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M E M O R A N D U M

TO: Art Lehberger, Section Chief
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FROM: Nicholle Worland, Environmental Specialist 4 NW
Bureau of Evaluation and Planning

SUBJECT: Facility-wide Risk Assessment Modeling Review
Cooper University Hospital
PI #: 50078 PCP #: 220001

DATE: September 5, 2024

The Bureau of Evaluation and Planning (BEP) has completed its review of the Cooper University Hospital facility-wide risk assessment. This risk assessment is in response to the results of the second level risk assessment from March 2024, which evaluated PAH in the form of benzo(a)pyrene and formaldehyde emitted from one natural gas-fired combined heat and power (CHP) unit. After internal discussion, the BEP approved that this project be remodeled using facility-wide risk guidelines. This was due to the original predicted health risk associated with formaldehyde. With the new risk assessment, Cooper University Hospital was required to include all additional permitted sources at the facility with HAPs above reporting thresholds. As such, two natural-gas boilers were also included in this facility-wide analysis.

After review, the facility-wide air dispersion modeling and health risk assessment of these pollutants have predicted negligible health risk. The Table below indicates the maximum risk assessment results for each pollutant evaluated. Hazard quotients less than 1 and cancer risks less than ten in a million are considered to present a negligible health risk in this assessment.

	Maximum Predicted Cancer Risk	Maximum Long-Term Hazard Quotient	Maximum Short-Term Hazard Quotient[3]
Benzo(a)pyrene[1,2]	1.63E-07	1.36E-01	-
Formaldehyde	4.58E-06	3.91E-02	5.05E-01

[1] There is no short-term reference concentration for benzo(a)pyrene.
[2] Benzo(a)pyrene was used to evaluate PAH (polycyclic aromatic hydrocarbons).
[3] Two short-term scenarios were evaluated in this assessment. The results listed in this Table can be considered worst-case.

Attached is a summary of the air dispersion modeling and health risk assessment. If you have any questions, please contact either me at (609) 940-5913, or Claudia Peters at (609) 940-5957.

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Bureau of Evaluation and Planning
Summary of the Facility-wide Risk Assessment for
Cooper University Hospital – Camden, Camden County, New Jersey

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Facility Description and Location

Cooper University Hospital is a teaching hospital and biomedical research facility located in the city of Camden, Camden County, NJ. This facility-wide risk assessment evaluated emissions from an existing Solar Turbines Mercury 50-6400R unit, consisting of a natural gas-fired turbine and duct burner (U18, PT35). This CHP unit generates electricity for the facility and produces steam for heating via an associated heat recovery steam generator. Additionally, emissions from two natural gas boilers, B-2 and B-3 (U1), vented to one stack (PT1), were included in this analysis.

The facility is located in northwestern Camden County, approximately two kilometers southeast of Philadelphia, Pennsylvania. Camden County is part of the Coastal Plain physiographic region of New Jersey, with gently rolling hills complex terrain, and elevations ranging from mean sea level at the Delaware River to generally less than 40 meters above mean sea level. The surrounding area is a combination of medium and high intensity space. With more than 50% of the area within a 3-kilometer radius from the facility being classified as urban land use, urban dispersion coefficients were used in this modeling analysis. The 2021 estimated Census population of Camden (71,773) was used as the urban population in the analysis.

Emission Rates and Stack Parameters

Polycyclic aromatic hydrocarbons (PAH) in the form of benzo(a)pyrene and formaldehyde emitted from the facility's CHP unit (U18, PT35) and two boilers, B-2 and B-3 (U1, PT1), were modeled in this analysis. All emission rates were verified by the facility, reviewed by the Bureau of Stationary Sources (BoSS), and assumed to reflect the appropriate hours of operation.

All stack parameters used in analysis were obtained from the facility's permit. Stack parameters associated with the CHP unit remained consistent with the original March 2024 risk assessment. Worst-case available parameters were used for both emission points. Average stack parameters (stack temperature/flow rate) were used to evaluate long-term scenario. Meanwhile, minimum stack parameters (stack temperature/flow rate) were used in short-term analysis. In the case of the CHP unit, since the minimum flow rate is listed as 0 acfm in the permit, the BEP evaluated the short-term scenario twice. Once with the minimum permitted minimum flow rate and again with the permitted average flow rate. This approach was consistent with the original risk assessment in March 2024.

Tables 1 and 2 below list the stack parameters and emission rates modeled in this analysis.

