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Re: Black Creek Elementary Risk Assessment Technical Memo

Background

In March 2026, the S.C. Department of Environmental Services (SCDES) and U.S. Environmental Protection Agency (USEPA) were notified that the recently opened Black Creek Elementary School was constructed on land formerly used as a field for land-applying biosolids from the former Galey & Lord facility (G&L) located in Society Hill, South Carolina. Due to concerns of potential exposure to contaminants related to the history of land application on the school property, USEPA and SCDES launched an investigation to determine potential exposure risks to receptors at Black Creek Elementary School.

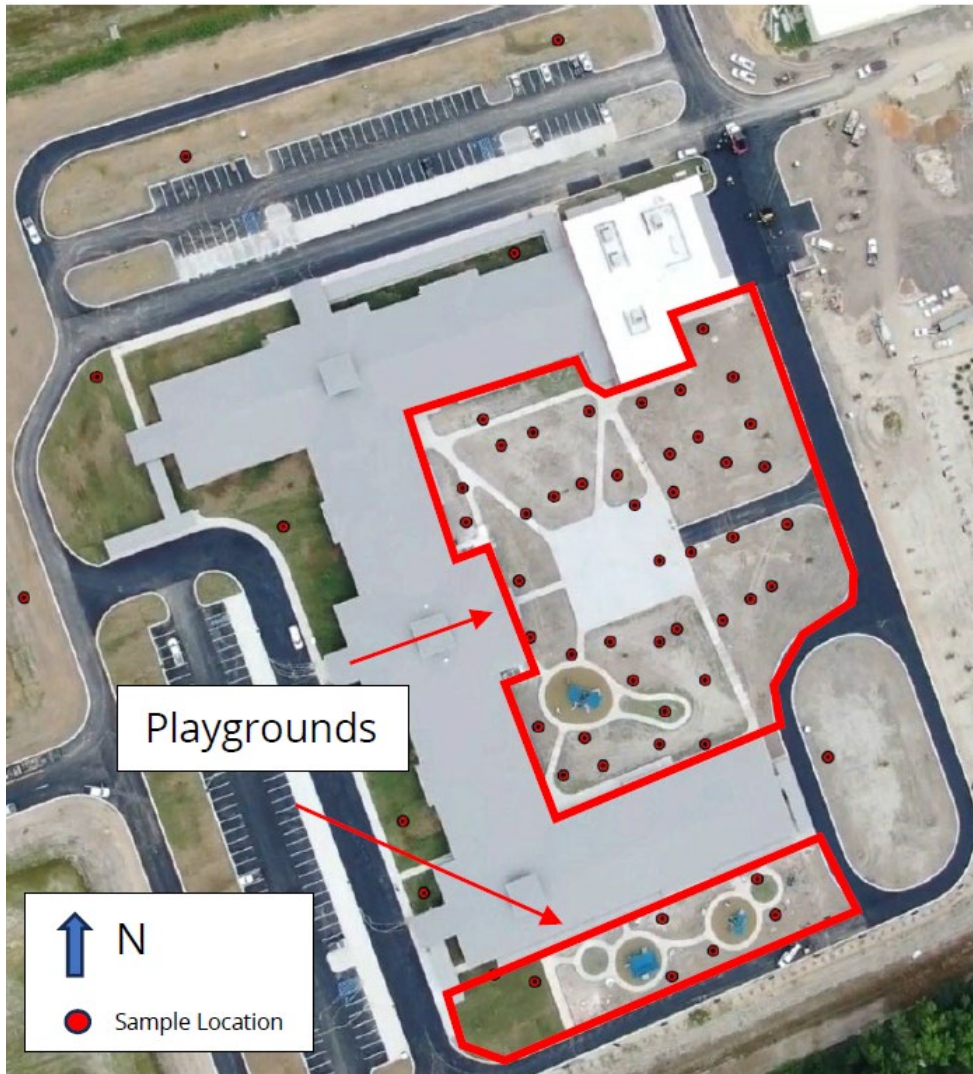
Investigation activities included a visit to the school by USEPA and SCDES risk assessors and project managers in March 2026, an April 2026 sampling event in which 68 surface soil samples were collected from school property, and several discussions between SCDES, USEPA, and Darlington County School District. USEPA and SCDES conducted independent risk assessments where site-specific risk parameters and conclusions were discussed and co-verified between both agencies. This technical memo is intended to provide a summary of the considerations and calculations of the SCDES risk assessment.

