# CASE STUDY SUMMARY

**Site number:** 01-585 **Karst region:** Valley & Ridge
**County:** Anderson

**Primary chlorinated solvent of concern:** TCE
**Period of operation:** 2 to 3 months in 1970
**Industrial activity:** Manufacturing plant

**Estimated volume and type of release:** Unknown volume; 6-m deep dry well was installed for disposal of TCE, TCA, methanol, and freon

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** I: High potential

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments |
|---|---|---|---|
| Clay with chert | Alluvium | 5 to 6 | Unsaturated |
| Shales with thin beds of limestone | Conasauga Group | 5 to 11 | Fractures, joints, and dissolution-enlarged openings |
| Interbedded siltstone, sandstone and shale | Rome Formation | 100 to 115 | Fractures and joints |

**Average depth to water:** 6 to 7 m
**Karst features in site vicinity:** Spring

**DNAPL observed:** No

**Highest concentration measured**
- **in ground water:** TCE 26 mg/L
- **in soils:** TCE 12 mg/kg in dry well

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** Yes

**Known horizontal extent of dissolved contamination:** Estimated 53 m x 29 m
**Known vertical extent of dissolved contamination:** 125 m in nearby process well
**Concentration at natural discharge point:** None given

**Dye-trace study results:** No dye traces

**Notes:** Dry well was used for disposal for a few months during 1970, beginning in approximately April

## CASE STUDY SUMMARY

**Site number:** 06-505 **Karst region:** Valley & Ridge
**County:** Bradley

**Primary chlorinated solvent of concern:** TCE; PCE
**Period of operation:** 1962 to present
**Industrial activity:** Manufacturing plant

**Estimated volume and type of release:** Unknown volume. Approximately 7,880 kilograms of solvents used annually. Ruptured drums known to have leaked into sewer system during loading activities

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** I-II: High/moderate potential

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments | Hydraulic properties |
|---|---|---|---|---|
| Clayey silt to silty clay with weathered shale and limestone | Alluvium, residuum, and colluvium | 4 to 12 | Granular porous material | -- |
| Shale and limestone | Conasauga Group | 6 to 41 | Fractures, joints, and dissolution-enlarged openings | $k_v$ = $6.5 \times 10^{-4}$ cm/s |

**Average depth to water:** 6 to 7 m
**Karst features in site vicinity:** Some wells were dry during investigation. Springs issue from faults

**DNAPL observed:** No

**Highest concentration measured**
- **in ground water:** PCE 25 mg/L; TCE 4 mg/L
- **in soils:** PCE 890 mg/kg; TCE 14 mg/kg

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** Yes

**Known horizontal extent of dissolved contamination:** About 430 m x 120 m
**Known vertical extent of dissolved contamination:** 36 m
**Concentration at natural discharge point:** PCE 0.079 mg/L; TCE 0.008 mg/L in wetlands area next to Mouse Creek

**Dye-trace study results:** One was completed for nearby Cleveland Utilities District

**Notes:** Soil remediation area is 7 m x 7 m x 4 m deep

# CASE STUDY SUMMARY

**Site number:** 15-508 **Karst region:** Valley & Ridge
**County:** Cocke

**Primary chlorinated solvent of concern:** TCE; 1,1,1-TCA
**Period of operation:** 1956-83
**Industrial activity:** Manufacturing plant

**Estimated volume and type of release:** Exact amount unknown. Reported volume of 4,500 liters 1,1,1-TCA. “Small” spills and leaks reported from drums and usage of TCE containers

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** II: Moderate potential

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments | Hydrologic properties |
|---|---|---|---|---|
| Gravel, silty clay, sandy clay | Regolith | 1 to 5 | Unsaturated | -- |
| Shale | Sevier Shale | 4 to 5 | Fractures and joints | k = less than 1 x $10^{-3}$ cm/s |
| Dolomite with interbedded limestone | Knox Group | 16 to 30 | Dissolution-enlarged openings | -- |

**Average depth to water:** 3 to 5 m in the shale and 6 to 8 m in dolomite
**Karst features in site vicinity:** Springs nearby

**DNAPL observed:** No

**Highest concentration measured**
- **in ground water:** TCE 5.76 mg/L
- **in soils:** TCE 0.035 mg/kg at 2 m deep

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** No

**Known horizontal extent of dissolved contamination:** 300 m x 220 m
**Known vertical extent of dissolved contamination:** 14 to 17 m
**Concentration at natural discharge point:** 0.016 mg/L TCE in spring

