INL/RPT-23-74602-Revision-1

MEASURED THERMAL AND FAST NEUTRON FLUENCE RATES ATR CYCLES 171A MP-2

October 2023

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Changing the World's Energy Future

Idaho National Laboratory

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MEASURED THERMAL AND FAST NEUTRON FLUENCE RATES ATR CYCLES 171A MP-2 Revision 1 4/21/23 thru 6/19/23

B. J. Walker and M. A. Reichenberger

October 9, 2023

MEASURED THERMAL AND FAST NEUTRON FLUENCE RATES
ATR CYCLE 171A
Revision 1
4/21/23 thru 6/19/23

B. J. Walker and M. A. Reichenberger

This report contains the thermal (2200 m/s) and fast (E>1MeV) neutron fluence rate data for ATR Cycle 171A which were measured by the Radiation Measurements Laboratory (RML) as requested by the Power Reactor Programs (ATR Experiments) Radiation Measurements Work Order.

This report contains fluence rate values corresponding to the particular elevations (relative to the 80-ft. core elevation) where the measurements were taken. The data in this report consists of (1) a table of the ATR power history and distribution, (2) a hard copy listing of all thermal and fast neutron fluence rates, (3) plots of both the thermal and fast neutron fluence rates, and the thermal and the fast neutron fluence rates, their assigned elevations and proper header identification of all monitor positions contained herein.

The fluence rates reported are for the average power levels given in the table of power history and distribution.

No neutron monitors were located in the N-2 position during this cycle.

During the irradiation of Cycle 152A, the RML performed additional flux measurements to assess core reconfiguration issues. Measurements using cadmium covered as well as bare neutron monitors in the Southwest, Southeast, and H positions of the Center lobe were performed to determine the division in neutron energy between epithermal and thermal neutrons. This is defined as the resonance correction defined in this report. It is used to quantify both thermal and fast neutron flux. For more information please refer to letter, “RADIATION MEASUREMENTS LABORATORY MEASUREMENTS OF IN CORE ATR PHYSICS TESTING DURING CYCLE 152A” dated January 24, 2013, to Casey Stengel from C. C. Jensen. The measured values documented in RML Procedure, “ACMM-3600, Flux Monitoring,” will be used indefinitely until further measurements supersede the current values.

DEFINITIONS OF REPORTED INFORMATION

ON PRINTED PAGES

1. CYCLE: The identification code given to a specific period of operation of the ATR for which the data in this report applies.

2. POSITION: The identification code given to a specific location in the ATR core area where neutron monitors were located and for which the data associated with the code apply. The letter code identifies the lobe and the number code identifies a monitor position.

3. MONITOR ID: The identification code given to a specific neutron monitor holder. The code is stamped on the holder. The letter code identifies the type of holder and the number is unique to allow tracking of the neutron monitors and their data.

4. EFPD: The acronym for, "Effective Full Power Days" which is the effective number of days the ATR operated at the average total core power level of the cycle. This value is obtained from the ATR power history and distribution.

5. AVERAGE MW: The average power level (in megawatts) at which the ATR lobe operated during the cycle. The values used for NW, NE, C, SW, and SE lobes are obtained from the ATR power history and distribution. The values used for the other lobes and core positions are determined as follows:

$$N = (NE + NW + C)/3$$
$$E = (NE + SE + C)/3$$
$$S = (SE + SW + C)/3$$
$$W = (NW + SW + C)/3$$

A1 through A8 = C
A9 = NE
A10 = SE
A11 = SW
A12 = NW

B1 or B2 = NE	I21 = NE	B9 = N
B3 or B4 = SE	I22 = SE	B10 = E
B5 or B6 = SW	I23 = SW	B11 = S
B7 or B8 = NW	I24 = NW	B12 = W

6. DATE: The calendar dates corresponding to the outage and operating time of the cycle. These dates include the forced outage time associated with the cycle as well as the operating time.

7. ELEVATION: The vertical position associated with the neutron fluence rate measurement value relative to the 80 ft. elevation of the ATR core. The elevation values are in inches and negative values are below the 80 ft. elevation (commonly referred to as centerline). The elevation values are established based on a 35.25" offset from the top of the wire to the core centerline with a 4.5" offset for the wirescanner fixturing.

An evaluation of the elevation tolerances is listed as follows:

Known Tolerances:

Holder Fabrication	+ 0.11 inch
Cutting the Monitor Wire to Length	+ 0.10 inch
Wire Alignment in the Holder	+ 0.13 inch
Mounting the Wire to the Scanner	+ 0.13 inch
Scanning Control	+ 0.01 inch
Scanner Home Positioning	+ 0.06 inch

Estimated Tolerances:

4.5" Wirescanner Fixture Offset	+ 0.25 inch
Stackup of the Safety Rod Components	$\pm$ 0.33 inch
Position of the Safety Rod Relative to 80 ft. during Operation	$\pm$ 0.75 inch*
Total Tolerance:	$\pm$ 1.87 inch

These elevation tolerances include only what are from random errors. Systematic errors or biases may also occur due to information input. However, procedural controls are used to minimize this information input error.

*This estimate does not include variations due to thermal and hydraulic effects.

8. "THERMAL": The equivalent 2200 m/s (0.025 eV) neutron fluence rate assuming a Maxwellian distribution for the thermalized neutrons at 20.44C. The fluence rate is determined from the Co-59 (n,γ) Co-60 reaction rate assuming a 37 barn 2200 m/s cross section for the reaction. Corrections for the epithermal reaction rate are made based on cadmium ratio measurements at each position of the fluence rate measurement. All fluence rate values are in units of neutrons per sqcm per second.

9. "FAST": The equivalent >1 MeV fission neutron energy fluence rate assuming a pure U-235 fission spectrum neutron energy distribution. The fluence rate is determined from the Ni-58(n,p)Co-58 reaction rate assuming a 0.092 barn fission spectrum averaged cross section for the reaction and a fission spectrum fraction of 0.692 for >1 MeV neutrons.

Corrections for the burnout of the Co-58 isomers are made based on the measured 2200 m/s fluence rate, the exposure duration and the burnout cross sections of the isomers [1650 barns (71 days), 1.7 E+5 barns (9.1 hours)] at each position of the fluence rate measurement.

10. CENTERLINE FLU. RATE: The neutron fluence rate at the elevation assignment nearest to the ATR core centerline elevation (0.0).

11. AVG. MAX. FLU. RATE: The average of the highest three adjacent values.

12. MAX. FLU. RATE/MW (AVG.): The average maximum fluence rate divided by the average power level (MW) of the lobe or position.

13. K FACTOR: The conversion factor determined from the neutron monitor activity for converting the net count rate at each elevation to the absolute reaction product (^{60}Co or ^{58}Co) radioactivity per unit mass of the monitor material (d/s/mg).

14. RESONANCE CORRECTION: The fractional correction factor used to correct the Co-59 (n,γ) Co-60 reaction rate for the epithermal neutron response at the position where the neutron monitor was located during irradiation. This correction factor was determined from cobalt "cadmium ratio" measurements at the same spatial location for the monitor geometry and atom density.

15. C/L BURNOUT CORRECTION: The correction factor for the burnout (transmutation) of the reaction products (Co-60, Co-58, Co-58m) of the neutron monitors during the cycle irradiation at the centerline fluence rate elevation. The burnout correction factors for other elevation assignments will vary (nonlinearly) depending on the "thermal" neutron fluence rates and cycle durations.

16. BACKGROUND (counts/sec.): The wire scanner detector background environment counting rate at the time the neutron monitor wires were scanned.

17. CHECK SOURCE (counts/sec.)
    Date Hour: The wire scanner detector check source count rate on the day the neutron monitor wires were scanned. The check source is a radioactive (^{60}Co) cobalt-aluminum wire mounted in a fixture which reproducibly positions it over the detector collimator. This check source is used to test counting functions (gain and stability) of the scanner counting system. The count rate is corrected for background and decay corrected to 08/30/08, 12:00.

ON PLOTS

18. REACTOR: Identification of the reactor with which the data are associated (normally ATR).

19. CYCLE POWER: The total megawatt days of power produced during the reactor cycle. This value is normally obtained from the ATR power history and distribution information supplied by PRP.

20. MATERIAL: The element name of the neutron monitor material. The "thermal" neutron monitor material is normally an alloy (CoAl) of cobalt (Co) and aluminum (Al) where the weight percent is given preceding the percent (%) symbol.

21. EXPERIMENT: The identification code given to the experiment located in the loop. This information is provided by PRP.

ADDITIONAL INFORMATION

Cycle 171A was the first operating cycle at ATR following the 6th core internals changeout. Following this 2-year long outages, the condition of the canal wirescanner that is used to measure the activity of Ni and Co/Al wires was suspect due to high traffic in the region of the canal where the wirescanner resides and the extended outage.

Before conducting the measurement of the activated Ni and Co/Al wires, the drive-motor of the scanning bed was jammed. Furthermore, the gain and offset of the shaping amplifier and analog to digital converter were respectively set to different values than how they were left following the cycle 170A flux wire measurements. These items were troubleshot and resolved before measurement of flux wires for 171A began.

The existing software to operate the wire-scanning bed does not provide instruction on the proper analysis of the amplifier gain settings. During the measurements, it was discovered that the software *assumes* that the energy calibration of the NaI detector is both linear and constant between the three peaks of interest,

- 811 keV – Co-58,
- 1173 keV – Co-60,
- 1333 keV – Co-60,

and that the spacing between these peaks does not change. However, it was observed that the assumed spacing between peaks was not appropriate and that the software was *incorrectly* integrating the area under the Co-60 peaks. This under-integration likely led to significant under-reporting of the thermal neutron fluence rates reported herein. The determination of the fast fluence-rate also requires correction based on thermal fluence and is therefore also suspect.

This inconsistency was not identified until the final wire was being measured. The present process requires that a wire segment from each wire be extracted and taken back to RML. Therefore, it was not possible to re-measure any wires. It is therefore recommended to disregard the absolute value of the following results. However, relative comparisons (between irradiation locations and along the axis of the core) should still be valid.

POWER HISTORY AND DISTRIBUTION
CYCLE 171 A
4/21/23
To
6/19/23

	NW	NE	C	SW	SE	TOTAL MWD
MWD	1094	1037	1125	1366	1257	5879
EFPD	55.12					
MWD/44 = EFF. TE.	24.86	23.57	25.57	31.05	28.57	
EFF. TE. / EFPD = PF	.451	.428	.464	.563	.518	
MWD/EFPD = AVG. POWER (MW)	19.85	18.81	20.41	24.78	22.80	
TOTAL MWD/EFPD = AVERAGE FULL POWER (MW)	106.66					

The following power history was used for fluence rate determinations

Days	Power (MW)	Power Factor (P.F.)
0.9	1.50	0.01
3.21	0	0
55.1	104.97	1
57	0	0

ATR NEUTRON MONITOR RESULTS

CYCLE: 171A POSITION: B-9 MONITOR ID: MP-01
EFPD: 55.1 AVERAGE MW: 19.7 DATE: 04/21/23 to 06/19/23

ELEVATION from core CL (inches)	"THERMAL" 2200 m/s CO (n/cm**2/sec)	"FAST" >1 MeV NI (n/cm**2/sec)
30.73	3.62E+12	7.81E+11
29.75	6.00E+12	9.19E+11
28.75	8.86E+12	1.16E+12
27.75	1.35E+13	1.48E+12
26.75	1.77E+13	1.96E+12
25.75	2.43E+13	2.53E+12
24.75	3.03E+13	3.14E+12
24.75	3.03E+13	3.14E+12
24.25	3.35E+13	3.42E+12
23.75	3.69E+13	3.81E+12
23.25	4.06E+13	4.15E+12
22.75	4.54E+13	4.43E+12
22.25	4.99E+13	4.86E+12
21.75	5.43E+13	5.25E+12
21.25	5.83E+13	5.66E+12
20.75	6.15E+13	5.85E+12
20.25	6.67E+13	6.17E+12
19.75	7.07E+13	6.57E+12
19.25	7.53E+13	7.07E+12
18.75	7.83E+13	7.51E+12
18.25	8.28E+13	8.27E+12
17.75	8.45E+13	9.12E+12
17.25	8.81E+13	1.05E+13
16.75	9.14E+13	1.12E+13
16.25	9.37E+13	1.17E+13
15.75	9.71E+13	1.17E+13
15.25	1.01E+14	1.26E+13
14.75	1.03E+14	1.24E+13
14.25	1.08E+14	1.20E+13
13.75	1.08E+14	1.25E+13
13.25	1.10E+14	1.39E+13
12.75	1.13E+14	1.48E+13
12.25	1.15E+14	1.53E+13
11.75	1.17E+14	1.52E+13
11.25	1.20E+14	1.50E+13
10.75	1.23E+14	1.43E+13
10.25	1.26E+14	1.31E+13
9.75	1.29E+14	1.31E+13
9.25	1.28E+14	1.48E+13
8.75	1.29E+14	1.65E+13
8.25	1.31E+14	1.74E+13
7.75	1.31E+14	1.77E+13
7.25	1.34E+14	1.78E+13
6.75	1.36E+14	1.79E+13
6.25	1.35E+14	1.66E+13
5.75	1.39E+14	1.57E+13
5.25	1.39E+14	1.78E+13
4.75	1.37E+14	1.92E+13
4.25	1.38E+14	1.98E+13
3.75	1.38E+14	2.05E+13
3.25	1.38E+14	2.02E+13
2.75	1.39E+14	1.94E+13
2.25	1.43E+14	1.77E+13
1.75	1.47E+14	1.52E+13
1.25	1.47E+14	1.51E+13
0.75	1.45E+14	1.80E+13
0.25	1.40E+14	1.96E+13
-0.25	1.38E+14	2.00E+13
-0.75	1.37E+14	2.00E+13
-1.25	1.38E+14	1.98E+13
-1.75	1.36E+14	1.98E+13
-2.25	1.39E+14	1.75E+13