Sampling and Data Evaluation

On April 8, 2026, 68 surface soil (0-6 inch) samples were collected from school grounds. These included 43 samples from the large playground (utilized for students in 1st-5th grade), 11 samples from the small playground (utilized for students from the 3-year-old, preschool, and kindergarten classes). These playground areas are outlined below in red in Figure 1. Additionally, there were 9

samples from other locations on school grounds, 3 samples from undeveloped areas on the school property, and duplicate samples. Because the school property is connected to a municipal water source, groundwater samples were not collected.

Figure 1. Playground Areas at BCE



There were no exceedances of residential screening levels for pesticides, herbicides or polychlorinated biphenyls (PCBs) in the samples. Arsenic concentrations exceeded residential screening levels but were within state background levels. Thus, arsenic was eliminated as a contaminant of potential concern (COPC). All other metals were below screening levels. Three per- and polyfluoroalkyl substances (PFAS) were found to exceed screening criteria for at least one sampling location. Perfluorodecanoic acid (PFDA) exceeded residential screening levels in most samples, perfluorooctanoic acid (PFOA) exceeded industrial screening levels in

most samples, and perfluorooctanesulfonic acid (PFOS) exceeded residential screening levels at one sampling location. Consequently, PFDA, PFOA, and PFOS were retained as COPCs for this risk assessment.

Exposure point concentrations (EPCs) for use in risk calculations were developed by grouping sample concentrations from the small playground and the large playground. EPCs, which represented the 95% upper confidence limit of measured concentrations for COPCs at each playground, are reported below in mg/kg or ppm (parts per million).

Table 1. Calculated Exposure Point Concentrations

	PFDA	PFOA	PFOS
Small playground	0.000315	0.000274	0.003529
Large Playground	0.000243	0.000479	0.003587

Exposure Setting and Pathways

As discussed with Darlington County School District officials, the large and small playgrounds are the primary outdoor spaces regularly utilized by students (primarily during a one-hour recess). For both playgrounds, there are large areas which are covered with concrete or other impermeable material. The remaining playground areas largely consist of uncovered soil and sparse vegetation. Fences line the perimeter of each playground area, preventing access to other areas during recess.

A retention pond is located along the northwestern edge of the property. It is located far from school grounds and is within a fence, limiting access. Large undeveloped areas are also present on the property. However, there are no current uses or plans for future use of these areas, according to district officials.

Biosolids from the G&L facility were formerly applied while the property was in agricultural use. During school construction, soil was excavated and redistributed throughout the property. There is a potentially complete exposure pathway to receptors at the school via uncovered soil on playgrounds. The exposure routes associated with PFDA, PFOS, and PFOA exposure in this pathway are incidental ingestion of soil and, to a lesser degree, dermal contact with soil.

Site-Specific Exposure Factors and Risk Calculations

Risks to each receptor were quantified using the USEPA Regional Screening Level Calculators. Site-specific risk parameters for each receptor type were developed following thorough discussion between USEPA, SCDES, and the Darlington County School District.

The exposure frequency (EF) for students was determined to be 200 days/year, based on a 180-day school year and 20 days to account for summer school (which was reported to be 4 days/week and last 4-5 weeks). The EF for teachers was determined to be 250 days/year, based on the default assumptions for the indoor worker scenario outlined by USEPA. While recess reportedly lasts approximately 1 hour each day, a conservative exposure time (ET) of 4 hours/day was used to account for any additional potential daily uses of the playground by students and staff.

There were four groups of receptors (types of people potentially exposed to uncovered soil) identified at the school: students from 3-years-old through 5-years-old (kindergarten) using the small playground, students from 1st-5th grade who use the larger playground, and the staff associated with each group of students. Risks calculations accounted for two exposure scenarios: the "short-term" and the "long-term."

The short-term exposure scenario is representative of risks to date, since the school began operation. Therefore, the short-term exposure duration (ED) was 1 year for all receptors.

For students, the long-term represents the maximum potential duration of attendance at BCE, including an ED=3 years for time spent on the small playground between 3-years-old and kindergarten, and an ED=5 years for time spent on the large playground between 1st to 5th grade. The risks calculated from these two EDs were summed to determine cumulative risk to a student through the entirety of their time at school, beginning at 3-years-old and ending upon the completion of 5th grade. For teachers, the EPA's standard worker scenario assumes an ED or employment period of 25 years. However, a conservative 30-year employment period was used for these calculations.

