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DEPARTMENT OF ECOLOGY
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March 13, 2025

James P. Kiernan
Chevron Environmental Management and Real Estate Company
6001 Bollinger Canyon Road
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(jkiernan@chevron.com)

Re: Ecology's Request on Additional Vapor Intrusion Evaluation

Site Name: Texaco 211577 Monterey

Site Location: 631 Queen Anne Avenue N, Seattle, WA 98109

Facility Site No.: 77774779

Cleanup site ID No.: 6663

Dear James Kiernan:

On August 22, 2024, the Washington State Department of Ecology (Ecology) received the *Response to Ecology's Comment letter dated July 10, 2024 (August 2024 Response Letter),* for the Texaco 211577 Monterey facility (Site). The Site cleanup is currently conducted under an *Agreed Order No. 16537* (*AO 16537*), effective August 21, 2019.

In 2022, under *AO 16537*, Chevron Environmental Management Company (CEMC) conducted soil vapor and indoor air sampling at Monterey and Del Roy Apartments buildings, which are part of the Site. CEMC submitted the *Summary of Soil Vapor and Ambient Air Sampling Events – April and November 2022* report on June 16, 2023 (*June 2023 Summary Report*) to summarize the sampling data. Ecology provided our comments in a *Comment Letter* on July 10, 2024 (*July 2024 Comment Letter*). CEMC submitted the *August 2024 Response Letter* on August 22, 2024. Ecology appreciates your quick response.

After a further review of the sampling data and your response in the *August 2024 Response Letter*, Ecology has determined that **additional soil vapor and air sampling is needed to further evaluate the vapor intrusion (VI) pathway at the Site**.

Specifically, Ecology has the following comments and recommendations on the VI evaluation at the Site:

1. Generic TPH air cleanup level

In future deliverables, please only use the Method B generic total petroleum hydrocarbons (TPH) cleanup level of 46 micrograms per cubic meter (µg/m^3), as provided in Ecology's CLARC database.[1] The old TPH cleanup level (140 µg/m^3) shall not be used.

2. Site-specific TPH air cleanup level

Although Ecology's Guidance for Evaluating Vapor Intrusion in Washington State (VI Guidance)[2] includes an option to calculate a site-specific air cleanup level for TPH (Appendix E), our experience indicates there is a more efficient and accurate process. Ecology has the following comments on the site-specific TPH air cleanup level:

- The most efficient process to evaluate VI risk of TPH at a site includes 2 steps:
    - Compare the concentrations of individual petroleum components at each sampling location to the cleanup levels in Ecology's CLARC database;[1] and
    - Calculate additive cancer risk and noncancer hazard for all the TPH fractions and individual components present at each sampling location (see Enclosure A).

Ecology only needs the results of the two steps listed above when determining if VI presents a potential risk at a site.

- A site-specific cleanup level **does not override** the two steps listed above. It is an additional step and usually is **not helpful**. Ecology does **not** recommend calculating the site-specific TPH cleanup level.
    - If you still want to calculate a site-specific TPH cleanup level, it must be calculated using indoor air only (not sub-slab soil vapor). The Site-specific TPH cleanup level provided in Table 2 of the *August 2024 Response Letter* were calculated using sub-slab soil vapor concentrations. It is not an appropriate way to calculate Site-specific cleanup level.
    - If calculating a site-specific TPH cleanup level, there must be one TPH cleanup level calculated for each air sample for each sampling event because the fractionation between samples and sampling events varies significantly. It is not appropriate to use a

[1] https://ecology.wa.gov/regulations-permits/guidance-technical-assistance/contamination-cleanup-tools/clarc/data-tables
[2] https://apps.ecology.wa.gov/publications/documents/0909047.pdf

site-specific indoor air TPH cleanup level from one sample and/or sampling event and apply it to another sample and/or sampling event.

- Ecology provided a risk assessment worksheet to CEMC in July 2024 to show the calculated additive cancer risk and noncancer hazard for the Site. The *August 2024 Response Letter* states that the worksheet was not put out for public comment. Please note that Ecology often uses site-specific tools to assist in a site investigation and does not always put out these tools for public comment. You are welcome to perform the calculations using your own tools (such as a spreadsheet) following the steps in this letter and Enclosure A. If you decide to do so, please submit your calculation with the results for Ecology's review.

