TOXECON™ RETROFIT FOR MERCURY AND MULTI-POLLUTANT CONTROL ON THREE 90-MW COAL-FIRED BOILERS

Quarterly Technical Progress Report
Reporting Period: April 1, 2006 – June 30, 2006
Report No. 41766R09

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July 31, 2006

DOE Cooperative Agreement No. DE-FC26-04NT41766

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DISCLAIMER

ABSTRACT

With the Nation's coal-burning utilities facing tighter controls on mercury pollutants, the U.S. Department of Energy is supporting projects that could offer power plant operators better ways to reduce these emissions at much lower costs. Sorbent injection technology represents one of the simplest and most mature approaches to controlling mercury emissions from coal-fired boilers. It involves injecting a solid material such as powdered activated carbon into the flue gas. The gas-phase mercury in the flue gas contacts the sorbent and attaches to its surface. The sorbent with the mercury attached is then collected by a particulate control device along with the other solid material, primarily fly ash.

We Energies has over 3,200 MW of coal-fired generating capacity and supports an integrated multi-emission control strategy for SO_2, NO_x, and mercury emissions while maintaining a varied fuel mix for electric supply. The primary goal of this project is to reduce mercury emissions from three 90-MW units that burn Powder River Basin coal at the We Energies Presque Isle Power Plant. Additional goals are to reduce nitrogen oxide (NO_x), sulfur dioxide (SO_2), and particulate matter (PM) emissions, allow for reuse and sale of fly ash, demonstrate a reliable mercury continuous emission monitor (CEM) suitable for use in the power plant environment, and demonstrate a process to recover mercury captured in the sorbent. To achieve these goals, We Energies (the Participant) will design, install, and operate a TOXECON™ system designed to clean the combined flue gases of Units 7, 8, and 9 at the Presque Isle Power Plant.

TOXECON™ is a patented process in which a fabric filter system (baghouse) installed downstream of an existing particulate control device is used in conjunction with sorbent injection for removal of pollutants from combustion flue gas. For this project, the flue gas emissions will be controlled from the three units using a single baghouse. Mercury will be controlled by injection of activated carbon or other novel sorbents, while NO_x and SO_2 will be controlled by injection of sodium-based or other novel sorbents. Addition of the TOXECON™ baghouse will provide enhanced particulate control. Sorbents will be injected downstream of the existing particulate control device to allow for continued sale and reuse of captured fly ash from the existing particulate control device, uncontaminated by activated carbon or sodium sorbents.

Methods for sorbent regeneration, i.e., mercury recovery from the sorbent, will be explored and evaluated. For mercury concentration monitoring in the flue gas streams, components available for use will be evaluated and the best available will be integrated into a mercury CEM suitable for use in the power plant environment. This project will provide for the use of a control system to reduce emissions of mercury while minimizing waste from a coal-fired power generation system.

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EXECUTIVE SUMMARY

Wisconsin Electric Power Company (We Energies) signed a Cooperative Agreement with the U.S. Department of Energy (DOE) in March 2004 to fully demonstrate TOXECON™ for mercury control at the We Energies Presque Isle Power Plant. The primary goal of this project is to reduce mercury emissions from three 90-MW units (Units 7, 8, and 9) that burn Powder River Basin (PRB) coal. Additional goals are to reduce nitrogen oxide (NO_x), sulfur dioxide (SO_2), and particulate matter (PM) emissions, allow for reuse and sale of fly ash, demonstrate a reliable mercury continuous emission monitor (CEM) suitable for use in the power plant environment, and demonstrate a process to recover mercury captured in the sorbent.

We Energies has teamed with ADA-ES, Inc., (ADA-ES) and Cummins & Barnard, Inc., (C&B) to execute this project. ADA-ES is providing engineering and management on the mercury measurement and control systems. Cummins & Barnard is the engineer of record and will be responsible for construction, management, and start-up of the TOXECON™ equipment.

This project was selected for negotiating an award in January 2003. Preliminary activities covered under the "Pre-Award" provision in the Cooperative Agreement began in March 2003. This Quarterly Technical Progress Report summarizes progress made on the project from April 1, 2006, through June 30, 2006. During this reporting period, work was conducted on the following tasks:

- Task 7. Procure Mercury Continuous Emissions Monitor (CEM) Package and Perform Engineering and Performance Assessment.
- Task 10. Erect Structural Steel, Baghouse, and Ductwork.
- Task 15. Operate, Test, Data Analysis, and Optimize TOXECON™ for Mercury Control.
- Task 18. Revise Design Specifications, Prepare O&M Manuals.
- Task 19. Reporting, Management, Subcontracts, Technology Transfer.

INTRODUCTION

DOE awarded Cooperative Agreement Number DE-FC26-04NT41766 to We Energies to demonstrate TOXECON™ for mercury and multi-pollutant control, a reliable mercury continuous emission monitor (CEM), and a process to recover mercury captured in the sorbent. Under this agreement, We Energies is working in partnership with the DOE.

Quarterly Technical Progress Reports will provide project progress, results from technology demonstrations, and technology transfer information.

Project Objectives

The specific objectives of this project are to demonstrate the operation of the TOXECON™ multi-pollutant control system and accessories, and

- Achieve 90% mercury removal from flue gas through activated carbon injection
- Evaluate the potential for 70% SO_2 control and trim control of NO_x from flue gas through sodium-based or other novel sorbent injection
- Reduce PM emission through collection by the TOXECON™ baghouse
- Recover 90% of the mercury captured in the sorbent
- Utilize 100% of fly ash collected in the existing electrostatic precipitator
- Demonstrate a reliable, accurate mercury CEM suitable for use in the power plant environment
- Successfully integrate and optimize TOXECON™ system operation for mercury and multi-pollutant control

Scope of Project

The "TOXECON™ Retrofit for Mercury and Multi-Pollutant Control on Three 90-MW Coal-Fired Boilers" project will be completed in two Budget Periods. These two Budget Periods are:

<u>Budget Period 1</u>: Project Definition, Design and Engineering, Prototype Testing, Major Equipment Procurement, and Foundation Installation. Budget Period 1 initiated the project with project definition activities including NEPA, followed by design, which included specification and procurement of long lead-time major equipment, and installation of foundations. In addition, testing of prototype mercury CEMs was conducted. Activities under Budget Period 1 were completed during 1Q05.

