<2	<2	<2	5.4	
		9/1/2002		69	190	<2	<2	<2	<2	<2	3.1	
		3/1/2003		42	65	<1	<1	<1	<1	<1	2.1	
		9/1/2003		130	95	<1	<1	<1	<1	<1	7.4	
		3/31/2004		58	31	1.6	<1	<1	<1	<1	3.9	
		9/20/2004		250	190	4	<2	<2	<2	<2	16	
		3/21/2005		200	100	<2.5	<2	<2	<2	<2	14	
South of Lagoons Near Bldg	RW-3	12/21/1994		22,985	3,060		<10	78	39	116	<5	<5
		6/29/1995		2,261	1,075	<5	<5	11	<5	8	42	
		6/29/1995	Dup	2,128	1,022		<5	12	<5	9	37	
		10/2/1995		1,044	382	<5	<5	<5	<5	<5	13	
		3/28/1996		303	217	1	<2	3.1	2.1	7.5	2.7	
		10/15/1996		2,070	920	<5	<10	7	<5	5	22	
		4/30/1997		775	629	<5	<10	<5	<5	<5	21	
		10/15/1997		1,930	489	542	108	750	593	141	<1	<1
		3/26/1998		990	670	<20	<20	<20	<20	<20	39	
		9/30/1998		1,000	350	<10	<10	<10	<10	<10	15	
		3/23/1999		140	34	<4	<4	<4	<4	<4	<4	
		7/16/1999	CTI	810	235	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
		7/16/1999	GZA	110	42	<2.0	<4.0	<2.0	<2.0	<2.0	<2.0	<2.0
		7/20/1999		870	190	<5.0	<20	<5.0	<5.0	<5.0	<5.0	<5.0
		7/21/1999		1,200	470	<5.0	<10	<5.0	<5.0	7.5	8.9	<7.5
		7/22/1999		1,300	580	<5.0	<10	<5.0	<5.0	8.8	13	<7.5
		8/17/1999		2,100	890	<20	<20	<20	<20	<20	22	<20
		9/17/1999		3,900	1,300	5.4	<2	10	4.9	24	20	
		3/22/2000		2,600	430	<50	<50	<50	<50	<50	<50	
		9/1/2000		1,500	340	10	<20	<20	<20	<20	<20	
		3/1/2001		1,500	810	1.9	<20	<20	<20	<20	<20	
		9/1/2001		1,300	950	1.3	<10	<10	<10	<10	28	
		3/1/2002		720	280	<2	<5	<5	<5	<5	<5	
		9/1/2002		580	400	<2	<5	<5	<5	<5	8.3	
		3/1/2003		350	180	<1	<2.5	<2.5	<2.5	<2.5	5.5	
		9/1/2003		700	220	<1	<5	<5	<5	<5	6.2	
		3/31/2004		2,400	790	10	16	<10	<10	11	23	
		9/20/2004		3,100	1100	<20	<20	<20	<20	<20	100	
		3/21/2005		5,700	2000	<20	<20	<20	<20	<20	<50	
South of Lagoons	RW-4	6/29/1995		309	919	<5	<5	<5	<5	<5	8	
		10/2/1995		225	186	<5	5	<5	<5	<5	<5	
		3/28/1996		41	65	1	<2	<1	<1	<1	9	
		3/28/1996	Dup	44	68.3		<2	<1	<1	<1	9.1	
		10/15/1996		718	211	<5	<10	<5	<5	<5	6	
		4/30/1997		593	211	<5	<10	<5	<5	<5	7	
		10/15/1997		230	308	405	97	<1	53	<1	<1	<1
		3/26/1998		300	510	<20	<20	<20	<20	<20	<20	
		9/30/1998		<5	<5	<5	<5	<5	<5	<5	<5	
		3/23/1999		270	190	<5	<5	<5	<5	<5	9.2	
		9/17/1999		270	150	<2	<2	<2	<2	<2	3.9	
		3/22/2000		250	200	2.4	<2	<2	<2	<2	9.4	
		9/1/2000		210	250	5	5.2	<2	<2	<2	7.5	
		3/1/2001		260	310	<5	<5	<5	<5	<5	7.5	
		9/1/2001		340	290	3.9	<2.5	<2.5	<2.5	<2.5	9.4	
		3/1/2002		160	230	<2	<2	<2	<2	<2	<2	
		9/1/2002		190	90	<2	<2	<2	<2	<2	3.1	
		3/1/2003		380	620	<5	<5	<5	<5	<5	8.8	
		9/1/2003		110	72	<1	<1	<1	<1	<1	4.2	
		3/31/2004		130	120	3.1	1.4	<1	<1	<1	4.2	
		9/20/2004		170	9.3	2.3	<2	<2	<2	<2	14	
		3/21/2005		210	6.8	<2.5	<2	<2	<2	<2	8.3	









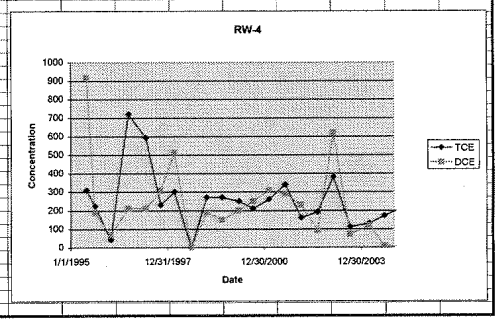
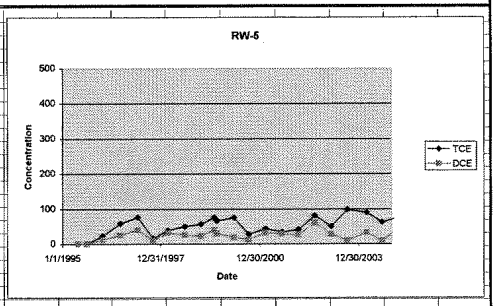
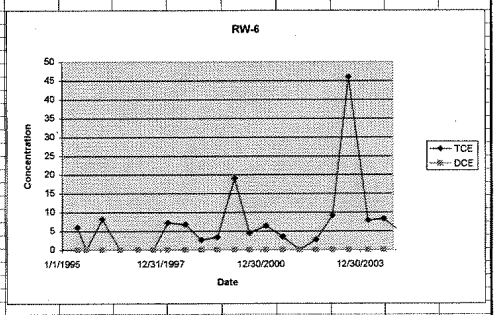
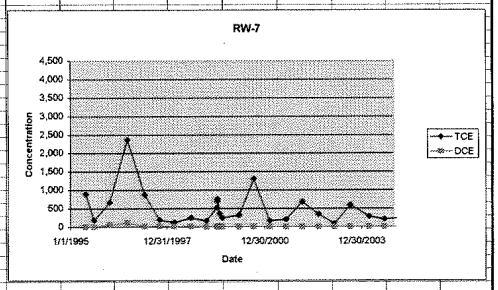


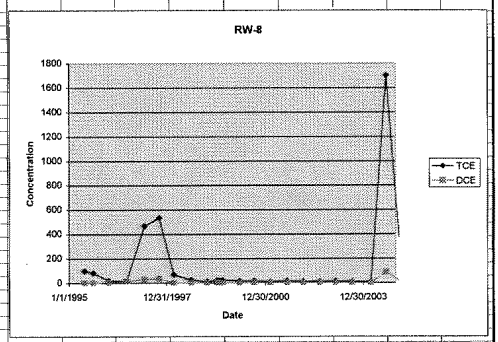
TABLE 1
VOC ANALYTICAL RESULTS FOR GROUNDWATER
1987 - 2005
Former Hallmack Facility
Harrodsburg, Kentucky

Area of Site	Well ID	Date	TCE	C-1,2-DCE	T-1,2-DCE	Vinyl Chloride	1,1-DCA	1,1-DCE	1,1,1-TCA	PCE	1,1,2-TCA
		Groundwater Protection Standard =>	5	70	100	2	5	7	200	5	
			ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
East of Bldg	RW-5	6/29/1995	<5	<5	<5	<5	<5	<5	<5	<5	
Near NE Corner		10/2/1995	<5	<5	<5	<5	<5	<5	<5	<5	
		3/28/1996	23	12	<1	<2	<1	<1	<1	15	
		10/15/1996	58	25	<5	<10	<5	<5	<5	9	
		4/30/1997	76	40	<5	<10	<5	<5	<5	17	
		10/15/1997	16	10	44	<1	<1	<1	<1	2	
		3/26/1998	39	32	<1	<1	<1	<1	<1	18	
		9/30/1998	50	26	<1	<1	<1	<1	<1	8.9	
		3/23/1999	56	23	<1	<5	<1	<1	<1	9.2	
		8/17/1999	75	40	<1.0	<1.0	<1.0	<1.0	<1.0	8.2	<1.0
		9/17/1999	66	30	<1	<1	<1	<1	<1	6.8	
		3/22/2000	75	20	<1	<1	<1	<1	<1	19	
		9/1/2000	27	12	<1	<1	<1	<1	<1	7.1	
		3/1/2001	43	32	<1	<1	<1	<1	<1	11	
		9/1/2001	34	29	<1	<1	<1	<1	<1	3	
		3/1/2002	40	26	<1	<1	<1	<1	<1	10	
		9/1/2002	81	60	<1	<1	<1	<1	<1	6.9	
		3/1/2003	50	28	<1	<1	<1	<1	<1	8.9	
		9/1/2003	96	9.9	2.3	<1	<1	<1	<1	12	
		3/31/2004	89	33	1.5	<1	<1	<1	<1	17	
		9/20/2004	62	8.2	<1	<1	<1	<1	<1	29	
		3/21/2005	75	44	2	<1	<1	<1	<1	18	
SW of Bldg	RW-6	6/29/1995	6	<5	<5	<5	<5	<5	<5	<5	
Near Tapp Road		10/2/1995	<5	<5	<5	<5	<5	<5	<5	<5	
		3/28/1996	8.2	<1	<1	<2	<1	<1	<1	<1	
		10/15/1996	<5	<5	<5	<10	<5	<5	<5	<5	
		4/30/1997	<5	<5	<5	<10	<5	<5	<5	<5	
		10/15/1997	<1	<1	<1	<1	<1	<1	<1	<1	<1
		3/26/1998	7.2	<1	<1	<1	<1	<1	<1	<1	
		9/30/1998	6.8	<1	<1	<1	<1	<1	<1	<1	
		3/23/1999	2.6	<1	<1	<1	<1	<1	<1	<1	
		9/17/1999	3.3	<1	<1	<1	<1	<1	<1	<1	
		3/22/2000	19	<1	<1	<1	<1	<1	<1	<1	
		9/1/2000	4.5	<1	<1	<1	<1	<1	<1	<1	
		3/1/2001	6.4	<1	<1	<1	<1	<1	<1	<1	
		9/1/2001	3.5	<1	<1	<1	<1	<1	<1	<1	
		3/1/2002	<1	<1	<1	<1	<1	<1	<1	<1	
		9/1/2002	2.7	<1	<1	<1	<1	<1	<1	<1	
		3/1/2003	9.1	<1	<1	<1	<1	<1	<1	<1	
		9/1/2003	46	<1	<1	<1	<1	<1	<1	<1	
		3/31/2004	7.8	<1	<1	<1	<1	<1	<1	<1	
		9/20/2004	8.3	<1	<1	<1	<1	<1	<1	<1	
		3/21/2005	4.8	<1	<1	<1	<1	<1	<1	<1	
		7/27/2005	3.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
S of Bldg	RW-7	6/29/1995	883	<5	<5	<5	<5	<5	<5	<5	
Near Tapp Road		10/2/1995	176	<5	<5	<5	<5	<5	<5	<5	
		3/28/1996	665	54	<1	<2	<1	<1	<1	<1	
		10/15/1996	2,360	118	<5	<10	<5	<5	<5	<5	
		4/30/1997	872	7	<5	<10	<5	<5	<5	<5	
		10/15/1997	190	20	<1	<1	<1	<1	<1	<1	<1
		3/26/1998	120	7.8	<1	<1	<1	<1	<1	<1	
		9/30/1998	240	13	<2	<1	<1	<1	<1	<1	
		3/23/1999	160	<1	<1	<1	<1	<1	<1	<1	
		7/20/1999	520	3.2	<2.5	<5.0	<2.5	<2.5	<2.5	<2.5	<3.8
		7/21/1999	690	3.2	<2.5	<5.0	<2.5	<2.5	<2.5	<2.5	<3.8
		7/22/1999	750	3.8	<2.5	<5.0	<2.5	<2.5	<2.5	<2.5	<3.8
		8/17/1999	360	14	<10	<10	<10	<10	<10	<10	<10
		9/17/1999	240	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	
		3/22/2000	310	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	
		9/1/2000	1,300	<10	<10	<10	<10	<10	<10	<10	
		3/1/2001	160	<5	<5	<5	<5	<5	<5	<5	
		9/1/2001	200	1.8	<1	<1	<1	<1	<1	<1	
		3/1/2002	680	<5	<5	<5	<5	<5	<5	<5	
		9/1/2002	340	2.1	<2	<2	<2	<2	<2	<2	
		3/1/2003	79	<1	<1	<1	<1	<1	<1	<1	
		9/1/2003	590	<1	<1	<1	<1	<1	<1	<1	
		3/31/2004	280	<5	<5	<5	<5	<5	<5	<5	
		9/20/2004	210	<2	<2	<2	<2	<2	<2	<2	
		3/21/2005	240	<2	<2	<2	<2	<2	<2	<2	
		7/27/2005	150	2.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
S of Bldg Near Road	RW-8	6/29/1995	98	<5		<5	<5	<5	<5	<5	
		10/2/1995	82	<5	<5	<5	<5	<5	<5	<5	
		3/28/1996	18	2.8	<1	<2	<1	<1	<1	<1	
		10/15/1996	14	14	<5	<10	<5	<5	<5	<5	
		4/30/1997	465	31	<5	<10	<5	<5	<5	<5	
		10/15/1997	532	34	<1	<1	<1	<1	<1	<1	<1
		3/26/1998	67	<1	<1	<1	<1	<1	<1	<1	
		9/30/1998	24	<1	<2	<1	<1	<1	<1	<1	
		3/23/1999	11	<1	<1	<1	<1	<1	<1	<1	
		7/21/1999	21	4.2	<2.0	<4.0	<2.0	<2.0	<2.0	<2.0	<3.0
		7/22/1999	13	<0.5	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.75
		8/17/1999	17	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
		9/17/1999	22	<1	<1	<1	<1	<1	<1	<1	
		3/22/2000	15	<1	<1	<1	<1	<1	<1	<1	
		9/1/2000	16	<1	<1	<1	<1	<1	<1	<1	
		3/1/2001	7.2	<1	<1	<1	<1	<1	<1	<1	
		9/1/2001	15	<1	<1	<1	<1	<1	<1	<1	
		3/1/2002	12	<1	<1	<1	<1	<1	<1	<1	
		9/1/2002	10	<1	<1	<1	<1	<1	<1	<1	
		3/1/2003	14	<1	<1	<1	<1	<1	<1	<1	
		9/1/2003	8.5	<1	<1	<1	<1	<1	<1	<1	
		3/31/2004	8.5	<1	<1	<1	<1	<1	<1	<1	
		9/20/2004	1700	90	<20	<20	<20	<20	<20	<20	
		3/21/2005	9.6	<1	<1	<1	<1	<1	<1	<1	
		7/27/2005	650	18	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
South of Bldg	RW-9	6/29/1995	11,050	710	<5	<5	<5	<5	<5	<5	
Near Bldg		10/2/1995	16,110	680	<5	<5	<5	<5	<5	<5	
		10/2/1995 Dup	15,870	630		<5	<5	<5	<5	<5	
		3/28/1996	14,600	703	<25	<50	<25	<25	<25	<25	
		10/15/1996	14,200	779	<5	<10	<5	<5	<5	<5	
		10/15/1996 Dup	14,500	841		<10	5	<5	<5	<5	
		4/30/1997	14,700	977	5	<10	<5	5	<5	<5	
		10/15/1997	14,800	472	379	115	76	117	<1	<1	<1
		3/26/1998	13,000	2,100	<100	<100	<100	<100	<100	<100	
		9/30/1998	12,000	640	<200	<200	<200	<200	<200	<200	
		3/23/1999	21,000	1100	<40	<40	<40	<40	<40	<40	
		7/16/1999 CTI	2,730	307	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
		7/16/1999 GZA	3,600	420	<50	<100	<50	<50	<50	<50	<75
		7/20/1999	660	44	<40	<80	<40	<40	<40	<40	<50
		7/21/1999	470	20	<20	<40	<20	<20	<20	<20	<30
		7/22/1999	790	47	<40	<80	<40	<40	<40	<40	<60
		8/17/1999	1,500	60	<10	<10	<10	<10	<10	<10	<10
		9/17/1999	11,000	490	<250	<250	<250	<250	<250	<250	
		3/22/2000	14,000	440	<400	<400	<400	<400	<400	<400	
		9/1/2000	4,200	250	<25	<25	<25	<25	<25	<25	
		3/1/2001	43,000	1,500	<100	<100	<100	<100	<100	<100	
		9/1/2001	460	25	<10	<10	<10	<10	<10	<10	
		3/1/2002	16,000	730	<5	<5	<5	<5	<5	9.2	
		9/1/2002	42,000	2,300	<200	<200	<200	<200	<200	<200	
		3/1/2003	13,000	730	<100	<100	<100	<100	<100	<100	
		9/1/2003	30,000	2,300	<500	<500	<500	<500	<500	<500	
		3/31/2004	36,000	1,900	<500	<500	<500	<500	<500	<500	
		9/20/2004	40,000	1,300	<200	<200	<200	<200	<200	<200	
		3/21/2005	14,000	<250	<250	<250	<250	<250	<250	<250	









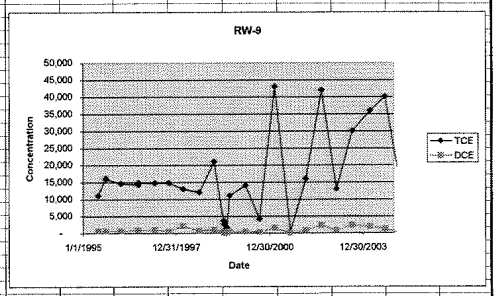
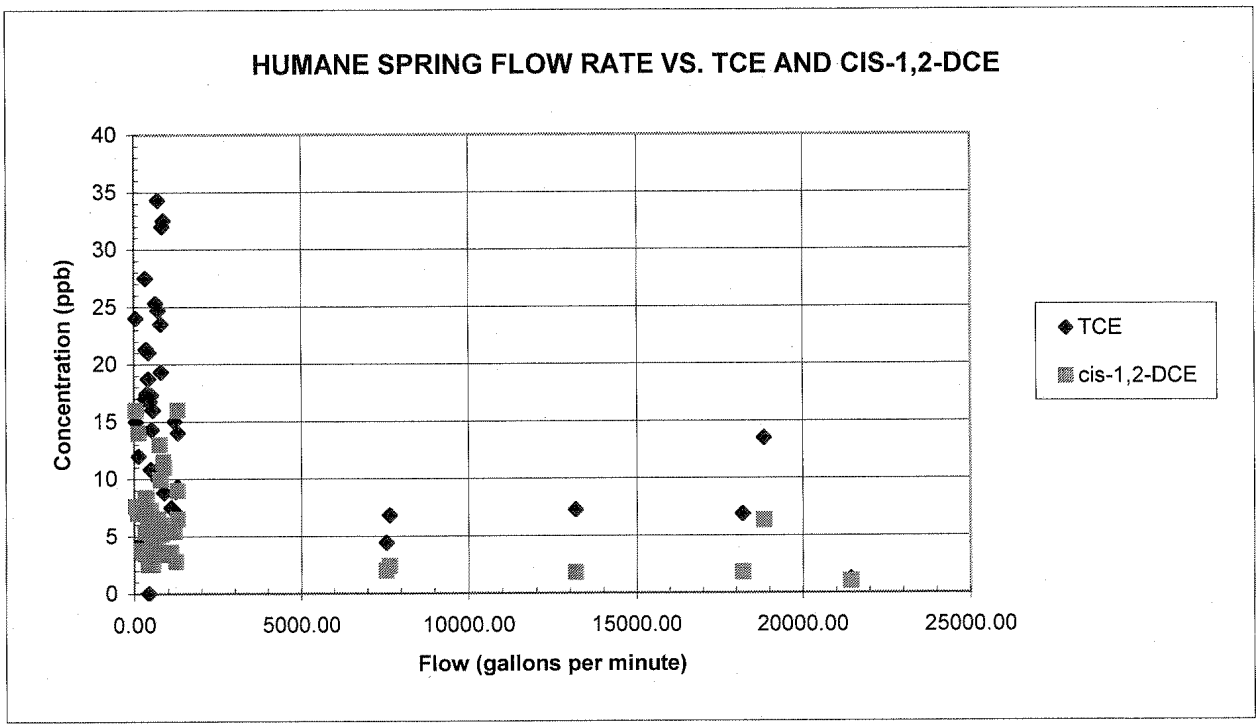


TABLE 2
HUMANE SPRING FLOW RATES AND TCE AND CIS-1,2-DCE CONCENTRATIONS
Former Hallmack Facility
Harrodsburg, Kentucky

DATE	TCE (ug/L)	cis-1,2-DCE (ug/L)	FLOW RATE (gpm)
March 28, 1996	10.8	7.3	494
April 30, 1997	14	16	1302
March 23, 1998	9.3	9	1297
March 23, 1998	6.9	6.5	1297
March 25, 1998	8.8	11	886
March 27, 1998	7	7	117
March 30, 1998	0	2.5	431
April 1, 1998	16	2.5	548
April 6, 1998	12	14	139
April 9, 1998	11	13	763
May 8, 1998	6.8	2.4	7674
June 12, 1998	4.4	2	7567
July 20, 1998	1.2	1	21448
September 30, 1998	4.4	3.8	220
September 18, 2001	24	16	60
March 11, 2002	4.1	3.5	350
September 18, 2002	15	7.6	60
March 3, 2003	7.5	3.6	1100
September 30, 2003	15	5.4	1200
February 26, 2004	17.4	7.3	380
March 16, 2004	19.3	6	802
March 17, 2004	14.3	5.2	525
March 18, 2004	16.7	5.9	467
March 19, 2004	17	5.4	345
March 22, 2004	24.7	4.5	707
March 24, 2004	25.3	6	639
March 26, 2004	17.3	5.3	502
March 29, 2004	18.7	6.1	422
March 31, 2004	32	5.2	831
April 2, 2004	34.3	6.5	707
April 5, 2004	21	7	433
April 7, 2004	21.3	8.2	365
April 9, 2004	27.5	8.4	345
April 12, 2004	13.5	6.3	18842
April 14, 2004	7.25	1.8	13172
April 16, 2004	10.5	3.4	754
April 19, 2004	32.5	11.5	866
April 21, 2004	23.5	9.9	787
April 23, 2004	6.85	1.8	18209
April 26, 2004	8.9	2.8	1238
April 28, 2004	9.95	3.5	707
April 30, 2004	10.5	4.2	707

Notes:
1. Flow rates in gallons per minute (gpm) for 1996 and 1997 were estimated by CTE and for 1998 and later were estimated by GZA using a calibrated staff guage installed within the stream formed by Humane Spring.
2. Trichloroethylene (TCE) and cis-1,2-dichloroethylene (cis-1,2-DCE) concentrations are reported in micrograms per liter (ug/L).

TABLE 2 PLOTS
HUMANE SPRING FLOW RATES AND TCE AND CIS-1,2-DCE CONCENTRATIONS
Former Hallmack Facility
Harrodsburg, Kentucky



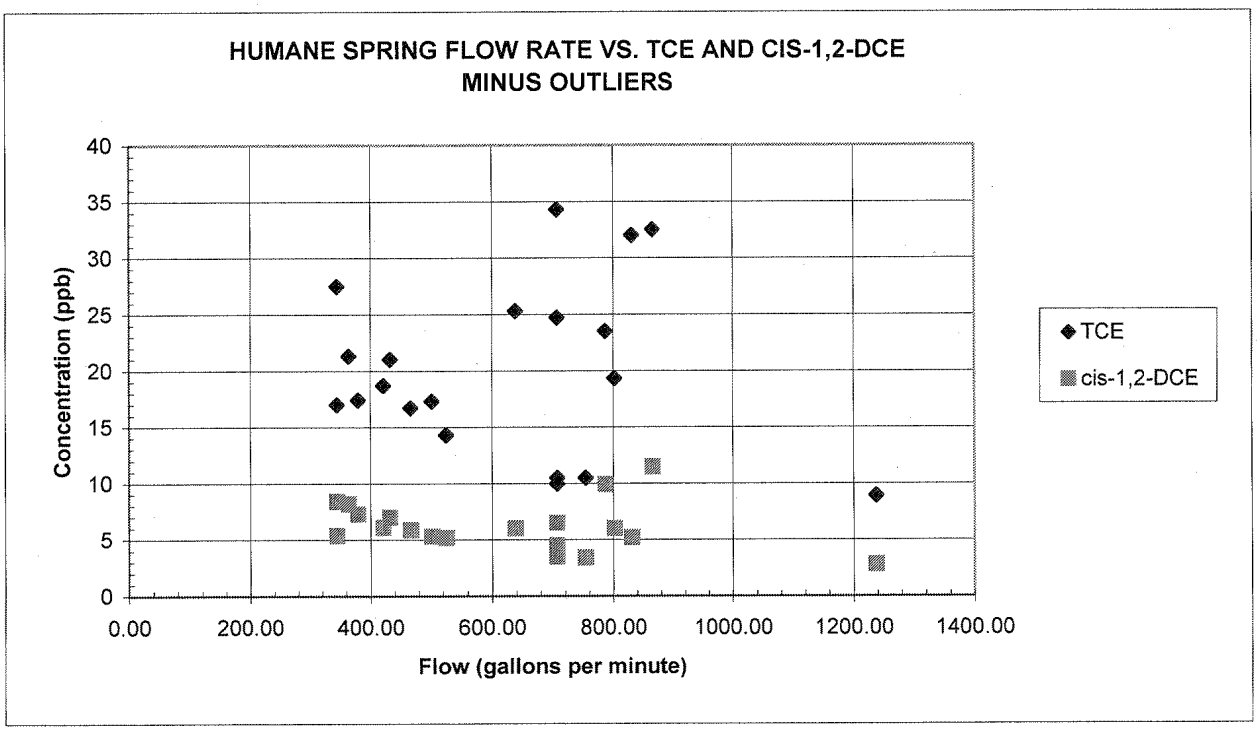


TABLE 3
SUMMARY OF ANALYTICAL RESULTS 1991-2004
HUMANE SPRING
Former Hallmack Facility
Harrodsburg, Kentucky

		Sample Date =>	10/29/91	12/18/91	2/18/92	12/21/93	12/21/94	3/29/95	6/29/95	10/2/95	3/28/96	10/15/96	4/30/97	10/14/97	3/23/98	3/23/98	3/23/98	3/25/98	3/25/98
		Sample Location =>	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 2	Site 3	Site 1	Site 3
		Spring Discharge Rate (CFS/GPM) =>									1.1/494		2.9/1302	0.4/180	2.89/1297			1.93/886	
	401 KAR 5:031 Standard																		
Parameter	Table 1	Table 3																	
Petroleum VOCs	(ug/L)	(ug/L)																	
Benzene	71	1.2													0.27	<0.2	0.26	<0.20	0.26
Toluene	424,000	14,300													0.54	0.55	0.5	0.29	0.42
Ethylbenzene	29,000	3,100													0.29	0.46	0.36	<0.20	0.45
m&p-xylene															0.84	1	0.85	0.43	0.97
o-xylene															1	0.99	1.6	<0.20	0.67
Styrene															<.020	<0.20	0.93	<0.20	<0.20
Methyl-tert-butyl ether															<1.0	<1.0	2.9	2.8	<1.0
Isopropylbenzene															<0.20	0.99	<0.20	<0.20	0.67
1,3,5-Trimethylbenzene															<0.20	<0.20	<0.20	<0.20	<0.20
1,2,4-Trimethylbenzene															0.93	0.96	0.68	<0.20	0.9
Chlorinated VOCs																			
Chloroform	470	5.7													<0.20	<0.20	<0.20	<0.20	<0.20
1,1-Dichloroethane			<2	<5	<2	<5	<5		<5	<5	<1	<5	<5	<1	<0.20	<0.20	<0.20	<0.20	<0.20
1,1-Dichloroethene	1.85	0.033	<2	<2	<2	<5	<5	<5	<5	<5	<1	<5	<5	<1	<0.20	<0.20	<0.20	<0.20	<0.20
cis-1,2-Dichloroethene			48	21	14	20	16	29	20	14	7.3	19	16	0.5	6.5	10	6.7	11	9
Tetrachloroethene	8.85	0.8	<2	<2	<2	<5	<5	<5	6	<5	<1	<5	<5	<1	0.58	0.34	0.36	0.43	<0.20
Trichloroethene	80.7	2.7	36	23	20	24	23	26	14	10	10.8	28	14	29	6.9	9.2	6.4	8.8	7.7
1,1,1-Trichloroethane	1,030,000	18,400	<2	<2	<2	<5	<5	<5	<5	<5	<1	<5	<5	<1	<0.20	<0.20	<0.20	<0.20	<0.20
1,1,2-Trichloroethane	41.8	0.6	<2	<2	<2	<5	<5							<1	<0.20	<0.20	<0.20	<0.20	<0.20
Vinyl Chloride	525	2	1.6	<2	<2	<2	<2	<5	<5	<5	<2	<10	<10	41/<1	<0.40	<0.40	<0.40	<0.40	<0.40
TOTAL VOCs			85.6	44	34	44	39	55	40	24	18.1	47	30	29.5	17.85	24.49	21.54	23.75	21.04

TABLE 3
SUMMARY OF ANALYTICAL RESULTS 1991-2004
HUMANE SPRING
Former Hallmack Facility
Harrodsburg, Kentucky

		Sample Date =>	3/27/98	3/27/98	3/27/98	3/27/98	3/30/98	3/30/98	3/30/98	3/30/98	4/1/98	4/1/98	4/1/98	4/1/98	4/6/98	4/6/98	4/6/98	4/6/98
		Sample Location =>	Site 1	Site 2	Site 3	Site 3 Dup	Site 1	Site 2	Site 2 Dup	Site 3	Site 1	Site 2	Site 3	Site 3 Dup	Site 1	Site 1 Dup	Site 2	Site 3
		Spring Discharge Rate (CFS/GPM) =>	0.26/117				0.96/431				1.22/548				0.31/139			
	401 KAR 5:031 Standard																	
Parameter	**Table 1**	**Table 3**																
Petroleum VOCs	(ug/L)	(ug/L)																
Benzene	71	1.2	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Toluene	424,000	14,300	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Ethylbenzene	29,000	3,100	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
m&p-xylene			<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
o-xylene			<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Styrene			<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Methyl-tert-butyl ether																		
Isopropylbenzene																		
1,3,5-Trimethylbenzene																		
1,2,4-Trimethylbenzene																		
Chlorinated VOCs																		
Chloroform	470	5.7	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethane			<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethene	1.85	0.033	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
cis-1,2-Dichloroethene			7	6	5	5	2.5	8	7	7	2.5	2.5	2.5	2.5	14	14	12	10
Tetrachloroethene	8.85	0.8	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Trichloroethene	80.7	2.7	7	6	5	6	<5	6	6	6	16	<5	<5	<5	12	10	10	8
1,1,1-Trichloroethane	1,030,000	18,400	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1,2-Trichloroethane	41.8	0.6	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Vinyl Chloride	525	2	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
TOTAL VOCs			14	12	10	11	2.5	14	13	13	18.5	2.5	2.5	2.5	26	24	22	18

TABLE 3
SUMMARY OF ANALYTICAL RESULTS 1991-2004
HUMANE SPRING
Former Hallmack Facility
Harrodsburg, Kentucky

		Sample Date =>	4/9/98	4/9/98	4/9/98	4/9/98	5/8/98	5/8/98	5/8/98	5/8/98	5/8/98	6/12/98	6/12/98	6/12/98	6/12/98	7/20/98	7/20/98	7/20/98	7/20/98
		Sample Location =>	Site 1	Site 2	Site 3	Site 3 Dup	Site 1	Site 2	Site 3	Site 3 Dup	Site 4	Site 1	Site 1 Dup	Site 2	Site 3	Site 1	Site 1 Dup	Site 2	Site 3
		Spring Discharge Rate (CFS/GPM) =>	1.7/763				17.1/7,674					16.86/7,567				47.79/21,448			
	401 KAR 5:031 Standard																		
Parameter	Table 1	Table 3																	
Petroleum VOCs	(ug/L)	(ug/L)																	
Benzene	71	1.2	<5	<5	<5	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.2	0.2
Toluene	424,000	14,300	<5	<5	<5	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.47	0.47
Ethylbenzene	29,000	3,100	<5	<5	<5	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.20	0.2	0.24	<0.20	<0.20	<0.20	0.2	0.21
m&p-xylene			<5	<5	<5	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.20	0.74	0.8	0.2	<0.20	<0.20	0.83	0.83
o-xylene			<5	<5	<5	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.20	0.24	0.26	<0.20	<0.20	<0.20	0.26	0.41
Styrene			<5	<5	<5	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Methyl-tert-butyl ether							<2.0	<2.0	<2.0	<2.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Isopropylbenzene							<1.0	<1.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
1,3,5-Trimethylbenzene							<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.32	0.3
1,2,4-Trimethylbenzene							<1.0	<1.0	<1.0	<1.0	<1.0	<0.20	0.49	0.53	<0.20	<0.20	<0.20	0.47	0.47
Chlorinated VOCs																			
Chloroform	470	5.7	<5	<5	<5	<5	<1.0	<1.0	<1.0	<1.0	<1.0	0.24	0.25	0.28	0.35	<0.20	<0.20	<0.20	<0.20
1,1-Dichloroethane			<5	<5	<5	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
1,1-Dichloroethene	1.85	0.033	<5	<5	<5	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
cis-1,2-Dichloroethene			13	13	12	11	2.4	2.1	2.4	2.2	1.3	2	1.9	2.1	0.53	1	1.1	0.6	0.61
Tetrachloroethene	8.85	0.8	<5	<5	<5	<5	<1.0	<1.0	<1.0	<1.0	<1.0	0.25	0.25	0.26	0.89	<0.20	<0.20	<0.20	<0.20
Trichloroethene	80.7	2.7	11	10	9	9	6.8	6.8	7.4	7.4	4.6	4.4	4.3	4.5	1.3	1.2	1.2	0.69	0.67
1,1,1-Trichloroethane	1,030,000	18,400	<5	<5	<5	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
1,1,2-Trichloroethane	41.8	0.6	<5	<5	<5	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Vinyl Chloride	525	2	<10	<10	<10	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
TOTAL VOCs			24	23	21	20	9.2	8.9	9.8	9.6	5.9	6.89	8.37	8.97	3.27	2.2	2.3	4.04	4.17

TABLE 3
SUMMARY OF ANALYTICAL RESULTS 1991-2004
HUMANE SPRING
Former Hallmack Facility
Harrodsburg, Kentucky

		Sample Date =>	9/30/98	3/23/99	7/16/99	7/20/99	7/21/99	7/22/99	8/17/99	9/28/99	4/13/00	9/26/00	3/27/01	9/18/01	3/11/02	9/18/02	3/3/03	9/30/03
		Sample Location =>	Site 3	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1
		Spring Discharge Rate (CFS/GPM) =>	220	8,500						150	2,000	12,000	550	60	350	60	1,100	1,200
	401 KAR 5:031 Standard																	
Parameter	**Table 1**	**Table 3**																
Petroleum VOCs	(ug/L)	(ug/L)																
Benzene	71	1.2																
Toluene	424,000	14,300																
Ethylbenzene	29,000	3,100																
m&p-xylene																		
o-xylene																		
Styrene																		
Methyl-tert-butyl ether																		
Isopropylbenzene																		
1,3,5-Trimethylbenzene																		
1,2,4-Trimethylbenzene																		
Chlorinated VOCs																		
Chloroform	470	5.7	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane			<1.0	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethene	1.85	0.033	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene			3.8	9.3	17	15	12	9.1	24	18	3.5	2.4	5.7	16	3.5	7.6	3.6	5.4
Tetrachloroethene	8.85	0.8	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethene	80.7	2.7	4.4	16	13	13	18	12	23	16	9.1	10	6.4	24	4.1	15	7.5	15
1,1,1-Trichloroethane	1,030,000	18,400	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	41.8	0.6	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vinyl Chloride	525	2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
TOTAL VOCs			8.2	25.3	30	28	30	21.1	47	34	12.6	12.4	12.1	40	7.6	22.6	11.1	20.4

TABLE 3
SUMMARY OF ANALYTICAL RESULTS 1991-2004
HUMANE SPRING
Former Hallmack Facility
Harrodsburg, Kentucky

		Sample Date =>	2/26/04	2/27/04	3/16/04	3/17/04	3/18/04	3/19/04	3/22/04	3/24/04	3/26/04	3/29/04	4/2/04	4/5/04	4/7/04	4/9/04	4/12/04
		Sample Location =>	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1
		Spring Discharge Rate (CFS/GPM) =>	385	802	525	467	345	707	639	502	422	831	707	433	365	345	18,842
	401 KAR 5:031 Standard																
Parameter	**Table 1**	**Table 3**															
Petroleum VOCs	(ug/L)	(ug/L)															
Benzene	71	1.2															
Toluene	424,000	14,300															
Ethylbenzene	29,000	3,100															
m&p-xylene																	
o-xylene																	
Styrene																	
Methyl-tert-butyl ether																	
Isopropylbenzene																	
1,3,5-Trimethylbenzene																	
1,2,4-Trimethylbenzene																	
Chlorinated VOCs																	
Chloroform	470	5.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethene	1.85	0.033	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene			7.5	6	5.2	5.9	5.4	4.5	6	5.3	6.1	5.2	6.5	7	8.2	8.4	6.3
Tetrachloroethene	8.85	0.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethene	80.7	2.7	19.3	19.3	14.3	16.7	17	24.7	25.3	17.3	18.7	32	34.3	21	21.3	27.5	13.5
1,1,1-Trichloroethane	1,030,000	18,400	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	41.8	0.6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vinyl Chloride	525	2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
TOTAL VOCs			26.8	25.3	19.5	22.6	22.4	29.2	31.3	22.6	24.8	37.2	40.8	28	29.5	35.9	19.8

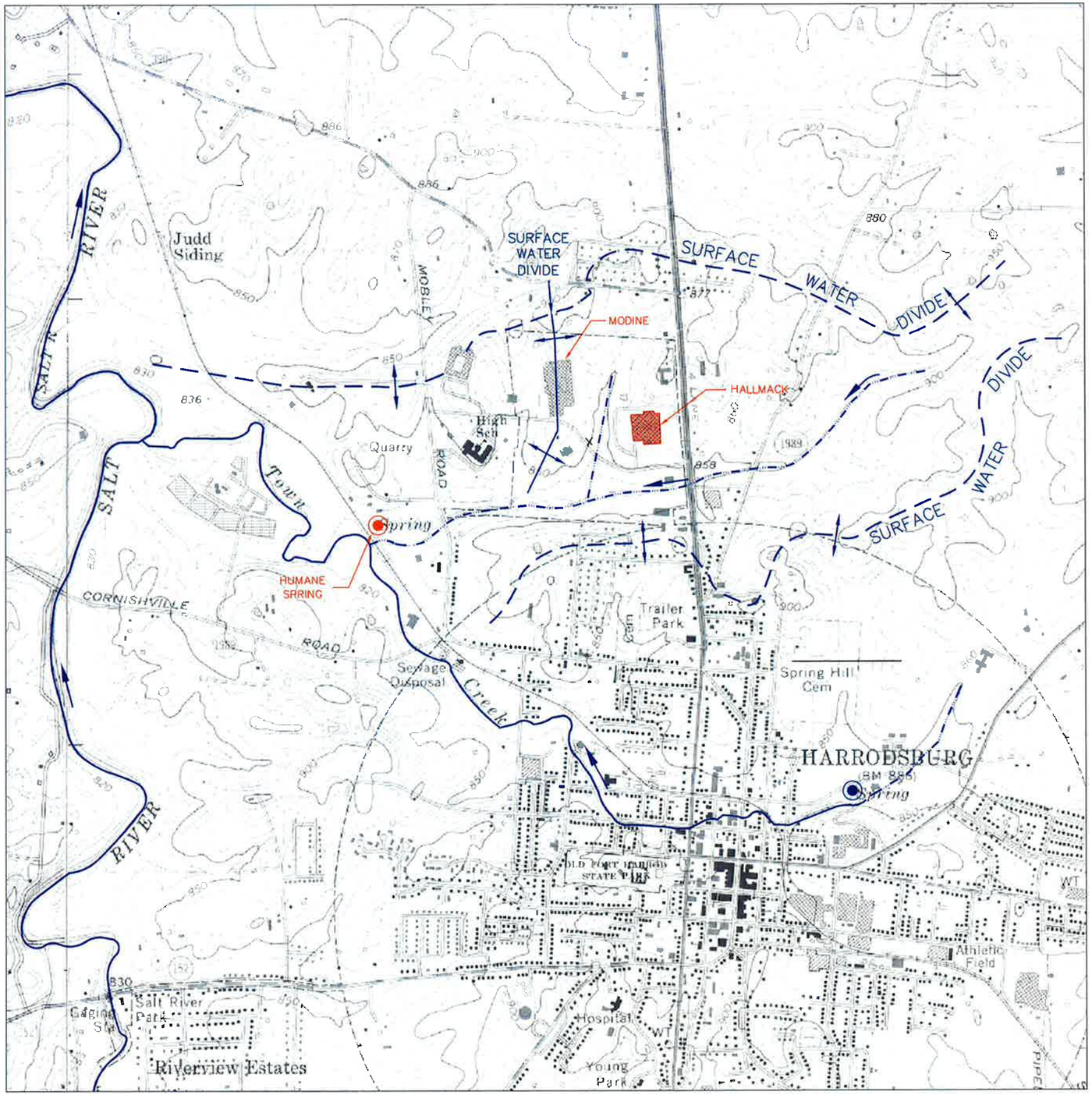
TABLE 3
SUMMARY OF ANALYTICAL RESULTS 1991-2004
HUMANE SPRING
Former Hallmack Facility
Harrodsburg, Kentucky

		Sample Date =>	4/14/04	4/16/04	4/19/04	4/21/04	4/23/04	4/26/04	4/28/04	4/30/04	9/20/04
		Sample Location =>	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1
		Spring Discharge Rate (CFS/GPM) =>	13,172	754	866	787	18,209	1,238	707	707	700
	401 KAR 5:031 Standard										
Parameter	**Table 1**	**Table 3**									
Petroleum VOCs	(ug/L)	(ug/L)									
Benzene	71	1.2									
Toluene	424,000	14,300									
Ethylbenzene	29,000	3,100									
m&p-xylene											
o-xylene											
Styrene											
Methyl-tert-butyl ether											
Isopropylbenzene											
1,3,5-Trimethylbenzene											
1,2,4-Trimethylbenzene											
Chlorinated VOCs											
Chloroform	470	5.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethene	1.85	0.033	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene			1.8	3.4	11.5	9.9	1.8	2.8	3.5	4.2	3.9
Tetrachloroethene	8.85	0.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethene	80.7	2.7	7.3	10.5	32.4	23.5	6.9	8.9	10	10.5	12
1,1,1-Trichloroethane	1,030,000	18,400	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	41.8	0.6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vinyl Chloride	525	2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
TOTAL VOCs			9.1	13.9	43.9	33.4	8.7	11.7	13.5	14.7	15.9

Notes:

1. Analytical results for samples collected in 1991 through 1997 were reported by Consoer Townsend Evirodyne Engineers (CTE) of Fairfax, Virginia.
2. Samples were collected in 1998 by GZA GeoEnvironmental, Inc. (GZA) or Commonwealth Technology, Inc. (CTI), on behalf of GZA.
3. Site 1 - refers to samples collected from near Humane Spring; Site 2 - refers to samples collected approximately half the distance between Humane Spring and Town Creek; Site 3 - refers to samples collected from the stream near Town Creek; and Site 4 - refers to samples collected from Town Creek downstream from the stream formed by Humane Spring.
4. 401 KAR5:031 Standards in micrograms per liter (ug/L) refers to Kentucky Surface Water Standards in ug/l. Table 1 concentrations are Water Quality Criteria for Protection of Human Health from the Consumption of Fish Tissue and Table 3 concentrations are Domestic Water Supply Source Criteria. Note that other standards may apply.
5. Results are reported in ug/L. "<" indicates that the parameter was not detected at a concentration greater than the method detection limit indicated. A blank space indicates that the parameter was not analyzed.
6. Cis-1,2-dichloroethene results include total-1,2-dichloroethene results reported by CTE for samples collected prior to 1998.
7. The spring discharge rate is reported in cubic feet per second (CFS) and gallons per minute (GPM).
8. February, March and April 2004 analytical data and flow rates are the averages value of 2 or 3 analyses or measurements.

FIGURES



SCALE: 1" = 1000'
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PROJ MGR: MJK
DESIGNED BY: MJK
REVIEWED BY: MAP
OPERATOR: DL
DATE: JANUARY 2005

FORMER HALLMACK FACILITY
HARRODSBURG, KENTUCKY

SITE LOCATION MAP

PROJECT NO.
150290.70

FIGURE NO.
1

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GZA-J:\ENV\150290.MAP\CADD\150290\Submitted Drawings\FIG-1 SITE LOCATION MAP.DWG [FIG. 1] March 13, 2007 - 8:59am deborah.landi

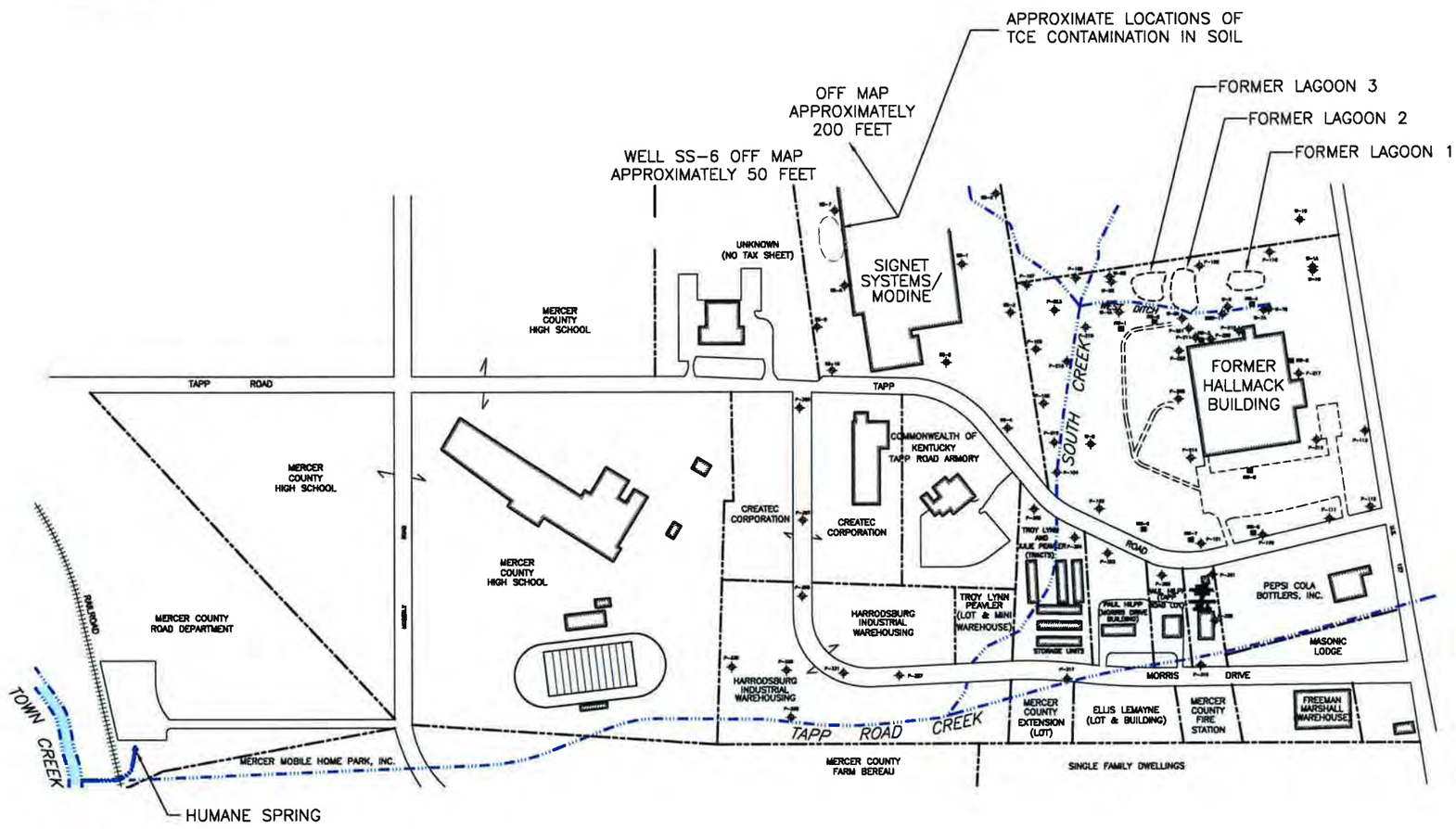
LEGEND:

RW-6 SS-8 WELL LOCATION

INTERMITTENT DRAINAGE

PROPERTY BOUNDARY

NOTES:
1. THE LOCATIONS OF ROADS, PROPERTY BOUNDARIES, BUILDINGS, DRAINAGES AND WELLS ARE APPROXIMATE. FEATURES WERE DERIVED FROM VARIOUS MAPS, AERIAL PHOTOGRAPHS AND OBSERVATIONS MADE AT DIFFERENT DATES.



SCALE: 1" = 300'
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DESIGNED BY: MJK
REVIEWED BY: MAP
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DATE: JANUARY 2005

FORMER HALLMACK FACILITY
HARRODSBURG, KENTUCKY

SITE AND VICINITY PLAN

PROJECT NO.
150290.70

FIGURE NO.
2

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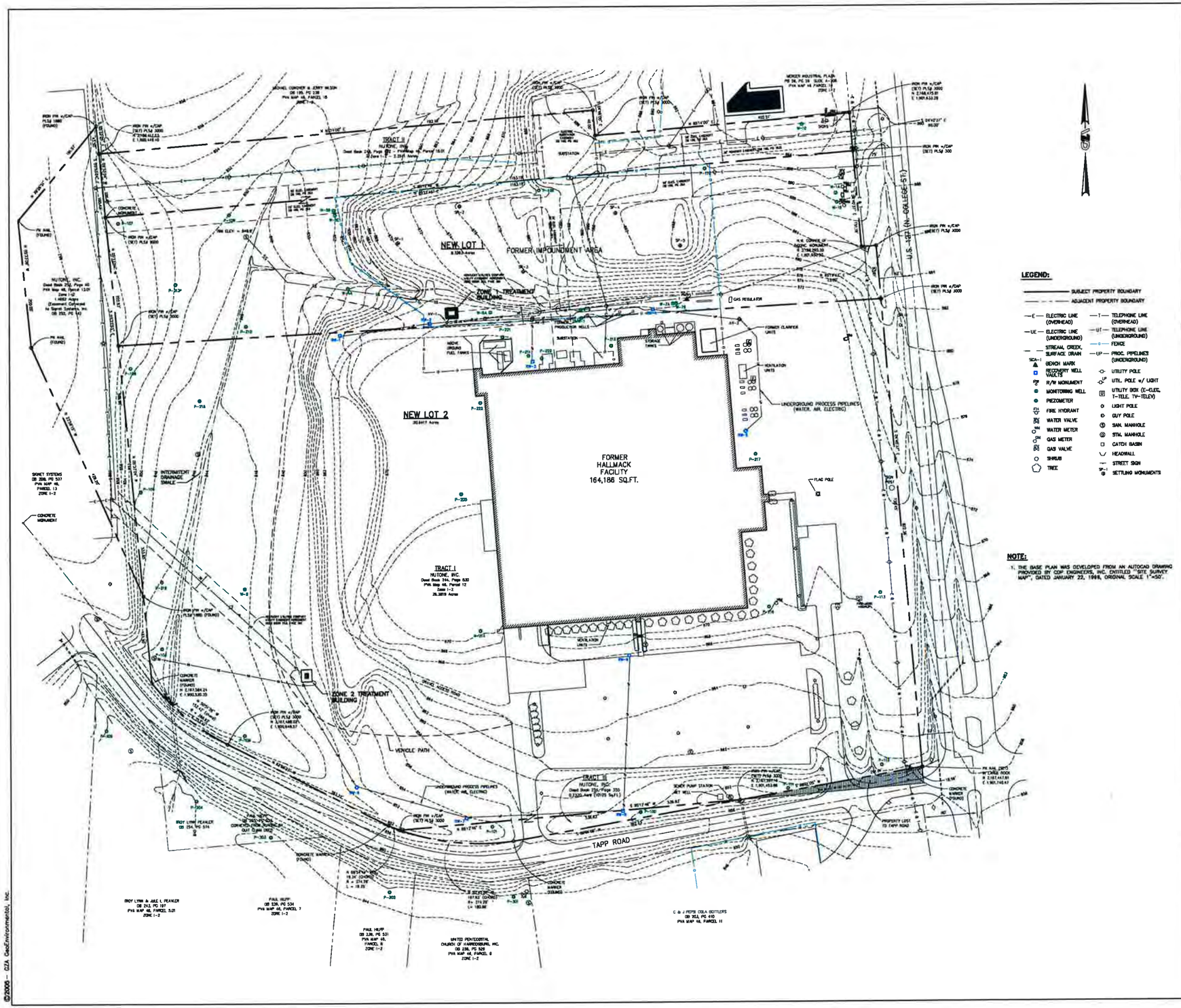
GZA-J:\ENV\150290 MAP\CADD\150290\Submitted Drawings\FIG-2 SITE & VICINITY PLAN.DWG [Layout1] March 13, 2007 - 9:00am deborah landi



LEGEND:

- SUBJECT PROPERTY BOUNDARY
- ADJACENT PROPERTY BOUNDARY
- ELECTRIC LINE (OVERHEAD)
- ELECTRIC LINE (UNDERGROUND)
- STREAM, CREEK, SURFACE DRAIN
- BENCH MARK
- RECOVERY WELL VAULTS
- R/W MONUMENT
- MONITORING WELL
- PIEZOMETER
- FIRE HYDRANT
- WATER VALVE
- WATER METER
- GAS METER
- GAS VALVE
- SHRUB
- TREE
- TELEPHONE LINE (OVERHEAD)
- TELEPHONE LINE (UNDERGROUND)
- FENCE
- PROC. PIPELINES (UNDERGROUND)
- UTILITY POLE
- UTIL. POLE w/ LIGHT
- UTILITY BOX (E-ELEC, T-TELE, TV-TELEV)
- LIGHT POLE
- GUY POLE
- SAN. MANHOLE
- STM. MANHOLE
- CATCH BASIN
- HEADWALL
- STREET SIGN
- SETTLING MONUMENTS

NOTE:

1. THE BASE PLAN WAS DEVELOPED FROM AN AUTOCAD DRAWING PROVIDED BY CDF ENGINEERS, INC. ENTITLED "SITE SURVEY MAP", DATED JANUARY 22, 1998, ORIGINAL SCALE 1"=50'.

