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4 December 2015

Melanie Morash
Remedial Project Manager
U.S. Environmental Protection Agency
Region 9
75 Hawthorne Street (SFD-7-1)
San Francisco, CA 94105

RE: Revisions to Indoor Air Mitigation Plans: RES021, RES084/085, and RES105/124/125
Offsite Operable Unit, Sunnyvale, California

Dear Ms. Morash:

This letter is submitted on behalf of Philips Semiconductors Inc (Philips) in response to the comments received on December 1, 2015 with regard to the indoor air mitigation plans submitted to EPA on November 20, 2015 for Residence #21, #84/85, and #105/124/125.

The mitigation plans submitted on November 20 were prepared in response to an email request from the EPA on September 18 (Residence #21 and #84/85) and November 19 (Residence #105/124/125) and comments received via email on October 29 and discussed via conference call on November 5. The enclosed revised mitigation plans were prepared in response to EPA comments received via email on December 1. Written responses to General and QA Office Comments are provided below.

<u>EPA General Comments</u>

SMDS Piping: *The proposed mitigation plan calls for "laying evenly spaced perforated pipe (3 to 4 inches in diameter) on the floor of the crawlspace. Perforated pipe may be all or partially entrenched due to crawlspace height approximately 20 inches."*

At a minimum, the perforated pipe should be 4-inch diameter perforated pipe (not 3-inch) with one pipe laid midway along the length and one pipe laid midway along the width, intersecting at the center of the crawlspace, with a T-connection.

In addition, this perforated pipe should be installed such that it does not at all reduce the existing height between the subfloor and ground. This means installing the perforated pipe in a trench that is filled with gravel level with the ground. This can be done by digging 6-inch by 6-inch trenches in the crawlspace soil and laying the 4-inch perforated pipe into the trench with one row of perforations facing up and then backfilling the trench with gravel to be level

with the crawlspace ground. In this way, access to the crawlspace will not be impaired (e.g. causing reduced clearance below the subfloor by pipes laid on top of the ground).

Response: The mitigation plans have been revised in accordance with the recommendation of the Proposed Soil Gas Mitigation Standard for Existing Homes by ANSI/AARST[1]: "To achieve unobstructed PFE [pressure field extension] under the entire membrane, it is recommended to consider attaching suction points under the membrane to perforated pipe not less than 10 feet (3 m) in length and 4 inches (10 cm) in nominal diameter minimum, or other flat engineered soil gas conveyance material with similar airflow capacity."

Additionally, the perforated pipe at Residence #105/124/125 will be installed to ensure adequate access for trade personnel. Based on the 2013 California Residential Code, Title 24, Part 2.5, "Access shall be provided to all under-floor spaces. Access opening through the floor shall be a minimum of 18 inches by 24 inches (457 mm by 610 mm)." The industry applies this minimum of 18 inches to the crawl space height, throughout the space. Additionally, permanent wood foundation crawl spaces must be no less than 18 inches in height according to the same part of the code [Figure R403.1(3)]. Trenching of perforated pipe will be implemented if the mitigation installer deems it necessary or if the resultant height from the top of perforated pipe to the bottom of untreated wood or ductwork is less than 18 inches. The mitigation plan for Residence #105/124/125 has been revised to clarify this issue. Residence #21 and #84/85 are expected to have adequate clearance (greater than 2.5 feet crawl space height) without trenching. Trenching specifications are notably not included in the ANSI/AARST proposed standards; therefore, trenching, if necessary, will be installed at the mitigation installers discretion.

Vapor Barrier: *To minimize punctures and abrasion penetrations of the vapor barrier a minimum of a 20-mil vapor barrier should be installed over the ground (not 12 mil). Install a continuous 20-mil vapor barrier (e.g. Cleanspace 20 mil vapor retarder or VaporBlock Plus 20, or equivalent)*.