<u>Budget Period 2</u>: CEM Demonstration, TOXECON™ Erection, TOXECON™ Operation, and Carbon Ash Management Demonstration. In Budget Period 2, the TOXECON™ system will be constructed and operated. Operation will include optimization for mercury control, parametric testing for SO_2 and NO_x control, and long-term testing for mercury control. The mercury CEM and sorbent regeneration processes will be demonstrated in conjunction with the TOXECON™ system operation.

The project continues to move through Budget Period 2 as of the current reporting period. Each task is described in the Statement of Project Objectives (SOPO) that is part of the Cooperative Agreement.

EXPERIMENTAL

None to report.

RESULTS AND DISCUSSION

Following are descriptions of the work performed on project tasks during this reporting period.

Task 1 – Design Review Meeting

Work associated with this task was previously completed.

Task 2 – Project Management Plan

Work associated with this task was previously completed.

Task 3 – Provide NEPA Documentation, Environmental Approvals Documentation, and Regulatory Approval Documentation

Work associated with this task was previously completed.

Task 4 – Balance-of-Plant (BOP) Engineering

Work associated with this task was completed during 1Q05 in Budget Period 1.

Task 5 – Process Equipment Design and Major Equipment Procurement

Work associated with this task was completed during 1Q05 in Budget Period 1.

Task 6 – Prepare Construction Plan

Work associated with this task was completed during 1Q05 in Budget Period 1. The Construction Plan was issued on January 26, 2005.

Task 7 – Procure Mercury Continuous Emission Monitor (CEM) Package and Perform Engineering and Performance Assessment

The overall goal of this task is to have a compliance-grade, reliable, certified mercury CEM installed and operational for use in the TOXECON™ evaluation. ADA-ES has teamed with Thermo Electron Corporation on this task. The Thermo Electron CEM was described in detail in a previous Quarterly Technical Progress Report (DOE Report Number 41766R05).

CEM Update

Background

On June 30, 2005, a beta version (C-Series) Thermo Electron CEM was installed at the outlet of the air preheater on Unit 8. Two new iSeries Mercury Freedom System™ CEMs were installed in December 2005, one replacing the beta CEM and one at the outlet duct of the baghouse. Data from the two CEMs are shown in Task 15 as part of the TOXECON™ testing.

Site Progress

During 2Q06, the CEMs were monitored for long-term operation while the baghouse was offline. A software update was performed that cleared some alarms going to the plant DCS. Programming updates in the DCS allowed several other alarms to be properly transmitted from the CEMs to the DCS.

The CEMs were programmed to perform an EDS datalogger-initiated calibration at 7:35 a.m. every day. This calibration was not designed to automatically update the calibration factors. A second calibration was programmed through the CEM itself to initiate at 8:35 a.m. This calibration was designed to update the calibration factors to reduce drift. These CEM-initiated calibrations were aborting on a frequent but unpredictable basis. Thermo was notified of this issue and performed investigations into the problem. A representative from Thermo will update software and hardware in the calibrators and analyzers next quarter.

Preliminary CEM manuals were delivered during this quarter. Revisions were being made on an ongoing basis during this quarter.

The Hydra equipment was delivered to the site this quarter. The Hydra is the name for the system that connects multiple probes and hot lines to one CEM. The Hydra at Presque Isle will connect Units 7, 8, and 9 to the inlet CEM. A switching box will allow operators to sample from any one of the three ducts. This system will be installed and checked next quarter.

Task 8 – Mobilize Contractors

Contractor mobilization was completed in 2Q05. Jamar, Boldt, Northland Electric, United Anco, PCI, Wheelabrator, and CaTS demobilized from the site during 4Q05. CaTS personnel completed their assignments and CaTS Construction Management Team demobilized from the site during 1Q06.

Task 9 – Foundation Erection

All major foundation work by Boldt Construction Company was completed during 1Q05.

Task 10 – Erect Structural Steel, Baghouse and Ductwork

The erection work associated with this task was initiated during 2Q05.

The work effort for this task during 2Q06 was limited to final exception/punch list item work. Some minor access platform work to address exception/punch list items continued during this quarter.

Task 11 – Balance-of-Plant Mechanical and Civil/Structural Installations

Primary work associated with this task was completed in 4Q05. Exception/punch list item completion was the primary focus during this quarter.

Task 12 – Balance-of-Plant Electrical Installations

Primary work associated with this task was completed in 4Q05. Exception/punch list item completion was the primary focus during this quarter.

Task 13 - Equipment Pre-Operational Testing

Pre-operational testing was completed in 4Q05.

Task 14 – Start-Up and Operator Training

Startup of all major equipment was completed in 4Q05. Final O&M manuals were received for most major equipment in 2005. Startup of the PAC system occurred in 1Q06.

The operator-training program was completed during 4Q05 to train the plant operations personnel.

The baghouse was initially brought into operation on December 17, 2005, with flue gas from Unit 7. Initial operation with Unit 8 occurred on January 5, 2006, and Unit 9 on January 27, 2006.

Task 15 – Operate, Test, Data Analysis, and Optimize TOXECON™ for Mercury Control

Baghouse Cage Inspections

During the inspections for damaged bags described in the 1Q06 Quarterly Technical Progress Report (DOE Report Number 41766R08), We Energies personnel noticed when replacing damaged bags that several of the cages were separated at the connecting collar. A more detailed inspection of the cages in one compartment was initiated. This inspection showed that a majority of the cages had some kind of defect, such as separation at the connection of the two cage pieces or broken welds. A decision was made to inspect and repair, as needed, every cage in every compartment. The items that were checked and repaired during inspections included the following:

- Connecting rings – check for separation and broken welds
- Locking pins – check for proper seating
- Cage separation – check for separation at the middle of the cage, whether due to a defect or an unknown reason

Figure 1 shows the installation of the upper section of the cage with the connecting collar welded to the lower section. Figure 2 shows the connecting portion of the upper section of the cage. This figure shows the locking pin that should be seated flush with the ring after the connection of the two sections.

Figure 1. Baghouse Cage Connection.

Figure 2. Baghouse Cage Upper Section.

Table 1 contains a summary of the cage inspection results; detailed field drawings by compartment can be found in Appendix A. As shown in the table, the percent of cages that did not have any problems ranged from less than 1% to a high of 33.3%, with only three compartments above 10%.

Table 1. Summary of Cage Inspections.

