



Argon Extraction Facility Updates

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Princeton University, INFN, UH



02/11/2024



Overview

- Structured the entire Urania package using WBS
- Each WBS has been expended with all the known items
- A BoE document has been prepared to justify each expense
- Differently from what presented in the previous weeks items not currently funded are now defined as “unassigned”.
- For each item we assigned an uncertainty/ranking that could potentially be used to compute contingency following NSF requirements

Code	Uncertainty	Definition
J - Scientist/Engineering Judgement	30%	Using best understanding without justification.
P - Parametric	30%	Using a scaling to estimate the cost of the current project based on historical data from previous similar projects.
E - Past Exact / Equivalent Experience	20%	Using a similar cost from past experience.
A - Past Actual Costs	10%	Using a cost from a similar project.
VE - Vendor Estimate	20%	Using Vendor estimation without a recent quote or knowledge the price fluctuates.
VQ - Vendor Quote	10%	Using a concrete estimate and specify a fixed dollar value for a specific time frame. Will need back-up documentation ex. Provide the quote.
S - Spent	0%	Spent

Status of the Urania Project

- Urania has been divided in WP based on WBS
 1. Site Design + Permits
 2. KM Expenses
 3. Early Site work package
 4. PEMB + Site Development package (electrical, plumbing etc..)
 5. Storage and Transportation
 6. Piping
 7. Air Cooler Support & Sound Abatement
 8. Utilities Fixed Cost
 9. Startup & Commissioning

Site Design + Permits

- **Site Design + Permits**

1. Still missing some number from UH (Geotechnical report expenses).
2. Aecom new quotation has been inserted. They are asking for 2 Change Order (CO). CO#2 is due to the additional work done by then (design of pipes below 2 inches) + work they are going to do (design of the Polaris tower anchor bolts etc..),
3. CO#3 is under negotiation and wants to cover Construction Administration.

WBS #	Contract/Work	Granted [\$]	Projected Cost [\$]	Spent/Committed [\$]	Quotation [\$]	Estimation [\$]	BoE	Delta [\$]	Paid by	Company		
4.01.03.02.A	Site design & Land Development	499,455 US\$	559,494 US\$	332,859 US\$	221,635 US\$	5,000 US\$	-	-60,039 US\$				
4.01.03.02.A1	Main Urania plant design contract	499,455 US\$		263,224 US\$			S		Houston	AECOM		
4.01.03.02.A2	Change order #1 (PEMB)			69,635 US\$			S		Houston	AECOM		
4.01.03.02.A3	Change order #2 (KM Interconnection Piping Design + Anchor Bolts Design + Piping under 2 inches design)				54,496 US\$		VQ		Houston	AECOM		
4.01.03.02.A4	Change order #3 (Construction Administration)				167,139 US\$		VQ		Houston	AECOM		
4.01.03.02.A5	Geotechnical Report					5,000 US\$	VE		Houston	Terracon		
4.01.03.02.B	Permits (Before Start-Up)			2,313 US\$	2,313 US\$	0 US\$	0 US\$		-	497,142 US\$		
4.01.03.02.B1	Building and improvement notice					50 US\$				S		Princeton
4.01.03.02.B2	Septic permit			410 US\$			S		Princeton	Dolores County		
4.01.03.02.B3	Publication in local newspaper			173 US\$			S		Princeton	Dolores County		
4.01.03.02.B4	Stormwater discharge design			1,500 US\$			S		Princeton	Greg Wickstorm		
4.01.03.02.B5	Driveway Permit			180 US\$			S		Princeton	Dolores County		

Kinder Morgan Connection Piping

- **KM Connection Piping**

1. This works covers the KM metering station + inlet and outlet of their plant. Note as this does not cover the connection piping with the Urania Plant (see other sections)

