www.epa.gov

Reuse and the Benefit to Community
A Beneficial Effects Economic Case Study for the Delaware City PVC Plant Superfund Site

Introduction

From approximately 1961 through 1981, the Stauffer Chemical Company manufactured polyvinyl chloride (PVC) on property in New Castle County, Delaware, that would later become the Delaware City PVC Plant Superfund Site (Site). Formosa Plastics Corporation of Delaware (Formosa) continued manufacturing operations on this property from 1981 until operations ceased in 2018. Former waste disposal practices resulted in contamination of soil and groundwater, as well as nearby wetlands. EPA added the Site to the Superfund Program's National Priorities List (NPL) in 1983. Today, with a substantial portion of the cleanup completed, the Site is home to the Delaware Logistics Park (DLP). The DLP is comprised of four industrial buildings with 2 million square feet of distribution and fulfillment space. The Site also supports the continued operation of long-time businesses. The Site's reuse and redevelopment have bolstered the regional economy and attracted new businesses to the area. Agricultural, industrial, and commercial land uses continue above areas affected by groundwater contamination.

Superfund site restoration and reuse can revitalize local economies with jobs, new businesses, tax revenues, and local spending. Cleanup may also take place while active land uses remain on site. This case study explores the ongoing cleanup and reuse of the Delaware City PVC Plant Superfund Site, illustrating the beneficial effects of Superfund redevelopment.

Beneficial Effects

Site businesses employ about 95 people, providing an estimated annual employment income of about $5.1 million and generating $36 million in annual sales revenue.

Site properties are currently valued at over $40 million and generate about $633,000 in annual property tax revenues.

New tenants continue to move into the Delaware Logistics Park, including two distribution centers owned by Amazon and Newacme, slated to open in 2021.

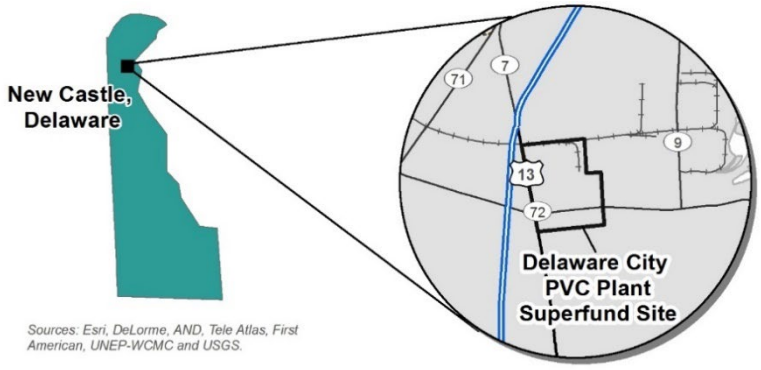

Figure 1. The location of the Delaware City PVC Plant Site in New Castle, Delaware.

Site History

The Site occupies approximately 400 acres in New Castle County, Delaware. The Site is near the unincorporated community of Wrangle Hill and is surrounded by agricultural, commercial, and industrial operations. According to the U.S. Census Bureau's 2019 estimates, nearly 559,000 people live in New Castle County. The closest home is within a mile of the Site; 72 people live within a one-mile radius. Within a one-mile radius of the Site, 14 percent of the population is considered low-income, compared to the state average of 27 percent.

In the early 1960s, Stauffer Chemical Company (Stauffer) built a carbon disulfide (CS2) production plant at the Site and began operating. In or around 1966, Stauffer expanded operations by building a PVC production plant, which it operated between 1966 and 1981. During this time, Stauffer constructed several impoundments as part of the PVC plant. Two of the impoundments were concrete-lined aeration lagoons and three were earthen off-grade batch pits used to dispose of PVC that did not meet quality standards. Stauffer used one basin to collect stormwater, chemical spills, and occasionally process wastewater from the plant. Until 1972, plant operations included storage of PVC resin in a pile north of the plant. When needed, Stauffer removed PVC sludge from the impoundments and buried it on the north side of the aeration lagoons. The company capped the sludge disposal area in 1978.

