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UGI Columbia Gas Plant

Columbia, Pennsylvania
CERCLIS #PAD980539126

Site Exposure Potential

The UGI Columbia Gas Plant covers 0.65 hectares in Columbia, Pennsylvania (Figure 1). The Susquehanna River flows about 120 m southeast of the site, discharging into Chesapeake Bay 72 km downstream.

Columbia Gas manufactured gas at the site from 1851 to 1949. In 1932, Columbia Gas became a subsidiary of Pennsylvania Power and Light (PP&L). In 1949, the property was transferred to Lancaster County Gas Company, which later merged with UGI Corporation. Gas manufacturing ceased at the site and the plant was later decommissioned. The land was privately purchased in 1976 and used as a boat dealership. PP&L bought the site in 1994.

Before 1910, the facility reportedly generated gas from wood. In 1910, the plant was rebuilt so that gas could be manufactured from coal. A hazard ranking conducted for EPA in 1993 concluded that the site consisted of three contaminant sources: the city holder, the relief holder, and contaminated soil (NUS 1993). Details on the gas manufacturing process at the plant, including the exact use of these holders (underground storage tanks of unknown construction) were incomplete in the documents reviewed for this report. Hazardous substances associated with the site's contaminant sources and

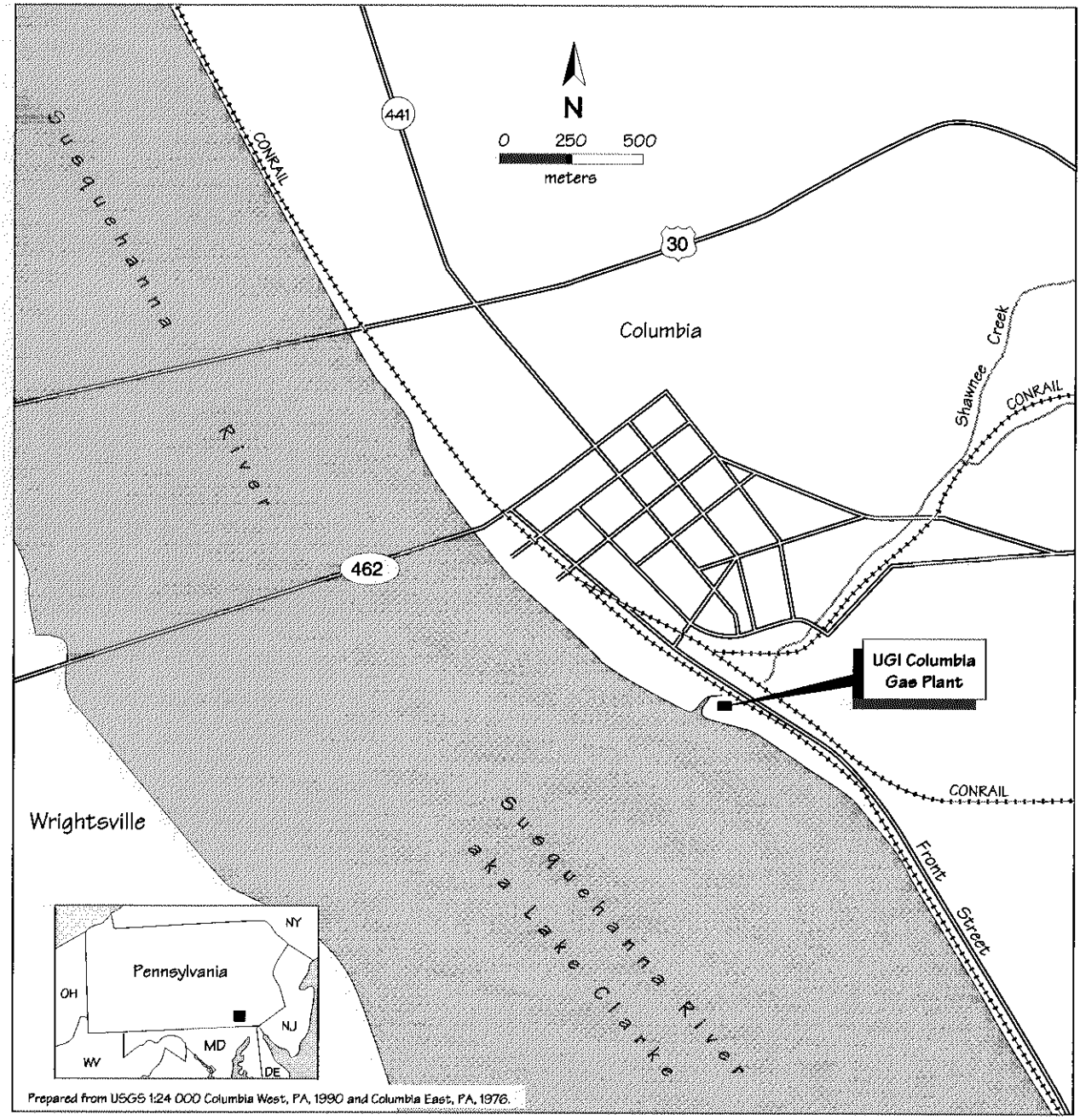

Figure 1. The UGI Columbia Gas Plant in Columbia, PA.

waste streams include PAHs, VOCs, SVOCs, trace elements, and cyanide. Liquid waste streams from the gas-manufacturing process were directed to a separator that separated the tar from water. The separator overflowed during heavy rains and discharged to an open ditch that led to the Susquehanna River. The exact location of

this ditch was not displayed on maps available for the site (see Figure 2 for site map). Investigations completed in 1986 and 1987 found an area of tar-contaminated river sediment southwest and directly downstream of the site, but the area was covered with fill material when inspected in 1991 (NUS 1991). In 1947, an event described as a "structural failure of the relief holder" occurred, but no information was found on what, if any, contaminants were released. When the property was regraded after 