-2.75	1.42E+14	1.53E+13
-3.25	1.38E+14	1.60E+13
-3.75	1.36E+14	1.70E+13
-4.25	1.33E+14	1.71E+13
-4.75	1.32E+14	1.71E+13
-5.25	1.33E+14	1.75E+13
-5.75	1.33E+14	1.63E+13
-6.25	1.31E+14	1.48E+13
-6.75	1.32E+14	1.37E+13
-7.25	1.31E+14	1.43E+13
-7.75	1.27E+14	1.53E+13
-8.25	1.23E+14	1.59E+13
-8.75	1.20E+14	1.60E+13
-9.25	1.17E+14	1.60E+13
-9.75	1.16E+14	1.56E+13
-10.25	1.16E+14	1.47E+13
-10.75	1.13E+14	1.27E+13
-11.25	1.12E+14	1.25E+13
-11.75	1.11E+14	1.29E+13
-12.25	1.07E+14	1.28E+13
-12.75	1.04E+14	1.25E+13
-13.25	9.92E+13	1.22E+13
-13.75	9.55E+13	1.17E+13
-14.25	9.30E+13	1.03E+13
-14.75	8.99E+13	9.01E+12
-15.25	8.88E+13	8.48E+12
-15.75	8.59E+13	8.01E+12
-16.25	8.23E+13	7.57E+12
-16.75	7.63E+13	6.83E+12
-17.25	7.52E+13	6.76E+12
-17.75	7.21E+13	6.26E+12
-18.25	6.80E+13	6.15E+12
-18.75	6.41E+13	5.63E+12
-19.25	5.88E+13	5.29E+12
-19.75	5.59E+13	4.76E+12
-20.25	5.33E+13	4.52E+12
-20.75	4.84E+13	4.38E+12
-21.25	7.97E+11	0.00E+00

CENTER LINE FLU. RATE	1.40E+14	2.00E+13
AVG. MAX. FLU. RATE	1.47E+14	2.02E+13
MAX. FLU. RATE/MW (AVG.)	7.45E+12	1.02E+12
K FACTOR	1330.38	2710.12
RESONANCE CORRECTION	0.84	NA
C/L. BURNOUT CORRECTION	1.001	1.896
BACKGROUND (COUNTS/SEC.)	1.43	1.43
CHECK SOURCE (COUNTS/SEC.)		
07/24/23 09:43	3568.	3568.

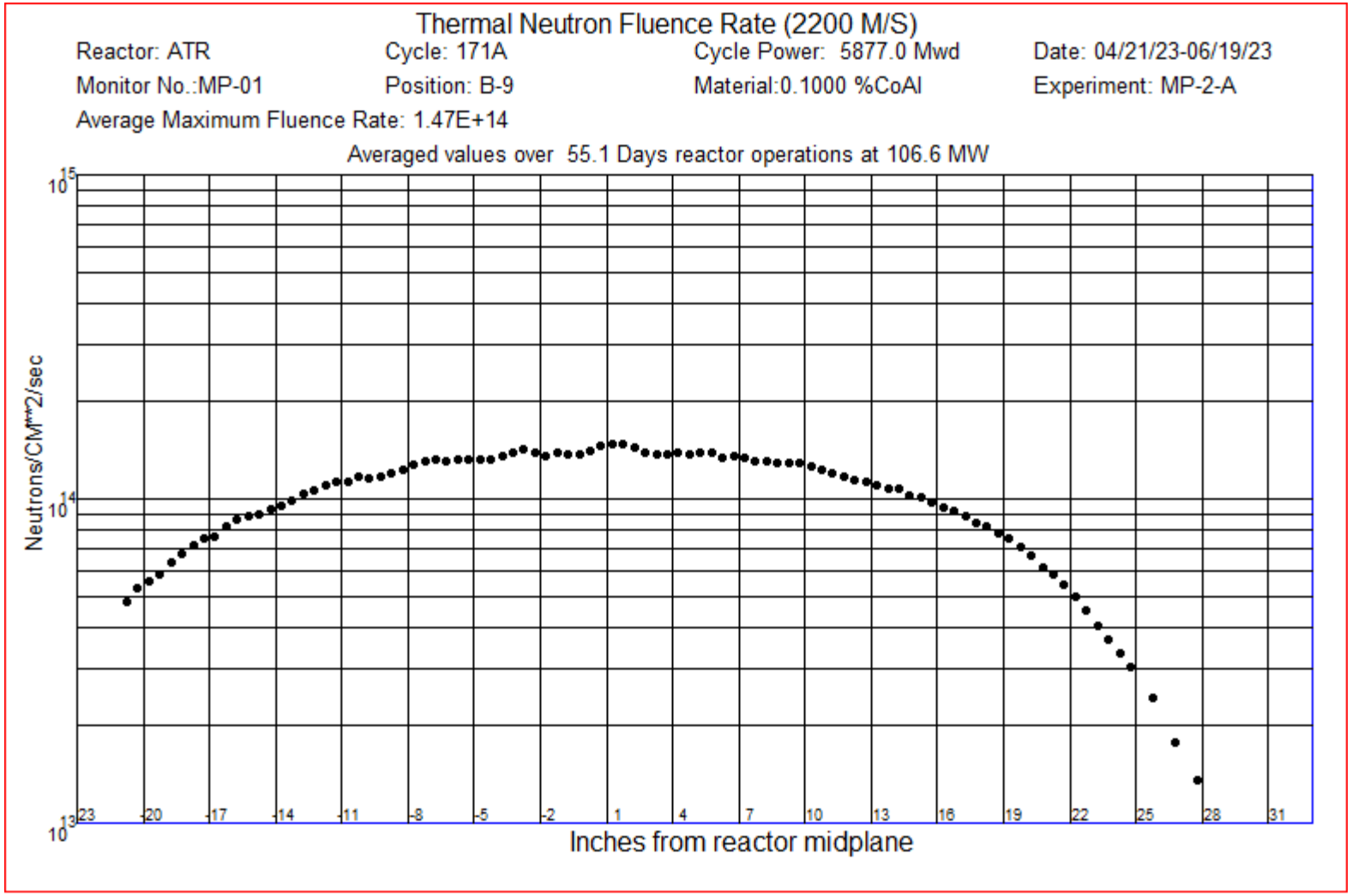
ATR NEUTRON MONITOR RESULTS

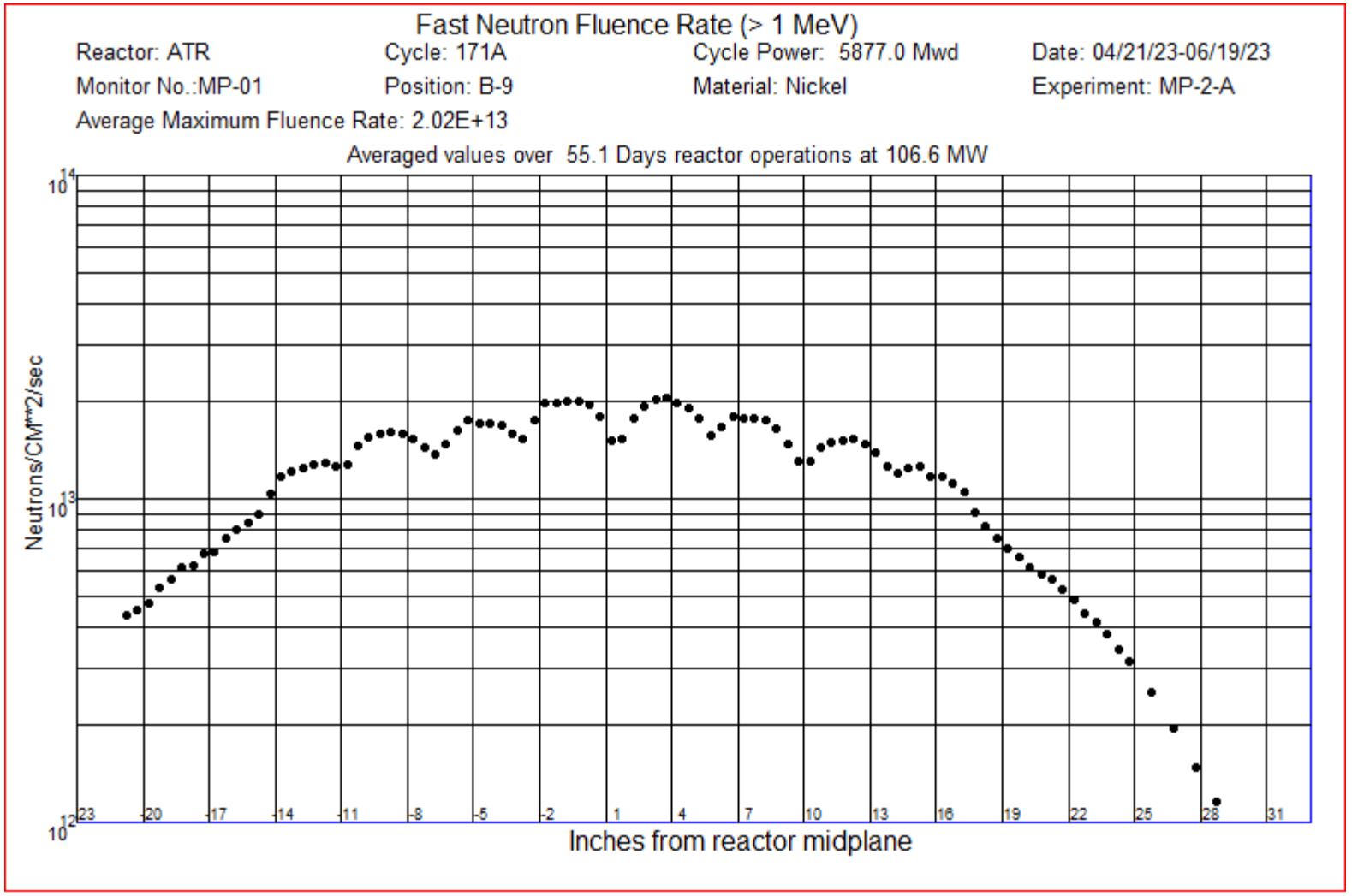
CYCLE: 171A POSITION: B-9 MONITOR ID: MP-02
EFPD: 55.1 AVERAGE MW: 19.7 DATE: 04/21/23 to 06/19/23

