



RHODE ISLAND

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

235 Promenade Street, Providence, RI 02908-5767

TDD 401-222-4462

Notification to Project Stakeholders and the General Public

Draft Five-Year Review Report

Anthony Carnevale Elementary School and Del Sesto Middle School

50-152 Springfield Street, Providence, Rhode Island

November 15, 2011

In accordance with the *Second Assented to Supplemental Order* regarding the Springfield Street Schools Site (the Site), the Rhode Island Department of Environmental Management (RIDEM) is providing notice to persons listed in *Appendix A* of the *Agreement for Resolution of Claims*, the City of Providence School Board, the City of Providence Department of Public Property (collectively referred to herein as "Project Stakeholders"), and the general public that RIDEM has received the Draft Five-Year Review Report of the approved remedial action implemented at the Site. The Draft Five-Year Review included the following activities:

- review of pertinent documents which describe the environmental condition of the Site, the remedial action implemented, and the results of monitoring conducted over the past 5 years;
- inspection of the Site to identify and document the condition of the engineered controls and any conditions posing increased risk to students and faculty of the Schools from the previously identified environmental contaminants;
- interviews of school personnel and others responsible for the operation and maintenance of the remedial controls to evaluate if the controls have been functioning as designed and to compile reports of potential issues; and
- preparation of a Five-Year Report documenting the results of the activities summarized above and recommendations for ensuring the on-going effectiveness of the remedial actions, for review by Project Stakeholders.

Project Stakeholders and members of the general public are encouraged to review the Draft Five-Year Environmental Review Report for the Site and submit comments concerning the content, concerns and recommendations in writing to RIDEM. There is a 30 day(s) comment period, commencing on the above-listed date, during which written comments or concerns may be submitted to:

Mr. Jeffrey Crawford
R.I. Department of Environmental Management
235 Promenade Street
Providence, RI 02908-5767
Telephone: 401-222-2797 extension 7102
Email: jeff.crawford@dem.ri.gov

Written comments must be received by RIDEM before 4:00pm on December 16, 2011. Comments, concerns, recommendations and RIDEM responses will be documented in an addendum to the Draft Five-Year Report. RIDEM will consider these comments, concerns, recommendations when evaluating the continued effectiveness of the remedial actions.

Draft Five-Year Review Report Anthony Carnevale Elementary School and Del Sesto Middle School

50-152 Springfield Street
Providence, RI

November 2011



FUSS & O'NEILL

317 Iron Horse Way
Suite 204
Providence, RI 02908



FUSS & O'NEILL

November 15, 2011

Ms. Kelly Owens
Supervising Engineer
Office of Waste Management
Rhode Island Department of Environmental Management
235 Promenade Street
Providence, RI 02908

RE: Draft Five Year Review Report
Anthony Carnevale Elementary School and Del Sesto Middle School
50-152 Springfield Street
Providence, Rhode Island 02909

Dear Ms. Owens:

Fuss & O'Neill, Inc. (Fuss & O'Neill) is pleased to present the attached draft report of the Five Year Review conducted for the Anthony Carnevale Elementary School and Del Sesto Middle School complex located on Springfield Street in Providence, RI. This report was prepared as a draft copy of the findings of our assessment for distribution, review and comment by project stakeholders. This draft report was completed on behalf of the Rhode Island Department of Environmental Management (RIDEM) in accordance with the requirements of the *Second Assented to Supplemental Order* in the matter of the Rhode Island Superior Court case of *Hartford Park Tenants Association, et al. vs. RIDEM, et al.*

If you have any questions or require additional information, please do not hesitate to contact the undersigned.

Sincerely,

Patrick J. Dowling, CPG
Project Manager

John A. Chambers, PG, LSP
Vice President

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Connecticut
Massachusetts
Rhode Island
South Carolina

Attachment: Draft Five Year Review

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1 Objective

Fuss & O'Neill, Inc. (Fuss & O'Neill) was retained by the Rhode Island Department of Environmental Management (RIDEM) to assist in performing a Five-Year Review of the remedial actions implemented at the Anthony Carnevale Elementary School and Del Sesto Middle School site located at 50-152 Springfield Street in Providence, Rhode Island (the site).

The Five-Year Review was performed in accordance with the *Second Assented to Supplemental Order*, which states that every five years, RIDEM “shall conduct a review of the approved remedial action at the Springfield Street Schools Site to assure that human health and the environment are being protected by the remedial action being implemented.” The specific scope and requirements of the Five-Year Review documented in the *Second Assented to Supplemental Order and Agreement for Resolution of Claims* includes:

- providing written notification of the impending Five-Year Review to the project stakeholders and the general public,
- review of the remedial actions implemented at the site to evaluate their effectiveness at protecting human health and the environment,
- preparation of a *Draft Five-Year Review Report* summarizing the results of the Five-Year Review and submission of the report to the project stakeholders and the general public
- providing written notification to the project stakeholders and the general public which requests comments regarding the *Draft Five-Year Review Report* and informs of the opportunity to request a public meeting,
- if requested, advertise, coordinate, and attend a public meeting to discuss the *Draft Five-Year Review Report* and document additional comments, and
- preparation of a *Five-Year Review Report* addendum which includes a compilation of comments received and RIDEM responses and submission of the final *Draft Five-Year Review Report* to the project stakeholders and the general public.

The purpose of this *Draft Five-Year Review Report* is to document the results of the Five-Year Review performed in accordance with the above-summarized scope and provide recommendations to ensure the long-term effectiveness of the remedial actions. This document also includes recommendations for modifying the on-going quarterly monitoring program in a manner which will facilitate more conclusive evaluations of the remedial actions.

2 Background

2.1 Site Description and Physical Setting

The 9.91-acre site is comprised of City of Providence (the City) Tax Assessor’s Plat 115 Lots 585, 127, 128, 215, 216, 217, 218, 234, 235, 236, and 237. The site is located on the west side of Springfield Street and the south side of Hartford Avenue in a residentially zoned section of the City. A portion of a United States Geological Survey (USGS) topographic map showing the subject site location is provided as *Figure 1*.

Structures on the site include one approximately 40,000 square foot elementary school and one approximately 66,000 square foot middle school, each constructed between 1999 and 2000. A site plan is provided as *Figure 2*.

The nearest surface water body, the Woonasquatucket River, is located approximately 2,000 feet northeast of the site. The Woonasquatucket River is classified by RIDEM as Class B1. Class B1 waters are designated for fish and wildlife habitat and primary and secondary contact recreational activities. They should be suitable for compatible industrial processes and cooling, hydropower, aquacultural uses, navigation, and irrigation and other agricultural uses. These waters should have good aesthetic value. Primary contact recreational activities may be impacted due to pathogens from approved wastewater discharges (RIDEM, 2010a). Additionally, the Woonasquatucket River is included on the *State of Rhode Island 2010 303(d) List of Impaired Waters* (RIDEM, 2011).

The groundwater beneath the site is classified by RIDEM as GB (RIDEM, 2010b). GB groundwater is designated to be not suitable for public or private drinking water use. GB groundwater areas are typically located beneath highly urbanized areas, permanent waste disposal areas and the area immediately surrounding the permanent waste disposal areas (RIDEM, 2010c).

The RIDEM *Groundwater Classification & Wellhead Protection Area Map* of the Providence quadrangle showed no wellhead protection areas (WHPAs) within a one mile radius of the subject site. The nearest GA groundwater area is located approximately 900 feet south of the site (RIDEM, 2010b).

Based on the results of previous environmental investigations performed at the site, the depth to groundwater beneath the site ranges between approximately 6 to 18 feet below grade, depending on seasonal fluctuations. Based on USGS mapping and the local topography and surface water features, the inferred groundwater flow direction at the site is to the northeast, towards the Woonasquatucket River. No field sampling, piezometric mapping, or water level gauging was conducted by Fuss & O'Neill during this Five-Year Review to confirm the inferred groundwater flow direction and depth.

2.2 Previous Environmental Investigations, Remedial Actions, and Remedial Design Investigation

ATC Associates, Inc. (ATC) completed a Phase I Environmental Site Assessment (ESA) of the site on behalf of the City on March 12, 1999. The Phase I ESA revealed that the site had been historically utilized as a municipal landfill from the mid-1960s until the mid-1970s. Since that time, the site remained wooded until development as an elementary and middle school site in 1999.

In March and April 1999, ATC submitted a *Site Investigation Report* (SIR) and *SIR Addendum* to RIDEM which, in conjunction with the March 1999 *Phase I ESA Report*, documented the results of geophysical surveys, test pit excavations, and soil, groundwater, and soil vapor sampling

performed at the site by ATC on behalf of the City. In summary, the test pit investigation indicated that buried solid waste, which reportedly consisted of domestic garbage, generally extended from minimum depths of just below the ground surface (i.e. within 1 foot of surface grade) to maximum depths up to approximately 16 feet below grade. ATC estimated that approximately 200,000 cubic yards of buried solid waste were present at the site. Additionally, samples of surface soil were reported to contain concentrations of arsenic, lead, and/or total petroleum hydrocarbons (TPH) which exceeded the applicable Residential Direct Exposure Criteria promulgated in the RIDEM *Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (Remediation Regulations)*. Subsurface soil samples collected from between 4 and 8 feet below grade in test pits were reported to contain concentrations of arsenic, lead, and/or TPH which exceeded the RIDEM Residential Direct Exposure Criteria. The concentrations of volatile organic compounds (VOCs) in groundwater samples collected by ATC were reportedly less than the applicable RIDEM GB Groundwater Objectives. Soil vapor samples were reported to contain concentrations of VOCs and/or typical landfill gases, including methane and carbon dioxide, which exceeded laboratory reporting limits.

A *Remedial Action Work Plan (RAWP)*, which described remedial actions proposed to mitigate risk to human health and the environment posed by environmental concerns identified at the site, was completed by ATC and submitted to RIDEM on April 2, 1999. The RAWP presented a proposed remedial plan including:

- The excavation and off-site disposal of approximately 20,000 cubic yards of buried solid waste from the proposed building locations.
- Construction of an engineered cap, with a minimum thickness of 1.5 to 2 feet, across the site to mitigate the potential for direct exposure to and migration of remaining solid waste and soil containing metals and TPH.
- Placement of orange snow fence at the interface of the cap and the existing ground surface to serve as a visible demarcation barrier.
- Recording of an Environmental Land Usage Restriction (ELUR) with the property deeds for the site.
- Installation of sub-slab ventilation systems within both of the school buildings to mitigate the potential for VOCs and landfill gases detected in soil vapor to migrate into overlying indoor air space and pose inhalation risk to building occupants. These systems included the following components:
 - Multiple lengths of two-inch slotted polyvinyl chloride (PVC) piping connected to two legs of four-inch solid PVC piping underlying the slabs of both schools.
 - One electrically operated blower per piping leg (four blowers total) to power the ventilation systems.
 - One moisture separator tank per piping leg (four tanks total) to collect moisture from the piping.

- One high-water level float sensor per tank (four float sensors total) which shut down blowers when the moisture separator tanks reach capacity.
 - One carbon filtration vessel per piping leg (four carbon filters total) to remove VOCs from system effluent.
 - Monitoring components connected to each piping leg, including vacuum gauges, sample ports, and thermometers.
- Installation of interior methane sensors at multiple locations throughout both of the school buildings

The proposed remedial actions detailed in the RAWP and summarized above were approved by RIDEM in an *Order of Approval* issued to the City on June 4, 1999. The remedial actions were implemented concurrently with development of the site in 1999 and 2000.

