



Managed by Fermi Research Alliance, LLC for the U.S. Department of Energy Office of Science

NML Run 4 06/01/2022→10/27/2023

system operations wrap-up

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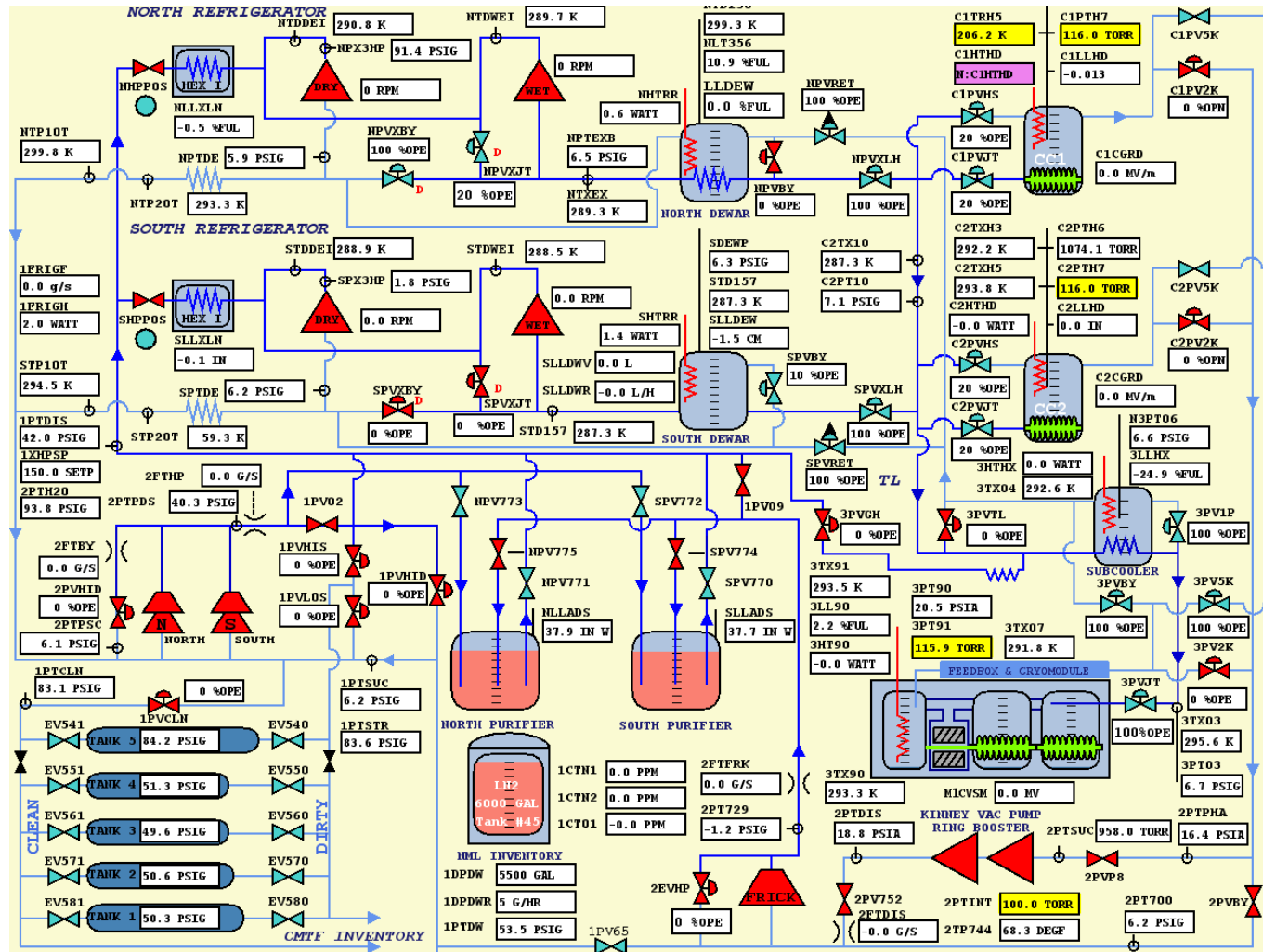
2 Nov 2023

Weekly Status Report

- System status
- Run 4: metrics
- Run 4: availability
- Operation contingency proposal
- Action item list

System Status

- System at 300K, all systems off, cave posted ODH0



Run 4: metrics

Cryogen consumption		Liquid Nitrogen	Gaseous Helium
Run 4 total		~1,231,000 gallon	~180,000scf
		~107 gal/h	~ 4.5 tube trailers
Machine hours		Run time	Availability
480 days cryoplant run time		~11,500 hours	
2x Mycom 2012		~11,500 hours	~92% @4K
Kinney Vacuum pump		~11,000 hours	
Frick Compressor		~3,500 hours	~74% @2K (target 85%)
Preliminary emissions computation			
LN ₂ Production	~1,231,000 gal LN2	1.57 kWh/gal ⁽²⁾ · 0.371 kgCO ₂ /kWh ⁽¹⁾	710 Tons CO ₂
LN ₂ Transport	~32,000 Tanker miles ⁽⁴⁾	1.75 kgCO ₂ /mile ⁽³⁾	56 Tons CO ₂
Electric Power Generation	~6,300 MWh	0.371 kgCO ₂ /kWh ⁽¹⁾	2,337 Tons CO ₂
Total			3,103 Tons CO₂
Monthly			193 Tons CO ₂