Compartment	Number in Each Category						% Good
	Could Not Pull Cage	Broken Ring Welds	Clip Not Seated	Both Ring and Clip Problems	Ring and Clip Good – Separated	Ring and Clip Good – No Separation	
1A	0	1	145	104	71	3	0.93
1B	1	1	193	86	27	16	4.9
2A	0	43	95	65	91	30	9.3
2B	0	15	149	92	41	27	8.3
3A	0	151	27	38	0	108	33.3
3B	0	107	59	81	45	32	9.9
4A	0	3	229	57	4	31	9.6
4B	0	41	127	61	70	25	7.7
5A	0	2	227	80	0	15	4.6
5B	0	18	158	122	0	26	8.0
6A	1	27	73	215	0	8	2.5
6B	1	13	72	235	0	3	0.93
7A	0	26	219	63	0	16	4.9
7B	12	15	184	88	0	25	7.7
8A	21	52	106	131	0	14	4.3
8B	18	25	176	97	0	8	2.5
9A	1	0	254	47	0	22	6.8
9B	16	2	245	44	0	17	5.2
10A	1	106	106	21	1	89	27.5
10B	14	81	106	70	1	52	16.0

Bag Testing

In March 2006, inspections were performed to determine if bags were damaged during hopper overheating. Visibly damaged bags were seen only in compartments 3A (83 damaged or melted) and 4A (117 damaged or melted). Select bags pulled during the inspections were sent out for analysis. The reports are shown in Appendix B. Grubb Filtration performed tests on one bag that had melted fabric on the bottom and two that were visually undamaged. Testing was done on the unburned sections of fabric from the damaged bag and showed a 30% loss in strength. The strength loss was the same near the burned areas, indicating that the heat damage was localized. This loss of strength was not considered unusual for bags that have been in use for several months. There was no abnormal shrinkage and very little dust on any of the bags.

Results from Environmental Consultant Company (ECC) on a bag from compartment 3 showed that there was no evidence of any fine micron penetration or leakage, and that the strengths and flex endurances were slightly lower than expected. Overall, the level of deterioration was rated at 20% termination.

Baghouse Restart

After the inspections and repairs were completed, the baghouse was brought back online on May 12, 2006, with flue gas from Unit 7. The hopper heaters remained off during the startup and subsequent operation. There was an additional deviation from the normal startup procedure. After the initial two compartments were in service and a 1-mill load was reached, four additional compartments were opened without pausing. The correct procedure is to open one compartment, let the compartment come up to temperature, and then open the next one. This procedure is intended to minimize condensation in the baghouse. After pulling ash from the hoppers on May 15, water was seen in the bottom of eight hoppers. Flue gas was diverted from the compartments and an inspection performed. Figure 3 shows evidence of water flowing down the walls of the compartments.

After several inspections, it was determined that condensation from the cold startup of the baghouse was the likely cause of water in the hoppers. The hopper heaters were turned on and the baghouse taken off bypass and returned to normal operation with flue gas from Unit 7. Instructions were given to the operating staff on the importance of following the startup procedure to allow each compartment to come to operating temperature before adding additional compartments, thus building up the heat in a controllable fashion.

Figure 3. Water Marks in Baghouse Hoppers.

The baghouse compartments (except for #4) were brought back in service (taken off bypass) on May 22 and there was no evidence of free water in the hoppers. On May 25, the hopper heaters were turned off because of the concern they might be causing overheating of the PAC/ash. On May 26, operations found water in three hoppers (#1, #2, and #3). The set points for the hopper heaters were reduced by 25 ºF on all compartments except for #4 (the test compartment) and all heaters were returned to service.

PAC injection began on May 30, 2006. Ash was pulled every four hours to prevent buildup of material in the hoppers. The cleaning cycle was set to 2.3" WC for one unit to the baghouse (4.6" WC for two units, 6.5" WC for three units) with a default of 72 hours. The cleaning logic is programmed to pulse six of the 36 pulse-pipes in successive compartments until the flange-to-flange pressure drop is lowered by 0.5" WC.

Hopper Temperatures

During early 2Q06, thermocouples were placed on each compartment hopper (two each) to monitor temperatures and alert operators in the event of rising temperatures. The thermocouples were placed on the exterior between the hopper wall and a heater. Appendix C shows detailed graphs of each compartment thermocouple for May 29 through June 25. Compartment #4 still had the four internal thermocouples that were installed in 1Q06 for the hopper test.

The baghouse temperature data for the first two weeks during PAC injection (June 5 and 12, with one unit) were reviewed in detail to get a picture of the normal operating range. Table 2 presents a summary of typical values for each thermocouple location at the ten compartments over the two-week period. The data in Table 2 are typical of operation with one unit through the baghouse; this same assessment will be repeated next quarter with data for all three units.

Over the course of a week, the temperatures at the thermocouple locations varied quite a bit, especially at the Outer Wall North locations (noted as OWN in Table 2). Although there was a wide range between maximum and minimum temperatures, the data are consistent for the two-week period. The difference between the values at each thermocouple location for the weeks of June 5 and 12 indicate an average difference between both the maximum and minimum temperatures of only 3.7ººF.

Also calculated is the average temperature for each 24-hour period during the two weeks, and the range in this value is shown in Table 2 for each thermocouple location. The north wall thermocouples also show more variability in the daily averages as well. In order to get an idea of the overall variability in temperatures for each thermocouple location, the average plus or minus the standard deviation calculated using four-hour averages is presented in the last column.

Table 2. Summary of Temperature Data for Hopper Thermocouples.