Table 1. Modeled Stack Parameters

	Short-Term	Long-Term	Short-Term	Long-Term
Emission Point	**U18 (PT35) – CHP Unit**		**U1 (PT1) – B-2 & B-3**	
UTM X-coordinate (m)	489977.14		489979.55	
UTM Y-coordinate (m)	4421221.89		4421214.01	
Stack Height (m)	21.64		33.5	
Stack Diameter (m)	1.22		2.03	
Stack Temperature(K)	255.37	416.48	522.04	533.15
Exhaust Volume (acfm)[a]	0 and 47,000	47,000	3,500	11,000
Exhaust Velocity (m/s)[a]	0 and 19.0	19.0	0.5	1.6
Exhaust Flow Rate (acm/s)[a]	0 and 22.2	22.2	1.7	5.2

[a] A minimum flow rate was not provided for U18(PT35) by the facility and is listed as 0 acfm in the permit. Since this might not reflect actual worst case operating conditions and would result in very low dispersion, the short-term modeling was run with both the recorded minimum and average flow rates listed in the permit.

Table 2. Modeled Emission Rates

	U18 (PT35) – CHP Unit		U1 (PT1) – B-2 & B-3[1]	
	Short Term (lb/hr)	**Long-Term (tpy)**	**Short Term (lb/hr)**	**Long-Term (tpy)**
Benzo(a)pyrene[2,3]	-	6.75E-04	-	1.88E-05
Formaldehyde	2.02E-01	8.83E-01	5.36E-03	1.42E-02

[1] Modeled emission rates for U1 are listed as the sum of B-2 and B-3 as they vent to one stack (PT1).
[2] Short-term emissions were not modeled for benzo(a)pyrene as there is no short-term reference concentration for this pollutant.
[3] Benzo(a)pyrene was used to evaluate PAH (polycyclic aromatic hydrocarbons).

Modeling Methodology

Modeling was performed using the AERMOD model (version 23132) in urban mode to evaluate the emissions of two pollutants individually. The BEP's preprocessed 2016-2020 meteorological surface data from Philadelphia International Airport (WBAN 13739), along with concurrent upper air data from the Sterling, VA Station (WBAN 93734) was used in the analysis. The EPA's Building Profile Input Program (BPIP-PRIME-version 04274) was used to evaluate aerodynamic downwash potential from various buildings on and around the facility.

A Cartesian receptor grid was used in the analysis. Due to public accessibility, receptors were placed throughout the facility with a spacing of 25 meters (m). The grid was centered around the facility with 50 m spacing from the hospital campus boundary out to 1,000 m, 100 m spacing to 2,000 m, 250 m spacing to 3,500 m, and 500 m spacing to 5,500 m. Receptor elevations were determined with the use of AERMAP (version 18081).

Modeling Results

A risk assessment was performed to evaluate the worst-case risk associated with exposure to PAH in the form of benzo(a)pyrene and formaldehyde. The risk assessment only evaluated health risks associated with the inhalation pathway. Three types of risk were assessed 1) long-term cancer risk 2) long-term non-cancer risk and 3) short-term non-cancer risk. Cancer risks less than ten-in-a-million and hazard quotients less than 1 are both considered negligible risk in this assessment. The results from the modeling analysis and health risk assessment have predicted negligible risk at all receptors. The results can be found below in Tables 3, 4, & 5.

Table 3. Long-Term Cancer Risk Assessment

Pollutant	Maximum Long- Term Concentration (µg/m3)	Unit Risk Factor (µg/m3)-1	Incremental Cancer Risk	Result
Benzo(a)pyrene	2.71E-04	6.0E-04	1.63E-07	Negligible
Formaldehyde	3.52E-01	1.3E-05	4.58E-06	Negligible

Table 4. Long-Term Non-Cancer Risk Assessment

Pollutant	Maximum Long-Term Concentration (µg/m3)	Long-Term Reference Concentration (µg/m3)	Hazard Quotient	Result
Benzo(a)pyrene	2.71E-04	0.002	1.36E-01	Negligible
Formaldehyde	3.52E-01	9	3.91E-02	Negligible

Table 5. Short-Term Non-Cancer Risk Assessment

Pollutant	Maximum Short-Term Concentration (µg/m3)	Short-Term Reference Concentration (µg/m3)	Averaging Period (hr)	Hazard Quotient	Result
	Modeled Concentration with the Minimum Flow Rate for U18 (PT35)				
Benzo(a)pyrene[1]	-	-	-	-	-
Formaldehyde	2.78E+01	55	1	5.05E-01	Negligible
	Modeled Concentration with the Average Flow Rate for U18 (PT35)				
Benzo(a)pyrene[1]	-	-	-	-	-
Formaldehyde	4.56E+00	55	1	8.29E-02	Negligible

[1] There are no short-term reference concentrations for benzo(a)pyrene.