SCALE: 1" = 100'

0 50 100 200

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PROJ MGR: MJK
DESIGNED BY: MJK
REVIEWED BY: MAP
OPERATOR: DL
DATE: JANUARY 2005

FORMER HALLMACK FACILITY

HARRODSBURG, KENTUCKY

SITE PLAN

PROJECT NO.
150290.70

FIGURE NO.
3

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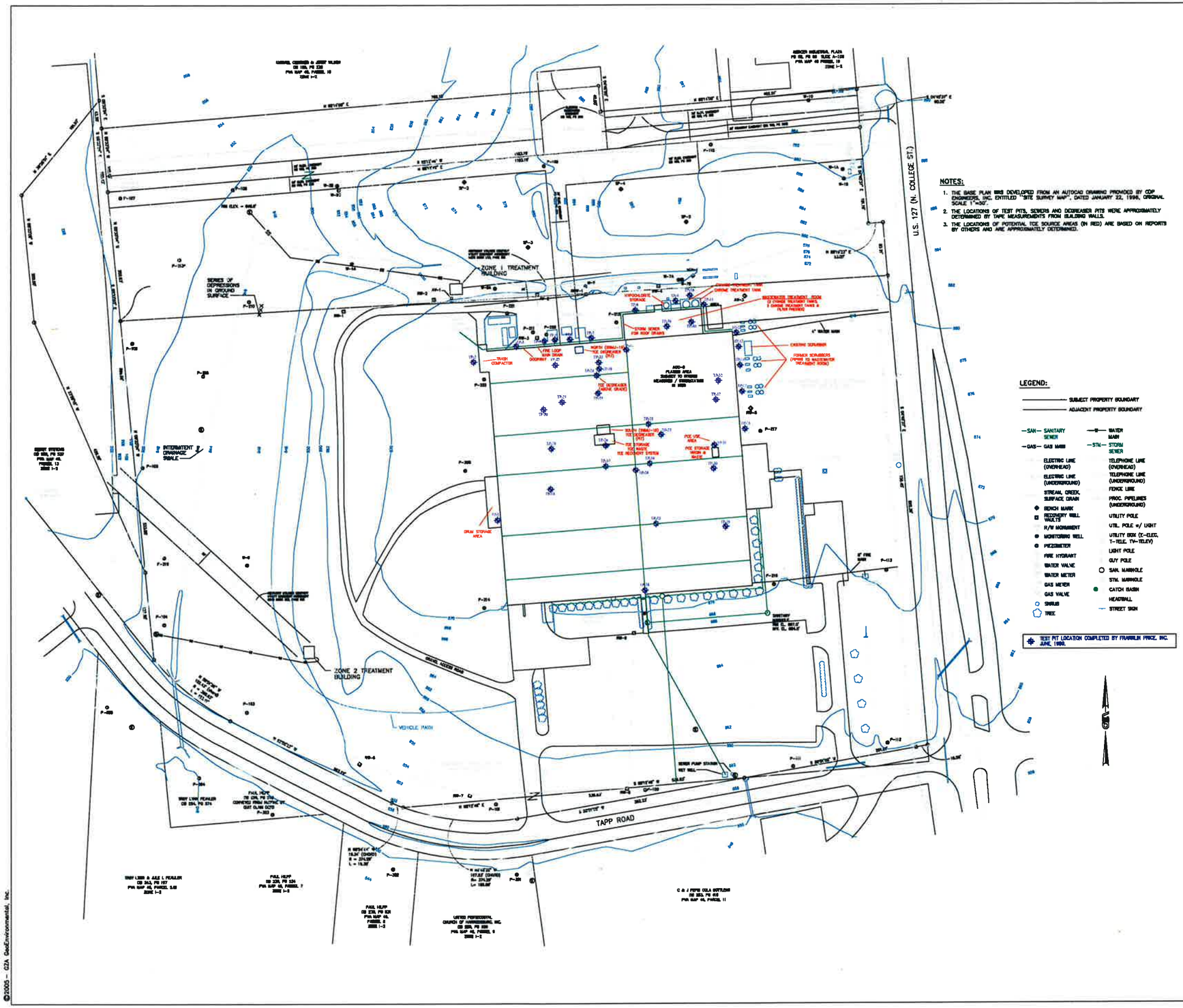
GZA-J:\ENV\150290 MAP\CADD\150290\Submitted Drawings\FIG-3 SITE PLAN.DWG [SITE] March 13, 2007 - 9:03am deborah landi



NOTES:

1. THE BASE PLAN WAS DEVELOPED FROM AN AUTOCAD DRAWING PROVIDED BY CDP ENGINEERS, INC. ENTITLED "SITE SURVEY MAP", DATED JANUARY 22, 1996, ORIGINAL SCALE 1"=50'.
2. THE LOCATIONS OF TEST PITS, SEWERS AND DEGREASER PITS WERE APPROXIMATELY DETERMINED BY TAPE MEASUREMENTS FROM BUILDING WALLS.
3. THE LOCATIONS OF POTENTIAL TCE SOURCE AREAS (IN RED) ARE BASED ON REPORTS BY OTHERS AND ARE APPROXIMATELY DETERMINED.

LEGEND:

- SUBJECT PROPERTY BOUNDARY
- ADJACENT PROPERTY BOUNDARY
- SAN — SANITARY SEWER
- GAS — GAS MAIN
- WATER MAIN
- STM — STORM SEWER
- ELECTRIC LINE (OVERHEAD)
- ELECTRIC LINE (UNDERGROUND)
- STREAM, CREEK, SURFACE DRAIN
- BENCH MARK
- RECOVERY WELL VAULTS
- R/W MONUMENT
- MONITORING WELL
- PIEZOMETER
- FIRE HYDRANT
- WATER VALVE
- WATER METER
- GAS METER
- GAS VALVE
- SHRUB
- TREE
- TELEPHONE LINE (OVERHEAD)
- TELEPHONE LINE (UNDERGROUND)
- FENCE LINE
- PROC. PIPELINES (UNDERGROUND)
- UTILITY POLE
- UTIL. POLE w/ LIGHT
- UTILITY BOX (E-ELEC, T-TELE, TV-TELEV)
- LIGHT POLE
- GUY POLE
- SAN. MANHOLE
- STM. MANHOLE
- CATCH BASIN
- HEADWALL
- STREET SIGN
- TEST PIT LOCATION COMPLETED BY FRANKLIN PRICE, INC. JUNE, 1998.

SCALE: 1" = 100'

0 50 100 200

GZA
GeoEnvironmental, Inc.
Engineers and Scientists
CROSSROADS CORPORATE CENTER
20900 SWENSON DRIVE, SUITE 150
PROVIDENCE, RHODE ISLAND 02903
(262) 754-2560
(262) 754-9711

PROJ MGR: MJK
DESIGNED BY: MJK
REVIEWED BY: MAP
OPERATOR: DL
DATE: JANUARY 2005

FORMER HALLMACK FACILITY

HARRODSBURG, KENTUCKEY

POTENTIAL SOURCE AREA SAMPLING PLAN

PROJECT NO.
150290.70

FIGURE NO.
4

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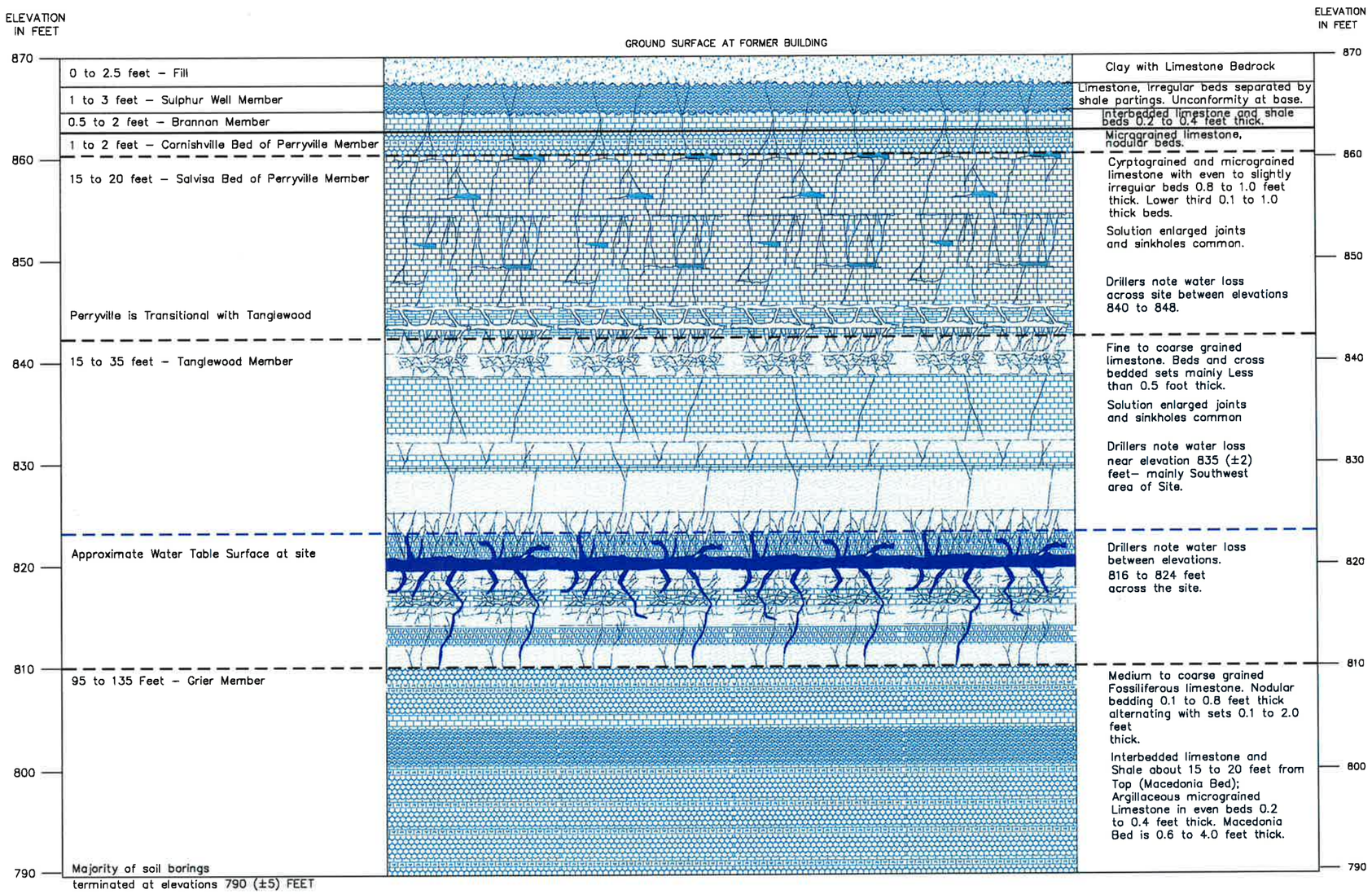
GZA-J:\ENV\150290.MAP\CADD\150290\Submitted Drawings\FIG-4 POTENTIAL SOURCE AREA SAMPLING PLAN.DWG [Layout1] March 13, 2007 - 9:04am deborah.landi



Legend:

- Clay Fill with pieces of Limestone
- Cross bedded Limestone
- Fossiliferous Limestone
- Fossiliferous Limestone – Irregular Beds
- Irregular Bedded Limestone
- Laminar Bedded Limestone
- Argillaceous Limestone

Notes:

1. Lithologic description from Kentucky Geologic Survey; 1985, Stratigraphy along and adjacent to the Bluegrass Parkway and 1972 Geologic Quadrangle Map, Harrodsburg Quadrangle, Kentucky.
2. Lithologic thicknesses are based on observations at site and vicinity.
3. Fractures and voids depicted are from boring logs of wells installed for Hallmack.

NOT TO SCALE

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Engineers and Scientists
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WAUKESHA, WISCONSIN 53186
(262) 754-2560
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PROJ MGR: MJK
DESIGNED BY: MJK
REVIEWED BY: MAP
OPERATOR: DL
DATE: JANUARY 2005

FORMER HALLMACK FACILITY
HARRODSBURG, KENTUCKY

SITE SPECIFIC GEOLOGICAL PROFILE

PROJECT NO.
150290.70

FIGURE NO.
5

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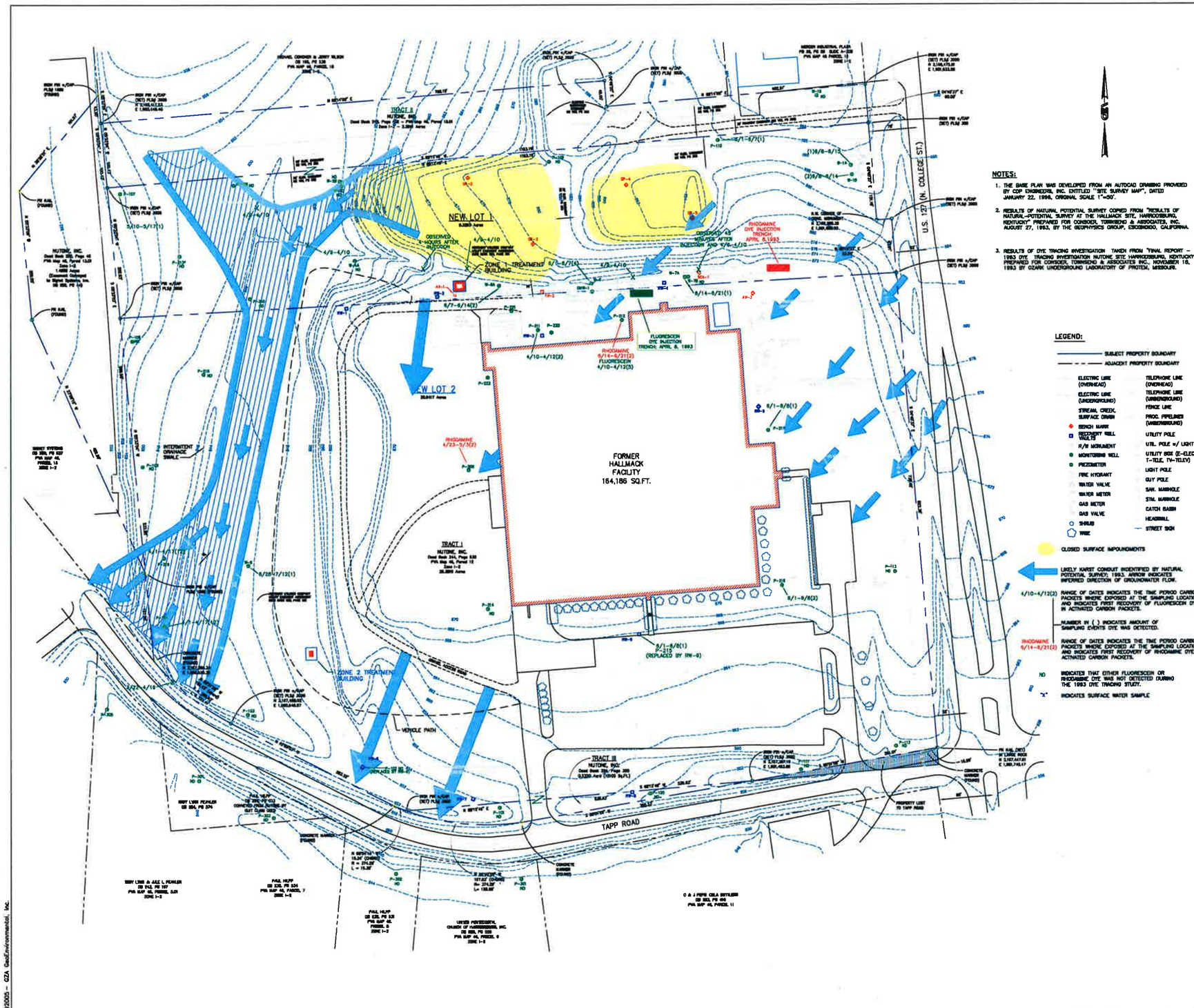
GZA–J:\ENV\150290.MAP\CADD\150290\Submitted Drawings\FIG-5 SITE SPECIFIC GEOLOGIC PROFILE.DWG [Layout1] March 13, 2007 – 9:58am deborah.landl



NOTES:

1. THE BASE PLAN WAS DEVELOPED FROM AN AUTOCAD DRAWING PROVIDED BY CDP ENGINEERS, INC. ENTITLED "SITE SURVEY MAP", DATED JANUARY 22, 1998, ORIGINAL SCALE 1"=50'.
2. RESULTS OF NATURAL POTENTIAL SURVEY COPIED FROM "RESULTS OF NATURAL-POTENTIAL SURVEY AT THE HALLMACK SITE, HARRODSBURG, KENTUCKY" PREPARED FOR CONSOER, TOWNSEND & ASSOCIATES, INC. AUGUST 27, 1993, BY THE GEOPHYSICS GROUP, ESCONDIDO, CALIFORNIA.
3. RESULTS OF DYE TRACING INVESTIGATION TAKEN FROM "FINAL REPORT – 1993 DYE TRACING INVESTIGATION NUTONE SITE HARRODSBURG, KENTUCKY" PREPARED FOR CONSOER, TOWNSEND & ASSOCIATES INC., NOVEMBER 18, 1993 BY OZARK UNDERGROUND LABORATORY OF PROTEM, MISSOURI.

LEGEND:

- SUBJECT PROPERTY BOUNDARY
- ADJACENT PROPERTY BOUNDARY
- ELECTRIC LINE (OVERHEAD)
- ELECTRIC LINE (UNDERGROUND)
- STREAM, CREEK, SURFACE DRAIN
- BENCH MARK
- MONITORING WELL (MW-1)
- R/W MONUMENT
- MONITORING WELL
- PIEZOMETER
- FIRE HYDRANT
- WATER VALVE
- WATER METER
- GAS METER
- GAS VALVE
- SHRUB
- TREE
- TELEPHONE LINE (OVERHEAD)
- TELEPHONE LINE (UNDERGROUND)
- FENCE LINE
- PROD. PIPELINES (UNDERGROUND)
- UTILITY POLE
- UTIL. POLE w/ LIGHT
- UTILITY BOX (E-ELEC. T-TELE, TV-TELEV)
- LIGHT POLE
- GUY POLE
- SAN. MANHOLE
- STM. MANHOLE
- CATCH BASIN
- HEADWALL
- STREET SIGN
- CLOSED SURFACE IMPOUNDMENTS
- LIKELY KARST CONDUIT (IDENTIFIED BY NATURAL POTENTIAL SURVEY; 1993. ARROW INDICATES INFERRED DIRECTION OF GROUNDWATER FLOW.
- 4/10-4/12(3) — RANGE OF DATES INDICATES THE TIME PERIOD CARBON PACKETS WHERE EXPOSED AT THE SAMPLING LOCATION AND INDICATES FIRST RECOVERY OF FLUORESCEIN DYE IN ACTIVATED CARBON PACKETS.
- NUMBER IN ( ) INDICATES AMOUNT OF SAMPLING EVENTS DYE WAS DETECTED.
- RHODAMINE 8/14-8/21(2) — RANGE OF DATES INDICATES THE TIME PERIOD CARBON PACKETS WHERE EXPOSED AT THE SAMPLING LOCATION AND INDICATES FIRST RECOVERY OF RHODAMINE DYE IN ACTIVATED CARBON PACKETS.
- ND — INDICATES THAT EITHER FLUORESCEIN OR RHODAMINE DYE WAS NOT DETECTED DURING THE 1993 DYE TRACING STUDY.
- "X" — INDICATES SURFACE WATER SAMPLE

SCALE: 1" = 100'
0 50 100 200

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PROJ MGR: MJK
DESIGNED BY: MJK
REVIEWED BY: MAP
OPERATOR: DL
DATE: JANUARY 2005

FORMER HALLMACK FACILITY

HARRODSBURG, KENTUCKEY

DYE TRACING AND NATURAL POTENTIAL SURVEY RESULTS

PROJECT NO.
150290.70

FIGURE NO.
6

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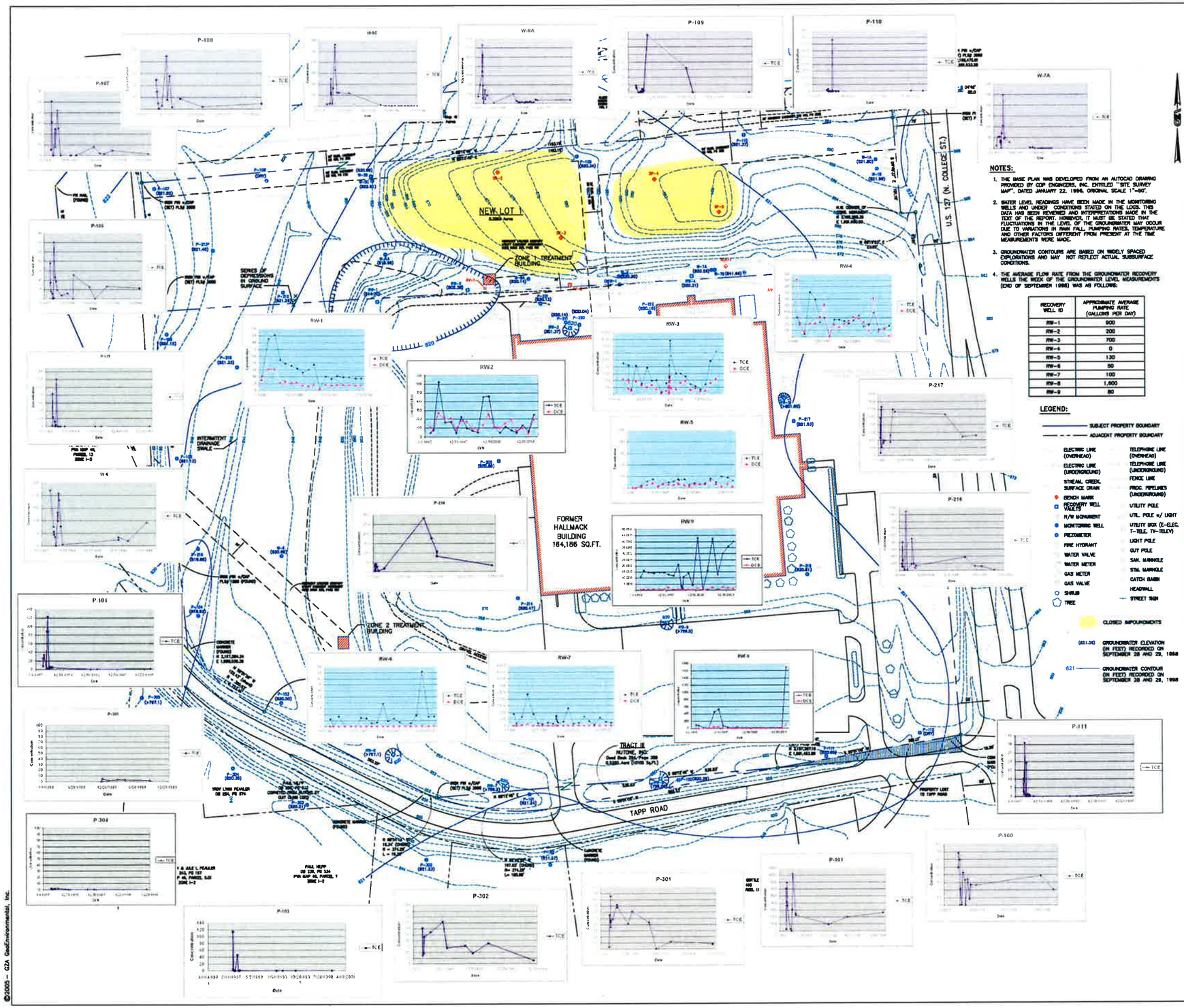
GZA–J:\ENV\150290.MAP\CADD\150290\Submitted Drawings\FIG-6 DYE TRACING & NP SURVEY RESULTS.DWG [Layout1] March 13, 2007 – 10:00am deborah.landi



NOTES:

1. THE BASE PLAN WAS DEVELOPED FROM AN AUTOCAD DRAWING PROVIDED BY COP ENGINEERS, INC. ENTITLED "SITE SURVEY MAP", DATED JANUARY 22, 1994, ORIGINAL SCALE 1"=50'.
2. WATER LEVEL READINGS HAVE BEEN MADE IN THE MONITORING WELLS AND UNDER CONDITIONS STATED ON THE LOGS. THIS DATA HAS BEEN REVIEWED AND INTERPRETATIONS MADE IN THE TEXT OF THE REPORT. HOWEVER, IT MUST BE STATED THAT FLUCTUATIONS IN THE LEVEL OF THE GROUNDWATER MAY OCCUR DUE TO VARIATIONS IN RAIN FALL, PUMPING RATES, TEMPERATURE AND OTHER FACTORS DIFFERENT FROM PRESENT AT THE TIME MEASUREMENTS WERE MADE.
3. GROUNDWATER CONTOURS ARE BASED ON WIDELY SPACED EXPLORATIONS AND MAY NOT REFLECT ACTUAL SUBSURFACE CONDITIONS.
4. THE AVERAGE FLOW RATE FROM THE GROUNDWATER RECOVERY WELLS THE WEEK OF THE GROUNDWATER LEVEL MEASUREMENTS (END OF SEPTEMBER 1998) WAS AS FOLLOWS:

RECOVERY WELL ID	APPROXIMATE AVERAGE PUMPING RATE (GALLONS PER DAY)
RW-1	900
RW-2	200
RW-3	700
RW-4	0
RW-5	130
RW-6	50
RW-7	100
RW-8	1,600
RW-9	80

LEGEND:

SUBJECT PROPERTY BOUNDARY
ADJACENT PROPERTY BOUNDARY
ELECTRIC LINE (OVERHEAD)
ELECTRIC LINE (UNDERGROUND)
STREAM, CREEK, SURFACE DRAIN
BENCH MARK
RECOVERY WELL VAULTS
R/W MONUMENT
MONITORING WELL
PIEZOMETER
FIRE HYDRANT
WATER VALVE
WATER METER
GAS METER
GAS VALVE
SHRUB
TREE
TELEPHONE LINE (OVERHEAD)
TELEPHONE LINE (UNDERGROUND)
FENCE LINE
PROC. PIPELINES (UNDERGROUND)
UTILITY POLE
UTIL. POLE w/ LIGHT
UTILITY BOX (E-ELEC. T-TELE. TV-TELEV)
LIGHT POLE
GUY POLE
SAN. MANHOLE
STM. MANHOLE
CATCH BASIN
HEADWALL
STREET SIGN
CLOSED IMPOUNDMENTS
(821.00) GROUNDWATER ELEVATION (IN FEET) RECORDED ON SEPTEMBER 28 AND 29, 1998
821 GROUNDWATER CONTOUR (IN FEET) RECORDED ON SEPTEMBER 28 AND 29, 1998

SCALE: 1" = 100'
0 50 100 200

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PROJ MGR: MJK
DESIGNED BY: MJK
REVIEWED BY: MAP
OPERATOR: DL
DATE: JANUARY 2005

FORMER HALLMACK FACILITY

HARRODSBURG, KENTUCKEY

POTENTIAL SOURCE AREA SAMPLING PLAN

PROJECT NO.
150290.70

FIGURE NO.
7

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GZA–J:\ENV\150290.MAP\CADD\150290\Submitted Drawings\FIG-7 SITE PLAN WITH TCE DATA PLOTS.DWG [Layout1 (2)] March 13, 2007 – 10:03am deborah.landi

APPENDIX A

Groundwater Flow Maps

Stokley-Cheeks & Associates, Inc.
(1988 and 1999)

HARRODSBURG VOCATIONAL SCHOOL

SIGNET SYSTEM

PROPERTY OF PAUL CONOVER

MERCER COUNTY HIGH SCHOOL

NATIONAL GUARD

CREATEC CORP.

INDUSTRAIL DEVELOPMENT COMMISSION OF HARRODSBURG

HALL MACK

PEPSI COLA CO.

MASONIC LODGE

CORNING GLASS

FIRE STATION

U.S. 127

N

P-110 822 W-1 P-109 W-5 P-108 P-107 822 P-213 W-4 W-8 P-212 W-7 P-211 P-210 P-106 P-218 821 P-217 P-205 P-105 P-306 P-219 W-6 P-214 P-216 P-113 P-104 P-307 P-305 P-103 P-112 P-111 P-100 P-102 P-101 P-304 P-303 P-301 P-302 P-308 817 818 819 820 821 P-309 P-339 P-335 P-331 P-327 815 816 P-317 822 P-310 P-336

20' WIDE ACESS EASEMENT

LEGEND

PROPERTY LINE

CREEK

WELL LOCATION

800 APPROXIMATE GROUNDWATER CONTOURS (BASED ON DATA OBTAINED ON 12/12/88

INFERRED GROUNDWATER CONTOURS (NO DATA IN THESE AREAS)

FARM (OWNER UNKNOWN AT THIS TIME)

SINGLE FAMILY DWELLINGS

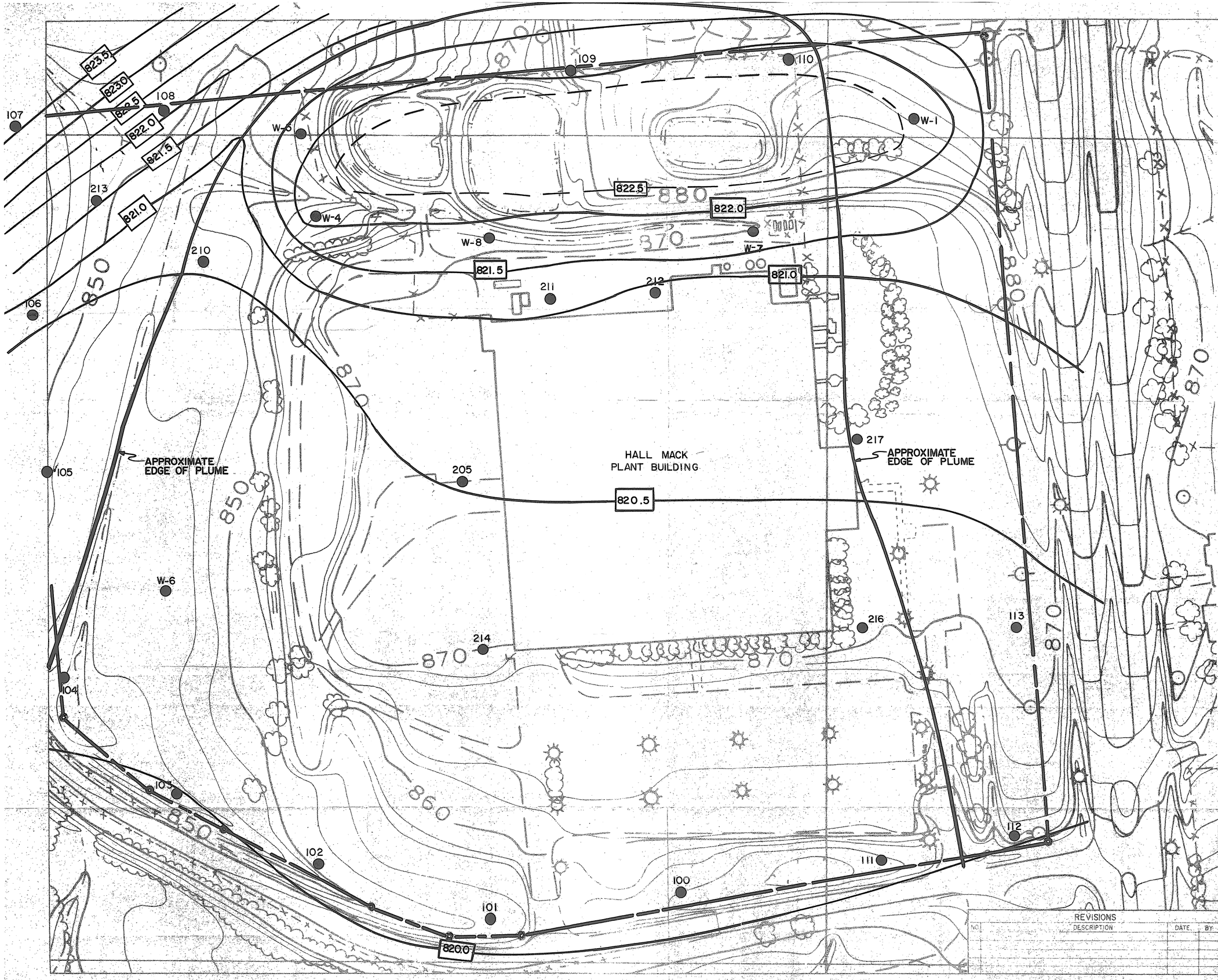
NOTE

THIS DRAWING IS ONLY INTENDED TO DEPICT WELL LOCATIONS, AND SHOULD NOT BE USED FOR ANY OTHER PURPOSE.

STOKLEY-CHEEKS & ASSOC. INC.
2520 REGENCY ROAD, SUITE 106, LEXINGTON, KENTUCKY 40503

APPROXIMATE GROUNDWATER CONTOUR MAP
HALLMACK FACILITY
HARRODSBURG, KENTUCKY

DRAWN BY	JOB NO.	DATE	SCALE	SHEET NO.
WDN	896	1-19-89	1"=100'	2



LEGEND

● COMPLETED MONITORING WELL

820.5 — WATER LEVEL CONTOURS

NOTE: THE WATER LEVEL CONTOURS SHOWN REPRESENT OUR INTERPOLATION OF GROUND-WATER LEVELS FROM DATA AVAILABLE ON 2-25-88. ACTUAL LEVELS MAY VARY FROM THOSE INDICATED BY THE CONTOURS.

REVISIONS

NO.	DESCRIPTION	DATE	BY

STOKLEY-CHEEKS & ASSOC., INC.

GEOTECHNICAL ENGINEERS & GEOLOGISTS
LEXINGTON, KENTUCKY

HALL MACK FACILITY

WELL LOCATION MAP (WATER LEVEL ISOPACH)

HARRODSBURG, KENTUCKY

SCALE	DRAWN BY	CHECKED BY	DATE	PROJECT NO	SHEET NO
1"=50'	LRT	CDH	2-26-88	896.000	3

Scott R. Smith
(1993)

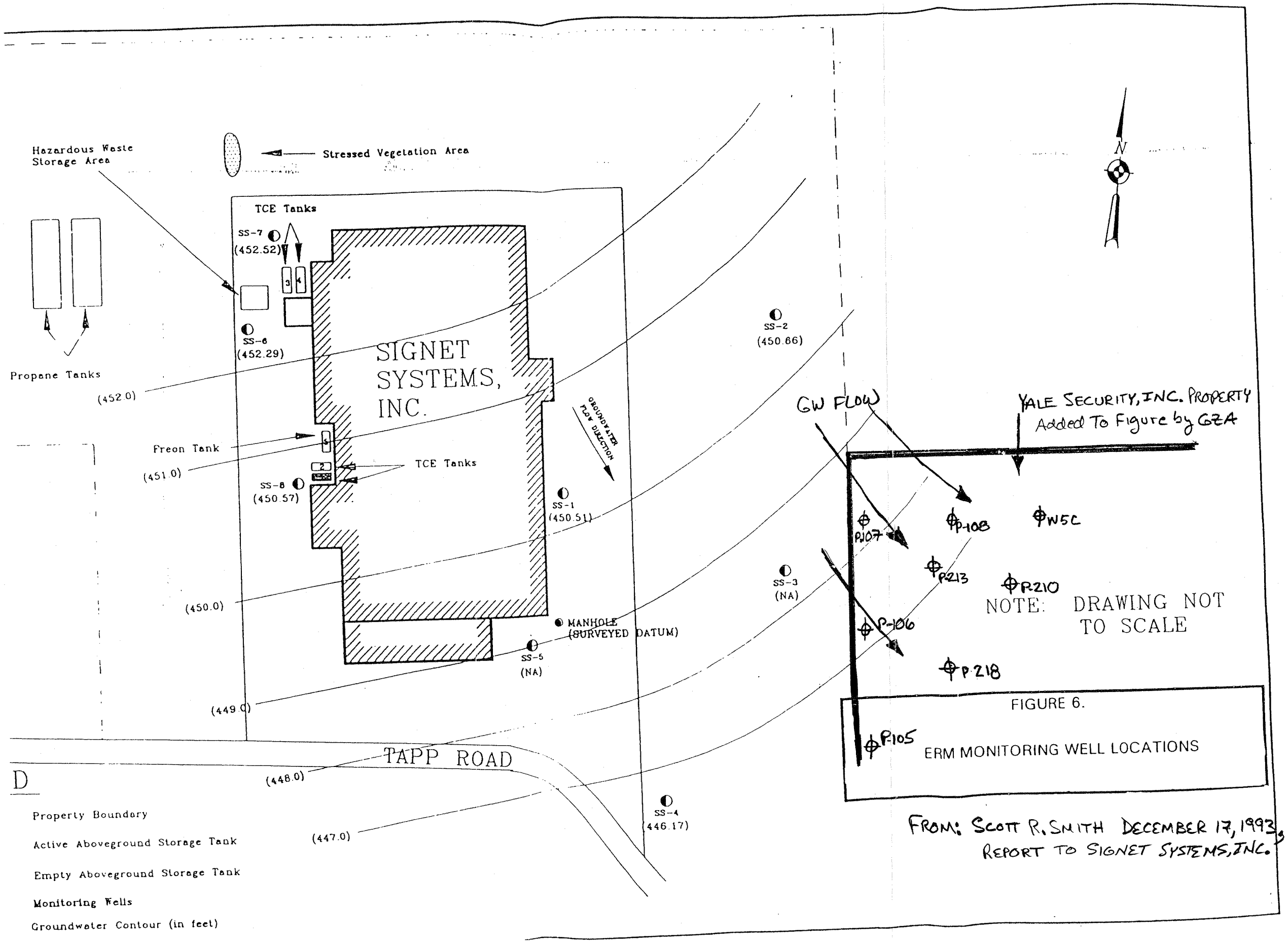
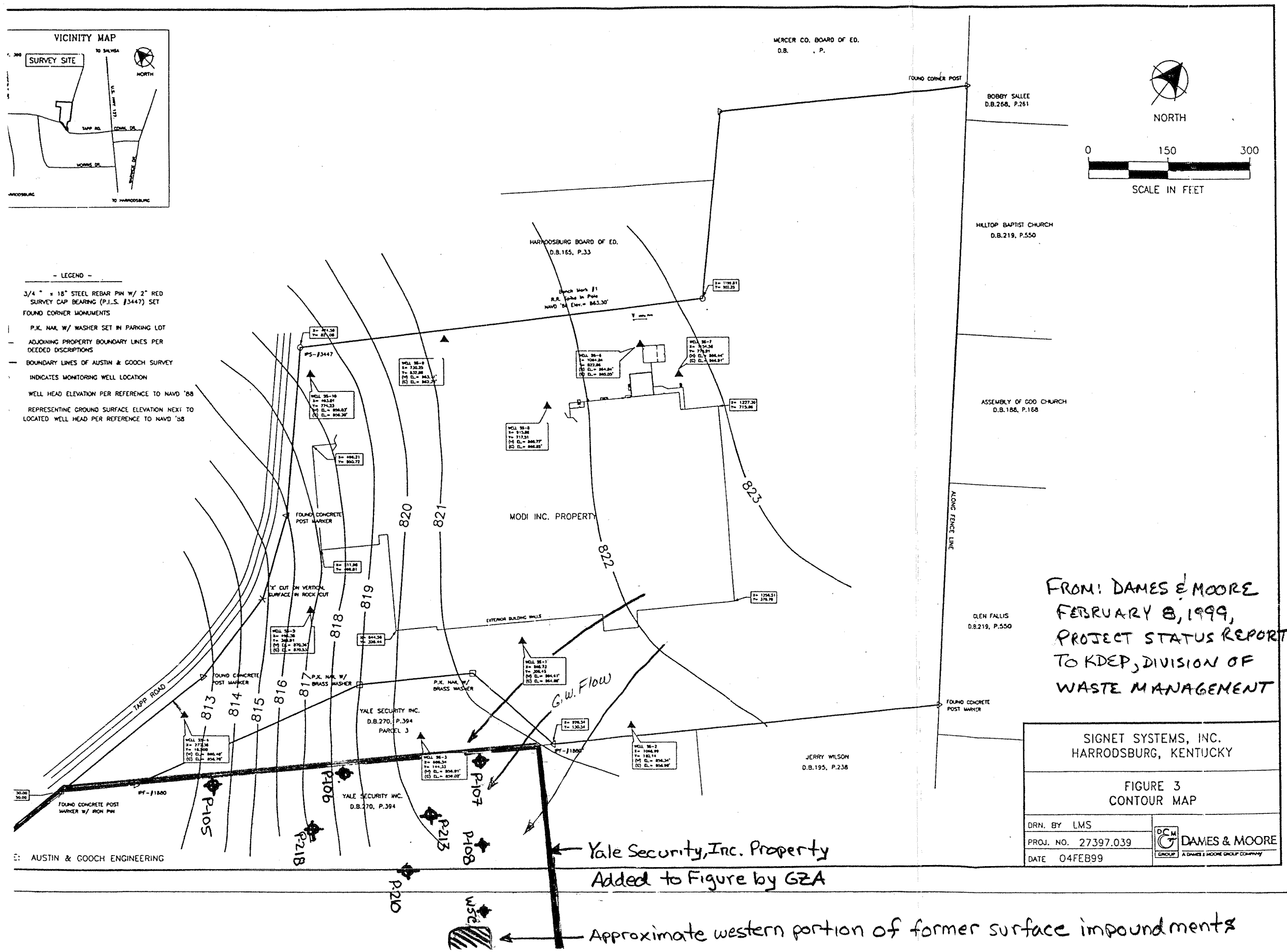


FIGURE 6.

ERM MONITORING WELL LOCATIONS

FROM: SCOTT R. SMITH DECEMBER 17, 1993
REPORT TO SIGNET SYSTEMS, INC.

Dames & Moore
(1999)


VICINITY MAP
SURVEY SITE
TO SALVISA
NORTH
U.S. HWY 127
TAPP RD.
COVAL DR.
WORRIS DR.
BRANCH DR.
TO HARRODSBURG
NORTH
0 150 300
SCALE IN FEET
- LEGEND -
3/4" x 18" STEEL REBAR PIN W/ 2" RED SURVEY CAP BEARING (P.L.S. #3447) SET
FOUND CORNER MONUMENTS
P.K. NAIL W/ WASHER SET IN PARKING LOT
ADJOINING PROPERTY BOUNDARY LINES PER DEEDED DISCRIPTIONS
BOUNDARY LINES OF AUSTIN & GOOCH SURVEY
INDICATES MONITORING WELL LOCATION
WELL HEAD ELEVATION PER REFERENCE TO NAVD '88
REPRESENTINE GROUND SURFACE ELEVATION NEXT TO LOCATED WELL HEAD PER REFERENCE TO NAVD '88
MERCER CO. BOARD OF ED.
D.B. , P.
FOUND CORNER POST
BOBBY SALLEE
D.B.268, P.261
HILLTOP BAPTIST CHURCH
D.B.219, P.550
ASSEMBLY OF GOD CHURCH
D.B.188, P.168
ALONG FENCE LINE
GLEN FALLIS
D.B.219, P.550
FOUND CONCRETE POST MARKER
HARRODSBURG BOARD OF ED.
D.B.165, P.33
Bench Mark #1
R.R. Spike in Pole
NAVD '88 Elev.= 863.30'
#5-#3447
FOUND CONCRETE POST MARKER
"X" CUT ON VERTICAL SURFACE IN ROCK CUT
MODI INC. PROPERTY
EXTERIOR BUILDING WALLS
TAPP ROAD
FOUND CONCRETE POST MARKER
P.K. NAIL W/ BRASS WASHER
P.K. NAIL W/ BRASS WASHER
YALE SECURITY INC.
D.B.270, P.394
PARCEL 3
G.W. Flow
#7-#1880
FOUND CONCRETE POST MARKER W/ IRON PIN
#7-#1880
YALE SECURITY INC.
D.B.270, P.394
JERRY WILSON
D.B.195, P.238
813
814
815
816
817
818
819
820
821
822
823
P-105
P-106
P-107
P-108
P-213
P-218
P-210
WS-2
AUSTIN & GOOCH ENGINEERING
Yale Security, Inc. Property
Added to Figure by GZA
Approximate western portion of former surface impoundments
FROM: DAMES & MOORE
FEBRUARY 8, 1999,
PROJECT STATUS REPORT
TO KDEP, DIVISION OF
WASTE MANAGEMENT
SIGNET SYSTEMS, INC.
HARRODSBURG, KENTUCKY
FIGURE 3
CONTOUR MAP
DRN. BY LMS
PROJ. NO. 27397.039
DATE 04FEB99
DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

APPENDIX B

Overview and Results of 1999 Field Activities

APPENDIX B
1999 SUPPLEMENTAL SOURCE INVESTIGATION

This is an Appendix to the September 2005 RCRA Post-Closure Permit Renewal Application prepared by GZA for the former Hallmack Facility in Harrodsburg, Kentucky. It is intended to be a part of the report and is not an independent document. It provides an overview of supplemental investigation and sampling activities performed at the Facility during 1999.

1.0 OVERVIEW OF INVESTIGATION

In 1999, GZA GeoEnvironmental, Inc. (GZA) evaluated existing data and historical operations at the former Hallmack facility ("Facility") and performed an investigation of potential trichlorethylene (TCE) source areas, which included areas that were and were not previously addressed by other investigators. The purpose of this study was to confirm that all potential chlorinated volatile organic compound (CVOC) source areas at the Facility had been identified and remediated to the extent practicable. A description of each area evaluated (or re-evaluated) and the rationale for any further investigation is summarized on Table B-1. Our evaluation of each area was based on the existing data, as documented in previous reports, our observations of the site and our understanding of the hydrogeology. Based on our evaluation, several areas were investigated by field activities in April 1999. The areas investigated are shown on Figure No. 4.

2.0 POTENTIAL SOURCE AREA AND PERCHED WATER EVALUATION

Each solid waste management unit (SWMU) and area of concern (AOC) previously identified at the site were reevaluated by GZA regarding its potential as a source area. There were 43 SWMUs (SWMU 1 through 42 and 28B) and two AOCs (AOC-A and -B) historically identified at the site. In addition to the previously identified SWMUs and AOCs, other areas of the site were evaluated regarding their potential as CVOC source areas. These areas included: (1) the tetrachloroethylene (PCE) storage area; (2) the TCE storage area; and (3) outdoor areas near doorways. A listing of each area evaluated (or re-evaluated) is summarized on the attached Table B-1. As shown on the table, after initial screening, additional field investigations were deemed justified for more than one-half of the identified areas (SWMUs, AOCs, etc.).

Many of the areas identified for further investigation were selected on the premise that TCE or PCE solvent as product or waste had been handled or managed in the area, or that material contaminated with TCE or PCE may have been handled or managed in the area. Although analytical data for the wastewater and surface impoundment sludge historically generated at Hallmack was not available, there was sufficient evidence to suggest that the wastewater (and subsequently, the sludge) may have contained TCE. Evidence in support of this assumption include (1) improved groundwater quality near the former surface impoundments after removal of the wastewater, sludge and underlying soil; and (2) soil samples believed to have been collected from the former surface impoundments following

removal of the sludge. Based on the assumption that the wastewater contained TCE, we deemed it reasonable to assume that wherever such wastewater was handled (stored, piped, or treated), there was a potential for TCE impact to the shallow soil and groundwater.

Several of the identified areas overlapped and were investigated concurrently. Others were widespread and required multiple sampling locations. All such areas investigated had been formally closed under the Facility permit at the time of these investigations.

2.1 OVERVIEW OF INVESTIGATION TECHNIQUES

As summarized on Table B-1, several areas were investigated as possible groundwater contamination sources. Test pits were proposed as the preferred investigative technique for the following reasons:

- The maximum depth of sampling, the bedrock surface, is less than 3 feet in most areas.
- Test pits allow the opportunity for clear and repeated observation of subsurface conditions, minimizing interpretations.
- The perched water may be present as a very thin layer in many areas and would be difficult to observe and sample in small diameter boreholes.
- Test pits can be allowed to remain open for subsequent clear visual observations and measurements.
- There is limited overhead clearance to accommodate drilling rigs.
- Experience at the site has shown that soil sampling based on hydraulic push or hammers results in limited sample recovery due to the presence of gravel fill beneath the concrete.

In addition to test pits, the work included the investigation and removal of the two former concrete-lined degreaser pits and the surrounding granular backfill. The former NuTone degreaser (SWMU-18) was previously identified as a TCE source and, based on analytical data reported by Consoer Townsend Envirodyne Engineers (CTE) and observations at SWMU-18, the former Textron degreaser (SWMU-19) was also a potential source. We anticipated that observations and groundwater pumping tests subsequent to removal of the concrete-lined pits would aid in the evaluation of the perched water.

2.2 TEST PITS

Forty-one test pits were excavated during the period of June 7 through 14, 1999, to evaluate potential source areas, perched water conditions and potential perched water migration conduits at the approximate locations shown on Figure No. 4. As shown on Figure No. 4, 16 test pits were completed outside the building and 25 test pits were completed inside the building.

The test pits were excavated using a backhoe (excavator) to the top of bedrock at depths of 0.5 to 5 feet. The test pits completed outside the building were approximately 2 feet by 4 feet. Test pits completed inside were approximately 3 feet square and were completed after saw cutting the concrete. Excavated material was classified, field screened using a photoionization detector (PID) and logged. PID screening results generally ranged from less than 1 to 4 instrument units. Soil encountered in the test pits consisted of clay fill with pieces of limestone bedrock generally 1 to 2 inches thick and up to 12 to 18 inches in the largest dimension. Test pits excavated over sanitary and storm sewers encountered fine gravel (pea stone) to the top of the sewer pipe.

The excavated material was placed adjacent to the test pit. Soil excavated from the outdoor test pits was later used to backfill the test pits. Clean granular soil excavated from the indoor test pits was also used as backfill. Clayey soil was disposed at an appropriate off-site facility with the soil excavated during the AOC-D Interim Measure in August 1999.

The test pits remained open for several weeks to allow for groundwater observations. Outdoor test pits were bermed to prevent storm water from entering and covered with plywood. These test pits were observed at future dates following or during rainfall and during pumping tests. Water observations are discussed in the following Section.

Based on visual observations and PID screening of soil samples, the test pits did not identify any new TCE source areas. As discussed below, the two former degreasers that were present in pits appear to have been TCE source areas.

2.3 PERCHED WATER EVALUATION

Perched water was observed to be present in several of the indoor test pits. Although the elevation of the water was inconsistent, it was generally encountered at depths greater than 30 inches below the floor and was typically encountered in test pits completed along the sewer pipes. Where bedrock was encountered at depths of less than 30 inches, perched water was not encountered. The only exception was in the former plating line area where the perched water was originally identified and the perched water was present on the concrete surface. Perched water was also encountered in outdoor test pits along the northern and eastern walls of the building, but only during and after a rain. The water in

the outdoor pits disappeared within two days after a rain. Water observed in the indoor test pits along sewer pipes remained for the duration of the investigation, June through October 1999.

Sanitary sewer lines were located and mapped inside the building using a camera equipped with a transponder and are approximately shown on Figure No. 4. A sewer main bisects the building trending south from near the northern wall and exits the building beneath the south-central doorway near groundwater recovery well RW-9. Three laterals trending east to west and four laterals trending west to east drain into the sewer main. Test pits were excavated along the sewer main and along six of the laterals to expose the pipes.

The sewer pipes were installed within trenches excavated into the bedrock and backfilled with fine gravel (peastone). Water was present in most of the test pits that were excavated along the sewers. Analytical testing of the water indicated that it contained TCE at concentrations ranging from less than 100 parts per billion (ppb) to 326 ppb. Analytical results are summarized in Table B-2.

Following the initial discovery of the perched water and the location of the sewer lines, we considered that the utility backfill might be a migration pathway for TCE into the aquifer, especially near recovery well RW-9. Although the water within the sewer pipe backfill contained VOCs, the relatively low concentrations indicated that the perched water is not the source of TCE detected in the groundwater aquifer at recovery well RW-9 where the TCE concentrations are typically greater than 10,000 ppb.

Test pits completed outside the building confirmed that (prior to demolition of the building in 2004) the roof drains entered a subsurface storm water pipe present outside the northern wall of the building which drained to a drainage ditch located northwest of the building. At least one of the ten roof drain downspouts on the northern wall of the building was observed in a test pit to be disconnected from the underground lateral drainage line. Consequently, rainwater flowed onto the ground surface and some may have entered the permeable soil surrounding the buried storm water pipe. Storm water that did not discharge into the drainage ditch may have flowed beneath the building.

In addition to rainwater from the storm drain system, the fire loop main-drain discharged water onto the ground surface along the northern wall of the building. The fire loop was originally drained in 1996. Since GZA's involvement at the site in late 1997, the fire loop main-drain was observed to be discharging onto the ground surface adjacent to the northern wall of the building at a rate of approximately 2 gallons per minute. Some of the fire loop water flowed across the ground surface to the drainage ditch north of the building, and some of the water infiltrated the ground surface and became perched. Valves responsible for leakage from the fire loop main-drain were identified during July 1999 and repaired.

Water was also present in the SWMU-18 degreaser pit. The water was previously sampled and analyzed in 1992 by CTE and again in early 1998 by GZA and contained TCE at concentrations of 85 ppb and 190 ppb, respectively. During September 1998, the water present in the pit was pumped and treated in the groundwater treatment system. Following pumping in September 1998, water re-entered the pit, apparently through the base and/or lower portions of the sidewalls, and was sampled two days later. The analytical testing detected TCE at 7,200 ppb, plus other CVOCs at lesser concentrations. These data suggested that TCE was present in the shallow soil or rock beneath the building, at least near the degreaser pits, and that the perched water may be providing a mechanism for the residual solvents to be transported to the aquifer.

3.0 DEGREASER PIT REMOVAL

During January 1999, in connection with the removal of the degreasing equipment at SWMU-18, the concrete degreaser pit was cleaned using high-pressure water and steam. Following three rinses with the high-pressure water, a rinseate sample was collected and analyzed for VOCs. The water sample contained 240,000 ppb TCE. This analytical test result suggested that, although this area had been formally closed, the SWMU-18 degreaser pit concrete, and perhaps the backfill surrounding it, was a likely TCE source to the perched water. This data, and information obtained during the 1992 SWMU assessment, suggested that the concrete lining of the degreaser pit at SWMU-19 (also formally closed) was also a possible TCE source to the perched water. To eliminate the concrete and fill from SWMUs-18 and -19 as potential ongoing TCE contamination sources, both degreaser pits (i.e., the concrete linings and backfill) were excavated on June 10 and 11, 1999.

3.1 NUTONE DEGREASER PIT (SWMU-18).

During removal of the SWMU-18 degreaser pit, a sewer lateral was observed immediately adjacent to the pit. The base of the sewer lateral excavation was at a depth of approximately 45 inches and the base of the degreaser pit was at a depth of approximately 60 inches. The gravel backfill at the base of the sewer lateral excavation was observed to be wet and there was standing water present in the base of the degreaser pit excavation. Observations suggest that perched water migrating beneath the building enters the sewer lateral backfill and flows toward the sewer main. In the area of the degreaser pit, the perched water is diverted from the sewer backfill into the degreaser pit backfill, which is deeper and contiguous with the sewer pipe backfill. When the concrete degreaser pit was present, the perched water apparently seeped through the concrete joints. With the concrete degreaser pit removed, the perched water accumulated at the base of the excavation.

3.2 TEXTRON DEGREASER PIT (SWMU-19)

One of the two former Textron degreasers (designated SWMU-19) was reportedly located in a pit approximately 4 feet deep along the northern wall of the building. Based on the presence of contaminated perched water in the pit of SWMU-18, contaminated perched water and a potential TCE source to the aquifer were anticipated to be present in and around SWMU-19.

The former SWMU-19 below-grade degreaser was reportedly removed in 1975 and the pit filled with concrete. According to CTE's SWMU assessment report, a soil boring was completed through the former pit. The soil boring encountered 8 inches of concrete, then silt and gravel, to a depth of 2.4 feet where CTE believed they encountered bedrock based on auger or sampler refusal. The soil sample that was collected and analyzed from the soil boring completed by CTE was retrieved from a depth of 8 inches (0.33 feet) to 2.4 feet. Although the soil sample was collected about 2 feet above the reported base of the degreaser pit, and an unknown distance horizontally from the former degreaser pit, the soil contained TCE at 5,400 ppb; PCE at 48 ppb; 1,1,1-trichloroethane at 130 ppb; and 1,2-dichloroethylene at 6 ppb.

The location of the former Textron degreaser pit was located with Geoprobe® borings during June 1999, and a portion of the overlying concrete was removed. The degreaser pit was observed to be concrete-lined to a depth of approximately 4 feet and filled with gravel. Approximately 4 inches of water was present in the bottom of the pit.

3.3 DEGREASER PIT REMOVAL.

As part of the perched water investigation, the two concrete-lined degreaser pits were removed and disposed. The concrete-lined pits, the material used to fill them, and the surrounding backfill were removed using an excavator and placed adjacent to the pits. Analytical testing of the excavated material detected TCE at 9,130 ppb (SWMU-18) and 26,200 ppb (SWMU-19). Analyses following the toxicity characteristic leaching procedure (TCLP) detected TCE at 2.0 milligrams per liter (mg/l) in the sample from SWMU-19. The TCLP TCE result for the material from SWMU-18 was reported as less than 0.2 mg/l. The excavated material was subsequently placed into roll-off boxes and transported by Clean Harbors to their Spring Grove Resource Recovery facility in Cincinnati, Ohio. Forty six tons of waste soil and concrete were disposed from the SWMU-18 degreaser pit as F001 hazardous waste and 35 tons of waste soil and concrete were disposed from the SWMU-19 degreaser pit as F001 and D040 hazardous waste at the EQ hazardous waste landfill in Wayne, Michigan. Based on the TCLP results, the material excavated from the SWMU-19 degreaser pit was designated a D040 waste and required stabilization prior to disposal. Analytical results are summarized in Table B-2.

Following removal of the excavated soil and concrete, the concrete surface was sampled and analyzed for volatile organic compounds (VOCs) by Clean Harbors. The samples were collected by scraping the concrete surface to a depth of approximately 0.5 centimeters. VOCs were not detected in the concrete sample.

Water present in the degreaser pit excavations was pumped and treated in the existing groundwater treatment system. Perched water that re-entered the excavations was sampled on several occasions during June and July 1999. Analytical testing detected TCE in the water from the SWMU-18 degreaser pit excavation at concentrations ranging from 3,400 to 24,900 ppb and in the water from the SWMU-19 degreaser pit excavation water at concentrations ranging from 23,000 to 62,000 ppb. Because these concentrations were notably less than the TCE concentrations detected in the water used to clean the concrete (240,000 ppb), we believe that the concrete was a significant source of the TCE detected in the perched water of the degreaser pit excavations. Analytical results are summarized in Table B-2.

