

# Depleted Argon Facilities



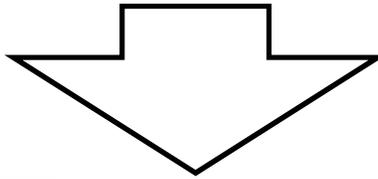
## Gas Extraction plant - Cortez, CO

Gas from well:

- Primarily Carbon Dioxide
- 600 ppm Argon

Plant output:

- 5% Argon
- 40% Nitrogen
- 55% Helium



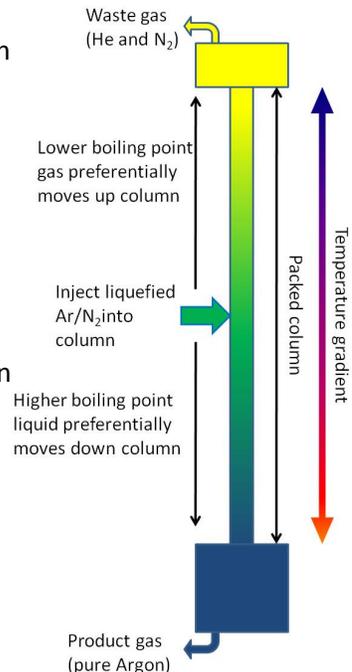
## Cryogenic Distillation Column - Fermilab

Gas received from VPSA plant in high pressure yellow cylinders

All input and output gases are monitored with a gas analyzer

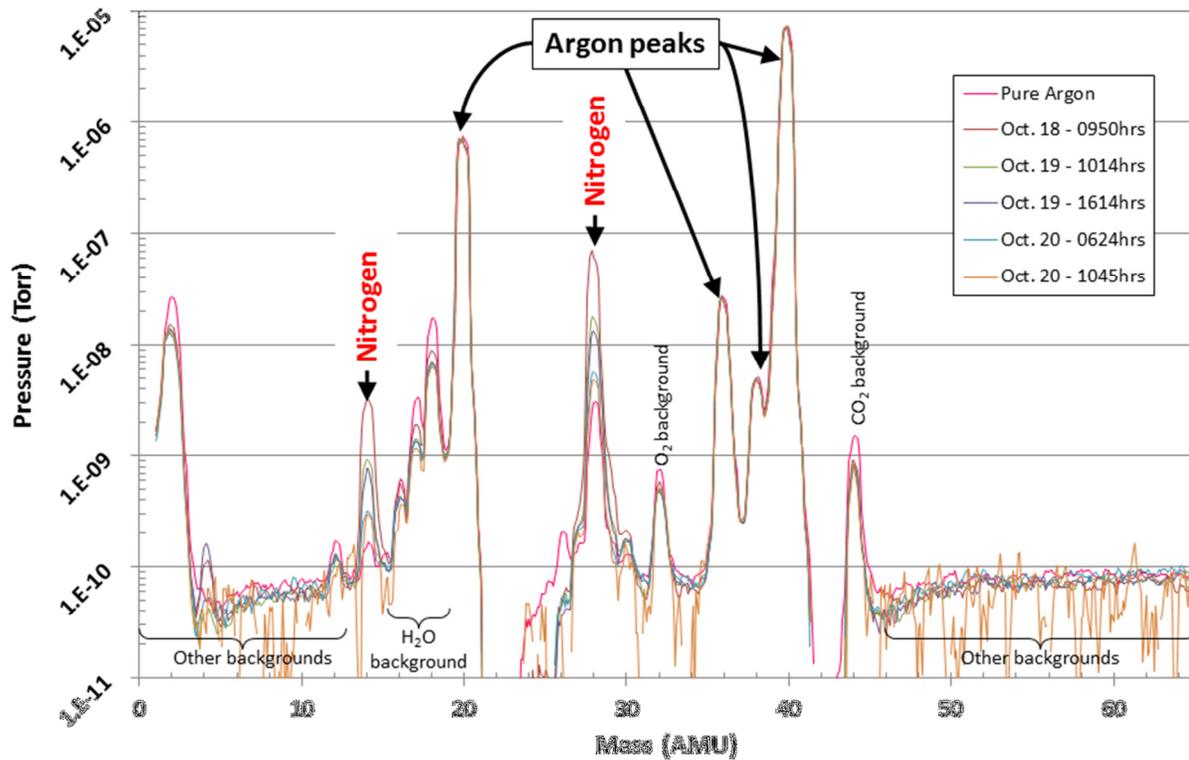
Recently commissioned with a gas mixture identical to VPSA output