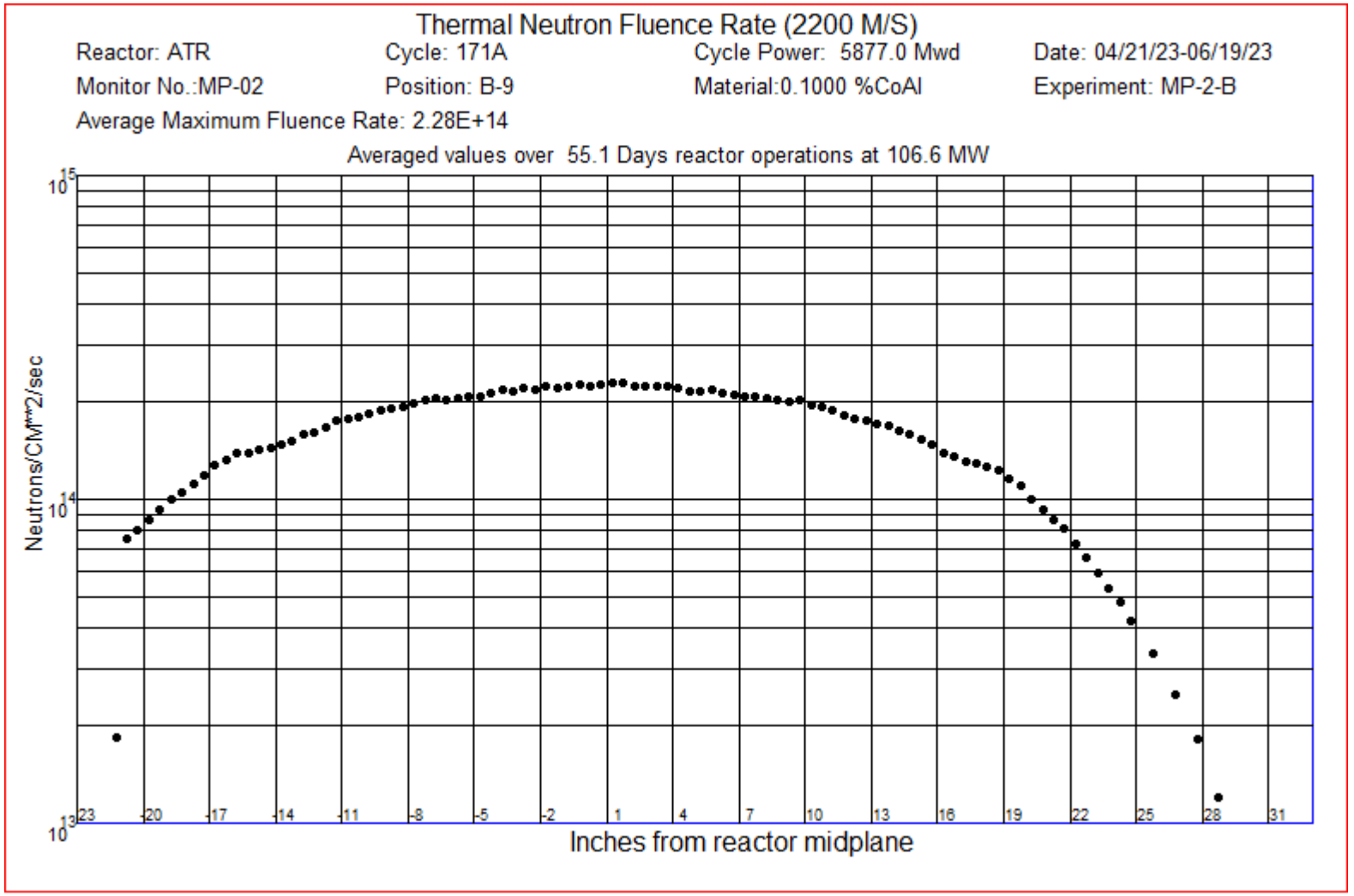
ELEVATION from core CL (inches)	"THERMAL" 2200 m/s CO (n/cm**2/sec)	"FAST" >1 MeV NI (n/cm**2/sec)
30.73	3.82E+12	9.48E+11
29.75	6.51E+12	1.21E+12
28.75	1.19E+13	1.53E+12
27.75	1.81E+13	2.01E+12
26.75	2.50E+13	2.66E+12
25.75	3.33E+13	3.45E+12
24.75	4.23E+13	4.28E+12
24.75	4.23E+13	4.28E+12
24.25	4.81E+13	4.79E+12
23.75	5.29E+13	5.32E+12
23.25	5.94E+13	5.64E+12
22.75	6.59E+13	6.26E+12
22.25	7.29E+13	6.63E+12
21.75	8.11E+13	7.18E+12
21.25	8.67E+13	7.61E+12
20.75	9.26E+13	8.14E+12
20.25	1.00E+14	8.76E+12
19.75	1.10E+14	9.13E+12
19.25	1.16E+14	9.71E+12
18.75	1.23E+14	1.03E+13
18.25	1.26E+14	1.08E+13
17.75	1.29E+14	1.21E+13
17.25	1.31E+14	1.35E+13
16.75	1.35E+14	1.47E+13
16.25	1.38E+14	1.60E+13
15.75	1.48E+14	1.66E+13
15.25	1.53E+14	1.68E+13
14.75	1.59E+14	1.68E+13
14.25	1.63E+14	1.65E+13
13.75	1.68E+14	1.58E+13
13.25	1.72E+14	1.69E+13
12.75	1.76E+14	1.77E+13
12.25	1.78E+14	1.81E+13
11.75	1.82E+14	1.85E+13
11.25	1.89E+14	1.86E+13
10.75	1.92E+14	1.90E+13
10.25	1.96E+14	1.82E+13
9.75	2.02E+14	1.77E+13
9.25	2.01E+14	1.81E+13
8.75	2.03E+14	1.90E+13
8.25	2.05E+14	1.97E+13
7.75	2.07E+14	2.02E+13
7.25	2.09E+14	2.04E+13
6.75	2.11E+14	2.05E+13
6.25	2.14E+14	2.00E+13
5.75	2.19E+14	1.95E+13
5.25	2.16E+14	1.90E+13
4.75	2.16E+14	1.96E+13
4.25	2.20E+14	1.97E+13
3.75	2.22E+14	1.99E+13
3.25	2.23E+14	2.02E+13
2.75	2.22E+14	2.00E+13
2.25	2.23E+14	1.99E+13
1.75	2.29E+14	1.99E+13
1.25	2.30E+14	1.91E+13
0.75	2.26E+14	1.86E+13
0.25	2.23E+14	1.89E+13
-0.25	2.25E+14	1.99E+13
-0.75	2.24E+14	1.97E+13
-1.25	2.22E+14	2.03E+13
-1.75	2.22E+14	2.03E+13
-2.25	2.17E+14	1.98E+13

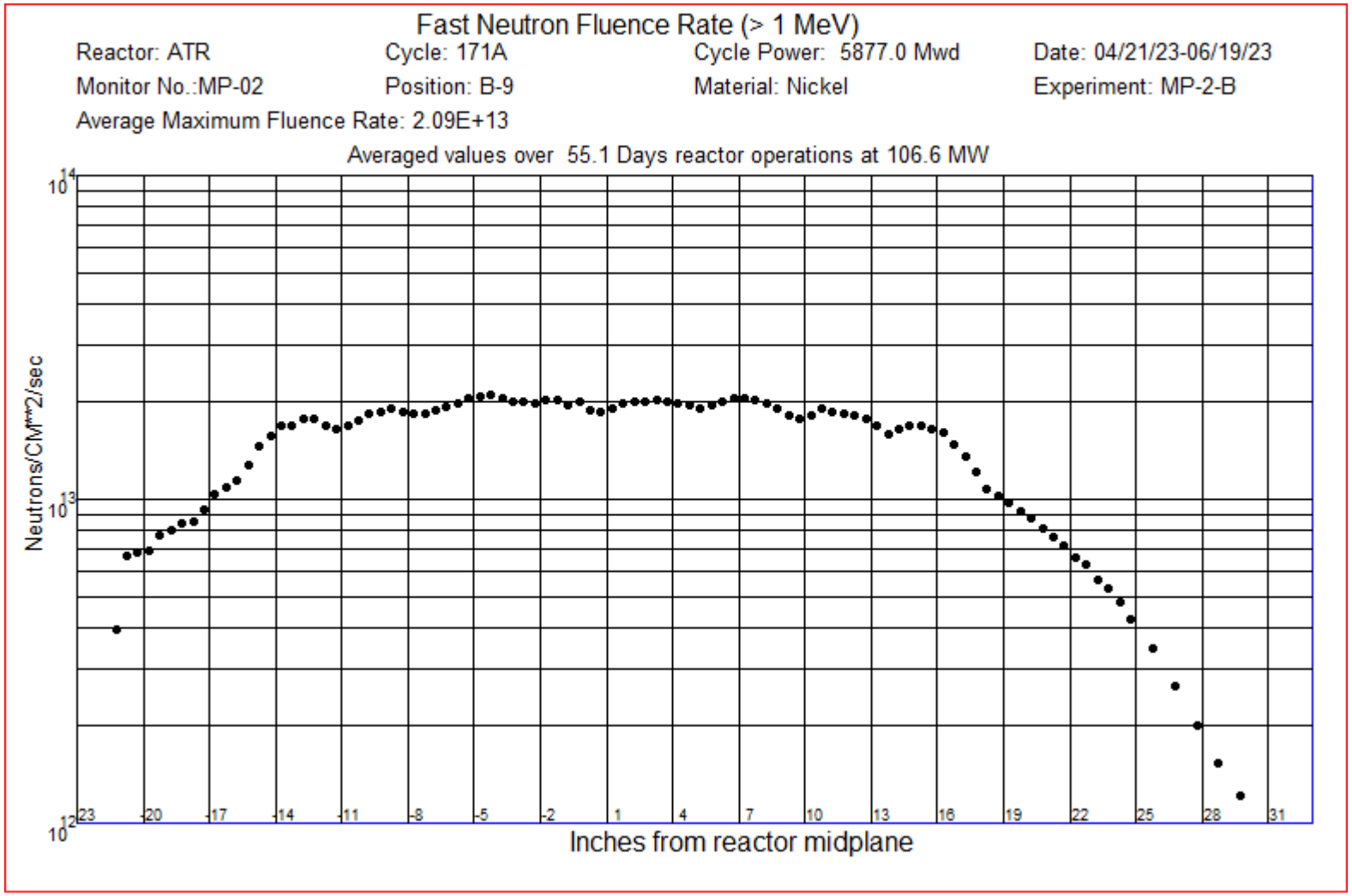
-2.75	2.21E+14	1.99E+13
-3.25	2.17E+14	2.00E+13
-3.75	2.17E+14	2.06E+13
-4.25	2.13E+14	2.11E+13
-4.75	2.07E+14	2.08E+13
-5.25	2.08E+14	2.05E+13
-5.75	2.05E+14	1.98E+13
-6.25	2.03E+14	1.94E+13
-6.75	2.06E+14	1.88E+13
-7.25	2.03E+14	1.83E+13
-7.75	1.99E+14	1.85E+13
-8.25	1.94E+14	1.87E+13
-8.75	1.90E+14	1.90E+13
-9.25	1.89E+14	1.87E+13
-9.75	1.84E+14	1.84E+13
-10.25	1.81E+14	1.75E+13
-10.75	1.77E+14	1.70E+13
-11.25	1.74E+14	1.65E+13
-11.75	1.66E+14	1.70E+13
-12.25	1.61E+14	1.77E+13
-12.75	1.58E+14	1.77E+13
-13.25	1.51E+14	1.68E+13
-13.75	1.48E+14	1.69E+13
-14.25	1.44E+14	1.57E+13
-14.75	1.43E+14	1.45E+13
-15.25	1.40E+14	1.28E+13
-15.75	1.39E+14	1.14E+13
-16.25	1.32E+14	1.09E+13
-16.75	1.28E+14	1.03E+13
-17.25	1.18E+14	9.27E+12
-17.75	1.12E+14	8.58E+12
-18.25	1.06E+14	8.44E+12
-18.75	1.00E+14	8.04E+12
-19.25	9.31E+13	7.75E+12
-19.75	8.64E+13	6.95E+12
-20.25	8.02E+13	6.87E+12
-20.75	7.53E+13	6.66E+12
-21.25	1.84E+13	3.97E+12

CENTER LINE FLU. RATE	2.25E+14	1.99E+13
AVG. MAX. FLU. RATE	2.28E+14	2.09E+13
MAX. FLU. RATE/MW (AVG.)	1.16E+13	1.06E+12
K FACTOR	1415.63	2837.98
RESONANCE CORRECTION	0.84	NA
C/L. BURNOUT CORRECTION	1.002	2.524
BACKGROUND (COUNTS/SEC.)	1.26	1.26
CHECK SOURCE (COUNTS/SEC.)		
07/25/23 08:50	3405.	3405.


Thermal Neutron Fluence Rate (2200 M/S)
Reactor: ATR
Cycle: 171A
Cycle Power: 5877.0 Mwd
Date: 04/21/23-06/19/23
Monitor No.:MP-01
Position: B-9
Material:0.1000 %CoAl
Experiment: MP-2-A
Average Maximum Fluence Rate: 1.47E+14
Averaged values over 55.1 Days reactor operations at 106.6 MW
Neutrons/CM**2/sec
10^15
10^14
10^13
-23
-20
-17
-14
-11
-8
-5
-2
1
4
7
10
13
16
19
22
25
28
31
Inches from reactor midplane


Fast Neutron Fluence Rate (> 1 MeV)
Reactor: ATR
Cycle: 171A
Cycle Power: 5877.0 Mwd
Date: 04/21/23-06/19/23
Monitor No.:MP-01
Position: B-9
Material: Nickel
Experiment: MP-2-A
Average Maximum Fluence Rate: 2.02E+13
Averaged values over 55.1 Days reactor operations at 106.6 MW
Neutrons/CM**2/sec
10^14
10^13
10^12
-23
-20
-17
-14
-11
-8
-5
-2
1
4
7
10
13
16
19
22
25
28
31
Inches from reactor midplane


Thermal Neutron Fluence Rate (2200 M/S)
Reactor: ATR
Cycle: 171A
Cycle Power: 5877.0 Mwd
Date: 04/21/23-06/19/23
Monitor No.:MP-02
Position: B-9
Material:0.1000 %CoAl
Experiment: MP-2-B
Average Maximum Fluence Rate: 2.28E+14
Averaged values over 55.1 Days reactor operations at 106.6 MW
Neutrons/CM**2/sec
10^15
10^14
10^13
-23
-20
-17
-14
-11
-8
-5
-2
1
4
7
10
13
16
19
22
25
28
31
Inches from reactor midplane


Fast Neutron Fluence Rate (> 1 MeV)
Reactor: ATR
Cycle: 171A
Cycle Power: 5877.0 Mwd
Date: 04/21/23-06/19/23
Monitor No.:MP-02
Position: B-9
Material: Nickel
Experiment: MP-2-B
Average Maximum Fluence Rate: 2.09E+13
Averaged values over 55.1 Days reactor operations at 106.6 MW
Neutrons/CM**2/sec
10^14
10^13
10^12
-23
-20
-17
-14
-11
-8
-5
-2
1
4
7
10
13
16
19
22
25
28
31
Inches from reactor midplane