As indicated in the RAWP, to finalize the design of the sub-slab ventilation systems and demonstrate that the systems were capable of functioning in a manner which prevented the migration of subsurface vapors into overlying indoor air space, ATC planned a Limited Design Investigation (LDI) to be conducted in July 1999. The LDI was to be conducted after the sub-slab ventilation systems and building foundations had been constructed, but before the buildings were complete and occupied. An objective of the LDI was to evaluate the radius of influence of the systems, defined as the distance from the system piping in which air flow is affected. The observation of vacuum effects in the subsurface at the soil vapor monitoring wells, which are located distal to the school foundations and underlying system piping, would indicate that the systems were effectively generating a vacuum in the subsurface beneath the buildings. The confirmed presence of a vacuum beneath the buildings would demonstrate that the systems, when operating as designed, are eliminating potential migration pathways for subsurface vapors to migrate into indoor air.

2.3 Operations and Monitoring Requirements

The April 1999 RAWP included a *Long-Term Operation and Maintenance Plan (O&M Plan)* which described monitoring and maintenance requirements for the engineered controls (i.e. sub-slab ventilation systems and site-wide cap) installed at the site as part of the approved remedial actions. The *O&M Plan* also included soil vapor and groundwater sampling activities to be included as part of the long-term monitoring program. The purpose of the monitoring requirements documented in the *O&M Plan* was to verify that the engineered controls were operating as designed and effectively mitigating potential risks posed to human and environmental receptors posed by solid waste, landfill gases, and compounds of concern in soil. *Table 1*, included below, summarizes the monitoring program documented in the *O&M Plan*, including the various monitoring tasks, numerical thresholds which would warrant further response actions if exceeded, and the potential response actions which would be considered in the event of an exceedance. In accordance with the *O&M Plan* and a correspondence dated

May 19, 1999 issued to RIDEM by the City, the monitoring program was to be executed on a quarterly basis for a period of at least 20 years following construction of the schools.

Table 1
Summary of Quarterly Monitoring Program Documented in
Long-Term Operation and Monitoring Plan

Monitoring Task	Task Scope	Thresholds for Additional Response Actions	Response Actions for Threshold Exceedances
engineered cap monitoring	visual inspection for exposed demarcation barrier (orange fence)	orange snow fence visible	notify school personnel and City's monitoring consultant if cap breach less than 1 ft ² , temporary repair by school personnel by filling with sand permanent repair by reestablishing vegetation or pavement by City's monitoring consultant and collection of composite soil sample from near breach to determine if further action is needed
	visual inspection for evidence of erosion	poor grass cover	notify City's monitoring consultant
sub-slab ventilation system monitoring	check gauges, valves, sensors, and blowers	malfunctioning	repair as needed
	field screening of influent and effluent vapor for methane, carbon monoxide, carbon dioxide, hydrogen sulfide, and VOCs to evaluate efficiency of pollution control equipment (i.e. carbon vessel)	none listed	solicit RIDEM approval to add end-of-pipe control measures
	check moisture separators	high water volume	drain and containerize water for off-site disposal
soil vapor monitoring	assess physical condition of soil vapor monitoring wells	damage observed	repair as needed
	field screening of soil vapor for methane, carbon monoxide, carbon dioxide, hydrogen sulfide, and VOCs	methane: 5,000 ppm	more thorough assessment including installation of additional monitoring wells; conversion of monitoring well to soil vapor extraction well if exceedance persists
		carbon monoxide: 9 ppm	
		carbon dioxide: 1,000 ppm	
		hydrogen sulfide: 10 ppm	
total VOCs: 5 ppm			

Monitoring Task	Task Scope	Thresholds for Additional Response Actions	Response Actions for Threshold Exceedances
	collection and laboratory analysis of two soil vapor samples for methane, carbon monoxide, carbon dioxide, hydrogen sulfide, and VOCs	methane: 5,000 ppm	more thorough assessment including installation of additional monitoring wells; conversion of monitoring well to soil vapor extraction well if exceedance persists
		carbon monoxide: 9 ppm	
		carbon dioxide: 1,000 ppm	
		hydrogen sulfide: 10 ppm	
		total VOCs: 5 ppm	
indoor air monitoring	inspection of interior methane monitors	malfunctioning, lack of electrical source	repair as needed
		alarm condition triggered	notify City Fire Dept., City's monitoring consultant, RIDEM; evacuate school; additional monitoring to determine if alarm is due to methane or system defect
	field screening of indoor air for methane, carbon monoxide, carbon dioxide, hydrogen sulfide, and VOCs	methane: 500 ppm	more thorough assessment including extensive sampling to further define extent and degree of vapor impacts; consider remedial measures if exceedance persists
		carbon monoxide: 9 ppm	
		carbon dioxide: 1,000 ppm	
	hydrogen sulfide: 5 ppm		
	total VOCs: 5 ppm		
groundwater monitoring	assess physical condition of groundwater monitoring wells	damage observed	repair as needed
	purge well of 3 to 5 well volumes and collect sample for laboratory analysis of VOCs	RIDEM GB Groundwater Objectives	more thorough assessment to identify extent and degree of impacted groundwater; consider remedial measures if exceedance persists

Notes:
ppm: parts per million

2.4 Results of Previous Five-Year Review

Prior to the implementation of the Five-Year Review documented herein, one previous Five-Year Review was conducted in 2006. The previous Five-Year Review performed at the site was documented in a report entitled *Field Inspection Report*, which discussed an inspection performed at the site by Mr. Jeffrey Crawford of the RIDEM Office of Waste Management on September 27, 2006. The following observations and deficiencies were documented in the *Field Inspection Report*:

- Exposed soil and barren spots were observed at several locations in the lawn around both the elementary school and middle school.
- Sub-slab ventilation system equipment inside the elementary school and middle school mechanical rooms was functioning at the time of the inspection.
- Cracks were observed in pavement outside the elementary school mechanical room which reportedly warranted filling with liquid asphalt.
- A depression containing standing water was observed in the asphalt outside the elementary school mechanical room.
- An approximately 20 foot by 20 foot depression was observed in the asphalt behind the elementary school which required immediate repair.
- A small depression was observed in asphalt adjacent to a stormwater catch basin located behind the elementary school.
- Asphalt at the base of a slide at the elementary school playground was worn and warranted cosmetic repair.
- Standing water and areas of patched asphalt, which were reportedly in need of major repair, were observed in the vicinity of a stormwater catch basin at the courtyard at the northern end of the middle school.
- Handicap ramps and walkways around the middle school had cracked or become displaced at several locations due to the apparent settling of underlying cap material.
- A hole was observed in the fence along the site boundary.

The *Field Inspection Report* concluded that the City had not yet repaired areas of damaged pavement observed in the vicinity of both schools, which had reportedly been identified prior to the September 27, 2006 inspection. A subsequent letter submitted to RIDEM by LFR, Inc. (LFR), the City's environmental monitoring consultant, in response to the *Field Inspection Report* documented repairs to deficiencies listed above which were performed in the summer of 2007. The repairs reportedly included the following:

- The catch basin at the courtyard at the northern end of the middle school was lowered and the surrounding area was regraded and repaved.
- Concrete and asphalt walkways and ramps around the middle school which had been damaged due to settling were repaired by removing the pavement, regrading underlying cap material, and repaving.

- The approximately 20 foot by 20 foot depression behind the elementary school was repaired by removing the pavement, regrading underlying cap material, installing a structural geomembrane fabric, and repaving.
- Areas of insufficient grass were reseeded using hydroseed.

3 2011 Five-Year Review

3.1 Public Notification Activities

3.1.1 Distribution of Public Notices

Public notification flyers, which provided notice and a description of the impending current Five-Year Review, were distributed by RIDEM on June 20, 2011. The flyers included notification of the start and end dates of a public comment period, which commenced on the distribution day and ended August 1, 2011. Additionally, the notification included appropriate contacts and instructions on how to acquire additional information or provide comment.

Copies of the public notification flyers were provided to the principals of both schools for distribution to students, teachers, and staff at the schools. Additionally, public notification flyers were mailed to the following recipients:

- Owners and occupants of properties abutting the site
- The Hartford Park Residents Association
- Mr. Steven Fischbach, Rhode Island Legal Services
- The Providence Teacher's Union
- The Providence Public Library – Olneyville Branch
- The Parent Teacher Organizations of both schools
- The school nurses for both schools
- Members of the Providence School Board
- Mr. Alan Sepe, Director of the Department of City Property

Each recipient received both an English and Spanish version of the flyer. The public notification flyers were also posted on the document repository for the site on the RIDEM Office of Waste Management's Site Remediation Section website. Copies of English and Spanish versions of the public notification flyers are attached hereto in *Appendix A*. The letters by RIDEM documenting that the flyers were provided to the principals of the schools are also included in *Appendix A* and were also posted on the on-line repository. The on-line repository website address is www.dem.ri.gov/programs/benviron/waste/springfd.htm.

3.1.2 Public Comments Received

Upon distribution of the public notices, RIDEM received comments from two individuals. These comments are discussed below.

On June 23, 2011, Mr. Jeffrey Crawford of RIDEM received a telephone call from Ms. Linda Marsella, owner and occupant of a property which abuts the site. Ms. Marsella indicated that she was not satisfied with maintenance of the school, as she was aware of broken windows, broken shades, and damaged toilets. Ms. Marsella further stated that she felt the schools were built too close to Springfield Street and speed bumps were warranted to control the speeds of buses. Upon evaluation of the comments provided by Ms. Marsella, her concerns, while potentially valid issues, were deemed to be outside of the scope of work of the Five-Year Review detailed herein. As discussed previously, the focus of the Five-Year Review was the evaluation of the effectiveness of the implemented remedial actions at the site.

On August 1, 2011, a comment letter was also submitted to Mr. Crawford by Mr. Steven Fischbach of Rhode Island Legal Services. This letter was submitted by Mr. Fischbach on behalf of the Plaintiffs in *Hartford Park Tenants Association v. RIDEM*. The following bullets paraphrase comments provided in the August 1, 2011 letter and responses developed as part of the Five-Year Review:

- **Comment:** *Plaintiffs want the Review to explain the reasons for persistent flooding, to investigate those areas for possible contamination and insure that the soil cap in those areas is still two feet deep. The areas of persistent flooding include the area to the left of the Middle School building, along Springfield Street, the area adjacent to the transformer unit behind the Middle School, and the ball field behind the Middle School.*

Response: During the inspection conducted as part of the Five-Year Review, standing water was observed at those areas identified in the comment letter. Shallow depressions in the ground at these landscaped areas appear to be the cause of the accumulation of surface water runoff at these areas following precipitation events. The shallow depressions may be caused by uneven settling rates in the subsurface as underlying solid waste decomposes or soils are compressed. However, in the absence of other evidence, the presence of these shallow depressions or other deeper cavities within the cap thickness is not considered evidence that subsurface contaminants present in existing soil beneath the cap have migrated upward into the soil comprising the cap. Additionally, no evidence was observed that these shallow depressions were the result of erosion of cap material. The shallow depressions appeared to be the result of subsurface subsidence associated with sub-cap solid waste decomposition rather than surficial erosion diminishing the surface soil cap layer.