A skin adherence factor (AF) of 0.2 and 0.07 mg/cm² was used for students and staff respectively, according to EPA standard assumptions for child and adult receptors. Standard assumptions of 200 mg/day for children (in this case, ages 3-11) and 100 mg/day for adults were also used for rate of incidental ingestion of soil (IRS). Children on the smaller playground (ages 3-5) were assumed to have an average body weight (BW) of 19 kg and have a skin surface area (SA) of 2373 cm²/day exposed to soil. An average BW of 32 kg and SA of 3273 cm²/day were used for children on the larger playground (ages 6-11). Finally, for teachers, an 80 kg BW and 6032 cm²/day SA were used. Values for teacher BW and SA represent EPA standard assumptions for adults, while values for students were based on average values for each age group, as outlined in the EPA Exposure Factors Handbook.

Table 2. Summary of Exposure Factors by Age

	3-5K	1st-5th grade	Staff
Exposure location	Small playground	Large playground	Both
Age	3-5	6-11	Adult
AF	0.2 mg/cm ²	0.2 mg/cm ²	0.07 mg/cm ²
BW	19 kg	32 kg	80 kg
SA	2373 cm ² /day	3273 cm ² /day	6032 cm ² /day
ED	3 yr	5 yr	30 yr
EF	200 day/yr	200 day/yr	250 day/yr
ET	4 hr/day	4 hr/day	4 hr/day
IRS	200 mg/day	200 mg/day	100 mg/day

Excess noncancer health effects were concluded if the hazard index (HI) calculated was greater than one, when results are rounded to one significant figure. HIs less than or equal to one were considered acceptable. Under current USEPA guidelines, PFDA, PFOS, and PFOA are evaluated for non-cancer effects.

Cancer risks greater than 1E-4 or 1/10,000 were considered excess. Only PFOA and PFOS are evaluated for cancer effects, because there are no known cancer effects from PFDA.

Results

For students and staff exposed to uncovered soil at both playgrounds, short-term cancer risks and non-cancer health effects for PFDA, PFOA, and PFOS do not exceed 1E-4 or an HI=1, respectively.

In the long-term, cancer risks do not exceed 1E-4 for staff and students, and non-cancer effects do not exceed levels of concern for adults. For the small playground, the long-term HI for PFDA was 1.12, which rounded to HI=1. For the larger playground, the long-term HI for PFDA was 0.552, which rounded to an HI of 0.6. Therefore, HIs for the individual playground exposures in the long-term do not exceed HI=1. However, for the long-term exposure scenario outlined in this risk assessment, individual long-term HIs from both playgrounds were summed together to calculate a cumulative HI across a student's time at school. This resulted in an HI of 1.67 (1.12+0.552), which rounds to HI=2 for PFDA, exceeding the USEPA threshold of HI=1.

While it is common to add HIs across exposure units to calculate a cumulative HI, this procedure is usually done under the presumption that exposure is concurrent. In this case, student exposure to each exposure unit (the small playground and large playground) is successive, rather than simultaneous. In other words, a student would not be expected to play on the small and large playground at the same time (as playgrounds are designated by grade), yet the cumulative

HI assumes that this is the case. Thus, it is possible that adding HIs leads to overestimation of the potential to observe non-carcinogenic health effects.

A summary of risk assessment calculation results is included in the tables below.

Table 3. Carcinogenic Risk- Short Term Exposure

Receptor	Exposure Duration	Exposure Route	PFDA	PFOA	PFOS	Rounded Total
3-5K Student	1 year	Ingestion	--	6.62E-07	1.15E-08	8E-07
		Dermal	--	1.57E-07	2.73E-09	
		Total	--	8.18E-07	1.42E-08	
1st-5th Student	1 year	Ingestion	--	6.87E-07	6.93E-09	9E-07
		Dermal	--	2.25E-07	2.27E-09	
		Total	--	9.11E-07	9.20E-09	
3-5K Staff	1 year	Ingestion	--	9.82E-08	1.70E-09	1E-07
		Dermal	--	4.15E-08	7.20E-10	
		Total	--	1.40E-07	2.42E-09	
1st-5th Staff	1 year	Ingestion	--	1.72E-07	1.73E-09	2E-07
		Dermal	--	7.25E-08	7.32E-10	
		Total	--	2.44E-07	2.46E-09	