4.0 PERCHED WATER PUMPING

Perched water present along the sewer main backfill in test pits TP-28 and TP-38 was pumped almost continuously from June 10 through 20, 1999. Water recovery from the test pits was minimal and recharge into the test pits was slow. During this period, water levels were measured in nearby test pits completed along the sewer main and laterals. Approximately 500 gallons of water were pumped and no appreciable response in water levels was observed in the nearby test pits. The water was pumped into drums and subsequently treated in the groundwater treatment system.

During the period of June 10 through August 30, 1999, both degreaser pits were kept dewatered. The water was pumped into drums and subsequently treated in the groundwater treatment system. Both degreaser pits were dry as of August 30, 1999, and remained dry until backfilled with gravel on October 25, 1999. The lack of water in the degreaser pits may be attributed to repair of the fire loop drain in July 1999 and/or drought conditions during this period.

5.0 SUPPLEMENTAL GROUNDWATER AQUIFER SAMPLING

Supplemental groundwater sampling was completed by GZA during July and August 1999. Groundwater sampling in July 1999 included recovery wells RW-3, RW-7, RW-8 and RW-9. Groundwater sampling in August included the four recovery wells listed above plus RW-5, Humane Spring and 23 on-site and off-site wells.

On July 16, 1999, recovery wells RW-3 and RW-9 were sampled to evaluate whether the removal and subsequent dewatering of the two degreaser pits affected groundwater quality. Duplicate samples were collected from each well and detected TCE at 110 ppb and 810

ppb in RW-3 and 2,700 ppb and 3,200 ppb in RW-9. TCE concentrations in RW-3 had been variable since 1995, ranging from approximately 300 ppb to 2,000 ppb, so the July 16th results were reasonably consistent, although variable between the duplicates. The TCE concentration in RW-9 had been in the 11,000 ppb to 21,000 ppb range since 1995. The July 16 results were initially thought to be related to the recent degreaser pit activities.

Based on the July 16 analytical results, groundwater samples were collected from RW-3, RW-7, RW-8 and RW-9 on July 20, 21 and 22, and August 18, 1999. The TCE concentrations in RW-3 increased during the period and were 870 ppb; 1,200 ppb; 1,300 ppb; and 2,100 ppb, respectively. Corrective Action Monitoring Program (CAMP) sampling on September 17, 1999, detected TCE at 3,900 ppb. The reason for the increase in concentrations is not known.

July and August 1999 TCE concentrations in RW-7 (360 ppb to 750 ppb) were relatively higher than the previous four semi-annual sampling events (120 ppb to 240 ppb). The reason for the higher TCE concentration is not known. CAMP sampling on September 17, 1999 detected TCE at 240 ppb.

July and August 1999 TCE concentrations in RW-8 (13 ppb to 21 ppb) were consistent with the previous two semi-annual sampling events (11 ppb to 24 ppb). CAMP sampling on September 17, 1999 detected TCE at 22 ppb.

The TCE concentration in RW-9 ranged from 470 ppb to 790 ppb in the July samples, was 1,600 ppb in the August sample and was 11,000 ppb on September 17, 1999. The decrease in TCE concentrations observed in the July samples was attributed to the recent pumping history of RW-9. During May and June 1999, the pump in RW-9 was out of service and was replaced on July 1, 1999.

Groundwater samples were collected in August 1999 from recovery well RW-5, Humane Spring and 23 on-site and off-site wells to evaluate changes in groundwater quality since startup of the groundwater remediation system. In general, the analytical data was consistent with previous analytical results from 1994 or 1995. Eleven wells that did not contain CVOCs when last sampled still contained no CVOCs and six other wells detected a similar range in CVOC concentrations as previously detected. One well, P-220 located immediately north of the building, detected an increase in TCE concentration from 12,620 ppb in 1995 to 25,000 ppb.

Four wells showed a decrease in TCE concentration. Well W-4A, a compliance monitoring well located southwest of the former lagoons, showed decreased TCE concentrations from 1,140 ppb in 1995 to 51 ppb. The decrease in TCE concentration is consistent with results from wells W-5C and W-7A, also located near the former lagoons. TCE concentrations in wells W-5C and W-7A decreased from several 100 ppb to non-

detect (less than 5 ppb) within 3 to 4 years following removal of the wastewater sludge and closure of the surface impoundments in 1989.

Other wells that showed a decrease in TCE concentration were P-214, located immediately southwest of the building, and P-301 and P-302, located immediately south of Tapp Road. The TCE concentrations in P-301 and P-302 were historically less than 100 ppb and were recently detected at 5.6 and 8.6 ppb. These two wells are the only locations, other than Humane Spring, where TCE is detected off-site at concentrations greater than the groundwater protection standard of 5 ppb. Note that the TCE contamination at Humane Spring is not believed to be solely from the Facility.

Review of analytical results of groundwater samples collected along the southwestern property boundary of the site indicates that the TCE is either not present, or is present at concentrations less than 5 ppb. Note that the southwestern portion of the site is downgradient from the former surface impoundments and the building.

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APPENDIX B - TABLE 1
SWMU, AOC AND POTENTIAL SOURCE AREA ASSESSMENT
Former Hallmack Facility
Harrodsburg, Kentucky

Potential Source Area (SWMU, AOC, Other)	Description	Further Assessment Performed? (Yes/No)	Rationale for Further Assessment	Comments
SWMU-1, -2, -3	**Former Wastewater/Sludge Lagoons.** Lagoon #1 received wastewater. Lagoons #2 and #3 were used to store sludge generated in Lagoon #1.	No		Source material (sludge and wastewater) and underlying soil were removed to bedrock. Area is secure beneath RCRA cap.
SWMU-4, -5, -6	**Scrubbers.** Three outdoor units for treating plating line fumes. East side of building. Concrete footings remain.	Yes	The fumes and subsequently the wastewater (WW) may have contained TCE. The WW was discharged through underground piping to the Site WW treatment (WWT) system. No sampling was done in area. May be perched water in area.	Excavated one test pit in area of each former scrubber to observe soil and perched water.
SWMU-7	**Baghouse.** Air filtering system to remove particulates from buffing and polishing. North side of building.	No		Not considered a source of TCE contamination.
SWMU-8, -9	**Filter Presses.** Located in WWT room. Used to dewater sludge from lagoons.	Yes	Waste handling and treatment practices are unknown. Potential for releases from the WWT activities which may have impacted perched water.	Excavated test pits as part of WWT room assessment.
SWMU-10	**Drum Accumulation Area.** Reportedly was one drum of TCE still bottoms generated from the carbon absorber unit (SWMU-13).	Yes	The area of the carbon absorber unit, which is located near the former NuTone degreaser (SWMU-18) had not been sampled. Sampling near SWMU-18 has identified TCE contamination.	Excavated test pit in area to evaluate shallow soil and perched water.
SWMU-11, -12	**Cyclones #1 and #2.** Removed particulates from buffing and polishing emissions. Were replaced by SWMU-7.	No		Not considered a source of TCE contamination.

APPENDIX B - TABLE 1
SWMU, AOC AND POTENTIAL SOURCE AREA ASSESSMENT
Former Hallmack Facility
Harrodsburg, Kentucky

Potential Source Area (SWMU, AOC, Other)	Description	Further Assessment Performed? (Yes/No)	Rationale for Further Assessment	Comments
SWMU-13	**Carbon Absorber Unit**. TCE reclamation unit near the SWMU-18 degreaser.	Yes	The area had not been sampled. Sampling near SWMU-18 has identified TCE contamination.	Excavated test pit in area to evaluate shallow soil and perched water.
SWMU-14	**Cyanide Treatment Tank**. Located outside near WWT room. Treated 18,000 to 20,000 gpd.	Yes	The area had not been sampled. Perched water may be present in area.	Excavated test pits in area to evaluate shallow soil and perched water.
SWMU-15	**Chrome Treatment Tank**. Located outside near WWT room. Treated 18,000 to 20,000 gpd.	Yes	The area had not been sampled. Perched water may be present in area.	Excavated test pits in area to evaluate shallow soil and perched water.
SWMU-16	**Clarifier**. Located outside near WWT room. Treated 160,000 gpd.	Yes	The area had not been sampled. Perched water may be present in area.	Excavated test pits in area to evaluate shallow soil and perched water.
SWMU-17	**Scrubber.** One outdoor unit for treating plating line fumes. East side of building. Was replaced by SWMU-4, -5, -6.	Yes	The fumes and subsequently the WW may have contained metals and TCE. The WW was discharged through underground piping to the Site WWT system. No sampling was done in area. May be perched water in area.	Excavated one test pit in area of former scrubber to observe soil and perched water.
SWMU-18	**NuTone Degreaser**. Present in a below-grade, concrete-lined pit.	Yes	Water in concrete-lined pit confirmed to be from perched water infiltration. Water in pit contains TCE and concrete cleaning confirmed that the concrete contains high concentrations of TCE and may be a source.	Removed concrete-lined pit and backfill and evaluated perched water conditions within pit. Also excavated test pits in area to evaluate shallow soil and perched water.
SWMU-19	**Two Degreasers used by Textron**. One was above-grade and one was in a concrete-lined pit.	Yes	Sampling results suggests area may be source. Perched water is suspected. Sampling at above-grade degreaser location detected 11,000 ppb TCE in soil.	Removed concrete-lined pit and backfill and evaluated perched water conditions within pit. Also excavated test pits in both areas to evaluate shallow soil and perched water.

APPENDIX B - TABLE 1
SWMU, AOC AND POTENTIAL SOURCE AREA ASSESSMENT
Former Hallmack Facility
Harrodsburg, Kentucky

Potential Source Area (SWMU, AOC, Other)	Description	Further Assessment Performed? (Yes/No)	Rationale for Further Assessment	Comments
SWMU-20	**Wastewater Piping.** Below-grade and above-grade piping for wastewater from plating line to WWT room.	No		Area was addressed during the plating line interim measures.
SWMU-21	**Paint Burnoff Oven.**	No		Low potential for impact to soil or groundwater.
SWMU-22	**Washer.** Used to wash degreasing solvents from parts prior to painting. Located near paint booth and paint gun cleaning which also used PCE. Water from washer was discharged to sanitary sewer.	No		General area was addressed during assessment of nearby PCE storage and use.
SWMU-23	**Wastewater Drainage Ditch.** Storm water ditch located along southern side of former lagoons.	No		Roof drainage is reportedly to ditch (SWMU-27). An assessment of the roof drain lines and storm sewer was performed as part of perched water evaluation.
SWMU-24	**Plating Line Safety Pits.** Pits in plating line used to collect plating bath overflows. Were filled with concrete at facility closure.	No		Area to be addressed during plating line interim measures.
SWMU-25	**Groundwater Contamination Plume**	No		
SWMU-26	**Possible Paint Striping Area Leading to POTW.** Bunded area which includes a floor drain.	No		Floor drain pipe was evaluated and soil was sampled. No further action is necessary. SWMU will be addressed in Major Permit Modification.

APPENDIX B - TABLE 1
SWMU, AOC AND POTENTIAL SOURCE AREA ASSESSMENT
Former Hallmack Facility
Harrodsburg, Kentucky

Potential Source Area (SWMU, AOC, Other)	Description	Further Assessment Performed? (Yes/No)	Rationale for Further Assessment	Comments
SWMU-27	**Stormwater Runoff Drainage Pipes.** Approximately 10 drainage pipes from building roof to drainage ditch SWMU-23.	Yes	Integrity of pipes is not known. Blockage and leaks in pipes may contribute to perched water near and beneath the building.	Evaluated drains and storm sewer along northern wall of building to determine if discharge contributes to perched water near building and potential source areas.
SWMU-28	**Drum Storage Area - Concrete Pad.** Concrete pad used for storage of waste-containing drums.	No		Concrete pad was removed and disposed as interim measures activities in 1997.
SWMU-28B	**Soil Beneath and Adjacent to Drum Storage Area Concrete Pad.** (Also referred by CTE as SWMU-43)	Yes	Contaminated soil was removed to bedrock. Residual contamination may be present in bedrock. Excavation backfill may contain perched water which may drive residual contamination into bedrock.	Excavated a test pit in backfill to evaluate area for perched water.
SWMU-29	**Scrubber Wastewater Lines.** Underground pipes from scrubbers (SWMU-4, -5, -6) to WWT room.	Yes	The fumes and subsequently the WW may have contained TCE. No sampling was done in area. May be perched water in area.	Excavated test pits to evaluate area. See SWMU-4, -5, -6.
SWMU-30	**Dumpsters and Trash Compactor**	Yes	Used to store solid waste. Could be source area if also used to dispose of waste solvent or plating waste.	Visually inspected area and condition of concrete beneath the compactor. Excavated one test pit in area to evaluate.
SWMU-31	**Baghouse Hopper and Waste Container.** Used to collect dust from baghouse, SWMU-7.	No		Not considered a source of TCE contamination.
SWMU-32	**Sludge Rolloff Containers.** Used to store and transport sludge derived from filter presses. No longer on-Site.	Yes	The area had not been sampled. Perched water may be present in area.	Excavated test pits in area to evaluate shallow soil and perched water which may have been affected by WWT operations.
SWMU-33	**Cyanide Pretreatment Tanks.** Two steel tanks located in WWT room.	Yes	The area had not been sampled. Perched water may be present in area.	Excavated test pits in area to evaluate shallow soil and perched water which may have been affected by WWT operations.

APPENDIX B - TABLE 1
SWMU, AOC AND POTENTIAL SOURCE AREA ASSESSMENT
Former Hallmack Facility
Harrodsburg, Kentucky

Potential Source Area (SWMU, AOC, Other)	Description	Further Assessment Performed? (Yes/No)	Rationale for Further Assessment	Comments
SWMU-34	**Chrome Pretreatment Tanks**. Two steel tanks located in WWT room.	Yes	The area had not been sampled. Perched water may be present in area.	Excavated test pits in area to evaluate shallow soil and perched water which may have been affected by WWT operations.
SWMU-35	**Trash and Refuse Burn Area**. Reportedly a 30-foot by 80-foot area along the western side of property.	Yes	Possibly used to dispose of waste other than general refuse.	Removed concrete and other debris.
SWMU-36	**Tumble Deburr Sump**. Shallow sump below grade received water from tumbler. Water was pumped to clarifier, SWMU-16.	No		Low potential for impact to soil or groundwater.
SWMU-37	**Paint Booth Baghouse and Waste Bucket.** Baghouse used to filter and recirculate powder paint overspray.	No		Powder paint was reportedly non-hazardous.
SWMU-38	**Washdown Floor Drains**. Floor drains and underground piping. Pipes lead to sanitary sewer line outside the south side of building. Nine floor drains identified during RFAs.	Yes	Location of floor drains suggest sewer pipes near plating line area and past degreaser locations. Sewer pipes enter sewer main near RW-9. May be conduit for perched water.	Exposed each sewer pipe to evaluate potential of permeable backfill as conduit for perched water migration. Also exposed the sewer main along south side of building.
SWMU-39	**Paint Waste Drum**. Satellite accumulation drum for waste PCE solvent used to clean paint guns.	Yes	PCE was used in area. Area was used to store waste and virgin PCE. History of PCE use in area is not known.	Excavated test pits in area to evaluate shallow soil and perched water.
SWMU-40	**Compressed Air Oil Filtering System**. System removed oil from air used in painting.	No		Oil was non-hazardous.

APPENDIX B - TABLE 1
SWMU, AOC AND POTENTIAL SOURCE AREA ASSESSMENT
Former Hallmack Facility
Harrodsburg, Kentucky

Potential Source Area (SWMU, AOC, Other)	Description	Further Assessment Performed? (Yes/No)	Rationale for Further Assessment	Comments
SWMU-41	**Storage Area.** Western interior of the building used to store finished goods.	No		Finished goods were not hazardous.
SWMU-42	**Boiler Room Floor Drains and Pipe.** Floor drains used to collect non-contact cooling water.	No		Drainage pipes may provide conduit for perched water flow. Area will be evaluated for potential contamination caused by WWT.
AOC-A	**Gasoline and Fuel Oil Tanks.** Underground storage tanks reportedly removed in the 1980s.	No		Petroleum contamination not identified in groundwater at the Site.
AOC-B	**Former TCE Degreaser Pads.** Reportedly was misnamed - actually was a concrete pad for former dust collector.	No		May have been source of metals contamination to shallow soil. Area was addressed as interim measures in 1997.
AOC-West	**Apparent Plating Waste** discovered along western area of Site.	No		Area was addressed by interim measure in 1998.
AOC-Plating Line	**Former Plating Line.** Concrete, soil and perched water contamination from past plating operations.	No		Area was addressed by interim measure in 1999.
TCE Storage Area	**TCE Storage Area.** Inside building near carbon absorber and degreaser.	Yes	The area had not been sampled. Sampling near SWMU-18 has identified TCE contamination.	Excavated test pit in area to evaluate shallow soil and perched water.
PCE Storage Area	**PCE Storage Area.** Inside building near paint gun cleaning.	Yes	The area had not been sampled. PCE was used in area. Area was used to store waste and virgin PCE. History of PCE use in are is not known.	Excavated test pits in area to evaluate shallow soil and perched water.

APPENDIX B - TABLE 2
TEST PIT AND DEGREASER PIT ANALYTICAL DATA
Former Hallmack Facility
Harrodsburg, Kentucky

LOCATION		DATE	Tetrachloroethene ug/l	Trichloroethene ug/l	t-1,2- dichloroethene ug/l
TP-41 - Sewer Main - North	Water	6/16/99	<5.0	18	<5.0
TP-28 - Sewer Main - Central	Water	6/11/99	8	326	<5.0
	Water	6/16/99	10	318	6
TP-38 - Sewer Main - South	Water	6/11/99	<5.0	167	5
	Water	6/16/99	<5.0	148	<5.0
TP-35 - East Sewer Lateral - North	Water	6/11/99	85	189	8
TP-33 - East Sewer Lateral - South	Water	6/11/99	<5.0	58	<5.0
TP-36 - West Sewer Lateral - North	Water	6/11/99	<5.0	126	<5.0
TP-37 - West Sewer Lateral - Central	Water	6/11/99	34	141	<5.0
TP-17 - Plating Area - Southeast	Water	6/16/99	<5.0	<5.0	<5.0
	Water from near former safety pit	7/29/99	<2.0	6.4	cis = 43
North Degreaser Pit (former Textron degreaser)	Water	6/11/99	<5.0	2,110	<5.0
	Water after several weeks of dewatering	7/20/99	<25	62,000	37 (cis=33)
	Water after several weeks of dewatering	8/19/99	<100	23,000	<100
	Soil/concrete composite (ug/kg)	6/16/99	<13	9,130	<13
	Soil/concrete composite TCLP (mg/l)	6/16/99	<0.200	1.57	
South Degreaser Pit (former NuTone degreaser)	Standing water in pit	6/14/92	<5.0	85	31(total)
	Standing water in pit	3/25/98	<5.0	190	24 (cis)
	Recharge within 48 hours after pumping	9/30/98	86	7,200	7.5
	Rinsate after cleaning concrete	1/14/99	<2,000	240,000	<2,000
	Water after removal of concrete pit	6/16/99	75	24,900	13
	Water after several weeks of dewatering	7/20/99	56	19,000	cis = 250
	Water after several weeks of dewatering	8/19/99	11	3,400	cis = 11
	Soil/concrete composite (ug/kg)	6/16/99	<13	26,200	<13
	Soil/concrete composite TCLP (mg/L)	6/16/99	<0.200	<0.200	

APPENDIX C

Analytical Results for 1998 and 2004 Supplemental Humane Spring Sampling

APPENDIX C
2004 HUMANE SPRING EVALUATION

This is an Appendix to the September 2005 RCRA Post-Closure Permit Renewal Application prepared by GZA for the former Hallmack Facility in Harrodsburg, Kentucky. It is intended to be a part of the Application and is not an independent document. It provides an overview of supplemental investigation and sampling activities performed at Humane Spring during 2004.

1.0 INTRODUCTION

This report presents the results of an evaluation of water quality at Humane Spring (the "Study") performed by GZA GeoEnvironmental, Inc. (GZA) for Kidde-Fenwal, Inc. in February through April 2004. More specifically, it presents an evaluation of the temporal changes in chlorinated volatile organic compound (CVOC) concentrations in the surface water emanating from Humane Spring. The Study was completed as a voluntary action and as part of broader assessment of the effectiveness of the groundwater remediation system (GRS) installed by others at the former Hallmack facility ("Facility"). The purpose of the Study was to provide direct evidence of the effects that groundwater withdrawal and treatment at the Facility may be having on surface water quality at Humane Spring.

2.0 BACKGROUND INFORMATION

This section provides background information pertaining to CVOCs in Humane Spring water. It was developed from extensive records documenting studies and remediation at the Facility. It is not intended to serve as record of all work at the Facility. We also note that because there is at least one other source of CVOC groundwater contamination in the Humane Spring watershed (Signet), it may not provide a complete record of all pertinent information.

2.1 HALLMACK CVOC GROUNDWATER CONTAMINATION

Groundwater CVOC contamination was first identified at the Facility during the 1980s. The primary contaminants at the Facility and Humane Spring are trichloroethylene (TCE) and cis-1,2-dichloroethylene (cis-1,2-DCE).

Groundwater extraction and treatment began at the Facility in April 1995. Since that time, the GRS has operated on essentially a continuous basis. Monitoring has demonstrated the GRS meets design operating criteria. As of April 2004, the GRS (which includes nine recovery wells) has extracted approximately 20 million gallons of groundwater and removed a total of approximately 24 gallons of CVOCs (computed as TCE with a specific gravity of 1.5). CVOC concentrations in groundwater samples collected from the nine recovery wells have fluctuated over time, but there are no obvious trends in these data.

Historical releases of TCE have occurred at the Facility likely from a variety of sources. In spite of extensive testing, the precise location, volume and nature of all the releases were not fully identified; however, the known source areas have been remediated to the extent practicable and no remaining source areas are known to exist. Extensive studies were performed to locate wells capable of containing CVOC-contaminated groundwater at the property. The GRS has operated to meet design criteria on a nearly continuous basis for nearly ten years.

2.2 HUMANE SPRING CVOC CONTAMINATION

Sampling and analysis of Humane Spring for CVOCs began in October 1991. Since that time, there have been at least 90 sampling events, with routine sampling on a semi-annual basis since 1995.

A dye tracing study was conducted at the Facility in 1993. The study is documented in a report prepared by the Ozark Underground Laboratory (Protem, Missouri) titled "Dye Tracing Investigation - Nutone Site - Harrodsburg, Kentucky." The study was comprehensive and involved the release of two dyes (Fluorescein and Rhodamine WT) and the collection and analysis, over a three-month period, of over 1,000 water samples from 83 locations.

During the study period, flow records were maintained for Humane Spring and precipitation measurements were made at the Facility. The Facility is located in the approximately 1-square mile surface watershed of Humane Spring. On an annual basis, the average flow in Humane Spring is approximately 1.1 cubic feet per second (CFS) (500 gallons per minute [gpm]), indicating an average annual recharge rate of 15 inches. This rate is consistent with regional information. Consequently, we believe groundwater flow beneath the Facility discharges at Humane Spring.

The dye trace study also confirmed that releases at the Facility discharge at Humane Spring. Ozark Underground Laboratory also concluded that at periods of high flows in Humane Spring (the result significant precipitation events) very small quantities of water from the Humane Spring watershed might discharge directly to Town Creek at Maple Spring. (Maple Spring is a small previously unnamed seep, in the undeveloped flood plain of Town Creek, located approximately 200 feet south of the confluence of Humane Spring water and Town Creek.) This conclusion is apparently based on the detection of one of the two dyes released, fluorescein, at trace concentration, on two of sixteen sampling events that used activated carbon samplers, and in none of the 13 water samples tested. In our opinion there is insufficient information presented to reach this conclusion. In any event, and as a practical matter, the dye trace study demonstrated that the potential for exposure to significant concentrations of contaminants released at the Facility is at Humane Spring.

Our review of the temporal changes in flow rates and dye concentrations in samples collected from Humane Spring indicate that on a mass basis, about 8% of the Fluorescein and 33% of the Rhodamine WT dyes released at the Facility were accounted for in Humane Spring flow. The relatively large differences in these mass flux estimates highlight the complexity of the flow system.

Groundwater transport rates between the Facility and Humane Spring are high. "Slugs" of dye-contaminated groundwater were observed in Humane Spring shortly after the release of the dyes. The Fluorescein "slug" first appeared 29 hours after the release, peaked 33 hours after the release and had a duration of about 12 hours. The Rhodamine WT "slug" first appeared 23 hours after release, peaked 27 hours after the release and had a duration of approximately eight hours. These data suggest an average contaminant transport rate between the Facility and Humane Spring of between 2,900 and 3,700 feet per day (between 2 and 2.5 feet per minute).

Flow rates in Humane Spring vary considerably with precipitation. During the dye test, a 1.9-inch precipitation event increased flow in Humane Spring from 0.2 CFS to 103 CFS. Increases in flow occur within 0.5 to 1.5 hours and decreases are observed within two hours of the end of precipitation. These data demonstrate there is little aquifer storage in the karst conduits. Consequently, the possibility of potentially large mobile pools of solvents being located in the karst conduits is small.

Consistent with evidence of limited storage, no order of magnitude increases in dye concentrations were observed during high flows. However, the mass of dye migration rate rose with increased flow rates (and little evidence of dilution). Further, dye concentrations varied over time and the variations were not always associated with changes in flow rates.

3.0 TESTING PROGRAM

GZA used information gleaned from the dye tracing study to design the current water quality assessment of Humane Spring. More specifically, the dye tracing study indicates that a one- to two-week shutdown of the pumping systems (in conjunction with CVOC monitoring of Humane Spring) should be a sufficient duration to measure the effects that the GRS is having on Humane Spring water quality. As it turned out, we had an opportunity to sample during a four-week shutdown period.

As an overview, the program consisted of a detailed evaluation of CVOC concentrations in Humane Spring with the GRS operating (to help establish initial baseline conditions), and daily testing of the Humane Spring over a four-week period with the GRS off, and an additional two weeks after the GRS was turned back on. Analytical procedures focused on the seven CVOCs prescribed by the RCRA Permit for the Facility. The two constituents that were consistently detected were TCE and cis-1,2-DCE. Hence, subsequent discussion with respect to the effectiveness of the GRS pertains primarily to these two constituents.

3.1 SAMPLING LOCATION AND PROCEDURES

Water quality samples for the investigation were collected from the east bank of the stream where the water exits from beneath the building. The samples were collected by submerging a 40 ml acid-preserved glass vial approximately 2 inches below the water surface. The cap was placed on the vial in a manner to minimize air being trapped. The vial was subsequently stored in a cooler, with ice, and shipped to GZA's Environmental Chemistry Laboratory in Hopkinton, Massachusetts. The Analytical Reports and Chain-of-Custody (COC) forms are included in this Appendix.

At the time of the sampling event, surface water levels were measured against a staff gauge installed by GZA in 1998, at the railroad culvert, located approximately 250 feet downstream from Humane Spring. The staff gauge data were recorded on the COC forms. The stage-discharge relationship that describes the hydraulic characteristics of the channel developed by GZA in 1998, was used to estimate actual stream flow. The Humane Spring discharge rates determined at the time of sampling are included on Table 1 for the February baseline sampling and Table 2 for the March through April 2004 sampling.

3.2 SAMPLING DURATION AND FREQUENCY

Sampling to establish baseline conditions was initiated on February 26, 2004, and lasted for 24 hours. A total of 26 samples were collected at a frequency that ranged from a two-minute interval and gradually increased to every two hours, as indicated in Table 1. Duplicates were collected at three sampling times to assess quality assurance procedures. Our intent was to evaluate the range of CVOC concentration variations during a 24-hour period and identify whether or not a trend was evident over that 24-hour period.

Sampling to establish effects of the GRS shutdown began on March 16, 2004, when the GRS was turned off, with consent of the Kentucky Department of Environmental Protection (KYDEP), at 1300 hours. GRS shutdown continued for an approximately four-week period until April 16, 2004. The GRS was turned back on at 0830 hours on April 16, 2004, and sampling continued for another two weeks, until April 30, 2004. Sampling occurred three times per day for the first four days and then was reduced to three times per day every two or three days (Monday, Wednesday and Friday) and finally two times per day (Monday, Wednesday and Friday) for the remainder of the duration (April 30, 2004), as indicated in Table 2.

3.3 LABORATORY ANALYSES

Samples were analyzed by GZA in accordance with United States Environmental Protection Agency (USEPA) Method 8021 (gas chromatograph). Based on the consistency

of the data, we determined that better laboratory precision was desirable and changed to USEPA Method 8260B (gas chromatograph-mass spectrometry).

Consistent with previous results, the primary CVOCs detected in the samples were TCE and cis-1,2-DCE. The analytical results for the February baseline sampling are summarized in Table 1 and on Chart 1 and the analytical results for the March through April sampling are summarized on Table 2 and Chart 2.

4.0 DATA EVALUATION

Three methods were used to evaluate the data. The first was a comparison of the mass of CVOCs collected by the GRS to that detected at Humane Spring. The second was a visual review of data for obvious trends. The third was a statistical evaluation of temporal changes in CVOC concentrations. Each method is described below.

4.1 CVOC MASS TRANSPORT DATA

During the past 9½ years, the GRS at the Facility removed an estimated 24 gallons (268 pounds) of CVOCs, with an average of approximately 28 pounds of CVOCs per year. Flow from Humane Spring is estimated to average 1.1 CFS or 5.9 million pounds of water per day. The average total CVOC concentration (consisting of TCE and cis-1,2-DCE) in Humane Spring over the 9½-year period that the GRS operated is 21 micrograms per liter or parts per billion (ppb). Using this concentration and the estimated average Humane Spring flow, we calculated that approximately 43 pounds per year of CVOCs are discharged at Humane Spring.

Because the precise locations of the CVOCs in the aquifer are not known, there are numerous ways to view these findings and a limited number of defendable conclusions that can subsequently be drawn. For the purposes of this evaluation, as a worst-case assessment, we note that if essentially all the CVOCs being removed by the GRS were instead released at Humane Spring, the data suggests that the long-term (yearly) average concentration of CVOCs could rise from 21 ppb to about 35 ppb, an increase which was not observed during our recent test.

4.2 VISUAL REVIEW OF DATA

There are a number of conclusions that can be drawn from a visual review of data. What we believe are the more pertinent observations are outlined below.

1. CVOC concentrations in the stream vary with time. The February baseline data (26 samples summarized in Table 1 and Chart 1) indicates that without changes in flow volume, variations in concentrations over short time periods are relatively small. During that period, the total CVOC concentrations ranged from 18.8 ppb to 28.4

ppb, with an average concentration of 24.6 ppb. This implies that sampling at any specific time during the day will be representative of the entire day.

2. Considering the available data, there is no strong correlation between Humane Spring flow and CVOC concentrations in the stream flow. A summary of 42 TCE and cis-1,2-DCE concentrations and Humane Spring flow rates collected is provided on Table 3. Chart 3 provides a plot of the flow rates versus the TCE and cis-1,2-DCE concentrations. The data appears to suggest that a small increase in flow rate results in small increases in CVOC concentrations and that large flow increases result in decreases in CVOC concentrations. Based on the available data collected since 1991, it is apparent that no dramatic increase in CVOC concentrations has occurred during storm events.

3. The temporal changes in CVOC concentrations observed over the four-week GRS shutdown test period (Chart 2) appear similar to the temporal changes observed over the entire record of testing (1991 through 2004), as summarized on Chart 4.

4. The historical variations in CVOC concentrations in Humane Spring water samples cannot be reasonably attributed to the operation of the GRS at the Facility. There is no evidence to conclude that operation of the GRS has an affect on the water quality at Humane Spring.

4.3 STATISTICAL EVALUATION OF DATA

Our goal in the statistical evaluation was to review the available data, apply the appropriate statistical tests and estimate if shutdown of the GRS had an affect on the TCE and cis-1,2-DCE concentrations.

4.3.1 Statistical Analysis Methodology

Given the inherit variability of the data, a method that allows for the statistical comparison of a constituent at a single sampling location to its historical background concentrations is through the use of control charts. The control chart methodology can be used to monitor the temporal variation of the TCE and cis-1,2-DCE data collected at Humane Spring. In essence, constituent data (TCE or cis-1,2-DCE) are plotted on a time scale (the X-axis of a chart) and inspected for obvious features, such as trends or sudden changes in concentration levels. If subsequent sampling periods yield a constituent value that falls outside predetermined boundaries (i.e., the control parameters), then the process is declared to be "out of control;" otherwise, the process is declared to be "in control." An "out of control" value is presumed to be caused by external actions other than normal environmental variability.

TCE and cis-1,2-DCE data evaluated were collected at Humane Spring from October 1991 to April 2004. Various processes and activities occurred during this time that may have caused CVOC concentrations to vary. Extensive sampling during the 24-hour period performed in February 2004 indicated that daily fluctuation of CVOC concentrations is slight. Lower fluctuations occur on a long-term basis, yet without any obvious or inherent trends. Hence, a mean and standard deviation were calculated since operations of the extraction system began in 1995, and these were defined to estimate the background (baseline) conditions prior to GRS shutdown.

The basic theory and methodology of control chart analyses is described by the USEPA (1989) and is recommended for use at RCRA facilities. The specific method suggested is a combined Shewhart-CUSUM control chart and requires at least eight independent samples from the location. For our analysis, the baseline data consists of 23 independent TCE and cis-1,2-DCE observations (excluding the three duplicate samples) obtained over a 24-hour period. A trend analysis was performed which indicated no statistically significant trend behavior or seasonality.

The process involved plotting of the TCE and cis-1,2-DCE data and selection of three control parameters, h, k and SCL. The parameter "k" is defined as the reference value or allowable slack for the process and is directly obtained from the displacement (D) that should be quickly detected; $k = D/2$. The USEPA (1989) recommends setting $k = 1$, which will allow a displacement of two standard deviations to be detected quickly.

When k is selected to be 1, the decision interval ("h") against which the cumulative sum in the CUSUM scheme will be compared is usually set at a value of 4 or 5. In the context of environmental monitoring, a value of $h = 5$ is recommended (Starks, 1988; Lucas, 1982). With $k = 1$ and $h = 5$, Starks (1988) recommends that the upper Shewhart control limit (SCL) be set at 4.5.

The methodology applied to the TCE and cis-1,2-DCE data from March 16 through April 30, 2004 (which includes the four-week GRS shutdown period), is described in the following five steps:

1. Select the control chart parameters. Following USEPA guidance, $k = 1$, $h = 5$ and SCL = 4.5.

2. Calculate the mean (Xbar) and standard deviation (S) of the historical CVOC data at Humane Spring.

3. Calculate the standardized mean (Z) for each value (X) where:
   $Z_i = (X - Xbar)\ (1 / S)$

4. For each CVOC value, compute the cumulative sum, S_i, as:
   $S_i = \max \{0, (Z_i - k) + S_{i-1}\}$

5. Plot the standardized values of S_i and Z_i versus Time on a control chart.

An "out of control" situation at sampling period T_i exists if for the first time, $S_i > h$ or $Z_i > SCL$. This would indicate statistically significant contamination at Humane Spring resulting from the GRS shutdown. Re-activation of the GRS in turn would be expected to return the GRS to an "in-control" situation.

The combined Shewhart-CUSUM control scheme represents an effective means of discerning meaningful deviations from a historical database with considerable variability. It is especially appropriate to apply in a situation where physical conditions will undergo a change that may impact water quality.

4.3.2 Results of Statistical Analysis

Results of the statistical analyses applied to the TCE and cis-1,2-DCE data are shown in Charts 5 and 6, respectively. Based on this evaluation, shutdown of the GRS did not cause an increase in CVOC concentrations at Humane Spring. The fluctuation observed during the four-week GRS shutdown was consistent with the variability that occurred during the preceding nine years of GRS operation.

4.4 DATA EVALUATION SUMMARY

Visual observations of data recorded during this testing period are uncertain but indicated that shutdown of the GRS had no obvious affect on CVOC concentrations in Humane Spring water. A rigorous statistical analyses of the same data also found no statistically significant changes in CVOC concentrations in Humane Spring water during GRS shutdown.

5.0 CONCLUSIONS

Two extensive tests of the Humane Spring flow have been completed. In 1993, a dye tracing study documented a portion of the recharge area of Humane Spring and provided data on groundwater flow rates between the Facility and Humane Spring. In 2004, CVOC testing of surface water from Humane Spring, in conjunction with shutdown of the GRS at the Facility, was used to evaluate the effects that the GRS has on CVOC concentrations at Humane Spring. Based on these tests, we conclude:

1. Two weeks is sufficient time to evaluate whether or not the GRS at the Facility affects CVOC concentrations (if at all) at Humane Spring.

2. The GRS was shut down for four weeks. During that period, samples of Humane Spring water were collected and analyzed for CVOCs. An analysis of the resulting data found that the GRS is having no statistically significant affect on water quality in Humane Spring.

3. Concentrations of CVOCs in Humane Spring water have varied with time, with no apparent temporal trends. Based on 90 analyses collected over 13 years, TCE concentrations have ranged from less than 1 ppb to 36 ppb with an average concentration of 12.7 ppb; and cis-1,2-DCE concentrations have ranged from less than 1 ppb to 48 ppb with an average concentration of 8.2 ppb.

4. The GRS at the Facility is removing a de minimis mass of CVOCs from groundwater. Shutting off the GRS will not prolong the duration over which CVOCs will discharge from Humane Spring.

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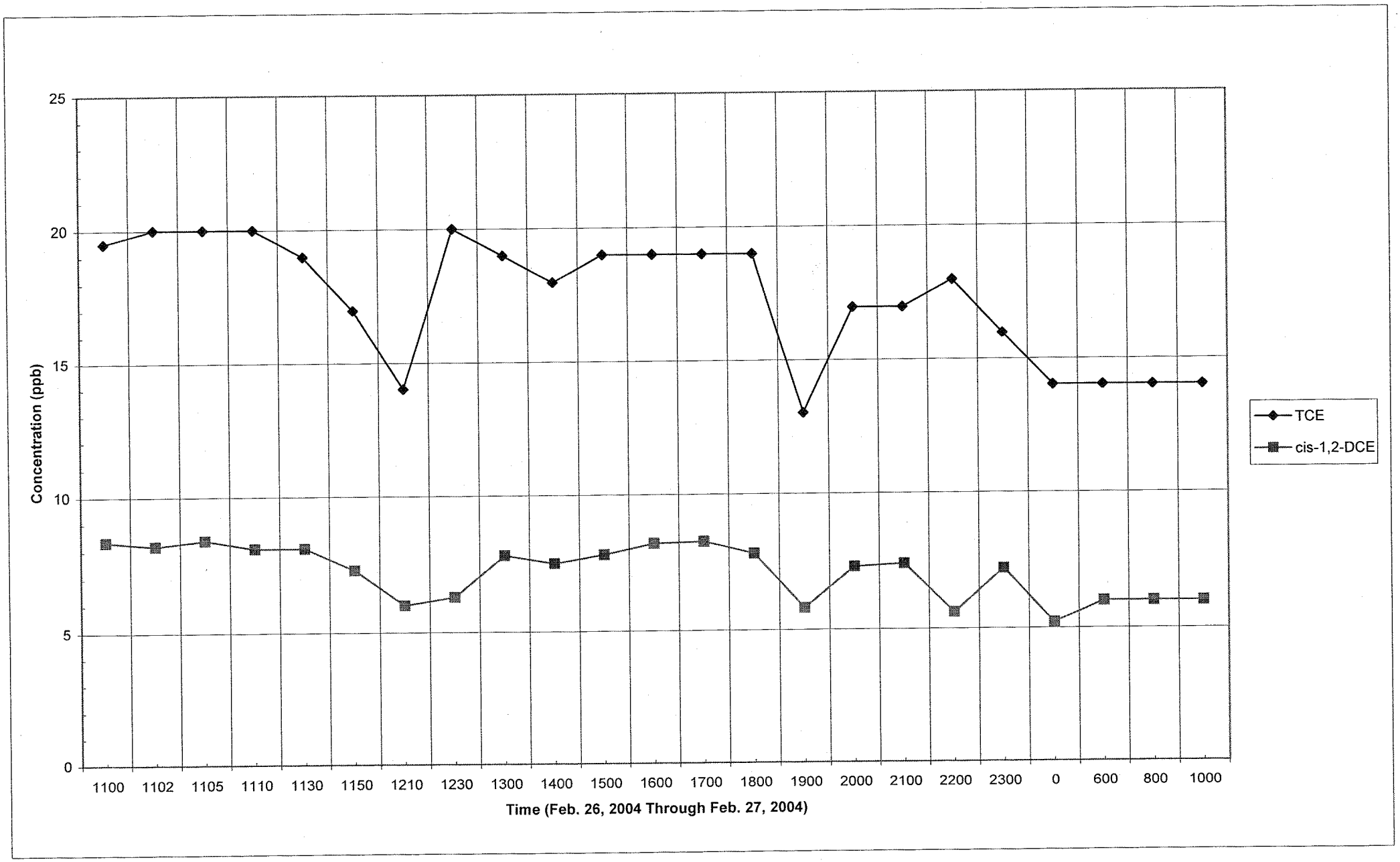
APPDNDIX C - TABLE 1
BASELINE DATA
FEBRUARY 2004
Former Hallmack Facility
Harrodsburg, Kentucky

DATE	TIME	cis-1,2 DCE (ug/L)	TCE (ug/L)	DCE+TCE (ug/L)	GAGE (ft)	FLOW (gpm)
2/26/04	1100	8.3	19	27.3	0.51	399
	1100 (dup)	8.4	20	28.4		
	1102	8.2	20	28.2		
	1105	8.4	20	28.4		
	1110	8.1	20	28.1		
	1130	8.1	19	27.1	0.50	365
	1150	7.3	17	24.3	0.50	365
	1210	6.0	14	20.0	0.50	365
	1230	6.3	20	26.3	0.50	365
	1300	7.8	19	26.8	0.50	365
	1400	7.5	18	25.5	0.50	365
	1500	7.8	19	26.8	0.50	365
	1600	8.2	19	27.2	0.51	399
	1700	8.2	19	27.2	0.51	399
	1700 (dup)	8.3	19	27.3	0.51	399
	1800	7.8	19	26.8	0.51	399
	1900	5.8	13	18.8	0.51	399
	2000	7.3	17	24.3	0.51	399
	2100	7.4	17	24.4	0.51	399
	2200	5.6	18	23.6	0.51	399
	2300	7.2	16	23.2	0.51	399
2/27/04	0	5.2	14	19.2	0.51	399
	600	6.0	14	20.0	0.50	365
	800	6.0	14	20.0	0.50	365
	1000	6.0	14	20.0	0.50	365
	1000 (dup)	6.0	14	20.0	0.50	365
MEAN		7.28	17.38	24.58		
ST. DEV.		1.06	2.42	3.34		
HIGH		8.4	20	28.4		
LOW		5.2	13	18.8		

Notes:

1. Humane Spring water samples were collected by GZA GeoEnvironmental, Inc. (GZA) near the source on the dates and times indicated. Water samples were analyzed by GZA's Environmental Chemistry Laboratory in Hopkington, Massachusettes by USEPA Method 8021. Duplicate samples (dup) were collected at times indicated.
2. Trichloroethylene (TCE) and cis-1,2-dichloroethylene (cis-1,2-DCE) concentrations are reported in micrograms per liter (ug/L) or parts per billion.
3. Gage readings refer to a staff gauge installed in 1998 by GZA in the stream formed by the spring. Gage readings are measured in feet and are used to determine the stream flow rate in gallons per minute (gpm).

APPENDIX C - CHART 1
HUMANE SPRING BASELINE DATA
FEBRUARY 26 AND 27, 2004
Former Hallmack Facility
Harrodsburg, Kentucky



APPENDIX C - TABLE 2
MARCH-APRIL 2004 DATA
HUMANE SPRING
Former Hallmack Facility
Harrodsburg, Kentucky

DATE	TIME	cis-1,2 DCE (ug/L)	TCE (ug/L)	GAGE (ft)	FLOW (gpm)	Comments
3/16/04	830	5.2	19	0.64	919	Remediation Systems off
	1300	6.2	20	0.62	813	
	1700	6.7	19	0.59	673	
	Daily Mean	6.0	19.3		802	
3/17/04	800	5.4	15	0.56	570	
	1300	4.5	14	0.54	502	
	1800	5.6	14	0.54	502	
	Daily Mean	5.2	14.3		525	
3/18/04	800	6.3	16	0.54	502	
	1300	5.5	16	0.53	467	
	1800	6.0	18	0.52	433	
	Daily Mean	5.9	16.7		467	
3/19/04	800	5.5	17	0.50	365	
	1200	5.3	17	0.48	324	
	Daily Mean	5.4	17.0		345	
3/22/04	800	4.0	24	0.60	707	
	1145	4.9	24	0.60	707	
	1545	4.7	26	0.60	707	
	Daily Mean	4.5	24.7		707	
3/24/04	745	5.9	25	0.58	639	
	1147	6.2	26	0.58	639	
	1540	5.9	25	0.58	639	
	Daily Mean	6.0	25.3		639	
3/26/04	745	4.5	17	0.54	502	
	1145	5.4	17	0.54	502	
	1545	5.9	18	0.54	502	
	Daily Mean	5.3	17.3		502	
3/29/04	815	6.2	19	0.52	433	
	1210	6.1	18	0.51	399	
	1545	6.0	19	0.52	433	
	Daily Mean	6.1	18.7		422	
3/31/04	815	4.3	27	0.64	919	
	1100	5.2	34	0.62	813	
	1530	6.0	35	0.61	760	
	Daily Mean	5.2	32.0		831	
4/2/04	714	6.1	34	0.60	707	
	1056	7.5	37	0.60	707	
	1538	6.0	32	0.60	707	
	Daily Mean	6.5	34.3		707	

APPENDIX C - TABLE 2
MARCH-APRIL 2004 DATA
HUMANE SPRING
Former Hallmack Facility
Harrodsburg, Kentucky

DATE	TIME	cis-1,2 DCE (ug/L)	TCE (ug/L)	GAGE (ft)	FLOW (gpm)	Comments
4/5/04	700	7.4	20	0.52	433	**Remediation System off**
	1100	6.2	22	0.52	433	
	1500	7.4	21	0.52	433	
	Daily Mean	7.0	21.0		433	
4/7/04	700	7.3	21	0.50	365	
	1100	8.7	22	0.50	365	
	1500	8.5	21	0.50	365	
	Daily Mean	8.2	21.3		365	
4/9/04	700	7.7	26	0.50	365	
	1500	9.0	29	0.48	324	
	Daily Mean	8.4	27.5		345	
4/12/04	840	7.4	16	1.48	18,842	
	1440	5.2	11	1.48	18,842	
	Daily Mean	6.3	13.5		18,842	
4/14/04	900	1.7	6.8	1.34	13,172	
	1440	1.8	7.7	1.34	13,172	
	Daily Mean	1.8	7.3		13,172	
4/16/04	830	3.3	11	0.65	972	**Remediation Systems on**
	1505	3.4	10	0.55	536	
	Daily Mean	3.4	10.5		754	
4/19/04	845	11	31	0.63	866	
	1404	12	34	0.63	866	
	Daily Mean	11.5	32.5		866	
4/21/04	845	13	34	0.61	760	
	1400	6.8	13	0.62	813	
	Daily Mean	9.9	23.5		787	
4/23/04	850	3.0	10	1.23	9,653	
	1534	0.64	3.7	1.63	26,766	
	Daily Mean	1.8	6.9		18,209	
4/26/04	930	2.6	8.6	0.70	1,238	
	1550	2.9	9.2	0.70	1,238	
	Daily Mean	2.8	8.9		1,238	
4/28/04	905	3.5	10	0.60	707	
	1450	3.5	10	0.60	707	
	Daily Mean	3.5	10.0		707	

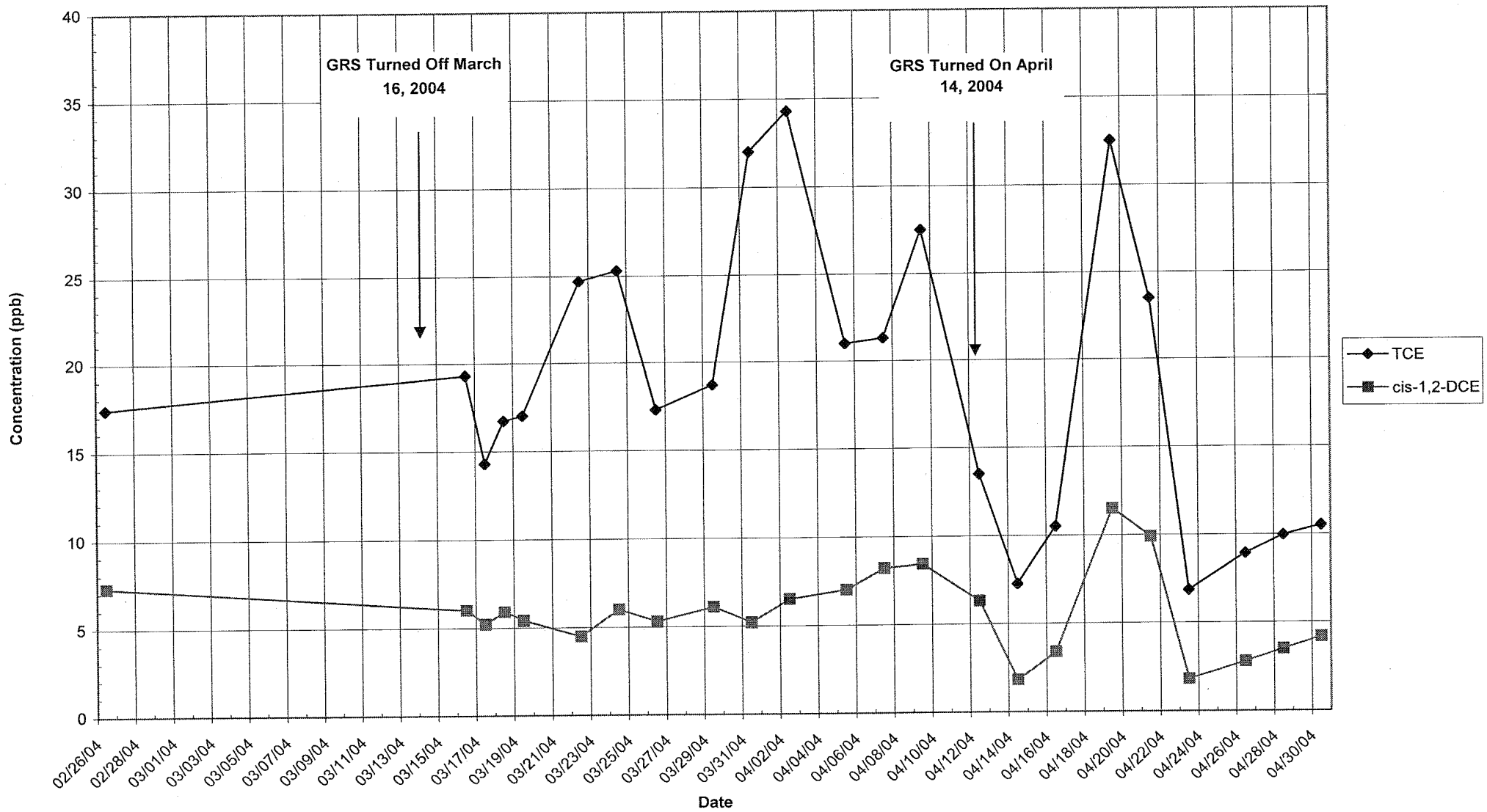
APPENDIX C - TABLE 2
MARCH-APRIL 2004 DATA
HUMANE SPRING
Former Hallmack Facility
Harrodsburg, Kentucky

DATE	TIME	cis-1,2 DCE (ug/L)	TCE (ug/L)	GAGE (ft)	FLOW (gpm)	Comments
4/30/04	924	4.0	10	0.60	707	**Remediation System on**
	1400	4.3	11	0.60	707	
	Daily Mean	4.2	10.5		707	
MEAN		5.73	19.47			
ST. DEV.		2.32	8.29			
HIGH		13	37			
LOW		0.64	3.7			

Notes:

1. Humane Spring water samples were collected by GZA GeoEnvironmental, Inc. (GZA) near the source on the dates and times indicated. Water samples were analyzed by GZA's Environmental Chemistry Laboratory in Hopkington, Massachusettes by USEPA Method 8260.
2. Trichloroethylene (TCE) and cis-1,2-dichloroethylene (cis-1,2-DCE) concentrations are reported in micrograms per liter (ug/L) or parts per billion.
3. Gage readings refer to a staff gauge installed in 1998 by GZA in the stream formed by the spring. Gage readings are measured in feet and are used to determine the stream flow rate in gallons per minute (gpm).
4. The Remediation System status referenced to under the comments column pertain to the groundwater remediation systems at the former Hallmack facility.