Compartment and Location	Maximum (ºF)	Minimum (ºF)	Average (ºF)	Range of 24-Hour Averages (ºF)	Overall Variability* (avg ± std dev, ºF)
1 OWW	280.9	229.8	250.8	242.4–257.9	250.5 ± 4.7
1 OWN	336.4	216.8	257.3	237.6–279.4	257.4 ± 11.0
2 OWW	276.7	234.7	250.8	242.2–257.0	249.5 ± 5.2
2 OWN	356.0	223.4	265.0	239.9–284.4	262.1 ± 16.6
3 OWW	287.9	230.3	252.5	237.3–259.9	252.5 ± 6.6
3 OWN	294.5	208.0	240.0	221.7–250.9	243.4 ± 10.8
4 OWW	319.7	240.5	273.4	253.3–281.1	270.9 ± 10.2
4 OWN	344.8	234.9	276.3	247.6–286.9	273.1 ± 14.1
4 IWN	380.8	272.2	310.4	285.5–321.7	306.8 ± 12.7
4 IWS	374.2	273.2	312.3	294.3–322.6	308.6 ± 11.4
4 IWE	326.2	251.0	287.4	278.4–300.6	289.3 ± 6.7
4 IWW	332.0	234.9	284.1	267.4–292.6	282.9 ± 7.8
5 OWW	309.1	263.1	289.1	282.5–292.7	288.8 ± 3.9
5 OWN	318.0	249.1	285.4	282.1–290.1	285.7 ± 4.6
6 OWW	296.3	244.4	268.0	253.4–273.3	267.1 ± 6.8
6 OWN	351.4	243.1	288.8	255.7–298.5	289.7 ± 13.6
7 OWW	278.4	229.9	249.6	239.1–255.2	251.0 ± 6.0
7 OWN	339.3	226.1	260.7	239.2–278.1	265.5 ± 14.3
8 OWW	294.3	231.6	256.2	245.2–263.8	254.9 ± 7.2
8 OWN	324.3	214.9	250.5	230.4–267.4	248.8 ± 13.3
9 OWW	294.2	234.2	256.0	243.9–262.9	256.1 ± 5.5
9 OWN	323.3	209.8	248.2	232.8–270.3	249.6 ± 12.8
10 OWW	293.7	230.7	263.7	246.0–271.3	263.5 ± 7.2
10 OWN	367.5	226.5	290.3	254.6–306.1	292.6 ± 15.5

* Based on four-hour averages, all others based on "raw" data.

Note: OWW = Outer Wall West; IWN = Inner Wall North; IWS = Inner Wall South
OWN = Outer Wall North; IWE = Inner Wall East; INW = Inner Wall West

Hopper Test

On May 24, 2006, We Energies performed a second test in compartment #4 hopper. The first test was described in the previous Quarterly Technical Progress Report and occurred when the baghouse was not online, so no flue gas was present in the hopper. For this test, four thermocouples were welded to each interior hopper wall and 360 pounds of fresh PAC was placed in the hopper. The thermocouples were placed so that they would be six inches below the upper surface of PAC. Two thermocouples were also placed between heaters and the outside wall of the hopper.

This second test was identical to the first test with the exception that the baghouse was on-line with flue gas from Unit 7. A total of 360 pounds of PAC was again loaded into the hopper. This was approximately four feet of material. The hopper heaters were turned on May 24 (Figure 4). The temperature in the hopper reached a maximum of 407 ºF. There was no sign of overheating during this time. Cycling of the hopper heaters is evident during this test.

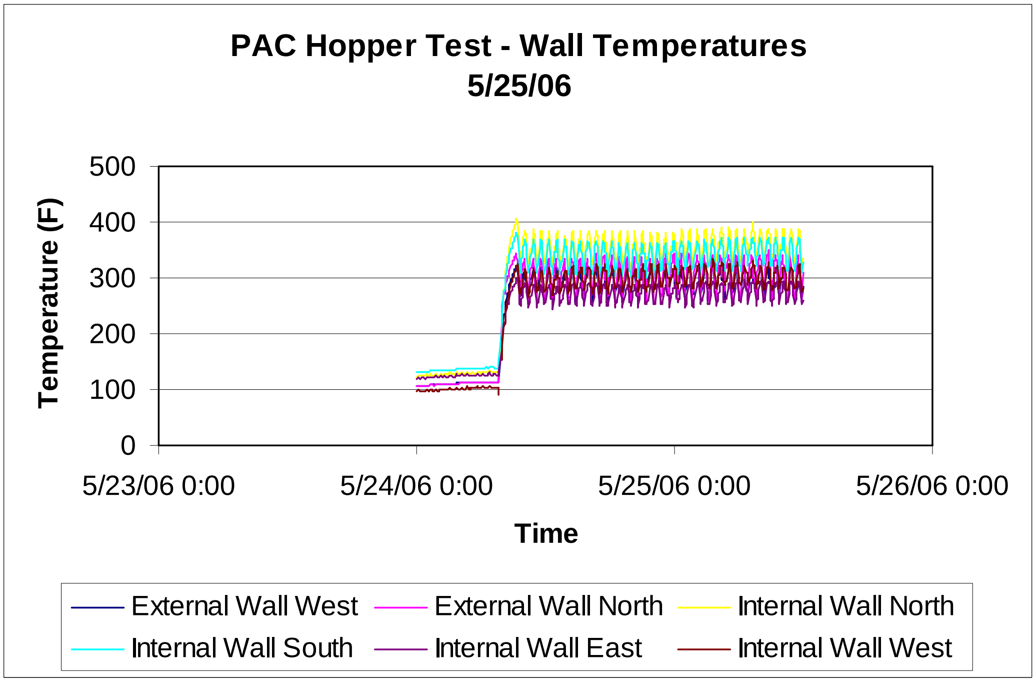


Figure 4. PAC Hopper Test—PAC Bed Temperatures.

Performance Data

PAC injection began on May 30, 2006, at 0.5 lb/MMacf, then was increased to 1.0 lb/MMacf after about an hour. Figure 5 shows the baghouse data from May 22 through June 5, including flange-to-flange pressure drop, tubesheet pressure drops, PAC injection concentration, outlet mercury concentration, and mercury removal. There is no mercury inlet number since the CEM was tied into Unit 8, which was offline for a scheduled outage. The mercury outlet reading responded quickly to the PAC injection, but the signal was very noisy compared to earlier parametric tests. Figure 6 shows the effect of flue gas temperature on the mercury reading. As noted last quarter, the outlet mercury value is affected by flue gas temperature when using DARCO® Hg sorbent.

The injection concentration was increased to 1.5 lb/MMacf on June 6, as seen in Figure 7. The PAC was shut off from June 12 through June 16 to allow the plant to perform particulate tests. Injection was resumed at 2 lb/MMacf on June 16. Figure 8 is a comparison of outlet mercury with flue gas temperature. The effect of temperature is more noticeable in this figure.