1979, tars within the relief holder were displaced and flowed onto the surrounding soil. The tars were then pushed into a railroad pedestrian tunnel bordering the site and a dike was built at the tunnel entrance to contain the tars. In 1987, a remedial action removed about 76 m^3 of tar-contaminated material from the tunnel, built a concrete floor in the tunnel, and capped the city and relief holders with concrete slabs (NUS 1993).

Groundwater discharge and surface water runoff are the potential pathways of contaminant transport from the site to NOAA trust resources and associated habitats. Preliminary investigations at the site indicated that the depth to the limestone bedrock at the site varies from about 2 to 8 m. Alluvial deposits at and near the site consist of silty clay overlying interbedded, coal-rich, laminated sands and coal-rich silty clays, and contain coarse sand or quartz pebble gravel in some locations. Surficial geology consists of a fill layer, alluvium, and limestone bedrock. The fill is a heterogeneous mixture of sand, ash, slag, cinders, brick, and wood chips. Where saturated, the bedrock and the overlying alluvium act as a single shallow aquifer beneath the site. Groundwater flows generally toward the Susquehanna River, although Shawnee Creek, which flows along the western boundary of the site, is also considered a discharge site for local groundwater. Bedrock fractures may provide a pathway for groundwater transport (NUS 1993).

The site drains overland southwest toward the Susquehanna River. The extent of drainage from the site to Shawnee Creek was not clear from information available. Preliminary investigations determined that the open ditch that received tar-separator overflow and discharged into the river was probably a major pathway for tar-contaminated substances from the site. The open ditch has since been covered by fill under the river floodplain. There is no clear drainage pathway to the river because of Front Street and railroad tracks between the site and the river. Three pipes were found in the river bank southwest of the site: one extended from the direction of the site and two extended from a municipal sewage plant directly south of the site. No other information was found on these pipes (Atlantic Environmental Services 1987).