In 1981, Stauffer sold the PVC plant to Formosa. Formosa continued to operate the PVC plant until it ceased operations in 2018. In 1982, chemical contamination was found in a water supply well on Site. Investigations revealed a contaminated groundwater plume below and west of the PVC plant. Subsequent investigations identified the source of the contamination as two unlined ditches, the three off-grade batch pits, two aeration lagoons, and a stormwater reservoir pond. Additional sources of contamination included the closed, buried sludge pits and former PVC resin storage area. Resin from the former PVC storage pile spread to a wetlands area to the north. PVC resin contamination further extended to an area of stressed vegetation northeast of the wetland. Additionally, groundwater sampling in 1980 and 1982 found high concentrations of Site-related contaminants in nearby residential and commercial wells. As contamination was found, Stauffer provided temporary water supplies to affected residents and businesses. EPA added the Site to the Superfund Program's NPL in 1983.

Figure 2. PVC plant prior to demolition.

Figure 3. Aerial view of PVC plant prior to demolition.

In 1987, Stauffer sold the CS2 plant to Akzo Nobel Chemicals, Inc. (Akzo). Akzo continued to operate the CS2 plant until 1992 when operations ceased. The CS2 plant was disassembled and closed under the supervision of the Delaware Department of Natural Resources and Environmental Control (DNREC). Contamination associated with the former CS2 plant and associated Akzo soils are being addressed under the Resource Conservation and Recovery Act (RCRA) Corrective Action Program. However, the western groundwater plume reaches under a portion of the Akzo property and is considered part of the Superfund site.

Site Cleanup

In 1984, Stauffer and Formosa signed an Administrative Order on Consent (AOC) with EPA under which they agreed to conduct a Remedial Investigation/Feasibility Study (RI/FS) and implement a cleanup to be selected by EPA. Completed in 1986, the RI/FS confirmed that soil and groundwater contamination presented an unacceptable risk to human health. The RI/FS also indicated Site contamination posed minimal risk to ecological receptors at the Site and in contaminated wetlands, as well as in Red Lion Creek to the north and Dragon Creek to the south of the Site (see Figure 5).

Figure 4. Delaware City PVC Plant Site during cleanup.

EPA selected the cleanup plan for the Site in a 1986 Record of Decision (ROD). Parts of the original cleanup plan were modified by an Explanation of Significant Differences in 1991. After issuance of the 1986 ROD, EPA divided the Site into two operable units (OUs): OU1 included contamination source areas within the PVC Plant and OU2 included contamination sources outside the PVC Plant and contaminated groundwater. Under the settlement, Formosa took responsibility for OU1 and Stauffer took responsibility for OU2.

Formosa's cleanup of OU1 included excavation and off-Site removal of PVC sludge and contaminated soil from the earthen off-grade batch pits and stormwater reservoir. Cleanup also included excavation and off-Site removal of PVC sludge from the unlined ditches and aeration lagoons, installation of monitoring wells and liners in the ditches and lagoons, and performance of routine groundwater sampling. To allow for continued operation of the PVC Plant during cleanup, and to prevent future contamination, EPA worked with Formosa to change the cleanup remedy to include an aboveground storage tank to hold stormwater runoff, rather than rebuild the off-grade batch pits and stormwater reservoir pond. Formosa completed construction of the OU1 remedy in 1992 and performed routine remedy operation and maintenance activities until 2018. Formosa completed demolition of the former PVC plant in fall of 2019 and the property is currently for sale.

Stauffer's cleanup of OU2 included constructing an additional cap over the buried sludge pits and consolidation and capping the former PVC resin storage area. Cleanup also included installing groundwater recovery wells above the western plume, treating groundwater, and installing monitoring wells. Stauffer also installed new water supply wells for three residential and three commercial properties in 1987. Stauffer completed construction of the remedy in 1992 and performs regular operation and maintenance activities, including inspecting and repairing the cap as needed and routine groundwater monitoring. The original OU2 groundwater remedy addressed groundwater contamination in the shallow Columbia Aquifer to the west of the PVC Plant. From 1995 to 2016, the western plume contaminant levels declined and ultimately achieved cleanup goals. Stauffer then shut down the