ATR NEUTRON MONITOR RESULTS

CYCLE: 171A POSITION: I-21 MONITOR ID: MP-03
EFPD: 55.1 AVERAGE MW: NA DATE: 04/21/23 to 06/19/23

ELEVATION from core CL (inches)	"THERMAL" 2200 m/s CO (n/cm**2/sec)	"FAST" >1 MeV NI (n/cm**2/sec)
30.73	1.00E+12	1.65E+11
29.75	1.64E+12	2.09E+11
28.75	2.72E+12	2.25E+11
27.75	4.38E+12	2.97E+11
26.75	6.40E+12	3.68E+11
25.75	9.34E+12	4.54E+11
24.75	1.34E+13	5.68E+11
24.75	1.34E+13	5.68E+11
24.25	1.55E+13	6.55E+11
23.75	1.74E+13	6.78E+11
23.25	1.95E+13	7.53E+11
22.75	2.15E+13	8.13E+11
22.25	2.36E+13	9.15E+11
21.75	2.49E+13	9.37E+11
21.25	2.72E+13	1.02E+12
20.75	2.85E+13	1.01E+12
20.25	3.02E+13	1.09E+12
19.75	3.12E+13	1.20E+12
19.25	3.22E+13	1.45E+12
18.75	3.29E+13	1.73E+12
18.25	3.20E+13	2.28E+12
17.75	2.98E+13	2.93E+12
17.25	3.05E+13	4.58E+12
16.75	3.22E+13	5.42E+12
16.25	3.32E+13	5.73E+12
15.75	3.36E+13	5.98E+12
15.25	3.39E+13	5.77E+12
14.75	3.31E+13	5.26E+12
14.25	3.29E+13	4.88E+12
13.75	3.35E+13	5.55E+12
13.25	3.52E+13	7.19E+12
12.75	3.71E+13	7.41E+12
12.25	3.83E+13	8.11E+12
11.75	3.97E+13	8.56E+12
11.25	3.97E+13	8.34E+12
10.75	4.00E+13	7.48E+12
10.25	4.29E+13	5.36E+12
9.75	4.87E+13	4.52E+12
9.25	4.97E+13	6.07E+12
8.75	4.90E+13	7.27E+12
8.25	4.94E+13	7.19E+12
7.75	5.03E+13	7.48E+12
7.25	5.11E+13	8.31E+12
6.75	5.15E+13	8.13E+12
6.25	5.55E+13	7.00E+12
5.75	5.82E+13	5.35E+12
5.25	5.78E+13	6.15E+12
4.75	5.63E+13	8.28E+12
4.25	5.55E+13	8.37E+12
3.75	5.55E+13	8.23E+12
3.25	5.63E+13	8.48E+12
2.75	5.67E+13	8.08E+12
2.25	5.83E+13	6.72E+12
1.75	6.23E+13	4.51E+12
1.25	6.30E+13	4.72E+12
0.75	6.00E+13	5.92E+12
0.25	5.77E+13	6.72E+12
-0.25	5.65E+13	8.19E+12
-0.75	5.66E+13	8.49E+12
-1.25	5.66E+13	8.26E+12
-1.75	5.76E+13	7.57E+12
-2.25	5.84E+13	6.22E+12

-2.75	6.07E+13	5.43E+12
-3.25	5.76E+13	6.58E+12
-3.75	5.55E+13	7.67E+12
-4.25	5.27E+13	7.47E+12
-4.75	5.17E+13	7.36E+12
-5.25	5.10E+13	7.26E+12
-5.75	5.06E+13	7.14E+12
-6.25	5.12E+13	6.03E+12
-6.75	5.02E+13	4.69E+12
-7.25	4.58E+13	4.96E+12
-7.75	4.17E+13	6.35E+12
-8.25	4.17E+13	7.96E+12
-8.75	4.10E+13	7.99E+12
-9.25	4.07E+13	7.65E+12
-9.75	3.89E+13	7.70E+12
-10.25	3.66E+13	6.91E+12
-10.75	3.44E+13	5.30E+12
-11.25	3.43E+13	5.16E+12
-11.75	3.38E+13	5.46E+12
-12.25	3.52E+13	5.69E+12
-12.75	3.50E+13	5.51E+12
-13.25	3.50E+13	5.49E+12
-13.75	3.35E+13	5.12E+12
-14.25	3.20E+13	4.25E+12
-14.75	3.03E+13	3.03E+12
-15.25	3.26E+13	2.08E+12
-15.75	3.28E+13	1.64E+12
-16.25	3.23E+13	1.40E+12
-16.75	3.11E+13	1.39E+12
-17.25	2.98E+13	1.22E+12
-17.75	2.82E+13	1.14E+12
-18.25	2.68E+13	1.08E+12
-18.75	2.44E+13	9.56E+11
-19.25	2.20E+13	8.59E+11
-19.75	1.95E+13	7.64E+11
-20.25	1.64E+13	7.66E+11
-20.75	1.53E+13	6.76E+11
-21.25	4.82E+11	2.55E+11

CENTER LINE FLU. RATE	5.77E+13	8.19E+12
AVG. MAX. FLU. RATE	6.18E+13	8.36E+12
MAX. FLU. RATE/MW (AVG.)	NA	NA
K FACTOR	250.19	2899.56
RESONANCE CORRECTION	0.98	NA
C/L. BURNOUT CORRECTION	1.001	1.355
BACKGROUND (COUNTS/SEC.)	1.50	1.50
CHECK SOURCE (COUNTS/SEC.)		
07/20/23 11:20	3422.	3422.
07/20/23 11:25	3494.	3494.

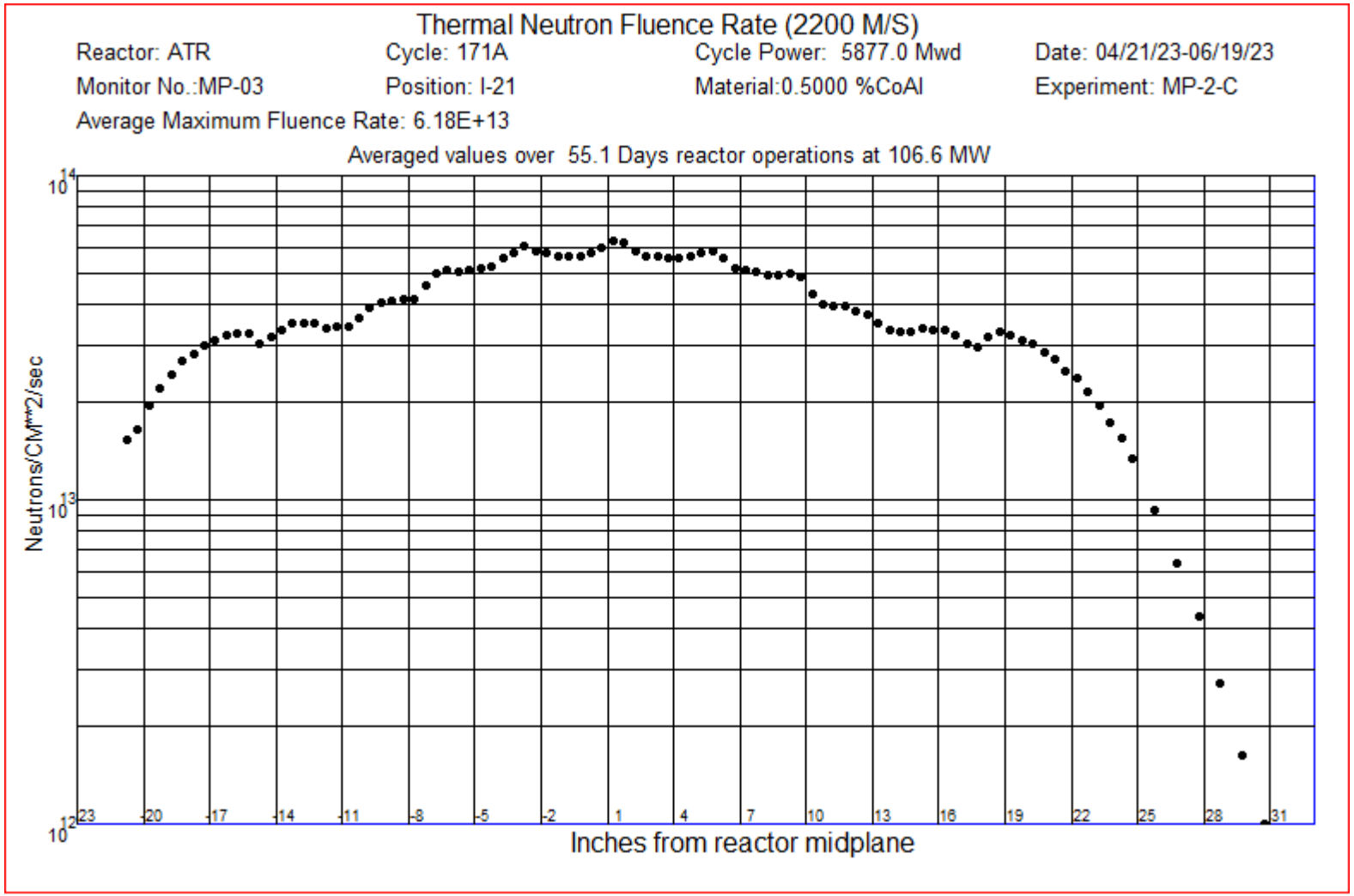
ATR NEUTRON MONITOR RESULTS

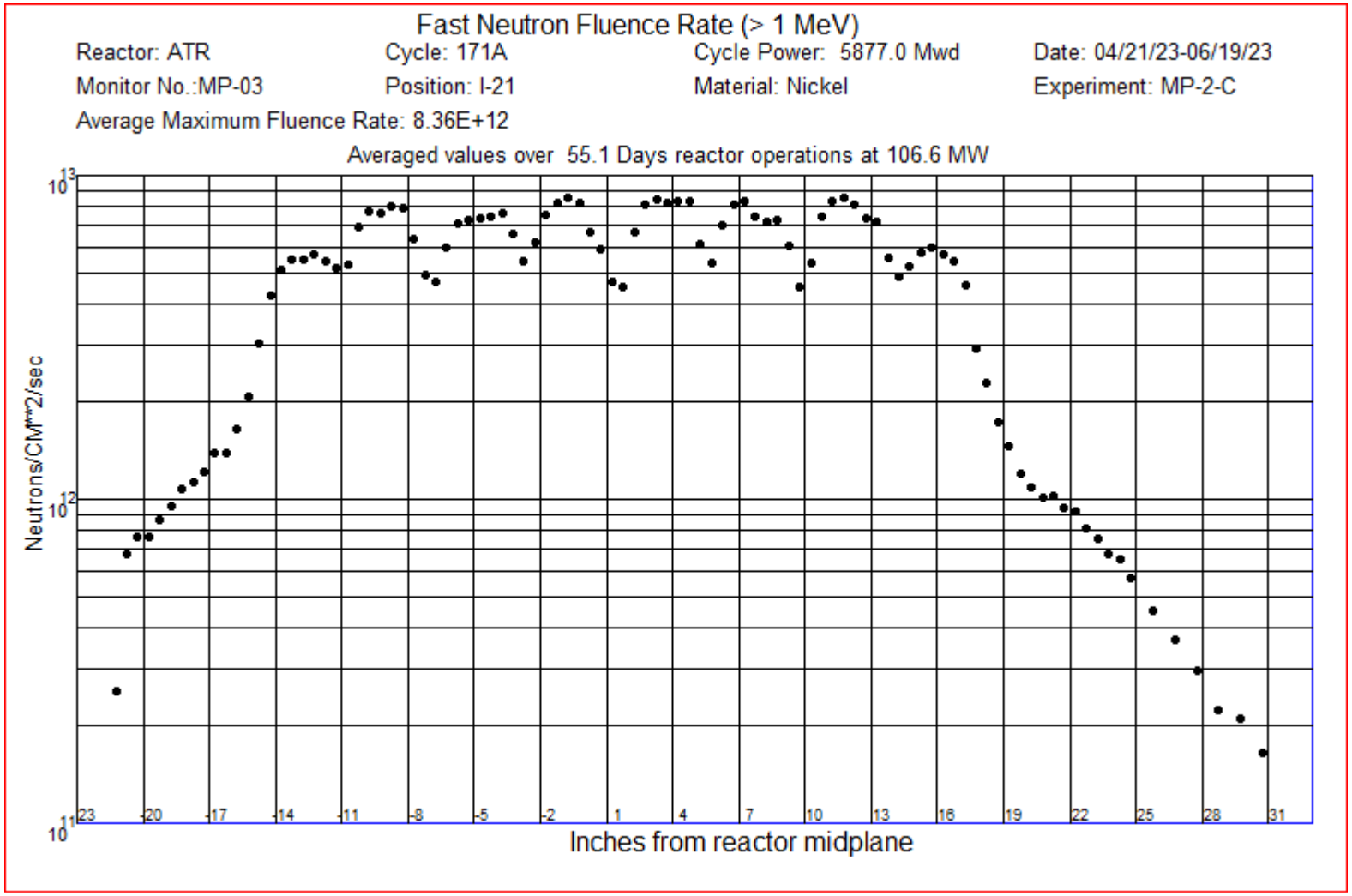
CYCLE: 171A POSITION: I-21 MONITOR ID: MP-04
EFPD: 55.1 AVERAGE MW: NA DATE: 04/21/23 to 06/19/23