Table 4. Carcinogenic Risk- Long Term Exposure

Receptor	Exposure Duration	Exposure Route	PFDA	PFOA	PFOS	Rounded Total
3-5K Student	3 years	Ingestion	--	1.98E-06	3.45E-08	3E-06
		Dermal	--	4.71E-07	8.18E-09	
		Total	--	2.46E-06	4.26E-08	
1st-5th Student	5 years	Ingestion	--	3.43E-06	3.47E-08	5E-06
		Dermal	--	1.12E-06	1.13E-08	
		Total	--	4.56E-06	4.60E-08	
Student Total	3 + 5 years	Ingestion	--	5.41E-06	6.92E-08	7E-06
		Dermal	--	1.59E-06	1.95E-08	
		Total	--	7.02E-06	8.86E-08	
3-5K Staff	30 years	Ingestion	--	3.79E-05	3.97E-09	5E-05
		Dermal	--	1.60E-05	1.68E-09	
		Total	--	5.40E-05	5.65E-09	
1st-5th Staff	30 years	Ingestion	--	3.86E-05	6.94E-09	5E-05
		Dermal	--	1.63E-05	2.93E-09	
		Total	--	5.48E-05	9.87E-09	

Table 5. Non-Carcinogenic HI- Short-Term Exposure

Receptor	Exposure Duration	Exposure Route	PFDA	PFOA	PFOS
3-5K Student	1 year	Ingestion	9.08E-01	5.27E-02	2.04E-01
		Dermal	2.16E-01	1.25E-02	4.83E-02
		Rounded Total	1E+00	7E-02	3E-01
1st-5th Student	1 year	Ingestion	4.16E-01	5.47E-02	1.23E-01
		Dermal	1.36E-01	1.79E-02	4.02E-02
		Rounded Total	6E-01	7E-02	2E-01
3-5K Staff	1 year	Ingestion	1.35E-01	7.82E-03	3.02E-02
		Dermal	5.69E-02	3.30E-03	1.28E-02
		Rounded Total	2E-01	1E-02	4E-02
1st-5th Staff	1 year	Ingestion	1.04E-01	1.37E-02	3.07E-02
		Dermal	4.39E-02	5.77E-03	1.30E-02
		Rounded Total	1E-01	2E-02	4E-02

Table 6. Non-Carcinogenic HI- Long-Term Exposure

Receptor	Exposure Duration	Exposure Route	PFDA	PFOA	PFOS
3-5K Student	3 years	Ingestion	9.08E-01	5.27E-02	2.04E-01
		Dermal	2.16E-01	1.25E-02	4.83E-02
		Total	1.12E+00	6.52E-02	2.52E-01
1st-5th Student	5 years	Ingestion	4.16E-01	5.47E-02	1.23E-01
		Dermal	1.36E-01	1.79E-02	4.02E-02
		Total	5.52E-01	7.26E-02	1.63E-01
Student Total	3+5 years	Rounded Total	2E+00	1E-01	4E-01
3-5K Staff	30 years	Ingestion	1.35E-01	7.82E-03	3.02E-02
		Dermal	5.69E-02	3.30E-03	1.28E-02
		Rounded Total	2E-01	1E-02	4E-02
1st-5th Staff	30 years	Ingestion	1.04E-01	1.37E-02	3.07E-02
		Dermal	4.39E-02	5.77E-03	1.30E-02
		Rounded Total	1E-01	2E-02	4E-02

Conclusions

SCDES's risk assessment concluded that PFDA, PFOA, and PFOS exposure that may have occurred during the school year did not present an excess cancer or non-cancer risk to staff or students. In the long-term, there are no excess cancer risks or non-cancer risks for students or staff.

While the conclusions of this risk assessment do not support the need for immediate action, limiting exposure to uncovered soil can help to address uncertainties related to risk quantification. For example, adding vegetation or other cover material to areas of exposed soil would significantly reduce the likelihood of students and staff having direct contact with soil, reducing risk. On a smaller scale, encouraging hand washing and cleaning shoes following time spent on the playgrounds would likely reduce the potential for incidental ingestion and dermal absorption of soil.