3. Ambient air concentrations

- Section 4.7 of Ecology's VI Guidance[2] recommends collecting upwind ambient air concentrations. It is important to determine the wind direction during a specific sampling event and provide rationale for how the upwind ambient air locations were determined.

- Table 3 of the *August 2024 Response Letter* contains both upwind and downwind air concentrations. The *August 2024 Response Letter* also states that "*Typically 'upwind' is only an indication of the wind direction at the time of sample collection. However, wind direction is variable. As a result, the highest value between 'upwind' and 'downwind' should be used to calculate the adjusted indoor air concentrations.*" Ecology does **not** agree with this statement. Upwind ambient air may have an influence on indoor air concentrations, but downwind air does not have an influence on the indoor air. The wind direction at the time of sampling is exactly the information we need. Only upwind air concentrations should be considered during a VI evaluation.

4. Potential indoor sources

- The *June 2023 Summary Report* states that cleaning products and paint may be potential sources for indoor air detections. The *August 2024 Response Letter* also states "*household products, chemicals, or materials inside the buildings*" may have contributed to the indoor air concentrations.

- Section 4.6.1 of Ecology's VI Guidance[2] recommends removing any indoor air sources at least one week prior to a sampling event to ensure indoor air samples accurately represent the indoor air quality without any influence from indoor air sources.

- If potential indoor air sources are not removed, please provide Ecology rationale as to why they cannot be removed and whether there are other suitable places to collect samples without being influenced by the potential indoor air sources. Presence of potential indoor air sources cannot be used as sole evidence to determine there is no VI risk. It can be considered in cases where it is impossible to remove the indoor air sources, especially when a chemical is

not detected in the sub-slab soil vapor or is detected in the indoor air at much higher concentrations than in the sub-slab soil vapor.

5. Observations from further data review

- Ecology further reviewed the soil vapor and indoor air data provided in the *June 2023 Summary Report*, and noticed the following:
    - TPH fraction EC 9-10 aromatics were not detected in any soil vapor or air samples. You may assign zero to the concentration of this fraction when calculating additive hazard.
    - TPH fraction EC 5-8 aliphatic was only detected in soil vapor samples from Del Roy (DRVP-2) and Monterey Apartments (MVP-2) in the April 2022 sampling event. On the other hand, TPH fraction EC 5-8 aliphatic was only detected in indoor air samples from Monterey Apartments in the November 2022 sampling event. Because this fraction was detected in soil vapor and air samples in different sampling events, and it was detected in 3 out of 4 ambient air samples, it is possible other sources such as ambient air may have contributed to the detection of EC5-8 aliphatic fraction in indoor air samples. Further evaluation is needed to confirm if this is the case and what the other sources might be.
    - TPH fraction EC 9-12 aliphatic was detected in all soil vapor samples collected from Del Roy and Monterey Apartments, and in 3 out of 4 indoor air samples. This fraction was not detected in ambient air samples. The data suggest that VI may be the source of EC 9-12 aliphatic fraction in indoor air.
    - This observation is consistent with a statement in Ecology's *July 2024 Comment Letter:* "*The non-carcinogenic hazard is mainly caused by long-chain aliphatic hydrocarbons (aliphatics EC >8-12)*."
    - This observation is also consistent with the current groundwater data, where diesel- and heavy-oil range petroleum hydrocarbons (TPH-D+TPH-O) are still above the MTCA Method A groundwater cleanup level in multiple monitoring wells located near the Monterey and Del Roy Apartments buildings.

- The discussion regarding the EC >8-12 aliphatic fraction on page 3 of the *August 2024 Response Letter* does not provide sufficient rationale to prove that VI is not an issue for TPH in the buildings. The default vapor attenuation factor recommended for use by EPA and Ecology is not always applicable to every building, especially those with preferential pathways, such as sump pumps or utility lines or cracks in a building's foundation that provide a conduit for vapors from the subsurface to the indoor air. Ecology does **not** agree with simply relying on the vapor attenuation factor to determine the VI contribution to indoor air concentrations.

6. Further VI evaluation at the Site

Additional soil vapor and indoor air sampling are needed to further evaluate the VI risk to the Monterey and Del Roy Apartments buildings. The additional sampling should meet the requirements below:

- Use the worst-case scenario for VI which appears to be in the winter months based on the 2022 data.
- Remove all potential indoor air sources, including the cleaning products and paint mentioned in the *June 2023 Summary Report*, at least one week prior to sampling. If any potential indoor air sources cannot be removed, please provide Ecology with rationale.
- Obtain upwind ambient air concentrations at the time of sampling. Please provide rationale to show that the location(s) are upwind at the time of the sampling event.
- Compare with the appropriate cleanup levels and calculate the additive risk and hazards. Ecology can provide technical assistance if needed.