APPENDIX C - CHART 2
FEBRUARY 26 THROUGH APRIL 30, 2004
HUMANE SPRING
Former Hallmack Facility
Harrodsburg, Kentucky



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Appendix C Tables to Attachment IV

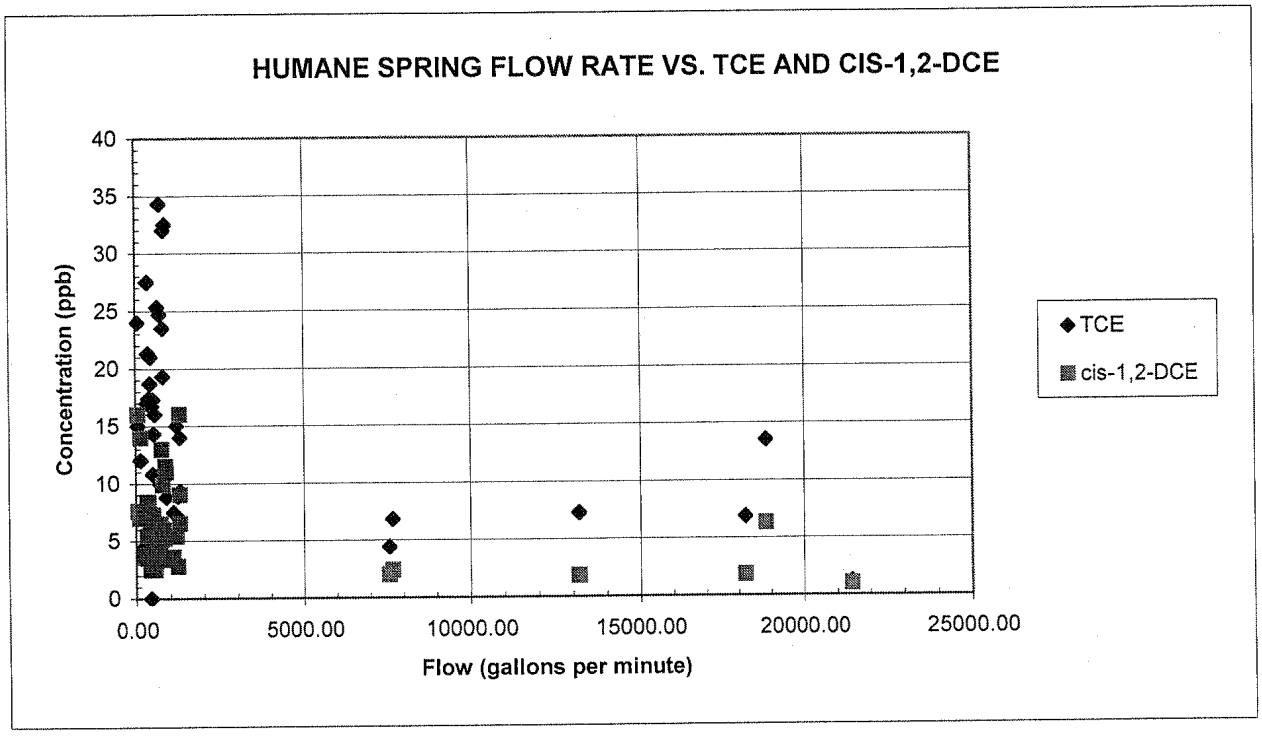
APPENDIX C - TABLE 3
HUMANE SPRING FLOW RATES AND TCE AND CIS-1,2-DCE CONCENTRATIONS
Former Hallmack Facility
Harrodsburg, Kentucky

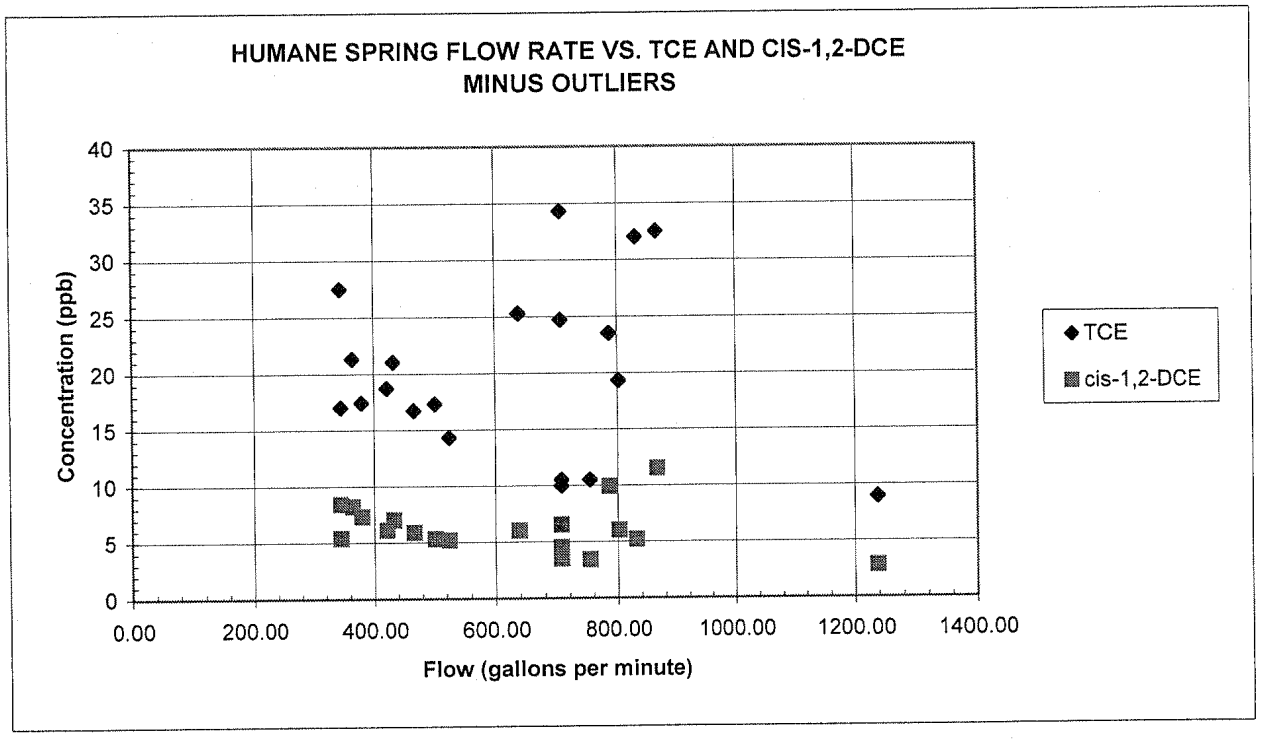
DATE	TCE (ug/L)	cis-1,2-DCE (ug/L)	FLOW RATE (gpm)
March 28, 1996	10.8	7.3	494
April 30, 1997	14	16	1302
March 23, 1998	9.3	9	1297
March 23, 1998	6.9	6.5	1297
March 25, 1998	8.8	11	886
March 27, 1998	7	7	117
March 30, 1998	0	2.5	431
April 1, 1998	16	2.5	548
April 6, 1998	12	14	139
April 9, 1998	11	13	763
May 8, 1998	6.8	2.4	7674
June 12, 1998	4.4	2	7567
July 20, 1998	1.2	1	21448
September 30, 1998	4.4	3.8	220
September 18, 2001	24	16	60
March 11, 2002	4.1	3.5	350
September 18, 2002	15	7.6	60
March 3, 2003	7.5	3.6	1100
September 30, 2003	15	5.4	1200
February 26, 2004	17.4	7.3	380
March 16, 2004	19.3	6	802
March 17, 2004	14.3	5.2	525
March 18, 2004	16.7	5.9	467
March 19, 2004	17	5.4	345
March 22, 2004	24.7	4.5	707
March 24, 2004	25.3	6	639
March 26, 2004	17.3	5.3	502
March 29, 2004	18.7	6.1	422
March 31, 2004	32	5.2	831
April 2, 2004	34.3	6.5	707
April 5, 2004	21	7	433
April 7, 2004	21.3	8.2	365
April 9, 2004	27.5	8.4	345
April 12, 2004	13.5	6.3	18842
April 14, 2004	7.25	1.8	13172
April 16, 2004	10.5	3.4	754
April 19, 2004	32.5	11.5	866
April 21, 2004	23.5	9.9	787
April 23, 2004	6.85	1.8	18209
April 26, 2004	8.9	2.8	1238
April 28, 2004	9.95	3.5	707
April 30, 2004	10.5	4.2	707

Notes:

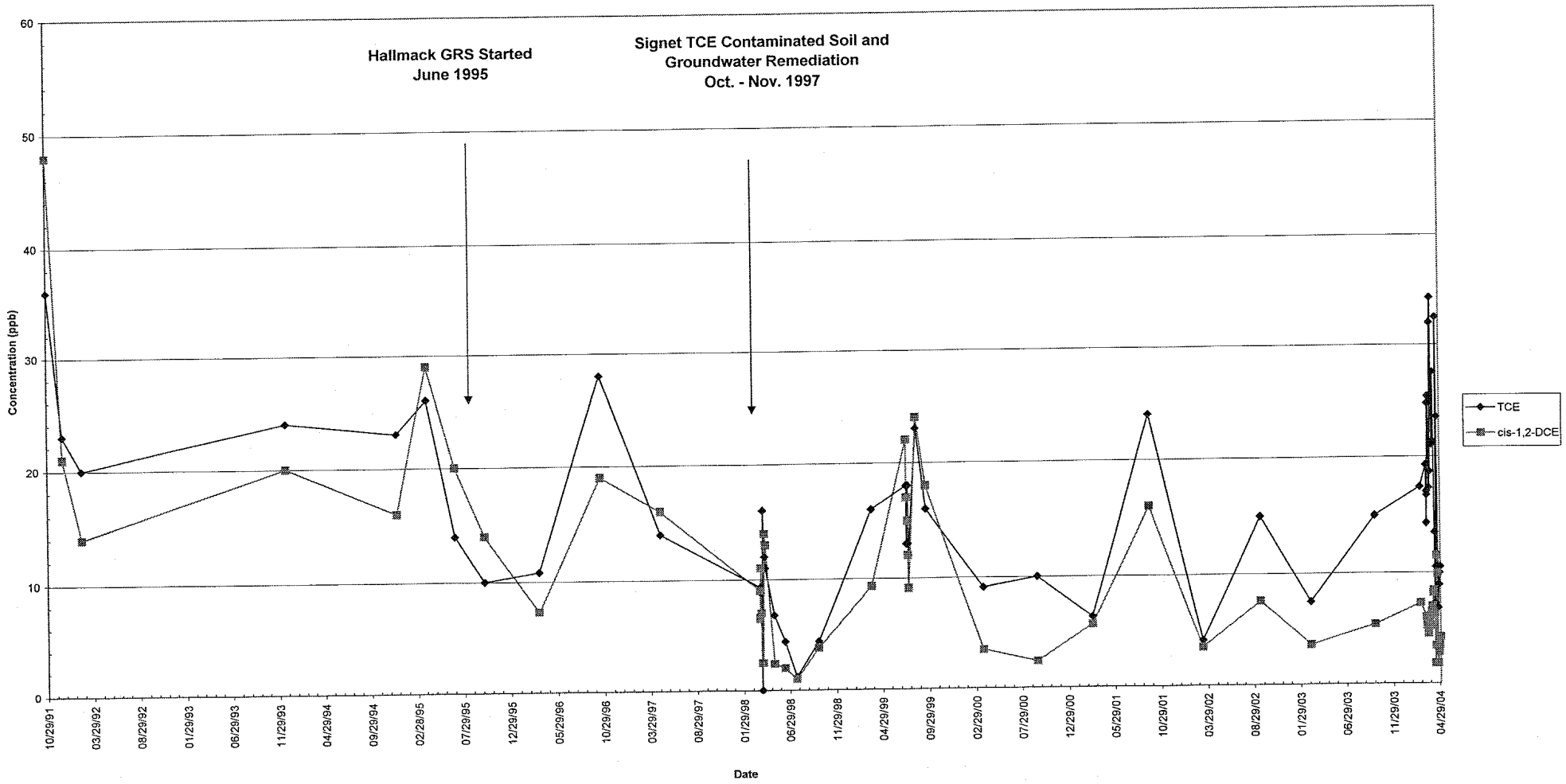
1. Flow rates in gallons per minute (gpm) for 1996 and 1997 were estimated by CTE and for 1998 and later were estimated by GZA using a calibrated staff guage installed within the stream formed by Humane Spring.
2. Trichloroethylene (TCE) and cis-1,2-dichloroethylene (cis-1,2-DCE) concentrations are reported in micrograms per liter (ug/L).

APPENDIX C - TABLE 3 CHARTS
HUMANE SPRING FLOW RATES AND TCE AND CIS-1,2-DCE CONCENTRATIONS
Former Hallmack Facility
Harrodsburg, Kentucky

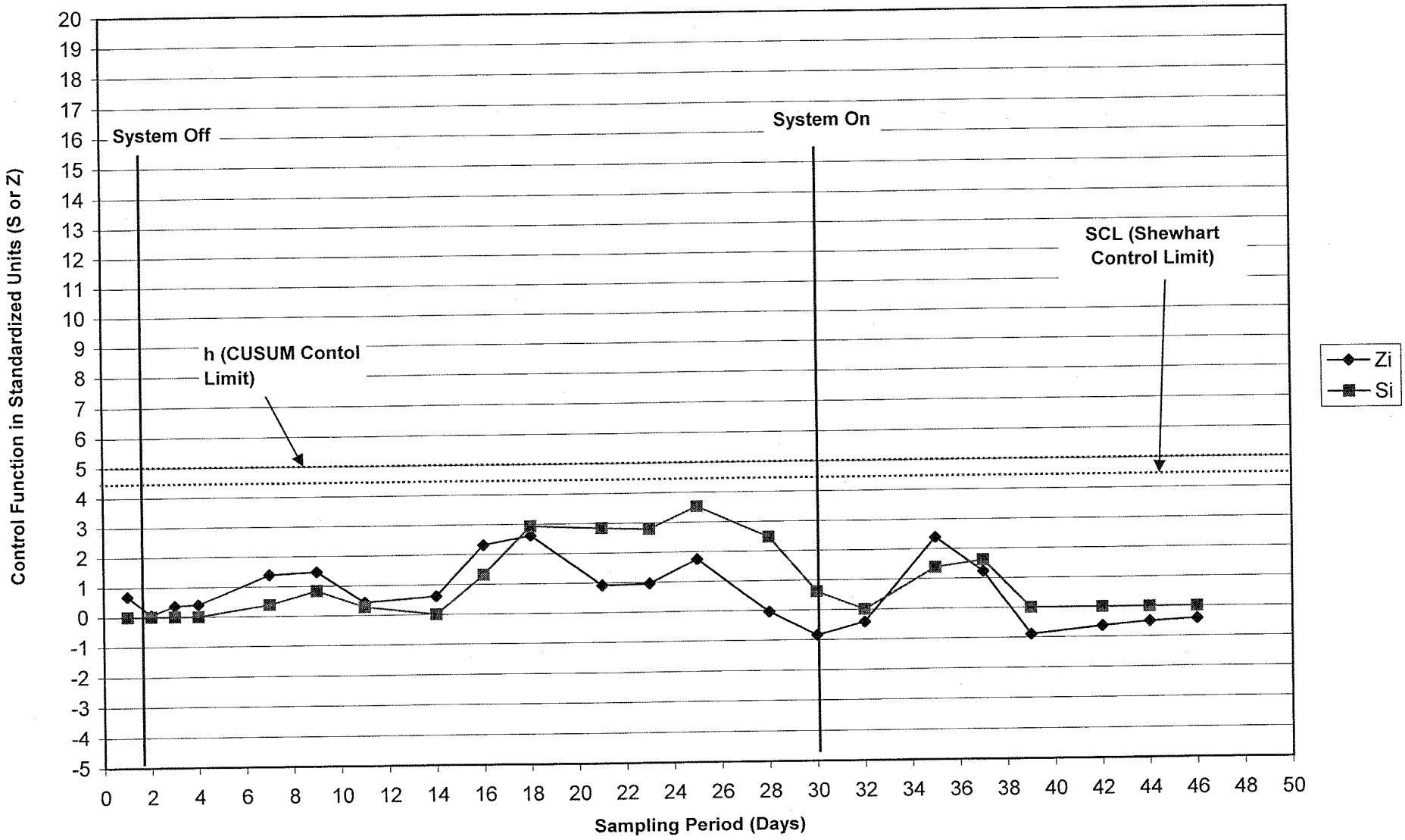




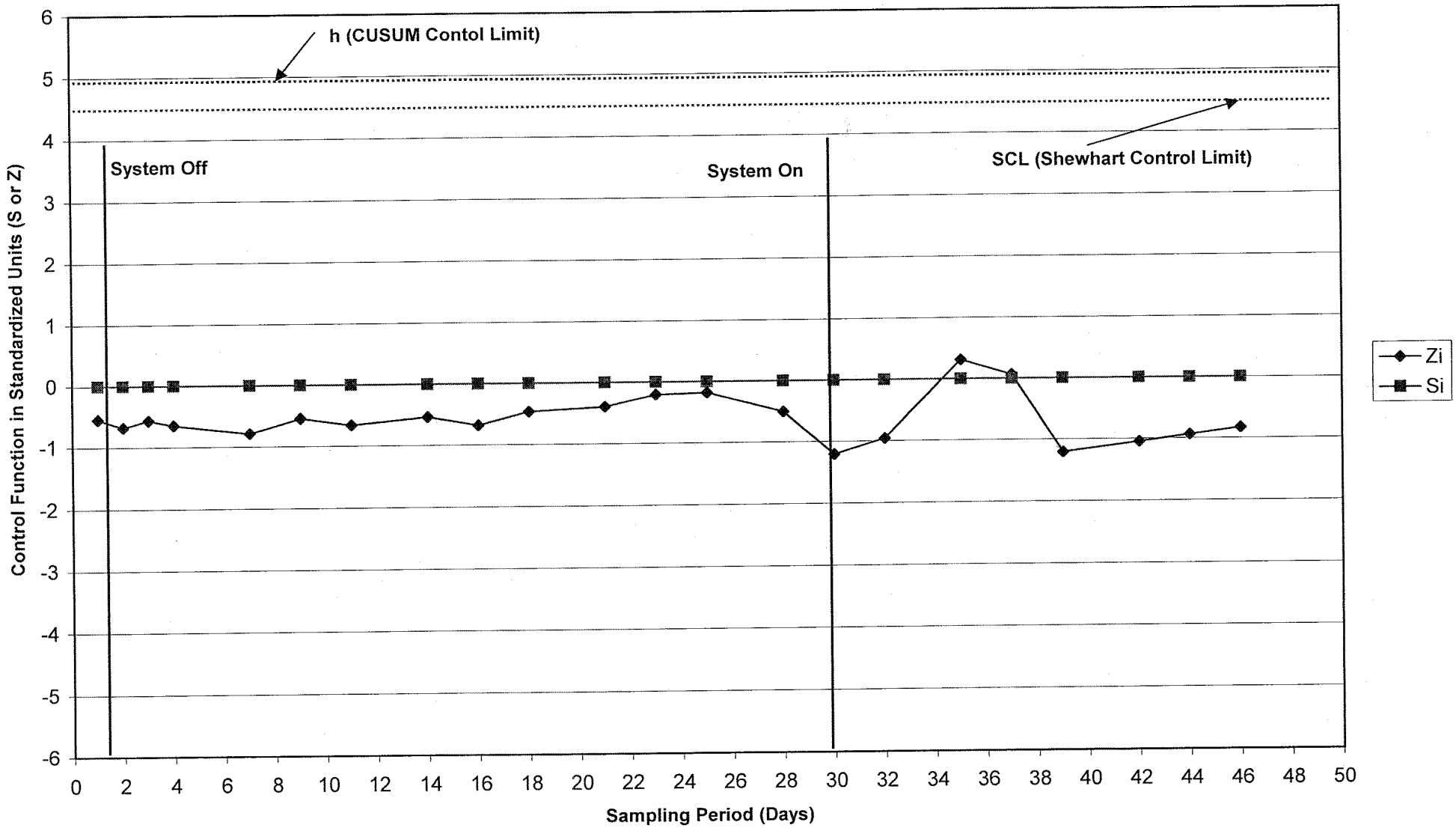
APPENDIX C - CHART 4
ANALYTICAL DATA
OCTOBER 1991 THROUGH APRIL 2004
HUMANE SPRING
Former Hallmack Facility
Harrodsburg, Kentucky



APPENDIX C - CHART 5
COMBINED SHEWHART-CUSUM CONTROL CHART FOR
TCE DURING SAMPLING PERIOD
Former Hallmack Facility
Harrodsburg, Kentucky



APPENDIX C - CHART 6
COMBINED SHEWHART-CUSUM CONTROL CHART FOR
CIS-1,2-DCE DURING SAMPLING PERIOD
Former Hallmack Facility
Harrodsburg, Kentucky



APPENDIX D

2000 Dye Tracing Investigation Report

APPENDIX D - TABLE 1
2000 DYE TRACING INVESTIGATION RESULTS
AT SIGNET SYSTEMS' PROPERTY
DYE RECEPTOR MONITORING BY GZA
Former Hallmack Facility
Harrodsburg, Kentucky

Sampling Location	Date Dye Receptor (Activated Charcoal) Placed	Date Dye Receptor (Activated Charcoal) Collected	# of Days Since Dye Release	# of Days Dye Receptor Exposed	Fluorescein (ppb)	Note	Rhodamine (ppb)	Note
Humane Spring	12/30/99	1/12/00	Prior to dye release	13	0.400	B	0.075	B
	1/12/00	1/13/00	1	1	0.086	B	0.024	B
	1/13/00	1/15/00	3	2	11.100		774.800	
	1/15/00	1/22/00	10	7	1.183	B	171.839	
	1/22/00	1/28/00	16	6	0.447	B	23.145	
	1/28/00	2/4/00	23	7	20.855		14.448	
	2/4/00	2/11/00	30	7	19.259		5.670	
	2/11/00	2/24/00	43	13	0.351	B	0.913	
RW-1	12/30/99	1/12/00	Prior to dye release	13	0.783	B	0.047	B
	1/12/00	1/13/00	1	1	0.440	B	0.061	B
	1/13/00	1/15/00	3	2	0.437	B	0.071	B
	1/15/00	1/22/00	10	7	0.668	B	0.124	B
	1/22/00	1/28/00	16	6	0.489	B	0.072	B
	1/28/00	2/4/00	23	7	0.486	B	0.055	B
	2/4/00	2/11/00	30	7	0.464	B	0.084	B
	2/11/00	2/24/00	43	13	0.930	B	0.027	B
P-105	12/30/99	1/12/00	Prior to dye release	13	0.012	B	0.034	B
	1/12/00	1/13/00	1	1	0.012	B	0.023	B
	1/13/00	1/15/00	3	2	0.012	B	0.028	B
	1/15/00	1/22/00	10	7	0.009	B	0.028	B
	1/22/00	1/28/00	16	6	0.015	B	0.029	B
	1/28/00	2/4/00	23	7	0.014	B	0.029	B
	2/4/00	2/11/00	30	7	0.012	B	0.025	B
	2/11/00	2/24/00	43	13	0.020	B	0.036	B

APPENDIX D - TABLE 1
2000 DYE TRACING INVESTIGATION RESULTS
AT SIGNET SYSTEMS' PROPERTY
DYE RECEPTOR MONITORING BY GZA
Former Hallmack Facility
Harrodsburg, Kentucky

Sampling Location	Date Dye Receptor (Activated Charcoal) Placed	Date Dye Receptor (Activated Charcoal) Collected	# of Days Since Dye Release	# of Days Dye Receptor Exposed	Fluorescein (ppb)	Note	Rhodamine (ppb)	Note
P-106	12/30/99	1/12/00	Prior to dye release	13	0.009	B	0.014	B
	1/12/00	1/13/00	1	1	0.009	B	0.016	B
	1/13/00	1/15/00	3	2	0.009	B	0.016	B
	1/15/00	1/22/00	10	7	0.008	B	0.015	B
	1/22/00	1/28/00	16	6	0.009	B	0.032	B
	1/28/00	2/4/00	23	7	0.047	B	0.048	B
	2/4/00	2/11/00	30	7	0.009	B	0.031	B
	2/11/00	2/24/00	43	13	0.086	B	0.064	B
P-107	12/30/99	1/12/00	Prior to dye release	13	0.033	B	0.066	B
	1/12/00	1/13/00	1	1	<0.001	ND	3155.100	
	1/13/00	1/15/00	3	2	0.013	B	0.885	
	1/15/00	1/22/00	10	7	<0.001	ND	17.919	
	1/22/00	1/28/00	16	6	0.021	B	0.704	
	1/28/00	2/4/00	23	7	0.061	B	3.126	
	2/4/00	2/11/00	30	7	0.009	B	0.279	
	2/11/00	2/24/00	43	13	<0.001	ND	3.092	
P-210	12/30/99	1/12/00	Prior to dye release	13	0.035	B	0.025	B
	1/12/00	1/13/00	1	1	<0.001	ND	48.140	
	1/13/00	1/15/00	3	2	<0.001	ND	2.955	
	1/15/00	1/22/00	10	7	0.077	B	1.905	
	1/22/00	1/28/00	16	6	0.027	B	0.442	
	1/28/00	2/4/00	23	7	0.287	B	0.873	
	2/4/00	2/11/00	30	7	0.068	B	0.867	
	2/11/00	2/24/00	43	13	0.086	B	0.290	B

APPENDIX D - TABLE 1
2000 DYE TRACING INVESTIGATION RESULTS
AT SIGNET SYSTEMS' PROPERTY
DYE RECEPTOR MONITORING BY GZA
Former Hallmack Facility
Harrodsburg, Kentucky

Sampling Location	Date Dye Receptor (Activated Charcoal) Placed	Date Dye Receptor (Activated Charcoal) Collected	# of Days Since Dye Release	# of Days Dye Receptor Exposed	Fluorescein (ppb)	Note	Rhodamine (ppb)	Note
P-213	12/30/99	1/12/00	Prior to dye release	13	<0.001	ND	0.010	B
	1/12/00	1/13/00	1	1	0.007	B	0.019	B
	1/13/00	1/15/00	3	2	0.007	B	0.061	B
	1/15/00	1/22/00	10	7	<0.001	ND	0.259	
	1/22/00	1/28/00	16	6	<0.001	ND	4.271	
	1/28/00	2/4/00	23	7	<0.001	ND	0.718	
	2/4/00	2/11/00	30	7	<0.001	ND	0.163	
	2/11/00	2/24/00	43	13	0.006	B	0.081	B
P-218	12/30/99	1/12/00	Prior to dye release	13	0.073	B	0.019	B
	1/12/00	1/13/00	1	1	0.016	B	0.025	B
	1/13/00	1/15/00	3	2	0.031	B	0.021	B
	1/15/00	1/22/00	10	7	0.016	B	0.015	B
	1/22/00	1/28/00	16	6	0.657	B	0.040	B
	1/28/00	2/4/00	23	7	0.071	B	0.024	B
	2/4/00	2/11/00	30	7	0.297	B	0.022	B
	2/11/00	2/24/00	43	13	0.453	B	0.018	B
P-306	12/30/99	1/12/00	Prior to dye release	13	0.046	B	0.026	B
	1/12/00	1/13/00	1	1	0.012	B	0.026	B
	1/13/00	1/15/00	3	2	<0.001	ND	<0.001	ND
	1/15/00	1/22/00	10	7	0.017	B	0.047	B
	1/22/00	1/28/00	16	6	0.021	B	0.015	B
	1/28/00	2/4/00	23	7	0.027	B	0.022	B
	2/4/00	2/11/00	30	7	0.022	B	0.025	B
	2/11/00	2/24/00	43	13	0.032	B	0.020	B

APPENDIX D - TABLE 1
2000 DYE TRACING INVESTIGATION RESULTS
AT SIGNET SYSTEMS' PROPERTY
DYE RECEPTOR MONITORING BY GZA
Former Hallmack Facility
Harrodsburg, Kentucky

Sampling Location	Date Dye Receptor (Activated Charcoal) Placed	Date Dye Receptor (Activated Charcoal) Collected	# of Days Since Dye Release	# of Days Dye Receptor Exposed	Fluorescein (ppb)	Note	Rhodamine (ppb)	Note
P-307	12/30/99	1/12/00	Prior to dye release	13	0.014	B	0.026	B
	1/12/00	1/13/00	1	1	0.014	B	0.060	B
	1/13/00	1/15/00	3	2	0.017	B	0.027	B
	1/15/00	1/22/00	10	7	0.002	B	0.025	B
	1/22/00	1/28/00	16	6	0.013	B	0.021	B
	1/28/00	2/4/00	23	7	0.023	B	0.085	B
	2/4/00	2/11/00	30	7	0.015	B	0.019	B
	2/11/00	2/24/00	43	13	0.028	B	0.027	B

Notes:
1. Dye was injected in Wells SS-3 and SS-8 on January 12, 2000, for Modine Systems, Inc. (Signet Systems) by K2 GeoEnvironmental, Inc. Both wells are 2-inch PVC with 10-foot screens.
2. Well SS-3 was presoaked with 225 gallons of fresh water then 1,000 gallons of water was added at 5 gallons per minute (gpm) with 1 pound of Rhodamine WT dye added during the first approximately 30 minutes.
3. Well SS-8 was presoaked with 100 gallons of fresh water then 1 pound of Fluorescein dye was added followed by 1,000 gallons of water at 15 gpm.
4. Detection is considered positive if dye is detected at ten times the initial background concentration for at least two consecutive sampling events. 'B' indicates that the detected dye concentration was less than ten times initial background.
5. "ND" indicates that the dye was not detected.
6. Results are reported in micrograms per liter (mg/L) or parts per billion (ppb).
7. Fluorescein detections in well P-218 were not considered positive by Crawford and Associates, Inc. because the concentrations were not detected at ten times the background concentration.

CRAWFORD AND ASSOCIATES, INC.

DYE TRACER STUDY REPORT

MARCH 23, 2000

1136 US Highway 31W By-Pass * Bowling Green, Kentucky 42101
Voice: (270) 745-9224 * **FAX:** (270) 846-4319 * **E-mail:** canda@premiernet.net

CRAWFORD AND ASSOCIATES, INC.

Groundwater Hydrologists, Geologists, Environmental Scientists
Groundwater Investigations • Fluorescent Dye Analysis

March 23, 2000

Mr. Mark Krumenacher
GZA GeoEnvironmental, Inc.
N4140 DuPlainville Road
Pewaukee, Wisconsin 53072

Subject: Former Hallmack Facility and Humane Spring Dye Receptor Sampling
Modine Manufacturing Company Dye Tracer Study
Harrodsburg, Kentucky

Dear Mr. Krumenacher,

Enclosed are the finalized laboratory report sheets (Appendix I) and chain of custody forms (Appendix II) for the dye receptors collected by Crawford & Associates, Inc. (C&A) on behalf of GZA GeoEnvironmental, Inc. (GZA) at and near the former Hallmack Facility in Harrodsburg, Kentucky. The Dye Tracer Study was designed and implemented at the adjacent Signet Systems (Signet) property by K2 GeoEnvironmental, Inc. (K2) on behalf of Modine Manufacturing Company (Modine).

Activated charcoal dye receptors were used by C&A to monitor the movement of the dye released into groundwater monitoring wells at Signet. To ascertain the background concentrations, dye receptors were placed at ten sample locations selected by GZA on December 30, 1999. Sampling locations consisted of seven wells on the former Hallmack facility property (piezometers P-105, P-106, P-107, P-210, P-213, and P-218; and recovery well RW-1), two piezometers south of Tapp Road (P-306 and P-307), and one surface water location at Humane Spring. The dye receptors were collected on January 12, 2000, prior to dye injection. The concentrations detected in sample set 01, collected January 12, 2000, were recorded and used as

1136 US Highway 31W By-Pass * Bowling Green, Kentucky 42101
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baseline levels for each subsequent sample collected and analyzed by C&A. Personnel from C&A collected dye receptors, in accordance with C&A's normal sampling procedures (Appendix III, Section I).

On January 12, 2000, Fluorescein and Rhodamine WT dyes, were injected into two wells on the Modine property by K2. The dye injection process was observed by personnel from C&A. After a pre-flush using 100 gallons of potable water, one pound of Fluorescein dye was injected into well SS-8 located west of the Signet building. Following the injection of Fluorescein dye, 1000 gallons of potable water were injected into the well at a rate of approximately 15 gallons per minute.

After a pre-flush of 225 gallons of potable water, 1000 gallons of potable water were injected into well SS-3 at a rate of approximately 5 gallons per minute, with one pound of Rhodamine WT added during the initial 30 minutes. Well SS-3 is located east of the Signet building on the former Hallmack facility property.

Following the dye injections, seven dye receptor sample sets were collected and analyzed by C&A during the period of January 13, 2000, through February 25, 2000. All samples were analyzed for detection of Fluorescein and Rhodamine WT dyes using a Shimadzu RF-5301 PC Spectrofluorophotometer in accordance with C&A's normal laboratory procedures (Appendix III, Section II). Samples were collected one day after injection (sample set 02), and three days after injection (sample set 03). Sample sets 04 through 07 were collected weekly after sample set 03 and sample set 08 was collected two weeks after sample set 07. All laboratory results were recorded on laboratory report sheets, Appendix I.

Dye receptor analytical results were evaluated by C&A. The dye concentrations were considered by C&A to be a positive dye detection only if concentrations were, at a minimum, 10 times the sample set 01 background concentrations. Based on this standard, Fluorescein dye, which was injected on the western side of the Signet building, was positively detected at one of the ten sampling locations, Humane Spring. Fluorescein was positively detected three weeks after dye injection at Humane Spring and one week thereafter.

Rhodamine WT dye, which was injected on the eastern side of the Signet building, was positively detected at four sampling locations (P-107, P-210, P-213, and Humane Spring). Rhodamine WT was positively detected one day after dye injection at location P-107 and for the remainder of the tracer study, except for sample set 07. Rhodamine WT was positively detected one day after dye injection at location P-210 and for the remainder of the tracer study. Rhodamine WT was positively detected eight days after dye injection at location P-213 through sample set 07. Rhodamine WT was also positively detected three days after dye injection at Humane Spring and for the remainder of the tracer study.

If C&A can be of any other assistance with the Former Hallmack Facility Dye Tracer Study please feel free to contact me at, (270) 745-9224.

Sincerely,

Andrei M. Kerpan
Hydrogeologist/Lab Manager

1136 US Highway 31W By-Pass * Bowling Green, Kentucky 42101
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APPENDIX I

Laboratory Report Sheets

1136 US Highway 31W By-Pass * Bowling Green, Kentucky 42101
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CRAWFORD AND ASSOCIATES, INC

* *Groundwater Hydrologists, Geologists, Environmental Scientists*
* *Laboratory Services*

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(270) 745-9224
E-mail: canda@dyetracing.com

LABORATORY REPORT SHEET

FLUORIMETRIC ANALYSIS RESULTS

FORMER HALLMACK SITE, HARRODSBURG, KY

Analysis requested by:

GZA Geoenvironmental, Inc.

TINOPAL CBS-X	FLUORESCEIN	EOSINE	D&C Red #28	RHODAMINE WT	SULPHORHODAMINE B
Fabric Brightening Agent 351	**Color Index:** Acid Yellow 73	**Color Index:** Acid Red 87	**Color Index:** Acid Red 92	**Color Index:** Acid Red 388	**Color Index:** Acid Red 52
Dye Receptor: Activated Charcoal	**Dye Receptor:** Activated Charcoal	**Dye Receptor:** Activated Charcoal	**Dye Receptor:** Activated Charcoal	**Dye Receptor:** Activated Charcoal	**Dye Receptor:** Activated Charcoal
Analysis by: Spectrofluorophotometer	**Analysis by:** Spectrofluorophotometer	**Analysis by:** Spectrofluorophotometer	**Analysis by:** Spectrofluorophotometer	**Analysis by:** Spectrofluorophotometer	**Analysis by:** Spectrofluorophotometer

Code Number	Event	Date Collected	Feature Name	Peakfit	Comment	CHARCOAL AND WATER SAMPLES											
						TINOPAL CBS-X		FLUORESCEIN		EOSINE		D&C RED #28		RHODAMINE WT		SULPHORHODAMINE B	
						Results	Conc in ppb	Results	Conc in ppb	Results	Conc in ppb	Results	Conc in ppb	Results	Conc in ppb	Results	Conc in ppb
DR.001.0	01	1/12/2000	HUMANE SPRING					B	0.400					B	0.075		
DR.001.0	02	1/13/2000	HUMANE SPRING					B	0.086					B	0.024		
DR.001.0	03	1/15/2000	HUMANE SPRING					B	11.100					+	774.800		
DR.001.0	04	1/21/2000	HUMANE SPRING					B	1.183					+	171.839		
DR.001.0	05	1/28/2000	HUMANE SPRING					B	0.447					+	23.145		
DR.001.0	06	2/4/2000	HUMANE SPRING					+	20.855					+	14.448		
DR.001.0	07	2/11/2000	HUMANE SPRING					+	19.259					+	5.670		
DR.001.0	08	2/24/2000	HUMANE SPRING					B	0.351					+	0.913		
DR.002.0	01	1/12/2000	P-105					B	0.012					B	0.034		
DR.002.0	02	1/13/2000	P-105					B	0.012					B	0.023		
DR.002.0	03	1/15/2000	P-105					B	0.012					B	0.028		
DR.002.0	04	1/21/2000	P-105					B	0.009					B	0.028		
DR.002.0	05	1/28/2000	P-105					B	0.015					B	0.029		
DR.002.0	06	2/4/2000	P-105					B	0.014					B	0.029		
DR.002.0	07	2/11/2000	P-105					B	0.012					B	0.025		
DR.002.0	08	2/24/2000	P-105					B	0.020					B	0.036		
DR.003.0	01	1/12/2000	P-106					B	0.009					B	0.014		
DR.003.0	02	1/13/2000	P-106					B	0.009					B	0.016		
DR.003.0	03	1/15/2000	P-106					B	0.009					B	0.016		
DR.003.0	04	1/21/2000	P-106					B	0.008					B	0.015		
DR.003.0	05	1/28/2000	P-106					B	0.009					B	0.032		
DR.003.0	06	2/4/2000	P-106					B	0.047					B	0.048		
DR.003.0	07	2/11/2000	P-106					B	0.009					B	0.031		

ND Below Quantitation Limit
B Background
N[illegible] Sam[illegible]

+ Positive
++ Very Positive
Ext[illegible]y Posi[illegible]

Created 1/21/2005

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CHARCOAL AND WATER SAMPLES

Code Number	Event	Date Collected	Feature Name	Peakfit	Comment	TINOPAL CBS-X Results	TINOPAL CBS-X Conc in ppb	FLUORESCEIN Results	FLUORESCEIN Conc in ppb	EOSINE Results	EOSINE Conc in ppb	D&C RED #28 Results	D&C RED #28 Conc in ppb	RHODAMINE WT Results	RHODAMINE WT Conc in ppb	SULPHORHODAMINE B Results	SULPHORHODAMINE B Conc in ppb
DR.003.0	08	2/24/2000	P-106					B	0.086					B	0.064		
DR.004.0	01	1/12/2000	P-107					B	0.033					B	0.066		
DR.004.0	02	1/13/2000	P-107					ND						+	3155.100		
DR.004.0	03	1/15/2000	P-107					B	0.013					+	0.885		
DR.004.0	04	1/21/2000	P-107					ND						+	17.919		
DR.004.0	05	1/28/2000	P-107					B	0.021					+	0.704		
DR.004.0	06	2/4/2000	P-107					B	0.061					+	3.126		
DR.004.0	07	2/11/2000	P-107					B	0.009					B	0.274		
DR.004.0	08	2/24/2000	P-107					ND						+	3.092		
DR.005.0	01	1/12/2000	P-210					B	0.035					B	0.025		
DR.005.0	02	1/13/2000	P-210					ND						+	48.140		
DR.005.0	03	1/15/2000	P-210					ND						+	2.955		
DR.005.0	04	1/21/2000	P-210					B	0.077					+	1.905		
DR.005.0	05	1/28/2000	P-210					B	0.027					+	0.442		
DR.005.0	06	2/4/2000	P-210					B	0.287					+	0.873		
DR.005.0	07	2/11/2000	P-210					B	0.068					+	0.867		
DR.005.0	08	2/24/2000	P-210					B	0.086					+	0.290		
DR.006.0	01	1/12/2000	P-213					ND						B	0.010		
DR.006.0	02	1/13/2000	P-213					B	0.007					B	0.019		
DR.006.0	03	1/15/2000	P-213					B	0.007					B	0.061		
DR.006.0	04	1/21/2000	P-213					ND						+	0.259		
DR.006.0	05	1/28/2000	P-213					ND						+	4.271		
DR.006.0	06	2/4/2000	P-213					ND						+	0.718		
DR.006.0	07	2/11/2000	P-213					ND						+	0.163		
DR.006.0	08	2/24/2000	P-213					B	0.006					B	0.081		
DR.007.0	01	1/12/2000	P-218					B	0.073					B	0.019		
DR.007.0	02	1/13/2000	P-218					B	0.016					B	0.025		
DR.007.0	03	1/15/2000	P-218					B	0.031					B	0.021		
DR.007.0	04	1/21/2000	P-218					B	0.016					B	0.015		
DR.007.0	05	1/28/2000	P-218					B	0.657					B	0.040		
DR.007.0	06	2/4/2000	P-218					B	0.071					B	0.024		
DR.007.0	07	2/11/2000	P-218					B	0.297					B	0.022		
DR.007.0	08	2/24/2000	P-218					B	0.453					B	0.018		
DR.008.0	01	1/12/2000	P-306					B	0.046					B	0.026		
DR.008.0	02	1/13/2000	P-306					B	0.012					B	0.026		
DR.008.0	03	1/15/2000	P-306					ND						ND			

ND Below Quantitation Limit
B Background
NS No Sample

\+ Positive
++ Very Positive
+++ Extremely Positive

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CHARCOAL AND WATER SAMPLES

Code Number	Event	Date Collected	Feature Name	Peakfit	Comment	TINOPAL CBS-X Results	TINOPAL CBS-X Conc in ppb	FLUORESCEIN Results	FLUORESCEIN Conc in ppb	EOSINE Results	EOSINE Conc in ppb	D&C RED #28 Results	D&C RED #28 Conc in ppb	RHODAMINE WT Results	RHODAMINE WT Conc in ppb	SULPHORHODAMINE B Results	SULPHORHODAMINE B Conc in ppb
DR.008.0	04	1/21/2000	P-306					B	0.017					B	0.047		
DR.008.0	05	1/28/2000	P-306					B	0.021					B	0.015		
DR.008.0	06	2/4/2000	P-306					B	0.027					B	0.022		
DR.008.0	07	2/11/2000	P-306					B	0.022					B	0.025		
DR.008.0	08	2/24/2000	P-306					B	0.032					B	0.020		
DR.009.0	01	1/12/2000	P-307					B	0.014					B	0.026		
DR.009.0	02	1/13/2000	P-307					B	0.014					B	0.060		
DR.009.0	03	1/15/2000	P-307					B	0.017					B	0.027		
DR.009.0	04	1/21/2000	P-307					B	0.015					B	0.025		
DR.009.0	05	1/28/2000	P-307					B	0.013					B	0.021		
DR.009.0	06	2/4/2000	P-307					B	0.023					B	0.085		
DR.009.0	07	2/11/2000	P-307					B	0.015					B	0.019		
DR.009.0	08	2/24/2000	P-307					B	0.028					B	0.027		
DR.010.0	01	1/12/2000	RW-1					B	0.783					B	0.047		
DR.010.0	02	1/13/2000	RW-1					B	0.440					B	0.061		
DR.010.0	03	1/15/2000	RW-1					B	0.437					B	0.071		
DR.010.0	04	1/21/2000	RW-1					B	0.668					B	0.124		
DR.010.0	05	1/28/2000	RW-1					B	0.489					B	0.072		
DR.010.0	06	2/4/2000	RW-1					B	0.486					B	0.055		
DR.010.0	07	2/11/2000	RW-1					B	0.464					B	0.084		
DR.010.0	08	2/24/2000	RW-1					B	0.930					B	0.027		

ND Below Quantitation Limit
B Background
NS No Sample

\+ Positive
++ Very Positive
+++ Extremely Positive

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APPENDIX II

Chain of Custody Forms

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* *Laboratory Services*

CHAIN OF CUSTODY RECORD

Former Hallmack Site, Harrodsburg, KY

Dye Tracer Study

Relinquished by (Signature)	Date	Received by (Signature)	Date
[illegible]	[illegible]		
Representing: C+L	Time 1800	Representing:	Time
Relinquished by (Signature)	Date	Received by (Signature)	Date
Representing:	Time	Representing:	Time

DR	GS	Station ID	Event	Feature Name	Date	Time	Initials	Preservation Method	Comments
X		DR.001.0	01	HUMANE SPRING	1/12/2000	9:15		Cooler	
X		DR.002.0	01	P-105	1/12/2000	9:20		Cooler	
X		DR.003.0	01	P-106	1/12/2000	9:46		Cooler	
X		DR.004.0	01	P-107	1/12/2000	9:35		Cooler	
X		DR.005.0	01	P-210	1/12/2000	10:10		Cooler	
X		DR.006.0	01	P-213	1/12/2000	9:40		Cooler	
X		DR.007.0	01	P-218	1/12/2000	10:00		Cooler	
X		DR.008.0	01	P-306	1/12/2000	9:22		Cooler	
X		DR.009.0	01	P-307	1/12/2000	9:26		Cooler	
X		DR.010.0	01	RW-1	1/12/2000	12:00		Cooler	

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CHAIN OF CUSTODY RECORD

Former Hallmack Site, Harrodsburg, KY

Dye Tracer Study

Relinquished by (Signature)	Date	Received by (Signature)	Date
[illegible]	1-13-00		
Representing: C.A	Time 1600	Representing:	Time
Relinquished by (Signature)	Date	Received by (Signature)	Date
Representing:	Time	Representing:	Time

DR	GS	Station ID	Event	Feature Name	Date	Time	Initials	Preservation Method	Comments
X		DR.001.0	02	HUMANE SPRING	1/13/2000	1405		Cooler	
X		DR.002.0	02	P-105	1/13/2000	1430		Cooler	
X		DR.003.0	02	P-106	1/13/2000	1420		Cooler	
X		DR.004.0	02	P-107	1/13/2000	1415		Cooler	
X		DR.005.0	02	P-210	1/13/2000	1440		Cooler	
X		DR.006.0	02	P-213	1/13/2000	1444		Cooler	
X		DR.007.0	02	P-218	1/13/2000	1435		Cooler	
X		DR.008.0	02	P-306	1/13/2000	1350		Cooler	
X		DR.009.0	02	P-307	1/13/2000	1400		Cooler	
X		DR.010.0	02	RW-1	1/13/2000	1449		Cooler	

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CHAIN OF CUSTODY RECORD

Former Hallmack Site, Harrodsburg, KY

Dye Tracer Study

Relinquished by (Signature)	Date	Received by (Signature)	Date
[illegible]	1-15-00		
Representing: C.A	Time 1200	Representing:	Time
Relinquished by (Signature)	Date	Received by (Signature)	Date
Representing:	Time	Representing:	Time

DR	GS	Station ID	Event	Feature Name	Date	Time	Initials	Preservation Method	Comments
X	X	DR.001.0	03	HUMANE SPRING	1/15/2000	935		Cooler	
X		DR.002.0	03	P-105	1/15/2000	1017		Cooler	
X		DR.003.0	03	P-106	1/15/2000	1012		Cooler	
X		DR.004.0	03	P-107	1/15/2000	1003		Cooler	
X		DR.005.0	03	P-210	1/15/2000	1033		Cooler	
X		DR.006.0	03	P-213	1/15/2000	1038		Cooler	
X		DR.007.0	03	P-218	1/15/2000	1024		Cooler	
X		DR.008.0	03	P-306	1/15/2000	946		Cooler	
X		DR.009.0	03	P-307	1/15/2000	952		Cooler	
X		DR.010.0	03	RW-1	1/15/2000	1042		Cooler	

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Dye Tracer Study

Relinquished by (Signature)	Date	Received by (Signature)	Date
[illegible]	1-21-00		
Representing:	Time	Representing:	Time
[illegible]	1700		
Relinquished by (Signature)	Date	Received by (Signature)	Date
Representing:	Time	Representing:	Time

DR	GS	Station ID	Event	Feature Name	Date	Time	Initials	Preservation Method	Comments
X	X	DR.001.0	04	HUMANE SPRING	1/21/2000	11:00		Cooler	
X		DR.002.0	04	P-105	1/21/2000	11:32		Cooler	
X		DR.003.0	04	P-106	1/21/2000	11:26		Cooler	
X		DR.004.0	04	P-107	1/21/2000	11:20		Cooler	
X		DR.005.0	04	P-210	1/21/2000	11:45		Cooler	
X		DR.006.0	04	P-213	1/21/2000	11:50		Cooler	
X		DR.007.0	04	P-218	1/21/2000	11:38		Cooler	
X		DR.008.0	04	P-306	1/21/2000	11:06		Cooler	
X		DR.009.0	04	P-307	1/21/2000	11:11		Cooler	
X		DR.010.0	04	RW-1	1/21/2000	11:56		Cooler	

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Dye Tracer Study

Relinquished by (Signature)	Date	Received by (Signature)	Date
[illegible]	1-25-00		
Representing: C.A	Time 1700	Representing:	Time:
Relinquished by (Signature)	Date	Received by (Signature)	Date
Representing:	Time	Representing:	Time

DR	GS	Station ID	Event	Feature Name	Date	Time	Initials	Preservation Method	Comments
X	X	DR.001.0	05	HUMANE SPRING	1/28/2000	10:45		Cooler	
X		DR.002.0	05	P-105	1/28/2000	10:50		Cooler	
X		DR.003.0	05	P-106	1/28/2000	11:06		Cooler	
X		DR.004.0	05	P-107	1/28/2000	11:01		Cooler	
X		DR.005.0	05	P-210	1/28/2000	11:20		Cooler	
X		DR.006.0	05	P-213	1/28/2000	11:33		Cooler	
X		DR.007.0	05	P-218	1/28/2000	11:47		Cooler	
X		DR.008.0	05	P-306	1/28/2000	10:44		Cooler	
X		DR.009.0	05	P-307	1/28/2000	10:56		Cooler	
X		DR.010.0	05	RW-1	1/28/2000	11:19		Cooler	

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Former Hallmack Site, Harrodsburg, KY

Dye Tracer Study

Relinquished by (Signature)	Date	Received by (Signature)	Date
[illegible]	2-9-00		
Representing: C.A.	**Time** 1330	**Representing:**	**Time**
Relinquished by (Signature)	**Date**	**Received by (Signature)**	**Date**
Representing:	**Time**	**Representing:**	**Time**

DR	GS	Station ID	Event	Feature Name	Date	Time	Initials	Preservation Method	Comments
X	X	DR.001.0	06	HUMANE SPRING	2/4/2000	10:18		Cooler	
X		DR.002.0	06	P-105	2/4/2000	11:03		Cooler	
X		DR.003.0	06	P-106	2/4/2000	10:57		Cooler	
X		DR.004.0	06	P-107	2/4/2000	10:40		Cooler	
X		DR.005.0	06	P-210	2/4/2000	11:15		Cooler	
X		DR.006.0	06	P-213	2/4/2000	11:20		Cooler	
X		DR.007.0	06	P-218	2/4/2000	11:10		Cooler	
X		DR.008.0	06	P-306	2/4/2000	10:29		Cooler	
X		DR.009.0	06	P-307	2/4/2000	10:34		Cooler	
X		DR.010.0	06	RW-1	2/4/2000	11:24		Cooler	

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CHAIN OF CUSTODY RECORD

Former Hallmack Site, Harrodsburg, KY

Dye Tracer Study

Relinquished by (Signature)	Date	Received by (Signature)	Date
	2-11-00		2-11-00
Representing:	Time	Representing:	Time
	1615		1615
Relinquished by (Signature)	Date	Received by (Signature)	Date
Representing:	Time	Representing:	Time

DR	GS	Station ID	Event	Feature Name	Date	Time	Initials	Preservation Method	Comments
X	X	DR.001.0	07	HUMANE SPRING	2/11/2000	1330	DK	Cooler	
X	-	DR.002.0	07	P-105	2/11/2000	1412	DK	Cooler	
X	-	DR.003.0	07	P-106	2/11/2000	1418	DK	Cooler	
X	-	DR.004.0	07	P-107	2/11/2000	1425	DK	Cooler	
X	-	DR.005.0	07	P-210	2/11/2000	1430	DK	Cooler	
X	-	DR.006.0	07	P-213	2/11/2000	1430	DK	Cooler	
X	-	DR.007.0	07	P-218	2/11/2000	1445	DK	Cooler	
X	-	DR.008.0	07	P-306	2/11/2000	1330	DK	Cooler	
X	-	DR.009.0	07	P-307	2/11/2000	1339	DK	Cooler	
X	-	DR.010.0	07	RW-1	2/11/2000	1358	DK	Cooler	

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CHAIN OF CUSTODY RECORD

Former Hallmack Site, Harrodsburg, KY

Dye Tracer Study

Relinquished by (Signature)	Date	Received by (Signature)	Date
Representing: CoA	Time 1630	Representing: C/A	Time 1030
Relinquished by (Signature)	Date	Received by (Signature)	Date
Representing:	Time	Representing: C	Time

DR	GS	Station ID	Event	Feature Name	Date	Time	Initials	Preservation Method	Comments
X	X	DR.001.0	08	HUMANE SPRING	2/25/2000	1345	DK	Cooler	
X	—	DR.002.0	08	P-105	2/25/2000	1418	DK	Cooler	
X	—	DR.003.0	08	P-106	2/25/2000	1413	DK	Cooler	
X	—	DR.004.0	08	P-107	2/25/2000	1440	DK	Cooler	
X	—	DR.005.0	08	P-210	2/25/2000	1458	DK	Cooler	
X	—	DR.006.0	08	P-213	2/25/2000	1503	DK	Cooler	
X	—	DR.007.0	08	P-218	2/25/2000	1453	DK	Cooler	
X	—	DR.008.0	08	P-306	2/25/2000	1352	DK	Cooler	
X	—	DR.009.0	08	P-307	2/25/2000	1422	DK	Cooler	
X	—	DR.010.0	08	RW-1	2/25/2000	1130	DK	Cooler	

APPENDIX III

Karst Groundwater Investigation Procedures

1136 US Highway 31W By-Pass * Bowling Green, Kentucky 42101
Voice: (270) 745-9224 * **FAX:** (270) 846-4319 * **E-mail:** canda@premiernet.net

KARST GROUNDWATER INVESTIGATION RESEARCH PROCEDURES

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Revised December 1, 1997

KARST GROUNDWATER INVESTIGATION RESEARCH PROCEDURES

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KARST GROUNDWATER INVESTIGATION RESEARCH PROCEDURES

Crawford and Associates, Inc.

1. INTRODUCTION

The following proposed research procedure has been used by Crawford to investigate the flow of groundwater in karst aquifers on numerous occasions since 1970.

2. PHASE I: SCOPE OF WORK

The scope of work consists of a review of literature, field survey for the karst hydrogeologic inventory, dye receptor placement, retrieval, and analysis for the background fuorescence study, and a potentiometric surface investigation.

2.1 Delineation of Study Area

The study area must extend in all directions away from the site until one of the following conditions is met:

1. The water table has been established by measurement to be higher than at the proposed dye injection location on site.

2. A definite discharge boundary has been reached, such as a large perennial stream.

Typically, the study area will cover several square miles, and sometimes it may even cover 80 square miles or more.

2.2 Review of Literature

Prior to initiating the field survey, a desktop study will be conducted to identify and review, as available, the following types of resources pertaining to karst features in the study area.

- Aerial photographs
- Geologic maps
- Flood maps
- Topographic maps
- Soil surveys
- Storm water reports

- Cave maps
- Maps showing locations of water and sewer pipes
- Previous reports about the site

References will be sought from state and federal agencies, and local caving organizations. Pertinent information from these resources will be transferred to a working base map for planning of the subsequent field survey.

2.3 Karst Hydrogeologic Inventory

The field survey for the Karst Hydrogeologic Inventory will be conducted under conditions ranging from moderate to high flow during a wet period such that the dominant resurgence points are active. The survey will be conducted by walking or floating all streams and associated impoundments (lakes, ponds) in the study area to visually identify karst features including but not limited to:

- Springs
- Soil springs
- Seeps
- Sinkholes
- Swallets
- Karst windows
- Sinking streams
- Caves

The features will be located on a 7.5-minute series topographic map. Each feature will be given a name and a unique inventory number. General information and physical characteristics of the feature will be recorded on the Karst Feature Inventory Form. The physical characteristics of resurgence point water will include a measurement of the discharge volume and measurement of the discharge temperature, specific conductance, and pH. The feature will be photographed to complete the inventory record.

Precise vertical and horizontal locations of the key resurgence points and any features potentially indicating groundwater elevations will be surveyed. Elevations will be measured to the nearest 0.01 foot referenced to the National Geodetic Vertical Datum of 1929 or local datum as available.

The equipment needed for the field survey includes the following:

1. Base maps and air photos for plotting features (7.5 minute topographic quadrangles)
2. Inventory forms
3. Meters for the measurement of temperature, pH, and specific conductivity
4. Decontamination kit
5. Camera for taking two photos of each spring and surface stream location (one from about 10-15 feet and one from about 100 feet)
6. Flagging to mark features for surveying and/or monitoring

7. A 200-foot tape measure for locating features and measuring stream reaches

8. Flow Probe, stream velocity meter, for taking a quick measurement of spring discharge. This is a current meter on a stick. We measure the spring velocity at one to three locations and measure the width and depth with a retractable carpenter's tape (it should not take more than 3 minutes to take this measurement).

9. Thigh-high rubber waders for walking streams

2.4 Background Fluorescence Investigation

The Background Fluorescence Monitoring task will involve the monitoring of resurgence points and streams in the study area for background concentrations of dye from previous dye traces, pollution, and natural interference. As part of this effort, local, state, and federal agencies will be contacted to inquire whether they have recently conducted, are conducting, or plan to conduct a dye trace study in the study area or any area potentially influencing the study area. The results of the monitoring will be used to evaluate the appropriate dyes and dye concentrations to be used if the dye tracer investigation is needed.

Dye receptors will be placed at or shortly after the time of the hydrogeologic inventory and will be retrieved after a period of approximately one week. Because of background fluctuation, particularly in urban and/or industrial areas, it may be necessary to measure background weekly over a two or three week period. All monitoring activities will be conducted in accordance with the Dye Receptor Deployment and Retrieval Procedures (Section I) and the Quality Assurance Quality Control Plan (Section II).

The receptors will consist of small packets constructed of fiberglass screen mesh with activated coconut charcoal in one chamber and a bundle of unbleached cotton in the other. The receptors will be secured in the main flow of the stream or resurgence point using a system of floaters and sinkers as needed with black nylon twine (for low visibility). In small springs or streams, the channel may be altered by moving rocks or by other minor means in order to maximize flow past the receptor. In shallow water, the receptors may be shielded to minimize photochemical decay of dyes in the sunlight. Receptors will be secured so that they can be retrieved under high water conditions.

Upon retrieval, each dye receptor will be washed off in the stream, placed in a clearly labeled, sealable, plastic bag, and stored in a cooler to reduce exposure to sunlight. The receptors will be delivered to the analytical laboratory (Crawford & Associates Laboratory) for analysis. The receptors will be prepared in accordance with the QA/QC plan (Section II) and analyzed for the presence of dyes that may be used during the Phase II investigation. The dyes most often used by Crawford and Associates are:

- **Fluorescein** (Acid Yellow 73)
- **Eosine** (Acid Red 87)

- **Rhodamine WT** (Acid Red 388)
- **Tinopal CBS-X** (Fabric brightening agent 351)
- **D&C Red #28**
- **D&C Green #8**
- **Lissamine FF**
- **Sulphorhodamine B** (Acid Red 52)
- **Solophenol 500%** (Direct Yellow 96)
- **D&C Red #3**
- **Palanil Luminous Red G**

2.5 Matrix Interference Investigation

A matrix interference investigation may be needed previous to selection of the dye or dyes to be used. This involves a laboratory investigation to measure the potential impact of chemicals in the groundwater on the dye concentration, the absorption of the dye by the charcoal or the release of dye from the charcoal during elution. Section V outlines the procedures used to conduct this investigation.

2.6 Hydrogeologic Investigation and Lineament Analysis

An investigation of the geology of the study area will be made. This will include a review of literature, geologic maps and well logs and a field investigation. The field investigation is necessary to confirm the accuracy of the geologic map and to identify important geologic features not on the map, such as joint sets, prominent bedding plane partings, chert or shale beds that might constitute confining layers, etc.

A lineament analysis will be performed for the area within and surrounding the study area. Lineaments and fracture traces will be identified from topographic and geologic maps, the county soil atlas and aerial photographs. This information combined with field measurements of joints, strike and dip, etc. will provide indicators of possible groundwater flow routes. It will also provide important information for locating monitoring wells if needed. A map will be prepared showing the lineaments identified in the area.