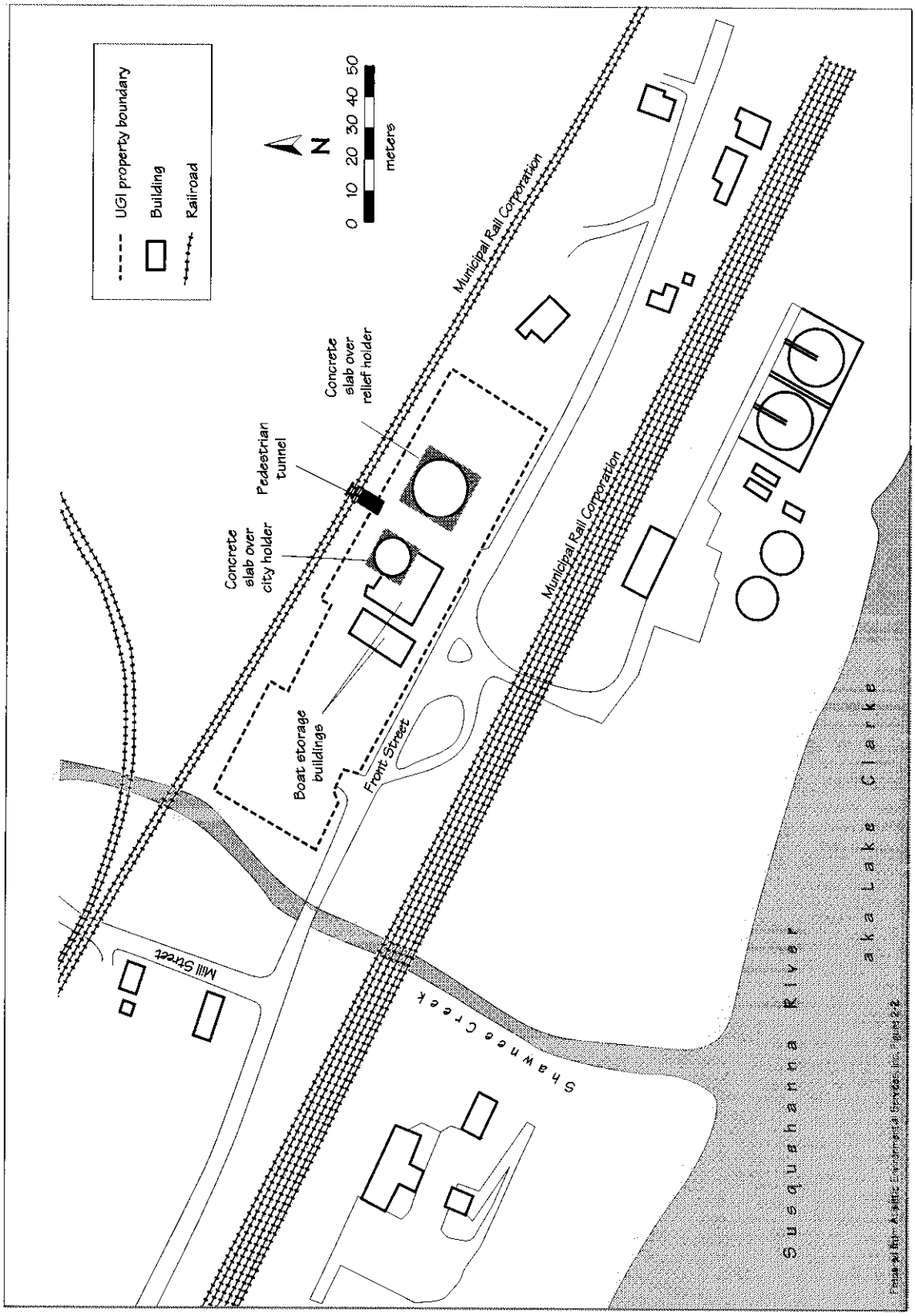

Figure 2. Detail of UGI Columbia Gas Plant.

NOAA Trust Habitat and Species

Habitats of potential concern to NOAA are surface water and associated bottom substrates of the Susquehanna River near the UGI Columbia Gas Plant site. The Susquehanna River basin encompasses 46 percent of Pennsylvania; a drainage area of 55,000 km^2 (USGS 1985). In general, development in the floodplain has resulted in extensive flood control modifications on the Susquehanna River, including the creation of a network of canals, levees, and holding ponds to contain spring floods. These actions have altered the natural river course and riverine habitats (Noland personal communication 1990; St. Pierre personal communication 1994). Moreover, hydroelectric dams have greatly reduced the habitat available for NOAA trust resources. Three major hydroelectric facilities are downstream from the site: the Safe Harbor Dam is 18 km downstream, the Holtwood Dam is 30 km, and the Conowingo Dam is 55 km. The Conowingo Dam is the only dam equipped with fish passage facilities. The Holtwood Dam thus limits natural upstream migration of anadromous fish (St. Pierre personal communication 1994) to approximately 42 river km upstream from the mouth of the Susquehanna River.