Ecology recommends submitting a work plan or similar document before the additional sampling to ensure all requirements are met. Please work with Ecology should any changes or adjustments to the work plan occur.

If you have any questions about this letter, please contact me at (425) 229-2565 or jing.song@ecy.wa.gov.

Sincerely,

Jing Song
Site Manager
Toxics Cleanup Program, NWRO

Enclosures (1): A – Vapor Intrusion Individual Chemical and Additive Hazard and Risk

cc: Renee Knecht, AECOM, (Renee.Knecht@aecom.com)
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Enclosure A: Vapor Intrusion
Individual Chemical and Additive Hazard and Risk

This attachment explains how to calculate additive noncancer hazard and cancer risk for indoor air samples containing multiple chemicals, which could include petroleum mixtures. Additive hazard and risk should be calculated for indoor air but not for sub-slab soil vapor.

Individual Chemical Noncancer Hazard and Additive Chemical Hazard

- *Individual Chemical Hazard*

  Hazard Quotient (HQ) = $\frac{Indoor\ Air\ Exposure\ Concentration}{Indoor\ Air\ Noncancer\ Cleanup\ Level} * noncancer\ hazard$(1)

  - **HQ = or < 1** indicates adverse effects from the individual chemical are **not expected.**
  - **HQ > 1** indicates adverse effects from the individual chemical **may be present.**

- *Additive Chemical Hazard*

  Hazard Index (HI) = HQ1 + HQ2 + HQ3

  - Add up all individual chemical HQs for chemicals that affect the same target organ or system.
    - Example: Add up all HQs for chemicals that effect the kidney. Do not include chemicals that effect other organs or systems, such as nervous system, liver, etc. Those should be added up separately. If a chemical is listed as affecting more than one organ or system, include it in both target organs or systems.
    - The result should be HIs for each organ or system that is impacted by the chemicals present at the site.
      - For example:
        - HI (Kidney) = #
        - HI (Liver) = #
    - Ecology assumes that petroleum fractions and individual components of petroleum affect the same suite of target organs, so one HI is calculated for all petroleum fractions and components.
  - **HI = or < 1** indicates adverse effects from all of the chemicals that have a noncancer effect on that same organ or system are **not expected.**
  - **HI > 1** indicates adverse effects from all of the chemicals that have a noncancer effect on that same organ or system **may be present.**

- *Additional Information*

  - For each chemical detected in one or more samples, calculate the HQ for each sample.

        - If a chemical was not detected in any samples, do not calculate an HQ. If a chemical was detected in some but not all samples, use half the detection limit for non-detected results.
    - For each sampling location, calculate the total HI for each target organ or system affected by the chemicals present at the site.
    - Indoor air exposure concentration = detected air concentration for that sample location.
    - Indoor air noncancer cleanup level = vapor intrusion indoor air **noncancer** cleanup level, obtained from CLARC for individual chemicals and calculated for petroleum fractions using the reference doses assigned to them (see table at the end of this attachment).
    - Noncancer Hazard = target noncancer hazard defined by MTCA (1).
    - Health effects are listed in CLARC "Noncancer Effects Table" worksheet, "Noncancer Organ/System Affected Inhalation Route" column.
    - Use 2 significant figure to determine if the HQ or HI of 1 is exceeded.
        - For example:
            - An HQ or HI of 1.1 or greater exceeds target noncancer hazard.
            - 1.05 should be rounded up to 1.1.
            - 1.04 should be rounded down to 1.0.