- **Comment:** *A number of trees that were planted in the soil cap have died. Plaintiffs want the Review to assess whether the trees died due to contaminants in the ground.*

Response: With the exception of one sapling which had no leaves, no additional evidence of dying or distressed trees and shrubs was noted during the inspection conducted as part of the Five-Year Review. While a forensic evaluation of the potential causes of stress to the sapling was not performed by Fuss & O'Neill as part of the Five-Year Review, the following observations and feedback from maintenance personnel were noted. No evidence of deep openings in the cap thickness or exposure of soil or solid waste materials

beneath the cap was observed in the vicinity of the distressed sapling. School maintenance personnel who participated in the inspection acknowledged that limited vegetation planted at the site has died in the past but they also noted that the apparent frequency of stressed vegetation at the site did not appear unusual relative to occurrences of stressed vegetation observed at other City-owned properties. These personnel stated that they believed that the incidents of dead plants may have been due to the lack of an irrigation system at the site and insufficient watering.

- **Comment:** *Plaintiffs want the Review to include interviews of staff regarding odors and to have the source of any odors investigated and explained.*

Response: During the inspection, direct observations for odors were noted and key facility staff members were queried regarding the past and current history of odors at the site. No suspicious odors were noted inside the school buildings during the inspection. Maintenance staff and the representative of the City's environmental monitoring consultant interviewed during the inspection indicated that they have not observed suspicious odors inside the buildings. Information provided by the nurses for each school related to odors is presented in *Section 3.4.3*.

- **Comment:** *The Review should examine whether any measures to prevent the repeated shutdown of this unit [the east sub-slab vapor extraction blower at the middle school] can be implemented.*

Response: This issue was evaluated during the Five-Year Review. Fuss & O'Neill recommends that the blowers associated with each sub-slab ventilation system leg are inspected more frequently to ensure that they are operative. Our observations and recommendations regarding this issue are discussed in more detail in *Section 4.2.2*.

- **Comment:** *The Review should determine why so many soil gas and groundwater wells have become non-functional and identify steps that should be implemented to prevent other wells from becoming destroyed.*

Response: The representative of the City's environmental monitoring consultant who participated in the inspection indicated that vandalism appeared to be the primary reason that monitoring wells at the site have been destroyed. Additionally, typical wear-and-tear associated with freeze-thaw effects, vehicular traffic, and subsurface settlement can often render environmental monitoring wells inoperative over time. Though it may be difficult to prevent these factors from resulting in inoperable monitoring wells, regular inspection of monitoring wells and timely replacement when necessary should facilitate effective continuation of the monitoring program at the present scale.

- **Comment:** *The Review should address whether more than 2 soil gas samples should be sent off to a lab for analysis, whether samples taken from the sub-slab ventilation system should be sent off to a lab*

for analysis, whether indoor samples taken with summa canisters should be made part of the quarterly monitoring regimen, and what is the source of VOCs detected in samples collected from soil vapor wells.

Response: The presence of VOCs in soil vapor samples collected at the site may be attributable in part to the buried solid waste at the site. However, the influence of the buried solid waste notwithstanding, the presence of VOCs in soil vapor at concentrations capable of being detected using laboratory instruments is generally not uncommon for highly urbanized areas, such as that at and adjacent to the site. In Fuss & O'Neill's opinion, the consistent presence of VOCs at detectable concentrations in the samples collected from the soil vapor wells as part of the monitoring program is not unexpected. Regardless of the concentrations of VOCs or other constituents in subsurface soil vapor beneath the site, the presence of a measurable vacuum in the subsurface environment would prevent the migration of subsurface vapors to indoor air. Additional recommendations related to monitoring for potential subsurface vapor migration are presented in *Section 4.2.2*.

- **Comment:** *There is no information about the direction of groundwater flow across the site. The presence of VOCs in soil gas samples taken from wells WB-2 and MPL 6 points to the need for the Review to include an evaluation of whether groundwater could be transporting those VOCs towards the school buildings.*

Response: Based on review of available documentation, no groundwater samples collected throughout the history of investigation activities at the site were reported to contain concentrations of VOCs exceeding the RIDEM GB Groundwater Objectives, which account for risks associated with potential migration of compounds from groundwater to indoor air through volatilization. Based on these results, groundwater beneath the site does not appear to contain concentrations of dissolved-phase VOCs which have likelihood to migrate to indoor air, regardless of groundwater flow direction. Furthermore, the sub-slab system at the site is designed to intercept and capture vapors from beneath the building, regardless of how those vapors migrated or came to be located beneath the building.

- **Comment:** *The Review should ascertain the source of methane [detected in soil vapor extracted from well MPL 6] and whether it could be related to former gas station located on the corner of Hartford Avenue and Springfield Street.*

Response: Methane is a by-product of bacterial decomposition of organic material under anaerobic conditions and is commonly detected in soil vapor at landfills. Therefore, the most likely source of methane in soil vapor at the site is the decomposition of buried solid waste at the site. An additional potential source could be methane emitted from natural gas or sewer utilities beneath the streets adjacent to the site.

- **Comment:** *At almost every monitoring event, there are exceedances of carbon dioxide in soil gas wells and in the vapor extraction system. The Review should examine whether carbon dioxide or*

VOCs are getting to the school building. The possible effect of settlement cracks in the walls of both buildings should be factored into this examination.

Response: The potential for VOCs or landfill gases to migrate into the buildings from the subsurface was considered as part of the Five-Year Review and is discussed in *Section 4.2.2*.

- **Comment:** *The Review should assess whether the soil cap in areas adjoining sinkhole areas that have been repaired is still 2 feet deep and whether the soil cap in those areas has become contaminated. The Review should also explain the reasons why the sinkholes developed in the first instance.*

Response: The development of shallow depressions and deeper cavities within the soil cap was addressed above in response to a previous comment.

- **Comment:** *The Review should examine whether the soil cap in these areas [slope behind elementary school and by cemetery] is still 2 feet deep.*

Response: The development of shallow depressions and deeper cavities within the soil cap was addressed above in response to a previous comment.

- **Comment:** *Plaintiffs ask that the School Nurse be queried about this issue [reports of headaches and stomach aches].*

Response: Information provided by the school nurses is presented in *Section 3.4.3*.

A copy of the August 1, 2011 comment letter submitted by Mr. Fischbach is included in *Appendix B*. A summary of the comments submitted by Ms. Marsella and the August 1, 2011 comment letter submitted by Mr. Fischbach were posted on the document repository for the site on the RIDEM's Office of Waste Management's Site Remediation Section website. The on-line repository website address is www.dem.ri.gov/programs/benviron/waste/springfd.htm.

3.2 Results of Past Monitoring Activities: 2006-2011

As part of this Five-Year Review, Fuss & O'Neill reviewed documents available in RIDEM's on-line repository for the site which described remedial controls and environmental monitoring activities performed since the previous 2006 Five-Year Review. The documents reviewed included reports detailing the results of 20 quarterly monitoring events performed by LFR and Arcadis, Inc. (Arcadis) from 2006 up to the second quarter of 2011. Quarterly reports for the second quarter of 2006 and the fourth quarter of 2009 were not observed in the on-line repository and thus were not included in the review.

3.2.1 Quarterly Soil Vapor, Indoor Air, and Sub-Slab Ventilation System Influent/Effluent Monitoring Activities

On a quarterly basis, Arcadis personnel visit the site to conduct monitoring of soil vapor, indoor air conditions, and ventilation system influent and effluent. This monitoring effort includes the following:

- Collection of soil vapor samples from soil vapor monitoring wells (approximately 27 wells; the number of wells sampled varies depending on accessibility and operative condition of wells) and field screening for methane, carbon dioxide, oxygen, carbon monoxide, hydrogen sulfide, and total VOCs content using a landfill gas analyzer and photo-ionization detector (PID).
- Collection of soil vapor samples from two soil vapor monitoring wells and submission to ConTest Analytical Laboratory (ConTest) for analysis of VOCs via United States Environmental Protection Agency (USEPA) Method TO-14.
- Field screening of indoor air at up to 11 locations inside the elementary school and up to 13 locations inside the middle school for methane, carbon dioxide, oxygen, carbon monoxide, hydrogen sulfide, and total VOCs using a multi-gas meter, PID, and Airmeter.
- Field screening of ambient exterior temperature and carbon dioxide concentrations.
- Collection of influent and effluent samples from each of the four ventilation system legs and field screening for methane, carbon dioxide, oxygen, carbon monoxide, hydrogen sulfide, and total VOCs content using a landfill gas analyzer and PID

The results of the above-listed monitoring activities, based on Fuss & O'Neill's review of available quarterly monitoring reports, are summarized below. Exceedances of thresholds documented in the *O&M Plan* and observed during the monitoring activities listed above are summarized in *Table 2*.

3.2.1.1 Frequent Exceedances

The only constituent which was consistently detected during field screening of soil vapor, indoor air, or ventilation system influent/effluent at concentrations exceeding the applicable numeric thresholds documented in the *O&M Plan* was carbon dioxide. As indicated in *Table 1*, no thresholds specific to constituents in system influent/effluent samples were included in the *O&M Plan*. However, the City's environmental monitoring consultant compared system influent/effluent field screening results to the thresholds for soil vapor documented in the *O&M Plan*. Carbon dioxide was detected via field screening at concentrations exceeding the threshold in one or more system influent/effluent samples during 16 of the 20 quarterly monitoring events reviewed by Fuss & O'Neill. Additionally, carbon dioxide was detected via field screening at concentrations exceeding the threshold in one or more soil vapor samples during each of the 20 quarterly monitoring events reviewed by Fuss & O'Neill. LFR and

Arcadis attributed the elevated (i.e. greater than thresholds) concentrations of carbon dioxide in soil vapor and system influent/effluent to bacterial respiration associated with natural decomposition of buried solid waste. Moreover, LFR/Arcadis stated that the presence of carbon dioxide in soil vapor and system influent/effluent did not pose a risk to site users.

Concentrations of carbon dioxide detected via field screening at one or more indoor air screening locations within the schools exceeded the applicable threshold during four of the 20 monitoring events reviewed by Fuss & O'Neill, including the fourth quarter 2008 event, the first quarter 2010 event, the second quarter 2010 event, and the first quarter 2011 event. Supplemental indoor air field screening performed in January 2009, in response to the fourth quarter 2008 exceedances, indicated that carbon dioxide concentrations were below applicable thresholds at that time. No additional actions in response to the exceedances observed in the first quarters of 2010 and 2011 were documented. LFR/Arcadis attributed the elevated concentrations of carbon dioxide detected in indoor air via field screening to respiration (i.e. breathing in and exhaling) by building occupants, rather than indoor intrusion of landfill gas.

3.2.1.2 *Isolated Exceedances*

In addition to the threshold exceedances for carbon dioxide summarized above, the following less frequent threshold exceedances for other constituents were observed in the quarterly monitoring reports reviewed by Fuss & O'Neill:

- **Fourth quarter 2008 event:** Hydrogen sulfide was detected via field screening in indoor air at one screening location in the elementary school and one screening location in the middle school at concentrations exceeding the applicable threshold documented in the *O&M Plan*. However, in each of the quarterly reports reviewed by Fuss & O'Neill, LFR and Arcadis erroneously compared the hydrogen sulfide indoor air screening results to the threshold for hydrogen sulfide in soil vapor instead of the threshold for indoor air. The threshold documented in the *O&M Plan* for hydrogen sulfide in indoor air is less than that for soil vapor. As such, these threshold exceedances detected via field screening were not identified by LFR/Arcadis as exceedances of the threshold, and therefore no additional response actions were performed.
- **First quarter 2009 event:** Methane was detected via field screening in soil vapor sampled at one monitoring location (MPL-7) at a concentration which exceeded the applicable threshold. In response, approximately two weeks following the event, LFR screened an additional sample collected at this location and found that the methane concentration detected via field screening again exceeded the threshold. However, LFR stated that, because oxygen was also detected at this location, it was unlikely that methane, which is produced under anaerobic conditions, was actually present. LFR further stated that MPL-7 was located in close proximity to Springfield Street and Hartford Ave, which suggested that the elevated methane concentration may have been due to a release from natural gas utilities in the street. Supplemental monitoring performed at MPL-7 in March and April 2009 indicated that methane was below field screening instrument detection limits at those times.