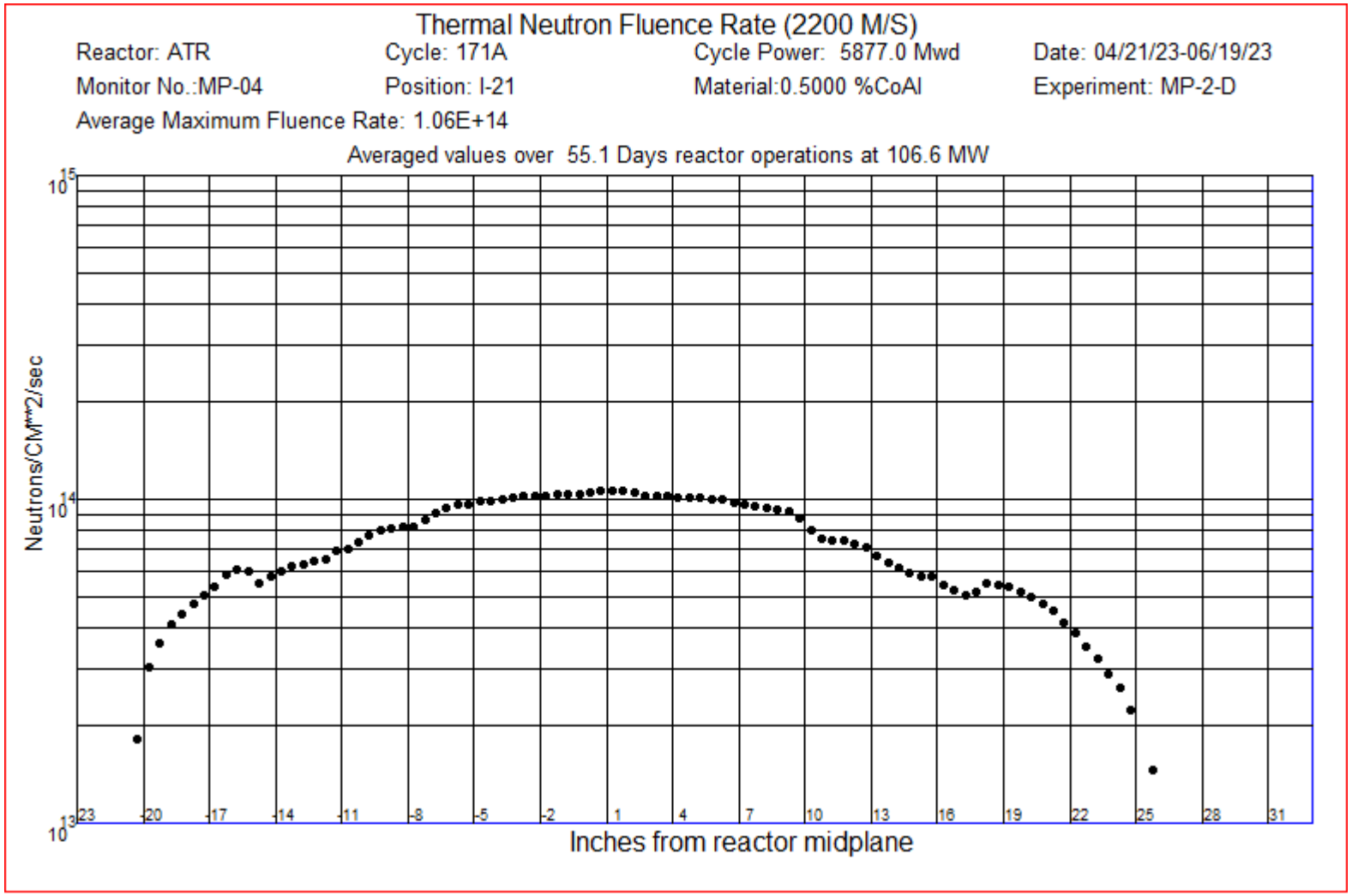
ELEVATION from core CL (inches)	"THERMAL" 2200 m/s CO (n/cm**2/sec)	"FAST" >1 MeV NI (n/cm**2/sec)
30.73	1.28E+12	2.35E+11
29.75	1.98E+12	2.56E+11
28.75	3.13E+12	3.61E+11
27.75	5.37E+12	4.03E+11
26.75	8.70E+12	6.00E+11
25.75	1.46E+13	6.69E+11
24.75	2.24E+13	8.71E+11
24.75	2.24E+13	8.71E+11
24.25	2.61E+13	9.36E+11
23.75	2.87E+13	1.04E+12
23.25	3.24E+13	1.10E+12
22.75	3.52E+13	1.17E+12
22.25	3.87E+13	1.29E+12
21.75	4.16E+13	1.44E+12
21.25	4.54E+13	1.43E+12
20.75	4.73E+13	1.60E+12
20.25	4.99E+13	1.74E+12
19.75	5.21E+13	1.90E+12
19.25	5.37E+13	2.28E+12
18.75	5.47E+13	2.69E+12
18.25	5.48E+13	4.09E+12
17.75	5.19E+13	7.07E+12
17.25	5.05E+13	8.60E+12
16.75	5.24E+13	9.33E+12
16.25	5.41E+13	9.67E+12
15.75	5.76E+13	9.80E+12
15.25	5.77E+13	9.75E+12
14.75	5.92E+13	8.12E+12
14.25	6.13E+13	6.12E+12
13.75	6.34E+13	7.05E+12
13.25	6.70E+13	8.14E+12
12.75	7.08E+13	8.72E+12
12.25	7.26E+13	8.99E+12
11.75	7.43E+13	8.81E+12
11.25	7.42E+13	8.30E+12
10.75	7.54E+13	6.87E+12
10.25	8.00E+13	5.12E+12
9.75	8.72E+13	4.93E+12
9.25	9.17E+13	5.36E+12
8.75	9.32E+13	5.37E+12
8.25	9.44E+13	5.71E+12
7.75	9.52E+13	5.58E+12
7.25	9.61E+13	5.59E+12
6.75	9.77E+13	5.43E+12
6.25	9.95E+13	5.04E+12
5.75	9.99E+13	5.09E+12
5.25	1.01E+14	5.93E+12
4.75	1.01E+14	6.14E+12
4.25	1.01E+14	6.30E+12
3.75	1.02E+14	6.19E+12
3.25	1.03E+14	5.98E+12
2.75	1.03E+14	5.91E+12
2.25	1.05E+14	5.08E+12
1.75	1.06E+14	4.91E+12
1.25	1.06E+14	5.40E+12
0.75	1.06E+14	6.09E+12
0.25	1.04E+14	6.05E+12
-0.25	1.04E+14	6.36E+12
-0.75	1.04E+14	6.30E+12
-1.25	1.03E+14	6.12E+12
-1.75	1.03E+14	5.87E+12
-2.25	1.02E+14	5.19E+12

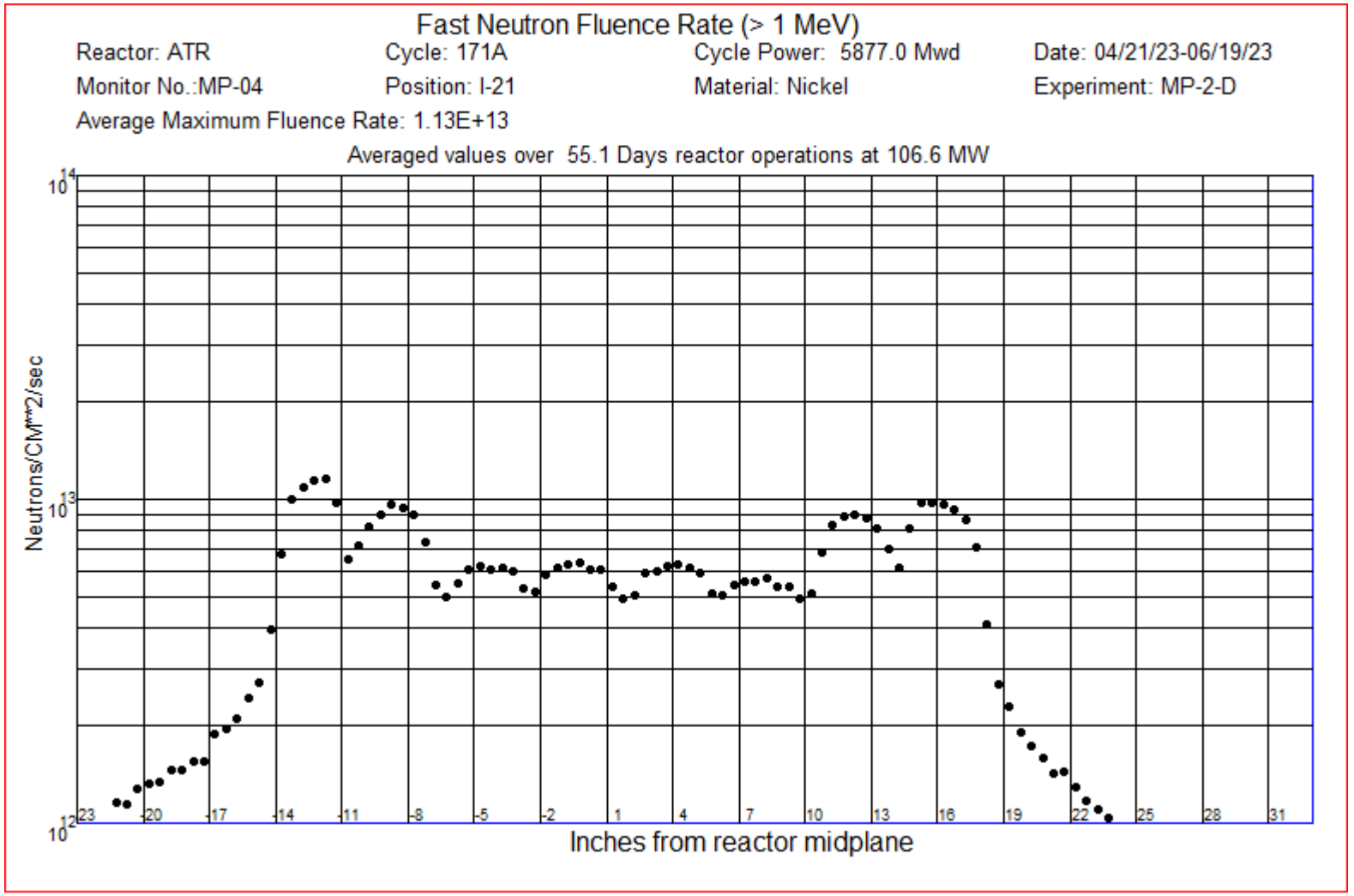
-2.75	1.02E+14	5.31E+12
-3.25	1.02E+14	5.98E+12
-3.75	1.00E+14	6.11E+12
-4.25	9.91E+13	6.10E+12
-4.75	9.83E+13	6.20E+12
-5.25	9.67E+13	6.03E+12
-5.75	9.61E+13	5.49E+12
-6.25	9.41E+13	5.01E+12
-6.75	9.08E+13	5.44E+12
-7.25	8.63E+13	7.34E+12
-7.75	8.20E+13	8.91E+12
-8.25	8.19E+13	9.42E+12
-8.75	8.12E+13	9.60E+12
-9.25	8.01E+13	8.92E+12
-9.75	7.77E+13	8.22E+12
-10.25	7.41E+13	7.18E+12
-10.75	7.03E+13	6.53E+12
-11.25	6.93E+13	9.76E+12
-11.75	6.53E+13	1.16E+13
-12.25	6.45E+13	1.15E+13
-12.75	6.33E+13	1.09E+13
-13.25	6.24E+13	1.00E+13
-13.75	5.99E+13	6.78E+12
-14.25	5.80E+13	3.94E+12
-14.75	5.51E+13	2.70E+12
-15.25	6.00E+13	2.42E+12
-15.75	6.05E+13	2.10E+12
-16.25	5.83E+13	1.96E+12
-16.75	5.37E+13	1.89E+12
-17.25	5.06E+13	1.56E+12
-17.75	4.78E+13	1.55E+12
-18.25	4.43E+13	1.45E+12
-18.75	4.10E+13	1.46E+12
-19.25	3.61E+13	1.34E+12
-19.75	3.04E+13	1.33E+12
-20.25	1.82E+13	1.27E+12
-20.75	8.19E+10	1.15E+12
-21.25	2.72E+10	1.16E+12

CENTER LINE FLU. RATE	1.04E+14	6.36E+12
AVG. MAX. FLU. RATE	1.06E+14	1.13E+13
MAX. FLU. RATE/MW (AVG.)	NA	NA
K FACTOR	268.55	2837.27
RESONANCE CORRECTION	0.98	NA
C/L. BURNOUT CORRECTION	1.001	1.666
BACKGROUND (COUNTS/SEC.)	1.36	1.36
CHECK SOURCE (COUNTS/SEC.)		
07/24/23 09:43	3568.	3568.