2.7 Mapping of Potentiometric Surface of the Uppermost Karst Aquifer

All accessible water wells and monitoring wells in the area will be measured during a dry period and the depth to water subtracted from the ground surface elevation. The ground surface elevations will be measured to 0.01 foot by leveling from benchmarks. In addition to wells, the elevations of springs, karst windows and selected points along streams and lakes will also be measured by leveling. These elevations and terrain features, such as, topography, sinkhole distribution, sinking streams, cave locations, etc. will be used to construct a map of the water table for the uppermost aquifer. If sufficient wells are available, it may be possible to delimit groundwater basin divides.

2.8 Preparation of Maps and Report

A) A Phase I report will be prepared that will discuss the following:

1. Previous research
2. Hydrogeologic inventory
3. Lineament analysis
4. Potentiometric surface
5. Background fluorescence
6. Hydrogeology
7. Karst groundwater basins
8. Hypothesized groundwater flow from site to a spring or springs
9. Hypothesized movement of contaminants within the aquifer.

B) A report that will discuss whether a Phase II dye tracer study is needed or not.

C) If a Phase II dye tracer study is needed then a detailed work plan will be prepared outlining all aspects of the Phase II investigation.

3. PHASE II: SCOPE OF WORK

A more detailed Scope of Work for the Phase II Dye Trace Investigation will be prepared, if needed, as part of the Phase I Karst Investigation. The following is a general outline of the research procedure to be used. The Phase I Karst Investigation will result in all the preliminary work for the dye trace including:

a) Karst Hydrogeologic Inventory
b) Hydrogeologic Investigation and Lineament Analysis
c) Mapping of the Potentiometric Surface
d) Background Fluorescence Investigation.

Also, the kinds and quantities of dyes will have been determined as part of the Phase I investigation as well as the selection of all dye receptor locations.

3.1 Background Fluorescence

Unless the dye trace can be started within two weeks of the collection of the background dye receptors for Phase I, a second Background Fluorescence Investigation will be necessary. Since background fluorescence can change, it is important to know the background fluorescence the week previous to dye injection. Because of background fluctuation, particularly in urban and/or industrial areas, it may be necessary to measure background levels weekly over a two or three week period, previous to dye injection

3.2 Class V Injection Well Permit

In Tennessee, the injection of a dye into subsurface waters requires authorization as a Class V Underground Injection Well from the Tennessee Division of Water Supply (TDWS). Therefore, the appropriate application will be made to TDWS and written authorization received from that agency prior to the initiation of any injection of dye at a site in Tennessee. In Kentucky, the Kentucky Division of Water must be notified in advance of the trace. In other states, the State Division of Water will be contacted and permission obtained from the appropriate state agency previous to dye injection.

3.3 Dye Injection

After the completion of the analysis of the background dye receptors, and the placement of dye receptors in all springs, karst windows, cave streams, lakes, surface streams, monitoring wells and selected water wells, dye will be injected directly into a sinking stream, sinkhole, well, or hole excavated in the soil.

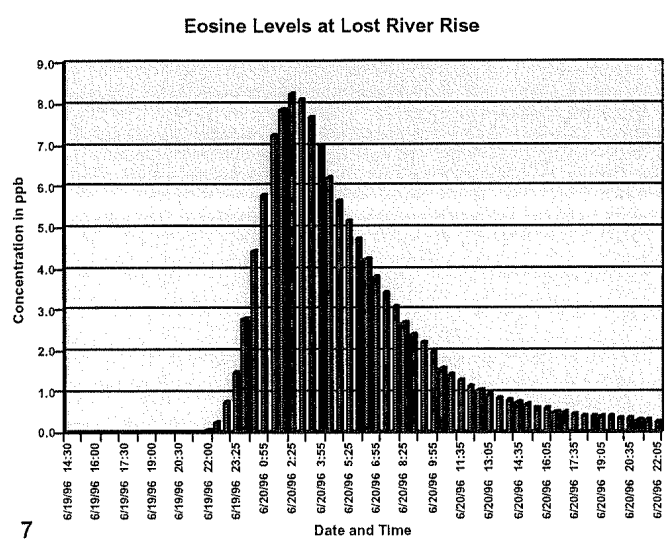
If a sinking stream or sinkhole can be located in the appropriate place for dye injection, it will be used. However, it is usually necessary to either dig a dye injection pit with a backhoe or drill an injection well. If it is more than about 17 feet to bedrock, then an injection well will be the only choice. It may not be necessary to drill a new well, however. Capacity tests can be performed on all existing monitoring wells, and if they will take water at a sufficient rate for dye injection and flushing, then it may be possible to use one or more of them for dye injection. If not, then it will be necessary to drill an injection well (which could also serve as a monitoring well). The well or wells will be drilled at sites where there is a good chance of intersecting a karst conduit. Such sites are where lineaments intersect, or where geophysical techniques (microgravity or natural potential) have identified them as favorable. Water from a hose or a water truck will be used to flush the dye past the soil into a bedrock crevice that leads to a cave stream. Usually about 500 gallons of water are injected into the hole or well to make sure that it drains sufficiently and to wet the soil so that less dye will be sorbed by clays. The dye is then injected and flushed with at least 2,000 gallons of water. Usually three or four dye traces can be performed simultaneously by using different dyes.

3.4 Dye Receptor Placement and Retrieval

Activated coconut charcoal and unbleached cotton dye receptors will be retrieved and fresh ones installed weekly (usually within 4 to 10 days depending on weather and other factors). If time-of-travel data are needed, they may be exchanged more frequently during the first two weeks. Additional information about dye receptor construction, placement, retrieval and transport is included in Section I Usually, dye receptors are exchanged weekly for at least two months after the first detection of dye at a spring. This is necessary to allow sufficient time for the dye to reach other receptor locations. If the karst aquifer has turbulent flow through well-developed bedrock conduits, the dye will usually resurge from a spring or springs within one week. However, if the dye must travel through a laminar flow, porous-media aquifer, even for a short distance, it could be months before the first arrival of dye at a spring.

3.5 Quantitative Dye Trace

This involves installing ISCO automatic water samplers at the hypothesized spring or springs. The collected samples are then analyzed on a Shimadzu spectrofluorophotometer RF 5301PC. This provides a graph of the complete dye breakthrough curve at the spring or springs (Figure 3.5.1). A quantitative trace is often performed simultaneously with the qualitative dye receptor trace. It provides more definitive proof of dye flow to a spring since the dye



concentration in the water is measured during the entire passage of the dye cloud as it flows from the spring. A quantitative trace is usually perform if there is a chance of litigation in the courts and/or if very important decisions are to be made based on the results of the dye trace.

3.6 Laboratory Analysis

Dye receptors and water samples will be analyzed at the Crawford and Associates Laboratory. The procedures used in the dye analysis and the QA/QC Plan are described in Section II.

3.7 Report, Map of Groundwater Flow and Cross-Sectional Profiles

The results of the Phase II Dye Tracer Investigation will be presented in the form of a report and a map showing the generalized route taken by the dye or dyes from the injection site or sites to a spring or springs. The potentiometric map will be used to estimate the route of the dye through the karst aquifer from the injection site to the spring or springs. Figure 3.7.1 is an example of a finished map containing dye receptor locations, potentiometric surface, dye trace results, and groundwater drainage divides. Cross-sectional profiles will be created so that relations can be made between the geology, hydrology and dye trace data. Figure 3.7.2 is an example of a cross-sectional profile along a traverse.

SECTION I

DYE RECEPTOR DEPLOYMENT AND RETRIEVAL

DYE RECEPTOR DEPLOYMENT AND RETRIEVAL

1. Receptor Construction

The receptors will consist of small packets constructed of vinyl-coated fiberglass screen mesh. The mesh is folded and stitched with monofilament nylon thread to form two enclosures, one for a bundle of unbleached cotton, and the other for 10 grams of activated coconut charcoal. The cotton will contain no dyes, softeners, chemicals, binders, or optical brighteners. Receptors will be prepared in advance in a dye-free environment and individually packaged in sealed polyethylene bags.

2. Grab Sample Vials

Grab sample vials are made of borosilicate glass suitable for fluorometric analysis. The caps used are PTFE lined to prevent contamination by fluorescent molecules that can leech out of standard rubber-lined caps.

3. Receptor Placement

Receptors (along with the grab sample vials) will be sealed in a polyethylene bag inside a cooler or other watertight container under chain-of-custody procedures for transportation to the site. The detectors will be inspected for signs of damage prior to deployment. Disposable latex gloves will be worn when handling the receptors in order to avoid transferring dyes from clothing and other items. Fresh gloves will be used for the placement of each receptor.
The receptors will be deployed in the water flow of the stream or resurgence point to be monitored. The receptors will be secured using a system of weights, floats, and tethers as necessary to secure the receptor in a location where flow past the receptor is maximized and exposure to sunlight is minimized. In areas accessible to the public, it may be necessary to make the receptor anchoring system inconspicuous in order to avoid tampering. In small springs or streams, the channel may be altered by moving rocks or by other minor means in order to maximize flow past the receptor. In shallow water, the receptors may be shielded to minimize photochemical decay of dyes in the sunlight. Receptors will be secured so that they can be retrieved under high water conditions.

Two dye receptors will be deployed at separate nearby locations at all key resurgence and stream points and at any site accessible to the public. This provides a backup in the event that the primary receptor is lost or stolen. Duplicate receptors from 10 percent of the receptor locations will be analyzed to evaluate quality control.

4. Receptor and Grab Sample Retrieval and Transport

When retrieving the receptor, the condition of the stream or resurgence point will be carefully examined for the presence of dye or evidence of tampering or other disturbance. The receptor will be retrieved from the spring by means of its tether. Where wading is necessary, the receptor will be approached from downstream and rubber boots will be thoroughly decontaminated prior to reuse. Disposable latex gloves will be worn during handling of each receptor, even if it is a duplicate receptor. The receptor will be rinsed in the water from which it was removed to clean it of accumulated sediment. The receptor will be placed in a labeled, sealable, polyethylene bag. The grab sample will be taken from the location the dye receptor was occupying prior to collection. If this is not feasible, then the sample should be taken from a location as close to the receptor as possible. The vial is then placed in the same bag as the dye receptor and placed in a closed container to shield it from sunlight. The receptor bag will be labeled (with a permanent ink marker) with the following data:

- Project name
- Sample identification numbers (derivative of the inventory number)
- Name of monitored point
- Date and time of retrieval
- Initials of staff collecting the receptor

Dye absorbed onto charcoal receptors is extremely stable at ambient temperatures. Retrieved receptors will be transported under chain of custody procedures at ambient temperatures in a dark, sealed container, such as a sample cooler. If holding time of the receptors is more than 24 hours they will be refrigerated to prevent mold growth.

SECTION II

LABORATORY PROCEDURES

AND

QUALITY ASSURANCE/QUALITY CONTROL PLAN

LABORATORY PROCEDURES
AND
QUALITY ASSURANCE/QUALITY CONTROL PLAN

1. Sample Custody

Water samples and charcoal and cotton dye receptors are received via overnight courier. Chain-of-custody forms (Figure 1.1) are signed and the project name, date and time of arrival are

Crawford and Associates, Inc

* *Groundwater Hydrologists, Geologists, Environmental Scientists*

* *Laboratory Services*

CHAIN OF CUSTODY RECORD

Project Name and Location

in association with

Company Name

Relinquished by (Signature)	Date	Received by (Signature)	Date
Representing:	Time	Representing:	Time
Relinquished by (Signature)	Date	Received by (Signature)	Date
Representing:	Time	Representing:	Time

DR	GS	Station ID	Event	Feature Name	Date	Time	Initials	Preservation Method	Comments

Figure 1.1

recorded in a bound laboratory logbook. One copy of the chain-of-custody form is added to the laboratory custody records and a second copy is taped to the sample container and locked in a refrigerator. Water samples collected with an ISCO Automatic Water Sampler are kept in the sampler bottom, which is custody sealed and noted on the Chain-of-custody form.

2. Sample Storage

Samples are kept in a locked refrigerator in a laboratory to which no one but laboratory personnel have access.

3. Documentation

Each dye receptor is kept in its original, labeled, sealed, polyethylene, zip-lock bag until it is removed from the refrigerator. The bags are opened one at a time and the receptor removed. It is washed in a high-speed jet of tap water to remove excess sediment, a typed laboratory identification tag containing the project name, site location number and collection date are stapled to it and it is then placed in an oven. A tag with the project name, site location number and collection date is attached to each water sample bottle. The bottles are then placed in a container labeled with the project name and collection date. ISCO Automatic Water Sampler bottoms are opened and the Quantitative Dye Trace form (Figure 3.1) is removed and inspected.

Crawford and Associates, Inc

* *Groundwater Hydrologists, Geologists, Environmental Scientists*
* *Laboratory Services*

ISCO AUTOMATIC WATER SAMPLER CHAIN OF CUSTODY FORM

Job: _____ Site: _____
Time: _____ Day: _____ Date: _____
Sampler Bottles Changed by: _____

Sample #1 Time: _____ Day: _____ Date: _____
Sample #2 Time: _____ Day: _____ Date: _____
Last Sample # Time: _____ Day: _____ Date: _____
Smapling Interval: _____ hours
Battery Status: _____ Battery Last Changed on: _____
Staff Gage Reading: _____
NOTES: _____

Note: This form must be attached to ISCO Sampler Bottom Carrying Case at all times. Replace with new form after washing bottles.

Relinquished by (Signature)	Date	Received by (Signature)	Relinquished by (Signature)	Date	Received by (Signature)
Representing:	Time	Representing:	Representing:	Time	Representing:
Relinquished by (Signature)	Date	Received by (Signature)	Relinquished by (Signature)	Date	Received by (Signature)
Representing:	Time	Representing:	Representing:	Time	Representing:

Figure 3.1

4. Instrumentation

After the elution of the activated charcoal receptors, the elutant is analyzed quantitatively for dye on a Shimadzu Model RF 5301PC scanning spectrofluorophotometer (Figure 4.1). Water samples are also analyzed on the Shimadzu Model RF 5301PC. The unbleached cotton dye receptors are analyzed qualitatively for Palanil Luminous Red G, Tinopal CBS-X and Direct Yellow 96 under a long-wave ultraviolet light.

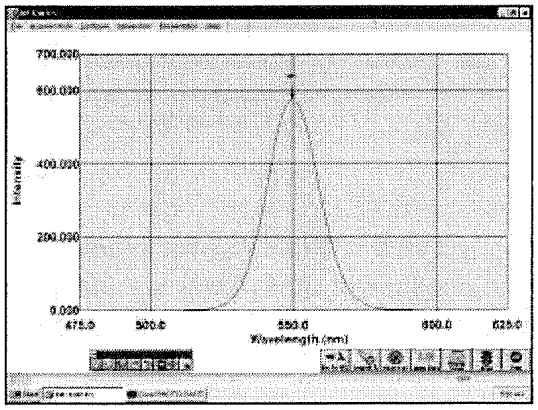


Figure 4.1

5. Charcoal Testing

5.1 Preparation

1. Charcoal dye receptors are washed under a high-speed jet of tap water to remove as much sediment as possible.

2. A typed label containing the site location name, sample number, and date of collection are stapled to each receptor.

3. The receptors are placed in an oven and dried for 12 hours at 120° C.

4. 0.5 grams of charcoal is weighed and placed into a disposable plastic container that is labeled with the sample identification number.

5. The remainder of the charcoal is returned to its original zip-lock bag and, along with the cotton receptor, stored until the dye trace investigation is complete.

6. 5.0 ml of Smart solution (an eluent consisting of 1-propanol 100% assay, distilled water, and ammonium hydroxide 28-30% assay mixed at a ratio of 5:3:2) is added to the charcoal and the plastic container is capped.

7. After 30 minutes, all of the elutant is transferred into a KIMAX®51 borosilicate glass test tubes that is then sealed with a polypropylene cap.

8. The sample trays are then placed in a constant temperature bath, covered to prevent photochemical decay and allowed to equilibrate to the 30° C analysis temperature.

9. The test tube is then placed in the Shimadzu RF 5301PC spectrofluorophotometer for analysis by synchronous scanning.

5.2 Analysis

Analysis on a scanning spectrofluorophotometer provides the lowest detection limits and most reliable dye analysis. For a typical analysis for Tinopal CBS-X Direct Yellow 96, Fluorescein, Rhodamine WT, Eosine, FD&C Red 3, D&C Red 28 or Sulphorhodamine B, a synchronous scan is performed where the excitation and emission monochromators are kept at a fixed wavelength separation during the scan. The emission spectra from the synchronous scan is displayed on the monitor and plotted on a laser printer (Figure 5.2.1). The printout has the file number, sample identifier, job name, date collected and scanning parameters at the bottom of the page. If the scan indicates positive results for fluorescent dye, a second printout is made utilizing spectrum integration and calibration curves stored in the computer to determine the concentration of the dye in question (Figure 5.2.2). If the emission spectra from two or more dyes overlap, then the spectra for each dye is separated by use of a non-linear curve-fitting computer program specifically designed for spectral separation (Figure 5.2.3). Spectrum integration and calibration curves stored in the computer are then used to determine the concentration of each individual dye present in the sample. For a sample where the concentration is approaching the quenching threshold, serial dilutions are made until it can be scanned without quenching occurring.

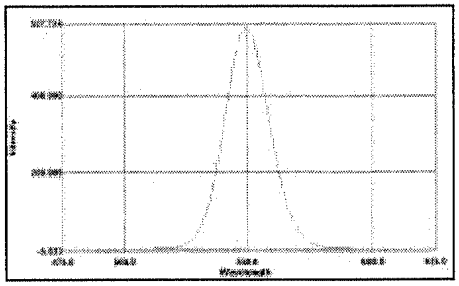


Figure 5.2.1

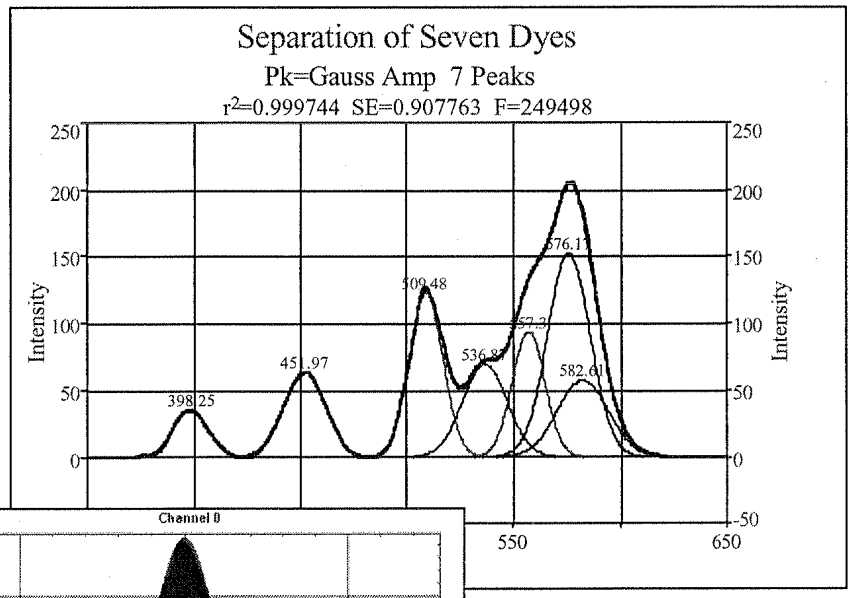


Figure 5.2.3

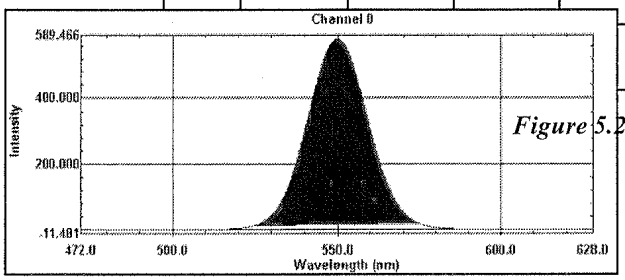


Figure 5.2.2

When certain dyes present in a sample interfere with the identification of others, one or more of the interfering dyes will be

selectively destroyed in that particular sample. When a sample is being analyzed for D&C Red #28 and Sulphorhodamine B simultaneously, anytime a peak is present in the appropriate wavelength range, the sample will be modified in order to separate the two peaks further. Other types of special analyses include Stoke's Shift variation, excitation spectrum scans, and emission spectrum scans.

6. Water Sample Testing

6.1 Preparation

1. Water samples are removed from locked refrigerator.

2. A typed laboratory identification tag containing the project name, site location number and collection date is taped to each sample bottle.

3. A 3.0 ml aliquot is withdrawn fom the bottle using a disposable polyethylene pipette and placed into a KIMAX®51 borosilicate glass test tube which is then sealed with a polypropylene cap.

4. The sample trays are then placed in a constant temperature bath, covered to prevent photochemical decay and allowed to equilibrate to the 30° C analysis temperature

5. The test tube is then placed in the Shimadzu RF 5301PC spectrofluorophotometer for analysis by synchronous scanning.

6.2 Analysis

The analysis for water samples is performed by synchronous scanning on the spectrofluorophotometer. The synchronous scanning technique is similar to the analysis for eluted charcoal samples with the scanning parameters adjusted to compensate for shifts in the excitation and emission maximum wavelengths as well as differences in the Stoke's shift caused by the differences in pH and polarity of water as compared to elutant. The emission spectra from the synchronous scan is displayed on the monitor and plotted on a laser printer. The printout has the sample identifier, job name, date collected and scanning parameters at the bottom of the page. If the scan indicates positive results for fluorescent dye, a second printout is made utilizing spectrum integration and calibration curves stored in the computer to determine the concentration of the dye in question. If the emission spectra from two or more dyes overlaps, then the spectra for each dye is separated by use of a non-linear curve-fitting computer program specifically designed for spectral separation. Spectrum integration is then used to determine the concentration of each individual dye present in the sample. For a sample where the concentration is approaching the quenching threshold, serial dilutions will be made until it can be scanned without quenching occurring.

7. Cotton Testing

Cotton dye receptors are washed under a high-speed jet of tap water to remove as much mud as possible and then observed under a long-wave ultraviolet light and visually compared to cotton standards for Palanil Luminous Red G, Direct Yellow 96 and Tinopal CBS-X. The cotton receptors are removed from the original, labeled, sealed, polyethylene bag one at a time, analyzed under the ultraviolet light, and then immediately returned to the zip-lock bag. Any cotton sample found to be positive for dye is placed in a freezer to prevent the dye from being broken down by microorganisms and stored until the dye trace investigation is complete.

8. Dye Quantification

8.1 Standards

The standards for analysis of water samples are prepared in distilled water. Standards for eluted charcoal sample analysis are prepared in the eluent to be used for eluting the dye from the charcoal. This is usually the Smart solution since research by Crawford and Associates (Turner, 1993) indicates that it elutes more dye from the charcoal than other eluents tested. The dye concentration in the dye sample used for standard preparation is based upon the dye assay figures provided by the dye manufacturer. Crawford and Associates, Inc. contacts the dye manufacturer and obtains the exact figures each time standards are made.

8.2 Notes on Dye Quantification

Dye concentrations are expressed in ppb. Although the dye concentration in water samples expressed in ppb is an accurate quantitative measurement of the amount of dye in the stream at the time the sample was collected, the same is not true for the eluted charcoal samples. It is only semi-quantitative compared with the actual quantity of dye in the water passing over the receptor. The quantity of dye absorbed by the charcoal is a function of the dye concentration in the water and the quantity, velocity, temperature and duration of exposure. Turbidity and the quantity and species of molecules competing with the dye for the charcoal acceptor sites can reduce the quantity of dye absorbed onto the charcoal. Also, the quantity of dye eluted from the charcoal is dependent on the amount of charcoal and eluent used, the type of eluent, whether the charcoal is wet or dry before elution, and the length of time the charcoal is eluted before being analyzed. The laboratory procedures can be standardized but the exposure variabilities while the receptor is in the stream cannot be. Although, dye concentrations for eluted samples are measured and recorded in ppb, these values will virtually always be much higher than the dye concentrations ever reached in the stream. Also, because of the several water exposure variables, the concentration of dye absorbed by the charcoal does not even accurately represent the quantity of dye that flowed in the stream past the dye receptor. Analysis of two dye receptors placed in the same general area of the same stream for the same time period will often result in large differences when expressed in ppb. Therefore, the

9. Criteria for Interpreting Results of Synchronous Scanning

Interpretation of dye tracing data is not the same as interpreting the results of chemical analyses. Background levels of dye are often present above the quantitation limits of the fluorescent dyes used for tracing. One of the reasons for these background levels is due to the commercial use of the various dyes used for tracing. Non-toxic fluorescent dyes are rare. For this reason, the dyes used for tracing can often be found in products ranging from food coloring to toilet bowl cleaners. Another reason for these background levels is the extremely low detection limits of fluorescent dyes. Virtually any tracer will have background levels if one can measure at very low concentrations. Figure 9.1 is a histogram of dye levels from an actual dye trace where background dye was present. This particular dye was not even used for the trace, nor had any other dye trace been performed in this area in the past. Background levels often fluctuate more in karst aquifers and to this end, Crawford and Associates developed a standard protocol used to determine what is background, what is positive, and what is negative (non-detect). This protocol is based upon the results of over 900 dye tracer investigations Dr. Crawford has performed over the last 20 years. It has been used for dye tracer studies at numerous State and EPA Superfund sites as well as at Industrial Sites.

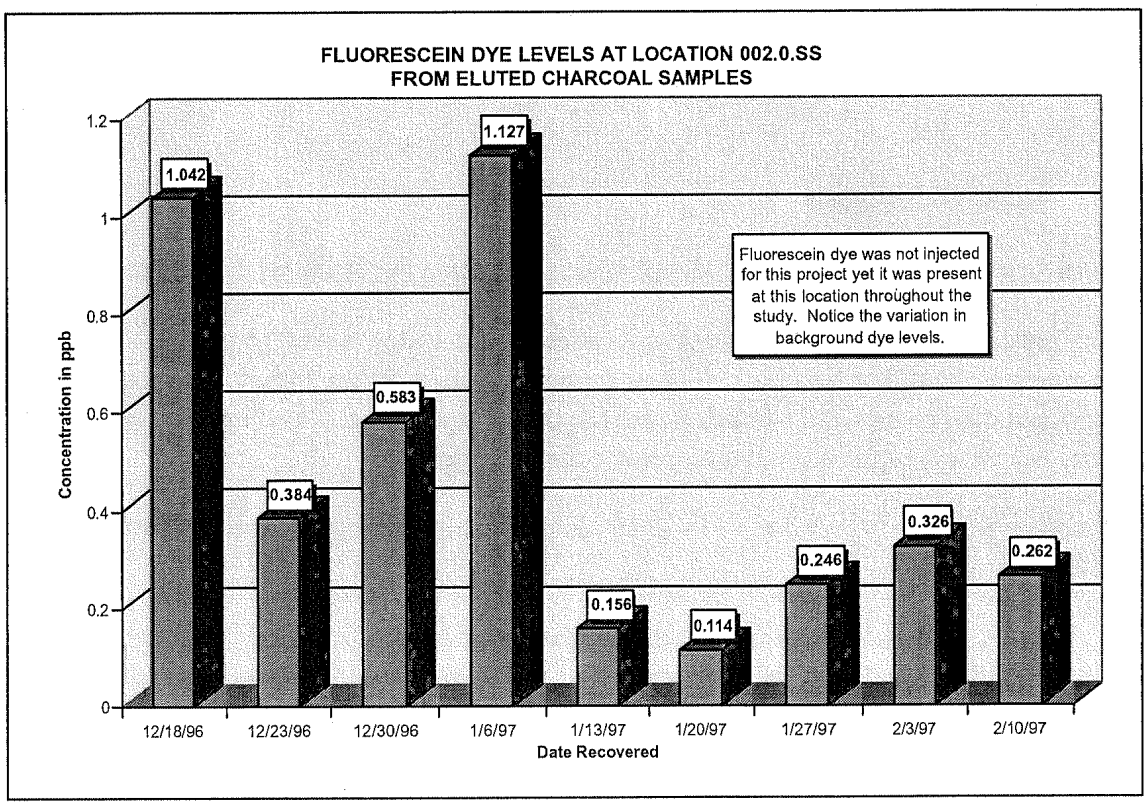


Figure 9.1

9.1 Background Samples

In order for background fluorescence to be recorded, it must meet the following conditions:

I. The recorded peak of the curve must be within + or - 5 nm for Fluorescein, Eosine, FD&C Red 3, D&C Red 28, Rhodamine WT and Sulphorhodamine B and within + or - 10 nm for D&C Green 8, Direct Yellow 96 and Tinopal CBS-X (Optical Brightener). The only times exceptions may be made are:

   A. A water sample collected at the same location verifies the presence of the dye in question.

   B. The emission spectra from one dye overlaps the excitation spectra of another dye, causing a shift in peak position.

II. The determined concentration for each dye must be greater than or equal to the quantitation limit.

III. The shape of the curve from the synchronous scanning must be the characteristic symmetrical shape of each particular dye as determined from its laboratory standard.

9.2 Regular Samples

Non-Detect Results (ND)- No dye detected at or above the determined quantitation limit.

Background Results (B)- Any sample which has a concentration greater than or equal to the quantitation limit, but less than 10 times the concentration of the highest background dye receptor analyzed shall be reported as Background (B) on the report sheet. Also included is any sample that does not meet the qualification for a positive result designation.

Positive Results (+, ++ or +++)- Any sample that is determined to be positive must meet the following criteria:

I. The recorded peak of the curve must be within + or - 5 nm for Fluorescein, Eosine, FD&C Red 3, D&C Red 28, Rhodamine WT and Sulphorhodamine B and within + or - 10 nm for D&C Green 8, Direct Yellow 96 and Tinopal CBS-X (Optical Brightener). The only times exceptions may be made are:

   A. A water sample collected at the same location verifies the presence of the dye in question.

   B. The emission spectrum from one dye overlaps the excitation spectra of another dye, causing a shift in peak position.

II. The determined concentration for each dye must be greater than or equal to 10 times the quantitation limit. This means that for a dye with a quantitation limit of 0.01 parts per billion, no sample can be designated Positive (+) unless its concentration is greater than or equal to 0.10 parts per billion.

III. A sample must have a concentration 10 times the concentration of the highest background dye receptor analyzed before being reported as Positive (+) on the report sheet.

IV. The concentration of the dye eluted from the charcoal must display a rise and fall, similar to a dye breakthrough, over a period of time (Figure 9.2.1). Consequently, no location shall

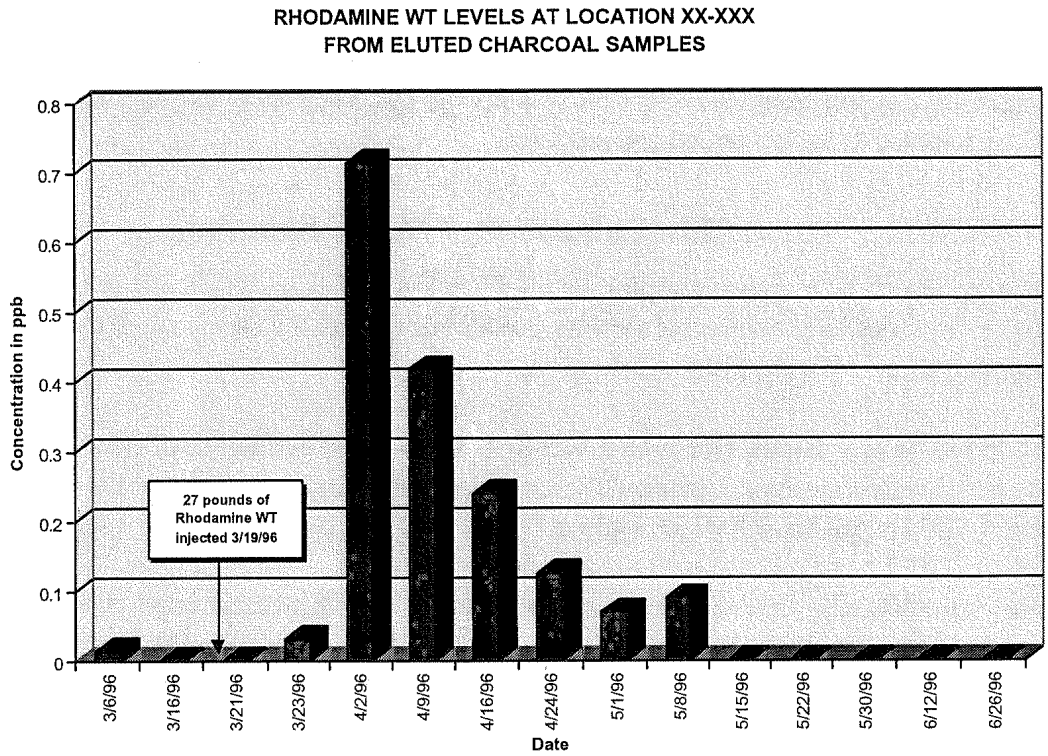


Figure 9.2.1

be called positive if there is only one occasion when the dye concentration met the above criteria. A minimum of two positives is needed in order to say that a particular location had a positive trace. If only one sample qualifies for a positive designation, then the location will either be designated as a potential positive, or the trace will be repeated.

V. The shape of the curve from the synchronous scanning must be the characteristic symmetrical shape of each particular dye as determined from its laboratory standard.

VI. The presence of dye at a particular location must not be attributable to any source other than the dye injected for the purpose of conducting the dye trace.

10. Quality Control Samples

10.1 Field Duplicates

Duplicate dye receptors are placed at 20 percent or more of the sites to be monitored. The second receptor serves as a back-up in the event that the primary receptor is lost or stolen. The secondary receptors are analyzed as duplicates for at least 10 percent of the total dye receptor locations.

10.2 Trip Blanks

At least two trip blanks are prepared in the laboratory and sent along with the new dye receptors to the field. The trip blanks are then kept with the old dye receptors as they are being collected in the field, returned to the laboratory, and analyzed.

11. Laboratory QA/QC Samples

Eluent Blank (for eluted samples only)- Each batch of eluent solution is analyzed for each dye before it is used to elute charcoal samples. Additionally, an eluent blank is analyzed at the beginning, end and every 20th sample throughout the analysis.

Distilled Water Blank (for water samples only)- Each batch of distilled water is analyzed for each dye before it is used. Additionally, a distilled water blank is analyzed at the beginning, end and every 20th sample throughout the analysis.

Charcoal Blank- A sample from each new sealed container of activated charcoal is eluted and analyzed for each dye before the remainder of the charcoal in the container is used. While this type of charcoal does possess fluorescence characteristics, the peaks do not coincide with the peaks for Fluorescein, Eosine, Rhodamine WT, Sulphorhodamine B, Lissamine, Tinopal CBS-X or Direct Yellow 96 in Smart solution.

Raman Scattering Sample- A Raman scattering pattern and signal-to-noise ratio check is performed on the distilled water blank at the beginning and end of each sample set analysis. This is the method recommended by the manufacturer for insuring that the instrument is working within specified parameters and for calibrating the instrument.

Laboratory Control Standards- A low concentration standard, at the quantitation limit for each of the dyes to be analyzed, is analyzed before and after each set of samples. This demonstrates that the Shimadzu is capable of detection at the minimum detection limit and provides data that can be used to determine the accuracy and precision of the analysis. One low concentration standard is also analyzed after every 20 samples.

12. Analysis Order

Analysis will be performed in the presumed sequence of no dye to low dye to high dye concentration as follows:

1. Distilled water blank
2. Eluent blank
3. Laboratory control standard for each dye
4. Trip blank
5. Samples of presumed low concentration
6. Samples of presumed high concentration
7. Distilled water blank
8. Laboratory control standard for each dye

SECTION III

FLUORESCENT CHARACTERISTICS OF TRACER DYES

FLUORESCENCE CHARACTERISTICS OF TRACER DYES

EMISSION WAVELENGTHS FOR DYES

ELUTED SAMPLES

Tinopal CBS-X	398.0 nm
Solophenol 500 (Direct Yellow 96)	458.0 nm
D&C Green #8	498.0 nm
Fluorescein	516.5 nm
Eosine	542 nm
FD&C Red #3	549 nm
D&C Red #28	564 nm
Rhodamine WT	568.5 nm
Sulphorhodamine B	576.5 nm

WATER SAMPLES

Tinopal CBS-X	397 nm
Solophenol 500 (Direct Yellow 96)	450 nm
D&C Green #8	488 nm
Fluorescein	508 nm
Eosine	535 nm
FD&C Red #3	546 nm
D&C Red #28	555 nm
Rhodamine WT	576 nm
Sulphorhodamine B	582 nm

SECTION IV

MATRIX INTERFERENCE INVESTIGATION

MATRIX INTERFERENCE INVESTIGATION RESEARCH PROCEDURES

1. SAMPLE COLLECTION

A water sample will be collected from each monitoring location and dye injection point for which matrix interference testing is desired. The selection of these locations will be based on:

1. pH and conductivity readings
2. Abnormal water color or odor
3. Results of previous analytical testing
4. The size and location of the hydrologic feature.

A water sample volume of at least 500 ml will be taken in a clean, well-labeled container. The label will contain the name and inventory number of the hydrologic feature, the job name, date and time of sample collection, and initials of persons collecting sample. Along with water samples from selected monitoring locations, a 500 ml volume of distilled water will be used as a control mechanism. This control sample will be processed using the same procedures as the matrix interference samples. The control sample will be used to quantify any effects the contaminants may have had upon dyes being tested

2. BACKGROUND DYE LEVELS

The water samples will be tested for background levels of selected dyes by synchronous scanning on a Shimadzu RF-5301 PC Spectrofluorophotometer. A 3 ml aliquot of water from each sample location will be analyzed in accordance with Crawford and Associates' Laboratory Procedures and Quality Assurance/Quality Control Plan (Section II).

3. SPIKED WATER SAMPLES

Standard concentrations of dye with which to spike the water samples will be made. The target spike concentration will be 1 ppb. A standard concentration of 10 ppb for each dye to be tested will be created first. Beginning with the control sample, 90 grams of water from each sample location will be placed in an appropriately labeled flask. Next, 10 grams of 10 ppb dye standard will be added for each dye which testing is desired. This will result in the water samples having a dye concentration of 1 ppb. Only two dyes will be tested in an individual flask. Although all charcoal dyes used by Crawford and Associates can be analyzed for simultaneously, this requires Peakfit analysis, which is very time consuming. Therefore, from one to three flasks containing spiked water samples will be used. The sample flasks will then be agitated to ensure thorough mixing of dye. Afterwards, 3 ml. aliquots will be removed from the labeled flasks with disposable

transfer pipettes and placed in labeled KIMAX®51 borosilicate glass test tubes. These samples will be analyzed in accordance with Crawford and Associates' Laboratory Procedures and Quality Assurance/Quality Control Plan (Section II) to asses what extent the contaminants have impacted the dye in the water.

4. SPIKED CHARCOAL SAMPLES

Charcoal packets containing 1.5 grams of activated coconut charcoal will be placed in each spiked solution. The charcoal packets will remain within the flasks for two hours. They will then be individually removed, processed, and analyzed in accordance with Crawford and Associates' Laboratory Procedures and Quality Assurance/Quality Control Plan (Section II).

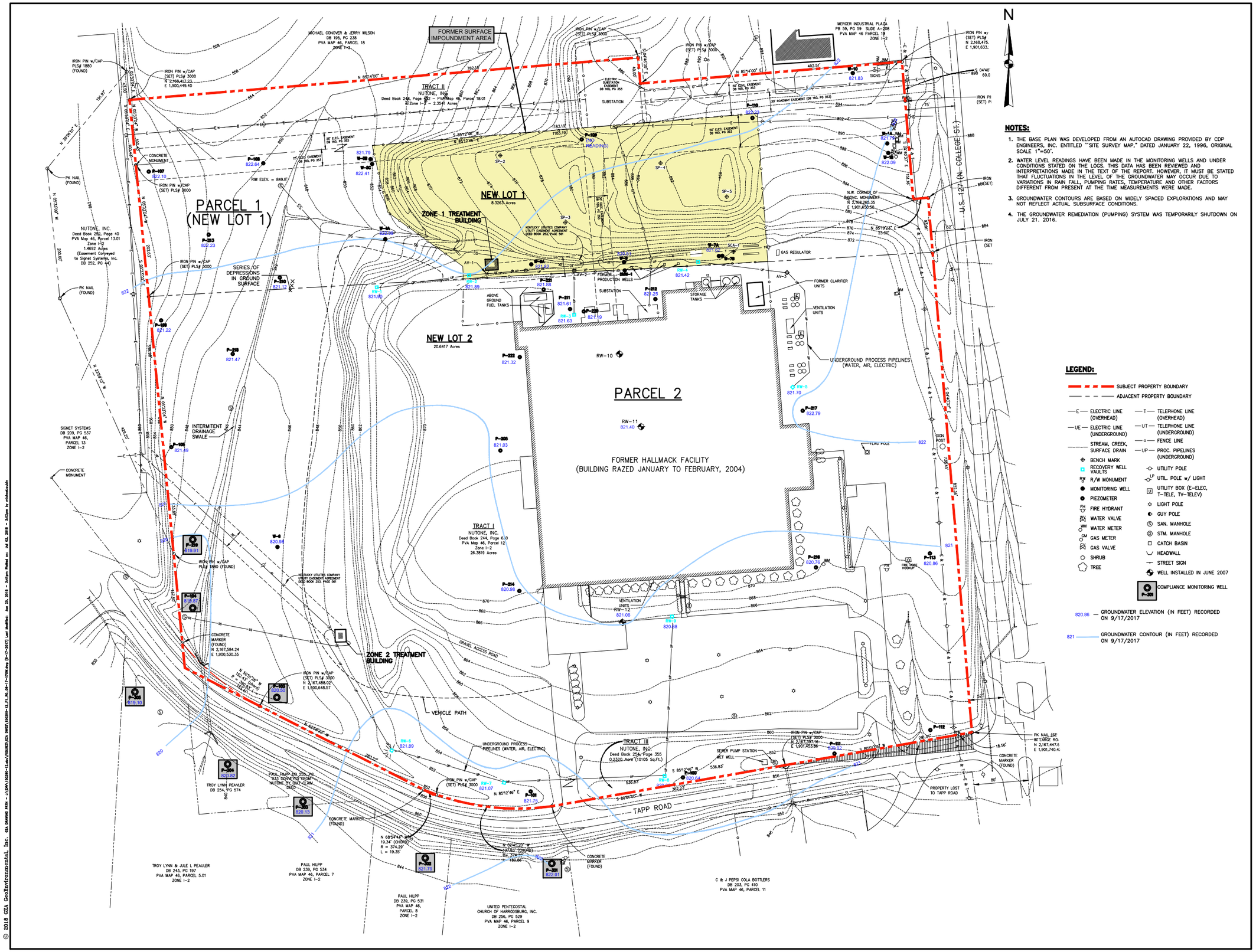
5. RESIDUAL DYE

A 3 ml aliquot of water will be removed from each of the spiked solutions and placed into labeled culture tubes. These will then be analyzed in accordance with Crawford and Associates' Laboratory Procedures and Quality Assurance/Quality Control Plan (Section II). This analysis is performed to obtain the concentrations of dye remaining in the spiked solution after removal of the charcoal.

6. MATRIX INTERFERENCE REPORT

The results from each of the four scanning events will be recorded and plotted. Results are then analyzed to assess the impact of contaminants upon tested dyes. A small report will be generated that addresses the impact of matrix interference on each of the dyes tested. Dye type and quantity injected will be determined, in part, by the information included in this report.

ATTACHMENT VI
SITE PLAN


N
FORMER SURFACE IMPOUNDMENT AREA
PARCEL 1
(NEW LOT 1)
NEW LOT 1
8.3263 Acres
ZONE 1 TREATMENT BUILDING
NEW LOT 2
20.6417 Acres
PARCEL 2
FORMER HALLMACK FACILITY
(BUILDING RAZED JANUARY TO FEBRUARY, 2004)
TRACT I
NUTONE, INC.
Deed Book 244, Page 6.0
PVA Map 46, Parcel 12
Zone I-2
26.3819 Acres
TRACT II
NUTONE, INC.
Deed Book 248, Page 492 – PVA Map 46, Parcel 18.01
Zone I-2 – 2.3541 Acres
TRACT III
NUTONE, INC.
Deed Book 254, Page 355
0.2320 Acre (10105 Sq.Ft.)
ZONE 2 TREATMENT BUILDING
TAPP ROAD
U.S. 127 (N. COLLEGE ST.)
MICHAEL CONOVER & JERRY WILSON
DB 195, PG 238
PVA MAP 46, PARCEL 18
ZONE I-2
NUTONE, INC.
Deed Book 252, Page 40
PVA Map 46, Parcel 13.01
Zone I-2
1.4692 Acres
(Easement Conveyed to Signet Systems, Inc.
DB 252, PG 44)
SIGNET SYSTEMS
DB 208, PG 537
PVA MAP 46,
PARCEL 13
ZONE I-2
TROY LYNN & JULE L PEAULER
DB 243, PG 197
PVA MAP 46, PARCEL 5.01
ZONE I-2
PAUL HILPP
DB 239, PG 534
PVA MAP 46, PARCEL 7
ZONE I-2
PAUL HILPP
DB 239, PG 531
PVA MAP 46,
PARCEL 8
ZONE I-2
UNITED PENTECOSTAL
CHURCH OF HARRODSBURG, INC.
DB 256, PG 529
PVA MAP 46, PARCEL 9
ZONE I-2
C & J PEPSI COLA BOTTLERS
DB 203, PG 410
PVA MAP 46, PARCEL 11
MERCER INDUSTRIAL PLAZA
PB 59, PG 59 SLIDE A-208
PVA MAP 46 PARCEL 19
ZONE I-2
SERIES OF DEPRESSIONS IN GROUND SURFACE
INTERMITENT DRAINAGE SWALE
ABOVE GROUND FUEL TANKS
SUBSTATION
STORAGE TANKS
GAS REGULATOR
FORMER CLARIFIER UNITS
VENTILATION UNITS
UNDERGROUND PROCESS PIPELINES (WATER, AIR, ELECTRIC)
FLAG POLE
SIGN POST
FIRE HOSE HOOKUP
GRAVEL ACCESS ROAD
VEHICLE PATH
SEWER PUMP STATION WET WELL
PROPERTY LOST TO TAPP ROAD
CONCRETE MARKER (FOUND)
PK NAIL (FOUND)
IRON PIN w/CAP (SET) PLS# 3000
IRON PIN w/CAP PLS# 1880 (FOUND)
RM ELEV. = 849.8'
N 85°14'00" E
S 85°14'00" W
N 85°19'23" E
23.60'
N.W. CORNER OF BROVAC MONUMENT
N 2,168,265.35
E 1,901,850.50
KENTUCKY UTILITIES COMPANY UTILITY EASEMENT AGREEMENT DEED BOOK 253, PAGE 561
ELECTRIC SUBSTATION EASEMENT DB 160, PG 353
50' ELEC. EASEMENT DB 160, PG 353
30' ROADWAY EASEMENT (DB 160, PG 353)
25' ELEC. EASEMENT DB 160, PG 353
30' ELEC. EASEMENT DB 160, PG 353
PROPOSED PRODUCTION WELLS
RW-1
RW-2
RW-3
RW-4
RW-5
RW-6
RW-7
RW-8
RW-9
RW-10
RW-11
RW-12
SP-1
SP-2
SP-3
SP-4
SP-5
P-101
P-102
P-103
P-104
P-105
P-106
P-107
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P-136
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P-139
P-140

ATTACHMENT VII
SEPTEMBER 22, 2022 RESPONSE TO NOTICE TO DEFICIENCY

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September 22, 2022
GZA File 20.0150290.00

Ms. April J. Webb, P.E., Manager
Kentucky Division of Waste Management
Hazardous Waste Branch
300 Sower Boulevard
Frankfort, Kentucky 40601

RE: Response to August 10, 2022, Notice of Deficiency
RCRA Post-Closure Permit Renewal Application
Kidde Fenwal Inc., Former Hallmack Facility, Harrodsburg, Kentucky
EPA ID #KYD-081-017-667, AI #48471, APE20180001

Dear Ms. Webb

On behalf of Kidde-Fenwal, Inc., GZA GeoEnvironmental, Inc. (GZA) prepared this response to the Kentucky Division of Waste Management's ("Division") August 10, 2022 Notice of Deficiency (NOD) pertaining to the July 5, 2018, RCRA Post-Closure Permit Renewal Application ("Application") for the Former Hallmack Facility in Harrodsburg, Kentucky (the "Facility"). The NOD is provided in **Attachment 1**.

On April 3, 2020, Kidde-Fenwal, Inc. became a subsidiary of Carrier. Due to the passage of time since the Application was submitted (on July 5, 2018), and as requested in the NOD, a redline copy of applicable portions of the Application is provided in **Attachment 2**. Changes to the Application consist of the following:

1. Cover page, cover letter, and headers on table of contents and text pertaining to dates and contact information;
2. Application Pages 1 and 2 pertaining to filing of the Environmental Covenant;
3. Word changes on Page 6 to updated existing data; and
4. Application Attachment III, Post-Closure Plan, footer (date), contact information in Section 4.0, Page III-3, and clarify bond numbers (page III-4).

Division NOD comments are provided below in *italics*, with GZA's responses following.

Division General Comments

Division General Comment No. 1:

"Several items have been missed from this application, as the Kentucky RCRA Permitting Checklist was not followed. Specific comments below refer to these checklists. Checklists and forms can be found online in the KDEP [Kentucky Department of Environmental Protection] Hazardous Waste Forms Library."

GZA Response to Division General Comment No. 1:

Note that with respect to Part B, with written concurrence from the Division on February 7, 2018 (see **Attachment 3**), the Application was prepared to be consistent with the United States Environmental Protection Agency's (USEPA) 1998 Post-Closure Rule following the requirements of 40 CFR 270.28, in lieu of preparation of a full Part B permit application.

Consistent with the September 15, 2005 Resource Conservation and Recovery Act (RCRA) Post-Closure Permit Renewal Application, and as referenced in the July 2018 Application on Page 1, for post-closure permits, per §270.28, the owner or operator is required to submit only the information specified in §§ 270.14(b)(1), (4), (5), (6), (11), (13), (14), (16), (18) and (19), (c), and (d), unless the Regional Administrator determines that additional information from §§ 270.14, 270.16, 270.17, 270.18, 270.20, or 270.21 is necessary; which was not requested. The RCRA Permit Renewal Application was developed based on the required information specified in the Rule. The Division's October 2020 *Part B-Facility Description Checklist* is provided in **Attachment 4**.

Division Specific Comments

Division Specific Comment No. 1:

"40 CFR Part 270.10 requires that any RCRA permit application contain the information required in 270.13 (known as the Part A Permit Application). A complete Part A consists of the Part A Forms (see the Part A Checklist for a complete listing of the required forms) in addition to the maps, drawings, and photographs as required by 270.13."

GZA Response to Division Specific Comment No. 1:

The Division October 2020 *Part A – Part A Application Forms Checklist,* USEPA *Hazardous Waste Permit Part A Form (8700-23)*, and Division *Part A Application Addendum (EPA Form 8700-23; DWM 7058A (June 2017)*) are provided in **Attachment 5**.

Division Specific Comment No. 2:

"40 CFR Section 270.11 requires the owner/operator must provide signatures signed by an authorized person in the permit renewal application. You can find helpful information about the signatory requirement for RCRA permit applications in the Part L Checklist."

GZA Response to Division Specific Comment No. 2

Division October 2020 *Part L-Signature Checklist* and a cover letter signed by an authorized representative of the Facility owner are provided in **Attachment 6**.

Division Specific Comment No. 3:

"401 KAR 39:120 Section 2 requires the owner/operator to submit a filing fee with the permit renewal application. In addition, Section 3 of this regulation requires the owner/operator to submit appropriate permit review fee. The total required fee for a post closure renewal is $13,000. The check should be submitted to the Kentucky Division of Waste Management, Hazardous Waste Branch, but should be made payable to the Kentucky State Treasurer."

GZA Response to Division Specific Comment No. 3

A check for the $13,000 fee payable to the Kentucky State Treasurer is attached to the hard copy and a photocopy of the check is provided in **Attachment 7**.

Division Specific Comment No. 4:

"Per 40 CFR 270.14(b)(15), incorporated with 401 KAR 39:090 Section 1 and 7, the owner/operator must establish financial assurance for closure of the facility. In addition, 40 CFR 264.143 and 264.151 provide you detail information and submittal requirements. See the Part I Checklist for financial assurance requirements. The application must clearly and accurately state the amounts required, and the mechanisms by which each amount is covered, both for post-closure care and the required non-sudden liability."

GZA Response to Division Specific Comment No. 4:

Financial assurance pertaining to post-closure care actions is presented in the Application, Attachment III – Post Closure Plan, Section 5.0 Post-Closure Cost Estimate, Page III-4. **Attachment 8** includes the following:

1. October 2020 Division *Part I-Closure, Post-Closure Plans and Financial Requirements Checklist*;
2. March 2021 Rider No. 1 to the payment and performance bonds;
3. May 12, 2009, Division acknowledgment and approval of the payment and performance bonds;
4. April 28, 2009 correspondence from United Technologies forwarding the payment and performance bonds to the Division;
5. 2009 copy of the existing *Performance Bond to Demonstrate Closure and/or Postclosure Care* (Bond Number 08966128); and
6. 2009 copy of the *Payment Bond to Demonstrate Liability Coverage* (Bond Number 08966129).

Division Specific Comment No. 5:

"Provide in the revised application a complete list of all SWMUs and AOCs at the site, preferably tabulated, summarizing status for each, declaring if they have been issued NFAs, closure approvals, if they required institutional/engineering controls, etc."

GZA Response to Division Specific Comment No. 5:

A list of SWMUs and AOCs is included as **Attachment 9.** Each SWMU and AOC identified at the Facility were closed prior to the September 15, 2005 RCRA Post-Closure Permit Application and issuance of the 2007 Permit.

We trust this information adequately addresses the NOD. Should you have any questions please contact Tony at 401-374-2317 or via email at anthony.urbano@gza.com.

Sincerely,

GZA GeoEnvironmental Inc.

Anthony Urbano

Anthony B. Urbano
Senior Project Manager

Mark J. Krumenacher, P.G.
Senior Principal

cc: Donald Sorbello, Carrier (via email)
Jamie Schiff, Textron (via email)

Attachments: Attachment 1 - Notice of Deficiency, Dated August 10, 2022
Attachment 2 - Redline Changes to RCRA Post-Closure Permit Renewal Application
Attachment 3 - Division Email, Dated February 7, 2018
Attachment 4 - Division Part B - Facility Description Checklist
Attachment 5 - Division Part A - Application Forms and Signed Addendum
Attachment 6 - Division Part L - Signature Checklist and Signed Cover Letter
Attachment 7 - Photocopy of $13,000 Check
Attachment 8 - Division Financial Requirement Checklist and Copies of Bonds
Attachment 9 - List of SWMUs and AOCs

ATTACHMENT 1

Notice of Deficiency, Dated August 10, 2022

Andy Beshear
GOVERNOR

ENERGY AND ENVIRONMENT CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
300 Sower Boulevard
Frankfort, Kentucky 406 01
Phone: (502) 564 -2150
Fax: 502-564-4245

Rebecca Goodman
SECRETARY

Anthony R. Hatton
COMMISSIONER

August 10, 2022

Donald Sorbello
Remediation Senior Manager
Carrier
13995 Pasteur Blvd.
Palms Beach Gardens, FL 33418

RE: RCRA Post Closure Permit Renewal Application
Former Hallmack Facility, Harrodsburg, Kentucky
EPA ID # KYD-081-017-667, AI # 48471, APE20180001

Dear Mr. Sorbello:

The Kentucky Division of Waste Management (Division) received your Post Closure Permit Renewal Application in July of 2018. This correspondence is the Division's written notice of deficiency (NOD) for the application. Attached is a list of the specific application deficiencies.

In accordance with 401 KAR 39:120 Section 6(6)(a), you have 45 days to satisfy this NOD or request a reasonable time extension for response to the NOD. 401 KAR 39:120 Section 6(6)(b) describes a possible consequence for failure to meet the described deadline. Response to the NOD should include a redline copy of the revised application as well as a Response to Comments document explaining any action taken to each comment. For questions regarding this correspondence, feel free to contact Mr. Sajjad Quabili, P.E. at (502) 782-6457 or at Sajjadur.Quabili@ky.gov.

Sincerely,

8/11/2022

x April J Webb

Signed by: April J Webb

April J. Webb, P.E., Manager
Hazardous Waste Branch
Division of Waste Management

AW/an/km
ec: TEMPO
Richard Thomas, Frankfort Regional Office
William Fortune, GZA GeoEnvironmental, Inc.
EPA Region 4, Carlos Merizalde

Kidde Fenwal Inc, Former Hallmack Facility

Hazardous Waste Post-Closure Permit Renewal

Notice of Deficiency

General Comments

1. Several items have been missed from this application, as the Kentucky RCRA Permitting Checklist was not followed. Specific comments below refer to these checklists. Checklists and forms can be found online in the KDEP Hazardous Waste Forms Library.