- **Second quarter 2009 event:** Carbon monoxide was detected via field screening in soil vapor at one monitoring location (ENE-1) at a concentration which exceeded the applicable threshold. No additional discussion of this exceedance was provided in the corresponding monitoring report.
- **First quarter 2010 event:** Carbon monoxide was detected via field screening in soil vapor at two monitoring locations (MPL-6 and MPL-7) at concentrations which exceeded the applicable threshold. No additional discussion of these exceedances was provided in the corresponding monitoring report.
- **First quarter 2011 event:** Methane was detected via field screening in soil vapor at one monitoring location (MPL-7) at a concentration which exceeded the applicable threshold. As noted previously, MPL-7 is located in close proximity to Springfield Street and Hartford Ave. Arcadis reported that, during the monitoring event, a contractor was observed cleaning or repairing a sewer line in Hartford Avenue. As such, the elevated methane concentration observed at MPL-7 was suspected to be due to migration of sewer gas at that time. Supplemental field screening of methane at this location in March 2011 indicated that the concentration of methane at MPL-7 was less than the applicable threshold.

Aside from those summarized above, Fuss & O'Neill noted no other reported field screening or laboratory analytical detections of VOCs, methane, carbon monoxide, or hydrogen sulfide in soil vapor, indoor air, or system influent/effluent at concentrations which exceeded applicable thresholds documented in the *O&M Plan*.

3.2.2 Quarterly Groundwater Monitoring Activities

The quarterly monitoring activities also included collection of groundwater samples from up to five monitoring wells installed at the site. The groundwater monitoring wells sampled during the most recent quarterly monitoring event were identified as ATC-1, MW-6, MW-7, and MW-8. A fifth well identified as ATC-4 is also present at the site. The sampling method reportedly includes gauging the depth of groundwater followed by purging of a volume of groundwater equaling three well volumes. Groundwater samples are then collected and submitted to ConTest for analysis of VOCs via USEPA Method 8260.

Beginning in the second quarter 2008 through the first quarter 2011, only three of the five monitoring wells were sampled because the other two were reported to be obstructed, inaccessible due to snow, or dry. In the fourth quarter 2010 and first quarter 2011, a third well was reported to be obstructed and thus a groundwater sample was not collected from that well. On March 25, 2011, Arcadis submitted a correspondence to RIDEM describing monitoring well installation activities proposed to replace the three obstructed wells. Three replacement monitoring wells, MW-6, MW-7, and MW-8, were then installed on April 25, 2011.

The results of the groundwater monitoring activities for the majority of the quarterly monitoring events reviewed by Fuss & O'Neill indicated that one or more VOCs were detected in at least one groundwater sample at concentrations exceeding laboratory reporting limits.

However, no detections of VOCs at concentrations exceeding the RIDEM GB Groundwater Objectives were reported for any of the groundwater samples documented in any of the quarterly monitoring reports reviewed by Fuss & O'Neill.

3.2.3 Quarterly Engineered Cap Inspection Activities

The monitoring activities included visual inspection of the engineered cap during each monitoring event. Beginning in the first quarter 2006 event and continuing to the second quarter 2007 event, cap deficiencies were reportedly observed during each event. These reported deficiencies were consistent with those documented during the previous Five-Year Review discussed in *Section 2.4* and generally included areas of poor grass coverage, small cavities in the cap thickness in lawn areas, depressions in pavement, asphalt damage around the courtyard catch basin, and settled pavement. As summarized in *Section 2.4*, these deficiencies were repaired in the summer of 2007.

No cap deficiencies were reported in the fourth quarter 2007 or the first and second quarters 2008. Then, from the third quarter 2008 to the second quarter 2009, minor cap deficiencies including poor grass cover and small cavities in the cap thickness in lawn areas were reported during each event. However, the deficiencies observed during this period were reportedly repaired by either the date of the corresponding report or by the next monitoring event. In contrast, small cavities or areas of vehicular damage observed in the lawn beginning in first quarter 2010 reportedly lingered without repair for the next few quarters. By the fourth quarter 2010, these deficiencies had been repaired. Arcadis reported that several cavities were observed along the middle school foundation during the first and second quarter 2011 events. These deficiencies were attributed to erosion from stormwater runoff and settling.

Visual observation of the orange snow fence demarcation barrier was not reported during any of the 20 quarterly monitoring events reviewed by Fuss & O'Neill. Additionally, no evidence that site users were actually exposed to soil and solid waste underlying the cap was documented in any of the 20 quarterly monitoring events reviewed by Fuss & O'Neill.

3.2.4 Sub-Slab Ventilation Systems and Methane Sensors Operations

During each monitoring event, the blowers which powered the sub-slab ventilation systems were inspected to evaluate the operating condition. One or more blowers were found to be not operating during the following quarterly monitoring events due to high water level in the moisture separator tanks installed as part of the systems:

- second quarter 2007
- first quarter 2008
- first quarter 2009
- third quarter 2009
- third quarter 2010
- first quarter 2011

RIDEM was reportedly notified of the inoperative blowers during each of these incidents and water was drained from the tanks and piping at the time of the inspection or a few days later. Monitoring of the system influent/effluent was not performed at the affected systems during these quarters due to the high water level. No documentation regarding the management or disposal of the drained water was documented in the corresponding quarterly reports.

In addition to the interruptions in system operation due to water accumulation discussed above, the following incidents impacting operation of the sub-slab ventilation systems were reported:

- **Fourth quarter 2008 event:** Carbon dust was observed to have been emitted from the carbon vessel in one of the middle school systems due to a loose fitting on the top of the vessel. The dust had not escaped from the blower shed and the blower was reported functioning normally. The vessel was repaired during the subsequent school winter vacation.
- **Second quarter 2009 event:** One blower in both the elementary school and middle school was observed to be off. An electrician determined that the motors on the blowers were in need of repair or replacement. As such, influent/effluent samples were not collected from the inoperative systems during this event.
- **Third quarter 2009 event:** Repairs of the malfunctioning blowers identified during the previous monitoring event were on-going at the time of this monitoring event. As such, influent/effluent samples were not collected from the impacted systems during this event. Fuss & O'Neill infers that the ventilation system legs associated with the blowers being repaired at the time of this event had been inoperative since the preceding monitoring event, when the blowers were observed to be off.
- **Third quarter 2010 event:** One blower in the middle school was not operating because repairs of a carbon vessel were in progress at the time of the monitoring event. Carbon dust had been emitted from the vessel and exhaust stack prior to the monitoring event. As such, the system was shut down and repairs to PVC piping inside the vessel were performed. Influent/effluent samples were not collected from the impacted system during this event.

Several incidents involving operation of the methane sensors installed in the schools were also observed during the monitoring period, as summarized below:

- **Third quarter 2007 event:** One methane sensor in the middle school was reportedly signaling a low-level alarm at the time of the event. The calibration contractor for the site, Diamond Calibration, indicated that the sensor was out of calibration due to recent changes in weather conditions. The concentrations of methane in indoor air in the middle school were reportedly below instrument detection limits based on screening performed at that time.
- **First quarter 2009 event:** One or more methane sensors were signaling elevated methane concentrations at some locations. The concentrations of methane in indoor

air at these locations were reportedly below instrument detection based on screening performed at that time. The methane sensors were recalibrated.

- **Second quarter 2009 event:** One or more methane sensors were again signaling elevated methane concentrations at some locations. The concentrations of methane in indoor air at these locations were reportedly below instrument detection based on screening performed at that time. The methane sensors were recalibrated and a circuit board and sensor in the middle school were replaced.
- **Fourth quarter 2010 event:** One methane sensor in the middle school was giving a faulty reading at the time of the inspection. Also, a second sensor in the middle school was reading 14% of the lower explosive limit for methane. The concentrations of methane in indoor air at the sensor location were reportedly below instrument detection based on screening performed at that time. In response to the faulty reading, the sensors were rechecked days after the inspection and found to be functioning normally.

3.3 Site Inspection

Fuss & O'Neill conducted an inspection of the site on October 31, 2011. Mr. Timothy Clinton of Fuss & O'Neill was accompanied during the inspection by the following individuals:

- Ms. Donna Pallister, PE, LSP, Senior Environmental Engineer for Arcadis
- Mr. Rupert Burtan, Resident District Manager for Aramark Education (the City's school maintenance contractor)
- Mr. Reggie Setts, Director of Operations for Aramark Education
- Mr. Joe Conti, maintenance staff for Aramark Education
- Mr. Jeffrey Crawford, Project Manager for RIDEM

The inspection included visual observations of the site grounds, portions of the interior ground levels of the school buildings, and the three sub-slab ventilation blower sheds at the site. Information provided by the attendees during the inspection is presented in *Section 3.4* and in previous sections of this report. Photographs taken during the inspection are presented in *Appendix C*.

3.3.1 Site Grounds

Concerns observed by Fuss & O'Neill during the inspection included several cavities within the cap thickness at observed grassy areas immediately adjacent to the middle school foundation. These included cavities observed near the electrical transformers behind the middle school and in the courtyard area at the northern end of the middle school. Several areas where cavities had recently been repaired by filling with soil were also observed in these areas. The orange snow fence placed at the interface of the soil cap and underlying existing soil was not observed at any location during the inspection.

Areas of standing water demarcating shallow depressions in the cap were observed at multiple locations throughout the site. These included several wet areas in the grassy area behind the middle school, one wet area near Springfield St in the grassy area between the two schools, and

several puddles observed on the asphalt pavement behind the elementary school. The standing water was indicative of saturated or poorly drained soil at landscaped areas and depressions in the surface topography at grassy or paved areas. Additionally, several areas of poor grass cover or dead grass were observed in the grassy area behind the middle school.

Evidence of subsurface settling was observed during the inspection of the site grounds. This evidence included the cavities observed along the middle school foundation, visible cracks in the exterior building façade and foundation, minor cracks in asphalt pavement, and a gap in a joint in the concrete sidewalk along the middle school. In particular, a large vertical gap (i.e. several inches wide) was observed at the junction of the blower shed of the elementary school and the main building. A cinder block wall between transformers behind the middle school also appeared to be leaning slightly. These observations could be indicative of decomposition of buried solid waste and resulting subsurface settling causing uneven movement of the ground surface (i.e. development of deeper cavities and shallow depressions) and shifting of surface improvements.

3.3.2 Building Interiors

The inspection included a walk through the main hallways in the ground levels of both school buildings. No unusual odors were observed during the interior inspections. No significant cracks were observed in the buildings, although full observation of the concrete floor slabs was limited by the presence of floor tiles throughout the structures.