American shad and American eel are the only two NOAA trust resources recently identified above the Holtwood Dam in the Susquehanna River near the site (Jackson personal communication 1993; St. Pierre personal communication 1994). Stocking efforts and trap/transport/release operations maintain shad in the upper river. Adult American shad are trapped at the Conowingo Dam fish lift and released farther upstream in Columbia and Middleton, Pennsylvania. Hatchery-raised American shad fry and fingerlings are stocked in the Juanita River, a tributary of the Susquehanna River, approximately 115 km upstream from the site at Thompsontown, Pennsylvania. These stocking efforts are designed to propagate the American shad populations in the central Susquehanna River watershed (St. Pierre personal communication 1994). Habitats near the site are likely to provide spawning habitat to adult American shad, while juvenile shad use surface water near the UGI site for rearing (Jackson personal communication 1993).

Although there are American eel throughout the river basin, there has been a marked reduction in the population within the last ten years. Naturally migrating juvenile eel (elvers) returning from the sea cannot pass the three dams downstream of the site. The existing, very limited American eel population is a remnant stock previously released by the Pennsylvania Fish Commission. Stocking of eel was discontinued in the 1970s. If abundant numbers of elvers reappear at the Conowingo Dam fish lift, they will be permitted to use the fish passage facilities or will be trapped and transported upstream (St. Pierre personal communication 1994).

A restoration program has been instituted for American shad, blueback herring, alewife, and American eel. The scope of this program is to (1) encourage the utilities to implement facility

improvements that will enable migration, and (2) sustain hatchery and lift-, trap-, and transport-stocking of juveniles and adults until the fish populations naturally rejuvenate. A permanent passageway at the Conowingo Dam was completed in 1991 and successfully passed American shad in 1991 (27,227 individuals), 1992 (25,721), 1993 (13,546), and 1994 (30,000+ [still counting]; St. Pierre personal communication 1994).

The remaining utilities on the river will begin similar fish run-restoration programs for their facilities. It is expected that both these projects will be completed by the year 2000, ultimately restoring multi-species migration and greatly reducing out-migration mortality attributed to hydroelectric turbines. Authorities are optimistic that near-historic patterns of migration and spawning populations of American shad, blueback herring, alewife, and American eel can be restored in the upcoming decades, after fish passage facilities are installed on the Susquehanna River (St. Pierre personal communication 1994).

Although there are no commercial or recreational fisheries for NOAA trust resources near the site, these fisheries are expected to reappear as stocks proliferate and habitats are restored (St. Pierre personal communication 1994).

Site-Related Contamination

The contaminants of primary concern to NOAA are PAHs and trace elements (Table 1). Previous investigations at the site have identified contaminants from the facility in groundwater and soil at the site, and in sediments in a portion of the Susquehanna River. Numerous PAHs were detected in surface and subsurface soils at the site. No screening criteria or guidelines are available for these contaminants in soils. The trace elements arsenic, cadmium, copper, lead, mercury, nickel, and zinc were detected in surface soils at concentrations above average U.S. soil concentrations (TRC 1986).

The PAHs acenaphthene, naphthalene, and phenanthrene, as well as the aromatic hydrocarbons ethylbenzene and toluene, were each detected in groundwater at the site at concentrations that exceeded the LOEL reported in the EPA AWQC development documents. Concentrations of benzene (310 mg/l) and several PAHs were also detected, though there are no screening guidelines or criteria for these contaminants. Of the trace elements detected in groundwater, only lead was detected at concentrations exceeding the freshwater AWQC by more than ten times (NUS 1991). Although mercury was below the detection limit of 0.2 µg/l, this detection limit is more than ten times the chronic AWQC of 0.012 µg/l.

Table 1. Maximum concentrations of selected analytes from investigations at the UGI Columbia Gas Plant site.

