TECHNICAL INFORMATION | GUIDE 01

Selecting a Soil Vapor Extraction Blower

A practical guide to defining the operating point, comparing blower technologies, and avoiding selection mistakes that limit remediation performance.

PUBLISHED	July 2026
AUDIENCE	Remediation engineers, consultants, contractors, and system operators
COVERS	SVE applications in the vadose zone; not multi-phase liquid recovery design

The short version
Select the blower at a verified system operating point - required airflow at the total suction pressure the complete system will impose. Pilot-test data, a system curve, the blower manufacturer's performance curve, and off-gas treatment limits should converge on the same design decision.

Educational use only. Site-specific design must be completed or reviewed by qualified professionals and must satisfy applicable permits, codes, manufacturer requirements, and health and safety plans.

SELECTION AT A GLANCE

Start with the system, not the blower catalog

Soil vapor extraction applies a vacuum to the unsaturated zone to induce controlled airflow and recover volatile contaminants for aboveground treatment. The blower is only one part of a connected hydraulic and treatment system.[1,2]

Five decisions that drive selection

- **Design airflow:** total expected flow across the active well field.
- **Required suction:** subsurface response plus losses through wells, piping, separators, filters, and treatment.
- **Gas condition:** temperature, moisture, particulates, condensate potential, and chemical compatibility.
- **Operating envelope:** startup, normal operation, optimization, and late-stage lower-flow conditions.
- **Controls and constraints:** turndown, noise, electrical service, emissions control, and maintenance access.

Recommended workflow

STEP	OUTPUT
1. Characterize	Contaminant, geology, moisture, groundwater position, utilities, and discharge constraints.
2. Pilot test	Measured flow-vacuum behavior, well response, vapor chemistry, temperature, and moisture loading.
3. Build curve	System resistance over the expected flow range, including aboveground equipment.
4. Compare	Manufacturer curves and allowable envelopes for candidate blower technologies.
5. Validate	Motor load, treatment capacity, controls, sound, heat, materials, and upset response.

Core design rule
The selected operating point is where the blower performance curve intersects the system curve. Do not specify flow and vacuum as unrelated maximum values; confirm that the blower can deliver the required flow at the required suction under the same stated inlet conditions.[2]

Why oversizing is not a harmless default

A larger unit can increase capital cost, energy use, noise, heat, control complexity, and the risk of operating outside a stable or efficient range. It can also overload moisture-control or vapor-treatment components. A modest, documented allowance is useful; an arbitrary margin is not a substitute for pilot data and a system curve.

DEFINE THE OPERATING POINT

Translate field response into flow and suction requirements

The blower must overcome every pressure loss between the formation and the final discharge while delivering the airflow needed to create the intended subsurface capture and mass-removal response.

1. Use pilot testing to anchor the design

A step test at one or more extraction locations should record stabilized wellhead vacuum, airflow, observation-point vacuum response, vapor concentration, temperature, and moisture behavior at several operating settings. USACE guidance emphasizes using pilot-test data to develop the system response and to support blower sizing.[2]

MEASURE	WHY IT MATTERS	WATCH FOR
Airflow	Defines the recovered gas volume at each test condition.	State whether flow is actual or standardized and record temperature and pressure basis.
Wellhead vacuum	Shows the suction needed at the extraction point.	Gauge location, pulsing, restrictions, and water accumulation.
Vacuum response	Supports radius-of-influence and capture interpretation.	Prefer pressure response plus airflow evidence; a single pressure reading is not a complete capture demonstration.
Vapor chemistry	Drives materials, treatment selection, permit evaluation, and mass-rate estimates.	Concentration can change substantially during startup and optimization.
Moisture / condensate	Determines separation, drainage, and blower protection needs.	Seasonal change, high water table, entrainment, and cooling in the piping.

2. Account for the complete pressure path

FORMATION + WELL Subsurface vacuum and entry losses	**CONVEYANCE** Pipe, fittings, valves, manifold	**PRETREATMENT** Separator, filter, heat exchanger	**VAPOR CONTROL** Carbon or oxidation train

Pressure-budget check
Required blower inlet suction = formation/well requirement + conveyance losses + pretreatment losses + vapor-control losses + a justified allowance for fouling and control. Because air is compressible, use actual volumetric flow at the local pressure and temperature when calculating piping losses.[2,3]

3. Plot more than one operating condition

Evaluate startup, expected normal operation, a high-resistance condition such as a loaded filter or carbon bed, and a late-stage or reduced-well condition. Confirm each point against the candidate blower curve, motor rating, permissible temperature, and manufacturer operating limits.