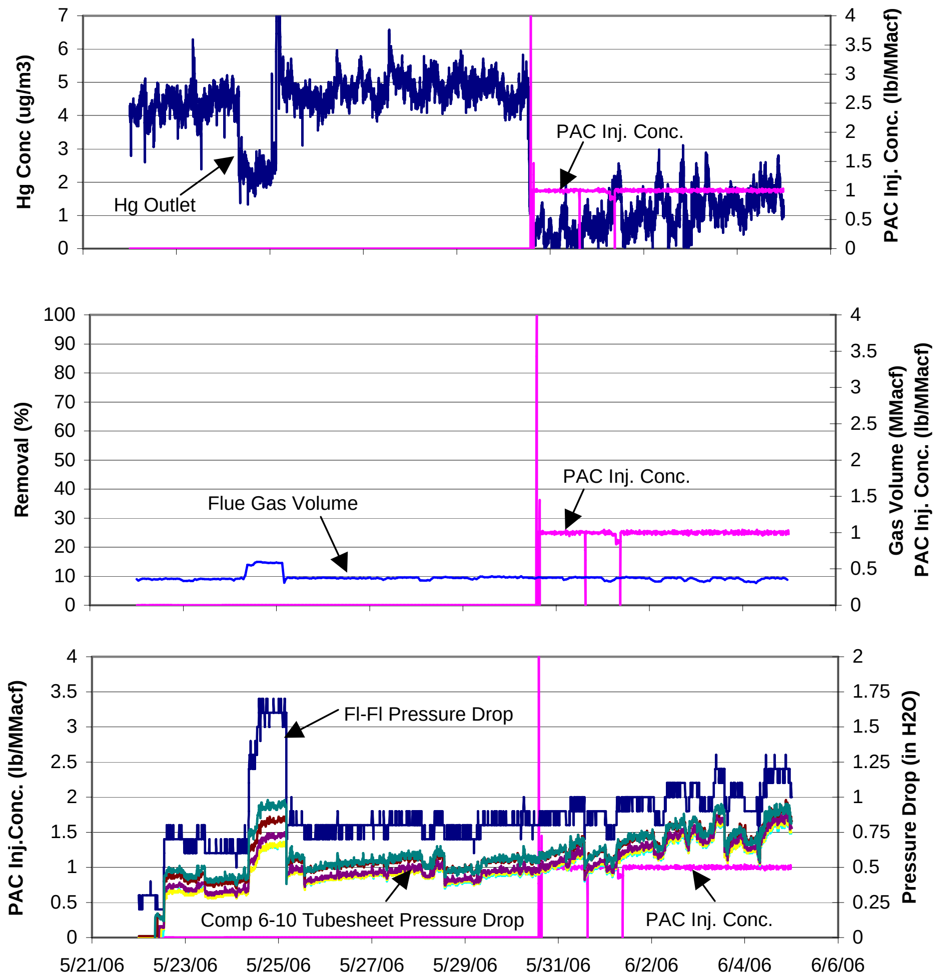


Figure 5. Baghouse Performance Data for 5/22/06 to 6/5/06.

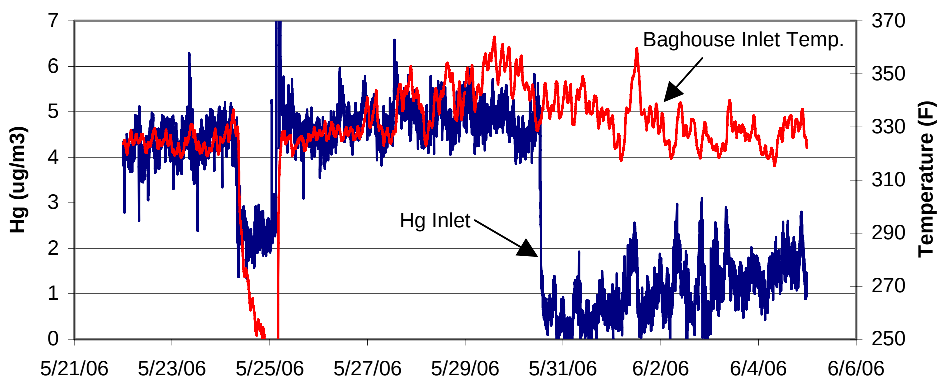


Figure 6. Effect of Flue Gas Temperature on Outlet Mercury for 5/22/06 to 6/5/06.

