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MEMORANDUM

SUBJECT: Vapor Intrusion Issues at the Proposed Leander, Texas School

TO: John Rinehart, EPA Region 6

FROM: Jim Weaver, Hydrologist

CC: John M. Johnston, Chief Regulatory Support Branch
Gene Stroup, NERL Tech Support Liason

The following comments are based on review of "Environmental Evaluation Report, Grandview Hills Elementary School Property, Leander Independent School District 12024 Vista Parke Drive, Austin, Texas, April 2007."

Chemical use and Disposal Policies. The report summarizes waste disposal policies and practices: the policy of the facility was to limit disposal of waste chemicals down the Building A sink drains to less than 100 ml per sink per day, practice of accumulating small quantities of used chemicals, and not importing wastes from other buildings to Building A at any time. Although these policies represent the desired practice, there is no assurance that deviations never occurred.

Chemicals. The report mentions a variety of chemicals that were in use by the property owner and leasees of parts of the property. These include benzene, petroleum oils, chlorinated solvents, acetone, phenol, alcohols, surfactants, and others. The lists of chemicals used are incomplete (see page 1-6). Chemicals were reacted to create new compounds (page 1-7, 1-8) which would have resulted in the new compounds and also reaction byproducts, which are not specifically identified in this report.

Indoor Air Analysis. In analysis of vapor intrusion, the air exchange rate and the volume of air within the building are dominant. Although the qualitative statement that "…building had been closed for several days," (page ES-3) suggests a reduced air exchange rate, it does not quantify the air exchange rate for the building and is impact on indoor air concentrations. The actual air exchange rate during this testing is unknown, and it is not known how similar these conditions are to the completed school.

The volume of space enclosed by the building presents a mixing volume. The larger the volume, the greater the dilution of air phase concentrations. Since the building had been "gutted" and consisted mostly of a large space (as so indicated on page 1-6), measured indoor air concentrations would be low, because of the large dilution volume of the building. The seven indoor air sampling locations in Building A are described on page 4-1 and are said to represent 8,000 of floor space each. Since most of the interior walls had been removed, the samples composite air from the entire open interior space. The rough similarity of results for each sample reflects mixing within the building.

The conservatism claimed on page 4-2 is partly justified: the HAVC system in the operating school would provide mixing of air within the building similar to the seven composited samples, but it would likely bring in outside air at a specified rate. The total volume of air in the occupied spaces is likely to be reduced from the building as a whole (one example: dropped ceilings). Although likely to reduce vapor transport across the slab, the effect of the flooring material over the concrete depends on the details of its construction (i.e., the degree to which it actually reduces the permeation of the slab by diffusion of volatile chemicals.).

For the purpose of converting this space to a school, indoor air measurements should be made under the realistic conditions that will exist after renovation is completed. These include internal partitioning of the space, the actual ventilating conditions (i.e., HVAC, doors, windows), and the flooring over the concrete slab.

Indoor air concentrations are subject to seasonal variation. Heating of interior spaces during the winter can create a preferential flow path that draws contaminated air from the subsurface into the buildings. A set of representative climatic conditions should be established for measuring indoor air and a schedule of indoor air measurements should be established.

Condition of the Slab. The inspection of the exposed concrete floor in January 2007, after removal of the interior walls and infrastructure including piping, resulted in the observation that "the concrete floor was generally in good shape, with some hairline fractures of the concrete at the surface that did not show separation or significant gaps." (page 1-6). Since a major transport mechanism for vapors entering buildings is diffusion, large cracks or conduits are not necessary for vapor intrusion.

Subslab sampling. Subslab sampling is notorious for leakage of poorly sealed probes. This may be indicated by the reductions in concentrations between April and March samples (stated on page 5-9). The accepted way to assess leakage is to use one of several available tracers.

Mass of chemicals. Statement of mass of chemicals calculated from vapor concentrations isn't meaningful for two reasons. First, the rest of the report focuses on concentration-based risk levels. Second, the total mass of chemicals would be properly determined by including the mass in all phases. Depending on the partitioning relationships, only a small fraction of the total mass may be contained in the air phase.

Summary. Despite the comment on page 5-1 that the concrete slab cuts off in-building exposure to subsurface chemicals, the data collected in the indoor air sampling show that there is transport of chemicals across this building's slab. For this testing, the building was first vented (during construction) and cleaned before samples were taken, still there was accumulation of a number of organic contaminants in the building's air. The conditions of the test: no HVAC, no room partitions, no flooring material do not match operating conditions of the proposed school. The claim of conservatism is only partly justified.

In addition to moving air around the building, the HVAC system will heat and cool the air. Coupled with seasonal climate variation, these factors influence transport of vapors into indoor air. At a minimum, sampling needs to be performed under the realistic configuration of the building, at different seasons of the year. The sampling needs to be performed according to established protocols (see ITRC, 2007), use of which are not described in the report.

The presence of tri-methylbenzenes might indicate that there have been releases of the diesel fuel that is acknowledge to have been used/stored on the site. The tri-methylbenzenes are known constituents of diesel fuel. The degree to which a diesel fuel release fits into the underlying conceptualization of contamination at the site should be addressed: in the report there is an implicit assumption that contamination could only have come from chemicals disposed down the drain lines. If there were other releases around the property that caused either soil or ground water contamination, then an alternate conceptualization is necessary. This might be suggested by the xylenes and tri-methylbenzenes found in soil gas away from the buildings.

Because of the presence of contaminants below the slab, preventing exposures to hazardous chemicals in this building must rely on mitigation measures, either through contaminant removal, the HVAC system, reduction in slab permeability, or installation of a subslab venting system. Because of the widespread site contamination by tri-methylbenzenes, the mitigation system should serve the entire building. Reliance on these measures, however, requires testing as no sampling has been performed under the completed operating conditions of the building during various seasons. A monitoring plan should be developed that accounts for the long-term components of the building (i.e., the flooring and partitioning of the interior space) and the temporally varying components (i.e., heating and cooling, wind patterns).

Please contact me at 705-355-8329 if you have any questions concerning these comments.