WBS #	Contract/Work	Granted [\$]	Projected Cost [\$]	Spent/Committed [\$]	Quotation [\$]	Estimation [\$]	BoE	Delta [\$]	Paid by	Company
4.01.03.01	KM Metering Station & Plant Interconnection	121,000 US\$	1,118,527 US\$	1,016,843 US\$	0 US\$	101,684 US\$	-	-997,527 US\$		
4.01.03.01.01	Main contract	121,000 US\$		1,016,843 US\$			S		Princeton	KM
4.01.03.01.02	Addendum to KM					101,684 US\$	VE		Princeton	KM

Early Site Work Package (ESWP)

- **Early Site work package**

1. Worked to collect as many quotation as possible anticipating also future works.
2. Some parts are still TBD and quotation are pending mainly related to the missing design work from AECOM (CO#2)

WBS #	Contract/Work	Granted [\$]	Projected Cost [\$]	Spent/Committed [\$]	Quotation [\$]	Estimation [\$]	BoE	Delta [\$]	Paid by	Company		
4.01.03.02.c	Early Site Work Package Implementation & Modifications	450,000 US\$	1,654,317 US\$	953,945 US\$	348,372 US\$	352,000 US\$	-	-1,204,317 US\$				
4.01.03.02.C1	Early site work package (ESWP)	450,000 US\$	1,609,317 US\$	950,945 US\$	306,372 US\$	352,000 US\$	-					
4.01.03.02.C1.0	Main ESWP Contract	450,000 US\$		949,145 US\$			S		Houston	MedvedGBL		
4.01.03.02.C1.0	Cold Weather Protection				20,000 US\$		VQ		Houston	MedvedGBL		
4.01.03.02.C1.0	Bond				19,000 US\$		VQ		Houston	MedvedGBL		
4.01.03.02.C1.0	Mandatory Site Tests (required by law)				85,190 US\$		VQ		Houston	Geomat		
4.01.03.02.C1.0	Site Surveys							2,000 US\$	VE	Princeton	MedvedGBL	
4.01.03.02.C1.0	Septic permit design				1,800 US\$				S	Princeton	Greg Wickstorm	
4.01.03.02.C1.0	Underground package (plumbing & electrical & septic)						182,182 US\$		VQ	Houston	MendevGBL	
4.01.03.02.C1.0	Foundation for the pipe rack							100,000 US\$	P	Houston	MendevGBL	
4.01.03.02.C1.0	Foundation for the Aircooler sound walls							50,000 US\$	P	Houston	MendevGBL	
4.01.03.02.C1.1	Installation of the Polaris + PEMB anchor bolts							50,000 US\$	E	Houston	MendevGBL	
4.01.03.02.C1.1	Trenching and Escavation for Kinder Morgan connection piping							50,000 US\$	E	Princeton	MendevGBL	
4.01.03.02.C1.1	Accidental expenses							100,000 US\$	P	Princeton	MendevGBL	
4.01.03.02.C2	Colorado civil engineer				45,000 US\$	3,000 US\$	42,000 US\$	0 US\$	-			
4.01.03.02.C2.0	Construction drawings for sound walls + air cooler support						5,000 US\$		VQ	Princeton	GoffEngineering	
4.01.03.02.C2.0	Site work supervision and others					3,000 US\$	37,000 US\$		VQ	Princeton	GoffEngineering	

PEMB + Site Development

- **PEMB+ Site Development**

1. Working with several GC.
2. Tried to breakdown costs of the GC. So far we have 1 quotation that is however really not covering what we need and 1 that instead is going in the right direction.
3. Need most likely 1 more week