Individual Chemical Cancer Risk and Additive Cancer Risk

- *Individual Chemical Risk*

  Excess Lifetime Cancer Risk (ELCR) = $\frac{Indoor\ Air\ Exposure\ Concentration}{Indoor\ Air\ Cancer\ Cleanup\ Level} * cancer\ risk$(1E-06)

    - ELCR = or < 1E-06 indicates that the individual chemical presents an **acceptable cancer risk**
    - ELCR > 1E-06 indicates that the individual chemical presents an **unacceptable cancer risk**

- *Additive Chemical Risk*

  Additive Excess Lifetime Cancer Risk (AELCR) = ELCR1 + ELCR2 + ELCR3

    - Add up all individual chemical ELCRs regardless of the type of cancer.
    - ELCR = or < 1E-05 indicates that all of the chemicals that cause a cancer risk (carcinogens) present an **acceptable cancer risk.**
    - ELCR > 1E-05 indicates that all carcinogens present an **unacceptable cancer risk.**

- *Additional Information*
    - For each carcinogen detected in one or more samples, calculate the ELCR for each sample.
        - If a chemical was not detected in any samples, do not calculate an ELCR. If a chemical was detected in some but not all samples, use half the detection limit for non-detected results.
    - For each sampling location, calculate the AELCR across all carcinogens.
    - Indoor air exposure concentration = detected air concentration for that sample location.
    - Indoor air cancer cleanup level = CLARC vapor intrusion indoor air **cancer** cleanup level.
    - Cancer risk = target cancer risk defined by MTCA (1E-06).
    - You do not need to know the type of cancer because you add up all the ELCRs regardless of what type of cancer is caused by the chemical.
    - Use 2 significant figure to determine if the ELCR of 1E-06 or an AELCR of 1E-06 is exceeded.
        - For example:
            - An ELCR of 1.1E-06 or greater exceeds target.
            - An AELCR of 1.1E-05 or greater exceeds target.
            - 1.05E-06 should be rounded up to 1.1E-06.
            - 1.04E-06 should be rounded down to 1.0E-6.

Non-Detects

- Use ½ the detection limit as an indoor air concentration for any chemicals that are not detected if they have been detected in previous sampling events or in other air samples in the same sampling event. This is especially important when it is a chemical that is not detected in upwind ambient outdoor air and is detected in the sub-slab soil vapor since that implies it is only being released inside the building or intruding from the subsurface.
- It is appropriate in some cases to provide 2 calculations: one using ½ the detection limit and another using 0 for the non-detects to provide an additional line of evidence. This is appropriate when there are upwind ambient outdoor air concentrations of this chemical and/or it is not detected in the sub-slab soil vapor. In these cases, a site-specific decision can be made with all of the data taken into consideration based on sufficient rationale.
- When subtracting outdoor air concentrations from indoor air concentrations, if a chemical was detected in previous sampling events but not in the current sampling event, do not use ½ the detection limit for the outdoor air concentration. Outdoor ambient concentrations of

chemicals change during different time periods due to differences in emissions and weather, so it is not expected that they will be the same at every sampling event.

TPH Specific Information

- If TPH is present at the site, use the aliphatic and aromatic fractions in the additivity calculations along with the other chemicals present at the site. CLARC does not contain indoor air cleanup levels for the aliphatic and aromatic fractions. Please use the ones in the table below. When there is a "(minus …)" next to a fraction, subtract the concentration of the chemical listed from the fraction concentration.
    - For example, for aliphatics EC>5-8 (minus n-hexane), take the concentration of hexane and subtract it from the concentration for the aliphatics EC>5-8 and use that adjusted concentration as your exposure concentration. The hazard associated with n-hexane will be evaluated separately.

Chemical	Method B		Method C		Commercial Worker	
	Noncancer CUL (ug/m3)	**Cancer CUL (ug/m3)**	**Noncancer CUL (ug/m3)**	**Cancer CUL (ug/m3)**	**Noncancer CUL (ug/m3)**	**Cancer CUL (ug/m3)**
Aliphatics EC>5-8 (**minus n-hexane**)	2.74E+03	NA	5.99E+03	NA	2.33E+04	NA
Aliphatics EC>8-12 *	4.58E+01	NA	1.00E+02	NA	3.90E+02	NA
Aliphatics EC>12-16	4.58E+01	NA	1.00E+02	NA	3.90E+02	NA
Aromatics EC>9-10 (**minus xylene, ethylbenzene**)	1.82E+02	NA	3.99E+02	NA	1.55E+03	NA
Aromatics EC>10-12 (**minus naphthalene**)	1.37E+00	NA	3.00E+00	NA	1.17E+01	NA
Aromatics EC>12-16 (**minus 1-methylnaphthalene**)	1.82E-01	NA	3.99E-01	NA	1.55E+00	NA

Note:
CUL – Cleanup level
* Use the EC>8-12 CUL for the laboratory reported aliphatics range of EC>9-12
NA – not applicable; there is no cancer cleanup level