

NanoVapor Gas-Freeing Technology

Vapor Absorption Technology

NANO VAPOR
Safer. Faster. Greener.



א.ב. טכנולוגיות
מיחזור תעשייתיות בע"מ

NANO VAPOR™

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NanoVapor.com

The NanoVapor Vapor Absorption Process – Two integrated components

1 Advanced Scrubber Design

- ✓ Safe, reliable, modular, and cost-effective.
- ✓ No energy inputs are required
- ✓ scrubber configurations can be set up to control VOC, H₂S, ammonia, or many other emissions.

2 Targeted proprietary chemistries

- ✓ Capturing and Recovering VOC's
- ✓ Removing and capturing H₂S
- ✓ Chemistry formulation for HAPS, Hazardous Air Pollutants, such as
 - sulfur dioxide, mercaptans, ammonia



NanoVapor VAS patented mechanical and chemical technologies combined, provides for up to 99 percent recovery or removal of VOCs, HAPs, and other unwanted contaminants

Proprietary chemistries

- ✓ The absorption system is based on a lean oil absorber implemented in a bubble column reactor.
- ✓ Many “heavy”, non-saturated hydrocarbons can be used as the absorbent. NanoVapor chose to base its implementation on “renewable”, plant based hydrocarbons.
- ✓ In addition to being safer to the environment and humans, they have a very low VOC footprint, which is very advantageous in many situations.
- ✓ The absorbent can also be chosen to be compatible with the local availability and disposal market.

Operation

- 1- A VOC rich stream of gas is applied to the bottom of a column of absorbent via the nano-bubble generator.
- 2- The bubbles rise through the media and the VOC is absorbed in the oil.
- 3- The emission concentration follows a typical absorbent curve. Initially the VOC emissions are near zero.
- 4- Over time as the absorption chemistry saturates, emissions increase. Additional chemistry is added and saturated one removed at a rate that provides one with the emissions target.



Advantages

- Captures VOC's and retains them for later use



- Recirculation technology
- >99% efficiency in vapor recovery C5-C20
- Successfully tested under TCEQ observation
- No VOC, NO_x, CO₂, or other emissions
- Vapors are added to the absorbent chemistry and when saturated can be used as an energy source or feedstock.

Advantages

- ✓ NanoVapor VAS offers oil loading efficiencies greater than that of a standard packed column.
- ✓ The handling of the spent absorbent offers the largest advantage over other technologies.
 - ✓ a) Dispose of the spent oil in the waste fuel market.
 - ✓ b) Dispose of the spent oil in a refineries oil recovery treatment center.
 - ✓ c) Distill the spent oil to allow reuse of the original oil and recover the condensed vapors for re-introduction to the original process or sale.
- ✓ NanoVapor offers at least the following advantages over carbon.
 - ✓ a) Initial acquisition cost
 - ✓ b) Disposal costs) and options)
 - ✓ Ease of use
- ✓ Lower emissions
- ✓ Lower CAPEX NanoVapor capital cost is lower
- ✓ NanoVapor VAS does not introduce an ignition source into the environment

NanoVapor Vapor Absorption System –VAS- versus others

- When searching for air compliance solutions, there are a number of options that might qualify as a BACT (Best Available Control Technology).
- Conventional wet scrubbers, carbon absorption systems, thermal oxidation, and flaring—the historically default technologies—are often operationally or economically unviable.

NanoVapor Patented VAS combines innovative, non-traditional technologies to meet the challenges of the new, more stringent 21st-century environmental compliance regulations

Competitive comparison

Advantages	NanoVapor VAS	Packed Column	Sparger Scrubber	Thermal Oxidation	Carbon Absorption	Flares
> 90% efficient	YES	NO	NO	YES	YES	YES
Meets regulatory requirements	YES	NO	NO	YES	YES	YES
Recovery of otherwise lost VOCs	YES	NO	NO	NO	NO	NO
Flexibility: High/Low CFM and PPM	YES	NO	NO	YES	NO	YES
Self contained (no outside power)	YES	NO	YES	NO	YES	NO
No heat generation or reactions	YES	YES	YES	NO	NO	NO
No NO _x or CO ₂ generation	YES	YES	YES	NO	YES	NO
No media disposal	YES	NO	NO	YES	NO	YES
No fuel feedstocks required	YES	YES	YES	NO	YES	NO
Manages HAPs, H ₂ S, ammonia, etc.	YES	YES	YES	YES	NO	YES
ASME-coded vessels	YES	NO	NO	NO	NO	NO

Contaminants treated

Contaminants	NanoVapor VAS	Packed Column	Sparger Scrubber	Thermal Oxidation	Carbon Absorption	Flares
BETX > 1000 PPM	YES	NO	NO	YES	NO	YES
BETX < 1000 PPM	YES	YES	YES	NO	YES	NO
Total VOCs (>C4) > 1000 PPM	YES	NO	NO	YES	NO	YES
Total VOCs (>C4) < 1000 PPM	YES	YES	YES	NO	YES	NO
Total VOCs (<C3)	NO	NO	NO	YES	NO	YES
H ₂ S	YES	YES	YES	NO	NO	NO
Ammonia	YES	YES	YES	NO	NO	NO
Mercaptans	YES	YES	YES	NO	NO	NO