**Dye-trace study results:** None

**Notes:**

# CASE STUDY SUMMARY

**Site number:** 19-565 **Karst region:** Outer Central Basin
**County:** Davidson

**Primary chlorinated solvent of concern:** TCE; 1,2-DCE
**Period of operation:** pre-1961 to present
**Industrial activity:** Manufacturing plant

**Estimated volume and type of release:** Listed in file documents as "several hundred gallons." Estimated spill volume of 570 to 800 liters of TCE in 1976

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** II: Moderate potential

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments | Hydraulic Properties |
|---|---|---|---|---|
| Sand and clay | Fill | 2 to 3 | Unsaturated | -- |
| Sandy, silty and gravel | Alluvium | Up to 15 | Granular porous material; perched | k= 2.3 x $10^{-5}$cm/s |
| Fossiliferous limestone with shale | Catheys and Leipers Formations | 50 to 60 | Dissolution-enlarged openings | |

**Average depth to water:** 2 to 4 m in alluvium and 8 to 13 m in limestone
**Karst features in site vicinity:** Springs

**DNAPL observed:** No

**Highest concentration measured**
- **in ground water:** TCE 10 mg/L; 1,2-DCE 2.1 mg/L
- **in soils:** TCE 0.022 mg/kg

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** No

**Known horizontal extent of dissolved contamination:** 183 m long x 243 m wide in 1993
**Known vertical extent of dissolved contamination:** 12 to 15 m
**Concentration at natural discharge point:** TCE 1.6 mg/L at seep location on unnamed creek

**Dye-trace study results:** None

**Notes:** Loss of sulfuric acid from manufacturing process created a dissolution opening beneath the site

# CASE STUDY SUMMARY

**Site number:** 26-501 **Karst region:** Highland Rim
**County:** Coffee

**Primary chlorinated solvent of concern:** PCE; TCE
**Period of operation:** 1953-82
**Industrial activity:** Waste disposal

**Estimated volume and type of release:** Landfill and leaching pit, volume disposed unknown

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** I-II: High/moderate potential

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments | Hydraulic properties |
|---|---|---|---|---|
| Clay with silt and sand | Shallow aquifer, regolith | 9-14 | Granular porous material | k=$3.3x10^{-4}$ cm/s |
| Clayey gravel to gravelly clay | Intermediate aquifer, regolith | 7-17 | Granular porous material | k= average $9.3x10^{-3}$ cm/s, range $3.7x10^{-2}$ cm/s to $7.2x10^{-4}$ cm/s |
| Dense cherty limestone | Deep aquifer, Fort Payne Formation | 3-9 | Dissolution-enlarged openings | -- |
| Dark, grayish black carbon-aceous shale | Confining unit, Chattanooga Shale | 6 - 8 | Confining unit | -- |

**Average depth to water:** 1.5 to 6 m
**Karst features in site vicinity:** None

**DNAPL observed:** No

**Highest concentration measured**
- **in ground water:** PCE 120 mg/L; TCE 89 mg/L
- **in soils:** PCE 95.6 mg/kg; TCE 39 mg/kg

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** Yes

**Known horizontal extent of dissolved contamination:** 2,600 x 760 m
**Known vertical extent of dissolved contamination:** 30 m
**Concentration at natural discharge point:** None reported

**Dye-trace study results:** None

**Notes:** Most files for this site are at TDEC Division of Solid Waste Management

# CASE STUDY SUMMARY

**Site number:** 26-502 **Karst region:** Highland Rim
**County:** Franklin

**Primary chlorinated solvent of concern:** TCFM; PCE; TCE
**Period of operation:** 1953-80
**Industrial activity:** Waste disposal

**Estimated volume and type of release:** Quantity unknown

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** I-II: High/moderate potential

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments |
|---|---|---|---|
| Clay with silt and sand | Shallow aquifer, regolith | 12 - 20 | Granular porous material |
| Clayey gravel to gravelly clay | Intermediate aquifer, regolith | 3 - 9 | Granular porous material |
| Dense cherty limestone | Deep aquifer, Fort Payne Formation | 7 -11 | Dissolution-enlarged openings |
| Dark, grayish black carbon-aceous shale | Confining unit, Chattanooga Shale | 6 - 8 | Confining unit |

**Average depth to water:** 6 to 15 meters
**Karst features in site vicinity:** Springs

**DNAPL observed:** No

**Highest concentration measured**
- **in ground water:** TCFM 170 mg/L; PCE 12 mg/L; TCE 26 mg/L
- **in soils:** PCE 7.3 mg/kg; TCE 1.0 mg/kg