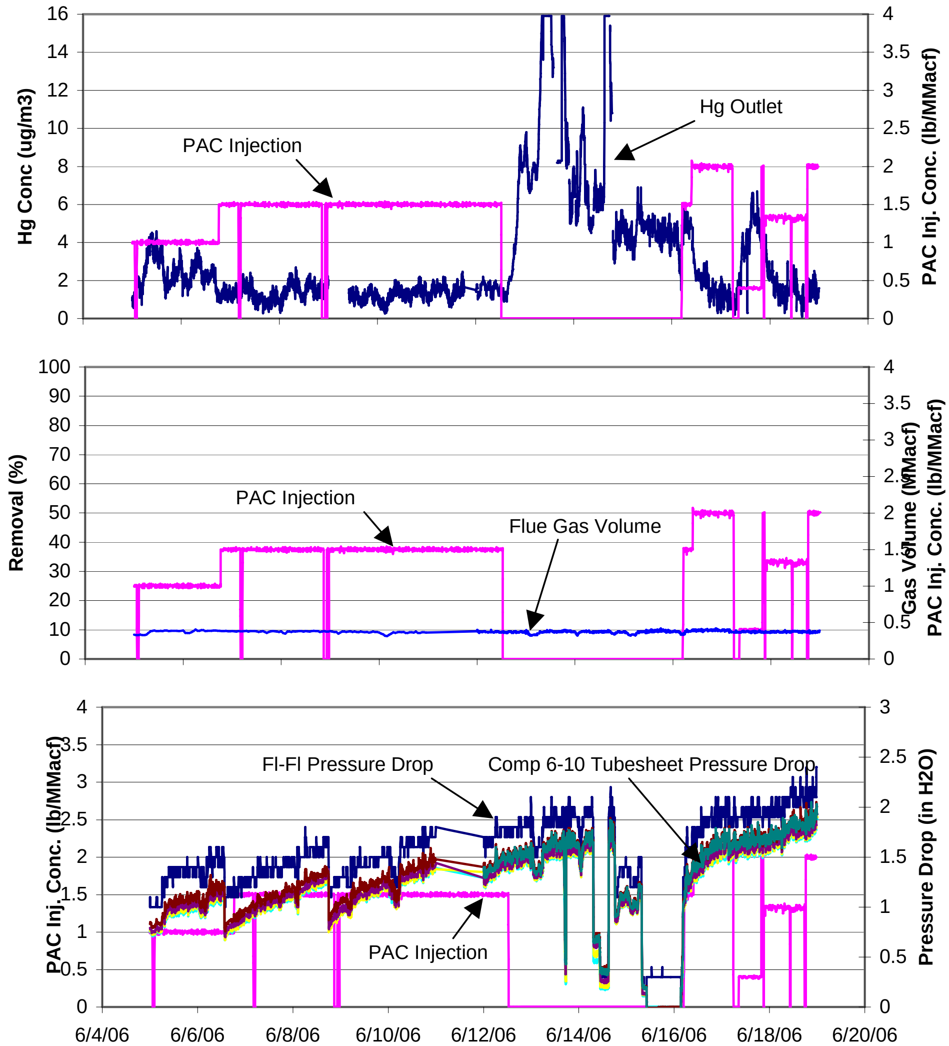


Figure 7. Baghouse Performance Data for 6/5/06 to 6/19/06.

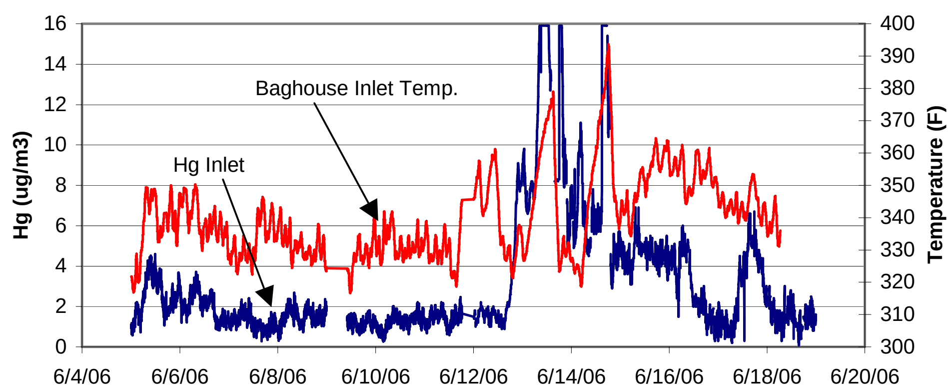


Figure 8. Effect of Flue Gas Temperature on Outlet Mercury for 6/5/06 to 6/19/06.

PAC injection was kept at 2 lb/MMacf until June 29, as seen in Figure 9. At that time, plant personnel attempted to remove ash and PAC from the ash silo and encountered problems with excessive dusting. The new flow control valve to the dustless unloader was unable to provide the required steady flow of PAC/ash to the mixer. In addition, there appeared to be problems with adequate fluidizing airflow to the bottom of the ash silo. PAC injection was stopped until the problem can be fixed. The problem with the ash silo and unloader remains an outstanding issue as of the end of the quarter. Unit 8 was tied into the baghouse on June 21, resuming inlet mercury readings. Unit 9 was tied into the baghouse on June 29. Figure 10 shows the effect of temperature on outlet mercury readings for this time period.

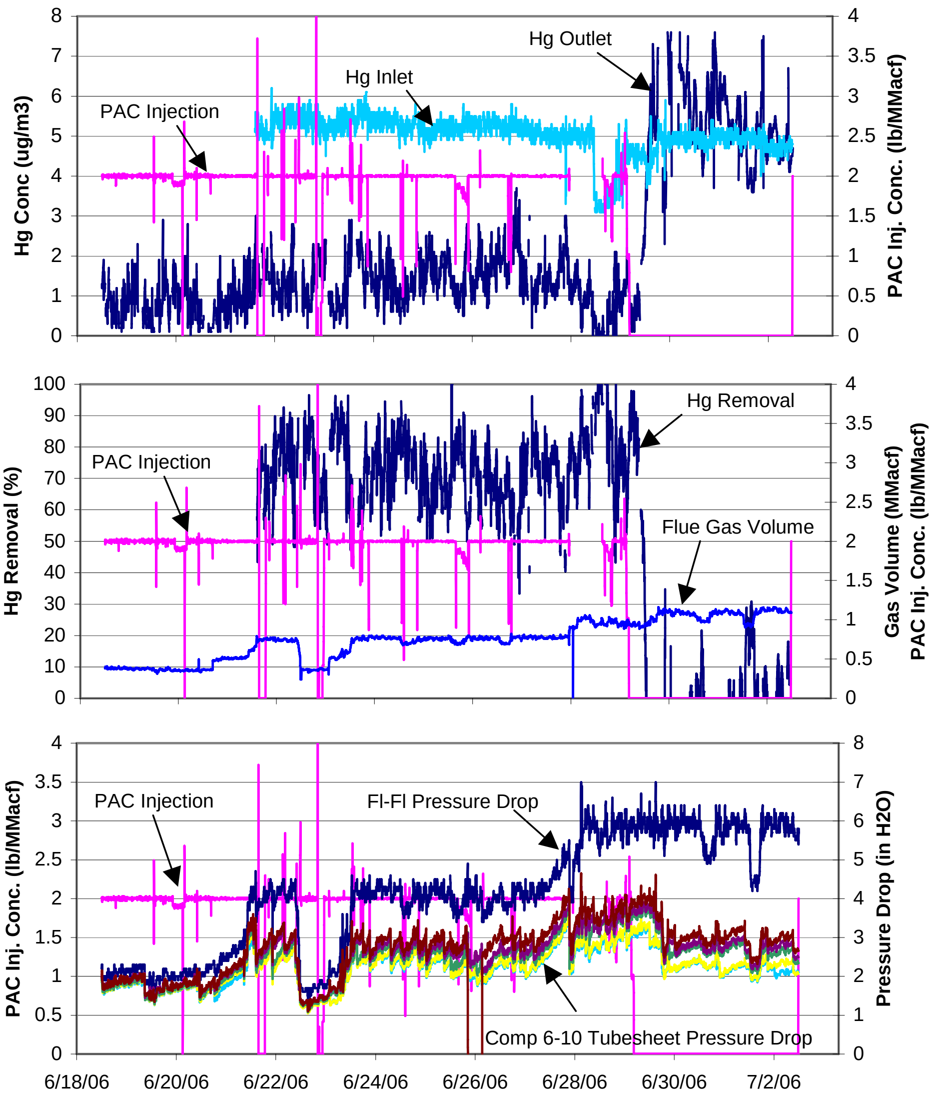


Figure 9. Baghouse Performance Data for 6/19/06 to 7/1/06.