Thermal Neutron Fluence Rate (2200 M/S)
Reactor: ATR
Cycle: 171A
Cycle Power: 5877.0 Mwd
Date: 04/21/23-06/19/23
Monitor No.:MP-03
Position: I-21
Material:0.5000 %CoAl
Experiment: MP-2-C
Average Maximum Fluence Rate: 6.18E+13
Averaged values over 55.1 Days reactor operations at 106.6 MW
Neutrons/CM**2/sec
10^14
10^13
10^12
-23
-20
-17
-14
-11
-8
-5
-2
1
4
7
10
13
16
19
22
25
28
31
Inches from reactor midplane


Fast Neutron Fluence Rate (> 1 MeV)
Reactor: ATR
Cycle: 171A
Cycle Power: 5877.0 Mwd
Date: 04/21/23-06/19/23
Monitor No.:MP-03
Position: I-21
Material: Nickel
Experiment: MP-2-C
Average Maximum Fluence Rate: 8.36E+12
Averaged values over 55.1 Days reactor operations at 106.6 MW
Neutrons/CM**2/sec
10^13
10^12
10^11
-23
-20
-17
-14
-11
-8
-5
-2
1
4
7
10
13
16
19
22
25
28
31
Inches from reactor midplane


Thermal Neutron Fluence Rate (2200 M/S)
Reactor: ATR
Cycle: 171A
Cycle Power: 5877.0 Mwd
Date: 04/21/23-06/19/23
Monitor No.:MP-04
Position: I-21
Material:0.5000 %CoAl
Experiment: MP-2-D
Average Maximum Fluence Rate: 1.06E+14
Averaged values over 55.1 Days reactor operations at 106.6 MW
Neutrons/CM**2/sec
10^15
10^14
10^13
-23
-20
-17
-14
-11
-8
-5
-2
1
4
7
10
13
16
19
22
25
28
31
Inches from reactor midplane


Fast Neutron Fluence Rate (> 1 MeV)
Reactor: ATR
Cycle: 171A
Cycle Power: 5877.0 Mwd
Date: 04/21/23-06/19/23
Monitor No.:MP-04
Position: I-21
Material: Nickel
Experiment: MP-2-D
Average Maximum Fluence Rate: 1.13E+13
Averaged values over 55.1 Days reactor operations at 106.6 MW
Neutrons/CM**2/sec
10^14
10^13
10^12
-23
-20
-17
-14
-11
-8
-5
-2
1
4
7
10
13
16
19
22
25
28
31
Inches from reactor midplane

The following are supplemental measurements for MP-2 holders 01 – 04 during cycle 171A.
The “RML Flux Data Sheet”s include ionization chamber measurement results (most notably k-factors for both Ni and Co wires for the holders.
Then the raw NaI measurement results for each holder are listed.
The multiplication of the raw NaI net count rates for each position can be multiplied by the corresponding k-factor (wire and holder) to determine the specific activity of the wire at that location.
Specific activity is in terms of “Bq/mg” where mg is defined as the mass of the wire.
A correction must be applied for the purity of the wire.
In the case of Ni, that is nominally 97% pure.
For Co, it is nominally 0.1% or 0.5% depending on the holder (defined in the Flux Data Sheet).

RML FLUX DATA SHEET

Cycle: 171A
Percent CoAl: 0.1000
Starting Date: 042123
End Date: 061923

Average Power:

NW	NE	C	SW	SE
19.85	18.81	20.41	24.78	22.80

Reactor power: 106.66
EFPD: 55.1
Days Down: 57.0
Ion Chamber (Date): 081523

Date Sample	Sample Number	Wire	Position	Exper. Number	Res. Table	Cut Location	Ion Cham. Reading	Dis/Sec FAC (E7)	Weight	Net Count/S	K-Factor	Avg. K-Factor	Avg. Comp K-Factor
072423	MP-01	Co	B-9	MP-2-A	5	1275	0.355	1.722	5.18	887	1330		
072523	MP-02	Co	B-9	MP-2-B	5	1550	0.635	1.749	5.89	1332	1416	1373	1373

COBALT K-FACTORS

THERE ARE NO K-FACTORS WHICH DEVIATE BY GREATER THAN 5%

THE STANDARD DEVIATION FOR COBALT K-FACTORS: 4.066E+01
THE STANDARD DEVIATION OF THE MEAN: 2.875E+01

CYCLE: 171A

Date Sample	Sample Number	Wire	Position	Exper. Number	Res. Table	Cut Location	Ion Cham. Reading	Dis/Sec FAC (E7)	Weight	Net Count/S	K-Factor	Avg. K-Factor	Avg. Comp K-Factor
072423	MP-01	Ni	B-9	MP-2-A	5	1350	0.387	3.865	6.18	893	2710		
072523	MP-02	Ni	B-9	MP-2-B	5	1525	0.268	3.848	6.14	592	2838	2774	

NICKEL K-FACTORS

THERE ARE NO K-FACTORS WHICH DEVIATE BY GREATER THAN 5%

THE STANDARD DEVIATION FOR NICKEL K-FACTORS: 6.099E+01
THE STANDARD DEVIATION OF THE MEAN: 4.312E+01

RML WIRE SCANNER
RESULTS OF SCAN MP-01 Date:24-JUL-23

SCAN ID: MP-01 COBALT---CREATED: 12:23:51 24-JUL-23
BACKGROUND: TOTAL= 5.440E+02 COUNTS IN REGION=8.5000E+01 CPS= 1.43

POS	TOTAL	C/S	NET C/S
1	728.0	24.68	23.25
50	1178.0	39.93	38.50
50	1178.0	39.93	38.50
100	1718.0	58.24	56.81
150	2594.0	87.93	86.50
200	3394.0	115.05	113.62
250	4634.0	157.08	155.66
300	5748.0	194.85	193.42
300	5748.0	194.85	193.42
325	6360.0	215.59	214.16
350	6998.0	237.22	235.79
375	7686.0	260.54	259.11
400	8578.0	290.78	289.35
425	9428.0	319.59	318.16
450	10253.0	347.56	346.13
475	10997.0	372.78	371.35
500	11578.0	392.47	391.05
525	12560.0	425.76	424.33
550	13297.0	450.75	449.32
575	14155.0	479.83	478.40
600	14697.0	498.20	496.77
625	15532.0	526.51	525.08
650	15842.0	537.02	535.59
675	16511.0	559.69	558.27
700	17127.0	580.58	579.15
725	17553.0	595.02	593.59
750	18176.0	616.14	614.71
775	18938.0	641.97	640.54
800	19267.0	653.12	651.69
825	20088.0	680.95	679.52
850	20206.0	684.95	683.52
875	20545.0	696.44	695.01
900	21046.0	713.42	712.00
925	21439.0	726.75	725.32
950	21783.0	738.41	736.98
975	22308.0	756.20	754.77
1000	22883.0	775.69	774.27
1025	23499.0	796.58	795.15
1050	24063.0	815.69	814.27
1075	23916.0	810.71	809.28
1100	24075.0	816.10	814.67
1125	24405.0	827.29	825.86
1150	24429.0	828.10	826.67
1175	24902.0	844.14	842.71
1200	25279.0	856.92	855.49
1225	25066.0	849.69	848.27
1250	25918.0	878.58	877.15
1275	25885.0	877.46	876.03
1300	25539.0	865.73	864.30
1325	25743.0	872.64	871.22
1350	25597.0	867.69	866.27
1375	25657.0	869.73	868.30
1400	25804.0	874.71	873.28
1425	26638.0	902.98	901.55
1450	27322.0	926.17	924.74
1475	27376.0	928.00	926.57
1500	26970.0	914.24	912.81
1525	26064.0	883.53	882.10
1550	25668.0	870.10	868.67
1575	25501.0	864.44	863.01
1600	25687.0	870.75	869.32
1625	25352.0	859.39	857.96
1650	25882.0	877.36	875.93

1675	26364.0	893.69	892.27
1700	25733.0	872.31	870.88
1725	25328.0	858.58	857.15
1750	24660.0	835.93	834.50
1775	24586.0	833.42	832.00
1800	24745.0	838.81	837.39
1825	24703.0	837.39	835.96
1850	24356.0	825.63	824.20
1875	24532.0	831.59	830.16
1900	24413.0	827.56	826.13
1925	23715.0	803.90	802.47
1950	22859.0	774.88	773.45
1975	22377.0	758.54	757.11
2000	21822.0	739.73	738.30
2025	21569.0	731.15	729.72
2050	21731.0	736.64	735.22
2075	21077.0	714.47	713.05
2100	20990.0	711.53	710.10
2125	20637.0	699.56	698.13
2150	19975.0	677.12	675.69
2175	19500.0	661.02	659.59
2200	18558.0	629.08	627.66
2225	17883.0	606.20	604.77
2250	17425.0	590.68	589.25
2275	16838.0	570.78	569.35
2300	16646.0	564.27	562.84
2325	16112.0	546.17	544.74
2350	15439.0	523.36	521.93
2375	14328.0	485.69	484.27
2400	14121.0	478.68	477.25
2425	13546.0	459.19	457.76
2450	12798.0	433.83	432.40
2475	12068.0	409.08	407.66
2500	11084.0	375.73	374.30
2525	10549.0	357.59	356.16
2550	10066.0	341.22	339.79
2575	9137.0	309.73	308.30
2600	193.0	6.54	5.11

SCAN ID: MP-01 NICKEL---CREATED: 12:23:51 24-JUL-23
BACKGROUND: TOTAL= 5.440E+02 COUNTS IN REGION=8.5000E+01 CPS= 1.43

POS	TOTAL	C/S	NET C/S
1	1361.0	46.14	44.71
50	1572.0	53.29	51.86
50	1572.0	53.29	51.86
100	1944.0	65.90	64.47
150	2408.0	81.63	80.20
200	3094.0	104.88	103.45
250	3833.0	129.93	128.50
300	4604.0	156.07	154.64
300	4604.0	156.07	154.64
325	4926.0	166.98	165.55
350	5395.0	182.88	181.45
375	5758.0	195.19	193.76
400	6004.0	203.53	202.10
425	6432.0	218.03	216.61
450	6808.0	230.78	229.35
475	7196.0	243.93	242.50
500	7331.0	248.51	247.08
525	7540.0	255.59	254.16
550	7893.0	267.56	266.13
575	8312.0	281.76	280.33
600	8724.0	295.73	294.30
625	9417.0	319.22	317.79
650	10306.0	349.36	347.93
675	11670.0	395.59	394.16
700	12292.0	416.68	415.25
725	12735.0	431.69	430.27
750	12570.0	426.10	424.67
775	13298.0	450.78	449.35
800	13005.0	440.85	439.42
825	12309.0	417.25	415.83
850	12848.0	435.53	434.10
875	14145.0	479.49	478.06
900	14880.0	504.41	502.98
925	15223.0	516.03	514.61
950	15064.0	510.64	509.22
975	14719.0	498.95	497.52
1000	13878.0	470.44	469.01
1025	12470.0	422.71	421.28
1050	12390.0	420.00	418.57
1075	14006.0	474.78	473.35
1100	15571.0	527.83	526.40
1125	16316.0	553.08	551.66
1150	16538.0	560.61	559.18
1175	16490.0	558.98	557.55
1200	16466.0	558.17	556.74
1225	15394.0	521.83	520.40
1250	14318.0	485.36	483.93
1275	16213.0	549.59	548.16
1300	17562.0	595.32	593.89
1325	18092.0	613.29	611.86
1350	18748.0	635.53	634.10
1375	18422.0	624.47	623.05
1400	17683.0	599.42	598.00
1425	15866.0	537.83	536.40
1450	13479.0	456.92	455.49
1475	13375.0	453.39	451.96
1500	15982.0	541.76	540.33
1525	17732.0	601.08	599.66
1550	18288.0	619.93	618.50
1575	18345.0	621.86	620.44
1600	18062.0	612.27	610.84
1625	18216.0	617.49	616.06
1650	15926.0	539.86	538.44
1675	13760.0	466.44	465.01
1700	14583.0	494.34	492.91
1725	15622.0	529.56	528.13
1750	15940.0	540.34	538.91

1775	16007.0	542.61	541.18
1800	16272.0	551.59	550.16
1825	15154.0	513.69	512.27
1850	13932.0	472.27	470.84
1875	12839.0	435.22	433.79
1900	13436.0	455.46	454.03
1925	14544.0	493.02	491.59
1950	15406.0	522.24	520.81
1975	15648.0	530.44	529.01
2000	15785.0	535.08	533.66
2025	15493.0	525.19	523.76
2050	14519.0	492.17	490.74
2075	12763.0	432.64	431.22
2100	12634.0	428.27	426.84
2125	13065.0	442.88	441.45
2150	13184.0	446.92	445.49
2175	12986.0	440.20	438.77
2200	12908.0	437.56	436.13
2225	12637.0	428.37	426.94
2250	11251.0	381.39	379.96
2275	9948.0	337.22	335.79
2300	9407.0	318.88	317.45
2325	8996.0	304.95	303.52
2350	8634.0	292.68	291.25
2375	8002.0	271.25	269.83
2400	7960.0	269.83	268.40
2425	7470.0	253.22	251.79
2450	7483.0	253.66	252.23
2475	6972.0	236.34	234.91
2500	6713.0	227.56	226.13
2525	6131.0	207.83	206.40
2550	5888.0	199.59	198.16
2575	5850.0	198.31	196.88
2600	39.0	1.32	0.00