	Soil (mg/kg)			Water (µg/l)			Sediment (mg/kg)		
Analytes	Sub-surface	Surface	U.S. Ave.[a]	Surface Water	Ground-water	Chronic AWQC[b]	River	ERL[e]	ERM[e]
TRACE ELEMENTS									
Arsenic	ND	13	5.0	11	16	NA	2.7	8.2	70
Cadmium	ND	5	0.06	<4	4.5	1.1+	ND	1.2	9.6
Copper	NA	280	30	16	56	12.0+	83	34	270
Lead	ND	390	10	23	110	3.2+	45	46.7	218
Mercury	NA	0.65	0.03	<0.2	<0.2	0.012	0.025	0.15	0.71
Nickel	NA	72	40	16	53	160+	21	20.9	51.6
Zinc	NA	1080	50	43	230	110+	200	150	410
PAHs									
Acenaphthene	190	3.8	NA	ND	800	520[c]	36	0.016	0.5
Anthracene	60	NA	NA	ND	510	NA	29	0.853	1.1
Fluorene	190	NA	NA	ND	630	NA	28	0.019	0.54
Naphthalene	1320	13	NA	ND	25,000	620[c]	12	0.16	2.1
Phenanthrene	1500	3.4	NA	ND	4,100	6.3[d]	89	0.24	1.5
Benzo(a)pyrene	350	6.2	NA	ND	210	NA	8.3	0.43	1.6
Chrysene	3.8	5.5	NA	ND	180	NA	13	0.384	2.8
Fluoranthene	ND	6.6	NA	ND	480	NA	27	0.6	5.1
Pyrene	1700	12	NA	ND	850	NA	55	0.665	2.6
Benzo(a)anthracene	2.7	4.6	NA	ND	270	NA	13	0.261	1.6
Total PAHs	2,500	66	NA	ND	14,000	NA	310	4.022	45
VOCs									
Benzene	0.02	ND	NA	20	310	NA	ND	NA	NA
Ethyl benzene	0.012	ND	NA	6	60	32[c]	ND	NA	NA
Toluene	0.022	ND	NA	4	190	18[c]	ND	NA	NA

a: Lindsay (1979).
b: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (U.S. EPA 1993).
c: Insufficient data to develop criteria. Value presented is the freshwater chronic Lowest Observed Effect Level (U.S. EPA 1993).
d: Proposed criterion (U.S. EPA 1993).
e: Long and MacDonald (1992).
+: Value is dependent on hardness (100 mg/l $CaCO_3$ used).
ND: Not detected.
NA: Not analyzed or not available.
<: Not detected at detection limit listed.

A 1986 investigation delineated a zone of tar-contaminated sediment that extended a minimum of 3.3 m into the river along a 20-m stretch of the riverbank (TRC Environmental Consultants 1986). Another investigation of the river sediments in 1987 determined that tar impacts in the river sediment (approximately 612 m^3) extended approximately 33 m along the riverbank and about 16 m into the river (Atlantic Environmental Services 1987). The 1987 report concluded that tar was actively migrating through the floodplain sediments into the river sediments and that the source was probably the open ditch that received the tar separator overflow. Sediment sampling for the 1986 investigation reported ten PAHs with concentrations that exceeded ERM concentrations, all of which came from the same sample station located directly downgradient of the site. The 1991 investigation did not find the visibly tar-contaminated sediments reported in the 1986 and 1987 reports, but rather found the area to be covered with fill material. Sample results from the fill area had lower concentrations of contaminants, none of which exceeded ERM concentrations (naphthalene, 0.630 mg/kg; phenanthrene, 1.30 mg/kg; fluoranthene, 1.5 mg/kg; pyrene, 1.5 mg/kg; and benzo(a)pyrene, 0.620 mg/kg). No trace elements were detected in sediments at concentrations that exceeded ERM screening guidelines, but copper and zinc in sediment exceeded ERL values (NUS 1991).

None of the contaminants identified in surface water from the Susquehanna River was detected at concentrations above chronic freshwater AWQC.

Work plans have been developed to further characterize the extent of site-related contamination in river sediments and contamination of soil, surface water, and groundwater at the site (Atlantic Environmental Services 1993, 1994).

Summary

PAHs and trace elements have been detected at elevated concentrations in on-site soil and groundwater at the site. PAHs have also been detected at elevated concentrations in Susquehanna River sediments. These habitats currently support populations of the NOAA trust resources American shad and American eel. Sampling done in the mid-1980s documented contaminant migration from the site to the river: tar-contaminated river sediments extended about 33 m along the riverbank and about 16 m into the river. Ten PAHs were detected at levels above ERM concentrations. The contaminated area has since been covered with fill material. Sampling has found reduced concentrations of contaminants in the surface sediment, but there is no record that contaminants have been removed from the sediment. Further sampling should more accurately determine the vertical and lateral extent of the sediment contamination. The planned restoration of the Susquehanna River by 2000 could allow more NOAA trust resources to migrate to this section of the river, potentially exposing these fish to toxic concentrations of contaminants.

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