The inspection also included observation of the methane sensor display panels in each of the main offices of the schools. Labels on the panels indicated that they had been calibrated on October 24, 2011. Additionally, the sensors were reading 1 to 4% of the lower explosive limit at the time of the inspection. According to quarterly monitoring reports reviewed as part of the Five-Year Review, the sensors are set to read above zero when calibrated using a zero methane gas. This calibration technique prevents the sensors from going into an alarm condition due to sudden temperature drop, while still providing a conservative level of protection because the alarm limit does not change. One of the wall-mounted methane sensors was observed in each of the schools as well. The sensors were mounted a few inches above the floor.

Each of the sub-slab ventilation system blower sheds was inspected. The blowers were observed to be operating at the time of the inspection. Carbon vessels, blowers, and moisture separator tanks were observed in each shed. Monitoring components observed on this equipment included a vacuum gauge, pressure gauge, temperature gauge, multiple sampling ports, and a viewing window for water inside the moisture separator tank. Several 55-gallon drums reportedly used for storage of water drained from the moisture separator tanks or monitoring well installation soil cuttings were also observed in the sheds.

3.4 Interviews

As introduced previously, the maintenance personnel and Arcadis personnel who participated in the inspection were interviewed by Mr. Clinton during the site inspection. The Five-Year Review also included interviews of the school nurses on the day of the inspection. The results of these interviews are presented in the following subsections and in previous sections of this report.

3.4.1 Maintenance Personnel

Mr. Rupert Burtan, Resident District Manager for Aramark Education, the City's school maintenance contractor, indicated that Aramark personnel are responsible for maintenance of the site grounds and are not involved with monitoring or maintenance of the interior sub-slab ventilation systems. Maintenance personnel perform detailed inspections of the site grounds approximately once every four to six weeks, which is more frequent than grounds inspections conducted at other school properties that they maintain in the City.

Mr. Reggie Setts, Director of Operations for Aramark Education, and Mr. Joe Conti, maintenance staff for Aramark Education, stated that they often have issues with cavities developing within the cap thickness at landscaped areas of the site. These cavities are most frequently observed adjacent to or near the back exterior wall of the middle school building or along the wall within the courtyard at the northern end of the middle school building. Rarely are such cavities observed near the elementary school. In some cases, the cavities have reportedly been deep enough to expose the bottom of the middle school foundation.

In response to observations of cavities within the cap thickness, maintenance personnel typically make the repairs themselves by filling the cavity with soil and applying grass seed. However, soil which is added to the cavities reportedly often settles out and the cavities develop again and require repeated repairs. Messrs. Burtan, Setts, and Conti agreed that the development of cavities and depressions in the ground surface is likely indicative of decomposition of solid waste in the subsurface and subsequent settling of overlying materials. With the exception of those pavement repairs discussed in *Section 2.4*, response actions performed to repair areas impacted by settling have reportedly been limited to landscaped areas.

Mr. Conti stated that on one occasion, he observed a complete hole in the cap near the back of the middle school building which resulted in exposure of the orange snow fence at the base of the cap. This particular breach in the cap was reportedly filled with soil, seeded, and no issues have been observed at this location since the repairs.

3.4.2 City Monitoring Consultant

Ms. Donna Pallister, Senior Environmental Engineer for Arcadis, the City's environmental monitoring consultant, indicated that Arcadis personnel conduct inspections of the site grounds and building exteriors as part of the quarterly monitoring events. She indicated that cracks in the exterior façade are more prevalent on the middle school than the elementary school. This may be because the middle school was constructed on pilings while the elementary school was constructed on a concrete slab. As such, the middle school may be more prone to uneven shifting and damage due to settling in the underlying soil.

Ms. Pallister stated that the only compound consistently detected during the quarterly soil vapor, ventilation system influent/effluent, and indoor air screening activities at concentrations exceeding thresholds documented in the *O&M Plan* was carbon dioxide. The exceedances of the thresholds for carbon dioxide are most frequently observed in samples collected from soil vapor monitoring wells. Ms. Pallister stated that elevated carbon dioxide in soil vapor is more frequently observed in the summer months, which suggests that increased bacterial activity and

decomposition in the subsurface during warm periods is affecting the concentration of carbon dioxide in soil vapor. Concentrations of carbon dioxide in soil vapor reportedly tend to drop off during colder months.

Ms. Pallister recalled one occasion when methane was detected in a soil vapor sample at a concentration exceeding the threshold. This sample was collected from a well at the northern portion of the site at the time of a break in a natural gas utility beneath Hartford Avenue. Ms. Pallister suspected that this utility break may have caused the elevated methane concentration observed at the nearby sampling location.

As part of the quarterly monitoring, Arcadis reportedly checks the operative condition of each of the four sub-slab ventilation system blowers. Ms. Pallister stated that the blower at the eastern side of the middle school building occasionally shuts down due to high water level in the moisture separator tank. These shutdowns typically correlate to precipitation events and the presence of cavities within the cap thickness near the back exterior wall of the middle school. Ms. Pallister suspects that surface water runs off into cavities which develop in the soil cap behind the middle school, as discussed previously. This runoff water is then taken up by the ventilation system leg connected to the eastern blower of the middle school, causing the moisture separator tank to fill and activate the high water shutoff, which results in the blower shutting down. Ms. Pallister does not believe that groundwater is causing the shutdown. As a result of the shutdowns, Arcadis personnel reportedly visit the site after precipitation events to check the status of the blowers. However, Ms. Pallister stated that the eastern blower in the middle school still shuts down once every couple months. She stated that she was not aware of any instances when blowers in the elementary school have shut down due to accumulation of water in the moisture separator tanks.

Even though the data is not reported in the quarterly monitoring reports, Ms. Pallister stated that Arcadis checks the vacuum readings of each sub-slab ventilation system leg during the quarterly monitoring events. When the blowers are operative, a vacuum level of approximately 3.5 to 4 inches of water reportedly persists inside the piping of each leg. The vacuum levels observed by Mr. Clinton of Fuss & O'Neill during the inspection were consistent with this statement.

Ms. Pallister stated that VOCs are never detected in the ventilation system influent or effluent samples at concentrations exceeding the screening instrument detection limits. As such, conclusions regarding the effectiveness of the carbon filters at reducing the concentration of VOCs in the soil vapor extracted by the ventilation systems cannot be made.

The interior methane sensor readings are reportedly checked by Arcadis as part of the quarterly monitoring effort. Ms. Pallister stated that Diamond Calibration calibrates the interior sensors on a monthly basis. The sensors are reportedly calibrated to read just above 0% of the lower explosive limit to prevent sudden temperature changes from triggering an alarm. Ms. Pallister was not aware of any instances of the interior methane sensors reading an alarm condition which were not associated with a system fault or attributable to calibration issues.

3.4.3 School Medical Staff

The Five-Year Review included interviews of Ms. Patricia Arcieri, school nurse for Del Sesto Middle School, and Ms. Anne Marie Anderson, school nurse for Carnevale Elementary School.

Ms. Arcieri stated that she receives reports of headaches from middle school students and staff more frequently at the beginning of the school year than at the end. Ms. Arcieri also indicated that she has not personally noticed suspicious odors potentially attributable to intrusion of subsurface vapors in the middle school nor received complaints of suspicious odors from middle school students or staff.

Ms Anderson stated that she does not believe that the reports of stomach aches and headaches which she receives are attributable to the environmental condition of the site. Ms. Anderson further stated that the number of such complaints reported at Carnevale Elementary is not substantially different than that of other schools. Ms. Anderson also indicated that she has not personally noticed suspicious odors potentially attributable to intrusion of subsurface vapors in the elementary school nor received complaints of suspicious odors from elementary school students or staff.

4 Conclusions and Recommendations

4.1 Compliance with Operations and Monitoring Requirements

Based on the Five-Year Review documented herein, Fuss & O'Neill identified the following instances of non-compliance with the operations and monitoring requirements documented in the *O&M Plan*:

- **Incorrect threshold for hydrogen sulfide:** As introduced in *Section 3.2.1*, the incorrect threshold for hydrogen sulfide in indoor air was reported in the quarterly monitoring reports reviewed as part of this Five Year-Review. The threshold for hydrogen sulfide in indoor air documented in the *O&M Plan* is 5 ppm. However, the threshold reported in the quarterly monitoring reports and used for comparison to measured indoor air concentrations is 10 ppm. As introduced in *Section 3.2.1.2*, during one of the 20 monitoring events included in the Five-Year Review, the concentration of hydrogen sulfide detected in indoor air at two locations via field screening exceeded the applicable threshold of 5 ppm documented in the *O&M Plan*. However, because the incorrect threshold was being used, these exceedances were not specifically discussed in the corresponding quarterly monitoring report. No other exceedances of the threshold for hydrogen sulfide have been noted.
- **Lack of laboratory analysis for landfill gases:** The *O&M Plan* indicates that the two samples collected from soil vapor monitoring wells will be analyzed at a laboratory for VOCs and landfill gases, including hydrogen sulfide, carbon monoxide, carbon dioxide, and methane. Despite the wording of this requirement in the *O&M Plan*, the monitoring reports reviewed as part of this Five-Year Review indicated that the soil vapor samples were submitted to the laboratory only for analysis of VOCs and analyzed

in the field for the landfill gases with a portable field instrument. However, use of portable field screening instruments to evaluate concentrations of landfill gases in soil vapor at landfills is a commonly-used and widely-accepted industry practice, and is not anticipated to significantly affect the reliability of the resulting data.

- **Damaged soil vapor monitoring wells:** The *O&M Plan* indicates that damaged soil vapor monitoring wells should be repaired as necessary. The most recent monitoring report submitted by Arcadis (June 2011) indicated that soil vapor monitoring wells WB-5 and WB-7 had been destroyed. Monitoring well WB-7 has been excluded from the monitoring program since May 2008.
- **Appropriate response to exceedances of thresholds for carbon dioxide:** The *O&M Plan* specifies response actions which should be implemented in the event of persisting exceedances of thresholds. In the event of exceedances of thresholds for samples collected from soil vapor monitoring wells, the specified response actions detailed in the *O&M Plan* include installation of additional soil vapor monitoring wells and conversion of monitoring wells to soil vapor extraction wells. In the event of exceedances of thresholds for indoor air, thorough assessment to define the extent of exceedances and consideration of remedial measures are specified as necessary response actions. As discussed in *Section 3.2.1*, carbon dioxide was detected in one or more influent/effluent samples and/or soil vapor samples at concentrations exceeding the threshold during each of the 20 monitoring events included in the Five-Year Review. Additionally, carbon dioxide was detected in indoor air at a concentration exceeding the threshold during four of the monitoring events included in the Five-Year Review. Additional assessment was performed in response to only one of these instances. Furthermore, no indication that the specified response actions were implemented in response to the carbon dioxide exceedances identified for soil vapor and system influent/effluent was observed in the documentation reviewed as part of the Five-Year Review.

While the issues summarized above represent instances of non-conformance with the technical requirements of the *O&M Plan*, these non-conformance issues have not significantly diminished the effectiveness of the overall monitoring program at evaluating performance of the remedial actions nor have they resulted in significantly increased risk posed to site users. Rather than focus on these instances of non-conformance as a reliable measure of the effectiveness of the sub-slab ventilation systems, Fuss & O'Neill recommends that the monitoring focus on the vapor capture zone of the sub-slab systems, which was approved by RIDEM as part of the original RAWP, as a more reliable measure of the effectiveness of the sub-slab system. Details of this recommendation are documented below in *Section 4.2.2*.

4.2 Effectiveness of Remedial Actions

4.2.1 Soil Cap

The remedial approach implemented for the site included construction of a site wide soil cap to mitigate the potential for site users to be exposed to existing soil which was reported to contain contaminants at concentrations exceeding the RIDEM Residential Direct Exposure Criteria.

