



Tanks and Emergency Response Section
Minnesota Pollution Control Agency

**Air Emission Controls for Soil Venting Systems and
Air Strippers**

Fact Sheet 3.32

April 1998

This document was developed for use at petroleum storage tank release sites. It outlines procedures for evaluating air emissions from soil venting systems and air strippers and describes sampling, analyses, and control requirements

I. SOIL VENTING SYSTEMS

The Division of Air Quality (AQ) of the Minnesota Pollution Control Agency (MPCA) has developed significant emission rates (SERs) based on toxicologic information and the characteristics of typical soil venting systems. If contaminant emission rates exceed these SERs, emission controls may be necessary.

A. INITIAL SAMPLING

1. Initial Sampling Schedule:

- a. Sampling is not required during pilot testing.
- b. Sample vent stack within the first 12 hours after startup (regular laboratory turnaround time).
- c. Resample at seven days after system startup (the laboratory analyses should be expedited with a two week turnaround time).
- d. Resample at 14 days after system startup (the laboratory analyses should be expedited with a one week turnaround time).
- e. The soil venting system must be shut down after the third sampling event.

2. Analytical Requirements:

All air samples should be analyzed for benzene, ethyl benzene, toluene, total xylenes (BETX), and for any other compound detected during the remedial investigation. The air samples should be collected and analyzed using U.S. Environmental Protection Agency (EPA) method 18 (or the appropriate method as shown on Form 2, Column A).

B. EMISSION RATE CALCULATIONS

1. Air Emission Concentration (EC): Write the contaminant concentrations (in micrograms per cubic meter [$\mu\text{g}/\text{m}^3$]) on Form 2, Column B under "Emission Concentration."
2. Gas Flow Rate (GF):
 - a. The GF rate through the venting stack must be measured at the same time that the vent stack samples are collected.
 - b. Write the flow rate (in cubic meters per second [m^3/sec]) on Form 2, Column C under "Gas Flow Rate Through Vent Stack."
3. Emission Rate (ER):
 - a. Compute the ER for each contaminant using the following formula:
$$\text{ER} = \text{EC} \times \text{GF} \text{ or } \text{Column B} \times \text{Column C}$$
 - b. Write the ER (in micrograms per second [$\mu\text{g}/\text{sec}$]) on Form 2, Column D under "Emission Rate."

C. REQUIREMENTS FOR AIR TOXIC EMISSION CONTROLS

1. If the ERs for the second and third sampling events are all below the SERs, the soil venting system may be restarted immediately without emission controls.
2. If the ER for any one contaminant is above the SER for both the second and third sampling event, then emission controls are required. SERs for contaminants are given on Form 2, Column E.

If contaminants are encountered for which the SERs are not listed on Form 2 under Column E, MPCA Division of AQ should be contacted for the appropriate SER values. The soil venting system must remain shut down until emission controls have been installed.

3. If the ER for any one contaminant is above the SER for either the second or third sampling events, the consultant should submit a recommendation regarding future actions. The recommendation should be telephoned to the site project manager in the Tanks and Emergency Response Section of the MPCA immediately after receiving the third round of sampling results. Possible recommendations include:
 - Additional sampling.
 - Emissions control installation.

The soil venting system must remain shut down until it is determined that emission controls are not needed or until emission controls are in place.

4. Permissible Emission Control Technology: Any air emission control device that can be shown to be effective and cost efficient may be acceptable (contingent upon MPCA approval).

D. SYSTEM MONITORING

1. Pre-treatment Air Quality Monitoring: Pre-treatment soil venting system vent stack samples must be collected on a quarterly basis regardless of whether air emission control devices are necessary. Samples should be analyzed for BETX plus any other contaminants shown to have been present in previous testing. Calculate the emission rates as instructed above. If the ER for any one contaminant is found to be above the SER, see Section C, parts 3-4 for emissions control criteria.
2. Post-Treatment Air Quality Monitoring:
 - a. A minimum of quarterly sampling of post-treatment air emissions is required. If carbon filters are used as the emission control devices, the rate of consumption must be determined. Air quality samples should be collected from the post-treatment portion of the vent stack at an interval frequent enough to determine when the carbon unit should be replaced.
 - b. The post-treatment air quality samples should be sampled and analyzed using EPA method 18 (or appropriate method). Samples should be analyzed for BETX and for any other contaminant determined to be present. ECs should be written on Form 2 in Column B in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). The GF rate through the vent stack GF should be measured and written on Form 2 in Column C in units of m^3/sec .
 - c. $\text{ER} = \text{EC} \times \text{GF}$. Write this value (in units of μ/sec) on Form 2 in Column D.
 - d. If post-treatment ECs for any compound are above the SERs (Form 2, Column E), the emission controls must be upgraded.
 - e. Emission controls can be removed if the ERs for all contaminants are below the SERs for two consecutive quarters or if it can be demonstrated that the ERs are consistently below the SERs. The MPCA Tanks and Emergency Response project manager should be notified if emission controls are removed.
 - f. If carbon filtration units are used, proper disposal or recycling is required; documentation of disposal/recycling procedures should be included with the progress reports.

E. REPORTING:

Annual monitoring reports to Tanks and Emergency Response staff of the MPCA are required for all air stripper systems associated with petroleum storage tank sites. Please refer to fact sheet #3.31, "Corrective Action Design System Monitoring Worksheet" for reporting requirements.

F. SITES WITH BOTH SOIL VENTING SYSTEMS AND AIR STRIPPER SYSTEMS

1. The need for air toxic emission controls is based upon the total amount of contaminants volatilizing from the site. If the added ERs for the soil venting system and the air stripper system are above the SERs for any one contaminant, then air emissions controls are required on one or both of the systems so as to reduce total emissions to below the SERs.
2. If the ground water stripper system and the soil venting system are vented through the same venting stack, the necessity for emission controls should be determined using the criteria listed in procedures above.