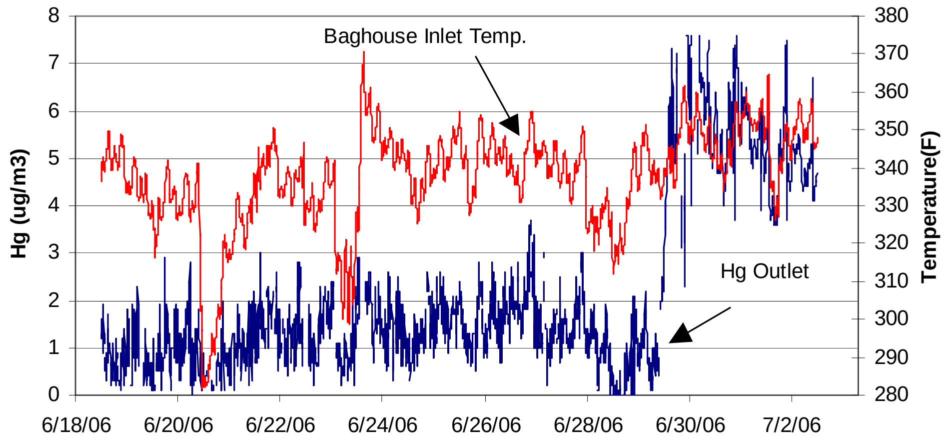


Figure 10. Baghouse Temperature Data for 6/19/06 to 7/1/06.

A check on the effect of flue gas temperature on the outlet analyzer function was investigated to rule out any effect on mercury readings. Figure 11 is a comparison of flue gas temperature with two temperatures in the outlet analyzer. The internal (ambient) analyzer temperature is the temperature near the electronics. The bench temperature is taken near the measurement cell of the analyzer. This figure shows very steady temperature readings when compared with flue gas temperature.

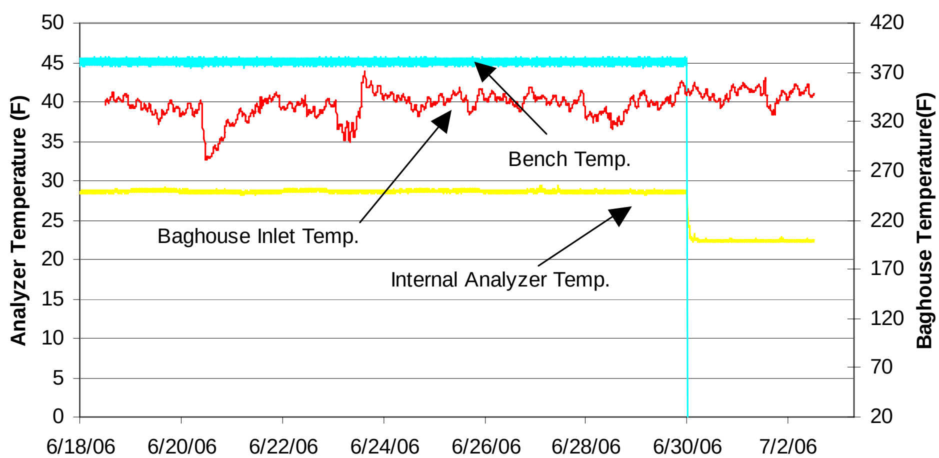


Figure 11. Effect of Flue Gas Temperature on CEM Temperatures.

Column Reactor Tests

In 1Q06, ADA-ES tested PAC from the silo at Presque Isle in a two-inch column reactor using simulated flue gas. The purpose of these tests was to determine if there was a measurable heat of adsorption created from the flue gas contacting the carbon. During this quarter, the tests were repeated using a granular carbon. This was performed to determine if particle size would have an effect on any heat buildup in the column. Figure 12 shows no noticeable temperature increase in the column.

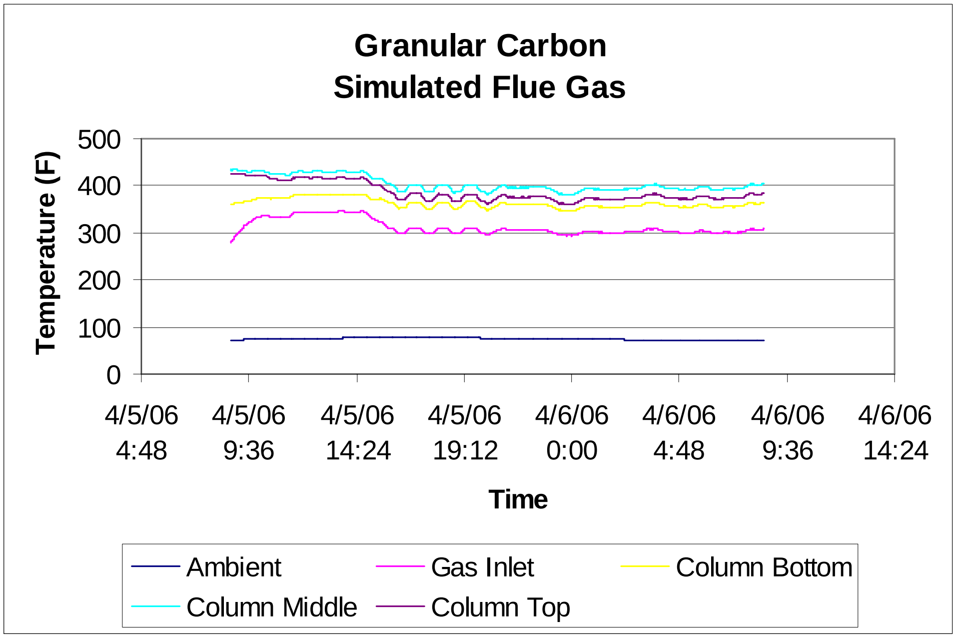


Figure 12. Column Reactor Test Using Granular Carbon.

Mercury Quality Index Test

Background and Objective

None of the standard tests used for quality assurance testing of activated carbon are specific to mercury. An effort was undertaken last quarter to develop a test method for mercury uptake in sorbents, referred to as the "Mercury Quality Index," or MQI. Please refer to the last quarterly report for additional background and a figure describing the configuration of the apparatus.