However, the Five-Year Review documented herein revealed that cavities regularly develop within the thickness of the soil cap as a result of decomposition and shifting of underlying solid waste and soil which results in subsequent downward settling of cap materials. On one known occasion, this issue caused a complete hole in the cap and orange snow fence present at the base of the cap to become exposed.

Site grounds maintenance personnel queried as part of this Five-Year Review indicated that the grounds of the site are thoroughly inspected approximately once every four to six weeks. Observed cavities are filled with soil and seeded. Nevertheless, cavities within the soil cap continue, including at locations where repairs had been made previously. However, as noted above, this issue has resulted in breach of the entire cap thickness and exposure of the underlying orange snow fence on only one occasion. With this rare exception, a thickness of soil cap which prevents direct exposure to underlying existing soil has been present across the site during the monitoring period included in this Five-Year Review. Despite the long-term presence of a cap across the site, a thinner cap caused by subsurface settling represents increased potential for a complete cap breach, in comparison to a cap which is 1.5 to 2 feet in thickness at all areas, as specified in the RAWP.

To address this concern and enhance the long-term effectiveness of the soil cap, Fuss & O'Neill recommends that the frequency at which the grounds are inspected be increased (i.e. every two weeks, particularly during the school year). Observed cavities should be repaired by filling and thorough compaction at the time that they are observed.

4.2.2 Sub-Slab Ventilation Systems

The remedial approach implemented for the site also included construction of sub-slab ventilation systems in each school. The remedial objective of these systems is to prevent vapors associated with contaminants and decomposing buried solid waste at the site from migrating into overlying indoor air space.

Based on the Five-Year Review documented herein, thresholds established in the *O&M Plan* for indoor air screening conducted as part of the quarterly monitoring program have been exceeded at the site. As discussed in *Section 3.2.1*, the exceedances of thresholds for indoor air identified during this review included two exceedances for hydrogen sulfide observed on one occasion and four incidents of multiple exceedances for carbon dioxide. In summary, out of a total of 432 indoor air screenings performed during the monitoring period reviewed as part of the Five-Year Review, exceedances of thresholds for indoor air were observed on 12 total occasions, which yields an exceedance rate of approximately 3%. These results are indicative of an overall trend of compliance with indoor air thresholds at the site and suggest that potential migration of subsurface vapors from the subsurface to indoor air at the site is not a persistent concern.

Furthermore, carbon dioxide, which was the only compound detected in indoor air at concentrations exceeding the threshold during multiple events, is generated by multiple other aboveground sources at the site, including respiration (i.e. breathing in and exhaling) by building occupants. Therefore, the presence of elevated levels of carbon dioxide in indoor air may not necessarily be attributable to migration of subsurface vapors. Due to uncertainty related to other potential vapor sources, the current monitoring program may not facilitate definitive

conclusions regarding the effectiveness of the sub-slab ventilation systems at mitigating the potential for intrusion of subsurface vapors to indoor air. Regardless of source, to mitigate potential adverse health effects associated with elevated carbon dioxide levels in indoor air, Fuss & O'Neill recommends that the HVAC systems for the schools be checked regularly and maintained so that the systems are effectively balanced to ensure the optimum indoor air quality, including carbon dioxide levels which are appropriate for occupied buildings.

Fuss & O'Neill believes that there are modifications to the monitoring program that could be made that would reduce the uncertainty associated with the current program. For instance, as introduced previously in *Sections 3.1.2* and *4.1*, confirmation of a measurable vacuum in the subsurface environment throughout the site would demonstrate that vacuum conditions exist beneath the buildings. Though the systems are currently equipped to measure vacuum inside the system piping legs, confirmation of a measurable vacuum in the subsurface environment surrounding the piping could be achieved by measuring vacuum levels at subsurface monitoring locations outside the piping. Such measurements could be made at the soil vapor monitoring wells installed around the perimeter of the site, similar to the radius of influence measurements associated with the LDI proposed in the RAWP. Confirmation of the presence of a vacuum in the subsurface environment would support a definitive conclusion that the systems are effectively preventing migration of subsurface vapors into indoor air. Therefore, regardless of the concentrations of constituents in subsurface soil vapor at the site, risk posed to building occupants by intrusion of subsurface vapors would be mitigated.

Finally, as discussed in *Sections 3.2.4* and *3.4.2*, there have been multiple instances where the blowers powering the sub-slab ventilation systems have shut down. The eastern middle school blower reportedly shuts down most frequently, typically due to accumulation of water in the moisture separator tank. Regardless of the reason, an inoperative ventilation system clearly is not effectively mitigating potential migration of subsurface vapors to indoor air. Therefore, regular confirmation that the blowers are operating appropriately is paramount to ensuring the effectiveness of the ventilation systems. To this end, Fuss & O'Neill recommends that more frequent inspections of the operative condition of the blowers be required and/or the ventilation systems be adjusted to reduce the recurrence of shut downs due to high water levels in the moisture separator tanks. Alternatively, mechanical controls could be implemented to notify maintenance personnel of interruptions in operations. If any blower is found to be inoperative for any reason, effort should be made to restore operation of the blower as quickly as possible.

5 References

ATC Associates, Inc., Phase I Environmental Site Assessment, Springfield Avenue Lots, Providence, Rhode Island, March 12, 1999.

ATC Associates, Inc., Remedial Action Work Plan, Springfield Avenue Lots, Providence, Rhode Island, April 2, 1999.

ATC Associates, Inc., Site Investigation Report, Springfield Avenue Sites, Providence, Rhode Island, March 25, 1999.

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Rhode Island Department of Environmental Management, 2010b, Groundwater Classification & Wellhead Protection Area Maps, 2010; via <http://www.dem.ri.gov/maps/gw.htm>, accessed May 2011.

Rhode Island Department of Environmental Management, 2010c, Rules and Regulations for Groundwater Quality; RIDEM, Division of Water Resources, 2010.

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United States Geological Survey, 1987, Providence, Rhode Island Quadrangle, 7.5-Minute Series Topographic Map; United States Department of the Interior, U.S. Geological Survey, 1987.

6 Limitations of Work Product

This document was prepared for the sole use of the Rhode Island Department of Environmental Management, the only intended beneficiaries of our work. Those who may use or rely upon the report and the services (hereafter “work product”) performed by Fuss & O'Neill, Inc. and/or its subsidiaries or independent professional associates, sub-consultants and subcontractors (collectively the “Consultant”) expressly accept the work product upon the following specific conditions.

1. Consultant represents that it prepared the work product in accordance with the professional and industry standards prevailing at the time such services were rendered.
2. The work product may contain information that is time sensitive. The work product was prepared by Consultant subject to the particular scope limitations, budgetary and time constraints and business objectives of the Client which are detailed therein or in the contract between Consultant and Client. Changes in use, tenants, work practices, storage, Federal, state or local laws, rules or regulations may affect the work product.
3. The observations described and upon which the work product was based were made under the conditions stated therein. Any conclusions presented in the work product were based solely upon the services described therein, and not on scientific or engineering tasks or procedures beyond the scope of described services.
4. In preparing its work product, Consultant may have relied on certain information provided by state and local officials and information and representations made by other parties referenced therein, and on information contained in the files of state and/or local agencies made available at the time of the project. To the extent that such files which may affect the conclusions of the work product are missing, incomplete, inaccurate or not provided, Consultant is not responsible. Although there may have been some degree of overlap in the information provided by these various sources, Consultant did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this project. Consultant assumes no responsibility or liability to discover or determine any defects in such information which could result in failure to identify contamination or other defect in, at or near the site. Unless specifically stated in the work product, Consultant assumes no responsibility or liability for the accuracy of drawings and reports obtained, received or reviewed.
5. If the purpose of this project was to assess the physical characteristics of the subject site with respect to the presence in the environment of hazardous substances, waste or petroleum and chemical products and wastes as defined in the work product, unless otherwise noted, no specific attempt was made to check the compliance of present or past owners or operators of the subject site with Federal, state, or local laws and regulations, environmental or otherwise.
6. If water level readings have been made, these observations were made at the times and under the conditions stated in the report. However, it must be noted that fluctuations in water levels may occur due to variations in rainfall, passage of time and other factors and such fluctuations may effect the conclusions and recommendations presented herein.

7. Except as noted in the work product, no quantitative laboratory testing was performed as part of the project. Where such analyses have been conducted by an outside laboratory, Consultant has relied upon the data provided and, unless otherwise described in the work product, has not conducted an independent evaluation of the reliability of these tests.
8. If the conclusions and recommendations contained in the work product are based, in part, upon various types of chemical data, then the conclusions and recommendations are contingent upon the validity of such data. These data (if obtained) have been reviewed and interpretations made by Consultant. If indicated in the work product, some of these data may be preliminary or screening-level data and should be confirmed with quantitative analyses if more specific information is necessary. Moreover, it should be noted that variations in the types and concentrations of contaminants and variations in their flow paths may occur due to seasonal water table fluctuations, past disposal practices, the passage of time and other factors.
9. Chemical analyses may have been performed for specific parameters during the course of this project, as described in the work product. However, it should be noted that additional chemical constituents not included in the analyses conducted for the project may be present in soil, groundwater, surface water, sediments or building materials at the subject site.
10. Ownership and property interests of all documents, including reports, electronic media, drawings and specifications, prepared or furnished by Consultant pursuant to this project are subject to the terms and conditions specified in the contract between the Consultant and Client, whether or not the project is completed.
11. Unless otherwise specifically noted in the work product or a requirement of the contract between the Consultant and Client, any reuse, modification or disbursement of documents to third parties will be at the sole risk of the third party and without liability or legal exposure to Consultant.
12. In the event that any questions arise with respect to the scope or meaning of Consultant's work product, immediately contact Consultant for clarification, explanation or to update the work product. In addition, Consultant has the right to verify, at the party's expense, the accuracy of the information contained in the work product, as deemed necessary by Consultant, based upon the passage of time or other material change in conditions since conducting the work.

Any use of or reliance on the work product shall constitute acceptance of the terms hereof.