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** Yes

**Known horizontal extent of dissolved contamination:** 2,000 x 400 m
**Known vertical extent of dissolved contamination:** 26 m
**Concentration at natural discharge point:** None reported

**Dye-trace study results:** None

**Notes:** Most files for this site are at TDEC Division of Solid Waste Management.

# CASE STUDY SUMMARY

**Site number:** 26-505 **Karst region:** Highland Rim
**County:** Coffee

**Primary chlorinated solvent of concern:** PCE; 1,1,1-TCA
**Period of operation:** 1950-72
**Industrial activity:** Disposal of waste solvents and acids

**Estimated volume and type of release:** Quantity unknown

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** I: Confirmed presence

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments | Hydraulic properties |
|---|---|---|---|---|
| Clay with silt and sand | Shallow aquifer | 3 - 9 | Granular porous material | $k=3.3x10^{-4}$ cm/s |
| Sandy clay | Confining layer | 1 - 8 | Granular porous material | -- |
| Clayey gravel to gravelly clay | Intermediate aquifer | 5- 15 | Granular porous material | $k=5.7x10^{-3}$ cm/s |
| Dense cherty limestone | Deep aquifer, Fort Payne Formation | 3 - 6 | Dissolution-enlarged openings | -- |
| Dark, grayish black carbon-aceous shale | Confining unit, Chattanooga Shale | 6 - 8 | Confining unit | -- |

**Average depth to water:** 5 - 8 m
**Karst features in site vicinity:** None

**DNAPL observed:** Yes

**Highest concentration measured**
- **in ground water:** 1,1,1-TCA 290 mg/L; PCE 140 mg/L
- **in soils:** PCE 3,000 mg/kg

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** Yes

**Known horizontal extent of dissolved contamination:** 420 x 270 m
**Known vertical extent of dissolved contamination:** 11 m
**Concentration at natural discharge point:** PCE 0.004 to 1.1 mg/L in ditch H; 1,1,1-TCA 1.0 to 0.37 mg/L in ditch H. Ditch H is approximately 75 m southeast of site

**Dye-trace study results:** None

**Notes:** Most files for this site are at TDEC Division of Solid Waste Management. DNAPL is currently being recovered from an extraction well at this site

# CASE STUDY SUMMARY

**Site number:** 28-502 **Karst region:** Highland Rim
**County:** Giles

**Primary chlorinated solvent of concern:** 1,1,1-TCA; PCE
**Period of operation:** 1974 to present
**Industrial activity:** Manufacturing plant. Uses 2 degreasers

**Estimated volume and type of release:** Unknown. Generates 3 to 5 drums per year of spent degreaser which is shipped offsite within 90 days. An area about 8,800 square meters onsite is contaminated. In 1989, the plant generated 5,053 liters (28 drums) of PCE

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** I: High potential

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments |
|---|---|---|---|
| Yellow brown clay with gravel size chert | Fort Payne Formation (weathered) | 20 | Granular porous material |
| Cherty limestone and dolomite with shale base | Fort Payne Formation (partially weathered) | 10 | Dissolution-enlarged openings |
| Phosphatic shale | Maury Formation | 1 | Fractures and joints |
| Shale | Chattanooga Shale | 0 to 4 | Confining unit |
| Fossiliferous limestones and calcareous shale | Undifferentiated Ordovician limestones | Less than 300 | Fractures, joints, and dissolution-enlarged openings |

**Average depth to water:** 5 to 8 m
**Karst features in site vicinity:** Springs

**DNAPL observed:** No

**Highest concentration measured**
- **in ground water:** PCE 16 mg/L
- **in soils:** 1,1,1-TCA 250 mg/kg

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** Yes

**Known horizontal extent of dissolved contamination:** 36 m x 46 m
**Known vertical extent of dissolved contamination:** 2 to 5 m
**Concentration at natural discharge point:** None given

**Dye-trace study results:** Yes

**Notes:**

# CASE STUDY SUMMARY

**Site number:** 32-512 **Karst region:** Valley & Ridge
**County:** Hamblen

**Primary chlorinated solvent of concern:** TCE
**Period of operation:** 1967-90
**Industrial activity:** Manufacturing plant

**Estimated volume and type of release:** Unknown. Liquid wastes were poured directly onto ground near raw materials storage shed and the main plant. Approximately 1400 cubic meters of soil have been remediated

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** II: Moderate potential

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments |
|---|---|---|---|
| Red clay with rock fragments | Regolith | 5 to 17 | Unsaturated |
| Silicious, grey, fine-grained dolomite | Longview Dolomite of the Knox Group | 90 | Dissolution-enlarged openings |