WBS #	Contract/Work	Granted [\$]	Projected Cost [\$]	Spent/Committed [\$]	Quotation [\$]	Estimation [\$]	BoE	Delta [\$]	Paid by	Company	
4.01.03.04	PEMB	250,000 US\$	170,187 US\$	137,258 US\$	32,929 US\$	0 US\$	-	79,813 US\$			
4.01.03.04.01	PEMB main contract	250,000 US\$		133,975 US\$			S		Princeton	GWB	
4.01.03.04.02	PEMB addendum				32,929 US\$		VQ		Princeton	GWB	
4.01.03.04.03	PEMB acoustic study			3,283 US\$		S	Princeton		Soluzioni Acustiche		
4.01.03.05	Site Development Package	850,000 US\$	1,029,640 US\$	0 US\$	29,640 US\$	1,000,000 US\$	-	-179,640 US\$			
4.01.03.05.01	General contractor	850,000 US\$	1,000,000 US\$	0 US\$	0 US\$	1,000,000 US\$	-				
4.01.03.05.01.0	PEMB Erection	850,000 US\$				80,000 US\$	J		Princeton		
4.01.03.05.01.0	Interior Finishes					250,000 US\$	J		Princeton		
4.01.03.05.01.0	Equipment Positioning					100,000 US\$	J		Princeton		
4.01.03.05.01.0	Plumbing					100,000 US\$	J		Princeton		
4.01.03.05.01.0	HVAC					150,000 US\$	J		Princeton		
4.01.03.05.01.0	Electrical					300,000 US\$	J		Princeton		
4.01.03.05.01.0	Fire Alarm, Lighting etc.					20,000 US\$	J		Princeton		
4.01.03.05.02	Air compressor				29,640 US\$		29,640 US\$			VQ	Princeton
4.01.03.06	HHV Connection and Transformers	100,000 US\$	526,523 US\$	167,788 US\$	308,735 US\$	50,000 US\$	-	-426,523 US\$			
4.01.03.06.01	HHV original deposit (EEA)	100,000 US\$		5,000 US\$			S		Princeton	EEA	
4.01.03.06.02	HHV connection (EEA)				308,735 US\$		VQ		Houston	EEA	
4.01.03.06.03	HHV connection (Tri-State & Transmissions)						50,000 US\$		E	Houston	Tri-State Generation & Transmission
4.01.03.06.04	Transformers				162,788 US\$				S	Princeton	Newton Transformatori

Storage and Transportation

- **Storage And Transportation of Polaris plant now in UH**
 1. No changes compared to last week, still working on quotations and on reconstructing the exact UH budget. We expect to have an update this week

WBS #	Contract/Work	Granted [\$]	Projected Cost [\$]	Spent/Committed [\$]	Quotation [\$]	Estimation [\$]	BoE	Delta [\$]	Paid by	Company
4.01.03.03	Storage in Houston & Transportation	300,000 US\$	345,000 US\$	165,000 US\$	0 US\$	180,000 US\$	-	-45,000 US\$		
4.01.03.03.01	Rent of warehouse	300,000 US\$		165,000 US\$		30,000 US\$	P		Houston	DSRK Properties
4.01.03.03.02	Handling in Houston part I (unloading)								Houston	McRAY Crane & Rigging
4.01.03.03.03	Handling in Houston part II (loading)								Houston	McRAY Crane & Rigging
4.01.03.03.04	Transp. from Houston to Cortez								Houston	

Piping

- **Piping and Interconnection**


1. Several companies have been contacted. Received so far 2 quotation from Italian company and 1 from a US company to do: provisioning+delivery+installation. Few more are supposed to come this week

1. Forind
2. HALO (US)
3. Tesi

WBS #	Contract/Work	Granted [\$]	Projected Cost [\$]	Spent/Committed [\$]	Quotation [\$]	Estimation [\$]	BoE	Delta [\$]	Paid by	Company
4.01.03.08	Interconnection Piping (IP) & Polaris Electrical Work	0 US\$	1,569,819 US\$	0 US\$	1,219,819 US\$	350,000 US\$	-	-1,569,819 US\$		
4.01.03.08.01	Interconnection Piping (IP)		1,019,819 US\$	0 US\$	1,019,819 US\$	0 US\$	-			
4.01.03.08.01.0	Provision of IP with insulations (Piping, Fitting, Flanges, Piperack, Gaskets)				734,746 US\$		VQ		unassigned	FORIND Srl
4.01.03.08.01.0	Prefabrication				127,424 US\$				unassigned	FORIND Srl
4.01.03.08.01.0	Transport				64,081 US\$				unassigned	FORIND Srl
4.01.03.08.01.0	On Site Installation (includes trip)				93,567 US\$				unassigned	FORIND Srl
4.01.03.08.02	Interconnection Piping between Urania and the KM facility (includes installation)		50,000 US\$			50,000 US\$	P		unassigned	
4.01.03.08.03	Polaris Electrical Work		450,000 US\$	0 US\$	200,000 US\$	250,000 US\$	-			
4.01.03.08.03.0	Cold box modification					150,000 US\$	P		unassigned	Polaris
4.01.03.08.03.0	Electrical for inverters + cabling for Polaris LV switchgear				200,000 US\$		VE		unassigned	Polaris
4.01.03.08.03.0	Installation and tests					100,000 US\$	E		unassigned	Polaris
4.01.03.08.04	Interconnection piping between Urania and the Carleton Filling Station (includes installation)		50,000 US\$			50,000 US\$	P		unassigned	