Tables



Summary of Threshold Exceedances Observed During Quarterly Monitoring Events
Draft Five-Year Review Report

Anthony Carnevale Elementary School and Del Sesto Middle School
50-152 Springfield Street
Providence, RI

November 2011

Monitoring Event	Samples Collected from Influent and Effluent Sample Ports Connected to Piping of the Sub-Slab Ventilation Systems	Samples Collected from Exterior Soil Vapor Monitoring Wells Located Around Perimeter of Site	Screening of Indoor Air at Locations Throughout Buildings
First Quarter 2006		carbon dioxide	
Second Quarter 2006	<i>no monitoring report available</i>		
Third Quarter 2006	carbon dioxide	carbon dioxide	
Fourth Quarter 2006	carbon dioxide	carbon dioxide	
First Quarter 2007	carbon dioxide	carbon dioxide	
Second Quarter 2007		carbon dioxide	
Third Quarter 2007	carbon dioxide	carbon dioxide	
Fourth Quarter 2007	carbon dioxide	carbon dioxide	
First Quarter 2008		carbon dioxide	
Second Quarter 2008	carbon dioxide	carbon dioxide	
Third Quarter 2008	carbon dioxide	carbon dioxide	
Fourth Quarter 2008	carbon dioxide	carbon dioxide	carbon dioxide (2) hydrogen sulfide (2)
First Quarter 2009	carbon dioxide	carbon dioxide methane	
Second Quarter 2009	carbon dioxide	carbon dioxide carbon monoxide	
Third Quarter 2009		carbon dioxide	
Fourth Quarter 2009	<i>no monitoring report available</i>		
First Quarter 2010	carbon dioxide	carbon dioxide carbon monoxide	carbon dioxide (2)
Second Quarter 2010	carbon dioxide	carbon dioxide	carbon dioxide (4)
Third Quarter 2010	carbon dioxide	carbon dioxide	
Fourth Quarter 2010	carbon dioxide	carbon dioxide	
First Quarter 2011	carbon dioxide	carbon dioxide methane	carbon dioxide (2)
Second Quarter 2011	carbon dioxide	carbon dioxide	

Notes

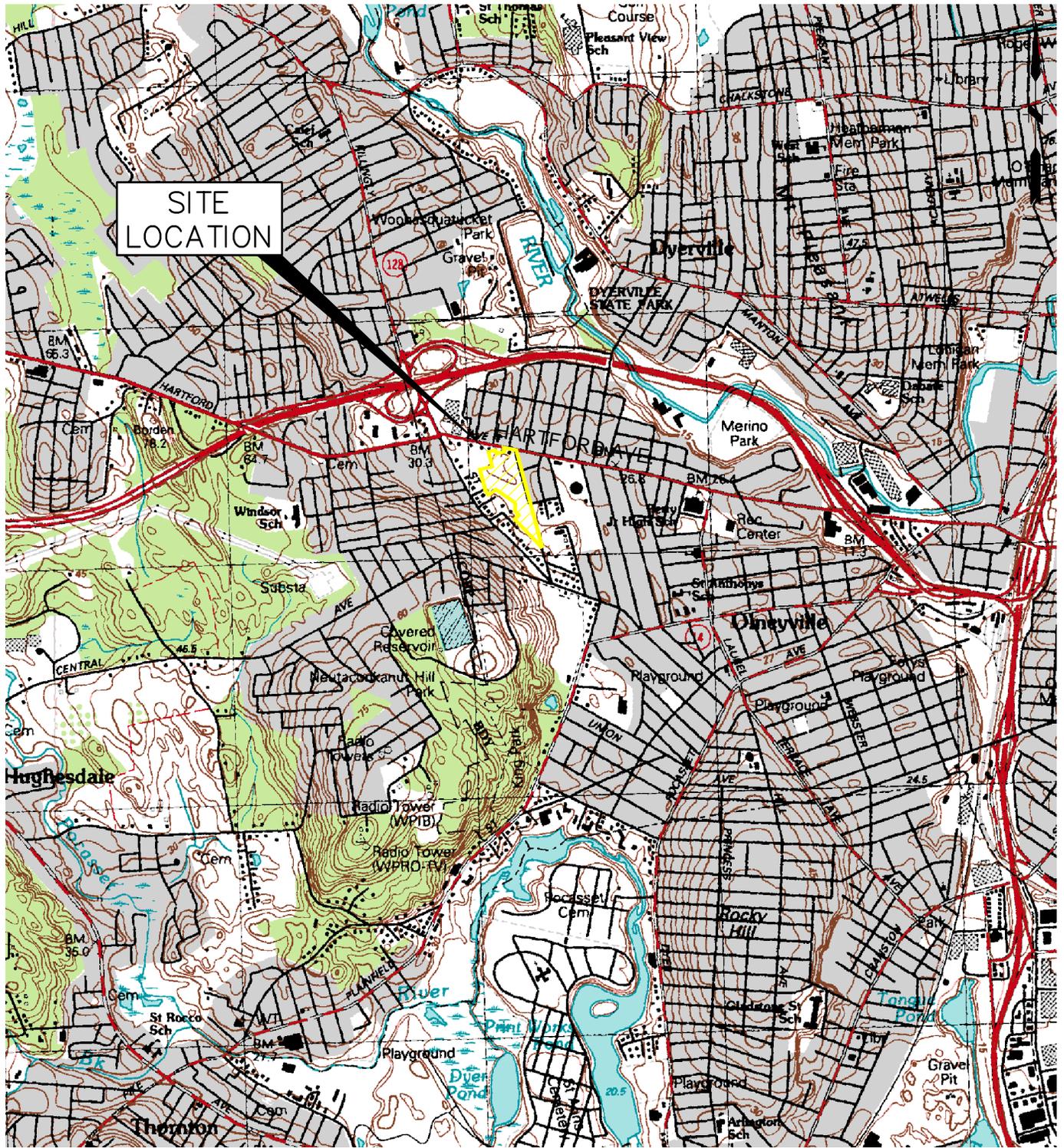
All exceedances listed herein identified via field screening using portable instruments

Number of indoor air screening locations where exceedances of corresponding threshold were observed during monitoring event is shown in parentheses

Figures



File Path: J:\DWG\2010\1411A10\Environmental\Plan\20101411A10_STP01-USGS.dwg, Layout: FIGURE 1, Plotted: Mon, Nov 07, 2011, 1:16 PM, User: tidinton
 Plotter: ACROPLOT.PC3 CTB File: FO 2008 COLOR (HALF)CTB
 LAYER STATE:



MAP REFERENCE:

THIS MAP WAS PREPARED FROM THE FOLLOWING
 7.5X15 MINUTE SERIES TOPOGRAPHIC MAPS:
 PROVIDENCE, RHODE ISLAND-MASSACHUSETTS
 QUADRANGLE, 1987.

SOURCE: THE RHODE ISLAND GEOGRAPHIC
 INFORMATION SYSTEM (RIGIS).



SITE LOCATION

SCALE:	
HORIZ: 1" = 2000'	
VERT: _____	
DATUM:	
HORIZ: _____	
VERT: _____	
GRAPHIC SCALE	

FUSS & O'NEILL
 317 IRON HORSE WAY, SUITE 204
 PROVIDENCE, RI 02908
 401.861.3070
 www.fando.com

RIDEM
 SITE LOCATION MAP
 CARNEVALE ELEMENTARY SCHOOL AND
 DEL SESTO MIDDLE SCHOOL
 50-152 SPRINGFIELD STREET
 PROVIDENCE RHODE ISLAND

PROJ. No.: 20101411A10
 DATE: NOVEMBER 2011
FIGURE 1



MAP REFERENCE:

THIS MAP WAS PREPARED FROM THE FOLLOWING AERIAL PHOTOGRAPHY COLLECTED APRIL 2008, © 2008 PICTOMETRY INTERNATIONAL.

SOURCE: THE RHODE ISLAND GEOGRAPHIC INFORMATION SYSTEM (RIGIS).

LEGEND

- SITE BOUNDARY
- PARCEL LINE
- 115-585 PLAT AND LOT NUMBER

File Path: J:\DWG\2010\1411A10\Environmental\Plan\20101411A10_STP01-Aerial.dwg. Layout: FIGURE 2. Plotted: Mon, Nov 07, 2011 - 2:00 PM. User: teahon
MS VIEW: Plotter: ACROPLOT.PC3 CTB File: FO 2008 COLOR (HALF)CTB

SCALE:	
HORZ.:	1" = 200'
VERT.:	
DATUM:	
HORZ.:	
VERT.:	
GRAPHIC SCALE	

FUSS & O'NEILL
 317 IRON HORSE WAY, SUITE 204
 PROVIDENCE, RI 02908
 401.861.3070
 www.fando.com

RIDEM
 SITE PLAN
 CARNEVALE ELEMENTARY SCHOOL AND
 DEL SESTO MIDDLE SCHOOL
 50-152 SPRINGFIELD STREET
 PROVIDENCE RHODE ISLAND

PROJ. No.: 20101411A10
 DATE: NOVEMBER 2011

FIGURE 2

Appendix A

Public Notification Flyers and Letters to Principals





RHODE ISLAND

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

235 Promenade Street, Providence, RI 02908-5767

TDD 401-222-4462

June 20, 2011

Ms. Dinah Larbi- Principal
Governor Christopher DelSesto Middle School
Springfield Street
Providence, Rhode Island

Ms. Mari-Ellen Boisclair, Principal
Anthony Carnevale Elementary School
Springfield Street
Providence, Rhode Island

Dear Principles Larbi and Boisclair:

Please find attached copies of the Public Notices concerning the Department's Superior Court Ordered Five-Year Review of the remedial actions previously performed on the Delsesto and Carnevale School properties by the City of Providence and its environmental contractor. The Notices are double sided and are translated in both English and Spanish. The copies have been provided to you so that they may be distributed to students, teachers and workers at the schools based on the approval of the City. All questions concerning distribution of the flyers should be referred to Carleton Jones per Adrienne Southgate of the City Solicitor's Office.

Thank you in advance for your help in the distribution of these flyers.

Sincerely,

Jeffrey Crawford
Project Manager
RI Department of Environmental Management

CC: Leo Hellested, Chief
Kelly Owens, Supervising Engineer
Susan Forcier, DEM Office of Legal Services



RHODE ISLAND

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

235 Promenade Street, Providence, RI 02908-5767

TDD 401-222-4462.

Notification To Project Stakeholders and the General Public
Commencement of Five-Year Environmental Review
Anthony Carnevale Elementary School and Del Sesto Middle School
50-152 Springfield Street, Providence, Rhode Island
June 20, 2011

In accordance with the *Second Assented to Supplemental Order* regarding the Springfield Street Schools Site (the Site), the Rhode Island Department of Environmental Management (RIDEM) is providing notice to persons listed in *Appendix A* of the *Agreement for Resolution of Claims*, the City of Providence School Board, the City of Providence Department of Public Property (collectively referred to herein as "Project Stakeholders"), and the general public that RIDEM is conducting a Five-Year Review of the approved remedial action implemented at the Site. The Five-Year Review will include the following activities:

- review of pertinent documents which describe the environmental condition of the Site, the remedial action implemented, and the results of monitoring conducted over the past 5 years;
- inspection of the Site to identify and document the condition of the engineered controls and any conditions posing increased risk to students and faculty of the Schools from the previously identified environmental contaminants;
- interviews of school personnel and others responsible for the operation and maintenance of the remedial controls to evaluate if the controls have been functioning as designed and to compile reports of potential issues; and
- preparation of a Five-Year Report documenting the results of the activities summarized above and recommendations for ensuring the on-going effectiveness of the remedial actions, for review by Project Stakeholders.

Project Stakeholders and members of the general public with information regarding the remedial action implemented at the Site or with concerns regarding the environmental condition of the Site are encouraged to submit such information or concerns in writing to RIDEM. There is a 30-day comment period, commencing on the above-listed date, during which written comments or concerns may be submitted to:

Mr. Jeffrey Crawford
R.I. Department of Environmental Management
235 Promenade Street
Providence, RI 02908-5767
Telephone: 401-222-2797 extension 7102
Email: jeff.crawford@dem.ri.gov

Written comments must be received by RIDEM before 4:30pm on August 1, 2011. Comments and RIDEM responses will be documented in the Five-Year Report. RIDEM will consider these comments and concerns when evaluating the continued effectiveness of the remedial actions.