RML WIRE SCANNER
RESULTS OF SCAN MP-02 Date:25-JUL-23

SCAN ID: MP-02 COBALT---CREATED: 11:16:32 25-JUL-23
BACKGROUND: TOTAL= 8.070E+02 COUNTS IN REGION=1.5100E+02 CPS= 1.26

POS	TOTAL	C/S	NET C/S
1	717.0	24.31	23.04
50	1194.0	40.47	39.21
50	1194.0	40.47	39.21
100	2157.0	73.12	71.86
150	3246.0	110.03	108.77
200	4471.0	151.56	150.30
250	5926.0	200.88	199.62
300	7514.0	254.71	253.45
300	7514.0	254.71	253.45
325	8527.0	289.05	287.79
350	9368.0	317.56	316.30
375	10509.0	356.24	354.97
400	11646.0	394.78	393.52
425	12878.0	436.54	435.28
450	14298.0	484.68	483.41
475	15276.0	517.83	516.57
500	16284.0	552.00	550.74
525	17612.0	597.02	595.75
550	19290.0	653.90	652.63
575	20343.0	689.59	688.33
600	21489.0	728.44	727.18
625	22083.0	748.58	747.31
650	22580.0	765.42	764.16
675	22872.0	775.32	774.06
700	23561.0	798.68	797.41
725	24176.0	819.53	818.26
750	25771.0	873.59	872.33
775	26620.0	902.37	901.11
800	27646.0	937.15	935.89
825	28438.0	964.00	962.74
850	29262.0	991.93	990.67
875	29844.0	1011.66	1010.40
900	30581.0	1036.64	1035.38
925	30849.0	1045.73	1044.47
950	31604.0	1071.32	1070.06
975	32773.0	1110.95	1109.69
1000	33344.0	1130.31	1129.04
1025	34004.0	1152.68	1151.41
1050	34963.0	1185.19	1183.92
1075	34816.0	1180.20	1178.94
1100	35116.0	1190.37	1189.11
1125	35408.0	1200.27	1199.01
1150	35761.0	1212.24	1210.97
1175	36077.0	1222.95	1221.69
1200	36538.0	1238.58	1237.31
1225	36940.0	1252.20	1250.94
1250	37812.0	1281.76	1280.50
1275	37281.0	1263.76	1262.50
1300	37332.0	1265.49	1264.23
1325	37937.0	1286.00	1284.74
1350	38377.0	1300.92	1299.65
1375	38513.0	1305.53	1304.26
1400	38348.0	1299.93	1298.67
1425	38513.0	1305.53	1304.26
1450	39548.0	1340.61	1339.35
1475	39605.0	1342.54	1341.28
1500	38962.0	1320.75	1319.48
1525	38499.0	1305.05	1303.79
1550	38816.0	1315.80	1314.53
1575	38567.0	1307.36	1306.09
1600	38251.0	1296.64	1295.38
1625	38364.0	1300.47	1299.21
1650	37528.0	1272.14	1270.87

1675	38144.0	1293.02	1291.75
1700	37396.0	1267.66	1266.40
1725	37522.0	1271.93	1270.67
1750	36862.0	1249.56	1248.30
1775	35842.0	1214.98	1213.72
1800	35934.0	1218.10	1216.84
1825	35451.0	1201.73	1200.47
1850	35150.0	1191.53	1190.26
1875	35552.0	1205.15	1203.89
1900	35084.0	1189.29	1188.02
1925	34416.0	1166.64	1165.38
1950	33611.0	1139.36	1138.09
1975	32948.0	1116.88	1115.62
2000	32725.0	1109.32	1108.06
2025	31903.0	1081.46	1080.19
2050	31334.0	1062.17	1060.91
2075	30707.0	1040.92	1039.65
2100	30257.0	1025.66	1024.40
2125	28865.0	978.47	977.21
2150	28083.0	951.97	950.70
2175	27503.0	932.31	931.04
2200	26407.0	895.15	893.89
2225	25784.0	874.03	872.77
2250	25086.0	850.37	849.11
2275	24937.0	845.32	844.06
2300	24409.0	827.42	826.16
2325	24259.0	822.34	821.08
2350	23114.0	783.53	782.26
2375	22319.0	756.58	755.31
2400	20665.0	700.51	699.24
2425	19558.0	662.98	661.72
2450	18538.0	628.41	627.14
2475	17601.0	596.64	595.38
2500	16370.0	554.92	553.65
2525	15221.0	515.97	514.70
2550	14140.0	479.32	478.06
2575	13292.0	450.58	449.31
2600	3302.0	111.93	110.67

SCAN ID: MP-02 NICKEL---CREATED: 11:16:32 25-JUL-23
BACKGROUND: TOTAL= 8.070E+02 COUNTS IN REGION=1.5100E+02 CPS= 1.26

POS	TOTAL	C/S	NET C/S
1	1551.0	52.58	51.31
50	1934.0	65.56	64.30
50	1934.0	65.56	64.30
100	2366.0	80.20	78.94
150	2993.0	101.46	100.19
200	3793.0	128.58	127.31
250	4706.0	159.53	158.26
300	5568.0	188.75	187.48
300	5568.0	188.75	187.48
325	6054.0	205.22	203.96
350	6568.0	222.64	221.38
375	6752.0	228.88	227.62
400	7265.0	246.27	245.01
425	7448.0	252.47	251.21
450	7788.0	264.00	262.74
475	8059.0	273.19	271.92
500	8409.0	285.05	283.79
525	8763.0	297.05	295.79
550	8787.0	297.86	296.60
575	9120.0	309.15	307.89
600	9419.0	319.29	318.02
625	9725.0	329.66	328.40
650	10815.0	366.61	365.35
675	12012.0	407.19	405.92
700	12888.0	436.88	435.62
725	13799.0	467.76	466.50
750	13822.0	468.54	467.28
775	13760.0	466.44	465.18
800	13513.0	458.07	456.80
825	13050.0	442.37	441.11
850	12313.0	417.39	416.13
875	12972.0	439.73	438.47
900	13413.0	454.68	453.41
925	13654.0	462.85	461.58
950	13706.0	464.61	463.35
975	13470.0	456.61	455.35
1000	13619.0	461.66	460.40
1025	12897.0	437.19	435.92
1050	12306.0	417.15	415.89
1075	12613.0	427.56	426.30
1100	13204.0	447.59	446.33
1125	13614.0	461.49	460.23
1150	13886.0	470.71	469.45
1175	13946.0	472.75	471.48
1200	13878.0	470.44	469.18
1225	13408.0	454.51	453.24
1250	12909.0	437.59	436.33
1275	12695.0	430.34	429.08
1300	13044.0	442.17	440.91
1325	12976.0	439.86	438.60
1350	13040.0	442.03	440.77
1375	13181.0	446.81	445.55
1400	13112.0	444.47	443.21
1425	13006.0	440.88	439.62
1450	12741.0	431.90	430.63
1475	12220.0	414.24	412.97
1500	12039.0	408.10	406.84
1525	12312.0	417.36	416.09
1550	12931.0	438.34	437.08
1575	12814.0	434.37	433.11
1600	13286.0	450.37	449.11
1625	13251.0	449.19	447.92
1650	13179.0	446.75	445.48
1675	13083.0	443.49	442.23
1700	13332.0	451.93	450.67
1725	13707.0	464.64	463.38
1750	14217.0	481.93	480.67

1775	14254.0	483.19	481.92
1800	13999.0	474.54	473.28
1825	13647.0	462.61	461.35
1850	13440.0	455.59	454.33
1875	12923.0	438.07	436.80
1900	12726.0	431.39	430.13
1925	12998.0	440.61	439.35
1950	13335.0	452.03	450.77
1975	13709.0	464.71	463.45
2000	13545.0	459.15	457.89
2025	13591.0	460.71	459.45
2050	13082.0	443.46	442.19
2075	12809.0	434.20	432.94
2100	12603.0	427.22	425.96
2125	13277.0	450.07	448.80
2150	14116.0	478.51	477.24
2175	14252.0	483.12	481.86
2200	13839.0	469.12	467.86
2225	14120.0	478.64	477.38
2250	13297.0	450.75	449.48
2275	12336.0	418.17	416.91
2300	10964.0	371.66	370.40
2325	9813.0	332.64	331.38
2350	9643.0	326.88	325.62
2375	9276.0	314.44	313.18
2400	8647.0	293.12	291.86
2425	8208.0	278.24	276.97
2450	8270.0	280.34	279.08
2475	8052.0	272.95	271.69
2500	7994.0	270.98	269.72
2525	7369.0	249.80	248.53
2550	7481.0	253.59	252.33
2575	7413.0	251.29	250.02
2600	5851.0	198.34	197.08

RML FLUX DATA SHEET

Cycle: 171A
Percent CoAl: 0.5000
Starting Date: 042123
End Date: 061923

Average Power:

19.85	18.81	20.41	24.78	22.80
NW	NE	C	SW	SE

Reactor power: 106.66
EFPD: 55.1
Days Down: 57.0
Ion Chamber (Date): 081523

Date Sample	Sample Number	Wire	Position	Exper. Number	Res. Table	Cut Location	Ion Cham. Reading	Dis/Sec FAC (E7)	Weight	Net Count/S	K-Factor	Avg. K-Factor	Avg. Comp K-Factor
072023	MP-03	Co	I-21	MP-2-C	6	1600	0.756	1.761	6.39	1665	1251		
072423	MP-04	Co	I-21	MP-2-D	6	1475	1.470	1.823	6.89	2896	1343	1297	259

COBALT K-FACTORS

THERE ARE NO K-FACTORS WHICH DEVIATE BY GREATER THAN 5%

THE STANDARD DEVIATION FOR COBALT K-FACTORS: 4.379E+01
THE STANDARD DEVIATION OF THE MEAN: 3.097E+01

CYCLE: 171A

Date Sample	Sample Number	Wire	Position	Exper. Number	Res. Table	Cut Location	Ion Cham. Reading	Dis/Sec FAC (E7)	Weight	Net Count/S	K-Factor	Avg. K-Factor	Avg. Comp K-Factor
072023	MP-03	Ni	I-21	MP-2-C	6	1350	0.166	3.824	4.65	471	2900		
072423	MP-04	Ni	I-21	MP-2-D	6	1150	0.108	3.824	5.32	274	2837	2868	

NICKEL K-FACTORS

THERE ARE NO K-FACTORS WHICH DEVIATE BY GREATER THAN 5%

THE STANDARD DEVIATION FOR NICKEL K-FACTORS: 2.971E+01
THE STANDARD DEVIATION OF THE MEAN: 2.101E+01

RML WIRE SCANNER
RESULTS OF SCAN MP-03 Date:20-JUL-23

SCAN ID: MP-03 COBALT---CREATED: 16:50:55 20-JUL-23
BACKGROUND: TOTAL= 5.390E+02 COUNTS IN REGION=8.9000E+01 CPS= 1.50

POS	TOTAL	C/S	NET C/S
1	912.0	30.92	29.42
50	1459.0	49.46	47.96
50	1459.0	49.46	47.96
100	2392.0	81.08	79.59
150	3829.0	129.80	128.30
200	5572.0	188.88	187.39
250	8112.0	274.98	273.49
300	11605.0	393.39	391.89
300	11605.0	393.39	391.89
325	13383.0	453.66	452.17
350	15038.0	509.76	508.27
375	16876.0	572.07	570.57
400	18614.0	630.98	629.49
425	20394.0	691.32	689.83
450	21476.0	728.00	726.50
475	23480.0	795.93	794.44
500	24583.0	833.32	831.83
525	26065.0	883.56	882.06
550	26912.0	912.27	910.78
575	27805.0	942.54	941.05
600	28401.0	962.75	961.25
625	27570.0	934.58	933.08
650	25666.0	870.03	868.54
675	26264.0	890.31	888.81
700	27772.0	941.42	939.93
725	28661.0	971.56	970.06
750	28958.0	981.63	980.13
775	29225.0	990.68	989.18
800	28563.0	968.24	966.74
825	28394.0	962.51	961.01
850	28844.0	977.76	976.27
875	30378.0	1029.76	1028.27
900	31958.0	1083.32	1081.83
925	33027.0	1119.56	1118.06
950	34163.0	1158.07	1156.57
975	34176.0	1158.51	1157.01
1000	34452.0	1167.86	1166.37
1025	36938.0	1252.14	1250.64
1050	41845.0	1418.47	1416.98
1075	42779.0	1450.14	1448.64
1100	42177.0	1429.73	1428.23
1125	42443.0	1438.75	1437.25
1150	43282.0	1467.19	1465.69
1175	43964.0	1490.31	1488.81
1200	44267.0	1500.58	1499.08
1225	46049.0	1615.75	1614.26
1250	48315.0	1695.26	1693.77
1275	47950.0	1682.46	1680.96
1300	46696.0	1638.46	1636.96
1325	46061.0	1616.18	1614.68
1350	46035.0	1615.26	1613.77
1375	46760.0	1640.70	1639.21
1400	47064.0	1651.37	1649.87
1425	48391.0	1697.93	1696.43
1450	51678.0	1813.26	1811.77
1475	52206.0	1831.79	1830.29
1500	49793.0	1747.12	1745.63
1525	47852.0	1679.02	1677.52
1550	46913.0	1646.07	1644.57
1575	46994.0	1648.91	1647.42
1600	46969.0	1648.04	1646.54
1625	47785.0	1676.67	1675.17

1650	48481.0	1701.09	1699.59
1675	50325.0	1765.79	1764.29
1700	47807.0	1677.44	1675.94
1725	46097.0	1617.44	1615.94
1750	45305.0	1535.76	1534.27
1775	44448.0	1506.71	1505.22
1800	43865.0	1486.95	1485.45
1825	43509.0	1474.88	1473.39
1850	43979.0	1490.81	1489.32
1875	43193.0	1464.17	1462.67
1900	39444.0	1337.08	1335.59
1925	35868.0	1215.86	1214.37
1950	35891.0	1216.64	1215.15
1975	35315.0	1197.12	1195.62
2000	35061.0	1188.51	1187.01
2025	33529.0	1136.58	1135.08
2050	31526.0	1068.68	1067.18
2075	29640.0	1004.75	1003.25
2100	29559.0	1002.00	1000.50
2125	29141.0	987.83	986.33
2150	30360.0	1029.15	1027.66
2175	30137.0	1021.59	1020.10
2200	30172.0	1022.78	1021.28
2225	28901.0	979.69	978.20
2250	27601.0	935.63	934.13
2275	26139.0	886.07	884.57
2300	28100.0	952.54	951.05
2325	28255.0	957.80	956.30
2350	27811.0	942.75	941.25
2375	26856.0	910.37	908.88
2400	25713.0	871.63	870.13
2425	24347.0	825.32	823.83
2450	23111.0	783.42	781.93
2475	21093.0	715.02	713.52
2500	19034.0	645.22	643.72
2525	16825.0	570.34	568.84
2550	14188.0	480.95	479.45
2575	13226.0	448.34	446.84
2600	461.0	15.63	14.13

