

# ARID MEMBRANE CRU

## Gasoline Vapor Recovery System



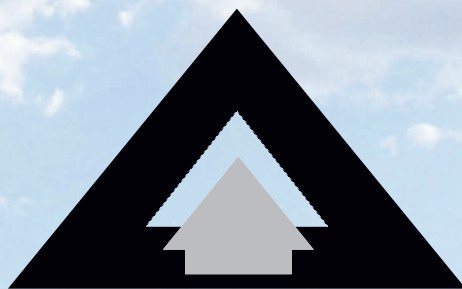
The ARID Membrane CRU (Carbon Retrofit Unit) Gasoline Vapor Recovery System is installed at high capacity, bulk terminals for reducing hydrocarbon emissions while at the same time increasing loading rack rates.

Vapors displaced from cargo tanks at the loading rack are directed to the ARID CRU which uses selectively permeable membranes to separate this stream into a hydrocarbon-rich stream and a hydrocarbon-lean stream.

The enriched vapor stream is routed to the existing absorber (or “scrubber”), already present in conjunction with bulk terminals using a dual bed carbon adsorption system.

These enriched vapors are then converted to liquid phase product and returned back to the bulk storage tanks. The hydrocarbon-lean stream is directed to the carbon adsorption bed, where the bed acts as a “polishing unit”.

ARID CRU units have yielded a decrease in measured emission levels far below allowable limits while also increasing the permitted throughput and loading capacity at bulk terminals. One bulk terminal increased their loading rate from 4 arm to 9 arm simultaneous operation after installation of the CRU while maintaining emission levels at 1/60th below the allowable level.



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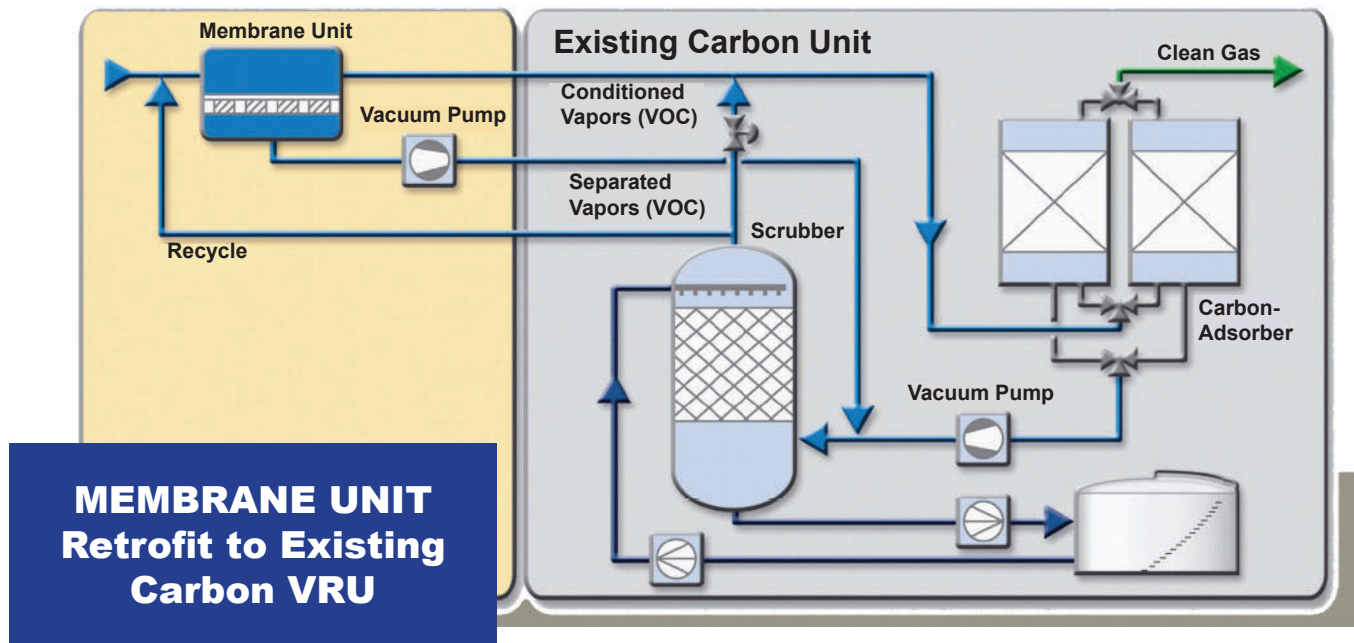
## CRU SYSTEM BENEFITS:

- Large reduction of hydrocarbon mass loading to the existing VRU
- Increased safety of the carbon bed system due to reduction of exothermic reactions (lower mass loading)
- Active adsorption sites not reduced by polar additives or high water vapor content
- Significant increase of the capacity of the retrofitted system
- Increased efficiency and lower emission level
- Pre-assembled, skid mounted design
- Easy implementation, dovetail to existing PLC
- Hybrid system best utilizes membrane and adsorption technologies within their optimum ranges
- Low maintenance

## ARID CRU SOLUTION:

The Carbon Retrofit Unit significantly reduces the hydrocarbon concentration and mass flow entering the adsorbers. The separated enriched stream by-passes the adsorbers and directly enters the existing absorption system (scrubber). This enables adsorber performance increase and higher loading rack rates.

The CRU is installed upstream of the existing active carbon system. The vapor stream is separated by the membrane unit into two streams. The stream passing through the membranes is highly enriched with hydrocarbons and is routed directly to the existing scrubber unit, where the hydrocarbons are liquified. The hydrocarbon lean stream is directed to the existing adsorbers for final polishing. The integration of the CRU is easy and cost effective with only minor modifications of the existing active-carbon-based vapor recovery unit. The retrofit system is primarily comprised of the membrane modules and a vacuum pump (with optional blower).



## PetroDiamond Unit (Long Beach, California):

- Increased nominal capacity of membrane stage with McGill carbon bed unit
- Reduction of benzene emissions by more than 75%
- Reduction of other aromatics by more than 95%
- Improved separation of polar molecules such as ethanol
- Reduced specific power consumption at increased flow rates



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