

***USA Liquid Argon Market Overview***  
***Prepared for the LANNDD Feasibility Study***

**June 24, 2002**

# USA Argon Purity Specifications

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Here are general liquid argon purity specifications

Component	Industrial Grade	SEMI Specification
Minimum Purity	99.997%	99.9985%
Oxygen	5 PPM	2 PPM
Moisture	10.5 PPM	1 PPM
Nitrogen	20 PPM	10 PPM
Hydrogen		1 PPM
Carbon Dioxide	1 PPM	---
Carbon Monoxide and Carbon Dioxide	---	0.5 PPM
Total Hydrocarbons	1 PPM	0.5 PPM

## Notes:

- For high purity applications, customer specifies maximum contaminant levels in product.
- Oxygen and moisture levels less than 0.5 PPM are achievable and are dependent upon purification equipment installed at argon refinery.
- It is possible to procure the argon at LANNDD purities avoiding the need for an on-site purifier

Source: CGA Commodity Specification for Argon G-11.1, 5th edition

## ***USA Argon Cost Model***

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**Here is a cost model for USA liquid argon...**

<b>Purity Specification</b>	<b>CGA Industrial Specification</b>	<b>SEMI Specification</b>	<b>LANNDD Purity Specification</b>
Cost (USD) per one hundred cubic feet (CCF)	\$3.50/CCF	\$4.50/CCF	\$5.50/CCF
Capacity of LANNDD	2 BCF	2 BCF	2 BCF
Est. Total Cost of Argon	\$70 Million	\$90 Million	\$110 Million

### **Notes:**

- In this case, LANNDD purity argon contains <0.5 ppm O<sub>2</sub> and <0.5 ppm H<sub>2</sub>O, all other contaminants meet CGA industrial specification
- Pricing can be impacted by market conditions at the time project starts

## ***Estimated Time to Fill LANNDD***

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**The estimated time to fill the LANNDD is...**

<b>Purity Specification</b>	<b>CGA Industrial Specification</b>	<b>SEMI Specification</b>	<b>LANNDD Purity Specification</b>
Time to Fill LANNDD	Approx. 12 to 24 months	Approx. 12 to 24 months	Approx 12 to 24 months
Capacity of LANNDD	2 BCF	2 BCF	2 BCF
Comments	Product can be produced at any argon production facility	Product can be produced at many facilities	Product can be produced at a limited number of facilities (depends upon refinery purification equipment)