Specific Comments

1. 40 CFR Part 270.10 requires that any RCRA permit application contain the information required in 270.13 (known as the Part A Permit Application). A complete Part A consists of the Part A Forms (see the Part A Checklist for a complete listing of the required forms) in addition to the maps, drawings, and photographs as required by 270.13.

2. 40 CFR Section 270.11 requires the owner/operator must provide signatures signed by an authorized person in the permit renewal application. You can find helpful information about the signatory requirement for RCRA permit applications in the Part L Checklist.

3. 401 KAR 39:120 Section 2 requires the owner/operator to submit a filing fee with the permit renewal application. In addition, Section 3 of this regulation requires the owner/operator to submit appropriate permit review fee. The total required fee for a post closure renewal is $13,000. The check should be submitted to the Kentucky Division of Waste Management, Hazardous Waste Branch, but should be made payable to the Kentucky State Treasurer.

4. Per 40 CFR 270.14(b)(15), incorporated with 401 KAR 39:090 Section 1 and 7, the owner/operator must establish financial assurance for closure of the facility. In addition, 40 CFR 264.143 and 264.151 provide you detail information and submittal requirements. See the Part I Checklist for financial assurance requirements. The application must clearly and accurately state the amounts required, and the mechanisms by which each amount is covered, both for post-closure care and the required non-sudden liability.

5. Provide in the revised application a complete list of all SWMUS and AOCs at the site, preferably tabulated, summarizing status for each, declaring if they have been issued NFAs, closure approvals, if they required institutional/engineering controls, etc.

ATTACHMENT 2

Redline Changes to RCRA Post-Closure Permit Renewal Application

Proactive by Design

RCRA POST-CLOSURE PERMIT RENEWAL APPLICATION

FORMER HALLMACK FACILITY
Harrodsburg, Kentucky

Permit NO. KYD-081-017-667

~~July 2018~~September 2022
File No.~~03~~20.0150290.10

PREPARED FOR:
Kentucky Department for Environmental Protection
Division of Waste Management
Frankfort, Kentucky

Prepared By:

GZA GeoEnvironmental, Inc.
~~20900 Swenson Drive, Suite 150 | Waukesha, WI 53186~~
17975 West Sarah Lane, Suite 100 Brookfield, WI 53045

~~28~~ 29 Offices Nationwide
www.gza.com

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~~July 3, 2018~~September 22, 2022
File No. 20.0150290.10

Kentucky Department for Environmental Protection
Division of Waste Management
Frankfort Office Park
14 Reilly Road
Frankfort, Kentucky 40601-1190

Attention: ~~Ms. Ashley Bandy~~April J. Webb, P.E.
~~Project~~ Manager - Hazardous Waste Branch ~~Corrective Action Section~~

Subject: RCRA Post-Closure Permit Renewal Application
Former Hallmack Facility
Harrodsburg, Kentucky
Permit Number KYD-081-017-667

Dear Ms. ~~Bandy~~Webb:

On behalf of Kidde-Fenwal, Inc. (Kidde/ "Permittee"), GZA GeoEnvironmental, Inc. (GZA) prepared this RCRA Post-Closure Permit Renewal Application ("Application") for the Former Hallmack facility ("Facility") in Harrodsburg, Kentucky, Permit No. KYD-081-017-667. The existing Facility permit was issued on February 22, 1996, and was to expire on March 2, 2017; however, the permit renewal was postponed in July 13, 2016, January 19, 2017, and January 2, 2018 letters to UTC from the Kentucky Division of Waste Management (KDWM) to allow for a monitored natural attenuation (MNA) evaluation and was extended to July 9, 2018 in a June 25, 2018 letter to UTC; see References 1, 2, and 3.

The revised Post-Closure Plan, Attachment III to the Permit Renewal Application, which describes the actions to be taken during the effective period of the renewed Permit, was based on the experience of more than 22 years of post-closure care.

As of ~~March 31, 2005~~ April 3, 2020, Kidde-Fenwal, Inc. became a subsidiary of ~~United Technologies Corporation (UTC)~~Carrier. To satisfy the financial assurance and liability requirements of the RCRA Post-Closure Permit, the Permittee will be using performance bond (# 08966128) and liability bond (#08966129), which will be updated upon approval of the new permit.

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We look forward to working with you. Should you have any questions please contact the undersigned at 262-754-2560

Sincerely,

GZA GeoEnvironmental, Inc.

Anthony Urbano
Senior Project Manager

Mark Krumenacher, P.G.
Senior Principal

cc: ~~Ms. Beth Lang~~Donald Sorbello, Carrier
~~Bart Schaffer~~Richard Thomas, Frankfort Regional Office
Jamie Schiff - Textron

1.0 GENERAL DESCRIPTION OF THE FACILITY [§§ 270.14(B)(1)] 1

2.0 DESCRIBE SECURITY PROCEDURES AND EQUIPMENT [§§ 270.14(B)(4)] 4

3.0 GENERAL INSPECTION SCHEDULE [§§ 270.14(B)(5)] 4

4.0 JUSTIFICATION FOR ANY REQUEST FOR WAIVER OF PREPAREDNESS AND PREVENTION REQUIREMENTS 5

5.0 FACILITY LOCATION INFORMATION [§§ 270.14(B)(11)] 5

6.0 COPY OF THE CLOSURE PLAN AND POST-CLOSURE PLAN [§§ 270.14(B)(13)] 5

7.0 DOCUMENTATION THAT POST-CLOSURE NOTICES HAVE BEEN FILED [§§ 270.14(B)(14)] 6

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ATTACHMENTS

ATTACHMENT I FACILITY LOCATION MAP (USGS TOPOGRAPHIC MAP)

ATTACHMENT II FACILITY TOPOGRAPHIC SURVEY

ATTACHMENT III POST-CLOSURE PLAN

ATTACHMENT IV MNA EVALUATION

ATTACHMENT V SEPTEMBER 2005 CONCEPTUAL HYDROGEOLOGIC MODEL

ATTACHMENT VI SITE PLAN

RCRA POST-CLOSURE PERMIT RENEWAL APPLICATION

The Hazardous Waste Management Post-Closure Permit ("RCRA Permit") (No. KYD-081-017-667, issued March 2007) renewal application was prepared on behalf of Kidde-Fenwal, Inc. (Kidde/ "Permittee"), by GZA GeoEnvironmental Inc. (GZA) for the former Hallmack property ("Facility") located in Harrodsburg, Kentucky. The RCRA Permit renewal application was prepared in general accordance with the 1998 Post-Closure Rule (63 Federal Register 56709; October 22, 1998).

With written concurrence from the Kentucky Division of Waste Management (KDWM) on February 7, 2018 (via email Reference 4), the Post-Closure Permit Application was prepared to be consistent with the United States Environmental Protection Agency's (USEPA) 1998 Post-Closure Rule following the requirements of 40 CFR 270.28, in lieu of preparation of a full Part B permit application. For post-closure permits, per §270.28, the owner or operator is required to submit only the information specified in §§ 270.14(b)(1), (4), (5), (6), (11), (13), (14), (16), (18) and (19), (c), and (d), unless the Regional Administrator determines that additional information from §§ 270.14, 270.16, 270.17, 270.18, 270.20, or 270.21 is necessary; which was not requested. The RCRA Permit Renewal Application was developed based on the required information specified in the Rule.

1.0 GENERAL DESCRIPTION OF THE FACILITY [§§ 270.14(B)(1)]

The former Hallmack property (Facility) is comprised of two adjacent parcels of land located at 1010 and 1020 North College Street in Harrodsburg, Mercer County, Kentucky at the approximate location shown on Attachment I. A Facility Topographic Survey is included as Attachment II. The former operations at the Facility included the manufacturing of die cast metal bathroom accessories and other decorative household fixtures from 1968 to 1986. The Facility property has remained vacant since manufacturing ceased and the Facility closed in 1986. Following many years of remedial investigations and corrective actions, the building, exterior structures and pavement were demolished in 2004 (Reference 5).

The 1010 North College Street (southern) parcel is comprised of approximately 21 acres. The 1010 North College Street Lot supported a Groundwater Remediation System (GRS) comprised of groundwater monitoring and extraction wells, associated plumbing and two groundwater treatment buildings.

The 1020 North College Street (northern) Parcel is comprised of approximately 8 acres and includes the fenced area of three former surface impoundments previously used to store wastewater and sludge. Based on reports prepared at the time of closure of the former surface impoundments, the wastewater treatment sludge was removed from the three former surface impoundments to the top of bedrock. Upon removal of the sludge, the impoundment walls (comprised of clay soil) were subsequently graded over the bedrock surface to form a sloping plane, which was then capped with a 5 to 8 feet thick engineered composite cap in accordance with approved closure plans. The engineered composite cap is comprised of a minimum of 4-inches of topsoil, 20-inches of compacted clay, a filter fabric, 12-inch drainage layer of crushed limestone, a 36 ml Hypalon impermeable membrane, underlain by a 24-inch compacted clay liner. Thus, the existing RCRA Permit is for the storage of relatively low permeability clay soil that comprised the former surface impoundment walls and at the time of closure was believed to contain hazardous waste (§§ 261.31 Industry and Hazardous Waste No. F006) by the contained-in rule.

On August 26, 1991, a Notice of Hazardous Waste Activity was placed on the property that gives notice that the property was used for the disposal of hazardous waste (Reference 6). ~~In 2018,~~ Kidde plans on recording ~~plans to record~~ an

Environmental Covenant that will prohibit certain activities to reduce human exposure to hazardous substances in soil and groundwater at the property. The Environmental Covenant will be in substantially the same form as the draft provided in Appendix A of Attachment III. The proposed Environmental Covenant will restrict the use of the property for residential activities, will prohibit the use of groundwater for drinking water or other domestic purposes, will restrict disturbance of the engineered composite cap, will restrict disturbance of soil, will prohibit actions that may cause risk of migration of hazardous substances, and will prevent the construction of any buildings on the property without approval by KYDEP and without adequate vapor intrusion protection.

Former manufacturing operations at the Facility included nickel, copper and chromium electroplating and used trichloroethylene (TCE) as a degreasing solvent prior to metal plating. The rinse water generated in the electroplating process, which was also believed to contain TCE, was treated in the wastewater treatment room and then transferred to surface impoundment No. 1. Metals within the wastewater were precipitated in the surface impoundment and the resulting sludge was transferred to surface impoundment Nos. 2 and 3 for storage. The supernatant from surface impoundment No. 1 was, for a period of time, discharged directly to a ditch present between the impoundments and the building. At a later time, the supernatant was additionally treated within a clarifier prior to discharge to the sanitary sewer. The sludge was stored in surface impoundment Nos. 2 and 3 and during the latter stages of Facility operation, the sludge was dewatered using a filter press and disposed off the Facility property as a hazardous waste (F006).

Based on historical documents for the Facility, the F006 hazardous waste was removed from the former surface impoundments in 1987 following closure plans approved by KDEP in December 1986. The December 1986 closure plan approval specified that the contaminants of concern associated with the former surface impoundments were cadmium, hexavalent chromium, nickel, and/or cyanide. The residual waste present in soil used to construct the impoundments was determined through soil sampling to be limited to those contaminants of concern at concentrations greater than background.

GZA's Former Surface Impoundment Sampling Report (Reference 7), which was submitted to KYDEP on January 6, 2017, included analytical testing of soil samples collected from below the engineered composite cap. The soil samples were analyzed for cadmium, hexavalent chromium, nickel, and cyanide, the only parameters detected at concentrations greater than background concentrations in the soil remaining in the former impoundments following removal of the plating sludge. The only parameter which exceeded US EPA's Industrial Regional Screening Level in the soil samples collected by GZA was hexavalent chromium.

The engineered composite cap prevents exposure to underlying soil to most individuals. Although unlikely, potential construction workers could be exposed to the underlying soil that contains the hexavalent chromium. A limited risk assessment included in the Former Surface Impoundment Sampling Report concluded that the hexavalent chromium concentrations detected were less than the site-specific screening value protective of potential construction workers and emergency /utility workers. To further protect occupants, institutional controls at the Facility (Appendix A of Attachment III) will ~~provide secondary protection to human health by limiting~~ limit land use and activities. GZA concluded that the test results supported a contained-out determination for the soil present beneath the engineered composite cap at the location of the former surface impoundments. In place media such as soil does not meet the definition of solid waste and the risk-based standards, supplemented by a risk assessment, demonstrate that hazardous waste is not present beneath the former surface impoundment cap.

Historically, two degreasers were present below-grade within the former building in concrete-lined pits. An additional degreaser and a solvent still were located above-grade on the concrete floor. Each degreaser used TCE as the degreasing solvent. Tetrachloroethylene (PCE) was also used for cleaning spray-painting equipment. The solvents were stored within

the former building in 55-gallon capacity drums near degreasing and painting operations. Waste solvent was stored in 55-gallon capacity drums on a concrete drum storage pad located outside the western wall of the former building. Additional detail concerning historical manufacturing operations is available in the Engineering Feasibility Study report (Reference 8 – Consoer Townsend Envirodyne Engineers, Inc., September 1995).

Due to the presence of TCE in the groundwater, a remediation system was installed that relied upon nine groundwater extraction wells (design approved by KDWM) to pump small amounts of groundwater for treatment using an air stripper system to reduce chlorinated Volatile Organic Compound (CVOC) concentrations, followed by disposal of the treated water at the City of Harrodsburg Publicly Owned Treatment Works (POTW).

The aquifer is comprised of karst limestone (Tanglewood Member) varying in thickness at the Facility from 30 to 60 feet, however the saturated thickness of the aquifer is less than 10 feet. The karst conduits identified at the Facility through a series of investigations are connected to Humane Spring located 3,300 feet downgradient of the Facility. A 1993 dye tracing investigation at the Facility demonstrated that groundwater can flow from the Facility, through karst conduits, and discharge from the spring within 26 hours. A 1999/2000 dye tracing investigation at the adjacent Modine property observed a similar hydraulic connection between that property and Humane Spring. The flow rate at Humane Spring is flashy and can vary from less than 100 gallons per minute (gpm) to greater than 60,000 gpm. Karst conduits make full hydraulic containment impractical.

The combined average flow rate from the groundwater recovery wells was about 4.5 gpm. The GRS was specifically designed to avoid installation of groundwater recovery wells from karst conduits identified at the property to avoid pumping, treatment and discharge of large volumes of water that contained very low to no concentrations of CVOCs, especially following precipitation events.

The GRS began operation in April 1995 and the nine groundwater extraction wells were operated between 1995 and 2008. In August 2008, three additional extraction wells were installed but only two wells were suitable for use in the GRS (in accordance with a Corrective Action Modification Design report prepared by GZA – Reference 9). KYDEP approved the Corrective Action Modification Design report on April 11, 2008 (Reference 10). The eleven extraction wells were operated until July 2016, when the GRS was shutdown to allow a Monitored Natural Attenuation (MNA) evaluation as approved by KYDEP (References 1-3). During the 21 years of GRS operation approximately 49 million gallons of groundwater was pumped from the aquifer and approximately 99 gallons of CVOCs (predominantly trichloroethene) was removed from the groundwater.

As described in Attachment IV (GZA's MNA Evaluation Report), the investigations and remedial actions performed from the late 1980s through 2005 removed the sources of the contamination from the Facility. Each of the 45 Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) considered potential primary contaminant source areas were identified, their mass reduced to the extent technically feasible, and administratively closed. In addition, approximately 25 remedial technologies were evaluated and discounted as technically not feasible.

Unrelated, off-Site sources of TCE groundwater contamination (i.e., beyond the control of the Permittee) contribute to the surface water contamination at Humane Spring and to groundwater contamination beneath the northwestern portion of the Site and between the Site and Humane Spring. The known off-Site CVOC sources at the adjacent Modine property was partially abated and the residual TCE contamination in soil, bedrock and groundwater are being evaluated. Note that the adjacent property is referenced in various reports for the former Facility as the Signet or Modine property but may be under different ownership at this time.

Greater than 20 years of groundwater remediation had only minimal impact on groundwater quality. Remaining residual CVOC contamination in the subsurface beneath the Facility and Modine in this geology cannot be feasibly and reliably located, targeted with active remedial technologies and removed. While partial CVOC removal was achieved with the previous GRS, that increment of removal may not have been greater than that achieved through natural attenuation over that same period of time and did not necessarily result in significant risk reduction. The inability to achieve groundwater restoration with the GRS which was designed after substantial investigation and studies, was due to the hydrogeological and contaminant factors and is not due to inadequate operation or design of the GRS.

The residual CVOC concentrations in the downgradient compliance wells and Humane Spring are decreasing and the GRS shutdown did not change that trend. There is evidence that natural attenuation occurring at the Facility, we are taking this opportunity to demonstrate and recognize its contribution (Attachment IV). It is GZA's opinion that the existing groundwater remediation system should remain off and replaced with MNA because:

(1) the Facility contaminants are not causing a risk to human health;

(2) the groundwater plume is stable and decreasing;

(3) the naturally occurring groundwater chemistry conditions are amenable to support biological degradation of the groundwater plume;

(4) the TCE concentrations in the downgradient compliance wells and Humane Spring are low and decreasing over time;

(5) since the shut-down of the GRS, there was no rebound in groundwater contaminant concentrations, the predominant contaminant (TCE) decreased in many of the former groundwater recovery wells, and there is evidence that CVOCs are anaerobically biodegrading via reductive dichlorination; and

(6) a combination of physical and natural biological processes will further reduce groundwater contaminant concentrations over time (the supporting information is provided in GZA's MNA Evaluation Report, Attachment IV).

To evaluate the effectiveness of MNA, groundwater and Humane Spring surface water monitoring will be performed in accordance with the Corrective Action Monitoring Plan included as Appendix B to the Post-Closure Plan (Attachment III).

2.0 DESCRIBE SECURITY PROCEDURES AND EQUIPMENT [§§ 270.14(B)(4)]

The Facility is comprised of vacant land with a fence encompassing the area surrounding the former surface impoundments. There are no activities other than ground maintenance and groundwater monitoring planned. There are no security procedures or security equipment warranted on the property, other than the maintaining the chain link fence which enclose the former surface impoundments.

3.0 GENERAL INSPECTION SCHEDULE [§§ 270.14(B)(5)]

During routine ground maintenance between March and November, visual inspections of the engineered composite cap constructed over the former surface impoundments will be observed for signs of erosion damage, appropriate vegetative cover, and run-on/run-off control systems. When inspections reveal that repairs are necessary, the inspector will notify the Permittee and the Permittee will implement appropriate corrective action.

The surface water at Humane Spring contains low concentrations of CVOCs. At the request of KDWM, even though it is recognized that multiple sources may be impacting the spring, Kidde agreed in 2007 to post signs near the spring which warn trespassers about the surface water quality which will be inspected on a semi-annual basis and replaced if damaged or faded.
The signs state "warning, pollutants in spring water, avoid contact, do not drink, for details contact 502-564-6716".

Due to the nature of the waste material present beneath the engineered composite cap (clay soil over bedrock), leachate and landfill gas will not develop. As such, leachate collection or gas venting systems were not installed during Facility closure and therefore, they are not addressed in the inspection schedule.

4.0 JUSTIFICATION FOR ANY REQUEST FOR WAIVER OF PREPAREDNESS AND PREVENTION REQUIREMENTS

The Facility meets the applicable requirements of Part 264 Subpart C (§§ 264.30 through 264.37), Preparedness and Prevention. Due to the nature of the waste material present beneath the engineered composite cap (clay soil over bedrock) fire, explosion, or any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil, or surface water which could threaten human health, or the environment will not occur.

The property is vacant, there are no operations at the Facility that handle hazardous waste, and there are no Facility personnel present on the property, so the equipment specified by Subpart C is not necessary and have not been installed.

Similarly, as there are no operations at the Facility that handle hazardous waste and there are no Facility personnel present on the property, the requirements of §§ 264.34 communication or alarm systems and §§ 264.35 aisle spaces do not apply to the Facility.

Due to the nature of the Facility, as described above, additional arrangements with local authorities are not necessary.

5.0 FACILITY LOCATION INFORMATION [§§ 270.14(B)(11)]

The Facility is not located in a county or election district listed in Appendix VI of Part 264, thus, no further information is

required to demonstrate compliance with §§ 264.18(a).

The Facility is located in an "Area of Minimal Flood Hazard" as depicted on FEMA Flood Map 21167C0140C, effective 9/17/2008.

6.0 COPY OF THE CLOSURE PLAN AND POST-CLOSURE PLAN [§§ 270.14(B)(13)]

The approved Closure Plan for the former surface impoundments was implemented prior to issuance of the Permit and is not repeated here.

The Post-Closure Plan (Attachment III) addresses the monitoring and maintenance activities associated with the area of the former surface impoundments and includes the Corrective Action Monitoring Plan to address the groundwater.

7.0 DOCUMENTATION THAT POST-CLOSURE NOTICES HAVE BEEN FILED [§§ 270.14(B)(14)]

Necessary notices were previously submitted to the appropriate authorities as part of the closure activities and were documented in Section I of the Part B Permit Application and are not repeated here.

8.0 POST-CLOSURE COST ESTIMATE AND FINANCIAL ASSURANCE [§§ 270.14(B)(16)]

The post-closure cost estimates and description of the financial assurance mechanisms are included in the Post-Closure Plan (Attachment III).

9.0 USE OF STATE-REQUIRED FINANCIAL MECHANISMS [§§ 270.14(B)(18)]

The post-closure cost estimates and description of the financial assurance mechanisms are included in the Post-Closure Plan (Attachment III).

10.0 TOPOGRAPHIC MAP [§§ 270.14(B)(19)]

A Site Survey Map, which includes topography, was prepared for the Facility by Carter Dixon Partners (CDP Engineers, Inc.) dated September 14, 2005, is included as Attachment II.

11.0 ADDITIONAL INFORMATION [§§ 270.14(C)]

The following additional information regarding groundwater is provided as required by §§ 270.14(c).

11.1 GROUNDWATER MONITORING DATA [§§ 270.14(C)(1)]

Groundwater monitoring data obtained during the interim status period was included in Section E of the Part B Permit Application and is not repeated here. Groundwater monitoring data obtained over the past ~~23~~27 years during the ~~46~~54 semi-annual Corrective Action Monitoring events was submitted semi-annually in reports to KDWM and is not repeated here. GZA's MNA Evaluation Report (Attachment IV) provides data to support the recommendation that the GRS be permanently abandoned, and the corrective action be MNA.

11.2 IDENTIFICATION OF UPPERMOST AQUIFER [§§ 270.14(C)(2)]

Based on a comprehensive review of existing information pertaining to the Facility and vicinity, the uppermost aquifer is described in detail in the September 2005 Conceptual Hydrogeologic Model prepared and included as Attachment V. The Conceptual Hydrogeologic Model describes the geologic and hydrogeologic setting; contaminant source and release information; contaminant distribution, transport and fate parameters; and spatial distribution of contaminants.

11.3 MAPPING AND COMPLIANCE POINTS [§§ 270.14(C)(3)]

Attachment VI contains a topographic map which delineates the waste management area, property boundary, proposed points of compliance, location of groundwater monitoring wells and the groundwater flow direction.

11.4 DESCRIPTION OF CONTAMINATION "PLUME" [§§ 270.14(C)(4)]

The nature and extent of groundwater contamination is complex and is described in the September 2005 Conceptual Hydrogeologic Model included as Attachment V and the more recent MNA Report as Attachment IV.

11.5 PROPOSED GROUNDWATER MONITORING PROGRAM [§§ 270.14(C)(5)]

The proposed groundwater monitoring program is described in the Corrective Action Monitoring Plan included in Attachment III as Appendix B.

11.6 DETERMINATION OF APPLICABLE GROUNDWATER PROGRAM [§§ 270.14(C)(7) AND (8)]

Following 30 years of corrective action; groundwater monitoring; supplemental sampling; comprehensive evaluations of conditions at the Facility and vicinity; and our understanding of the hydrogeologic conditions and contaminant sources, migration and fate; an MNA Corrective Action program was developed that recognizes the various contamination sources and designates the Facility property boundary as the "point of compliance."

The basis for this conclusion is presented in the Conceptual Hydrogeologic Model; and the data collected over approximately 30 years with the recent MNA evaluation that commenced in 2016. The Corrective Action Monitoring Plan, included as Appendix B to the Post-Closure Plan, provides a program for addressing conditions at the Facility and vicinity that are protective of human health and the environment and are consistent with the requirements of the Post-Closure Rule.

12.0 INFORMATION ON PERMITTED SOLID WASTE MANAGEMENT UNITS [§§ 270.14(D)]

The Post-Closure Permit is to address residual contaminated groundwater. The closure plans and reports for the three SWMUs identified as surface impoundment #1 (SWMU-1), surface impoundment #2 (SWMU-2) and surface impoundment #3 (SWMU-3) and Part B RCRA Permit Application includes the information required by §§ 270.14(d) and is not repeated here.

As described above, GZA's January 6, 2017 Former Surface Impoundment Sampling Report (Reference 7) included testing of soil samples below the engineered composite cap for cadmium, hexavalent chromium, nickel, and cyanide. GZA concluded that the test results supported a contained-out determination for the soil. In place media such as soil does not meet the definition of solid waste and the risk-based standards, supplemented by a risk assessment, demonstrate that hazardous waste is not present beneath the former surface impoundment cap.

13.0 REFERENCES

1. July 13, 2016 Kentucky Division of Waste Management (KDWM) letter to Elizabeth Lang at United Technologies Corporation (UTC).
2. January 19, 2017 KDWM letter to Elizabeth Lang at UTC.
3. January 2, 2018 and June 25, 2018 KDWM letters to Elizabeth Lang at UTC.
4. February 7, 2018 email from KDWM (Ashley Bandy) to GZA GeoEnvironmental Inc. (Mr. Anthony Urbano).
5. August 11, 2004, GZA GeoEnvironmental, Inc., Demolition Report, Former Hallmack Facility, Harrodsburg, Kentucky, prepared for Kidde-Fenwal, Inc.
6. August 26, 1991 Notice of Hazardous Waste Activity
7. January 6, 2017; GZA GeoEnvironmental, Inc.; Former Surface Impoundment Sampling Report; prepared for Kidde-Fenwal, Inc.
8. September 1995; Consoer Townsend Envirodyne Engineers, Inc.; Engineering Feasibility Study – Ground-water Remediation, Hallmack Facility, NuTone, Inc., Harrodsburg, KY; prepared for NuTone, Inc. (Kidde's predecessor in title to the Facility).
9. September 29, 2007 Corrective Action Modification Design Report prepared by GZA GeoEnvironmental, Inc. for Kidde-Fenwal, Inc.
10. April 11, 2008 KDWM letter to Elizabeth Lang at Kidde-Fenwal approving the September 29, 2007 Corrective Action Modification Design report.

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ATTACHMENT III
POST-CLOSURE PLAN

RCRA POST-CLOSURE PERMIT RENEWAL APPLICATION
FORMER HALLMACK FACILITY
HARRODSBURG, KENTUCKY
PERMIT NO. KYD-081-017-667

ATTACHMENT III
POST-CLOSURE PLAN

RCRA POST-CLOSURE PERMIT RENEWAL APPLICATION
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HARRODSBURG, KENTUCKY
PERMIT NO. KYD-081-017-667

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APPENDICES

Appendix A Environmental Covenant
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1.0 INTRODUCTION

This Post-Closure Plan was prepared as Attachment III to the July 2018 RCRA Post-Closure Permit Renewal Application ("RCRA Permit") and will also be the Property Management Plan for the former Hallmack Facility in Harrodsburg, Kentucky (the "Facility"); permit No. KYD-081-017-667. The Post-Closure Plan includes the following elements:

1. Monitoring and maintenance activities associated with the former surface impoundments;

2. Corrective Action Monitoring Plan;

3. Facility contact information;

4. Post-closure cost estimates and financial assurance mechanisms; and

5. Draft Environmental Covenant (Appendix A)

During manufacturing operations at the Facility (1968 to 1986), up to three surface impoundments were constructed and used to store electroplating wastewater and sludge. Based on reports prepared at the time of closure of the former surface impoundments (1987 to 1989), the wastewater treatment sludge was removed from the three former surface impoundments to the top of bedrock. Upon removal of the sludge, the impoundment walls were subsequently graded over the bedrock surface to form a sloping plane, which was then capped with a 5 to 8-foot thick engineered composite cap in accordance with approved closure plans. Thus, the existing RCRA Permit was for the storage of relatively low permeability clay soil that comprised the former surface impoundment walls and at the time of closure was believed to contain hazardous waste (§§ 261.31 Industry and Hazardous Waste No. F006) by the contained-in rule.

GZA's Former Surface Impoundment Sampling Report (Reference 7 in application), which was submitted to KYDEP on January 6, 2017, included testing of soil samples below the engineered composite cap for cadmium, hexavalent chromium, nickel, and cyanide. The only parameter which exceeded US EPA's Industrial Regional Screening Level was hexavalent chromium. The engineered composite cap prevents exposure to underlying soil to most individuals. Although unlikely, potential construction workers could be exposed to the underlying soil. GZA performed a limited risk assessment and found that the hexavalent chromium concentrations detected were below the site-specific screening value that is protective of potential construction workers and emergency /utility workers. GZA concluded that the test results supported a contained-out determination for the soil present beneath the engineered composite cap at the location of the former surface impoundments. In place media such as soil does not meet the definition of solid waste and the risk-based standards, supplemented by a risk assessment, demonstrate that hazardous waste is not present beneath the former surface impoundment cap.

2.0 MONITORING AND MAINTENANCE OF FORMER SURFACE IMPOUNDMENTS

This Post-Closure Plan describes the monitoring and maintenance activities associated with the former surface impoundments. The activities covered by this plan were developed to address procedures established to monitor and maintain the physical condition of the former surface impoundment cover.

2.1 INSPECTIONS

During routine ground maintenance between March and November, visual inspections of the engineered composite cap constructed over the former surface impoundments will be observed for signs of erosion damage, appropriate vegetative cover, and run-on/run-off control systems. In addition, the condition of the perimeter fence will be visually inspected. When inspections reveal that repairs are necessary, the inspector will notify the Permittee and the Permittee will implement appropriate corrective action.

2.2 SECURITY CONTROL DEVICES

The Facility is comprised of vacant land with a fence encompassing the area surrounding the former surface impoundments. Hazardous waste is not present beneath the former surface impoundments. There are no activities on the Facility other than ground maintenance and groundwater monitoring planned. There are no security procedures or security equipment warranted on the property, other than the maintaining the chain link fence which enclose the former surface impoundments. It is anticipated that maintenance and repair of the fence will be minimal and additional costs have not been budgeted.

2.3 COVER SETTLEMENT, SUBSIDENCE AND DISPLACEMENT

Due to the nature of the waste material present beneath the composite cap (clay soil over bedrock), as corroborated by more than 20 years of surface monument surveying with no settlement of the cap will not be a concern. As such, additional elevation surveying will not be performed.

2.4 VEGETATIVE COVER AND EROSION DAMAGE

During routine ground maintenance between March and November, visual inspections of the composite cap constructed over the former surface impoundments will be observed for appropriate vegetative cover and signs of erosion damage. When inspections reveal erosion or vegetation that needs to be addressed, the Permittee will implement appropriate corrective action. Based on more than 23 years of maintenance limited to vegetation control, there has been no need for erosion repair or reseeding which is anticipated to remain de minimis and budgeted accordingly.

2.5 RUN-ON/RUN-OFF CONTROL

Surface drainage at the former surface impoundment cap is primarily sheet flow off the cap to the north, east and west. Sheet flow to the south and southwest enters stone trenches and a ditch reportedly designed to handle a 25-year, 24-hour storm. Design calculations and details for the ditch were submitted with the approved Closure Plan. Based on more than 23 years of observations, stone trench and ditch repair are not anticipated and remain de minimis and budgeted accordingly.

3.0 CORRECTIVE ACTION MONITORING PLAN

The groundwater Corrective Action Monitoring Plan (CAMP) contained as Appendix B was prepared to support Monitored Natural Attenuation (MNA) as the Corrective Action to address the release of hazardous constituents; chlorinated volatile organic compounds (CVOCs), into the groundwater. The foundation of the CAMP is based on the MNA Report and Conceptual Hydrogeologic Model included as Attachments IV and V.

4.0 POST-CLOSURE CONTACT

The former Hallmack Facility is closed and the property is vacant. Inquiries regarding the Facility and the closed former surface impoundments should be directed to the following individual:

~~Ms. Beth Lang~~Donald Sorbello
c/o ~~United Technologies Corporation~~Carrier Corporation
~~United Technologies Building~~PO Box 4808, Building 7
~~9 Farm Springs~~Syracuse, New York 13221
~~9FS-MS 101~~(315) 525-4405
~~Farmington, Connecticut 06012~~
~~248-634-6048~~

The Facility copy of the Post-Closure Plan will be maintained by the environmental consultant (GZA GeoEnvironmental Inc.) and is available for inspection at any time (in PDF format).

4.1 POST-CLOSURE CERTIFICATION

Within 60 days of completion of the post-closure care period, certification will be submitted to Kentucky Division of Waste Management (KDWM) indicating that the post-closure care period was performed in accordance with the specifications of the approved Post-Closure Permit and Plan. The certification will be signed by the Permittee and by an independently-registered professional engineer.

5.0 POST-CLOSURE COST ESTIMATE

The estimated costs for post-closure care at the Facility are summarized below.

Activity	Estimated Annual Cost	Estimated 10-Year Cost
MONITORING AND MAINTENANCE OF FORMER SURFACE IMPOUNDMENTS		
1. Inspections	$100	$1,000
2. Maintenance – Vegetative Cover	$100	$1,000
3. Maintenance – Erosion Damage	$100	$1,000
4. Maintenance – Run-On/Run-Off System	$100	$1,000
COMPLIANCE MONITORING		
1. Semiannual Groundwater Monitoring	$25,000	$250,000
Total Estimated Costs for 10 Year Post-Closure Care:	$25,400	$254,000

During the post-closure care period of the Facility, the Permittee shall adjust the post-closure cost estimate for inflation within thirty (30) days after the end of the Permittee's fiscal year. Based on the Facility conditions and nature of the costs estimates, adjustments to the post-closure cost estimate are not anticipated to be necessary during the post-closure care period.

5.1 FINANCIAL ASSURANCE MECHANISM AND LIABILITY REQUIREMENTS FOR POST-CLOSURE

To satisfy the financial assurance and liability requirements of the RCRA Post-Closure Permit, the Permittee will be using ~~a~~ performance bond (#08966128) and liability bond (#08966129), which will be updated upon approval of the new permit.

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ATTACHMENT 3

Division Email, Dated February 7, 2018

Archived: Monday, August 29, 2022 1:33:22 PM
From: Bandy, Ashley (EEC)
Sent: Wed, 7 Feb 2018 12:25:37
To: Anthony Urbano
Subject: RE: Former Hallmack Facility, Harrodsburg, KY - Permit Renewal Application
Sensitivity: Normal

Good morning, Anthony.

After checking the regulations, yes, we are in agreement. I did not find out about any major changes regarding the Post-Closure permitting during the meetings, but just note that the numbers referencing the KY state regs have changed (if you reference and KARs). I hope this answers the questions that you had. Let me know if you have any other questions!

Thanks,
Ashley

From: Anthony Urbano [mailto:Anthony.Urbano@gza.com]
Sent: Thursday, February 1, 2018 10:31 AM
To: Bandy, Ashley (EEC) <ashley.bandy@ky.gov>
Cc: Beth Lang <beth.lang@utc.com>; Mark Krumenacher <mark.krumenacher@gza.com>
Subject: Former Hallmack Facility, Harrodsburg, KY - Permit Renewal Application

Ashley,

It was a pleasure talking to you on Tuesday. I would like to re-iterate my understanding of our conversation. As agreed between the parties in 2005, KDEP is using its (anticipated) discretion which allows Kidde-Fenwal, Inc. to prepare the Post-Closure Permit Application consistent with the United States Environmental Protection Agency's (USEPA) 1998 Post-Closure Rule. KDEP agrees that in lieu of preparation of a full Part B permit application, Kidde-Fenwal, Inc. will follow the requirements of 40 CFR 270.28 (similar to our last permit renewal application). Specifically, for post-closure permits, the owner or operator is required to submit only the information specified in §§ 270.14(b)(1), (4), (5), (6), (11), (13), (14), (16), (18) and (19), (c), and (d), unless the Regional Administrator determines that additional information from §§ 270.14, 270.16, 270.17, 270.18, 270.20, or 270.21 is necessary.

We understand that if learn new information at your internal KDEP meeting at the end of this week (regarding the permit renewal application process), then you will provide us that information.

Are we in agreement?

We appreciate your assistance in this matter.

As you requested, Beth Lang's mailing address is:

Beth Lang
Remediation Project Manager
United Technologies Corporation
5469 Jacobs Drive
Holly, MI 48442

Call me if you have any questions.

Anthony Urbano, P.E.
Senior Project Manager
GZA | 530 Broadway | Providence, RI 02909
o: 401.421.4140 | c: 401.374.2317 | d: 401.427.2732 | anthony.urbano@gza.com | www.gza.com

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For information about GZA GeoEnvironmental, Inc. and its services, please visit our website at www.gza.com.

ATTACHMENT 4

Division Part B – Facility Description Checklist

Facility Name: Former Hallmack Facility
EPA ID:KYD 081017667
Agency Interest ID:48471

Instructions: *The applicant must include the following statement at the beginning of the Part B section of the permit application: "The Code of Federal Regulations (CFRs) cited in this permit application shall be as established in 401 KAR Chapter 39"*

In order to help expedite the review process, please submit the following with the permit application: Part B – Facility Description Checklist. Columns "Submitted" and "Location in Application" must be completed by the applicant. Failure to do so may result in an Administrative Notice of Deficiency by the Division. The "Technically Adequate" column is for use by KDWM staff.

**Notes: Y for Yes. N for No. NA for Not Applicable.*

	Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
B.1	**General Description** A general description of the facility. Please identify the nature of the business, when it began or will begin operating, the size of the site, and whether the site history has changed (business sales shift or buyout by other investors, etc.). Facilities should briefly describe the process(es) involved in the generation of hazardous waste. Facilities accepting waste generated off-site should identify the types of industry served and briefly describe the waste generation process.	270.14(b)(1)	**Y**	**Application Pages 1-4**		Click here to enter text.
	B.1.1 Solid Waste Management Unit (SWMU) and/or Area of Concern (AOC)	270.14(d); 264.101	*A SWMU is any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility at which solid wastes have been routinely and systematically released.*			

	Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
	Provide the following information for SWMU unit(s) and/or AOC(s) located at the facility:					
	i. Designation of type of unit.		**NA**	**NA**		Each previously identified SWMU and AOC was closed prior to the 2007 Permit
	ii. General dimensions and structural description (supply any available drawings).		**NA**	Click here to enter text.		Click here to enter text.
	iii. When the unit will be or was operated.		**NA**	Click here to enter text.		Click here to enter text.
	iv. Specification of all wastes that will be or have been managed at the unit, to the extent available.		**NA**	Click here to enter text.		Click here to enter text.
	v. The location of the unit on the topographic map.		**NA**	Click here to enter text.		*See Checklist B.2.xiii below.*
	vi. Any available information pertaining to any release of hazardous wastes or hazardous constituents from such unit or units.		**NA**	Click here to enter text.		*This section should essentially provide a brief overview of the current or historical corrective action process for the unit.*
	vii. Specify schedule of compliance for each corrective action (where such corrective action cannot be completed prior to issuance of the permit) and assurances of financial responsibility for completing such corrective action.		**NA**	Click here to enter text.		Click here to enter text.
B.2	**Topographic Map**					
	Show a distance of 1,000 feet around the facility at a scale of 1 inch to not more than 200 feet (multiple maps may be submitted at this scale). Contours must	270.14(b)(19)	**Y**	**Application Attachment I and II**		Click here to enter text.

Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
be shown on the map. The topographic map shall clearly show the following:					
i. Map Scale and Date;		**Y**	Click here to enter text.		Click here to enter text.
ii. 100-year floodplain area		**NA**	Click here to enter text.		Click here to enter text.
iii. Surface waters including intermittent streams;		**Y**	Click here to enter text.		Click here to enter text.
iv. Surrounding land use (residential, commercial, agricultural, recreational);		**Y**	Click here to enter text.		Click here to enter text.
v. A wind rose (*i.e.*, prevailing wind-speed and direction);		**NA**	Click here to enter text.		Click here to enter text.
vi. Orientation of the map (north arrow);		**Y**	Click here to enter text.		Click here to enter text.
vii. Legal Boundaries of the hazardous waste management facility site;		**Y**	Click here to enter text.		Click here to enter text.
viii. Access control (fences, gates);		**Y**	Click here to enter text.		Click here to enter text.
ix. Injection and withdrawal wells both on-site and off-site;		**NA**	Click here to enter text.		Click here to enter text.

	Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
	x. Buildings; treatment, storage, or disposal operations; or other structure (recreation areas, runoff control systems, access and internal roads, storm, sanitary, and process sewerage systems, loading and unloading areas, fire control facilities, etc.);		**Y**	Click here to enter text.		Click here to enter text.
	xi. Barriers for drainage or flood control;		**NA**	Click here to enter text.		Click here to enter text.
	xii. Location of operational units within the HWM facility site, where hazardous waste is (or will be) treated, stored, or disposed (include equipment cleanup areas); and		**NA**	Click here to enter text.		Click here to enter text.
	xiii. Location of Solid Waste Management Units.	270.14(d)(1)(i)	**NA**	Click here to enter text.		Click here to enter text.
B.3	**Facility Location Information**	270.14(b)(11); 264.18				
	B.3.1 Seismic Requirements	270.14(b)(11)(i), (ii); 264.18(a)				*Seismic Requirements are applicable only to new facilities.*
	Identify the political Jurisdiction in which the facility is proposed to be located.	270.14(b)(11)(i)	**Y**	**Application Page 1**		*e.g., County, Township or Election District.*
	Identify if the proposed facility is listed in Appendix VI of 264.	270.14(b)(11)(i)	**N**	Click here to enter text.		Click here to enter text.
	If the proposed facility is located in an area listed in Appendix VI of 264, demonstrate compliance with the seismic standards of 40 CFR Part 270.14(b)(11)(ii).	270.14.(b)(11)(ii)	**NA**	Click here to enter text.		Click here to enter text.
	State or demonstrate that the facility is located at least 200 feet from a Fault which has had Displacement in Holocene Time.	270.14(b)(11)(ii); 264.18(a)	**NA**	Click here to enter text.		Click here to enter text.

Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
B.3.2 Subsurface Geology and Karst Features Demonstrate that the facility is not underlain by soluble limestone. This demonstration can be made by using commercially available geologic maps, and/or other geologic reports through the Kentucky Geologic Survey or any other established authority. If the site is in a region where limestone may be present, then a comprehensive site-specific evaluation prepared by a professional geologist may be necessary. OR Demonstrate compliance with the requirements of 39:060 Section 5(15)(b).	39:060 Section 5(15)	**NA**	Click here to enter text.		*The Facility is underlain by soluble limestone*
B.3.3 Floodplain Requirements	270.14(b)(11)(iii), (iv); 264.18(b)				*Applicant may go to FEMA's website at https://msc.fema.gov/portal/search to obtain the latest 100-year floodplain map. A colored copy that clearly shows the facility and the flood zones shall be submitted to the Division.*
A copy of the latest Federal Insurance Administration or other Flood Map.	270.14(b)(11)(iii)	**Y**	**Response to 8/10/2022 2022 NOD Attachment 4**		Click here to enter text.
Identify if the facility is located within the 100-year floodplain.	270.14(b)(11)(iii)	**N**	**Response to 8/10/2022 NOD Attachment 4**		Click here to enter text.

	Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
	If the facility is located within the 100-year floodplain, demonstrate compliance with 39:090 Sections 5.	39:090 Section 5	**NA**	Click here to enter text.		*Existing facilities located within the 100-year floodplain that do not comply with the requirements of 39:090 Section 5 shall provide a plan showing how the facility will be brought into compliance and a schedule for compliance.*
	B.3.4 Traffic Information Explain how the hazardous waste will be transported into and out of the facility (i.e., rail, highway, etc.). Facilities that accept waste generated off-site should also trace the transportation route from the nearest major highway exit to the facility. Show turns across traffic lanes and stacking lanes, if appropriate.	270.14(b)(10)	**NA**	Click here to enter text.		Click here to enter text.
	Estimate of number and types of vehicle around the facility.	270.14(b)(10)	**NA**	Click here to enter text.		Click here to enter text.
	Traffic control signs and signals.	270.14(b)(10)	**NA**	Click here to enter text.		Click here to enter text.
	Road surface composition and load-bearing capacity.	270.14(b)(10)	**NA**	Click here to enter text.		Click here to enter text.
B.4	**Requirements for Construction Permit** All applicants for construction permits shall submit to the Cabinet an alternative analysis plan in accordance with KRS 224.46-520(1). This plan shall include the following:	39:060 Section 5(8)				*With possible exceptions in Checklist B.4.1 below, the requirements for Construction Permit are only applicable to new facilities.*
	i. An evaluation of alternative site locations and other treatment, storage, and disposal approaches.		**NA**	Click here to enter text.		Click here to enter text.

Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
ii. An evaluation of the public health, safety and environmental aspects on the affected community.		**NA**	Click here to enter text.		Click here to enter text.
iii. An evaluation of the social and economic impacts of the proposal on the affected community.		**NA**	Click here to enter text.		Click here to enter text.
iv. An evaluation of the relationship of the proposal to the local planning and existing development.		**NA**	Click here to enter text.		Click here to enter text.
v. In support of the above evaluations, please include letters from the local police department, local hospital, local fire department and local emergency response team. These letters should state that the respective agencies are aware of the proposed facility's location and will be able to respond to any emergencies arising at the facility		**NA**	Click here to enter text.		Click here to enter text.
vi. Provide a letter from the local planning and zoning authority stating that the applicant has either fulfilled their requirements or that the site is not subject to local planning and zoning ordinances.		**NA**	Click here to enter text.		Click here to enter text.
For regional integrated waste treatment and disposal demonstration facilities, show that the applicant has been issued a certificate of environmental safety and public necessity.		**NA**	Click here to enter text.		Click here to enter text.
B.4.1 For a unit or facility that meets any of the criteria below, show that the applicant has obtained local government approval:	39:060 Section 5(9)	NA	Click here to enter text.		Click here to enter text.

	Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
	i. A new or proposed hazardous waste landfill, incinerator, or other site or facility for the land disposal of hazardous waste. ii. An existing hazardous waste landfill, incinerator, or other site or facility for the land disposal of hazardous waste that requests a permit modification that does not meet the criteria of a Class 1 or 2 modifications. iii. A new or existing hazardous waste treatment facility or hazardous waste storage facility that requests a permit modification to include a disposal facility instead of or in addition to any permitted hazardous waste activity already conducted by the applicant.					
B.5	**Financial Responsibility to Construct and Operate** Provide, in detail, documentation demonstrating the financial ability to operate and construct the waste facility. This must include:	401 KAR 39:090 Section 7; KRS 224.46-520(3)	NA	Click here to enter text.		Click here to enter text.
	i. A construction cost estimate.		NA	Click here to enter text.		Click here to enter text.
	ii. An operation cost estimate for the first year.		NA	Click here to enter text.		Click here to enter text.
	iii. Resources allocated such as a line of credit, allocations per the Chief Financial Officer, an annual report, or a commitment statement showing the dollar amount to construct and		NA	Click here to enter text.		Click here to enter text.

	Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
	operate and signed by the company Board of Directors, owner, etc.					
B.6	**Past Compliance Record and Background Information** Provide the following information:	39:060 Section 5(14)				*The requirements in this Checklist are not applicable to facilities regulated under interim status unless the Cabinet specifies otherwise in writing.*
	i. Organizational Structure. Refer to 39:060 Section 5(14)(a) for specific information to be submitted.	39:060 Section 5(14)(a)	NA	Click here to enter text.		Click here to enter text.
	ii. For each individual or other entity listed in *Checklist B.6.i* above, a current financial statement prepared by a certified public accountant.	39:060 Section 5(14)(c)	NA	Click here to enter text.		Click here to enter text.
	iii. A completed Form 7087H – Applicant Compliance Record. The form can be found at https://eec.ky.gov/Environmental-Protection/Waste/hazardous-waste/Pages/hazardous-waste-forms.aspx		NA	Click here to enter text.		Click here to enter text.
B.7	**Pre-application Public Meeting and Notice** Applicants must check 40 CFR Part 124.31(a) to determine the applicability of this requirement. If applicable, provide:	124.31				
	i. A summary of the pre-application public meeting.		NA	Click here to enter text.		Click here to enter text.

	Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
	ii. A list of attendees and their addresses.		NA	Click here to enter text.		Click here to enter text.
	iii. Copies of written comments or materials submitted at the meeting.		NA	Click here to enter text.		Click here to enter text.
B.8	**Fees** *All checks or money orders shall be made payable to the Kentucky State Treasurer, and must be <u>submitted with the permit application</u> to the Hazardous Waste Branch.* The following is a list of references to be used when calculating the applicable fees: Part A Filing Fee: • 401 KAR 39:120 Section 2. Part B Review Fee: • 401 KAR 39:120 Section 3. • KRS 224.46-016. • KRS 224.46-018.	39:120	Y	Response to 8/10/2022 NOD Attachment 7		*The total amount submitted by the applicant is:* $ 13,000 per August 10, 2022 NOD

Section and Requirement		Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments

National Flood Hazard Layer FIRMette

FEMA

84°51'10"W 37°46'54"N

84°50'32"W 37°46'25"N

Feet 1:6,000

0 250 500 1,000 1,500 2,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/25/2022 at 5:51 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

ATTACHMENT 5

Division Part A – Application Forms and Signed Addendum

Facility Name: Former Hallmack Facility
EPA ID:KYD081017667
Agency Interest ID:48471

Instructions: In order to help expedite the review process, please submit the following with the permit application: Part A – Part A Application Forms **Checklist. Columns "Submitted" and "Location in Application"** must be completed by the applicant. Failure to do so may result in an Administrative Notice of Deficiency by the Division. **The "Technically Adequate" column is for use by KDWM** staff.

All forms are available in the Hazardous Waste Forms Library. Both federal forms are part of the package named EPA 8700 Form.

**Notes: Y for Yes. N for No. NA for Not Applicable.*

Form	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
Federal Form 8700-12 RCRA Subtitle C Site Identification Form	RCRA Subtitle C Section 3010	**NA**	Click here to enter text.		*The Site Identification Form is a required submittal for all facilities which generates, transports, or recycles regulated wastes, or operates a hazardous waste treatment storage or disposal facility.*
Federal Form 8000-23 Hazardous Waste Permit Part A Form	40 CFR 270.13	**Y**	**Response to 8/10/2022 NOD Attachment 5**		*The Hazardous Waste Permit Part A Form is a required submittal for any new permit or permit renewal to operate a hazardous waste treatment, storage, or disposal facility.*
State Form DWM7058A Part A Addendum Form	401 KAR 39:060	**Y**	**Response to 8/10/2022 NOD Attachment 5**		*The Part A Addendum Form is a required submittal for for any new permit or permit renewal to operate a hazardous waste treatment, storage, or disposal facility.*

EPA ID Number	K	Y	D	0	8	1	0	1	7	6	6	7

OMB# 2050-0024; Expires 04/30/2024

United States Environmental Protection Agency

HAZARDOUS WASTE PERMIT PART A FORM

1. Facility Permit Contact

First Name	**Donald**	MI	Last Name **Sorbello**
Title	**Senior Manager Remediation Programs Carrier**		
Email	**donald.sorbello@carrier.com**		
Phone	**315-525-4405**	Ext	Fax

2. Facility Permit Contact Mailing Address

Street Address **PO Box 4808, Building 7**		
City, Town, or Village **Syracuse**		
State **New York**	Country	Zip Code **13221**

3. Facility Existence Date (mm/dd/yyyy)

1/1/1968

4. Other Environmental Permits

A. Permit Type	B. Permit Number	C. Description
		NONE

5. Nature of Business

None - formerly electroplating. Vacant property.

6. Process Codes and Design Capacities

Line Number		A. Process Code			B. Process Design Capacity		C. Process Total Number of Units	D. Unit Name
					(1) Amount	(2) Unit of Measure		
								NONE

7. Description of Hazardous Wastes (Enter codes for Items 7.A, 7.C and 7.D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. Processes									
								(1) Process Codes									(2) Process Description (if code is not entered in 7.D1))
																	NONE

8. Map

Attach to this application a topographical map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all spring, rivers, and other surface water bodies in this map area. See instructions for precise requirements.

9. Facility Drawing

All existing facilities must include a scale drawing of the facility. See instructions for more detail.

10. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment, and disposal areas; and sites of future storage, treatment, or disposal areas. See instructions for more detail.

11. Comments

Documents in response to items 8, 9 and 10 are attached.
Property is vacant.
No hazardsous waste remains on the property.
Groundwater contamiantion from past activites remains beneath property.

GRAPHIC SCALE IN FEET
0 500 1000 2000

GZA
GeoEnvironmental, Inc.
Engineers and Scientists
CROSSROADS CORPORATE CENTER
20900 SHORELINE DRIVE, SUITE 150
WAUKESHA, WISCONSIN 53186
(262) 754-2560
(262) 754-2711

PROJ MGR: MJK
DESIGNED BY: MJK
REVIEWED BY: MAP
OPERATOR: DL
DATE: JUNE 2018

FORMER HALLMACK FACILITY
HARRODSBURG, KENTUCKY

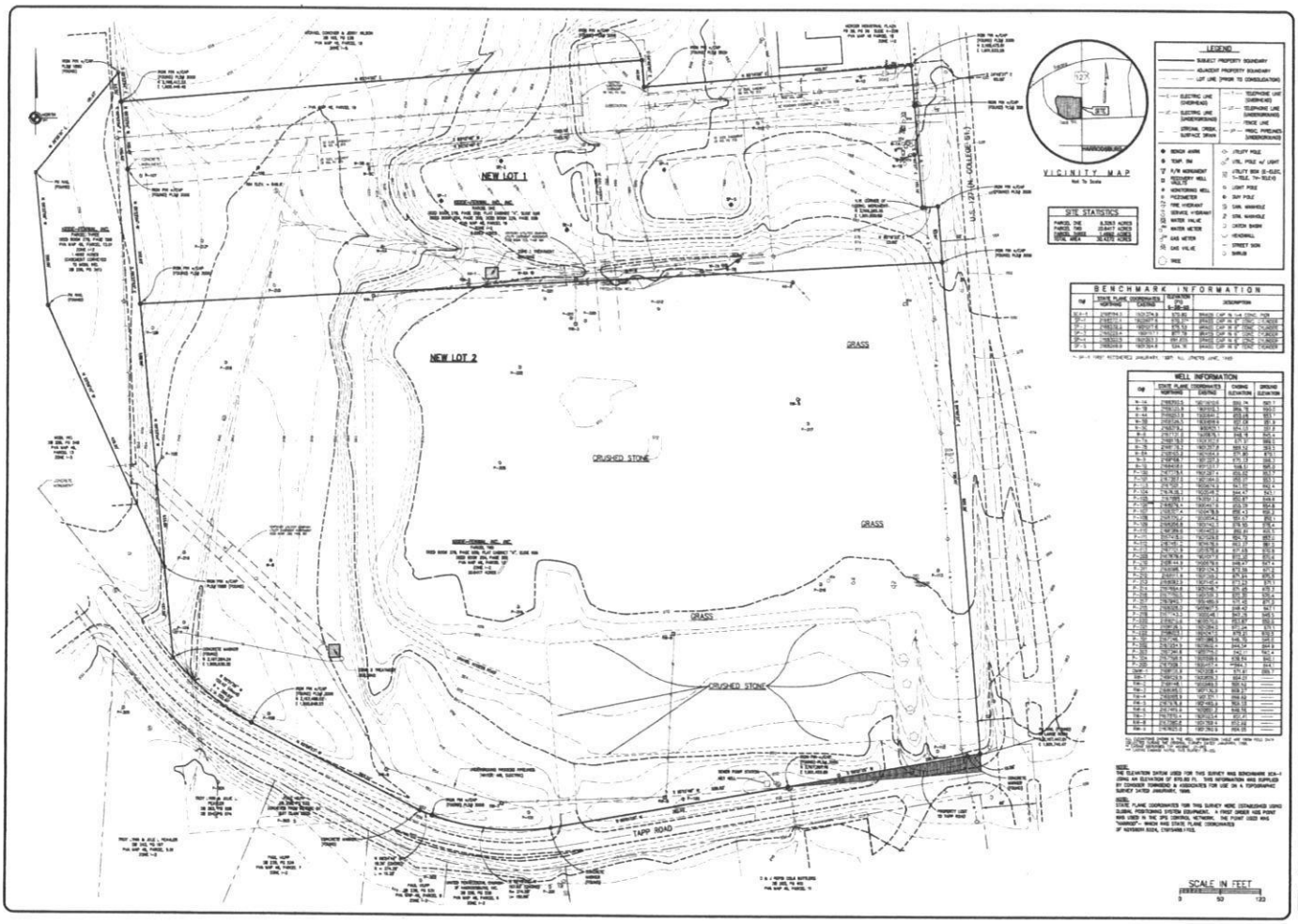
SITE LOCATION MAP

PROJECT NO.
150290.12

FIGURE NO.
1

©2003 - GZA GeoEnvironmental, Inc.