RHODE ISLAND

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

235 Promenade Street, Providence, RI 02908-5767

TDD 401-222-4462

Notificación dirigida a los depositarios del proyecto y al público en general

Inicio de la revisión ambiental de cinco años

Escuela primaria Anthony Carvenale y escuela secundaria Del Sesto

50-152 Springfield Street, Providence, Rhode Island

20 de junio, 2011

De acuerdo al *Segundo asentimiento a la orden suplementaria* con respecto al sitio en donde se encuentran las escuelas de la calle Springfield (el sitio), el Departamento de Control Ambiental (RIDEM, por sus siglas en inglés) está proveyendo aviso a las personas indicadas en el *Apéndice A del Acuerdo de resolución de quejas*, a la Junta Escolar de la ciudad de Providence, al Departamento de Propiedad Pública de la ciudad de Providence (de aquí en adelante designado como "Depositarios del Proyecto) y al público en general, que RIDEM está llevando a cabo la revisión del periodo de cinco años de las acciones aprobadas de remediación que se implementaron en el sitio. La revisión del periodo de cinco años incluirá las actividades siguientes:

- la revisión de los documentos pertinentes los cuales describen las condiciones ambientales del sitio, las acciones de remediación implementadas y los resultados del monitoreo que se llevó a cabo en los últimos 5 años;
- la inspección del sitio para identificar y documentar las condiciones de los controles realizados y de cualquier condición que presente un mayor riesgo tanto para los alumnos como para la facultad en dichas escuelas a causa de los contaminantes ambientes previamente identificados;
- entrevistas al personal escolar y a otras personas relevantes en la operación y mantenimiento de los controles de remediación para evaluar si dichos controles han estado funcionando tal como se diseñaron y que se recopilen informes de los posibles temas a surgir; y
- la preparación de un informe del periodo de cinco años en el cual se documenten los resultados del resumen de las actividades mencionadas anteriormente y las recomendaciones para asegurar la continua efectividad de las acciones de remediación, para que los depositarios del proyecto puedan revisarlo.

Se alienta a los depositarios del proyecto y a los miembros del público en general que disponen de información con respecto a la acción de remediación implementada en el sitio o que tengan alguna inquietud relacionada a las condiciones ambientales del lugar, que envíen por escrito a RIDEM tal información o inquietud. A partir de la fecha que se indica al principio de este aviso, hay un periodo de 30 días para presentar comentarios. Dichos comentarios o inquietudes deben presentarse a:

Mr. Jeffrey Crawford
RI Department of Environmental Management
235 Promenade Street
Providence, RI 02908-5767
Teléfono: 401-222-2797, extensión 7102
Correo electrónico: jeff.crawford@dem.ri.gov

RIDEM debe recibir los comentarios escritos antes de las 4:30pm el 1 de agosto, 2011. Los comentarios y respuestas de RIDEM quedarán documentados en el informe del periodo de cinco años; RIDEM tomará en cuenta esos comentarios e inquietudes cuando evalúe la continua efectividad de las acciones de remediación.

Appendix B

August 1, 2011 Comment Letter



**RHODE ISLAND LEGAL SERVICES, INC.
56 PINE STREET FOURTH-FLOOR
PROVIDENCE, RHODE ISLAND 02903**

**TELEPHONE: (401) 274-2652
TOLL FREE: 1-800-662-5034**

**TDD: (401) 272-5335
FAX: (401) 453-0310**

August 1, 2011

BY ELECTRONIC AND
REGULAR MAIL

Mr. Jeffrey Crawford
R.I. Department of Environmental Management
235 Promenade Street
Providence, RI 02908-5767

RE: Notice of Commencement of Five-Year Environmental Review, Anthony
Carnevale Elementary School and Del Sesto Middle School dated June 20, 2011

Dear Mr. Crawford:

On behalf of the Plaintiffs in Hartford Park Tenants Association v. R.I. Department of Environmental Management, CA 99-3048 (hereafter, "Plaintiffs"), I am responding to the above referenced notice to provide information regarding the remedial actions at the Springfield Street Schools Site and concerns about environmental conditions at said Site. Below is a list of items that the Plaintiffs want the Department of Environmental Management (DEM) to address in the Five Year Environmental Review (Review).

As you know, DEM rejected Plaintiffs' request for a sixty day extension of the comment period set out in the above referenced notice to allow a technical assistance provider from the U.S. Environmental Protection Agency to provide recommendations on issues that should be addressed in the Review. Thus, the information herein is submitted under protest. Plaintiffs are still working with EPA to secure that technical assistance, and Plaintiffs request that DEM consider any recommendations that the consultant may make after the close of this comment period. Moreover, Plaintiffs expressly reserve their rights to seek judicial redress for the manner in which DEM is conducting this Review. Plaintiffs also request that a copy of this letter be posted on the Internet document repository maintained by DEM for the Springfield Street Schools Site.

1. Environmental Conditions of Concern

- Persistent flooding of grounds: Plaintiffs want the Review to explain the reasons for persistent flooding, to investigate those areas for possible contamination (especially TPH and Arsenic) and insure that the soil cap in those areas is still 2 feet deep. The areas of persistent flooding include the area to the left of the Middle School building (as you face the building)

along Springfield Street, the area adjacent to the transformer unit behind the Middle School, and the ball field behind the Middle School.

- Dead trees throughout the site: A number of trees that were planted in the soil cap have died. Plaintiffs want the Review to assess whether the trees died due to contaminants in the ground. The areas where trees have died include the ball field behind Middle School, the area to the left of the Middle School building (as you face the building) along Springfield Street, and in the median strip in the Elementary School Parking Lot (between the parking lot and Springfield Street).
- Odors: During one of the recent monitoring events I received a complaint from staff about an odor in former music room in Middle School building. I did observe an odor at the time. I have also received odor complaints regarding the Elementary School gymnasium. Plaintiffs want the Review to include interviews of staff regarding odors and to have the source of any odors investigated and explained.

2. Concerns related to the Remedial Actions

- Frequent breakdown of sub-slab vapor extraction system in Middle School: There have been several times where the extraction unit in the front of the Middle School has been shut down, allegedly because it fills up with water during rain events. **Today I observed that this unit was not on.** The Review should examine whether any measures to prevent the repeated shut down of this unit can be implemented.
- Disrepair of groundwater and soil gas monitoring wells: While 3 broken groundwater wells were recently repaired there are two soil gas wells that were destroyed (WB 5 and WB 7). Also, **today I observed that the cover to MPL-7 was broken.** The Review should determine why so many soil gas and groundwater wells have become non-functional and steps that should be implemented to prevent other wells from becoming destroyed.
- VOCs in Soil Gas: Only two samples from soil gas wells (WB-2 and MPL 6) and no samples from the sub-slab vapor extraction system are sent to a laboratory for analysis. These locations are on opposite sides of the site (WB-2 is behind the Elementary School and MPL-6 is along Hartford Avenue by the Middle School Parking Lot). The most recent monitoring event (June 2011) showed exceedences of the CT Residential Indoor Air standards for Methylene Chloride, Tetrachloroethylene, Trichloroethylene and 1,2,4-Trimethylbenzene in both wells. Since May 2010, there have been exceedences of Methylene Chloride and Trichloroethylene in virtually every sample analyzed. At the same time the readings for Organic Vapors reported for these wells in all events was 0.0 ppm. The Review should address several issues raised by these numbers: a.) whether more than 2 soil gas samples should be sent off to a lab for analysis; b.) whether samples taken off the sub-slab ventilation system should sent off to a lab for analysis; c.) whether indoor samples taken with summa canisters

should be made part of the quarterly monitoring regimen (as is the case with Alvarez High School); and d.) what is the source of these VOCs and whether any further remedial actions are necessary to address them.

- Groundwater flow: there is no information about the direction of groundwater flow across the site. The presence of VOCs in soil gas samples taken at wells WB-2 and MPL 6 points to the need for the Review to include an evaluation of whether groundwater could be transporting those VOCs towards the school buildings.
- Methane in MPL 6: Methane has been detected in this well. The Review should ascertain the source of the methane and whether it could be related to former gas station located on the corner of Hartford Avenue and Springfield Street.
- Carbon Dioxide in soil gas monitoring wells and sub-slab system: At almost every monitoring event there are exceedences of Carbon Dioxide in soil gas wells and in the vapor extraction system. The Review should examine whether CO₂ or VOCs are getting into school building. The possible effect of settlement cracks in the walls of both buildings (visible on the first floor) should be factored into this examination.
- Former Sinkhole areas (near transformer behind Middle School, Middle School courtyard adjacent to cafetorium, near transformer in schoolyard behind Elementary School): The Review should assess whether the soil cap in areas adjoining sinkhole areas that have been repaired is still 2 feet deep and whether the soil cap in those areas has become contaminated (especially TPH and Arsenic). The Review should also explain the reasons why the sinkholes developed in the first instance. **Today I observed a small tree growing in a crack of a repaired sinkhole in the fenced in transformer unit behind the elementary school.**
- Erosion of slope behind elementary school and by the cemetery: The Review should examine whether the soil cap in these areas is still 2 feet deep.
- School Nurse Reports: The plaintiffs receive periodic reports from the School Nurse which document the reasons why students visit the nurse. The Plaintiffs are concerned about headaches and stomach aches reported to the School Nurse. Plaintiffs ask that the School Nurse be queried about this issue during the Review.

For the record, Plaintiffs express their concern about the lack of comments received as a result of the June 20, 2011 Notice. This notice was distributed at the very end of the school year, and many parents do not focus on school related issues over the summer break. As part of the Review and after the new school year begins, another notice should be sent out to parents explaining that the Review is underway, and that any parents who want to speak with the Reviewers about concerns can contact DEM for that purpose.

Very truly yours,

A handwritten signature in black ink, appearing to read 'S. Fischbach', written in a cursive style.

Steven Fischbach
Community Lawyer / Unit Head

CC: Curt Spaulding, Regional Administrator EPA Region 1
James Murphy, EPA Region 1
Susan Forcier, Esq.

Appendix C

Site Inspection Photographs



**Springfield Street Schools
Five-Year Review - November 2011
Site Inspection Photographs**



Standing water in shallow depression in grassy area behind middle school



Cracking in middle school façade



Cavity within cap thickness adjacent to middle school foundation

**Springfield Street Schools
Five-Year Review - November 2011
Site Inspection Photographs**



Repaired cavity adjacent to middle school foundation



Distressed sapling and standing water in depression in grassy area between schools



Standing water on pavement behind elementary school

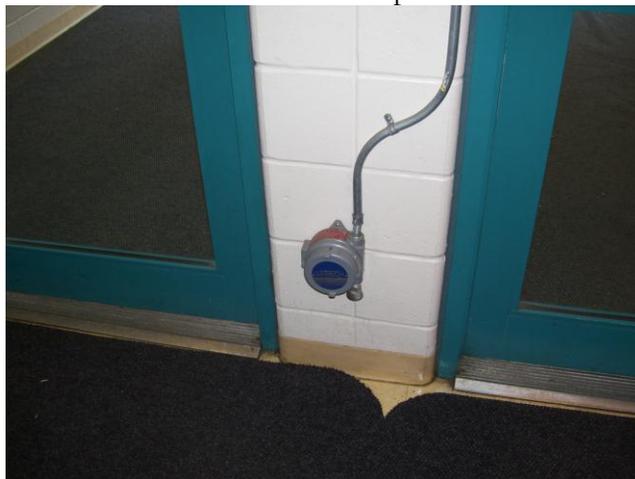
**Springfield Street Schools
Five-Year Review - November 2011
Site Inspection Photographs**



Gap between blower shed and main elementary school building



Methane sensor panel



Methane sensor

**Springfield Street Schools
Five-Year Review - November 2011
Site Inspection Photographs**



Water tank, blower, carbon vessel of sub-slab ventilation system



Influent sample port of sub-slab ventilation system



Vacuum gauge of sub-slab ventilation system