Piping Quotations

Offer Darkside Project REV.0.pdf



Località In Corsi, 09018 Serra (CA)
S.P. Serra - Ormai Km. 0,940
P.IVA 02224343926
Tel. +39 070 21 00 42
info@forind.it
www.forind.it

Offer: Darkside 20k Urania Project # 60705540

As per your R²Q, below the estimated quotation for the project in object based on your LIF-URANIA PIPING BOM

Supply

Item	Total €
Pipes	257.577,68 €
Fittings	111.078,51 €
Flanges	32.949,52 €
Pipe racks	250.000,00 €
Gasket, Bolt, nuts	30.000,00 €
	681.605,61 €

Prefabrication 118.208,35 € Esteemed

Optional

On site activities

Workers	58.800,00 €
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Esteemed 2 workers for 30 days
700 €/day each
Trip and stay esteemed 28.000,00 €

Transport (materials)
Esteemed #5 cntr 78.000,00 €



Offer validity: 30 days
Delivery time: TBD
Delivery terms: TBD
Payment terms: TRD

Note: as mentioned the quotation could be variable for this reason will follow the unit price for each item and voice of this offer.

Kind Regards
Massimo Lollini
Sales Director

in WWW.FORIND.SRI.IT

Offerta Tesi 2024.006 prot. 008.pdf

TECNOLOGIE E IMPIANTI

- Management € 350.000,00
- Forniture per piping e supporti € 205.000,00
- Calcoli, disegni e fornitura strutture per rack € 450.000,00
- Prefabbricazione e montaggio piping € 1.150.000,00
- Montaggio rack € 120.000,00
- TOTALE OFFERTA BUDGETTARIA € 2.275.000,00

Prezzi:

- Per le attività descritte, prezzi a corpo così come indicati al punto precedente

Tempistiche

- Alleghiamo il programma lavori preliminare

Fatturazioni e pagamenti


- Da definire

Chieti, 09/02/2024

TESI srl - Tecnologie e Impianti
Via Padre Ugo Frasca, 7
66100 CHIETI (CH) - ITALIA
P.IVA 02227110862
Project Manager
(ing. Bruno Oddi)

TESI S.r.l. - Via Padre Ugo Frasca, 7 - 66100 CHIETI (CH) Tel. +39 0871 952712 - Fax +39 0871 540191 - E-Mail: tesi@tesi-irf.com
Cod. Fisc./Partita IVA 02227110862 - Cap. Soc. € 10.000,00 I.V.

Halo Quote_Interconnection Piping Work in Cahone (Colorado).pdf



70 CR 4580 Bloomfield, NM 87413 Phone: 505.632.7007 - Fax: 505.632.2666

Date: 2/9/2024
Attention: Giacomo Gallina
Reference: Interconnection Piping Work in Cahone (Colorado)

Halo Services Inc. is pleased to submit this Quote of \$3,372,200 (Three Million, Three Hundred and Seventy-Two Thousand, Two Hundred Dollars) for the above-referenced project. Our proposal includes labor, equipment, and material costs to perform the tasks outlined in the work scope and clarifications.