GZA-J:\ENV\150290-12.obu\FIGURES\GZA CMCS\FIG-1 SITE LOCATION MAP.dwg [FIG 1] June 14, 2018 - 1:44pm michael.oubin



DRAFTING SERVICES PROVIDED BY:
DESIGN PARTNERS, INC.
CARTERET DESIGN PARTNERS
3230U Blazer Parkway
Lexington, Kentucky 40509
Ph. (859)294-7301
Fax (859)294-7302

DATE	BY	REVISION

SCALE: 1"=50'
DESIGNED BY: GDN
DRAWN BY: JPT
CHECKED BY: GDN
DATE: SEPTEMBER 13, 2005
CADD FILE ID: 0917-S-2

GZA GeoEnvironmental, Inc.
20000 Sherman Drive
Suite 100
Wauseka, WI 53186

TOPOGRAPHIC SITE SURVEY

FORMER HALLMACK FACILITY
HARRODSBURG, MERCER COUNTY, KENTUCKY

DRAWING
S-2

Former Hallmack Facility
No existing or future hazardous waste storage, treatment, or disposal areas.
Electric SubStation
Building for Former Groundwater Remediation System
Tapp Rd
N College St
Building for Former Groundwater Remediation System
Tapp Rd
Tapp Rd
Google Earth
800 ft
N

Kentucky Department for Environmental Protection
Division of Waste Management
Hazardous Waste Branch
300 Sower Boulevard, Frankfort, KY 40601
(502) 564-6716

Part A Application Addendum

(EPA Form 8700-23)

FOR OFFICIAL USE ONLY.
DO NOT WRITE IN THIS SPACE.

FEE SUBMITTED: $13,000 *(See instructions to determine your fee)* Fee was specified in Division 08/10/2022 NOD

I. Reason for Submittal *(see instructions)*

Reason for Submittal:

☐ **FIRST SUBMITTAL** – Must be accompanied by the completed forms EPA 8700-12 and Addendum DWM-7037A.

☐ **REVISION – Identify the classification of the revision.** See instructions for when a revised application should be submitted.
- ☐ **Class 1 not requiring approval**
- ☐ **Class 1 requiring approval**
- ☐ **Class 2**
- ☐ **Class 3**

☒ **RENEWAL** – See instructions for when a renewal application should be submitted.

☐ **STANDARDIZED PERMIT** – See instructions for the eligibility of a standardized permit.

II. ID Numbers

A. EPA ID Number: KYD 081017667

B. AGENCY INTEREST Number: 48471

III. Existing and New Facilities

Existing Facilities, the date operation began or construction commenced: (mm/dd/yyyy) __/__/1968

New Facilities, the date operation is expected to begin: (mm/dd/yyyy) __/__/____

IV. Contact Email Address

Facility Contact
Email address: donald.sorbello@carrier.com

V. Facility Operator (2)

Name of Facility Operator 2 (see Instructions): NA

VI. Type of Operator (2)

Type of Operator 2: ☐Federal (F) ☐State (S) ☐County (C) ☐Indian (I) ☐Municipal (M) ☐District (D) ☐Private (P) ☐Other (O) Specify:

VII. Operator Mailing Address (2)

Operator 2 Street Address or P.O. Box:

City:	State:	County:	Zip Code:

Facility Operator 2 Telephone Number: | **Phone Number Extension:**

New Operator Assumed Responsibility for Facility on this Date: (mm/dd/yyyy) __/__/____

VIII. Facility Operator (3)

Name of Facility Operator 3 (see Instructions): NA

IX. Type of Operator (3)

Type of Operator 3: ☐Federal (F) ☐State (S) ☐County (C) ☐Indian (I) ☐Municipal (M) ☐District (D) ☐Private (P) ☐Other (O) Specify:

X. Operator Mailing Address (3)

Operator 3 Street Address or P.O. Box:

City:	State:	County:	Zip Code:

Facility Operator 3 Telephone Number: | **Phone Number Extension:**

New Operator Assumed Responsibility for Facility on this Date: (mm/dd/yyyy) __/__/____

EPA ID Number: KYD 081017667 **Agency Interest Number:** 48471

XI. PROCESS DESCRIPTION: (See Instructions)

a. Commercial Indicator	b. Unique Unit or Group Name	c. Legal Status Code	d. Operating Status Code(s)	e. Description of Process
NA				

EPA ID Number: KYD 081017667 **Agency Interest Number:** 48471

XII. WASTE STREAM DESCRIPTION (See Instructions)

a. Line Number	b. Waste Stream Number	c. Waste Description
NA		

EPA ID Number: KYD 081017667	Agency Interest Number: 48471
XIII. Facility Status	X Waste is NOT received from off-site ☐ Accepts waste from any off-site source(s) [A] ☐ Accepts waste from only a restricted group of off-site sources [R]: Specify:
XIV. Facility Owner Certification	If the facility owner is also the facility operator, please skip this section and complete item XV below. I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. Lori Butler — Lori Butler — 09/22/2022 NAME (PRINT OR TYPE) — SIGNATURE — DATE
XV. Operator Certification	I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. NAME (PRINT OR TYPE) — SIGNATURE — DATE
XVI. Land Owner Certification	I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. Lori Butler — Lori Butler — 09/22/2022 NAME (PRINT OR TYPE) — SIGNATURE — DATE

ATTACHMENT 6

Division Part L – Signature Checklist and Signed Cover Letter

Facility Name: Former Hallmack Facility
EPA ID: KYD 081017667
Agency Interest ID: 48471

Instructions: In order to help expedite the review process, please submit the following with the permit application: Part L – Signatures Checklist. Columns "Submitted" and "Location in Application" must be completed by the applicant. Failure to do so may result in an Administrative Notice of Deficiency by the Division. The "Technically Adequate" column is for use by KDWM staff.

**Notes: Y for Yes. N for No. NA for Not Applicable.*

	Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
L.1	All permit applications must be signed by authorized representatives of the facility owner(s) and operator(s). To determine who is authorized to sign, please refer to 40 CFR Part 270.11.	270.11	**Y**	**Response to 8/10/2022 NOD Attachment 6**		Click here to enter text.
	L.1.1 Certification Include the following certification:	270.11(d)				
	i. Any person who is authorized to sign must make the following certification: "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted	270.11(d)(1)	**Y**	**Response to 8/10/2022 NOD Attachment 6**		Click here to enter text.

Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."					
ii. For remedial action plans (RAPs) under 40 CFR Part 264 Subpart H, if the operator certifies according to *Checklist L.1.1.i* above, then the owner may choose to make the following certification instead of the certification in *Checklist L.1.1.i* above: "Based on my knowledge of the conditions of the property described in the RAP and my inquiry of the person or persons who manage the system referenced in the operator's certification, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."	270.11(d)(2)	**NA**	Click here to enter text.		Click here to enter text.

Carrier Corporation
13995 Pasteur Boulevard
Palm Beach Gardens, FL 33418

Lori Butler
Vice President, EH&S
Office: 910-398-2467
Mobile: 561-512-9272
lori.butler@carrier.com

Attachment 6

September 21, 2022

Ms. April J. Webb, P.E., Manager
Kentucky Division of Waste Management
Hazardous Waste Branch
300 Sower Boulevard
Frankfort, Kentucky 406 01

RE: Cover Letter to July 5, 2018, RCRA Post Closure Permit Renewal Application
Kidde Fenwal Inc, Former Hallmack Facility, Harrodsburg, Kentucky
EPA ID # KYD-081-017-667, AI # 48471, APE20180001

Dear Ms. Webb

On behalf of Kidde-Fenwal, Inc., and in accordance with 40 CFR Part 270.11, this correspondence serves as the cover letter for the July 5, 2018, RCRA Post Closure Permit Renewal Application for the Former Hallmack Facility in Harrodsburg, Kentucky.

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Very truly yours,

Lori Butler
Vice President, Environmental, Health & Safety
Carrier Corporation
13995 Pasteur Boulevard
Palm Beach Gardens, Florida 33418
lori.butler@carrier.com

ATTACHMENT 7

Photocopy of $13,000 Check

ATTACHMENT 8

Division Financial Requirement Checklist and Copies of Bonds

Facility Name: Former Hallmack Facility
EPA ID: KYD 081017667
Agency Interest ID: 48471

Instructions: In order to help expedite the review process, please submit the following with the permit application:

1) Part I – Closure, Post-Closure Plans and Financial Requirements Checklist. Columns "Submitted" and "Location in Application" must be completed by the applicant. Failure to do so may result in an Administrative Notice of Deficiency by the Division. The "Technically Adequate" column is for use by KDWM staff.
2) A fee for facility investigation shall be as required by KRS 224.46-016(4) and 224.46-018(5)(a). A fee for corrective action shall be as required by KRS 224.46-016(4) and 224.46-018(5)(b).

**Notes: Y for Yes. N for No. NA for Not Applicable.*

Section and Requirement		Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
I.1	**Closure Plan**	270.14(b)(13)				*The applicant must submit a closure plan and if applicable, a post-closure plan.*
	I.1.1 Closure Performance Standard A description to demonstrate that the facility, including how each hazardous waste management unit at the facility, will be closed in a manner that:	264.111; 264.112(b)(1)				*This checklist shall apply to partial and/or final closure of the facility.*
	i. Minimizes the need for further maintenance.	264.111(a)	**NA**	Click here to enter text.		Click here to enter text.
	ii. Controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste	264.111(b)	**NA**	Click here to enter text.		Click here to enter text.

Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
decomposition products to the ground or surface waters or to the atmosphere.					
iii. Complies with the closure requirements of 40 CFR Part 264 Subpart G and unit-specific closure requirements.	264.111(c)	**NA**	Click here to enter text.		Click here to enter text.
I.1.2 Closure Activities Provide the following information:	264.112(b)				*The plan must identify steps necessary to perform partial and/or final closure of the facility at any point during its active life.*
i. For final closure of the facility, in addition to information requested in *Checklist I.1.1* above, the description must identify the maximum extent of the operations which will be unclosed during the active life of the facility.	264.112(b)(2)	**NA**	Click here to enter text.		Click here to enter text.
ii. An estimate of the maximum inventory of hazardous wastes ever on-site over the active life of the facility and a detailed description of the methods to be used to remove the inventory during partial closures and final closure.	264.112(b)(3)	**NA**	Click here to enter text.		*Methods to be used include, but not limited to, methods for removing, transporting, treating, storing, or disposing of all hazardous wastes, and identification of the type(s) of the off-site hazardous waste management units to be used, if applicable.*
iii. A detailed description of the steps needed to remove or decontaminate all hazardous waste residues and contaminated containment system components, equipment, structures, and soils during partial and final closure.	264.112(b)(4) 401 KAR 39:090 Sec 8 (1)	**NA**	Click here to enter text.		*The description shall include, but not limited to, procedures for cleaning equipment and removing contaminated soils, methods for sampling and testing surrounding soils, and criteria for determining the extent of decontamination required to satisfy the closure performance standard.*
iv. A detailed description of other activities necessary to satisfy *Checklist I.1.1* above, including, but not limited to, ground-water monitoring, leachate collection, and run-on and run-off control.	264.112(b)(5)	**NA**	Click here to enter text.		Click here to enter text.

Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
v. A schedule for closure of each hazardous waste management unit and for final closure of the facility. The schedule must include, at a minimum, the total time required to close each hazardous waste management unit and the time required for intervening closure activities which will allow tracking of the progress of partial and final closure. This schedule shall comply with: • All hazardous waste must be treated, removed from the unit of facility or dispose of on-site within 90 days after receiving the final volume of hazardous or non-hazardous wastes. • All partial and final closure activities must be completed within 180 days after receiving the final volume of hazardous or non-hazardous wastes.	264.112(b)(6); 264.113(a) and (b) 401 KAR 39:090 Sec 8 (8)	**NA**	Click here to enter text.		*If an extension to the closure period is required, applicant shall submit an extension request that complies with the requirements in 40 CFR Part 264.113(a) and (b).*
vi. For facilities that use trust funds to establish financial assurance under 40 CFR Part 264.143 or 264.145 and that are expected to close prior to the expiration of the permit, an estimate of the expected year of final closure.	264.112(b)(7)	**NA**	Click here to enter text.		Click here to enter text.
I.1.3 Closure of Containers Provide the following information:	264.178; 264.112(b)(3)				
i. An estimate of the on-site maximum inventory of hazardous wastes in containers over the active life of the facility.	264.112(b)(3)	**NA**	Click here to enter text.		Click here to enter text.
ii. A description of how all hazardous waste and hazardous waste residues will be removed from the containment system.	264.178	**NA**	Click here to enter text.		Click here to enter text.

Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
iii. A description of how the remaining containers, liners, bases, and soil containing or contaminated with hazardous waste or hazardous waste residues will be decontaminated or removed.	264.178	**NA**	Click here to enter text.		Click here to enter text.
I.1.4 Closure of Tanks Provide the following information:	264.197; 264.112(b)(3)				
i. An estimate of the on-site maximum inventory of hazardous wastes in tanks over the active life of the facility.	264.112(b)(3)	**NA**	Click here to enter text.		Click here to enter text.
ii. A description of how all waste residues, contaminated containment system components (liners, etc.), contaminated soils, and structures and equipment contaminated with waste, will be removed or decontaminated and managed as hazardous waste.	264.197(a); 264.197(b)	**NA**	Click here to enter text.		*If applicant demonstrates that not all contaminated soils can be practicably removed or decontaminated, the tank system must be closed in accordance with the closure, post-closure, and financial responsibility requirements for landfills. (See applicable Checklist I.1.7, I.2 through I.8 below)*
iii. If a tank system does not have secondary containment and is not exempt from the secondary containment requirements: • A closure plan that includes both a plan for complying with *Checklist I.1.4.ii* above and a contingent plan for complying with requirements of a tank system that will be closed as landfill (See comments in *Checklist I.1.4.ii* above). • A contingent post-closure plan for complying with requirements of a tank system that will be closed as landfill (See comments in *Checklist I.1.4.ii* above).	264.197(c)	**NA**	Click here to enter text.		*The secondary containment shall meet the requirements of 40 CFR Part 264.193(b) through (f). The secondary containment exemption shall be in accordance with 40 CFR Part 264.193(g).*

Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
• The cost estimates calculated for closure and post-closure care must reflect the costs of complying with the contingent closure plan and the contingent post-closure plan, if those costs are greater than the costs of complying with the closure plan prepared for the expected closure under *Checklist I.1.4.ii* above.		Click here to enter text.	Click here to enter text.		*Financial assurance must be based on the cost estimates in this specific checklist item.*
I.1.5 Closure of Incinerators Description of how at closure, all hazardous waste and hazardous waste residues will be removed from the incinerator, associated ductwork, piping, air pollution control equipment, sumps, and any other structures or operating equipment such as pumps, valves, etc., that have come into contact with the hazardous waste. Alternatively, a description of how the incinerator and associated units and equipment will be dismantled and disposed of as a hazardous waste will suffice.	264.351	**NA**	Click here to enter text.		*Hazardous waste residues shall include, but not limited to, ash, scrubber waters, and scrubber sludge.*
I.1.6 Closure of Surface Impoundments Provide the following information:	270.17(f); 264.228				*The applicant has the option of closing the surface impoundment using procedures in Checklist I.1.6.i or Checklist I.1.6.ii.*
i. Description of how to remove or decontaminate all waste residues, contaminated containment system components (liners, etc.), contaminated subsoils, and structures and equipment contaminated with waste and leachate, and manage them as hazardous waste unless 40 CFR Part 261.3(d) applies.	264.228(a)(1) and (b)	**NA**	Click here to enter text.		*If some waste residues or contaminated materials will be or are left in place at final closure, the applicant must comply with all the applicable post-closure requirements stated in 40 CFR Part 264.228(b) (See applicable Checklist I.2 through I.8 below).*

Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
ii. Description of how to: • Eliminate free liquids by removing liquid wastes or solidifying the remaining wastes and waste residues; • Stabilize remaining wastes to a bearing capacity sufficient to support final cover; and • Cover the surface impoundment with a final cover designed and constructed to: ➢ Provide long-term minimization of the migration of liquids through the closed impoundment; ➢ Function with minimum maintenance; ➢ Promote drainage and minimize erosion or abrasion of the final cover; ➢ Accommodate settling and subsidence so that the cover's integrity is maintained; and ➢ Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.	264.228(a)(2)	**NA**	Click here to enter text.		*The applicant shall provide engineering details on the final cover.*
iii. For impoundment that does not comply with the liner requirements of 40 CFR Part 264.221(a) and is not exempt from them in accordance with 40 CFR Part 264.221(b): • State the reasons why the impoundment does not comply with the liner requirements. • The closure plan for the impoundment must include both a plan for complying with *Checklist I.1.6.i* above and a contingent plan for complying with *Checklist I.1.6.ii* above in case not all contaminated subsoils can be practicably removed at closure; and	264.228(c)(1) and (2)	**NA**	Click here to enter text.		*This checklist item only applies if the applicant plans to close a surface impoundment in accordance with Checklist I.1.6.i above.*

Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
• A contingent post-closure plan in case not all contaminated subsoils can be practicably removed at closure (See comments in *Checklist I.1.6.i* above). • The cost estimates calculated for closure and post-closure care of an impoundment must include the cost of complying with the contingent closure plan and the contingent post-closure plan, but are not required to include the cost of expected closure under *Checklist I.1.6.i* above.					
I.1.7 Closure of Landfills Description of how the applicant will cover the landfill or cell with a final cover that is designed and constructed to: • Provide long-term minimization of migration of liquids through the closed landfill; • Function with minimum maintenance; • Promote drainage and minimize erosion or abrasion of the cover; • Accommodate settling and subsidence so that the cover's integrity is maintained; and • Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.	270.21(e); 264.310(a)	**NA**	Click here to enter text.		*The applicant shall provide engineering details on the final cover.*
I.1.8 Closure of Waste Piles Provide the following information:	270.18(h); 264.258				

Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
i. Description of how to remove or decontaminate all waste residues, contaminated containment system components (liners, etc.), contaminated subsoils, and structures and equipment contaminated with waste and leachate, and manage them as hazardous waste unless 40 CFR Part 261.3(d) applies.	264.258(a) and (b)	Click here to enter text.	Click here to enter text.		*If not all contaminated subsoils can be practicably removed or decontaminated, the applicant must perform post-closure care in accordance with the closure and post-closure care requirements that apply to landfills (40 CFR Part 264.310). (See applicable Checklist I.2 through I.8 below)*
ii. For waste pile that does not comply with the liner requirements of 40 CFR Part 264.251(a)(1) and is not exempt from them in accordance with 40 CFR Part 264.250(c) or 264.251(b): • State the reasons why the waste pile does not comply with the liner requirements. • The closure plan for the waste pile must include both a plan for complying with *Checklist I.1.8.i* above and a contingent plan for complying with post-closure care requirements (See comments in *Checklist I.1.8.i* above) in case not all contaminated subsoils can be practicably removed at closure; and • A contingent post-closure plan in case not all contaminated subsoils can be practicably removed at closure (See comments in *Checklist I.1.8.i* above). • The cost estimates calculated for closure and post-closure care of a waste pile must include the cost of complying with the contingent closure plan and the contingent post-closure plan, but are not required to include the cost of expected closure under *Checklist I.1.8.i* above.	264.258(c)	**NA**	Click here to enter text.		Click here to enter text.
I.1.9 Closure of Land Treatment Facilities	264.280(a)				

Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
Demonstrate that during closure period, the applicant will:					
i. Continue all operations (including pH control) necessary to maximize degradation, transformation, or immobilization of hazardous constituents within the treatment zone.	264.280(a)(1)	**NA**	Click here to enter text.		*Except to the extent such measures are inconsistent with Checklist I.1.9.viii below.*
ii. Continue all operations in the treatment zone to minimize run-off of hazardous constituents.	264.280(a)(2)	**NA**	Click here to enter text.		Click here to enter text.
iii. Maintain the run-on control system.	264.280(a)(3)	**NA**	Click here to enter text.		Click here to enter text.
iv. Maintain the run-off management system.	264.280(a)(4)	**NA**	Click here to enter text.		Click here to enter text.
v. Control wind dispersal of hazardous waste if required under 40 CFR Part 264.273(f).	264.280(a)(5)	**NA**	Click here to enter text.		Click here to enter text.
vi. Continue to comply with any prohibitions or conditions concerning growth of food-chain crops under 40 CFR Part 264.276.	264.280(a)(6)	**NA**	Click here to enter text.		Click here to enter text.
vii. Continue unsaturated zone monitoring except that soil-pore liquid monitoring may be terminated 90 days after the last application of waste to the treatment zone.	264.280(a)(7)	**NA**	Click here to enter text.		Click here to enter text.
viii. Establish a vegetative cover on the portion of the facility being closed at such time that the cover will not substantially impede degradation, transformation, or immobilization of hazardous constituents in the treatment zone. The	264.280(a)(8)	**NA**	Click here to enter text.		*This checklist may not apply if applicant demonstrates compliance with 40 CFR Part 264.280(d).*

Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
vegetative cover must be capable of maintaining growth without extensive maintenance.					
I.1.10 Closure of Boilers and Industrial Furnaces (BIFs) Provide the following information:	266.102(a)(2)(vii)				
i. Description of how at closure, all hazardous waste and hazardous waste residues will be removed from the BIFs, associated ductwork, piping, air pollution control equipment, sumps, and any other structures or operating equipment such as pumps, valves, etc., that have come into contact with the hazardous waste. Alternatively, a description of how the BIFs and associated units and equipment will be dismantled and disposed of as a hazardous waste will suffice.		**NA**	Click here to enter text.		Click here to enter text.
ii. If any wastes, waste residues, contaminated components, subsoils, structures or equipment will remain after closure, provide plans for closing the BIF unit as a landfill (40 CFR Part 264.310) and provide a post-closure care plan (See *Checklist I.2.4* below).		**NA**	Click here to enter text.		Click here to enter text.
I.1.11 Closure of Containment Buildings Provide the following information:	264.1102				
i. A description of how all waste residues, contaminated containment system components (liners, etc.), contaminated soils, and structures and equipment contaminated with waste, will be		**NA**	Click here to enter text.		Click here to enter text.

	Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
	removed or decontaminated and managed as hazardous waste.					
	ii. If not all contaminated subsoils can be practicably removed or decontaminated, the applicant must perform post-closure care in accordance with the closure and post-closure care requirements that apply to landfills (40 CFR Part 264.310). (See *Checklist I.2.4* below)		**NA**	Click here to enter text.		Click here to enter text.
	I.1.12 Closure of Miscellaneous Unit Applicant shall provide the closure information requested in unit-specific *Checklist I.1.3* to *I.1.11* above that is most appropriate for the miscellaneous unit.	270.23(a)(2)	**NA**	Click here to enter text.		*Applicant must close the miscellaneous unit in a manner that will ensure protection of human health and the environment.*
I.2	**Post-Closure Plans**	270.14(b)(13); 264.117 through 264.120				*Applicant of a hazardous waste disposal unit must have a written post-closure plan.*
	I.2.1 Inspection Plan A description of the inspections to be conducted during the post-closure care period, their frequency, the inspection procedures, and the logs to be kept. The following items, as applicable, should be included in the inspection plan: • Security control devices • Erosion damage • Cover settlement, subsidence and displacement • Vegetative cover condition • Integrity of run-on and run-off control measures • Cover drainage system function	264.118(a) and (b)	**Y**	**Application Attachment III Post-Closure Plan**		*The description shall apply to each hazardous waste management unit that is subject to post-closure requirements. The post-closure plan must identify the activities that will be carried on after closure of each disposal unit and the frequency of these activities.*

Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
• Leachate collection/detection and removal system maintenance • Gas venting system • Well condition • Benchmark integrity					
I.2.2 Monitoring Plan A description of the monitoring to be conducted during the post-closure care period, their frequency, including, as applicable, the procedures for conducting the following operations and evaluating the data gathered should include: • Groundwater monitoring (Use Part E – Groundwater Monitoring checklist) • Leachate collection/detection and removal	264.118(a) and (b)	**Y**	**Application Attachment III Post-Closure Plan Section 3.0 and Appendix B**		*The description shall apply to each hazardous waste management unit that is subject to post-closure requirements. The post-closure plan must identify the activities that will be carried on after closure of each disposal unit and the frequency of these activities.*
I.2.3 Maintenance Plan A description of preventative and corrective maintenance procedures, equipment procedures, equipment requirements and material needs, as well as their frequency. Include the following items in the maintenance plan, as applicable: • The integrity of the cap and final cover or other containment systems. • The function of the monitoring equipment. • Repair of security control devices. • Erosion damage repair. • Correction of settlement, subsidence and displacement.	264.118(a) and (b)	**NA**	**Application Attachment III Post-Closure Plan Section 1.0**		*The description shall apply to each hazardous waste management unit that is subject to post-closure requirements. The post-closure plan must identify the activities that will be carried on after closure of each disposal unit and the frequency of these activities.* *Hazardous waste is not present beneath the former surface impoundments*

Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
• Mowing, fertilization and other vegetative cover maintenance. • Repair of run-on and run-off control structures. • Leachate collection/detection system maintenance. • Well replacement. • The rationale to be used to determine the need for corrective maintenance activities.					
I.2.4 Post-Closure Care for Landfill Provide the following description:	264.310(b)				*In addition to the applicable information requested in Checklist I.2.1 through I.2.3 above, the applicant shall also use this checklist for unit(s) that will be closed as landfill.*
i. How to maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events.	264.310(b)(1)	**NA**	Click here to enter text.		Click here to enter text.
ii. Continuation to operate the leachate collection and removal system until leachate is no longer detected.	264.310(b)(2)	**NA**	Click here to enter text.		Click here to enter text.
iii. How to maintain and monitor the leak detection system in accordance with 40 CFR Part 264.301(c)(3)(iv) and (4), and 264.303(c), as well as comply with all other applicable leak detection system requirements.	264.310(b)(3)	**NA**	Click here to enter text.		Click here to enter text.
iv. How to maintain and monitor the groundwater monitoring system and comply with all other applicable requirements of 40 CFR Part 264 Subpart F.	264.310(b)(4)	**NA**	Click here to enter text.		Click here to enter text.
v. How to prevent run-on and run-off from eroding or otherwise damaging the final cover.	264.310(b)(5)	**NA**	Click here to enter text.		Click here to enter text.

Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
vi. How to protect and maintain surveyed benchmarks used in complying with 40 CFR Part 264.309.	264.310(b)(6)	**NA**	Click here to enter text.		Click here to enter text.
I.2.5 Post-Closure Care for Surface Impoundment Provide the following description:	264.228(b)				*In addition to the applicable information requested in Checklist I.2.1 through I.2.3 above, the applicant shall provide information requested in this checklist.*
i. How to maintain and monitor the leak detection system in accordance with 40 CFR Part 264.221(c)(2)(iv) and (3) and 264.226(d), as well as comply with all other applicable leak detection system requirements.	264.228(b)(2)	**NA**	Click here to enter text.		*Hazardous waste is not present beneath the former surface impoundment caps. The ground will be maintained in compliance with erosion control and stormwater regulations.*
ii. How to maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events.	264.228(b)(1)	**NA**	Click here to enter text.		Click here to enter text.
iii. How to maintain and monitor the groundwater monitoring system and comply with all other applicable requirements of 40 CFR Part 264 Subpart F.	264.228(b)(3)	**NA**	Click here to enter text.		Click here to enter text.
iv. How to prevent run-on and run-off from eroding or otherwise damaging the final cover.	264.228(b)(4)	**NA**	Click here to enter text.		Click here to enter text.
I.2.6 Post-Closure Care for Land Treatment Facilities Demonstrate that during post-closure care period, the applicant will:	264.280(c)				*In addition to the applicable information requested in Checklist I.2.1 through I.2.3 above, the applicant shall provide information requested in this checklist. This checklist may not apply if applicant demonstrates compliance with 40 CFR Part 264.280(d).*

Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
i. Continue all operations (including pH control) necessary to enhance degradation and transformation and sustain immobilization of hazardous constituents in the treatment zone to the extent that such measures are consistent with other post-closure care activities.	264.280(c)(1)	**NA**	Click here to enter text.		Click here to enter text.
ii. Maintain a vegetative cover over closed portions of the facility.	264.280(c)(2)	**NA**	Click here to enter text.		Click here to enter text.
iii. Maintain the run-on control system.	264.280(c)(3)	**NA**	Click here to enter text.		Click here to enter text.
iv. Maintain the run-off management system.	264.280(c)(4)	**NA**	Click here to enter text.		Click here to enter text.
v. Control wind dispersal of hazardous waste.	264.280(c)(5)	**NA**	Click here to enter text.		Click here to enter text.
vi. Continue to comply with any prohibitions or conditions concerning growth of food-chain crops.	264.280(c)(6)	**NA**	Click here to enter text.		Click here to enter text.
vii. Continue unsaturated zone monitoring except that soil-pore liquid monitoring may be terminated 90 days after the last application of waste to the treatment zone.	264.280(c)(7)	**NA**	Click here to enter text.		Click here to enter text.
I.2.7 Post-Closure Care for Miscellaneous Unit A detailed description of the procedures to ensure protection of human health and the environment, include the prevention of any releases to	270.23(a)(3); 264.603	**NA**	Click here to enter text.		*This checklist applies to miscellaneous unit that is a disposal unit and a treatment or storage unit that has contaminated soils or ground water that cannot be completely removed or decontaminated during closure.*

	Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
	groundwater or subsurface environment, surface water or wetlands or on the soil surface; or to air.					
	I.2.8 Post-Closure Security Provide the following information:	264.117(b) and (c)				
	i. During post-closure care period, if hazardous waste may remain exposed, or access by the public or domestic livestock may pose a hazard to human health, describe which security provisions (40 CFR Part 264.14) will continue.	264.117(b)	**NA**	Click here to enter text.		*There is no hazardous waste at the Facility*
	ii. Demonstrate that post-closure use of property on or in which hazardous wastes remain after partial or final closure will never disturb the integrity of the final cover, liner(s), or any other components of the containment system, or the function of the facility's monitoring systems.		**NA**	Click here to enter text.		*This checklist item is not applicable if applicant demonstrates that the disturbance is (1) Is necessary to the proposed use of the property, and will not increase the potential hazard to human health or the environment; or (2) Is necessary to reduce a threat to human health or the environment.*
	I.2.9 Post-Closure Contact Provide the name, address, and phone number of the person or office to contact about the hazardous waste disposal unit or facility during the post-closure care period.	264.118(b)(3)	**Y**	**Response to 8/10/2022 NOD Attachment 5**		Click here to enter text.
I.3	**Notification Requirement for Disposal Facilities**	270.14(b)(13)				
	I.3.1 Closure Certification A statement by the applicant which indicates that within 60 days of completion of closure of each hazardous waste surface impoundment, waste pile,	264.115; 264.280	**NA**	Click here to enter text.		*The certification must be signed by the owner or operator and by a qualified independent Professional Engineer registered in the Commonwealth of Kentucky (or by an independent qualified soil scientist in the case of a land treatment closure).*

Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
land treatment, and landfill unit, and within 60 days of the completion of final closure, the applicant will submit to the Division, by registered mail, a certification that the hazardous waste management unit or facility, as applicable, has been closed in accordance with the specifications in the approved closure plan.					
I.3.2 Survey Plat A statement by the applicant which indicates that no later than the submission of the certification of closure of each hazardous waste disposal unit, the applicant will submit to the local zoning authority, or the authority with jurisdiction over local land use, and to the Division, a survey plat indicating the location and dimensions of landfill cells or other hazardous waste disposal units with respect to permanently surveyed benchmarks.	264.116	**NA**	Click here to enter text.		*This plat must be prepared and certified by a professional land surveyor. The plat must contain a note, prominently displayed, which states the owner's or operator's obligation to restrict disturbance of the hazardous waste disposal unit in accordance with the applicable 40 CFR Part 264 Subpart G regulations.*
I.3.3 Post-Closure Certification A statement by the applicant which indicates that no later than 60 days after completion of the established post-closure care period for each hazardous waste disposal unit, the applicant will submit to the Division, by registered mail, a certification that the post-closure care period for the hazardous waste disposal unit was performed in accordance with the specifications in the approved post-closure plan.	264.120	**NA**	Click here to enter text.		*The certification must be signed by the owner or operator and by a qualified independent Professional Engineer registered in the Commonwealth of Kentucky.*
I.3.4 Post-Closure Notices	270.14(b)(14); 264.119				

	Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
	Provide the following information:					
	i. A statement by the applicant which indicates that no later than 60 days after certification of closure of each hazardous waste disposal unit, the owner or operator will submit to the local zoning authority, or the authority with jurisdiction over local land use, and to the Division a record of the type, location, and quantity of hazardous wastes disposed of within each cell or other disposal unit of the facility.	264.119(a)	**NA**	Click here to enter text.		Click here to enter text.
	ii. A statement by the applicant which indicates that the owner or operator will record a notation on the deed to the facility property or on some other instrument which is normally examined during title search, that will in perpetuity notify any potential purchaser of the property that: • The land has been used to manage hazardous wastes; and • Its use is restricted under 40 CFR part 264, subpart G regulations; and • The survey plat and record of the type, location, and quantity of hazardous wastes disposed of within each cell or other hazardous waste disposal unit of the facility required have been filed with the local zoning authority or the authority with jurisdiction over local land use and with the Division.	264.119(b)	**NA**	Click here to enter text.		*This notation must be done within 60 days of certification of closure of the first hazardous waste disposal unit and within 60 days of certification of closure of the last hazardous waste disposal unit. Owner or operator must submit a certification, signed by the owner or operator, that he has recorded the notation including a copy of the document in which the notation has been placed, to the Division.*
I.4	**Closure Cost Estimate**	270.14(b)(15); 264.142				*The applicant must have a detailed written estimate, in current dollars, of the cost of closing the facility. Estimate must be adjusted for annual inflation as specified in 40 CFR Part 264.142(b).*

	Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
	The applicant shall comply, at the minimum, with the following requirements when submitting the closure cost estimate:					
	i. The estimate must equal the cost of final closure at the point in the facility's active life when the extent and manner of its operation would make closure the most expensive.	264.142(a)(1)	**NA**	Click here to enter text.		Click here to enter text.
	ii. The estimate must be based on the costs to the owner or operator of hiring a third party to close the facility.	264.142(a)(2)	**NA**	Click here to enter text.		*The applicant may use costs for on-site disposal if he can demonstrate that on-site disposal capacity will exist at all times over the life of the facility.*
	iii. The estimate may not incorporate any salvage value that may be realized with the sale of hazardous wastes, or non-hazardous wastes if applicable under 40 CFR Part 264.113(d), facility structures or equipment, land, or other assets associated with the facility at the time of partial or final closure.	264.142(a)(3)	**NA**	Click here to enter text.		Click here to enter text.
	iv. The applicant may not incorporate a zero cost for hazardous wastes, or non-hazardous wastes if applicable under 40 CFR Part 264.113(d), that might have economic value.	264.142(a)(4)	**NA**	Click here to enter text.		Click here to enter text.
I.5	**Financial Assurance Mechanism for Closure** The financial assurance submittal must be accompanied by one of the financial instruments listed below: • Closure trust fund. • Surety bond guaranteeing payment into a closure trust fund.	270.14(b)(15); 264.143; 264.151; 401 KAR 39:090 Sections 1 & 7 KRS 224	**NA**	Click here to enter text.		*An applicant must establish financial assurance for closure of the facility. Refer to 40 CFR Part 264.143 and 264.151 for more detailed information and submittal requirements For financial assurance templates please visit our website at:* https://eec.ky.gov/Environmental-Protection/Waste/hazardous-

	Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
	• Surety bond guaranteeing performance of closure. • Closure letter of credit. • Closure insurance. • Insurers must be authorized in Kentucky. • Financial test and corporate guarantee for closure. • Cash Account and Certificate of Deposit.					waste/Pages/HW%20Financial%20Assurance%20Templates.aspx
I.6	**Post-Closure Cost Estimate** The applicant shall comply, at the minimum, with the following requirements when submitting the post-closure cost estimate:	270.14(b)(16); 264.144				*Applicant subject to contingent closure and post-closure plan must have a detailed written estimate, in current dollars, of the annual cost of post-closure monitoring and maintenance of the facility. Estimate must be adjusted for inflation as specified in 40 CFR Part 264.144(b).*
	i. The post-closure cost estimate must be based on the costs to the owner or operator of hiring a third party to conduct post-closure care activities.	264.144(a)(1)	**Y**	**Application Attachment I Post-Closure Plan Section 5.0**		Click here to enter text.
	ii. The post-closure cost estimate is calculated by multiplying the annual post-closure cost estimate by the number of years of post-closure care required.	264.144(a)(2)	**Y**	**Application Attachment I Post-Closure Plan Section 5.0**		Click here to enter text.
I.7	**Financial Assurance Mechanism for Post-Closure Care**	270.14(b)(16); 264.145; 264.151; 401 KAR 39:090 Section 7	**Y**	**Response to 8/10/2022 NOD Attachment 8**		*An applicant must establish financial assurance for post-closure care. Refer to 40 CFR Part 264.145 and 264.151 for more detailed information and submittal requirements.*

	Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
	The financial assurance submittal must be accompanied by one of the financial instruments listed in *Checklist I.5* above, but for post-closure.					
I.8	**Liability Requirements**	270.14(b)(17); 264.147				
	I.8.1 Coverage for Sudden Accidental Occurrences For hazardous waste treatment, storage, or disposal facility, demonstrate financial responsibility for bodily injury and property damage to third parties caused by sudden accidental occurrences. The liability coverage may be demonstrated by one or combinations of the financial instruments listed below: • Liability insurance. • Financial test or using the guarantee for liability coverage as specified in 40 CFR Part 264.147(f) and (g). • Letter of credit as specified in 40 CFR Part 264.147(h). • Surety bond as specified in 40 CFR Part 264.147(i). • Trust fund as specified in 40 CFR Part 264.147(j).	264.147(a)	**Y**	**Response to 8/10/2022 NOD Attachment 8**		*Liability coverage for sudden accidental occurrences must be in the amount of at least $1 million per occurrence with an annual aggregate of at least $2 million, exclusive of legal defense costs. Refer to 40 CFR Part 264.147 for more detailed information and submittal requirements. Combinations of financial instruments shall not include a financial test covering part of the liability coverage requirement with a guarantee unless the financial statement of the owner or operator is not consolidated with the financial statement of the guarantor. Combinations of financial instruments shall specify at least one such assurance as "primary" coverage and shall specify other assurance as "excess" coverage.*
	I.8.2 Coverage for Non-Sudden Accidental Occurrences For a surface impoundment, landfill, land treatment facility, or disposal miscellaneous unit that is used to manage hazardous waste, applicant must	264.147(b)	**Y**	**Response to 8/10/2022 NOD Attachment 8**		*The owner or operator must have and maintain liability coverage for non-sudden accidental occurrences in the amount of at least $3 million per occurrence with an annual aggregate of at least $6 million, exclusive of legal defense costs. Applicant who combine coverage levels for sudden (Checklist I.8.1 above) and non-*

	Section and Requirement	Regulation (Federal or State)	Submitted (Y/N/NA)*	Location in Application	Technically Adequate (Y/N)*	Comments
	demonstrate financial responsibility for bodily injury and property damage to third parties caused by non-sudden accidental occurrences. Applicant may use the financial instruments listed in *Checklist I.8.1* above. The comment on combinations of financial instruments in *Checklist I.8.1* above shall apply.					*sudden accidental occurrences must maintain liability coverage in the amount of at least $4 million per occurrence and $8 million annual aggregate.*
	I.8.3 Request for Variance If applicant can demonstrate to the satisfaction of the Division that the levels of financial responsibility required by Checklist I.8.1 or I.8.2 above are not consistent with the degree and duration of risk associated with treatment, storage, or disposal at the facility or group of facilities, the applicant may obtain a variance from the Division.	264.147(c)	**NA**	Click here to enter text.		*Variance request shall be made according to 40 CFR Part 264.147(c).*

RIDER No.1

To be attached to and form part of:

Bond Number	08966128
dated	04/14/2009
Issued by the	FIDELITY AND DEPOSIT COMPANY OF MARYLAND
In the amount of	$840.192.00
On behalf of (Original Principal)	KIDDE-FENWAL, INC. ACTING THROUGH ITS PARENT CORP. AND SOLE SHAREHOLDER UTC
and in favor of (oblige)	KENTUCKY DEPARTMENT OF ENVIRONMENTAL PROTECTION

Now therefore, it is agreed that in consideration of the total penal sum of this bond and premium charged, the attached bond shall be amended as follows:

The Principal Name shall be:	**Kidde-Fenwal, Inc., acting through its parent corporation and sole shareholder Carrier Corporation ("Carrier")**
The Principal Address shall be:	**Center for Intelligent Buildings 13995 Pasteur Boulevard Palm Beach Gardens, Florida, 33418**

All references to "UTC" shall be "Carrier".

It is further understood and agreed that all other terms and conditions of this bond shall remain unchanged.

This Rider is Effective on the 1st day of March, 2021.

Signed, Sealed & Dated this 1st day of March, 2021.

Kidde-Fenwal, Inc., acting through its parent corporation and sole shareholder Carrier Corporation ("Carrier")
(Principal)

By: Sandra Diaz
Sandra Diaz, Attorney-In-Fact

FIDELITY AND DEPOSIT COMPANY OF MARYLAND
(Surety)

By: Francesca Kazmierczak
Francesca Kazmierczak, Attorney-in-Fact

Edition: 1 (eff. 1 December 2019)

SPECIAL POWER OF ATTORNEY

CARRIER GLOBAL CORPORATION, a Corporation organized and existing under the laws of the State of Delaware, on behalf of itself, its subsidiaries and affiliates, (collectively referred to as the "Corporation"), hereby makes, constitutes and appoints AON RISK SERVICES NORTHEAST, INC. on behalf of certain of its employees as the Corporation's true and lawful attorneys-in-fact:

Francesca Kazmierczak
Cynthia Farrell
Theresan E. Rowedder
Sandra Diaz
Frances Rodriguez
Jennifer L. Jakaitis
Susan A. Welsh
KeAna Conrad

with full power to execute, seal and deliver on behalf of the Corporation, surety bonds and documents ancillary thereto issued in the course of the Corporation's business, subject to the provisions of the Insurance Brokerage and Service Agreement effective December 1, 2019, among Aon Risk Services, Inc. of Connecticut, Aon Risk Services, Inc. of New York, currently known as **AON RISK SERVICES NORTHEAST, INC. and CARRIER GLOBAL CORPORATION,** as amended or supplemented from time to time, and to bind the Corporation, thereby as if such writings had been duly executed and acknowledged by officers of the Corporation.

IN WITNESS WHEREOF, the Corporation has caused this Special Power of Attorney to be signed by its duly authorized representative this 27th day of November, 2019.

CARRIER GLOBAL CORPORATION

By: _____
Name: Christopher Witzky
Title: Vice President, Treasurer

UNITED STATES OF AMERICA) ss: TOWN OF FARMINGTON
STATE OF Connecticut)
COUNTY OF Hartford)

On this 2 day of Dec 2019, before me, a Notary Public in and for said County and State, personally appeared Christopher Witzky, who acknowledged himself to be the Vice President, Treasurer of CARRIER GLOBAL CORPORATION, the corporation named in the foregoing instrument, and that as such, being authorized so to do, executed the foregoing instrument for the same for the purposes therein contained by signing such document in his capacity as Vice President, Treasurer.

MARY FRANCES DOHERTY
Notary Public, State of Connecticut
My Commission Expires July 31, 2023

Mary Frances Doherty
, Notary Public

ZURICH AMERICAN INSURANCE COMPANY
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY
FIDELITY AND DEPOSIT COMPANY OF MARYLAND
POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That the ZURICH AMERICAN INSURANCE COMPANY, a corporation of the State of New York, the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, a corporation of the State of Illinois, and the FIDELITY AND DEPOSIT COMPANY OF MARYLAND a corporation of the State of Illinois (herein collectively called the "Companies"), by **Robert D. Murray, Vice President**, in pursuance of authority granted by Article V, Section 8, of the By-Laws of said Companies, which are set forth on the reverse side hereof and are hereby certified to be in full force and effect on the date hereof, do hereby nominate, constitute, and appoint **Debra A. DEMING, Cynthia FARRELL, Sandra DIAZ, Susan A. WELSH, Aklima NOORHASSAN, Francesca KAZMIERCZAK, Frances RODRIGUEZ, Peter HEALY, Nancy SCHNEE and Anne POTTER, all of New York, New York, EACH,** its true and lawful agent and Attorney-in-Fact, to make, execute, seal and deliver, for, and on its behalf as surety, and as its act and deed: **any and all bonds and undertakings,** and the execution of such bonds or undertakings in pursuance of these presents, shall be as binding upon said Companies, as fully and amply, to all intents and purposes, as if they had been duly executed and acknowledged by the regularly elected officers of the ZURICH AMERICAN INSURANCE COMPANY at its office in New York, New York., the regularly elected officers of the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY at its office in Owings Mills, Maryland., and the regularly elected officers of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at its office in Owings Mills, Maryland., in their own proper persons.

The said Vice President does hereby certify that the extract set forth on the reverse side hereof is a true copy of Article V, Section 8, of the By-Laws of said Companies, and is now in force.

IN WITNESS WHEREOF, the said Vice-President has hereunto subscribed his/her names and affixed the Corporate Seals of the said **ZURICH AMERICAN INSURANCE COMPANY, COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, and FIDELITY AND DEPOSIT COMPANY OF MARYLAND**, this 29th day of July, A.D. 2019.

ATTEST:
ZURICH AMERICAN INSURANCE COMPANY
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY
FIDELITY AND DEPOSIT COMPANY OF MARYLAND

By: Robert D. Murray
Vice President

Dawn E Brown

By: Dawn E. Brown
Secretary

State of Maryland
County of Baltimore

On this 29th day of July, A.D. 2019, before the subscriber, a Notary Public of the State of Maryland, duly commissioned and qualified, **Robert D. Murray, Vice President and Dawn E. Brown, Secretary** of the Companies, to me personally known to be the individuals and officers described in and who executed the preceding instrument, and acknowledged the execution of same, and being by me duly sworn, deposeth and saith, that he/she is the said officer of the Company aforesaid, and that the seals affixed to the preceding instrument are the Corporate Seals of said Companies, and that the said Corporate Seals and the signature as such officer were duly affixed and subscribed to the said instrument by the authority and direction of the said Corporations.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my Official Seal the day and year first above written.

Constance A. Dunn

Constance A. Dunn, Notary Public
My Commission Expires: July 9, 2023

EXTRACT FROM BY-LAWS OF THE COMPANIES

"Article V, Section 8, Attorneys-in-Fact. The Chief Executive Officer, the President, or any Executive Vice President or Vice President may, by written instrument under the attested corporate seal, appoint attorneys-in-fact with authority to execute bonds, policies, recognizances, stipulations, undertakings, or other like instruments on behalf of the Company, and may authorize any officer or any such attorney-in-fact to affix the corporate seal thereto; and may with or without cause modify of revoke any such appointment or authority at any time."

CERTIFICATE

I, the undersigned, Secretary of the ZURICH AMERICAN INSURANCE COMPANY, the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, and the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, do hereby certify that the foregoing Power of Attorney is still in full force and effect on the date of this certificate; and I do further certify that Article V, Section 8, of the By-Laws of the Companies is still in force.

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the ZURICH AMERICAN INSURANCE COMPANY at a meeting duly called and held on the 15th day of December 1998.

RESOLVED: "That the signature of the President or a Vice President and the attesting signature of a Secretary or an Assistant Secretary and the Seal of the Company may be affixed by facsimile on any Power of Attorney...Any such Power or any certificate thereof bearing such facsimile signature and seal shall be valid and binding on the Company."

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY at a meeting duly called and held on the 5th day of May, 1994, and the following resolution of the Board of Directors of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at a meeting duly called and held on the 10th day of May, 1990.

RESOLVED: "That the facsimile or mechanically reproduced seal of the company and facsimile or mechanically reproduced signature of any Vice-President, Secretary, or Assistant Secretary of the Company, whether made heretofore or hereafter, wherever appearing upon a certified copy of any power of attorney issued by the Company, shall be valid and binding upon the Company with the same force and effect as though manually affixed.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the corporate seals of the said Companies, this 1st day of March, 2021.

By: Brian M. Hodges
Vice President

TO REPORT A CLAIM WITH REGARD TO A SURETY BOND, PLEASE SUBMIT A COMPLETE DESCRIPTION OF THE CLAIM INCLUDING THE PRINCIPAL ON THE BOND, THE BOND NUMBER, AND YOUR CONTACT INFORMATION TO:

Zurich Surety Claims
1299 Zurich Way
Schaumburg, IL 60196-1056
www.reportsfclaims@zurichna.com
800-626-4577

THE FIDELITY AND DEPOSIT COMPANY

OF MARYLAND
1299 Zurich Way Schaumburg, IL 60196

Statement of Financial Condition
As Of December 31, 2018

ASSETS

Bonds	$ 245,255,635
Stocks	22,855,569
Cash and Short Term Investments	3,092,872
Reinsurance Recoverable	73,242,781
Federal Income Tax Recoverable	42,258
Other Accounts Receivable	4,801,363
TOTAL ADMITTED ASSETS	$ 349,290,278

LIABILITIES, SURPLUS AND OTHER FUNDS

Reserve for Taxes and Expenses		$ 106,785
Ceded Reinsurance Premiums Payable		46,727,605
Remittances and Items Unallocated		125,000
Payable to parents, subs and affiliates		28,621,373
Securities Lending Collateral Liability		0
TOTAL LIABILITIES		$ 75,580,762
Capital Stock, Paid Up	$ 5,000,000	
Surplus	268,709,716	
Surplus as regards Policyholders		273,709,716
TOTAL		$ 349,290,478

Securities carried at $162,739,508 in the above statement are deposited with various states as required by law.

Securities carried on the basis prescribed by the National Association of Insurance Commissioners. On the basis of market quotations for all bonds and stocks owned, the Company's total admitted assets at December 31, 2018 would be $349,736,423 and surplus as regards policyholders $274,155,661.

I, DENNIS F. KERRIGAN, Corporate Secretary of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, do hereby certify that the foregoing statement is a correct exhibit of the assets and liabilities of the said Company on the 31st day of December, 2018.

Corporate Secretary

State of Illinois
City of Schaumburg } SS:

Subscribed and sworn to, before me, a Notary Public of the State of Illinois, in the City of Schaumburg, this 20th day of March, 2019.

Notary Public

KATHERINE R SCHULTZ
Official Seal
Notary Public - State of Illinois
My Commission Expires Nov 16, 2019

RIDER No.1

To be attached to and form part of:

Bond Number	08966129
dated	04/14/2009
Issued by the	FIDELITY AND DEPOSIT COMPANY OF MARYLAND
In the amount of	$8.000.000.00
On behalf of (Original Principal)	KIDDE-FENWAL, INC. ACTING THROUGH ITS PARENT CORP. AND SOLE SHAREHOLDER UTC
and in favor of (oblige)	KENTUCKY DEPARTMENT OF ENVIRONMENTAL PROTECTION

Now therefore, it is agreed that in consideration of the total penal sum of this bond and premium charged, the attached bond shall be amended as follows:

The Parties shall be:	**Kidde-Fenwal, Inc., acting through its parent corporation and sole shareholder Carrier Corporation ("Carrier")**
The Principal Address shall be:	**Center for Intelligent Buildings 13995 Pasteur Boulevard Palm Beach Gardens, Florida, 33418**

It is further understood and agreed that all other terms and conditions of this bond shall remain unchanged.

This Rider is Effective on the 1st day of March, 2021.

Signed, Sealed & Dated this 1st day of March, 2021.

Kidde-Fenwal, Inc., acting through its parent corporation and sole shareholder Carrier Corporation ("Carrier")
(Principal)

By: Sandra Diaz
Sandra Diaz, Attorney-In-Fact

FIDELITY AND DEPOSIT COMPANY OF MARYLAND
(Surety)

By: Francesca Kazmierczak
Francesca Kazmierczak, Attorney-in-Fact

Edition: 1 (eff. 1 December 2019)

SPECIAL POWER OF ATTORNEY

CARRIER GLOBAL CORPORATION, a Corporation organized and existing under the laws of the State of Delaware, on behalf of itself, its subsidiaries and affiliates, (collectively referred to as the "Corporation"), hereby makes, constitutes and appoints AON RISK SERVICES NORTHEAST, INC. on behalf of certain of its employees as the Corporation's true and lawful attorneys-in-fact:

Francesca Kazmierczak
Cynthia Farrell
Theresan E. Rowedder
Sandra Diaz
Frances Rodriguez
Jennifer L. Jakaitis
Susan A. Welsh
KeAna Conrad

with full power to execute, seal and deliver on behalf of the Corporation, surety bonds and documents ancillary thereto issued in the course of the Corporation's business, subject to the provisions of the Insurance Brokerage and Service Agreement effective December 1, 2019, among Aon Risk Services, Inc. of Connecticut, Aon Risk Services, Inc. of New York, currently known as **AON RISK SERVICES NORTHEAST, INC. and CARRIER GLOBAL CORPORATION,** as amended or supplemented from time to time, and to bind the Corporation, thereby as if such writings had been duly executed and acknowledged by officers of the Corporation.

IN WITNESS WHEREOF, the Corporation has caused this Special Power of Attorney to be signed by its duly authorized representative this 27th day of November, 2019.

CARRIER GLOBAL CORPORATION

By: _____
Name: Christopher Witzky
Title: Vice President, Treasurer

UNITED STATES OF AMERICA) ss: TOWN OF FARMINGTON
STATE OF Connecticut)
COUNTY OF Hartford)

On this 2 day of Dec 2019, before me, a Notary Public in and for said County and State, personally appeared Christopher Witzky, who acknowledged himself to be the Vice President, Treasurer of CARRIER GLOBAL CORPORATION, the corporation named in the foregoing instrument, and that as such, being authorized so to do, executed the foregoing instrument for the same for the purposes therein contained by signing such document in his capacity as Vice President, Treasurer.

MARY FRANCES DOHERTY
Notary Public, State of Connecticut
My Commission Expires July 31, 2023

Mary Frances Doherty
, Notary Public

ZURICH AMERICAN INSURANCE COMPANY
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY
FIDELITY AND DEPOSIT COMPANY OF MARYLAND
POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That the ZURICH AMERICAN INSURANCE COMPANY, a corporation of the State of New York, the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, a corporation of the State of Illinois, and the FIDELITY AND DEPOSIT COMPANY OF MARYLAND a corporation of the State of Illinois (herein collectively called the "Companies"), by **Robert D. Murray, Vice President**, in pursuance of authority granted by Article V, Section 8, of the By-Laws of said Companies, which are set forth on the reverse side hereof and are hereby certified to be in full force and effect on the date hereof, do hereby nominate, constitute, and appoint **Debra A. DEMING, Cynthia FARRELL, Sandra DIAZ, Susan A. WELSH, Aklima NOORHASSAN, Francesca KAZMIERCZAK, Frances RODRIGUEZ, Peter HEALY, Nancy SCHNEE and Anne POTTER, all of New York, New York, EACH,** its true and lawful agent and Attorney-in-Fact, to make, execute, seal and deliver, for, and on its behalf as surety, and as its act and deed: **any and all bonds and undertakings,** and the execution of such bonds or undertakings in pursuance of these presents, shall be as binding upon said Companies, as fully and amply, to all intents and purposes, as if they had been duly executed and acknowledged by the regularly elected officers of the ZURICH AMERICAN INSURANCE COMPANY at its office in New York, New York., the regularly elected officers of the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY at its office in Owings Mills, Maryland., and the regularly elected officers of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at its office in Owings Mills, Maryland., in their own proper persons.

The said Vice President does hereby certify that the extract set forth on the reverse side hereof is a true copy of Article V, Section 8, of the By-Laws of said Companies, and is now in force.

IN WITNESS WHEREOF, the said Vice-President has hereunto subscribed his/her names and affixed the Corporate Seals of the said **ZURICH AMERICAN INSURANCE COMPANY, COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, and FIDELITY AND DEPOSIT COMPANY OF MARYLAND**, this 29th day of July, A.D. 2019.

ATTEST:
ZURICH AMERICAN INSURANCE COMPANY
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY
FIDELITY AND DEPOSIT COMPANY OF MARYLAND

By: Robert D. Murray
Vice President

By: Dawn E. Brown
Secretary

State of Maryland
County of Baltimore

On this 29th day of July, A.D. 2019, before the subscriber, a Notary Public of the State of Maryland, duly commissioned and qualified, **Robert D. Murray, Vice President and Dawn E. Brown, Secretary** of the Companies, to me personally known to be the individuals and officers described in and who executed the preceding instrument, and acknowledged the execution of same, and being by me duly sworn, deposeth and saith, that he/she is the said officer of the Company aforesaid, and that the seals affixed to the preceding instrument are the Corporate Seals of said Companies, and that the said Corporate Seals and the signature as such officer were duly affixed and subscribed to the said instrument by the authority and direction of the said Corporations.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my Official Seal the day and year first above written.