COMPARE BLOWER TECHNOLOGIES

Match the machine to the required operating envelope

FRTR identifies three common categories for SVE: positive-displacement blowers, centrifugal or regenerative blowers, and liquid-ring pumps. Their practical fit depends on the required vacuum-flow combination and gas-handling conditions.[1]

TYPE	TYPICAL FIT	STRENGTHS	SELECTION CAUTIONS
Regenerative / centrifugal	Higher-permeability formations; comparatively higher flow at lower vacuum.	Compact; relatively simple; useful where the system curve is dominated by airflow rather than deep vacuum.	Capacity can change markedly with suction; confirm stable operating range, inlet temperature, turndown method, and relief/bypass needs.
Positive displacement - rotary lobe	Moderate- to lower-permeability applications needing more consistent flow at higher vacuum.	Broad useful pressure capability; flow is comparatively less sensitive to pressure change.	Noise, pulsation, discharge temperature, overpressure protection, clearances, filtration, and oil-free/oil-lubricated configuration.
Liquid ring vacuum pump	High-vacuum or wet service; commonly considered when liquids may be present or for multi-phase applications.	Can tolerate wet gas and some liquid carryover better than dry machines.	Seal-liquid system, water quality and disposal, corrosion, freezing, utilities, heat rejection, and reduced efficiency.
Other vacuum technologies	Specialized duty where chemistry, vacuum, cleanliness, or footprint drives the decision.	May solve a defined constraint when standard blower types do not.	Require application-specific manufacturer review; do not generalize performance from a different gas or vacuum basis.

Use manufacturer curves correctly

Compare curves at the expected inlet pressure, gas temperature, gas composition, humidity, and electrical frequency. Confirm whether published capacity is actual inlet flow or standard flow. Obtain correction methods and allowable limits directly from the manufacturer for the proposed model.

Evaluate the full duty cycle

Startup
Potentially high vapor concentration, variable moisture, and rapidly changing flow.

Optimization
Individual wells throttled, pulsed, cycled, or taken offline.

Normal operation
The primary design point and expected energy-use basis.

Late stage
Lower mass loading and possibly a different active well network.

> **Variable-frequency-drive caution**
> A VFD can provide useful turndown only when the blower type and motor are approved for that control method and remain within minimum-speed, cooling, temperature, surge/stability, and other manufacturer limits.

VERIFY THE PROCESS TRAIN

Protect the blower - and the equipment downstream

SVE systems commonly include a moisture separator and particulate filter before the blower, followed by vapor treatment selected for the contaminant, concentration, and applicable discharge requirements.[1]

ITEM	DESIGN QUESTION	WHY IT CHANGES BLOWER SELECTION
Air/water separator	What is the expected condensate and entrained-liquid load? How is high level detected and drained?	Adds pressure loss and upset controls; liquid carryover can damage dry blowers.
Particulate filtration	What particle size and loading are expected? What is the clean and dirty pressure drop?	A dirty filter shifts the system operating point and may increase suction and temperature.
Temperature management	Will compression heat or upstream treatment raise gas temperature? Is cooling or dilution required?	Blower clearances, elastomers, bearings, motor load, and downstream media can be temperature-limited.
Vapor-phase carbon	What concentration, humidity, flow, changeout strategy, and allowable bed pressure drop apply?	Treatment capacity and pressure drop can constrain maximum practical blower flow.
Thermal / catalytic oxidation	What are the lower and upper concentration limits, dilution needs, residence conditions, and permitted emissions?	The oxidation system may require stable flow, added pressure, temperature interlocks, and concentration safeguards.
Silencer / discharge	What sound limit, stack configuration, and discharge pressure apply?	Backpressure and sound attenuation become part of the total system and motor-load check.

Minimum instrumentation and protective functions

- Blower inlet vacuum and discharge pressure
- Total flow plus individual well flow, as appropriate
- Inlet and discharge temperature
- Separator level and automatic shutdown
- Filter differential pressure
- Motor current or power and overload protection
- Treatment-train temperature and differential pressure
- Vapor sampling ports before and after treatment

Hazard review
Before startup, evaluate flammability, toxicity, oxygen-deficient or enriched conditions, static control, area electrical classification, hot surfaces, rotating equipment, condensate handling, and off-gas treatment upset modes. Establish alarm and shutdown setpoints through the project design and health and safety process.