NanoVapor – VAS



**Absorption Unit – Replaced the need for a thermal oxidizer;
Lower Capex and Opex, and no air permit required.**

Scalable to Meet Flow and Customer Requirements

NanoVapor Vapor Suppression (VSS) and Vapor Absorption (VAS) technologies

The ZERO Emissions solution for AST Tank Cleaning and Maintenance

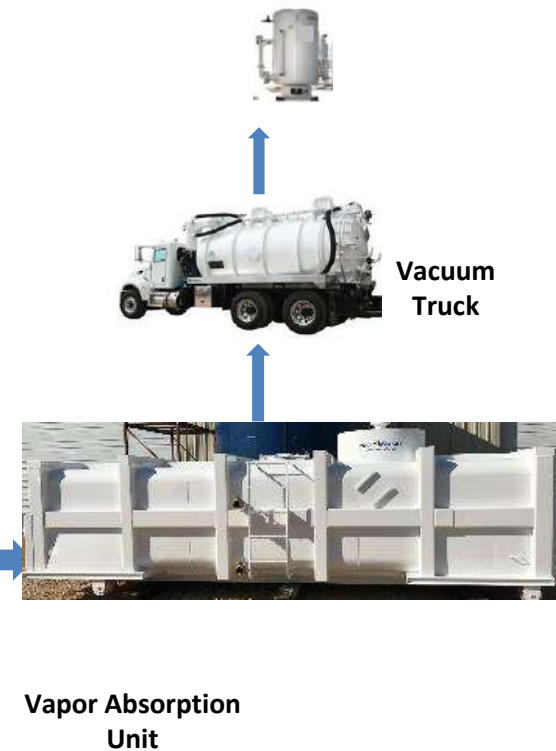
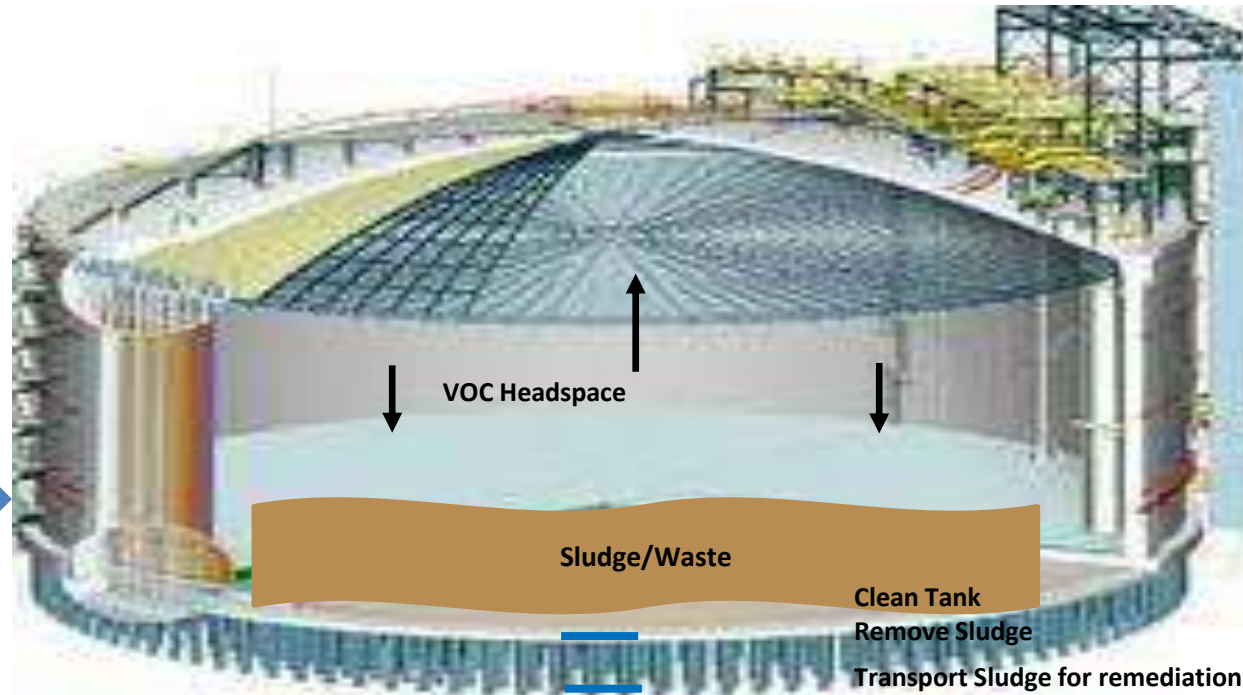
Step I – Purge
Headspace and
Suppress

Step II - Remaining
VOC's Sent to
Carbon Polisher

Step III – Clean
Tank



ST-1000 or New
Unit



The ZERO Emissions Solution

- קבלת מידע נוסף, יעוץ, סיוע והזמנות
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