SCAN ID: MP-03 NICKEL---CREATED: 16:50:55 20-JUL-23
BACKGROUND: TOTAL= 5.390E+02 COUNTS IN REGION=8.9000E+01 CPS= 1.50

POS	TOTAL	C/S	NET C/S
1	319.0	10.81	9.32
50	392.0	13.29	11.79
50	392.0	13.29	11.79
100	415.0	14.07	12.57
150	530.0	17.97	16.47
200	639.0	21.66	20.17
250	765.0	25.93	24.44
300	925.0	31.36	29.86
300	925.0	31.36	29.86
325	1048.0	35.53	34.03
350	1071.0	36.31	34.81
375	1171.0	39.69	38.20
400	1247.0	42.27	40.78
425	1383.0	46.88	45.39
450	1406.0	47.66	46.17
475	1507.0	51.08	49.59
500	1479.0	50.14	48.64
525	1589.0	53.86	52.37
550	1733.0	58.75	57.25
575	2074.0	70.31	68.81
600	2455.0	83.22	81.72
625	3237.0	109.73	108.23
650	4191.0	142.07	140.57
675	6506.0	220.54	219.05
700	7627.0	258.54	257.05
725	8011.0	271.56	270.06
750	8349.0	283.02	281.52
775	8036.0	272.41	270.91
800	7363.0	249.59	248.10
825	6841.0	231.90	230.40
850	7755.0	262.88	261.39
875	9937.0	336.85	335.35
900	10147.0	343.97	342.47
925	11023.0	373.66	372.17
950	11562.0	391.93	390.44
975	11258.0	381.63	380.13
1000	10092.0	342.10	340.61
1025	7133.0	241.80	240.30
1050	5856.0	198.51	197.01
1075	7815.0	264.92	263.42
1100	9379.0	317.93	316.44
1125	9268.0	314.17	312.67
1150	9588.0	325.02	323.52
1175	10610.0	359.66	358.17
1200	10357.0	351.08	349.59
1225	8766.0	297.15	295.66
1250	6615.0	224.24	222.74
1275	7619.0	258.27	256.78
1300	10322.0	349.90	348.40
1325	10472.0	354.98	353.49
1350	10299.0	349.12	347.62
1375	10561.0	358.00	356.50
1400	10051.0	340.71	339.22
1425	8304.0	281.49	280.00
1450	5486.0	185.97	184.47
1475	5718.0	193.83	192.33
1500	7259.0	246.07	244.57
1525	8330.0	282.37	280.88
1550	10198.0	345.69	344.20
1575	10563.0	358.07	356.57
1600	10280.0	348.47	346.98
1625	9381.0	318.00	316.50
1650	7688.0	260.61	259.11
1675	6641.0	225.12	223.62
1700	8162.0	276.68	275.18
1725	9591.0	325.12	323.62
1750	9469.0	320.98	319.49

1775	9375.0	317.80	316.30
1800	9281.0	314.61	313.11
1825	9145.0	310.00	308.50
1850	7711.0	261.39	259.89
1875	6032.0	204.47	202.98
1900	6515.0	220.85	219.35
1925	8506.0	288.34	286.84
1950	10646.0	360.88	359.39
1975	10723.0	363.49	362.00
2000	10276.0	348.34	346.84
2025	10438.0	353.83	352.33
2050	9494.0	321.83	320.33
2075	7375.0	250.00	248.50
2100	7187.0	243.63	242.13
2125	7614.0	258.10	256.61
2150	7871.0	266.81	265.32
2175	7641.0	259.02	257.52
2200	7608.0	257.90	256.40
2225	7147.0	242.27	240.78
2250	5986.0	202.92	201.42
2275	4327.0	146.68	145.18
2300	2944.0	99.80	98.30
2325	2334.0	79.12	77.62
2350	1994.0	67.59	66.10
2375	2002.0	67.86	66.37
2400	1772.0	60.07	58.57
2425	1665.0	56.44	54.94
2450	1600.0	54.24	52.74
2475	1437.0	48.71	47.22
2500	1313.0	44.51	43.01
2525	1188.0	40.27	38.78
2550	1211.0	41.05	39.56
2575	1081.0	36.64	35.15
2600	471.0	15.97	14.47

RML WIRE SCANNER
RESULTS OF SCAN MP-04 Date:24-JUL-23

SCAN ID: MP-04 COBALT---CREATED: 16:23:42 24-JUL-23
BACKGROUND: TOTAL= 5.220E+02 COUNTS IN REGION=8.1000E+01 CPS= 1.36

POS	TOTAL	C/S	NET C/S
1	1070.0	36.27	34.91
50	1632.0	55.32	53.96
50	1632.0	55.32	53.96
100	2553.0	86.54	85.18
150	4357.0	147.69	146.33
200	7027.0	238.20	236.84
250	11722.0	397.36	395.99
300	18001.0	610.20	608.84
300	18001.0	610.20	608.84
325	20979.0	711.15	709.79
350	23065.0	781.86	780.50
375	25960.0	880.00	878.64
400	28245.0	957.46	956.10
425	31021.0	1051.56	1050.20
450	33319.0	1129.46	1128.10
475	36355.0	1232.37	1231.01
500	37849.0	1283.02	1281.66
525	39944.0	1354.03	1352.67
550	41635.0	1411.36	1409.99
575	42937.0	1455.49	1454.13
600	43692.0	1481.08	1479.72
625	43831.0	1485.80	1484.44
650	41485.0	1406.27	1404.91
675	40363.0	1368.24	1366.88
700	41894.0	1420.14	1418.77
725	43267.0	1466.68	1465.32
750	44483.0	1560.81	1559.45
775	44525.0	1562.28	1560.92
800	45714.0	1604.00	1602.64
825	47311.0	1660.04	1658.67
850	48899.0	1715.75	1714.39
875	51669.0	1812.95	1811.59
900	54591.0	1915.47	1914.11
925	55945.0	1962.98	1961.62
950	57194.0	2006.81	2005.45
975	57182.0	2006.39	2005.02
1000	58032.0	2036.21	2034.85
1025	61533.0	2159.05	2157.69
1050	67072.0	2353.40	2352.04
1075	70494.0	2473.47	2472.11
1100	71614.0	2512.77	2511.41
1125	72494.0	2543.65	2542.29
1150	73155.0	2566.84	2565.48
1175	73786.0	2588.98	2587.62
1200	74996.0	2631.44	2630.08
1225	76406.0	2680.91	2679.55
1250	76662.0	2689.89	2688.53
1275	77248.0	2710.46	2709.09
1300	77304.0	2712.42	2711.06
1325	77681.0	2725.65	2724.29
1350	78326.0	2748.28	2746.92
1375	78933.0	2769.58	2768.22
1400	79045.0	2773.51	2772.15
1425	80228.0	2815.02	2813.66
1450	81073.0	2844.67	2843.31
1475	81545.0	2861.23	2859.87
1500	81162.0	2847.79	2846.43
1525	80112.0	2810.95	2809.59
1550	79849.0	2801.72	2800.36
1575	79607.0	2793.23	2791.87
1600	79215.0	2779.47	2778.11
1625	78666.0	2760.21	2758.85
1650	78163.0	2742.56	2741.20

1675	78192.0	2743.58	2742.22
1700	77980.0	2736.14	2734.78
1725	77101.0	2705.30	2703.94
1750	76087.0	2669.72	2668.36
1775	75492.0	2648.84	2647.48
1800	74297.0	2606.91	2605.55
1825	73828.0	2590.46	2589.09
1850	72272.0	2535.86	2534.50
1875	69819.0	2449.79	2448.43
1900	66353.0	2328.18	2326.81
1925	63057.0	2212.53	2211.16
1950	63015.0	2211.05	2209.69
1975	62492.0	2192.70	2191.34
2000	61622.0	2162.18	2160.81
2025	59848.0	2099.93	2098.57
2050	57060.0	2002.11	2000.74
2075	54168.0	1900.63	1899.27
2100	53385.0	1873.16	1871.80
2125	50374.0	1767.51	1766.15
2150	49768.0	1746.25	1744.88
2175	48838.0	1713.61	1712.25
2200	48122.0	1688.49	1687.13
2225	46196.0	1620.91	1619.55
2250	44769.0	1570.84	1569.48
2275	44036.0	1492.75	1491.38
2300	46274.0	1623.65	1622.29
2325	46717.0	1639.19	1637.83
2350	45013.0	1579.40	1578.04
2375	42900.0	1454.24	1452.88
2400	40501.0	1372.92	1371.55
2425	38274.0	1297.42	1296.06
2450	35450.0	1201.69	1200.33
2475	32846.0	1113.42	1112.06
2500	28969.0	982.00	980.64
2525	24375.0	826.27	824.91
2550	14668.0	497.22	495.86
2575	106.0	3.59	2.23
2600	62.0	2.10	0.74

SCAN ID: MP-04 NICKEL---CREATED: 16:23:42 24-JUL-23
BACKGROUND: TOTAL= 5.220E+02 COUNTS IN REGION=8.1000E+01 CPS= 1.36

POS	TOTAL	C/S	NET C/S
1	425.0	14.41	13.05
50	457.0	15.49	14.13
50	457.0	15.49	14.13
100	625.0	21.19	19.83
150	684.0	23.19	21.83
200	979.0	33.19	31.83
250	1052.0	35.66	34.30
300	1301.0	44.10	42.74
300	1301.0	44.10	42.74
325	1369.0	46.41	45.05
350	1494.0	50.64	49.28
375	1553.0	52.64	51.28
400	1622.0	54.98	53.62
425	1760.0	59.66	58.30
450	1926.0	65.29	63.93
475	1880.0	63.73	62.37
500	2072.0	70.24	68.88
525	2227.0	75.49	74.13
550	2409.0	81.66	80.30
575	2855.0	96.78	95.42
600	3341.0	113.25	111.89
625	5062.0	171.59	170.23
650	8846.0	299.86	298.50
675	10815.0	366.61	365.25
700	11622.0	393.97	392.60
725	11949.0	405.05	403.69
750	11915.0	403.90	402.54
775	11850.0	401.69	400.33
800	9800.0	332.20	330.84
825	7325.0	248.31	246.94
850	8361.0	283.42	282.06
875	9488.0	321.63	320.27
900	9989.0	338.61	337.25
925	10215.0	346.27	344.91
950	9940.0	336.95	335.59
975	9359.0	317.25	315.89
1000	7722.0	261.76	260.40
1025	5647.0	191.42	190.06
1050	5271.0	178.68	177.32
1075	5627.0	190.75	189.38
1100	5601.0	189.86	188.50
1125	5925.0	200.85	199.49
1150	5771.0	195.63	194.27
1175	5766.0	195.46	194.10
1200	5565.0	188.64	187.28
1225	5123.0	173.66	172.30
1250	5166.0	175.12	173.76
1275	6002.0	203.46	202.10
1300	6203.0	210.27	208.91
1325	6352.0	215.32	213.96
1350	6226.0	211.05	209.69
1375	5995.0	203.22	201.86
1400	5922.0	200.75	199.38
1425	5061.0	171.56	170.20
1450	4875.0	165.25	163.89
1475	5345.0	181.19	179.83
1500	6032.0	204.47	203.11
1525	6025.0	204.24	202.88
1550	6344.0	215.05	213.69
1575	6288.0	213.15	211.79
1600	6122.0	207.53	206.16
1625	5891.0	199.69	198.33
1650	5227.0	177.19	175.83
1675	5348.0	181.29	179.93
1700	6024.0	204.20	202.84
1725	6187.0	209.73	208.37
1750	6207.0	210.41	209.05

1775	6332.0	214.64	213.28
1800	6199.0	210.14	208.77
1825	5662.0	191.93	190.57
1850	5208.0	176.54	175.18
1875	5726.0	194.10	192.74
1900	7870.0	266.78	265.42
1925	9721.0	329.53	328.16
1950	10274.0	348.27	346.91
1975	10500.0	355.93	354.57
2000	9813.0	332.64	331.28
2025	9137.0	309.73	308.37
2050	8108.0	274.85	273.49
2075	7507.0	254.47	253.11
2100	11251.0	381.39	380.03
2125	13647.0	462.61	461.25
2150	13511.0	458.00	456.64
2175	12868.0	436.20	434.84
2200	11936.0	404.61	403.25
2225	8163.0	276.71	275.35
2250	4810.0	163.05	161.69
2275	3350.0	113.56	112.20
2300	2945.0	99.83	98.47
2325	2550.0	86.44	85.08
2350	2407.0	81.59	80.23
2375	2372.0	80.41	79.05
2400	1992.0	67.53	66.16
2425	2011.0	68.17	66.81
2450	1918.0	65.02	63.66
2475	1962.0	66.51	65.15
2500	1848.0	62.64	61.28
2525	1884.0	63.86	62.50
2550	1923.0	65.19	63.83
2575	1932.0	65.49	64.13
2600	1949.0	66.07	64.71