extraction and treatment systems with EPA approval. Near the end of the OU2 remedy construction, sampling found additional groundwater contamination in the shallow Columbia aquifer to the east of PVC plant. In response, between 1999 and 2001, Stauffer installed five new groundwater extraction wells to address the eastern plume of groundwater contamination. Information gathered between 2001-2014 indicated that Site-related contamination in groundwater was migrating eastward onto the adjacent property. In 2015, EPA and Bayer CropScience (BCS) (successor to Stauffer), reached agreement for a supplemental RI/FS for groundwater moving eastward from the Site. BCS began this work in 2016 and is expected to complete this work in 2022. Once the supplemental RI/FS is complete, EPA will select a cleanup plan to address the remaining groundwater issues.

The Delaware City Industrial Area Groundwater Management Zone prohibits unauthorized installation of groundwater wells at and surrounding the Site. Industrial zoning of the Site parcels ensures the property will not be used for residential or recreational purposes. Because waste remains in place on the Site above levels that would allow for unlimited use and unrestricted exposure, EPA will continue to monitor the Site through five-year reviews to make sure the remedy continues to protect public health and the environment.

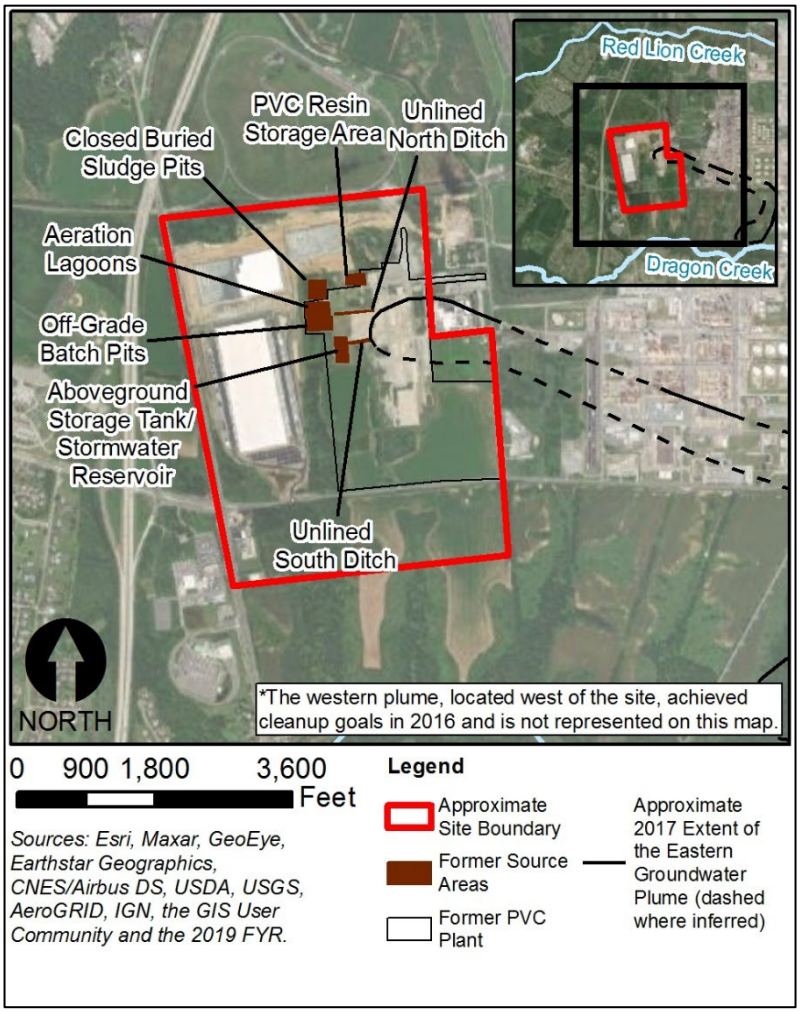

Figure 5. A map of the Delaware City PVC Plant remedial areas and approximate location of eastern groundwater plume.