ITEM	DESCRIPTION	ESTIMATE PRICE
1	PIPE MATERIAL COSTS	\$ 416,200.00
2	PIPE RACK MATERIAL COSTS	\$ 149,300.00
3	PIPE RACK FABRICATION	\$ 250,000.00
4	CONCRETE SUPPORTS	\$ 226,700.00
5	DELIVERY ON-SITE, CONSTRUCTION AND TESTING	\$ 2,330,000.00
	TOTAL	\$ 3,372,200.00

Tentative Delivery, Start, and Duration Dates

- After purchasing, materials should arrive at Halo's yard within 20-30 days.
- Estimated duration of Pipe Rack fabrication: 50 days
- Estimated Galvanization (Hot Dip) 30 days
- Estimated materials delivery to the site 90 days after issuance of the award.
- Estimated on-site construction to begin 45 to 60 days after the issuance of the award.
- Estimated duration of construction conducted on-site: 70 days

Clarifications:

- This quote is based on our interpretation of the provided information. The quote is subject to change based on additional work or requested changes.
- This quote includes bi-weekly progress payments relative to the agreed percentage complete.
- Payment for materials must be received before any purchases are made if the award is granted.
- Materials' pricing and availability are subject to change if an order is not placed within 30 days.
- Costs for delays caused by the customer, contractors, weather, or unforeseen changes beyond the control of Halo Services will be individually negotiated.
- This proposal is based on working 12 hours daily and five days weekly. Additional overtime requested to expedite the schedule will be negotiated separately.
- Our price is valid for 30 days.
- Sales tax has not been included but will be added at the time of invoicing.

Air Cooler Support & Sound Abatement

- **Air Cooler Support & Sound Abatement**

1. Received quotation for the air cooler after simplification of the project.

WBS #	Contract/Work	Granted [\$]	Projected Cost [\$]	Spent/Committed [\$]	Quotation [\$]	Estimation [\$]	BoE	Delta [\$]	Paid by	Company
4.01.03.07	Air Cooler Sound Abatement System	0 US\$	312,941 US\$	0 US\$	292,941 US\$	20,000 US\$	-	-312,941 US\$		
4.01.03.07.01	Sound ab. procurement+shipping				272,941 US\$		VQ		unassigned	Soluzioni Acustiche
4.01.03.07.02	Sound ab. delivery at place (dap)				20,000 US\$		VQ		unassigned	Soluzioni Acustiche
4.01.03.07.03	Sound ab. installation					20,000 US\$	VE		unassigned	

Start-UP & Utilities & Commissioning

- **Start-UP (2 calendar months. Utilities sized as for 1 month)**
 1. Detailed better Monthly operation costs in “Operations Running Costs” . They now include **Operators + Maintenance** as requested last week
 2. **OPERATORS/SUPERVISORS:** Personnel Cost derived from J. Orrel Estimate
 1. (Operator) 9 people \$ 1.5M x year + (Supervisors) \$ 150k x year
 3. **MAINTERNANCE**
 1. Site Maintenance (from Polaris estimate 5% of \$8M x year)
 2. Plant Maintenance Accident monthly expenses (\$ 5k)
 4. Two companies have been contacted for LN2 supply. Quotation should be in this week

Start-UP + 1 Month of Commissioning

- Note as the LN2 installation may go to 0\$ in case we sign a longer supply contract (>18 months) with the company (Airgas or Linde)