21 m to 40 m

**Average depth to water:** Havely Spring, several sinkholes near site
**Karst features in site vicinity:** Free product was found in soils but not checked for TCE

**DNAPL observed:** TCE 0.19 mg/L at 38 to 41 m

**Highest concentration measured**
- **in ground water:** TCE 25 mg/kg in 3- to 3.6-m interval
- **in soils:** No

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** About 95 x

**Known horizontal extent of dissolved contamination:** 73 m
**Known vertical extent of dissolved contamination:** 47 to 50 m
**Concentration at natural discharge point:** No data for spring or nearby creek

**Dye-trace study results:** None completed

**Notes:** Storm drain at site may have been used to dispose of liquid hazardous waste

## CASE STUDY SUMMARY

**Site number:** 33-556 **Karst region:** Valley and Ridge
**County:** Hamilton

**Primary chlorinated solvent of concern:** PCE
**Period of operation:** 1951-83
**Industrial activity:** Manufacturing plant

**Estimated volume and type of release:** Waste water containing solvents was discharged to surface lagoon, total volume unknown

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** I-II: High/moderate potential

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments | Hydraulic properties |
|---|---|---|---|---|
| Regolith - mottled silty clay and clayey silt | Shallow zone | 8.5 - 15 | Granulated porous material | $k = 1.9x10^{-4}$ cm/s<br>$T = 1.95\ m^2$/day |
| Alternating calcareous shale and argillaceous limestone | Bedrock zone, Leipers Formation and Sequatchie Formation | Undetermined as wells only penetrated upper 10 meters of rock | Fractures, joints, and dissolution-enlarged openings | -- |

**Average depth to water:** 4.5 to 6 m
**Karst features in site vicinity:** None noted

**DNAPL observed:** No

**Highest concentration measured**
- **in ground water:** PCE 84 mg/L; TCE 6.8 mg/L
- **in soils:** Not detected

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** Yes

**Known horizontal extent of dissolved contamination:** 300 x 200 m
**Known vertical extent of dissolved contamination:** 21 mg/L at 19.5 m
**Concentration at natural discharge point:** Tennessee River is major discharge point, approximately 450 m downgradient. Contaminant plume does not currently extend to Tennessee River

**Dye-trace study results:** None

**Notes:**

# CASE STUDY SUMMARY

**Site number:** 37-512 **Karst region:** Valley and Ridge
**County:** Hawkins

**Primary chlorinated solvent of concern:** 1,1,1-TCA
**Period of operation:** 1979-84
**Industrial activity:** Drum storage and degreasing to clean parts

**Estimated volume and type of release:** Small spills and leaks

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** I-II: High/moderate potential

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments | Hydraulic properties |
|---|---|---|---|---|
| Reddish brown clayey silt with shale and chert fragments | Regolith water-bearing unit | 0.5 - 5 | Granular porous material; perched in some areas | $k = 1.1x10^{-6}$cm/s |
| Weathered rock | | 0 - 6 | | $k = 2.3x10^{-4}$ cm/s |
| Dolomite and limestone interbedded with shale | Bedrock water-bearing unit | -- | Dissolution-enlarged openings | -- |

Note: Only low concentration (<0.005 mg/L) have been found in the bedrock

**Average depth to water:** 1 to 9 m
**Karst features in site vicinity:** Springs

**DNAPL observed:** No

**Highest concentration measured**
- **in ground water:** 1,1,1-TCA 4.4 mg/L
- **in soils:** 1,1,1-TCA 1.1 mg/kg

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** No

**Known horizontal extent of dissolved contamination:** 37 x 46 m
**Known vertical extent of dissolved contamination:** 13 m
**Concentration at natural discharge point:** None reported

**Dye-trace study results:** None

**Notes:**

## CASE STUDY SUMMARY

**Site number:** 54-505 **Karst region:** Valley and Ridge
**County:** McMinn

**Primary chlorinated solvent of concern:** 1,1,1-TCA; TCE
**Period of operation:** 1965-77
**Industrial activity:** Waste disposal of finishing oils; from 1965-72 burned in open pit, from 1972-77 disposal in pit continued, but burning stopped
**Estimated volume and type of release:** Estimates range from 4,000 to 420,000 liters discharged to open pit

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** I-II: High/moderate potential

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments |
|---|---|---|---|
| Regolith - clay with chert and sand particles | Unsaturated zone with some perched water | 11 -20 | Granular porous material; perched at top of rock |
| Dolomite | Aquifer. Longview and Chepultepec Dolomite of the Knox Group | -- | Dissolution-enlarged openings |