Response: The proposed vapor barrier is Dura-Skrim 12WB by Raven Engineered Films, which meets or exceeds the ASTM E-1745 Class C standard. Per the ANSI/AARST proposed standards (Section 8.6.2), "Soil gas retarder membranes shall meet ASTM E1745 class A, B or C. These specifications include water vapor permeance, tensile strength and puncture resistance. Heavier gauge sheeting or a means for protecting the membrane should be employed when crawl spaces are used for storage or frequent entry is required for maintenance of utilities or equipment." The crawlspaces of the three subject residences are not used for storage nor entail frequent entry. The 12 mil membrane was selected over the 6 mil to provide high tear resistance for infrequent entry required for maintenance of utilities or equipment and already demonstrates extra precaution over the 6 mil option. Additionally, annual maintenance inspections are designed to maintain the integrity of the barrier over time.

[1] American National Standards Institute and American Association of Radon Scientists and Technologists Consortium on National Radon Standards (ANSI/AARST), September 2015. Soil Gas Mitigation Standard for Existing Homes, Proposed Standard. SGM-SF 201x.

Suction Fan: *The fan operation audible alarm needs to have the capability of being silenced so that the occupants are not disturbed while waiting for a Locus technician to respond. This alarm needs to be installed in an easily accessible location in the residence (not the crawlspace) and should consist of BOTH an audible alarm and a flashing light.*

The audible alarm should be able to be silenced, while the flashing light should remain flashing until the fan is fixed. The costs of the fan operation and maintenance (e.g. motor and/or blower replacement) should be estimated for the anticipated life of the system and the owners should be compensated for these incurred costs. The exhaust discharge point should have a bird screen installed over the outlet (i.e. ¼ inch stainless steel wire screen).

Response: The alarm will be installed on the exterior of the building, readily visible, capable of being silenced, and will consist of both an audible alarm and a flashing light. Alarm specifications identified in the revised mitigation plans meet industry standards. No requirement was found in the existing standards, guidance, or proposed standards for an alarm that can be silenced while remaining flashing. As described in the mitigation plans, the owner and tenants will be instructed to call Locus in the event of an alarm. Additionally, signage will clearly indicate that the system is to remain on and instructions to call Locus in the event of an alarm or system off condition. Signage specifications are included in the revised mitigation plans.

Locus will maintain the mitigation system. Costs of items such as motor and/or blower replacement will be covered directly by Locus who will respond to notification from owners of any alarms or other issues identified. There are not expected to be any substantial costs to the owner for the implementation of this mitigation plan.

Additionally, the exhaust discharge point will entail a wire mesh or equivalent installed per recommendations in the ANSI/AARST proposed standards (Section 7.4.12.4): “Rodent/insect screen (mesh not smaller than 1/2 in. [13 mm]) is permitted and recommended where the Contractor or Client is concerned that debris or small animals might enter the point of discharge, or fan blades might cause injury to occupants.” Fan blades will not be exposed. For the purposes of guarding against debris and small animals, the plans have been revised accordingly.

Schedule: *The implementation schedule on page 3 states “within 120 calendar days of the property owners’ approval to proceed, the mitigation plan will be implemented”. As the mitigation installation is estimated to take 1-3 days, this 120 day period should be reduced to no more than 14 days.*

Response: The estimated time to install the mitigation system (1-3 days) is not the only factor to be considered for the period required between plan approval and the dates of the install. The installation date is dependent upon many factors including, but not limited to:

- Obtaining plan approval from the owner(s) and tenant(s) entailing a meeting onsite
- Providing a site visit for the mitigation installer (which may coincide with the owner/tenant meeting) for obtaining additional building-specific measurements and making final design decisions
- Gathering all site-specific installation materials

- Scheduling with the owner(s) and tenant(s) to minimize inconveniences associated with power interruption and any potential noise during installation
- Scheduling in accordance with all parties involved, including the mitigation installer, the owner(s), the tenant(s), Locus, EPA, and EPA's contractors
- Preparation of final O&M Plans for the property owner(s)

With the number of stakeholders involved in this project, it will not be feasible to complete the implementation within 14 days. However, in the interest of expediting the installation, Locus has revised the installation period in the mitigation plans from 120 to 90 days contingent on availability of system components, any permits required, and scheduling with the occupants and contractors. Locus will work as quickly as possible, but given the potential for delays, a 90 day period will allow the project to proceed on the predetermined schedule.

Operation and Maintenance: *On page 4, it is stated, "at the time the vapor intrusion mitigation is no longer needed ……". There is insufficient description as to how it is determined that "the vapor intrusion mitigation is no longer needed". See building-specific comments, attached to this e-mail, for further discussion of this item.*

Response: Detail regarding mitigation system termination has been added to the mitigation plans.