II. AIR STRIPPERS

The Division of AQ of the MPCA has developed SERs based on toxicologic information and the characteristics of typical air stripper systems. If contaminant emission rates exceed the SERs, emission control may be necessary.

A. INITIAL SAMPLING

1. Initial Sampling Schedule:
 - a. Sampling is not required during pilot testing.
 - b. Sample influent and effluent water at the end of first week of operation. The laboratory analyses should be expedited with a two week turnaround time.
 - c. Resample at the end of the second week. The laboratory analyses should be expedited with a one week turnaround time.
 - d. The stripper system must be shut down after the second sampling event.
2. Analytical Requirements:
 - a. If Minnesota Department of Health (MDH) list 465E sampling analysis has not been run on monitoring wells samples, then 465E should be performed on the first round of air stripper influent and effluent samples.

- b. If MDH list 465E sampling analysis has been performed on adjacent monitoring wells or on influent and effluent samples, then air stripper influent and effluent samples need to be analyzed for BETX and for other compounds detected during the remedial investigation.

B. EMISSION RATE CALCULATIONS

1. Ground Water Concentration (GC): Write the influent contaminant concentrations (in micrograms per liter [$\mu\text{g}/\text{l}$]) on Form 1, Column A under "Ground Water Concentration." Contact AQ if contaminants are encountered which are not on the form.
2. Stripper Influent Flow Rate (IFR):
 - a. For continuously operating systems, the water flow rate through the air stripper must be measured at the time of ground water sampling.
 - b. For systems operating cyclically, the average water flow rate over a representative period must be calculated.
 - c. Write the flow rate (in liters per second [l/sec]) on Form 1, Column B under "Stripper Influent Flow Rate." This value will likely be the same for every entry in the column.
3. Removal Factor (RF):
 - a. Compute the RF using the following formula:
$$\text{RF} = \frac{(\text{influent concentration} - \text{effluent concentration})}{\text{influent concentration}}$$
 - b. List the RF for each contaminant on Form 1, Column C. If the RF is not known, use a value 1.0.
4. Emission Rate (ER) Calculation:
 - a. Compute the ER for each contaminant using the following formula:
$$\text{ER} = \text{GC} \times \text{IFR} \times \text{RF} \text{ or } \text{Column A} \times \text{Column B} \times \text{Column C}$$
 - b. Write the ER (in $\mu\text{g}/\text{sec}$) on Form 1, Column D under "Emission Rate."

C. REQUIREMENTS FOR AIR TOXIC EMISSION CONTROLS

1. If the ERs fall below the SERs, then the stripper system may be restarted immediately without emission control.

2. If the ER for any contaminant is above the SER for both of the initial sampling events, then emission controls are required. SERs for contaminants are given on Form 1, Column E.

If contaminants are encountered for which the SERs are not listed on Form 1 under Column E, AQ should be contacted for the appropriate SER value (612/296-7757, TTY users call 612/282-5332 or Greater Minnesota 1-800/657-3864).

The stripper system must remain shut down until emission controls have been installed.

3. If the ER for any one contaminant is above the SER for just one of the sampling events, the consultant should make a recommendation regarding future actions. The recommendation should be telephoned to the appropriate project manager at the Tanks and Emergency Response Section of the MPCA immediately after receiving the second round of sampling results. The options might include:
 - a. Additional sampling.
 - b. Emissions control installation.

The air stripper must remain shut down until either it is determined that emission controls are not needed or until emission controls are in place.

4. Permissible Emission Control Technology:

Any air emission control device that can be shown to be effective and cost efficient may be acceptable.

D. SYSTEM MONITORING

1. **Water Quality Monitoring:** Influent and effluent ground water quality must be sampled on a quarterly basis, regardless of whether air emission control devices are in place. Samples should be analyzed for BETX plus any other contaminants previously detected. The ER for all contaminants must be calculated each quarter from the water quality data. If the ER for any one contaminant is found to be above the SER, see Section C, parts 3-4 above for emissions control criteria.
2. **Air Quality Monitoring if Air Emission Controls are In Place:**
 - a. A minimum of quarterly sampling of post-treatment air emissions is required. If carbon filters are used as the emissions control devices, the rate of consumption must be determined. Air quality samples should be collected from the vent stack at an interval frequent enough to determine when the carbon unit should be replaced.

- b. Air quality samples should be sampled and analyzed using U.S. EPA method 18 or appropriate method (see Form 2, Column A). Samples should be analyzed for BETX and any other contaminant determined to be present in the ground water. ECs should be written on Form 2, Column B in units of $\mu\text{g}/\text{m}^3$.

The GF rate through the vent stack should be measured and written on Form 2, Column C in units of m^3/sec .

- c. $\text{ER} = \text{EC} \times \text{GF}$. Write this value (in units of $\mu\text{g}/\text{sec}$) on Form 2, Column D.
- d. If post-treatment ECs for any compound are above the SERs (Form 2, Column E), the emission controls must be upgraded.
- e. Emission controls can be removed if the stripper emission rates calculated from influent and effluent ground water samples are below the SERs for two consecutive quarters or if it can be demonstrated that the ERs are consistently below the SERs. The MPCA Tanks and Emergency Response project manager should be notified if emission controls are removed.
- f. If carbon filtration units are used, proper disposal or recycling is required; documentation of disposal/recycling procedures should be included with the annual report.

E REPORTING:

Annual monitoring reports to Tanks and Emergency Response staff of the MPCA are required for all air stripper systems associated with petroleum storage tank sites. Please refer to fact sheet #3.31, "Corrective Action Design System Monitoring Worksheet" for reporting requirements.

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