WBS #	Contract/Work	Granted [\$]	Projected Cost [\$]	Spent/Committed [\$]	Quotation [\$]	Estimation [\$]	BoE	Delta [\$]	Paid by	Company	
4.01.04	Utilities Fixed Costs & Start-Up & Commissioning Running Costs	714,045 US\$	938,582 US\$	0 US\$	401,782 US\$	536,800 US\$	-	-224,537 US\$			
4.01.04.01	Utilities Fixed Costs (Before Start-UP)	714,045 US\$	155,000 US\$	0 US\$	3,000 US\$	152,000 US\$	-				
4.01.04.01.01	Water					1,000 US\$	P		Princeton		
4.01.04.01.02	Disposal & wasting					1,000 US\$	P		Princeton		
4.01.04.01.03	Network connection (Starlink rate)					1,000 US\$	VQ		Princeton	Starlink	
4.01.04.01.04	LIN system (installation)						150,000 US\$		E	Princeton	Airgas/Linde
4.01.04.01.05	Network Infrastructure (server)					2,000 US\$			VQ	Princeton	
4.01.04.02	Start-Up & Commissioning Running Costs			783,582 US\$	0 US\$	398,782 US\$	384,800 US\$		-		
4.01.04.02.01	Fluids						10,500 US\$		P	Princeton	
4.01.04.02.02	Supervision of suppliers and Polaris						100,000 US\$		P	Princeton	
4.01.04.02.03	LIN (vessel cool-down)						25,600 US\$		P	Princeton	Airgas
4.01.04.02.04	EEA deposit (electrical power)				300,000 US\$		VE	Princeton	EEA		
4.01.04.02.05	Monthly operational cost				98,782 US\$	228,700 US\$	VQ	Princeton	See "Operation Running Costs"		
4.01.04.02.06	Preparation for plant Start-UP					20,000 US\$	P	Princeton			

Running Costs in Details

1. No changes compared with last week.

WBS #	Contract/Work	Granted [\$]	Projected Cost [\$]	Sent/Committed [\$]	Quotation [\$]	Estimation [\$]	BoE	Delta [\$]	Paid by	Company
4.01.05	Monthly Operational Cost	NA	327,482 US\$	0 US\$	98,782 US\$	228,700 US\$	-	NA		
4.01.05.01	Personnels and Coordinators	NA	137,500 US\$	0 US\$	0 US\$	137,500 US\$	-	NA		
4.01.05.01.01	Paid personnel					125,000 US\$	P		DOE	DOE
4.01.05.01.02	Paid supervisors					12,500 US\$	P		DOE	DOE
4.01.05.02	Utilities		145,052 US\$	0 US\$	93,852 US\$	51,200 US\$	-			
4.01.05.02.01	Liquid nitrogen					51,200 US\$	P		DOE	Airgas/ Linde
4.01.05.02.02	Electrical power				93,852 US\$		VQ		DOE	EEA
4.01.05.03	Disposal & Wasting		1,000 US\$			1,000 US\$	J		DOE	
4.01.05.04	Gravelling and Road Maintenance		2,430 US\$			2,430 US\$	VQ		DOE	Dolores County
4.01.05.05	Magnesium Chloride Application		1,500 US\$			1,500 US\$	VQ		DOE	Dolores County
4.01.05.06	Water		1,000 US\$			1,000 US\$	J		DOE	
4.01.05.07	Plant Maintenance	33,000 US\$			33,000 US\$	P	DOE	NA		
4.01.05.08	Site Maintenance	5,000 US\$			5,000 US\$	P	DOE	NA		
4.01.05.09	Network Connection	1,000 US\$			1,000 US\$	VQ	DOE	Starlink		

Summary and Conclusions

- **Quotation + Estimation = \$ 5,451,338**
- **Quotation + Estimation + Spent = \$16,970,004** (including INFN cost for Polaris plant)
- **Estimations (under definition) = \$ 2,595,484**
- **Breakdown of the costs**

	Granted [\$]	Projected Cost [\$]	Spent/Committed [\$]	Quotation [\$]	Estimation [\$]	BoE	Delta [\$]	Responsibility
	3,284,500 US\$	3,625,837 US\$	1,329,001 US\$	506,351 US\$	1,790,484 US\$	-	-3,060,083 US\$	Princeton
		2,718,746 US\$	1,447,004 US\$	836,742 US\$	435,000 US\$	-		Houston
	8,742,661 US\$	8,742,661 US\$	8,742,661 US\$	0 US\$	0 US\$	-	0 US\$	INFN
	0 US\$	1,882,760 US\$	0 US\$	1,512,760 US\$	370,000 US\$	-	-1,882,760 US\$	unassigned
Gran Total	12,027,161 US\$	16,970,004 US\$	11,518,666 US\$	2,855,853 US\$	2,595,484 US\$	-	-4,942,843 US\$	