Post-Mitigation Sampling Plan: *Regarding the mitigation plan for Residence #105/124/125, the proposed air testing is only for the Residence #105 crawlspace and living space and not in Residences #124/125, if the Residence #105 air samples are below 0.48 µg/m3. Post-mitigation air testing should be conducted in each ground-floor unit, as the TCE transport between ground and crawlspace and crawlspace and indoor air can vary significantly for the different units.*

Response: The Residence #105/124/125 mitigation plan has been revised to entail post-mitigation sampling in each ground-floor unit.

<u>EPA QA Office General Comments (numbering based on Residence #84/85 memo)</u>

Comment 1: *[Description, Technical Specifications] The description of the system provided includes some technical specifications. These specifications are not complete and the plan does not provide any engineering diagrams of the proposed system. Information that should be provided includes:*

- *Technical specifications for the fan*
- *RES #21:Specifications for sealing crawlspace vents inside the enclosed patio*
- *Pressure and flow specifications for the system*
- *Electrical specifications for the system*
- *Location and design of sampling ports*
- *Proposed signage*
- *System design diagrams*

This section does specify concentration reduction requirements for the system based on the previous indoor air and crawlspace data. Because the measurements taken represent only a snapshot of potential vapor intrusion, the system should be designed to outperform these

requirements with a level of confidence. The goal for abatement in the crawlspace should be 0.48 µg/m3 for trichloroethene (TCE), not 2 µg/m3. If concentrations lower than 0.48 µg/m3 cannot be achieved in the crawlspace, more frequent long-term monitoring is required.

Response: The mitigation plans have been revised to include specifications and a system design diagram. Post-mitigation sampling will determine system effectiveness.

Occupation of the crawlspaces of the subject residences is not long-term. The screening level of 0.48 µg/m^3 is a long-term screening level, which will be achieved in the living space based on post-mitigation monitoring events, which will reasonably account for variability in conditions.

Comment 2: *[Potential Alternatives] If system improvements fail to consistently reduce TCE below the target concentration, evaluation of other conduits between the subsurface and indoor air, such as utility lines, should be investigated. Additional information may need to be collected to rule out potential contributions from indoor air background sources.*

Response: Additional language has been added for clarity.

Comment 3: *[Operation and Maintenance of Prosed Mitigation – Framework] The monitoring and inspection requirements in this section should include details and criteria in an operations, monitoring, and maintenance (OMM) plan. The OMM plan can apply to all residential mitigation systems installed and should include quality assurance for all measurements conducted*.

For example, there is no discussion of what will trigger the activation of the system alarm. Generally, it is recommended that the alarm be connected to a continuous pressure measurement upstream of the fan. This pressure measurement should be correlated to system flow during the system commissioning process and based on a percentage of total flow rate.

Response: In accordance with conclusions from the 5 November 2015 conference call with EPA and its representatives, a framework for operation and maintenance of the mitigation system is included in the mitigation plans. The framework identifies the types and frequency of follow-up activities for the purposes of owner and tenant review and approval of the mitigation plan. As described in the mitigation plan, as-built drawings and finalized O&M plans will ultimately be provided to homeowners and tenants. The trigger for activation of the alarm is included in the revised mitigation plans (Specifications). All other O&M plan comments will be addressed in the final deliverable.

Comment 4: *[Post-Mitigation Sampling Plan to Confirm Success of Mitigation] Information about post-mitigation sampling, with applicable quality assurance, should be included in the OMM plan. The OMM plan should address long-term indoor air monitoring. This building-specific plan should specify the number and locations of samples that will be collected to verify the performance of the specific mitigation system.*

Response: Regarding quality assurance, the Quality Assurance Project Plan for Additional Vapor Intrusion Evaluation, Appendix H of the EPA-approved workplan, will be applied to all residential sampling including post-mitigation and termination sampling. The sample locations are now included on the building layouts attached to the revised mitigation plans. The number of sampling events is already specified. A reference to the monitoring plan will be added to the final O&M plan as a single OMM plan deliverable.