Note: The bedrock aquifer was not investigated at this site. No wells completed more than 6 m into bedrock

**Average depth to water:** Wells sampled perched water at the top of rock
**Karst features in site vicinity:** Sinkholes, springs

**DNAPL observed:** No

**Highest concentration measured**
- **in ground water:** 1,1,1-TCA 0.091mg/L
- **in soils:** TCE 4.1 mg/kg

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** No

**Known horizontal extent of dissolved contamination:** 490 x 240 m
**Known vertical extent of dissolved contamination:** 26 m
**Concentration at natural discharge point:** 1,1,1-TCA 0.027 mg/L and 1,1-DCA 0.03 mg/L in Blair Spring, which is located approximately 365 meters southwest of the site

**Dye-trace study results:** None

**Notes:**

# CASE STUDY SUMMARY

**Site number:** 59-502 **Karst region:** Inner Central Basin
**County:** Marshall

**Primary chlorinated solvent of concern:** TCE
**Period of operation:** 1973-90
**Industrial activity:** Manufacturing plant with degreaser

**Estimated volume and type of release:** Approximately 13,000 liters of TCE leaked from supply line into sewer

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** I: High/Confirmed

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments |
|---|---|---|---|
| Clay and silt | Regolith | 4 to 9 | Granular porous material; perched |
| Thin limestone with shale partings | Lebanon Limestone | 12 to 20 | Leaky confining unit |
| Thick limestone | Ridley Limestone | 24 to 30 | Dissolution-enlarged openings |
| Argilllaceous limestone | Lower Ridley confinement* | 10 | Leaky confining layer |
| Thin limestone with shale partings | Pierce Limestone | 4.5 | Leaky confining unit |

**Average depth to water:** About 6 to 15 m
**Karst features in site vicinity:** Springs, sinkholes, sinking streams, caves

**DNAPL observed:** Yes

**Highest concentration measured**
- **in ground water:** TCE 950,000 mg/L (about 0.6 m of DNAPL)
- **in soils:** TCE 1,160 mg/kg at 3.5 m

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** Yes

**Known horizontal extent of dissolved contamination:** 370 m x 200 m in bedrock
**Known vertical extent of dissolved contamination:** About 70 m
**Concentration at natural discharge point:** TCE 0.0072 mg/L in Snell Branch Creek

**Dye-trace study results:** Yes

**Notes:** * This unit may or may not correspond with the Pierce Limestone

## CASE STUDY SUMMARY

**Site number:** 75-531 **Karst region:** Inner Central Basin
**County:** Rutherford

**Primary chlorinated solvent of concern:** TCE; PCE
**Period of operation:** 1977-79
**Industrial activity:** Waste recycler and reclaimer

**Estimated volume and type of release:** Reported receipt of 7,286 liters of chemical wastes

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** II: Moderate potential

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments |
|---|---|---|---|
| Silts, clay, sand | Regolith | Less than 1 | Unsaturated |
| Limestone with interbedded clay and some shale | Lebanon Limestone | 16 to 36 | Dissolution-enlarged openings |
| Limestone and shale | Ridley Limestone | Up to 33 | Dissolution-enlarged openings |

**Average depth to water:** Nearby domestic wells obtain water from 12 to 24 m deep
**Karst features in site vicinity:** Sinkholes located on and offsite

**DNAPL observed:** No

**Highest concentration measured**
- **in ground water:** Unknown. See notes
- **in soils:** PCE 0.52 mg/kg

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** No

**Known horizontal extent of dissolved contamination:** Unknown
**Known vertical extent of dissolved contamination:** Unknown
**Concentration at natural discharge point:** PCE 0.036 mg/kg in sediment sample of tributary stream

**Dye-trace study results:** None

**Notes:** No ground-water samples have been collected
Vertical contamination detected in soil to at least 15 centimeters

# CASE STUDY SUMMARY

**Site number:** 82-506 **Karst region:** Valley and Ridge (Alluvial plain)
**County:** Sullivan

**Primary chlorinated solvent of concern:** 1,1,1-TCA
**Period of operation:** 1975-79
**Industrial activity:** Storage and handling of drums containing waste chemicals

**Estimated volume and type of release:** Small spills and leaks, total quantity unknown

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** I-II: High/moderate potential

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments | Hydraulic properties |
|---|---|---|---|---|
| Regolith - consisting of fill, alluvium and residuum | Alluvial water-table aquifer | 0.5 - 1 meter fill<br>2 meters alluvium<br>0.5 meter residuum | Granular porous material | $k = 1.5x10^{-7}$ cm/s |
| Shale | Aquifer, Sevier Shale | -- | Fractures, joints, and dissolution-enlarged openings | -- |