Materials compatibility

Review wetted and exposed materials against the expected vapor and condensate composition. Include housings, coatings, seals, gaskets, flexible connectors, valves, instruments, drain components, and treatment media - not only the blower casing.

PROCUREMENT WORKSHEET

Put the design basis on one page

Complete this schedule before requesting final equipment selection. Attach pilot-test results, the system curve, candidate blower curves, and the pressure-drop basis.

INPUT	PROJECT VALUE
Project / site	____
Design basis date / revision	____
Required airflow	Normal: __________ Minimum: __________ Maximum: __________ Basis: actual / standard
Required inlet suction	Normal: __________ Maximum: __________ Units: __________
Discharge pressure	Normal: __________ Maximum: __________ Units: __________
Gas temperature	Inlet normal / max: __________ Ambient range: __________
Gas composition	Contaminants: __________________ Expected concentration range: __________________
Moisture / liquids	Relative humidity: __________ Condensate or carryover condition: __________________
Particulates	Expected loading: __________ Pretreatment: ______________________________
Operating schedule	Hours/day: __________ Continuous / intermittent / pulsed: __________________
Control range	Required turndown: __________ Control method: ____________________________
Electrical	Voltage / phase / frequency: ____
Area / safety	Classification, flammability, toxicity, and special requirements: __________________
Environment	Indoor / outdoor; altitude; weather; corrosion; freeze protection: __________________
Noise criterion	At location / distance: ____
Treatment constraints	Maximum flow, temperature, pressure drop, and concentration: __________________

Required vendor submittal
Performance curve with the selected point and full operating range; power and motor load; inlet and discharge temperatures; noise data; materials; dimensions and weight; utility requirements; control and protection requirements; maintenance intervals; and explicit deviations from the specification.

FINAL REVIEW

Confirm the selection before purchase and again at startup

Design review checklist

- Pilot data represent the expected geology and well-field configuration.
- System curve includes clean and credible loaded/fouled conditions.
- Candidate curve shows the required point within the allowable operating range.
- Motor load, discharge temperature, and materials are acceptable.
- Moisture, particulates, and condensate are controlled.
- Treatment and permit constraints accommodate the complete flow range.
- Controls, alarms, shutdowns, relief, and bypass provisions are defined.
- Noise, power, footprint, lifting, drainage, and service access are resolved.

Startup verification

- Verify rotation, alignment, lubrication, guards, flexible connectors, and valve lineup.
- Prove separator high-level, temperature, pressure, motor, and treatment interlocks.
- Start against the manufacturer-approved valve and control configuration.
- Record flow, suction, discharge pressure, temperature, motor load, and treatment differential pressure.
- Compare the measured operating point with the predicted system and blower curves.
- Balance wells methodically and document the final settings.
- Establish baseline vibration, sound, temperature, and differential-pressure readings.
- Train operators and issue the approved operating, maintenance, and sampling procedures.

When to revisit the selection
Re-evaluate the operating point when the active well field changes, groundwater or moisture conditions shift, treatment media or equipment changes, pressure drop trends upward, the unit remains heavily throttled, or field performance no longer matches the design basis.

References

[1] Federal Remediation Technologies Roundtable (FRTR). *Technology Screening Matrix: Soil Vapor Extraction.* Accessed July 28, 2026. https://frtr.gov/matrix/Soil-Vapor-Extraction/

[2] U.S. Army Corps of Engineers. *Engineering Manual EM 1110-1-4001: Soil Vapor Extraction and Bioventing.* June 3, 2002. https://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-1-4001.pdf

[3] U.S. Army Corps of Engineers. *Engineering Manual EM 1110-1-4010: Multi-Phase Extraction.* June 1, 1999. Used for compressible-flow and system-curve context. https://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-1-4010.pdf

[4] U.S. Environmental Protection Agency. *Soil Vapor Extraction (SVE) Technology: Engineering Issue Paper.* EPA/600/R-18/053, 2018. https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P1012UVE.TXT

Document control: Technical Guide 01 | July 2026 | Version 1.0