Beneficial Effects

Today, new businesses are locating facilities on part of the Site in the Delaware Logistics Park (DLP). The DLP is a commercial and industrial development of four buildings spanning two million square feet and provides already-built space ready for business occupancy. The DLP is being developed by NorthPoint Development. EPA's successful remediation of the western groundwater plume set the stage for the Site's redevelopment. With the western plume remediated, NorthPoint was able to redevelop the Site safely without relocating groundwater monitoring wells, implementing institutional controls, or installing vapor intrusion mitigation systems in the buildings. In support of this project, the State provided NorthPoint Development a $3.9 million capital expenditure grant in September 2019, under the condition that the park provide 800 new jobs. As of mid-2021, the DLP has three businesses that are open with more on the way.

Figure 6. Dart Container operating in the Delaware Logistics Park.

Figure 7. Stapleford's auto dealership on the southwest corner of the Site.

Delaware Logistics Center – Current and Future Uses

Dart Container

The Illinois-based manufacturer Dart Container was the first tenant in the DLP. The business manufactures more than 3,000 packaging products for the foodservice industry, including but not limited to cups, plates, containers, and lids. Dart Container is most known for its red Solo cup. In 2020, the business generated over $31 million in sales and about $2.7 million in estimated employment income.

Planned Businesses

Several businesses have plans to move to the DLP and its already-built space. In early 2021, Amazon confirmed a last-mile delivery center at the DLP. Amazon's last-mile delivery centers are connection points between Amazon fulfillment centers and customers' homes. More than 6,500 independent authors and small and medium businesses in Delaware are selling to customers in Amazon's store. The planned last-mile delivery station is part of Amazon's $3.2 billion investment in Delaware since 2010, which has contributed an additional $2.5 billion to the Delaware economy and has created more than 1,900 indirect jobs on top of Amazon's direct hires. Once fully operational, Amazon expects the new last-mile delivery center to provide between 100 and 150 full- and part-time jobs.

Newacme LLC is an Oregon-based business that plans to open a distribution center at the DLP. The business distributes indoor and outdoor furniture, pet supplies, trampolines, and other consumer products. Newacme plans to invest more than $1.5 million into the New Castle location for infrastructure to store and ship racking, furniture, and utility equipment. Once construction is complete, Newacme anticipates hiring more than 30 employees to staff the 217,000-square-foot warehouse.

Nearby Uses

Stapleford's

The family-run auto dealership Stapleford's has been selling and servicing vehicles in the New Castle area since 1912. In addition to being an auto dealership, this business also charters school busses. In 2020, the business generated nearly $5 million in sales and generated about $2.4 million in estimated employment income.

Verizon

Verizon operates a telecommunications utility service center along the southern edge of the Site. The service center supports Verizon service technicians in the New Castle area.

Figure 8. Verizon telecommunications utility service center on the southern edge of the Site.