Note: The bedrock aquifer was not investigated at this site. No wells have been completed in the bedrock aquifer

**Average depth to water:** 0.3 to 2 m
**Karst features in site vicinity:** None

**DNAPL observed:** No

**Highest concentration measured**
- **in ground water:** 1,1,1-TCA 51.84 mg/L
- **in soils:** 1,1,1-TCA 4.583 mg/kg

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** Yes

**Known horizontal extent of dissolved contamination:** 90 m x 30 m
**Known vertical extent of dissolved contamination:** 3 meters, bedrock not investigated
**Concentration at natural discharge point:** 1,1,1-TCA 0.01 mg/L in Cedar Creek, which is approximately 30 m west of the site

**Dye-trace study results:** None

**Notes:**

# CASE STUDY SUMMARY

**Site number:** 82-516 **Karst region:** Valley and Ridge
**County:** Sullivan

**Primary chlorinated solvent of concern:** TCE
**Period of operation:** 1967-74
**Industrial activity:** Waste disposal

**Estimated volume and type of release:** About 79,000 liters of drummed and bulk liquids discharged to open pit where they were burned; 272 drums removed in surface cleanup in 1984; 289 drums removed in subsurface cleanup in 1989

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** I: Confirmed presence

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Depth to water | Comments | Hydraulic properties |
|---|---|---|---|---|---|
| Soil, shaley silt loam to silt loam. | Unsaturated zone | less than 1.5 | -- | Unsaturated | -- |
| Weathered and fractured shale | | 6 | | | |
| Siltstone and shale, calcareous, low fracture density | Shallow, Sevier Formation | 21 | 12 to 35 meters | Low fracture density, poorly developed flow system | $k = 2.8x10^{-4}$ cm/s $T=0.09$ $m^2/d$ |
| Siltstone and shale, calcareous, high fracture density | Deep, Sevier Formation | 60 | 60 to 100 meters | Highly developed fracture network, high transmissivity | $k=4.5x10^{-4}$ cm/s $T=21$ $m^2/d$ |
| Dense hard shale | -- | -- | -- | Dense hard rock; low transmissivity | $T<0.01 m^2/d$ |

**Average depth to water:** See table above
**Karst features in site vicinity:** Numerous springs and seeps

**DNAPL observed:** Yes, recovered from 6 wells onsite

**Highest concentration measured**
- **in ground water:** TCE 960 mg/L
- **in soils:** TCE 5.34 mg/kg

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** Yes

**Known horizontal extent of dissolved contamination:** 550 x 335 m; DNAPL 230 x 90 m
**Known vertical extent of dissolved contamination:** 108 m; DNAPL at 72 m
**Concentration at natural discharge point:** TCE 0.025 mg/L in Black Creek, which is the main natural discharge point and is approximately 425 m downgradient from the site

**Dye-trace study results:** None

**Notes:**

# CASE STUDY SUMMARY

**Site number:** 86-501 **Karst region:** Western Toe of the Blue Ridge
**County:** Unicoi

**Primary chlorinated solvent of concern:** TCE
**Period of operation:** 1972-79
**Industrial activity:** Waste disposal, landfill

**Estimated volume and type of release:** TDSF documented 14,517 drum equivalent of hazardous substance; operators reported 800,000 liters on CERCLA notification form; actual amount is unknown, but suspected to be greater than above estimates. Landfill covers 22 hectares

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** I-II: High/moderate potential.

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments |
|---|---|---|---|
| Regolith - clay-rich with silt, sand, and boulder | Confining layer | 15 - 30 | Granular porous material; low conductivity |
| Highly fractured dolomite | Aquifer, Shady Dolomite | 75 - 120 | Highly fractured in some areas; flow through dissolution-enlarged opening in others |
| Siltstone, sandstone, and quartzite | Confining layer, Erwin Formation | -- | Confining layer |

A complex system of imbricate thrust faults underlie the landfill

**Average depth to water:** 10 to 40 m
**Karst features in site vicinity:** Springs, evidence of epikarst development

**DNAPL observed:** No

**Highest concentration measured**
- **in ground water:** TCE 0.29 mg/L; DCE 0.31 mg/L
- **in soils:** Not detected

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** No

**Known horizontal extent of dissolved contamination:** 150 m from landfill boundary
**Known vertical extent of dissolved contamination:** 54 m
**Concentration at natural discharge point:** TCE 0.007 mg/L at Henley Spring, which is a small spring located approximately 120 m from the landfill boundary