(1) [Environmental Disclosure Report](#) COMED (2021)

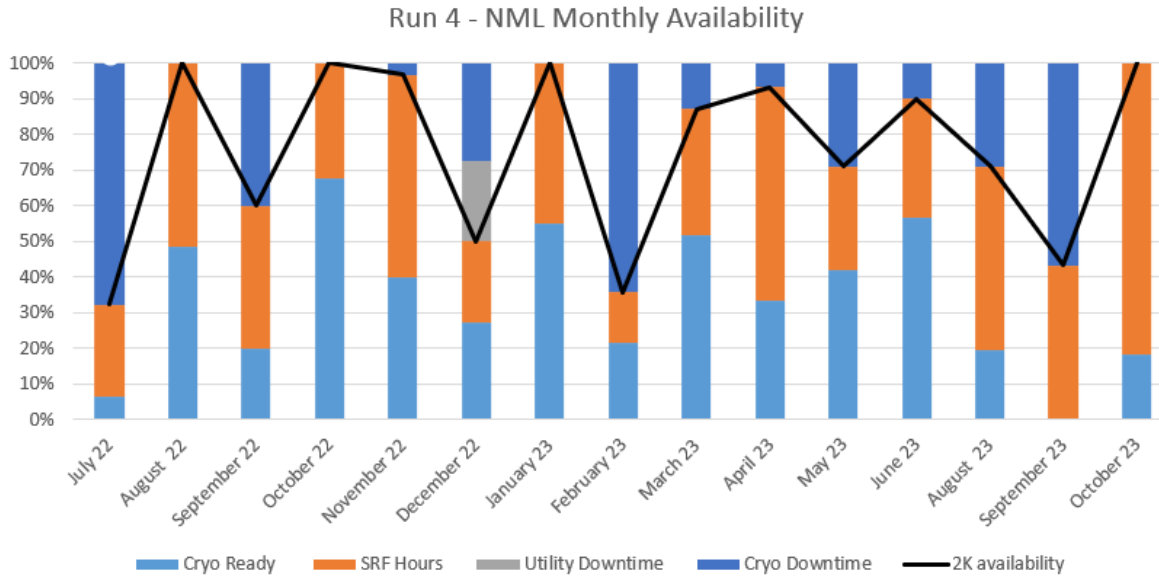
(2) [Indirect CO2 emissions compensation: Benchmark proposal for Air Separation Plants, Position Paper PP33/19](#), European Industrial Gases Association (EIGA) (2019)

(3) <https://www.epa.gov/smartway/smartway-carrier-performance-ranking> EPA (2018)

(4) Each trip to Wisconsin is 100 miles, with a capacity of 7500 gal.



Run 4: availability



SRF hours:

each SRF step logged in N:M1CVSM is considered as 24 hours of SRF usage

Run	eLog entry	Date of failure	Date resolved	Description of what failed	Downtime duration
Run 4	227125	4/11/2023	late 2023	Frick Failure	0 days
Run 4	229425	11/30/2023	12/8/2023	Water leak shutdown	8 days
Run 4	233042	2/1/2023	2/21/2023	Thermal bump #1 8th feb	20 days
Run 4	243600	6/26/2023	7/5/2023	Thermal bump #2 jun 30th	9 days
Run 4	245140	7/12/2023	7/20/2023	Mycom issues, Storm power glitch	8 days
Run 4	245607	7/31/2023	8/1/2023	Acnet outage	2 days
Run 4	246839	8/28/2023	9/8/2023	Thermal bump #3	10 days
Run 4	247695	9/18/2023	9/25/2023	Thermal bump #4 with 2x purifier regeneration	7 days

Operation metrics proposal

The SRF team has requested to have 26 weeks (6 months) of SRF active operation for every year from FY22 to FY26. Based on the overview of IOTA/FAST Runs 1 to 3. The following contingencies are proposed to account for the cryogenic system operation time and Liquid Nitrogen Consumption:

- 4 weeks for cool-down
- 4 weeks for warm-up
- 2 weeks for Utilities downtime
- 2 weeks for Cryo Downtime
- 2 weeks for SRF start-up



12 weeks total cryo + utility
downtime contingency

	Target	Run 1	Run 2	Run 3	Run 4
Cryo + utility downtime contingency consumed $100 \frac{\text{downtime weeks}}{\text{downtime contingency}}$	<100%	69%	209%	113%	149%
2K Usage metric $100 \frac{\text{SRF 2K hours} + \text{2K cryo idle hours}}{\text{SRF 2K weeks requested} + \text{SRF contingency}}$	<100%	101%	70%	156%	172%

Action Item List

Remaining tasks to complete shutdown

- Set cave to ODH 0, by 11/02

Shutdown priority interventions:

- Replace or rebuild known helium leaks:
 - Flow Orifices NR-FO-145-H and S-FO-145-H
 - North Mycom relief valve
- Inspect and likely replace North Mycom shaft seal
- Correct Kinney PLC programming
- Troubleshoot and/or replace inaccurate instrumentation:
 - N:3LLHX liquid level probe.
 - 12 Temperature sensors giving errant readings
 - 2 Vacuum gauges

Improvement projects

- Complete refurbishment of Frick compressor
- Relocate relief on Tank #5 to facilitate maintenance
- North Mycom relief modifications to improve maintenance and reduce likelihood of failures