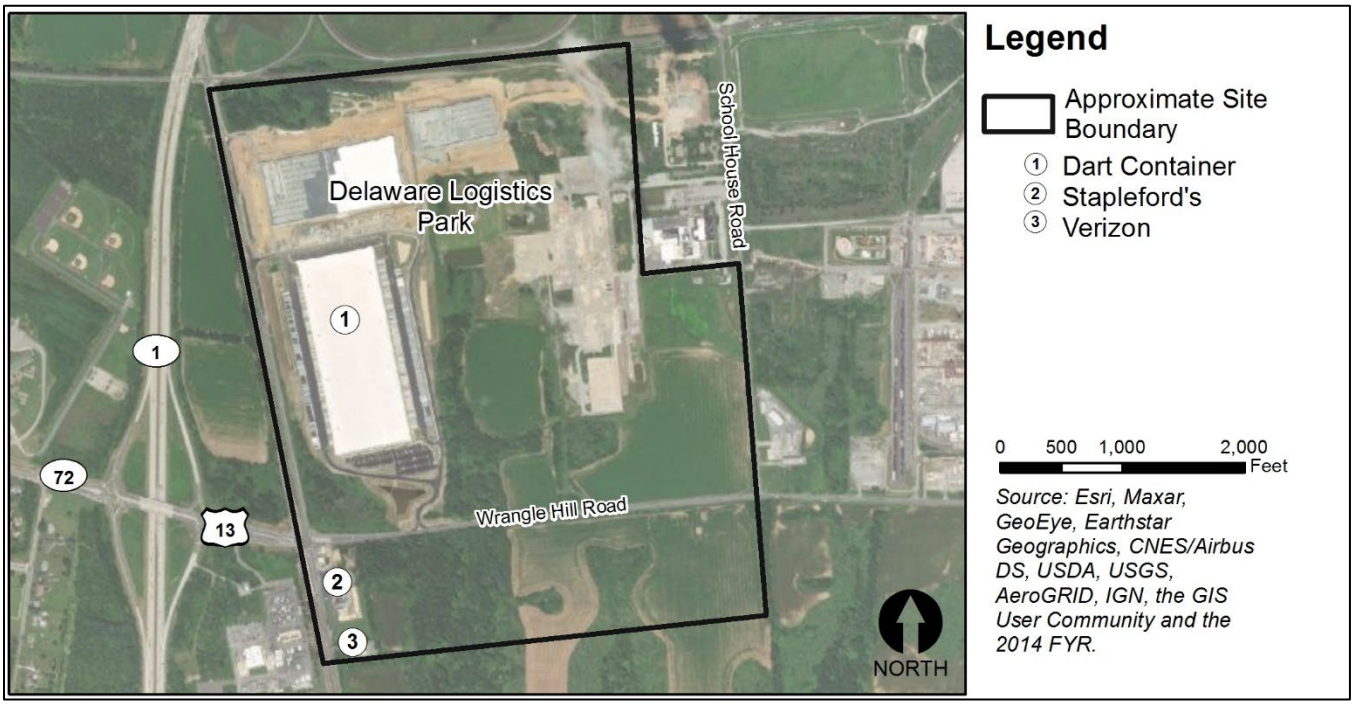

Figure 9. A map of the Delaware City PVC Plant Superfund Site, the DLP and Site businesses.

Figure 10. Part of the Delaware City PVC Plant Superfund Site before construction of the DLP.

Figure 11. Part of the Delaware City PVC Plant Superfund Site after construction of the DLP.

Property Values and Tax Revenues

On-Site businesses help generate property tax revenues that support local government and public services. Today, Site properties have a combined value of over $40 million. In 2020, Site properties generated over $600,000 in total property tax revenues. With Amazon and Newacme developing facilities on Site, the property values and taxes generated are anticipated to increase in coming years.

Looking Ahead

With the demolition of Formosa's former PVC plant in 2020, additional opportunities for redevelopment have opened on the Site. The former PVC plant property is currently for sale. The Site is well suited for industrial redevelopment, with easy access to highways and railways lines. New redevelopment on the Site will lead to increased jobs and tax revenues for the community. With the RI/FS for the eastern plume slated to finish in 2022, EPA will select a cleanup plan that addresses the contamination and is protective of human health and the environment. EPA will also work with prospective purchasers to ensure reuse is consistent with the remedy selected to address this contamination.

Conclusion

Cleanup efforts by EPA's Superfund program and RCRA Corrective Action program were vital to the successful beneficial reuse of the Delaware City PVC Plant Superfund Site. The cleanup not only protects public health and the environment but allowed for Formosa to continue operating on Site during cleanup. Delaware City's Industrial Area Groundwater Management Zone enables the municipality to further protect human health by ensuring no new groundwater wells are installed or used in the area of groundwater contamination. The Site's redevelopment as the DLP has already bolstered the regional economy and attracted businesses to the area. With additional areas of the Site becoming available for reuse, such as the former PVC plant area, the Site is expected to provide beneficial effects to the surrounding area for years to come. Today, on-Site businesses support local economic growth, providing about 95 jobs and about $5.1 million in estimated annual employment income. In 2020, on-site businesses generated about $36 million in sales revenue.

Figure 12. View of Dart Container's loading area.

For more information about EPA's Superfund Redevelopment Program, visit: https://www.epa.gov/superfund-redevelopment.