**Dye-trace study results:** None

**Notes:** Many (more than 2,400) exploration boreholes for mining have been drilled in the area, some near the landfill

# CASE STUDY SUMMARY

**Site number:** 89-504 **Karst region:** Highland Rim
**County:** Warren

**Primary chlorinated solvent of concern:** TCE; 1,2-DCE; PCE
**Period of operation:** 1960 to present
**Industrial activity:** Manufacturing plant

**Estimated volume and type of release:** Unknown. Suspected intermittent leaks
Potential dumping of drums

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** I: High/Confirmed

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments | Hydraulic properties |
|---|---|---|---|---|
| Regolith of silt, clay and chert | Weathered St. Louis Limestone | 5 to 9 | Granular porous material; perched in some areas | K=3 x 10-4 to 8.1 x 10-4 cm/s |
| Calcareous siltstones or sandstone | Upper Warsaw Lime-stone | 2 | Fractures and joints; leaky confining unit | -- |
| Limestone | Middle Warsaw Limestone | 9 to 12 | Cave streams; disso-lution enlarged open-ings | -- |
| Siliceous, calcareous cherty siltstone | Lower Warsaw Limestone | 9 to 12 | Fractures and joints; leaky confining unit | -- |

**Average depth to water:** 2 to 4 meters
**Karst features in site vicinity:** Sinkholes, sinking streams, caves, springs

**DNAPL observed:** Yes.

**Highest concentration measured**
- **in ground water:** 1,2-DCE 8.82 mg/L; TCE 1.11mg/L
- **in soils:** TCE 0.048 mg/kg about 7 m

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** No

**Known horizontal extent of dissolved contamination:** 122 m x 30 m in bedrock
**Known vertical extent of dissolved contamination:** 16- to 22-m screen interval
**Concentration at natural discharge point:** TCE 5.45 mg/L at spring north of site (1997 sample)

**Dye-trace study results:** Yes

**Notes:** Ground water from weathered St. Louis Limestone is discharging at a spring due north of the site. Approximately 20 centimeters of DNAPL detected in top of rock well. DNAPL was not present in well 5 days after initial detection

# CASE STUDY SUMMARY

**Site number:** 91-501 **Karst region:** Highland Rim
**County:** Wayne

**Primary chlorinated solvent of concern:** TCE
**Period of operation:** 1969-84
**Industrial activity:** Manufacturing plant

**Estimated volume and type of release:** Historically, 221 55-gallon drums were stored during 1974; 1,690,000 kg of contaminated soil has been removed from the site

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** I: High potential

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments |
|---|---|---|---|
| Silt, sand, clay and gravel | Alluvium | About 2.4 | Unsaturated |
| Clayey silts | Residuum | 1 to 2.4 | Granular porous material |
| Dolomitic limestone and siltstone | Fort Payne Formation | At least 30 | Fractures, joints, and dissolution-enlarged openings |
| Sandstone with siltstone | Hardin Sandstone | At least 36 | Fractures and joints |

**Average depth to water:** 1 to 4.6 m and 4.3 to 12 m
**Karst features in site vicinity:** Spring located 360 m to west of site

**DNAPL observed:** No

**Highest concentration measured**
- **in ground water:** TCE 250 mg/L
- **in soils:** TCE 0.019 mg/kg

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** Yes

**Known horizontal extent of dissolved contamination:** See notes
**Known vertical extent of dissolved contamination:** 30 m
**Concentration at natural discharge point:** TCE 0.0025 mg/L in Green River

**Dye-trace study results:** None

**Notes:** Contaminant extent in shallow zone is approximately 320 x 251 m and in the bedrock it is approximately 297 x 160 m

# CASE STUDY SUMMARY

**Site number:** 91-502 **Karst region:** Highland Rim
**County:** Wayne

**Primary chlorinated solvent of concern:** TCE; PCE
**Period of operation:** 1970-72
**Industrial activity:** Waste disposal

**Estimated volume and type of release:** About 40,000 liters (400 liters per week) were dumped at site. A settling pond of about 84 cubic meters contained TCE and PCB contaminants

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** I: High potential

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments |
|---|---|---|---|
| Gravel and chert | Tuscaloosa Formation | less than 0.5 | Unsaturated |
| Sands, silts, gravel and-chert | Residuum of Fort Payne Formation | 50 | Granular porous material |
| Chert and limestone | Fort Payne Formation (partially weathered) | 10 | Dissolution-enlarged openings |
| Shale | Chattanooga Shale | 15 to 16 (when present) | Leaky confining unit |
| Semi-confined shaley limestone | Wayne Formation and Brassfield Limestone | Unknown | Dissolution-enlarged openings |