Constance A. Dunn, Notary Public
My Commission Expires: July 9, 2023

EXTRACT FROM BY-LAWS OF THE COMPANIES

"Article V, Section 8, Attorneys-in-Fact. The Chief Executive Officer, the President, or any Executive Vice President or Vice President may, by written instrument under the attested corporate seal, appoint attorneys-in-fact with authority to execute bonds, policies, recognizances, stipulations, undertakings, or other like instruments on behalf of the Company, and may authorize any officer or any such attorney-in-fact to affix the corporate seal thereto; and may with or without cause modify of revoke any such appointment or authority at any time."

CERTIFICATE

I, the undersigned, Secretary of the ZURICH AMERICAN INSURANCE COMPANY, the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, and the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, do hereby certify that the foregoing Power of Attorney is still in full force and effect on the date of this certificate; and I do further certify that Article V, Section 8, of the By-Laws of the Companies is still in force.

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the ZURICH AMERICAN INSURANCE COMPANY at a meeting duly called and held on the 15th day of December 1998.

RESOLVED: "That the signature of the President or a Vice President and the attesting signature of a Secretary or an Assistant Secretary and the Seal of the Company may be affixed by facsimile on any Power of Attorney...Any such Power or any certificate thereof bearing such facsimile signature and seal shall be valid and binding on the Company."

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY at a meeting duly called and held on the 5th day of May, 1994, and the following resolution of the Board of Directors of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at a meeting duly called and held on the 10th day of May, 1990.

RESOLVED: "That the facsimile or mechanically reproduced seal of the company and facsimile or mechanically reproduced signature of any Vice-President, Secretary, or Assistant Secretary of the Company, whether made heretofore or hereafter, wherever appearing upon a certified copy of any power of attorney issued by the Company, shall be valid and binding upon the Company with the same force and effect as though manually affixed.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the corporate seals of the said Companies, this 1st day of March, 2021.

By: Brian M. Hodges
Vice President

TO REPORT A CLAIM WITH REGARD TO A SURETY BOND, PLEASE SUBMIT A COMPLETE DESCRIPTION OF THE CLAIM INCLUDING THE PRINCIPAL ON THE BOND, THE BOND NUMBER, AND YOUR CONTACT INFORMATION TO:

Zurich Surety Claims
1299 Zurich Way
Schaumburg, IL 60196-1056
www.reportsfclaims@zurichna.com
800-626-4577

THE FIDELITY AND DEPOSIT COMPANY

OF MARYLAND
1299 Zurich Way Schaumburg, IL 60196

Statement of Financial Condition
As Of December 31, 2018

ASSETS

Bonds	$ 245,255,635
Stocks	22,855,569
Cash and Short Term Investments	3,092,872
Reinsurance Recoverable	73,242,781
Federal Income Tax Recoverable	42,258
Other Accounts Receivable	4,801,363
TOTAL ADMITTED ASSETS	$ 349,290,278

LIABILITIES, SURPLUS AND OTHER FUNDS

Reserve for Taxes and Expenses		$ 106,785
Ceded Reinsurance Premiums Payable		46,727,605
Remittances and Items Unallocated		125,000
Payable to parents, subs and affiliates		28,621,373
Securities Lending Collateral Liability		0
TOTAL LIABILITIES		$ 75,580,762
Capital Stock, Paid Up	$ 5,000,000	
Surplus	268,709,716	
Surplus as regards Policyholders		273,709,716
TOTAL		$ 349,290,478

Securities carried at $162,739,508 in the above statement are deposited with various states as required by law.

Securities carried on the basis prescribed by the National Association of Insurance Commissioners. On the basis of market quotations for all bonds and stocks owned, the Company's total admitted assets at December 31, 2018 would be $349,736,423 and surplus as regards policyholders $274,155,661.

I, DENNIS F. KERRIGAN, Corporate Secretary of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, do hereby certify that the foregoing statement is a correct exhibit of the assets and liabilities of the said Company on the 31st day of December, 2018.

Corporate Secretary

State of Illinois
City of Schaumburg } SS:

Subscribed and sworn to, before me, a Notary Public of the State of Illinois, in the City of Schaumburg, this 20th day of March, 2019.

Notary Public

KATHERINE R SCHULTZ
Official Seal
Notary Public - State of Illinois
My Commission Expires Nov 16, 2019

ENERGY AND ENVIRONMENT CABINET

Steven L. Beshear
Governor

Department for Environmental Protection
Division of Waste Management
200 Fair Oaks Lane
Frankfort, Kentucky 40601-1190
www.kentucky.gov

Leonard K. Peters
Secretary

RECEIVED
MAY 20 2009

May 12, 2009

Mr. Wayne Wnuck
United Technologies Corporation
United Technologies Building
Hartford, Connecticut 06101

RE: Financial Assurance
Kidde-Fenwal, Inc.
KYD-081-017-667; Mercer County
A.I. # 48471

Dear Mr. Wnuck:

The Kentucky Division of Waste Management has reviewed the Payment and Performance bonds dated April 14, 2009, that are currently on file with the Division. In accordance with 401 KAR 34:100, the Performance Bond and Trust is approved for $840,192 in postclosure assurances. In accordance with 34:120 the Payment Bond is approved for $8,000,000 in sudden/nonsudden liability assurances. It should be noted the required amount of postclosure assurances as determined by the Division is $795,820. Your submission includes an excess amount of $44,372 based on the postclosure figures provided in your renewed part B permit that were adjusted for inflation. When a permitted site is closed and moves into postclosure status, the annual adjustment for inflation is no longer required. As such, the required postclosure amount will remain $795,820.

If you have any questions concerning the financial assurance requirements, please contact John Moore at (502) 564-6716.

Sincerely,

Bill Schneider

For April J. Webb, P.E., Manager
Hazardous Waste Branch

AJW/jm

United Technologies Corporation
United Technologies Building
Hartford, CT 06101
(860) 728-7000

United Technologies

Via Certified Mail

April 28, 2009

Mr. John Moore, Financial Assurance Coordinator
Kentucky Department of Environmental Protection
Division of Waste Management
Frankfort Office Park
200 Fair Oaks Lane
Frankfort, KY 40601

RE: Kidde Fenwal Inc. ("Kidde")
1010 and 1020 North College Street
Harrodsburg, KY 40330
EPA ID No. KYD081017667

Dear Mr. Moore:

In its letter dated March 27, 2009, United Technologies Corporation ("UTC") and its subsidiary Kidde proposed alternate financial assurance for liability and post closure care at the above referenced facility in the form of a Performance Bond to demonstrate post closure care (with an associated standby trust) and a Payment Bond to demonstrate liability coverage. UTC has fully executed and finalized the enclosed surety bonds and standby trust in accordance with an email dated April 07, 2009, which I received from John Moore, Financial Assurance Coordinator for the Kentucky Division of Waste Management, and Paragraph 5 of the Corporate Guarantees dated May 23, 2008. Based on your email, UTC and Kidde understand that you will now forward notice that the Kentucky Department of Environmental Protection (KYDEP) has approved Kidde's proposed alternate financial assurance.

In addition, pursuant to Paragraph 10 of the Corporate Guarantees dated May 23, 2008, UTC is notifying the KDEP and, by copy of this letter, Kidde, of the cancellation and termination of the prior Corporate Guarantees, taking effect following KYDEP's approval of the enclosed alternate financial assurance.

Please contact me at (860) 728-6511 if you have any questions or additional information.

Very truly yours,

W. F. Leikin

for Wayne G. Wnuck
Environmental Engineer

Enclosures

HART1-1539657-2

Performance Bond To Demonstrate Closure And/Or Postclosure Care

Date bond executed: 4/14/09 Effective Date: 4/14/2009
(Insert date executed) *(insert effective date)*

Principal: *(insert legal name and business of owner or operator)*

Kidde-Fenwal, Inc., acting through its parent corporation and sole shareholder United Technologies Corporation
(Name)

United Technologies Building, One Financial Plaza
(Street Address)

Hartford, CT 06101
(City, state, ZIP)

Type of organization: Corporation
(insert "individual," "joint venture," "partnership," or "corporation")

Commonwealth/State of Incorporation: Delaware
(insert appropriate state name)

Surety(ies): *(Name(s) and business address(es) of Surety(ies)*:

Fidelity and Deposit Company of Maryland
(Name)
3910 Keswick Road
(Headquarters street address)
Baltimore, MD 21211-2226
(City, state, ZIP)

EPA Identification Number, name, address, and closure and/or postclosure amount(s) for each facility guaranteed by this bond, indicating closure and postclosure amounts separately:

KYD081017667
(EPA Identification Number)

Kidde Fenwal, Inc., Former Hallmack Facility
(Facility Name)
1010 and 1020 North College Street
(Street address)
Harrodsburg, KY 40330
(City, state, ZIP)
$ 0.00
(closure amount)
$840,192.00
(postclosure amount)

Total penal sum of bond: $840,192.00
(insert total penal sum of bond)

Surety's Bond Number: 08966128
(insert bond number)

Know All Persons By These Presents, That We, the Principal and Surety(ies) hereto are firmly bound to the Energy and Environment Cabinet, hereinafter called the Cabinet, in the above penal sum for the payment of which we bind ourselves, our heirs, executors, administrators, successors, and assigns jointly and severally; provided that, where the Surety(ies) are corporations acting as co-sureties, we, the Sureties, bind ourselves in such sum "jointly and severally" only for the purpose of allowing a joint action or actions against any or all of us, and for all other purposes each Surety binds itself, jointly and severally with the Principal, for the payment of such sum only as is set forth opposite the name of such Surety, but if no limit of liability is indicated, the limit of liability shall be the full amount of the penal sum.

Whereas said Principal is required, under Kentucky Revised Statutes Chapter 224, to have a permit in order to own or operate each hazardous waste site or facility identified above, and

Whereas said Principal is required to provide financial assurance for closure, or closure and postclosure care, as a condition of the permit(s), and

Whereas said Principal shall establish a standby trust fund as is required when a surety bond is used to provide such financial assurance;

Now, Therefore, the conditions of this obligation are such that if the Principal shall faithfully perform closure, whenever required to do so, of each facility for which this bond guarantees closure, in accordance with the closure plan and other requirements of the permit as such plan and permit may be amended, pursuant to all applicable laws, statutes, rules, and regulations, as such laws, statutes, rules, and regulations may be amended,

And if the Principal shall faithfully perform postclosure care of each facility for which this bond guarantees postclosure care, in accordance with the postclosure plan and other requirements of the permit, as such plan and permit may be amended, pursuant to all applicable laws, statutes, rules, and regulations, as such laws, statutes, rules, and regulations may be amended.

Or, if the Principal shall provide alternate financial assurance as specified in 401 KAR 34:080 through 34:130, and obtain from the Director of the Division of Waste management in the Cabinet, hereinafter the Director of the Division, written approval of such assurance, within ninety (90) days after the date notice of cancellation is received by both the Principal and the Director of the Division, from the Surety(ies) then this obligation shall be null and void, otherwise it is to remain in full force and effect.

The Surety(ies) shall become liable on this bond obligation only when the Principal has failed to fulfill the conditions described above.

Upon notification by the Director of the Division that the Principal has been found in violation of the closure requirements of 401 KAR Chapter 34 for a facility for which this bond guarantees performance of closure, the Surety(ies) shall either perform closure in accordance with the closure plan and other permit requirements or place the closure amount guaranteed for the facility into the standby trust fund as directed by the Director of the Division.

Upon notification by the Director of the Division that the Principal has been found in violation of the postclosure requirements of 401 KAR Chapter 34 for a facility for which this bond guarantees performance of postclosure care, the Surety(ies) shall either perform postclosure care in accordance with the postclosure plan and other permit requirements or place the postclosure amount guaranteed for the facility into the standby trust fund as directed by the Director of the Division.

Upon notification by the Director of the Division that the Principal has failed to provide alternate financial assurance as specified in 401 KAR 34:080 through 34: 130, and obtain written approval of such assurance from the Director of the Division during the ninety (90) days following receipt by both the Principal and the Director of the Division of a notice of cancellation of the bond, the Surety(ies) shall place funds in the amount guaranteed for the facility(ies) into the standby trust fund as directed by the Director of the Division.

The Surety(ies) hereby waive(s) notification of amendments to the closure plans, permits, applicable laws, statutes, rules, and regulations and agree(s) that no such amendment shall in any way alleviate its/their obligation on this bond.

The liability of the Surety(ies) shall not be discharged by any payment or succession of payments hereunder, unless and until such payment or payments shall amount in the aggregate to the penal sum of the bond, but in no event shall the obligation of the Surety(ies) hereunder exceed the amount of said penal sum.

The Surety(ies) may cancel the bond by sending notice of cancellation by certified mail to the owner or operator and to the Director of the Division, provided, however, that cancellation shall not occur during the 120 days beginning on the date of receipt of the notice of cancellation by both the Principal and the Director of the Division, as evidenced by the return receipts.

The Principal may terminate this bond by sending written notice to the Surety(ies), provided, however, that no such notice shall become effective until the Surety(ies) receive(s) written authorization for termination of the bond by the Director of the Division.

In Witness Whereof, the Principal and Surety(ies) have executed this Performance Bond and have affixed under their seals on the date set forth above.

The persons whose signatures appear below hereby certify that they are authorized to execute this surety bond on behalf of the Principal and Surety(ies) and that the wording of this surety bond is identical to the wording specified in 401 KAR 34:080 as such regulations were constituted on the date this bond was executed.

Principal

Tom Rogan
(Signature)

Thomas I. Rogan
(Name, typed)

Vice President, Treasurer
(Title, typed)

Attest:

W. F. Leikin
(Signature)

William F. Leikin
(Name, typed)

Assistant General Counsel
(Title, typed)

(Corporate seal)

Corporate Surety(ies)

Fidelity and Deposit Company of Maryland
(Name)

(Corporate Seal):

3910 Keswick Road
(Street Address)

Baltimore, MD 21211-2226
(City, State, Zip)

Commonwealth/State of incorporation: MD Liability limit: $840,192.00

Cynthia Farrell
(Signature)

Halina Kazmierczak
(Signature)

Cynthia Farrell
(Name, typed)

Halina Kazmierczak
(Name, typed)

Attorney in Fact
(Title, typed)

Witness
(Title, typed)

(For every co-surety, provide signature(s), corporate seal, and other information in the same manner as for Surety above.)

(Name)

(Street Address)

(City, State, Zip)

Commonwealth/State of incorporation: _____ Liability limit: $_____

(Signature)

(Signature)

(Name, typed)

(Name, typed)

(Title, typed)

(Title, typed)

(Corporate seal)

Bond Premium: $3,361.00

(Note: Use of this form is required by 401 KAR 34:080.)
(Note: The Trust Agreement, Form number DEP-6035A, required by 401 KAR 34:080 must be submitted with this form.)

DEP-6035C, effective 2/10/94

ACKNOWLEDGEMENT OF SURETY

State of New York)

:ss:

County of New York)

On the 14th April, 2009, before me personally came Cynthia Farrell to me known, who, being by me duly sworn, did depose and say the (s)he resides at New York, NY and that (s)he is the Attorney-In-Fact of Fidelity and Deposit Company of Maryland the Corporation described in and which executed the above instrument; that (s)he knows the seal of said Corporation; that one of the seals affixed by order of the Board of Directors of said Corporation; and that (s)he signed his/her name thereto by like order.

Valorie M. Spates

VALORIE M. SPATES
Notary Public, State of New York
No. 01SP6135425
Qualified in Queens County
Commission Expires Oct. 17, 2009

ACKNOWLEDGEMENT OF PRINCIPAL

State of CONNECTICUT

County of HARTFORD

On 4/27/09 before me personally appeared _____ THOMAS I. LOGAN _____ who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of CONNECTICUT that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

(seal) Signature _____

My Commission Exp. Dec. 31, 2013

Power of Attorney
FIDELITY AND DEPOSIT COMPANY OF MARYLAND

KNOW ALL MEN BY THESE PRESENTS: That the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, a corporation of the State of Maryland, by WILLIAM J. MILLS, Vice President, and ERIC D. BARNES, Assistant Secretary, in pursuance of authority granted by Article VI, Section 2, of the By-Laws of said Company, which are set forth on the reverse side hereof and are hereby certified to be in full force and effect on the date hereof, does hereby nominate, constitute and appoint **Betty CALDERON, Vivian CARTI, Debra A. DEMING, Cynthia FARRELL, Thomas RHATIGAN and Evangelina L. DOMINICK, all of New York, New York, EACH** its true and lawful agent and Attorney-in-Fact, to make, execute, seal and deliver, for, and on its behalf as surety, and as its act and deed: **any and all bonds and undertakings,** and the execution of such bonds or undertakings in pursuance of these presents, shall be as binding upon said Company, as fully and amply, to all intents and purposes, as if they had been duly executed and acknowledged by the regularly elected officers of the Company at its office in Baltimore, Md., in their own proper persons. This power of attorney revokes that issued on behalf of Betty CALDERON, Vivian CARTI, Debra A. DEMING, Cynthia FARRELL, Thomas RHATIGAN, Evangelina L. DOMINICK, dated May 4, 2006.

FOR YOUR PROTECTION LOOK FOR THE 20 RIGHT WATERMARK

The said Assistant Secretary does hereby certify that the extract set forth on the reverse side hereof is a true copy of Article VI, Section 2, of the By-Laws of said Company, and is now in force.

IN WITNESS WHEREOF, the said Vice-President and Assistant Secretary have hereunto subscribed their names and affixed the Corporate Seal of the said FIDELITY AND DEPOSIT COMPANY OF MARYLAND, this 16th day of January, A.D. 2009.

ATTEST: **FIDELITY AND DEPOSIT COMPANY OF MARYLAND**

FIDELITY AND DEPOSIT COMPANY OF MARYLAND INCORPORATED 1890

By:

Eric D. Barnes *Assistant Secretary* *William J. Mills* *Vice President*

State of Maryland }
City of Baltimore } ss:

On this 16th day of January, A.D. 2009, before the subscriber, a Notary Public of the State of Maryland, duly commissioned and qualified, came WILLIAM J. MILLS, Vice President, and ERIC D. BARNES, Assistant Secretary of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, to me personally known to be the individuals and officers described in and who executed the preceding instrument, and they each acknowledged the execution of the same, and being by me duly sworn, severally and each for himself deposeth and saith, that they are the said officers of the Company aforesaid, and that the seal affixed to the preceding instrument is the Corporate Seal of said Company, and that the said Corporate Seal and their signatures as such officers were duly affixed and subscribed to the said instrument by the authority and direction of the said Corporation.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my Official Seal the day and year first above written.

Constance A. Dunn *Notary Public*
My Commission Expires: July 14, 2011

EXTRACT FROM BY-LAWS OF FIDELITY AND DEPOSIT COMPANY OF MARYLAND

"Article VI, Section 2. The Chairman of the Board, or the President, or any Executive Vice-President, or any of the Senior Vice-Presidents or Vice-Presidents specially authorized so to do by the Board of Directors or by the Executive Committee, shall have power, by and with the concurrence of the Secretary or any one of the Assistant Secretaries, to appoint Resident Vice-Presidents, Assistant Vice-Presidents and Attorneys-in-Fact as the business of the Company may require, or to authorize any person or persons to execute on behalf of the Company any bonds, undertaking, recognizances, stipulations, policies, contracts, agreements, deeds, and releases and assignments of judgements, decrees, mortgages and instruments in the nature of mortgages,...and to affix the seal of the Company thereto."

CERTIFICATE

I, the undersigned, Assistant Secretary of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, do hereby certify that the foregoing Power of Attorney is still in full force and effect on the date of this certificate; and I do further certify that the Vice-President who executed the said Power of Attorney was one of the additional Vice-Presidents specially authorized by the Board of Directors to appoint any Attorney-in-Fact as provided in Article VI, Section 2, of the By-Laws of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND.

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at a meeting duly called and held on the 10th day of May, 1990.

RESOLVED: "That the facsimile or mechanically reproduced seal of the company and facsimile or mechanically reproduced signature of any Vice-President, Secretary, or Assistant Secretary of the Company, whether made heretofore or hereafter, wherever appearing upon a certified copy of any power of attorney issued by the Company, shall be valid and binding upon the Company with the same force and effect as though manually affixed."

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the corporate seal of the said Company,

this 14th day of April, 2009

Greg E. Murray

Assistant Secretary

FIDELITY AND DEPOSIT COMPANY

OF MARYLAND
3910 KESWICK ROAD, BALTIMORE, MD 21211-2226

Statement of Financial Condition
As Of December 31, 2008

ASSETS

Bonds	$ 148,252,979
Stocks	23,313,771
Cash and Short Term Investments	7,904,491
Reinsurance Recoverable	5,939,089
Other Accounts Receivable	38,307,386
TOTAL ADMITTED ASSETS	$ 223,717,718

LIABILITIES, SURPLUS AND OTHER FUNDS

Reserve for Taxes and Expenses		$ 597,566
Ceded Reinsurance Premiums Payable		38,399,492
Securities Lending Collateral Liability		6,094,921
TOTAL LIABILITIES		$ 45,091,979
Capital Stock, Paid Up	$ 5,000,000	
Surplus	173,625,739	
Surplus as regards Policyholders		178,625,738
TOTAL		$ 223,717,718

Securities carried at $38,306,550 in the above statement are deposited as required by law.

Securities carried on the basis prescribed by the National Association of Insurance Commissioners. On the basis of December 31, 2008 market quotations for all bonds and stocks owned, the Company's total admitted assets would be $216,398,425 and surplus as regards policyholders $171,306,445.

I, DENNIS F. KERRIGAN, Corporate Secretary of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, do hereby certify that the foregoing statement is a correct exhibit of the assets and liabilities of the said Company on the 31st day of December, 2008.

Corporate Secretary

State of Illinios
City of Schaumburg } SS:

Subscribed and sworn to, before me, a Notary Public of the State of Illinois, in the City of Schaumburg, this 14th day of March, 2009.

Notary Public

NOTARY PUBLIC OFFICIAL SEAL STATE OF ILLINOIS
MARLO G. SARABYN
MY COMMISSION EXPIRES
NOVEMBER 25, 2011

PAYMENT BOND TO DEMONSTRATE LIABILITY COVERAGE

Surety Bond No. 08966129
(Insert number)

Parties: Kidde-Fenwal, Inc., acting through its parent corporation and sole shareholder United Technologies Corporation ("UTC")
(Insert name and address of owner or operator)
1010 and 1020 North College Street
Harrodsburg, Kentucky 40330

Principal, incorporated in Delaware
(Insert State of incorporation)

of Hartford, Connecticut,
(Insert city and State of principal place of business)
United Technologies Building, One Financial Plaza
Hartford, CT 06101

Surety Company(ies), of Fidelity and Deposit Company of Maryland

3910 Keswick Road Baltimore, MD 21211-2226
(Insert Surety(ies) place of business)

EPA Identification Number, name, and address for each facility guaranteed by this bond:

EPA Identification Number KYD081017667; Kidde-Fenwal, Inc., Former Hallmack Facility, 1010 and 1020 North College Street Harrodsburg, KY 40330.

	Sudden accidental occurrences	**Nonsudden accidental occurrences**
Penal Sum Per Occurrence.	$1,000,000.00	$3,000,000.00
	(Insert amount)	*(Insert amount)*
Annual Aggregate	$2,000,000.00	$6,000,000.00
	(Insert amount)	*(Insert amount)*

Purpose: This is an agreement between the Surety(ies) and the Principal under which the Surety(ies), its (their) successors and assignees, agree to be responsible for the payment of claims against the Principal for bodily injury and/or property damage to third parties caused by both sudden and nonsudden
(insert "sudden," "nonsudden" or "both sudden and nonsudden")
accidental occurrences arising from operations of the facility or group of facilities in the sums prescribed herein; subject to the governing provisions and the following conditions.

Governing Provisions:

(1) Kentucky Revised Statutes Chapter 224, as amended.

(2) Rules and regulations of the Energy and Environment Cabinet (the Cabinet), particularly 401 KAR 34:080 through 34:130 and 401 KAR 35:080 through 35:130.

Conditions:

(1) The Principal is subject to the applicable governing provisions that require the Principal to have and maintain liability coverage for bodily injury and property damage to third parties caused by both sudden and nonsudden accidental occurrences arising from
(insert "Sudden," "Nonsudden" or "Both Sudden and Nonsudden")
operations of the facility or group of facilities. Such obligation does not apply to any of the following:

(a) Bodily injury or property damage for which Kidde-Fenwal, Inc. and UTC is
(insert Principal)
obligated to pay damages by reason of the assumption of liability in a contract or agreement. This exclusion does not apply to liability for damages that Kidde-Fenwal, Inc. and UTC would be obligated to pay
(insert Principal)
in the absence of the contract or agreement.

(b) Any obligation of Kidde-Fenwal, Inc. and UTC under a workers' compensation,
(insert Principal)
disability benefits, or unemployment compensation law or similar law.

(c) Bodily injury to:

1. An employee of Kidde-Fenwal, Inc. or UTC arising from, and in the
(insert Principal)
course of, employment by Kidde-Fenwal, Inc. or UTC ; or
(insert Principal)

2. The spouse, child, parent, brother or sister of that employee as a consequence of, or arising from, and in the course of employment by Kidde-Fenwal, Inc. or UTC . This exclusion applies:
(insert Principal)

(A) Whether Kidde-Fenwal, Inc. or UTC may be liable as an employer
(insert Principal)
or in any other capacity; and

(B) To any obligation to share damages with or repay another person who must pay damages because of the injury to persons identified in paragraphs 1 and 2.

(d) Bodily injury or property damage arising out of the ownership, maintenance, use, or entrustment to others of any aircraft, motor vehicle or watercraft.

(e) Property damage to:

1. Any property owned, rented, or occupied by Kidde-Fenwal, Inc. or UTC
(insert Principal)

2. Premises that are sold, given away or abandoned by Kidde-Fenwal, Inc. or
(insert Principal)

UTC if the property damage arises out of any part of those premises:

3. Property loaned to Kidde-Fenwal, Inc. or UTC _____;
(insert Principal)

4. Personal property in the care, custody or control of Kidde-Fenwal, Inc. or UTC;
(insert Principal)

5. That particular part of real property on which Kidde-Fenwal, Inc., UTC,
(insert Principal)
or any contractors or subcontractors working directly or indirectly on behalf of Kidde-Fenwal, Inc. or UTC ____ are performing operations, if the
(insert Principal)
property damage arises out of these operations.

(2) This bond assures that the Principal will satisfy valid third party liability claims, as described in Condition 1.

(3) If the Principal fails to satisfy a valid third party liability claim, as described above, the Surety(ies) becomes liable on this bond obligation.

(4) The Surety(ies) shall satisfy a third party liability claim only upon the receipt of one of the following documents:

(a) Certification from the Principal and third party claimant(s) that the liability claim should be paid. The certification shall be worded as follows:

CERTIFICATION OF VALID CLAIM

The undersigned, as parties _____
(insert "sudden" or "nonsudden")

and _____
(insert name and address of third party claimant(s))

hereby certify that the claim of bodily injury and/or property damage caused by a _____
(insert "sudden" or "nonsudden")

accidental occurrence arising from operating _____ hazardous waste treatment,
(insert Principal)

storage, or disposal facility should be paid in the amount of $_____.

_____ _____

(Signature of Principal) *Date*

_____
(Name of Principal)

_____ _____
Signature of Notary Public) *Date Notary's Commission Expires:*

_____ _____
(Name of Claimant(s))) *Date*

_____
(Name of Claimant(s)))

_____ _____
Signature of Notary Public) *Date Notary's Commission Expires:*

or

(b) A valid final court order establishing a judgment against the Principal for bodily injury or property damage caused by sudden or nonsudden accidental occurrences arising from the operation of the Principal's facility or group of facilities.

(5) In the event of combination of this bond with another mechanism for liability coverage, this bond will be considered primary_____ coverage.

(6) The liability of the Surety(ies) shall not be discharged by any payment or succession of payments hereunder, unless and until such payment or payments shall amount in the aggregate to the penal sum of the bond. In no event shall the obligation of the Surety(ies) hereunder exceed the amount of said annual aggregate penal sum, provided that the Surety(ies) furnish(es) notice to the Director of the Division of Waste Management in the Cabinet, hereinafter the Director of the Division, forthwith of all claims filed and payments made by the Surety(ies) under this bond.

(7) The Surety(ies) may cancel the bond by sending notice of cancellation by certified mail to the Principal and the Director of the Division, provided, however, that cancellation shall not occur during the 120 days beginning on the date of receipt of the notice of cancellation by the Principal and the Director of the Division, as evidenced by the return receipts.

(8) The Principal may terminate this bond by sending written notice to the Surety(ies) and to the Director of the Division.

(9) The Surety(ies) hereby waive(s) notification of amendments to applicable laws, statutes, rules and regulations and agree(s) that no such amendment shall in any way alleviate its (their) obligation on this bond.

(10) This bond is effective from 4/14/09_____ (12:01 a.m., local time, at the
(insert date)
address of the Principal as stated herein) and shall continue in force until terminated as described above.

In Witness Whereof, the Principal and Surety(ies) have executed this Bond and have affixed their seals on the date set forth above.

The persons whose signatures appear below hereby certify that they are authorized to execute this surety bond on behalf of the Principal and Surety(ies) and that the wording of this surety bond is identical to the wording specified in 401 KAR 34:080 as such regulations were constituted o the date this bond was executed.

PRINCIPAL

Tom Rogan
(Signature)

Thomas I. Rogan *(Corporate Seal)*
(Name)

Vice President, Treasurer
(Title)

Attest:

W. F. Leikin
(Signature)

William F. Leikin *(Corporate Seal)*
(Name)

Assistant General Counsel
(Title)

CORPORATE SURETY(IES)

Fidelity and Deposit Company of Maryland

3910 Keswick Road, Baltimore, MD 21211-226

(Name and address)

State of incorporation: Maryland

Liability Limit: $8,000,000.00

Cynthia Farrell

(Signature)

Cynthia Farrell *(Corporate Seal)*

(Name)

Attorney in Fact

(Title)

Halina Kazmierczak

(Signature)

Halina Kazmierczak *(Corporate Seal)*

(Name)

Witness

(Title)

[For every co-surety, provide signature(s), corporate seal, and other information in the same manner as for Surety above.]

Bond premium: $32,000.00

DEP-6035O, effective 2/10/94

(Note: Use of this form is required by 401 KAR 34:080)

ACKNOWLEDGEMENT OF SURETY

State of New York)

:ss:

County of New York)

On the 14th April, 2009, before me personally came Cynthia Farrell to me known, who, being by me duly sworn, did depose and say the (s)he resides at New York, NY and that (s)he is the Attorney-In-Fact of Fidelity and Deposit Company of Maryland the Corporation described in and which executed the above instrument; that (s)he knows the seal of said Corporation; that one of the seals affixed by order of the Board of Directors of said Corporation; and that (s)he signed his/her name thereto by like order.

Valorie M. Spates

VALORIE M. SPATES
Notary Public, State of New York
No. 01SP6135425
Qualified in Queens County
Commission Expires Oct. 17, 2009

ACKNOWLEDGEMENT OF PRINCIPAL

State of CONNECTICUT

County of HARTFORD

On 4/27/09 before me personally appeared THOMAS I. LOGAN who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of CONNECTICUT that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

(seal) Signature

My Commission Exp. Dec. 31, 2013

Power of Attorney
FIDELITY AND DEPOSIT COMPANY OF MARYLAND

KNOW ALL MEN BY THESE PRESENTS: That the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, a corporation of the State of Maryland, by WILLIAM J. MILLS, Vice President, and ERIC D. BARNES, Assistant Secretary, in pursuance of authority granted by Article VI, Section 2, of the By-Laws of said Company, which are set forth on the reverse side hereof and are hereby certified to be in full force and effect on the date hereof, does hereby nominate, constitute and appoint **Betty CALDERON, Vivian CARTI, Debra A. DEMING, Cynthia FARRELL, Thomas RHATIGAN and Evangelina L. DOMINICK, all of New York, New York, EACH** its true and lawful agent and Attorney-in-Fact, to make, execute, seal and deliver, for, and on its behalf as surety, and as its act and deed: **any and all bonds and undertakings,** and the execution of such bonds or undertakings in pursuance of these presents, shall be as binding upon said Company, as fully and amply, to all intents and purposes, as if they had been duly executed and acknowledged by the regularly elected officers of the Company at its office in Baltimore, Md., in their own proper persons. This power of attorney revokes that issued on behalf of Betty CALDERON, Vivian CARTI, Debra A. DEMING, Cynthia FARRELL, Thomas RHATIGAN, Evangelina L. DOMINICK, dated May 4, 2006.

FOR YOUR PROTECTION LOOK FOR THE SECURITY WATERMARK

The said Assistant Secretary does hereby certify that the extract set forth on the reverse side hereof is a true copy of Article VI, Section 2, of the By-Laws of said Company, and is now in force.

IN WITNESS WHEREOF, the said Vice-President and Assistant Secretary have hereunto subscribed their names and affixed the Corporate Seal of the said FIDELITY AND DEPOSIT COMPANY OF MARYLAND, this 16th day of January, A.D. 2009.

ATTEST: **FIDELITY AND DEPOSIT COMPANY OF MARYLAND**

FIDELITY AND DEPOSIT COMPANY OF MARYLAND INCORPORATED 1890

By:

Eric D. Barnes *Assistant Secretary* *William J. Mills* *Vice President*

State of Maryland }
City of Baltimore } ss:

On this 16th day of January, A.D. 2009, before the subscriber, a Notary Public of the State of Maryland, duly commissioned and qualified, came WILLIAM J. MILLS, Vice President, and ERIC D. BARNES, Assistant Secretary of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, to me personally known to be the individuals and officers described in and who executed the preceding instrument, and they each acknowledged the execution of the same, and being by me duly sworn, severally and each for himself deposeth and saith, that they are the said officers of the Company aforesaid, and that the seal affixed to the preceding instrument is the Corporate Seal of said Company, and that the said Corporate Seal and their signatures as such officers were duly affixed and subscribed to the said instrument by the authority and direction of the said Corporation.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my Official Seal the day and year first above written.

Constance A. Dunn *Notary Public*
My Commission Expires: July 14, 2011

EXTRACT FROM BY-LAWS OF FIDELITY AND DEPOSIT COMPANY OF MARYLAND

"Article VI, Section 2. The Chairman of the Board, or the President, or any Executive Vice-President, or any of the Senior Vice-Presidents or Vice-Presidents specially authorized so to do by the Board of Directors or by the Executive Committee, shall have power, by and with the concurrence of the Secretary or any one of the Assistant Secretaries, to appoint Resident Vice-Presidents, Assistant Vice-Presidents and Attorneys-in-Fact as the business of the Company may require, or to authorize any person or persons to execute on behalf of the Company any bonds, undertaking, recognizances, stipulations, policies, contracts, agreements, deeds, and releases and assignments of judgements, decrees, mortgages and instruments in the nature of mortgages,...and to affix the seal of the Company thereto."

CERTIFICATE

I, the undersigned, Assistant Secretary of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, do hereby certify that the foregoing Power of Attorney is still in full force and effect on the date of this certificate; and I do further certify that the Vice-President who executed the said Power of Attorney was one of the additional Vice-Presidents specially authorized by the Board of Directors to appoint any Attorney-in-Fact as provided in Article VI, Section 2, of the By-Laws of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND.

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at a meeting duly called and held on the 10th day of May, 1990.

RESOLVED: "That the facsimile or mechanically reproduced seal of the company and facsimile or mechanically reproduced signature of any Vice-President, Secretary, or Assistant Secretary of the Company, whether made heretofore or hereafter, wherever appearing upon a certified copy of any power of attorney issued by the Company, shall be valid and binding upon the Company with the same force and effect as though manually affixed."

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the corporate seal of the said Company,

this 14TH day of April, 2009.

Gregg E. Murray

Assistant Secretary

FIDELITY AND DEPOSIT COMPANY

OF MARYLAND
3910 KESWICK ROAD, BALTIMORE, MD 21211-2226

Statement of Financial Condition
As Of December 31, 2008

ASSETS

Bonds	$ 148,252,979
Stocks	23,313,771
Cash and Short Term Investments	7,904,491
Reinsurance Recoverable	5,939,089
Other Accounts Receivable	38,307,386
TOTAL ADMITTED ASSETS	$ 223,717,718

LIABILITIES, SURPLUS AND OTHER FUNDS

Reserve for Taxes and Expenses		$ 597,566
Ceded Reinsurance Premiums Payable		38,399,492
Securities Lending Collateral Liability		6,094,921
TOTAL LIABILITIES		$ 45,091,979
Capital Stock, Paid Up	$ 5,000,000	
Surplus	173,625,739	
Surplus as regards Policyholders		178,625,738
TOTAL		$ 223,717,718

Securities carried at $38,306,550 in the above statement are deposited as required by law.

Securities carried on the basis prescribed by the National Association of Insurance Commissioners. On the basis of December 31, 2008 market quotations for all bonds and stocks owned, the Company's total admitted assets would be $216,398,425 and surplus as regards policyholders $171,306,445.

I, DENNIS F. KERRIGAN, Corporate Secretary of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, do hereby certify that the foregoing statement is a correct exhibit of the assets and liabilities of the said Company on the 31st day of December, 2008.

Corporate Secretary

State of Illinios
City of Schaumburg } SS:

Subscribed and sworn to, before me, a Notary Public of the State of Illinois, in the City of Schaumburg, this 14th day of March, 2009.

Notary Public

NOTARY PUBLIC OFFICIAL SEAL STATE OF ILLINOIS
MARLO G. SARABYN
MY COMMISSION EXPIRES
NOVEMBER 25, 2011

TRUST AGREEMENT
FOR CLOSURE AND POSTCLOSURE ASSURANCE

Trust Agreement, the "Agreement," entered into as of April 30, 2009 by and between
(date)

Kidde-Fenwal, Inc., acting through its parent corporation and sole shareholder United Technologies Corporation, a
(name of owner or operator)

Delaware Corporation, the "Grantor," and Union Bank, N.A., a national bank,
(Name of State) (insert "corporation," "partnership," "association," or "proprietorship") *(name of corporate trustee)* *(insert "incorporated in the State of _____" or "a national bank")*

the "Trustee."

Whereas, the Kentucky Energy and Environment Cabinet (the Cabinet), an agency of the Commonwealth of Kentucky, has established certain regulations applicable to the Grantor, requiring that an owner or operator of a hazardous waste site or facility shall provide assurance that funds will be available when needed for closure or postclosure care of the facility,

Whereas, the Grantor has elected to establish a trust to provide all or part of such financial assurance for the facilities identified herein,

Whereas, the Grantor, acting through its duly authorized officers, has selected the Trustee to be the trustee under this Agreement, and the Trustee is willing to act as trustee,

Now, Therefore, the Grantor and the Trustee agree as follows:

Section 1: Definitions. As used in this Agreement:

(a) The term "Grantor" means the owner or operator who enters into this Agreement and any successors or assigns of the Grantor.

(b) The term "Trustee" means the Trustee who enters into this agreement and any successor Trustee.

Section 2: Identification of Facilities and Cost Estimates. This Agreement pertains to the facilities and cost estimates identified on attached Schedule A *(on Schedule A, for each facility list the EPA Identification Number, name, address, and the current closure and/or postclosure cost estimates, or portions thereof, for which financial assurance is demonstrated by this Agreement)*.

Section 3: Establishment of Fund. The Grantor and the Trustee hereby establish a trust fund, the "Fund," for the benefit of the Cabinet. The Grantor and the Trustee intend that no third party have access to the Fund except as herein provided. The Fund is established initially as consisting of the property, which is acceptable to the Trustee, described in Schedule B attached hereto. Such property and any other property subsequently transferred to the Trustee is referred to as the Fund, together with all earnings and profits thereon, less any payments or distributions made by the Trustee pursuant to this Agreement. The Fund will be held by the Trustee, IN TRUST, as hereinafter provided. The Trustee shall not be responsible nor shall it undertake any responsibility for the amount or adequacy of, nor any duty to collect from the Grantor, any payments necessary to discharge any liabilities of the Grantor established by the Cabinet.

Section 4: Payment for Closure and Postclosure Care. The Trustee shall make such payments from the Fund as the Director of the Division of Waste Management in the Kentucky Energy and Environment Cabinet, hereinafter the Director of the Division, shall direct, in writing, to provide for the payment of the costs of closure and/or postclosure care of the facilities covered by this Agreement. The Trustee shall reimburse the Grantor or other persons as specified by the Director of the Division from the Fund for closure and post-closure expenditures in such

amounts as the Director of the Division shall direct in writing. In addition, the Trustee shall refund to the Grantor such amounts as the Director of the Division specifies in writing. Upon refund, such funds shall no longer constitute part of the Fund as defined herein.

Section 5: Payments Comprising the Fund. Payments made to the Trustee for the Fund shall consist of cash or securities acceptable to the Trustee.

Section 6: Trustee Management. The Trustee shall invest and reinvest the principal and income of the Fund and keep the Fund invested as a single fund, without distinction between principal and income, in accordance with general investment policies and guidelines which the Grantor may communicate in writing to the Trustee from time to time, subject, however, to the provisions of this Section. In investing, reinvesting, exchanging, selling, and managing the Fund, the Trustee shall discharge his duties with respect to the Trust Fund solely in the interest of the beneficiary and with the care, skill, prudence, and diligence under the circumstances then prevailing which persons of prudence, acting in a like capacity and familiar with such matters, would use in the conduct of an enterprise of a like character and with like aims; except that:

(a) Securities or other obligations of the Grantor, or any other owner or operator of the facilities, or any of their affiliates as defined in the Investment Company Act of 1940, as amended, 15 U.S.C. 80a-2.(a), shall not be acquired or held, unless they are securities or other obligations of the Federal or a State government;

(b) The Trustee is authorized to invest the Fund in time or demand deposits of the Trustee, to the extent insured by an agency of the Federal or State government; and

(c) The Trustee is authorized to hold cash awaiting investment or distribution uninvested for a reasonable time and without liability for the payment of interest thereon.

Section 7: Commingling and Investment. The Trustee is expressly authorized in its discretion:

(a) To transfer from time to time any or all of the assets of the Fund to any common, commingled or collective trust fund created by the Trustee in which the Fund is eligible to participate, subject to all of the provisions thereof, to be commingled with the assets of other trusts participating therein; and

(b) To purchase shares in any investment company registered under the Investment Company Act of 1940, 15 U.S.C. 80a1 et seq., including one which may be created, managed, underwritten, or to which investment advice is rendered or the shares of which are sold by the Trustee. The Trustee may vote such shares in its discretion.

Section 8: Express Powers of Trustee. Without in any way limiting the powers and discretions conferred upon the Trustee by the other provisions of this Agreement or by law, the Trustee is expressly authorized and empowered:

(a) To sell, exchange, convey, transfer or otherwise dispose of any property held by it, by public or private sale. No person dealing with the Trustee shall be bound to see to the application of the purchase money or to inquire into the validity or expediency of any such sale or other disposition;

(b) To make, execute, acknowledge and deliver any and all documents of transfer and conveyance and any and all other instruments that may be necessary or appropriate to carry out the powers herein granted;

(c) To register any securities held in the Fund in its own name or in the name of a nominee and to hold any security in bearer form or in book entry, or to combine certificates representing such securities with certificates of the same issue held by the Trustee in other fiduciary capacities, or to deposit or arrange for the deposit of such securities in a qualified central depositary even though, when so deposited, such securities may be merged and held in bulk in the name of the nominee of such depositary with other securities deposited therein by another person, or to deposit or arrange for the deposit of any securities issued by the United States Government, or any agency or instrumentality thereof, with a Federal Reserve bank, but the books and records of the Trustee shall at all times show that all such securities are part of the Fund;

(d) To deposit any cash in the fund in interest-bearing accounts maintained or savings certificates issued by the Trustee, in its separate corporate capacity, or in any other banking institution affiliated with the Trustee, to the extent insured by an agency of the federal or state government; and

(e) To compromise or otherwise adjust all claims in favor of or against the Fund.

Section 9: Taxes and Expenses. All taxes of any kind that may be assessed or levied against or in respect of the Fund and all brokerage commissions incurred by the Fund shall be paid from the Fund. All other expenses incurred by the Trustee in connection with the administration of this Trust, including fees for legal services rendered to the Trustee, the compensation of the Trustee to the extent not paid directly by the Grantor, and all other proper charges and disbursements of the Trustee shall be paid from the Fund.

Section 10: Annual Valuation. The Trustee shall annually, at least thirty (30) days prior to the anniversary date of establishment of the Fund, furnish to the Grantor and to the Director of the Division a statement confirming the value of the Trust. Any securities in the Fund shall be valued at market value as of no more than sixty (60) days prior to the anniversary date of establishment of the Fund. The failure of the Grantor to object in writing to the Trustee within ninety (90) days after the statement has been furnished to the Grantor and the Director of the Division shall constitute a conclusively binding assent by the Grantor, barring the Grantor from asserting any claim or liability against the Trustee with respect to matters disclosed in the statement.

Section 11: Advice of Counsel. The Trustee may from time to time consult with counsel, who may be counsel to the Grantor, with respect to any question arising as to the construction of this Agreement or any action to be taken hereunder. The Trustee will be fully protected, to the extent permitted by law, in acting upon the advice of counsel.

Section 12: Trustee Compensation. The Trustee shall be entitled to reasonable compensation for its services as agreed upon in writing from time to time with the Grantor.

Section 13: Successor Trustee. The Trustee may resign or the Grantor may replace the Trustee, but such resignation or replacement shall not be effective until the Grantor has appointed a successor Trustee and his successor accepts the appointment. The successor Trustee shall have the same powers and duties as those conferred upon the Trustee hereunder. Upon the successor Trustee's acceptance of the appointment, the Trustee shall assign, transfer, and pay over to the successor Trustee the funds and properties then constituting the Fund. If for any reason the Grantor cannot or does not act in the event of the resignation of the Trustee, the Trustee may apply to a court of competent jurisdiction for the appointment of a successor Trustee or for instructions. The successor Trustee shall specify the date on which it assumes administration of the Trust in a writing sent to the Grantor, the Director of the Division and the present Trustee by certified mail ten (10) days before such change becomes effective. Any expenses incurred by the Trustee as a result of any of the acts contemplated by this Section will be paid as provided in Section 9.

Section 14: Instructions to the Trustee. All orders, requests and instructions by the Grantor to the Trustee shall be in writing, signed by such persons as are designated in the attached Exhibit A or such other designees as the Grantor may designate by amendment to Exhibit A. The Trustee shall be fully protected in acting without inquiry in accordance with the Grantor's orders, requests and instructions. All orders, requests, and instructions by the Director of the Division to the Trustee shall be in writing, signed by the Director of the Division, and the Trustee shall act and shall be fully protected in acting in accordance with such orders, requests, and instructions. The Trustee shall have the right to assume, in the absence of written notice to the contrary, that no event constituting a change or a termination of the authority of any person to act on behalf of the Grantor or the Cabinet hereunder has occurred. The Trustee shall have no duty to act in the absence of such orders, requests, and instructions from the Grantor and/or the Cabinet, except as provided for herein.

Section 15: Notice of Nonpayment. The Trustee shall notify the Grantor and the Director of the Division by certified mail within ten (10) days following the expiration of the thirty (30) day period after the anniversary of the establishment of the Trust, if no payment is received from the Grantor during that period. After the pay-in period is completed, the Trustee shall not be required to send a notice of nonpayment.

Section 16: Amendment of Agreement. This Agreement may be amended by an instrument in writing executed by the Grantor, the Trustee, and the Director of the Division or by the Trustee and the Director of the Division if the Grantor ceases to exist.

Section 17: Irrevocability and Termination. Subject to the right of the parties to amend this Agreement as provided in Section 16, this Trust shall be irrevocable and shall continue until terminated at the written agreement of the Grantor, the Trustee, and the Director of the Division, or by the Trustee and the Director of the Division, if the Grantor ceases to exist. Upon termination of the Trust, all remaining Trust property, less final trust administration expenses, shall be delivered to the Grantor.

Section 18: Immunity and Indemnification. The Trustee shall not incur personal liability of any nature in connection with any act or omission, made in good faith, in the administration of this Trust, or in carrying out any directions by the Grantor or the Director of the Division issued in accordance with this Agreement. The Trustee shall be indemnified and saved harmless by the Grantor or from the Trust Fund, or both, from and against any personal liability to which the Trustee may be subjected by reason of any act or conduct in its official capacity, including all expenses reasonably incurred in its defense in the event the Grantor fails to provide such defense.

Section 19: Choice of Law. This Agreement shall be administered, construed, and enforced according to the laws of the Commonwealth of Kentucky.

Section 20: Interpretation. As used in this Agreement, words in the singular include the plural and words in the plural include the singular. The descriptive headings for each Section of this Agreement shall not affect the interpretation or the legal efficacy of this Agreement.

In Witness Whereof the parties have caused this Agreement to be executed by their respective officers duly authorized and their corporate seals to be hereunto affixed and attested as of the date first above written. The parties below certify that the wording of this Agreement is identical to the wording as specified in 401 KAR 34:080 as such regulations were constituted on the date first above written.

By Tom Reyer
(Signature of Grantor)

Vice President, Treasurer
(Title)

Attest: W. F. Sexton
(Signature)

Assistant General Counsel
(Title)

(Seal)

By P. P. Coward
(Signature of Trustee)

Vice President
(Title)

Attest: [illegible]
(Signature)

Vice President
(Title)

(Seal)

Certification of Acknowledgement

Commonwealth of Kentucky CONNECTICUT (if not in Kentucky, insert State) County of HARTFORD (insert name of county)

On this 20th DAY APRIL 2009 (date) before me personally came THOMAS I ROGAN (owner or operator)

to me known, who, being by me duly sworn, did depose and say that ~~she~~/he resides at:

14 REDBIRD TRAIL, OLD SAYBROOK, CT (address)

that ~~she~~/he is VICE PRESIDENT, TREASURER (title) of UNITED TECHNOLOGIES CORP (corporation)

the corporation described in and which executed the above instrument; that she/he knows the seal of said corporation; that the seal affixed to such instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said corporation; and that she/he signed her/his name thereto by like order.

(Signature of Notary Public)

My Commission Exp. Dec. 31, 2013

(Date Notary Public Commission Expires)

(Seal of Notary Public)

Certification of Acknowledgement

~~Commonwealth~~ State of ~~Kentucky~~ New York (if not in Kentucky, insert State) County of New York (insert name of county)

On this 4/21/09 (date) before me personally came Patricia Phillips Carey (owner or operator)

to me known, who, being by me duly sworn, did depose and say that she/he resides at:

551 Madison Ave N.Y. N.Y. 10022 (address)

that she/he is Vice President of Union Bank, NA
(title) (corporation)

the corporation described in and which executed the above instrument; that she/he knows the seal of said corporation; that the seal affixed to such instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said corporation; and that she/he signed her/his name thereto by like order.

Nancy J. Cohen
(Signature of Notary Public)

10/11/09
(Date Notary Public Commission Expires)

Nancy J. Cohen
Notary Public State of NY
No 01CO6134863
Qualified in New York County
My Commission Expires 10/11/09

(Seal of Notary Public)

Trust Fund Schedule A

KYD081017667

(EPA Identification Number)

Kidde Fenwal, Inc., Former Hallmack Facility

(Facility Name)

1010 and 1020 North College Street

(Street Name)

Harrodsburg, KY 40330

(City, State, Zip)

$0.00

(Closure Cost Estimate)

$840,192.00

(Postclosure Cost Estimate)

Trust Fund Schedule B – Standby Trust Fund Property

The fund consists of $840,192.00 in cash or securities to be transferred to the Trustee pursuant to Section 3 and 5 of this agreement.

Trust Fund Exhibit A

The following is a list of all persons who are authorized by the Grantor to give orders, requests and instructions to the Trustee:

Name: William F. Leikin

Title: Assistant General Counsel

Address: United Technologies Corporation, Mail Stop 524, United Technologies Building, One Financial Plaza, Hartford, CT 06101

Telephone Number: (860) 728-6430

(Note: Use of this form is required by 401 KAR 34:080)

ATTACHMENT 9

List of SWMUs and AOCs

Former SWMUs and AOCs Requiring No Further Investigation
Former Hallmack Facility
Harrodsburg, Kentucky

Unit/Area	Description
SWMU-1, -2, -3	**Former Wastewater/Sludge Lagoons.** Lagoon #1 received wastewater. Lagoons #2 and #3 were used to store sludge generated in Lagoon #1.
SWMU-4, -5, -6	**Scrubbers.** Three outdoor units for treating plating line fumes. East side of building. Concrete footings remain.
SWMU-7	**Baghouse.** Air filtering system to remove particulates from buffing and polishing. North side of building.
SWMU-8, -9	**Filter Presses**. Located in WWT room. Used to dewater sludge from lagoons.
SWMU-10	**Drum Accumulation Area**. Reportedly was one drum of TCE still bottoms generated from the carbon absorber unit (SWMU-13).
SWMU-11, -12	**Cyclones #1 and #2**. Removed particulates from buffing and polishing emissions. Were replaced by SWMU-7.
SWMU-13	**Carbon Absorber Unit**. TCE reclamation unit near the SWMU-18 degreaser.
SWMU-14	**Cyanide Treatment Tank**. Located outside near WWT room. Treated 18,000 to 20,000 gpd.
SWMU-15	**Chrome Treatment Tank**. Located outside near WWT room. Treated 18,000 to 20,000 gpd.
SWMU-16	**Clarifier**. Located outside near WWT room. Treated 160,000 gpd.
SWMU-17	**Scrubber.** One outdoor unit for treating plating line fumes. East side of building. Was replaced by SWMU-4, -5, -6.
SWMU-18	**NuTone Degreaser**. Present in a below-grade, concrete-lined pit.
SWMU-19	**Two Degreasers used by Textron**. One was above-grade and one was in a concrete-lined pit.
SWMU-20	**Wastewater Piping**. Below-grade and above-grade piping for wastewater from plating line to WWT room.
SWMU-21	**Paint Burnoff Oven**.
SWMU-22	**Washer.** Used to wash degreasing solvents from parts prior to painting. Located near paint booth and paint gun cleaning which also used PCE. Water from washer was discharged to sanitary sewer.

Former SWMUs and AOCs Requiring No Further Investigation
Former Hallmack Facility
Harrodsburg, Kentucky

Unit/Area	Description
SWMU-23	**Wastewater Drainage Ditch**. Storm water ditch located along southern side of former lagoons.
SWMU-24	**Plating Line Safety Pits**. Pits in plating line used to collect plating bath overflows. Were filled with concrete at facility closure.
SWMU-25	**Groundwater Contamination Plume**
SWMU-26	**Possible Paint Striping Area Leading to POTW**. Bunded area which includes a floor drain.
SWMU-27	**Stormwater Runoff Drainage Pipes**. Approximately 10 drainage pipes from building roof to drainage ditch SWMU-23.
SWMU-28	**Drum Storage Area - Concrete Pad**. Concrete pad used for storage of waste-containing drums.
SWMU-28B	**Soil Beneath and Adjacent to Drum Storage Area Concrete Pad**. (Also referred by CTE as SWMU-43)
SWMU-29	**Scrubber Wastewater Lines**. Underground pipes from scrubbers (SWMU-4, -5, -6) to WWT room.
SWMU-30	**Dumpsters and Trash Compactor**
SWMU-31	**Baghouse Hopper and Waste Container**. Used to collect dust from baghouse, SWMU-7.
SWMU-32	**Sludge Rolloff Containers**. Used to store and transport sludge derived from filter presses. No longer on-Site.
SWMU-33	**Cyanide Pretreatment Tanks**. Two steel tanks located in WWT room.
SWMU-34	**Chrome Pretreatment Tanks**. Two steel tanks located in WWT room.
SWMU-35	**Trash and Refuse Burn Area**. Reportedly a 30-foot by 80-foot area along the western side of property.
SWMU-36	**Tumble Deburr Sump**. Shallow sump below grade received water from tumbler. Water was pumped to clarifier, SWMU-16.
SWMU-37	**Paint Booth Baghouse and Waste Bucket.** Baghouse used to filter and recirculate powder paint overspray.

Former SWMUs and AOCs Requiring No Further Investigation
Former Hallmack Facility
Harrodsburg, Kentucky

Unit/Area	Description
SWMU-38	**Washdown Floor Drains**. Floor drains and underground piping. Pipes lead to sanitary sewer line outside the south side of building. Nine floor drains identified during RFAs.
SWMU-39	**Paint Waste Drum**. Satellite accumulation drum for waste PCE solvent used to clean paint guns.
SWMU-40	**Compressed Air Oil Filtering System**. System removed oil from air used in painting.
SWMU-41	**Storage Area**. Western interior of the building used to store finished goods.
SWMU-42	**Boiler Room Floor Drains and Pipe**. Floor drains used to collect non-contact cooling water.
AOC-A	**Gasoline and Fuel Oil Tanks**. Underground storage tanks reportedly removed in the 1980s.
AOC-B	**Former TCE Degreaser Pads.** Reportedly was misnamed - actually was a concrete pad for former dust collector.
AOC-West	**Apparent Plating Waste** discovered along western area of Site.

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION MANAGEMENT