Technical Appendix

Employment Information for On-Site Jobs

EPA obtained the data included in this appendix directly from reputable sources and reported the data as presented by those sources. Information on the number of employees and sales volume for on-site businesses came from the Hoovers/Dun & Bradstreet (D&B) database.[1] D&B maintains a database of over million businesses worldwide. When Hoovers/D&B database research was unable to identify employment and sales volume for on-site businesses, EPA used the Reference Solutions database.[2] These databases include data reported by businesses. Accordingly, some reported values might be underestimates or overestimates. In one instance, employment information came from a local article.

Wage and Income Information for On-Site Jobs

EPA obtained wage and income information from the U.S. Bureau of Labor Statistics (BLS). Part of the U.S. Department of Labor, the BLS is the principal federal agency responsible for measuring labor market activity, working conditions and price changes in the economy. All BLS data meet high standards of accuracy, statistical quality and impartiality.

EPA used the BLS Quarterly Census of Employment and Wages database to obtain average weekly wage data for businesses at the Delaware City PVC Plant Superfund site. Average weekly wage data were identified by matching the North American Industry Classification System (NAICS) codes for each type of business with weekly wage data for corresponding businesses in New Castle County. If weekly wage data were not available at the county level, EPA sought wage data by state or national level, respectively. In cases where wage data were not available for the six-digit NAICS code, EPA used higher-level (less-detailed) NAICS codes to obtain the wage data.

To determine the annual wages (mean annual) earned from jobs generated by each of the selected businesses at the New Castle Superfund site, EPA multiplied the average weekly wage figure by the number of weeks in a year (52) and by the number of jobs (employees) for each business.

[1] http://www.dnb.com
[2] http://thereferencegroup.com/

Table A-1. Delaware City PVC Plant Superfund Site: Information for On-Site Organizations and Businesses

On-Site Business	NAICS Code[a]	NAICS Title	Number of Employees	Average Weekly Wage (2020)[b]	Annual Wage (Mean Annual) per Employee	Total Annual Income[c]	Annual Sales (2020)[d]
Dart Container	326199[d]	All Other Plastics Product Manufacturing	60[e]	$872	$45,344	$2,720,640	$31,918,000
Stapleford's Sales and Services	423110	Automobile and Other Motor Vehicle Merchant Wholesalers	35[f]	$1,311	$68,172	$2,386,020	$4,900,000[f]
Verizon	517312[g]	Wireless Telecommunications Carriers (except Satellite)	NA	NA	NA	NA	NA
Total			**95**			**$5,106,660**	**$36,818,000**

[a] NAICS code provided in the D&B database, unless otherwise noted.
[b] Average weekly wage per employee based on BLS 2020 Average Weekly Wage data.
[c] Total annual income figures derived by multiplying "Number of Employees" by "Annual Wage (Mean Annual) per Employee."
[d] Data are from the Reference Solutions database, unless otherwise noted.
[e] From https://www.choosedelaware.com/success-stories/dart-container-first-delaware-logistics-center-tenant/.
[f] Data are from the D&B database.
[g] NAICS code is assumed.
NA = Not available.

Property Values and Local Tax Revenue Generated from Property Taxes

EPA obtained data on the most recently assessed values for property parcels at the Delaware City PVC Plant Superfund site in June 2021 through property records accessible through New Castle County's online property appraisal database[3]. EPA also obtained 2020 property tax information for the site parcels.

Table A-2. Property Value and Tax Summary for Taxes Payable in 2020

Parcel ID No.	Total Market Value of Land and Improvements	Total Property Tax[a] (2020)
1200700011	$12,200	$396
1200700025	$12,496,100	$0
1200700026	$5,336,500	$0
1201300005	$276,100	$8,951
1201300006	$95,600	$3,325
1201300007	$21,088,100	$566,608
1201300012	$269,600	$8,740
1201300013	$105,700	$3,427
1201300026	$1,012,200	$32,815
1201300028	$180,000	$5,835
1201300092	$89,600	$3,261
1201300093	$10,300	$0
Totals	**$40,972,000**	**$633,358**

[a] Parcels with $0 property tax values are exempt from property tax.

[3] http://www3.nccde.org/parcel/search/