- Purity achieved better than 99.95%
- Production rate is 1kg of argon per day

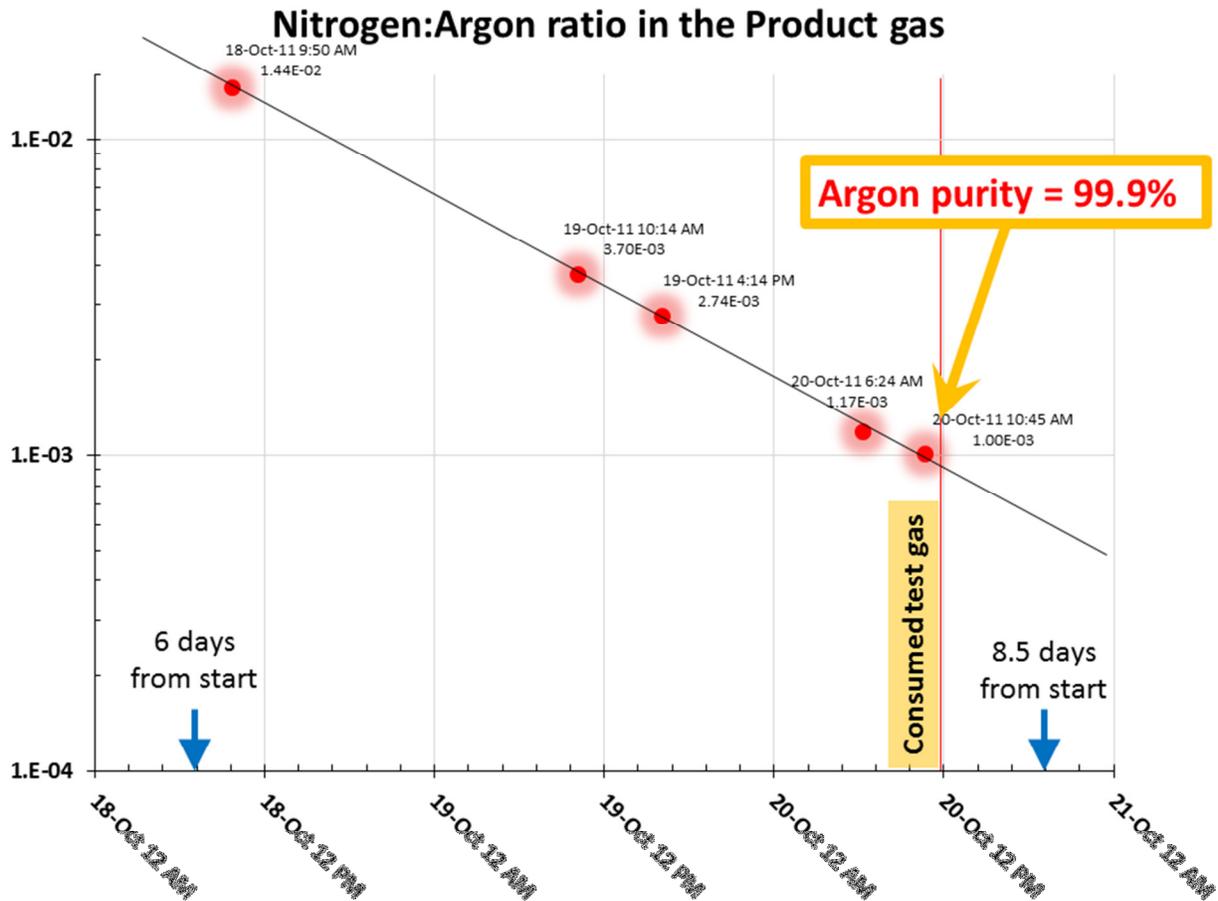


# Gas Analyzer Scans

## Distillation product compared to pure argon

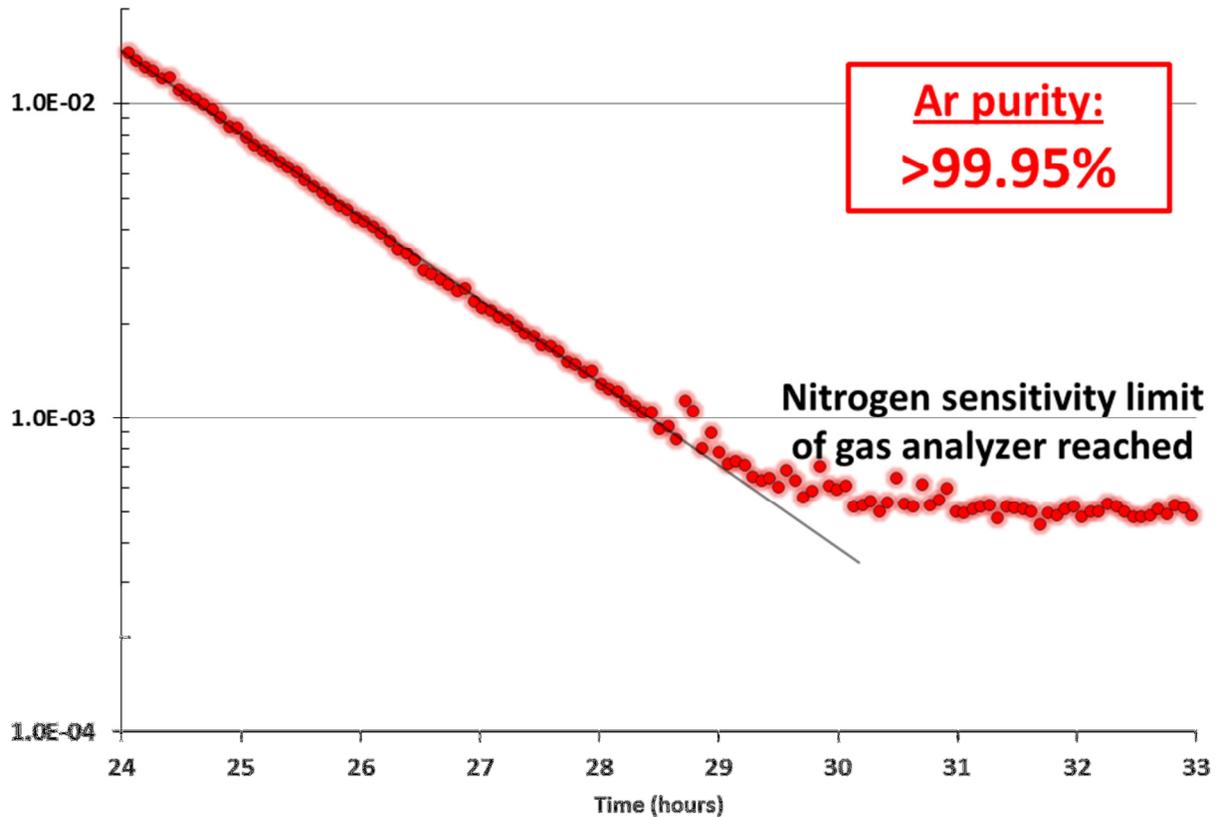


- Gas analyzer scan of the 'product' gas compared to a pure Argon.
- The background is the same in the product gas as it is with the pure argon. Our product is pure argon with a small nitrogen contamination.
- The nitrogen concentration is continuously decreasing and reaching the sensitivity limit of the gas analyzer (0.1% of the main component).



- In less than 1 week after starting the distillation column (including cooling) the argon purity reached during the first ever continuous distillation was better than 98%.
- In less than 10 days from the start the Argon purity was ~99.9% in the continuous distillation mode, and it was getting better; nearly reaching the limit of the RGA.
- When the gas was consumed the nitrogen level was still falling.

## Nitrogen:Argon ratio in the product gas



- With a large mass of liquid collected in the distillation column during the continuous distillation phase, we moved to batch distillation of this liquid
- During the batch purification test the nitrogen is reduced so far that the gas analyzer can no longer measure it
- At this level the argon purity reached is better than 99.95%
- We are confident we can reach 99.999% pure argon with the Distillation Column

# Distillation Column bottom line

*First continuous distillation*

- **Argon purity achieved**
  - Input gas contains only 5% Argon
  - Continuous distillation – 99.90%
  - Batch purification > 99.95%
- **Argon collection efficiency**
  - Collected ~12kg of argon from a total input of 14.9 kg
  - Collection efficiency = 80%
  - Will be better with less helium
- **Production rate ~1kg/day**