Comment 5: *[General, Testing of Effluent] In addition to the testing proposed in this plan, the effluent from the abatement system should be characterized to*

- *use as a benchmark for evaluation of the system;*
- *determine if outdoor air concentrations might be adversely impacted by emissions from individual or multiple mitigation systems;*
- *estimate emissions rates and mass removal;*
- *indicate whether system emissions are below regulatory thresholds for source controls.*

Response: The revised mitigation plans clarify that a sample port will be installed on the vapor stack above (downstream of) the suction fan. Below (upstream of) the fan a second port will allow for pressure and flow measurements. Emissions rates and mass removal can be calculated based on findings from these sample ports. Based on the Bay Area Air Quality Management District's Regulation 8 for Organic Compounds, Rule 47 Air Stripping and Soil Vapor Extraction Operations, operations that emit less than 0.5 pounds per day of TCE or PCE are exempt from the regulation. The TCE concentration that is equal to 0.5 pounds per day of emissions at an airflow of 126 cfm (suction fan RP145 by RadonAway), is approximately 44,000 $\mu g/m^3$. From the most recent soil gas investigation north of Duane Avenue, the maximum measured soil gas concentration was 84 $\mu g/m^3$. Regulatory thresholds for source controls are not expected to be exceeded.

For determination of possible effects to outdoor air concentrations, the existing record of outdoor concentrations throughout the neighborhood will be compared to those collected during post-mitigation sampling. A trend analysis may be used to determine whether outdoor air concentrations may be adversely impacted by emissions from individual or multiple mitigation systems.

Comment 6: *[General, QA/QC] The QA/QC for the proposed measurements should reference an EPA approved Quality Assurance Project Plan or Sampling and Analysis Plan (SAP). It is recommended that an OMM that meets EPA SAP requirements include measurements taken in the residential mitigation program.*

Response: The O&M plan will reference the EPA approved Quality Assurance Project Plan for Additional Vapor Intrusion Evaluation (Appendix H of the approved workplan), which is applicable to post-mitigation and termination sampling.

Comment 7: *[General, Adverse Effects] This plan does not address how the mitigation system will control for adverse effects such as back draft of combustion appliances.*

Response: The mitigation installer will be a licensed HVAC and general contractor, which will provide inspection and knowledgeable services in determining whether potential adverse effects exist and options to control for them. Refer to Specifications in the revised mitigation plans.

Building-Specific EPA QA Office Comments – Residence #21

Comment 8: *[General, Attached Garage] This plan does not sufficiently address how the attached slab-on-grade garage will be incorporated into the mitigation and monitoring strategy. The following should be addressed:*

- *Indoor air samples should be collected in the garage to determine if it is contributing to indoor air vapor concentrations*
- *Currently the garage is used for storage, evaluations for changes in use of this space are needed*
- *If the mitigation measures are not effective, the garage may need to be evaluated for mitigation.*

Response: Sample locations included in the revised Residence #21 mitigation plan include the garage. As 'occupiable space', the effectiveness criteria according to the mitigation plan is 0.48 µg/m^3.

Building-Specific EPA QA Office Comments – Residence #105/124/125

Comment 1: *[Summary of All Relevant Data] The data collected indicates the potential for significant vapor intrusion into this building. It is recommended that additional crawlspace and indoor air locations be selected to ensure the protectiveness of this mitigation:*

Response: The revised Post-Mitigation Sampling Plan allows for additional sample locations if accessible.

Comment 2: *[Proposed Mitigation Plan] Mitigation of this crawlspace presents significant challenges because of the limited clearance and elevated concentrations of trichloroethene (TCE). It is recommended that a worker health and safety plan be developed for mitigation of this space that addresses confined space and elevated TCE.*

Response: The maximum pathway sample result (19 µg/m^3) was well below the OSHA 8-hour time weighted average (TWA) protection exposure limit (PEL) of 537 mg/m^3. Therefore, permit requirements for confined space entry are not applicable under OSHA's final rule (Subpart AA 1226.1202). OSHA confined space entry training is a baseline requirement of all mitigation installers entering crawlspaces as a part of this mitigation. A standard health and safety plan will be reviewed each day prior to beginning site work.

If you have any questions regarding this correspondence, please call me at (415) 799-9937.

Sincerely,

J. Wesley Hawthorne
Senior Vice President

JWH/njl

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