**Average depth to water:** 13 to 60 meters
**Karst features in site vicinity:** Springs

**DNAPL observed:** No

**Highest concentration measured**
- **in ground water:** TCE 0.064 mg/L; PCE 40 mg/L
- **in soils:** TCE 0.215 mg/kg

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** Yes

**Known horizontal extent of dissolved contamination:** Unknown
**Known vertical extent of dissolved contamination:** About 53 m
**Concentration at natural discharge point:** TCE 0.0007 mg/L in Beech Creek

**Dye-trace study results:** None

**Notes:** Dump dimensions given in file report as 60 m long x 91 m wide x 23 m deep. Screen intervals of monitoring wells ranged from 1 to 53 m long

# CASE STUDY SUMMARY

**Site number:** 94-508 **Karst region:** Outer Central Basin
**County:** Williamson

**Primary chlorinated solvent of concern:** TCE; PCE
**Period of operation:** 1972-73
**Industrial activity:** Waste disposal

**Estimated volume and type of release:** Unknown. Approximately 800 55-gallon drums or about 170,000 liters were buried at site. In summer and fall of 1978, 50-80 barrels of unknown contents were buried in pits

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** II: Moderate potential

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments |
|---|---|---|---|
| Clay and silt, weathered rock | Colluvium | 1 to 4.6 | Unsaturated |
| Limestone with fossils | Bigby and Cannon Limestones | 0 to 4 | Dissolution-enlarged openings |
| Limestone with shale partings | Hermitage Formation | 8 to 31 | Fractures and joints; dissolution-enlarged openings near top; leaky confining unit |
| Limestone with fossils | Carters Limestone | 20 to 24 | Dissolution-enlarged openings |
| Fossiliferous lime-stone with shale | Lebanon Limestone | 6 at site | Dissolution-enlarged openings; leaky confining unit |

**Average depth to water:** 4.3 to 11 meters
**Karst features in site vicinity:** Springs

**DNAPL observed:** No

**Highest concentration measured**
- **in ground water:** TCE: 0.85 mg/L; PCE 0.21 mg/L
- **in soils:** PCE 0.024 mg/kg

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** No

**Known horizontal extent of dissolved contamination:** 300 m x 110 m
**Known vertical extent of dissolved contamination:** 4.9 to 13 m
**Concentration at natural discharge point:** trans-1,2-DCE 0.041 mg/L was detected in Hackett Spring

**Dye-trace study results:** No data available in case study file

**Notes:**

# CASE STUDY SUMMARY

**Site number:** 95-501 **Karst region:** Inner Central Basin
**County:** Wilson

**Primary chlorinated solvent of concern:** TCE
**Period of operation:** 1961-86
**Industrial activity:** Manufacturing plant

**Estimated volume and type of release:** Unknown. Release of contaminants reported as leaks from vapor degreaser or improper storage of containers. About 1,200 cubic meters of soil were treated by December 1995

**Potential of DNAPL occurrence [from U.S. EPA fact sheet (1992b)]:** I: High potential

**Site Hydrogeology**

| Generalized lithology | Hydrogeologic zone | Thickness, in meters | Comments | Hydrologic properties |
|---|---|---|---|---|
| Silty clay | Regolith | 0.45 to 2.8 | Granular porous material | $k = 1 \times 10^{-8}$ cm/s to $6 \times 10^{-4}$ cm/s |
| Fossiliferous limestone with thin shale partings | Lebanon Limestone | 16 to 30 | Dissolution-enlarged openings; leaky confining unit | |
| Limestone with some chert and magnesium | upper Ridley Limestone | 20 to 30 | Dissolution-enlarged openings | -- |

**Average depth to water:** Approximately 2 m below top of rock
**Karst features in site vicinity:** Interconnected bedrock fractures, sinkholes, springs

**DNAPL observed:** No

**Highest concentration measured**
- **in ground water:** TCE 290 mg/L
- **in soils:** TCE 2.1 mg/kg

**DNAPL suspected based on field sampling data [from U.S. EPA fact sheet (1992b)]:** Yes

**Known horizontal extent of dissolved contamination:** See notes
**Known vertical extent of dissolved contamination:** About 20 m
**Concentration at natural discharge point:** TCE 2.3 mg/L in nearby ditch

**Dye-trace study results:** None

**Notes:** Contaminant extent in residuum is about 60 m x 430 m and about 200 m x 360 m in upper 20 m of bedrock