Work to Date

Design and fabrication of the MQI apparatus began last quarter. Initial trials indicated that modifications to the apparatus were needed and further shakedown tests were required to ensure that all components were working properly. Work this quarter consisted of implementing modifications to improve performance and continued testing. An example of a recent mercury breakthrough curve, with a bed consisting of 0.001 grams DARCO® Hg-LH and 2.5 grams sand, is shown in Figure 13.

Testing and further refinement of the apparatus and drafting of the test procedure will continue in the next quarter.

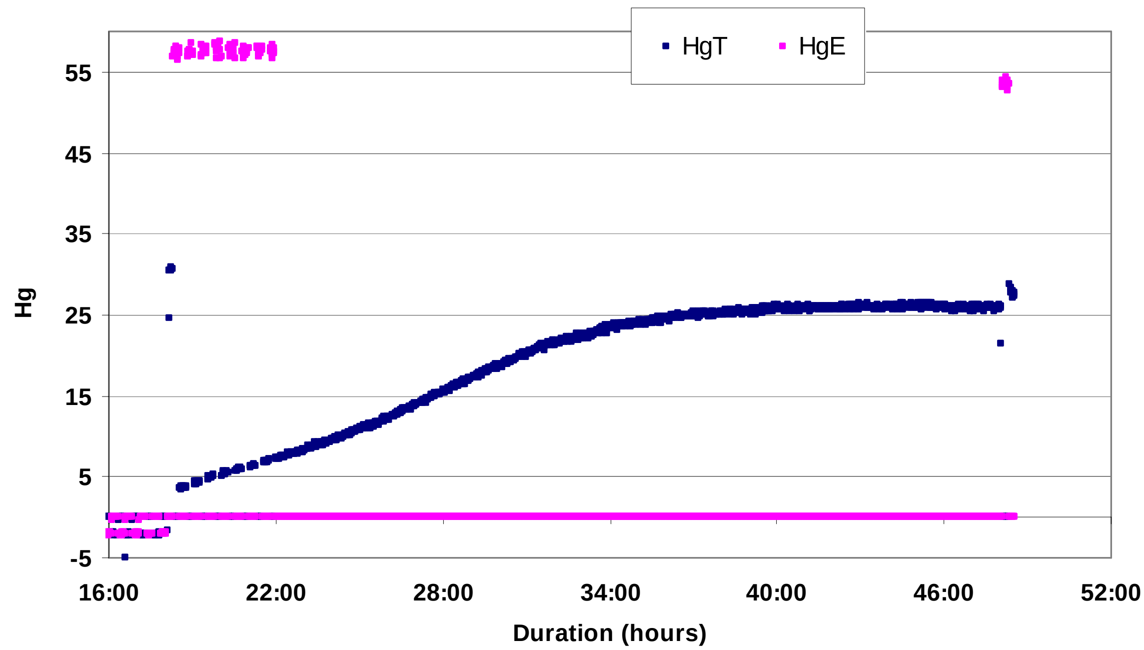


Figure 13. Mercury Breakthrough Curve using the MQI Apparatus.

Task 16 – Operate, Test, Data Analysis, and Optimize TOXECON™ for NO_x and SO_2 Control

No work was done on this task during this reporting period.

Task 17 – Carbon/Ash Management System

No work was done on this task during this reporting period.

Task 18 – Revise Design Specifications, Prepare O&M Manuals

Work was completed on preparation of C&B as-built drawings for the project during this reporting period.

Task 19 – Reporting, Management, Subcontracts, Technology Transfer

Reports as required in the Financial Assistance Reporting Requirements Checklist and the Statement of Project Objectives are prepared and submitted under this task. Subcontract management, communications, outreach, and technology transfer functions are also performed under this task.

Activity during this Reporting Quarter

- Quarterly Technical Progress Report delivered.
- Quarterly Financial Status Report delivered.
- Quarterly Federal Assistance Program/Project Status Report delivered.
- The Preliminary Public Design Report was revised and submitted.
- The Test Plan was revised and submitted.
- Made a presentation at the Presque Isle Celebration on April 21, 2006.
- Conducted a tour of the CEMs for the Michigan Department of Environmental Quality on April 20, 2006.
- Conducted an additional tour for MDEQ on June 28, 2006.
- Conducted a tour for EPA representatives on May 18, 2006.
- Conducted a tour for Associated Press reporter and photographer on May 18, 2006.
- Conducted tours for Wisconsin Public Service and Wyandotte Corporation on June 29, 2006.
- Attended the EPRI CEM Users Group Conference in May 2006.
- Presented a paper at the Electric Power Conference in May 2006.
- Presented a paper at the A&WMA Annual Conference in June 2006.
- Technical papers and presentations for future meetings include:
  - Mega Symposium (August 2006)
  - American Coal Council PRB Coal Use Conference (August 2006)
  - POWER-GEN International (November 2006)
  - Symposium on Western Fuels (October 2006)
  - 8th International Mercury as a Global Pollutant Conference (August 2006)

CONCLUSION

This is the ninth Quarterly Technical Progress Report under Cooperative Agreement Number DE-FC26-04NT41766. All major construction efforts were completed during 4Q05, and only punch list items remained during the current quarter. Work performed on punch list items included access platform work, elevator certification, HVAC modifications, touch-up painting, as-built drawings, updating manuals, and final cleanup.

Detailed cage inspections were performed this quarter. Problems with the cages were fixed and the cages and bags reinstalled in the compartments. Tests performed on bags removed last quarter show some strength reduction in the material. This loss was not considered unusual for bags that had been in service for several months.

The baghouse was returned to normal operation with flue gas from Unit 7 on May 22, 2006. The hopper temperatures showed normal operation of the hopper heaters consistent with the design and set points. A second hopper test using PAC in one compartment resulted in no apparent overheating of the material. It was determined that the hopper heaters needed to remain on to prevent condensation from occurring in the hoppers. Hopper heater temperature set points were reduced by 25 ºF (except for the #4 test hopper). PAC injection began on May 30 and baghouse performance appeared normal throughout June. Ash pulling frequency was increased to every four hours after PAC injection commenced. PAC injection was stopped on June 29 when problems with ash silo unloading were encountered.

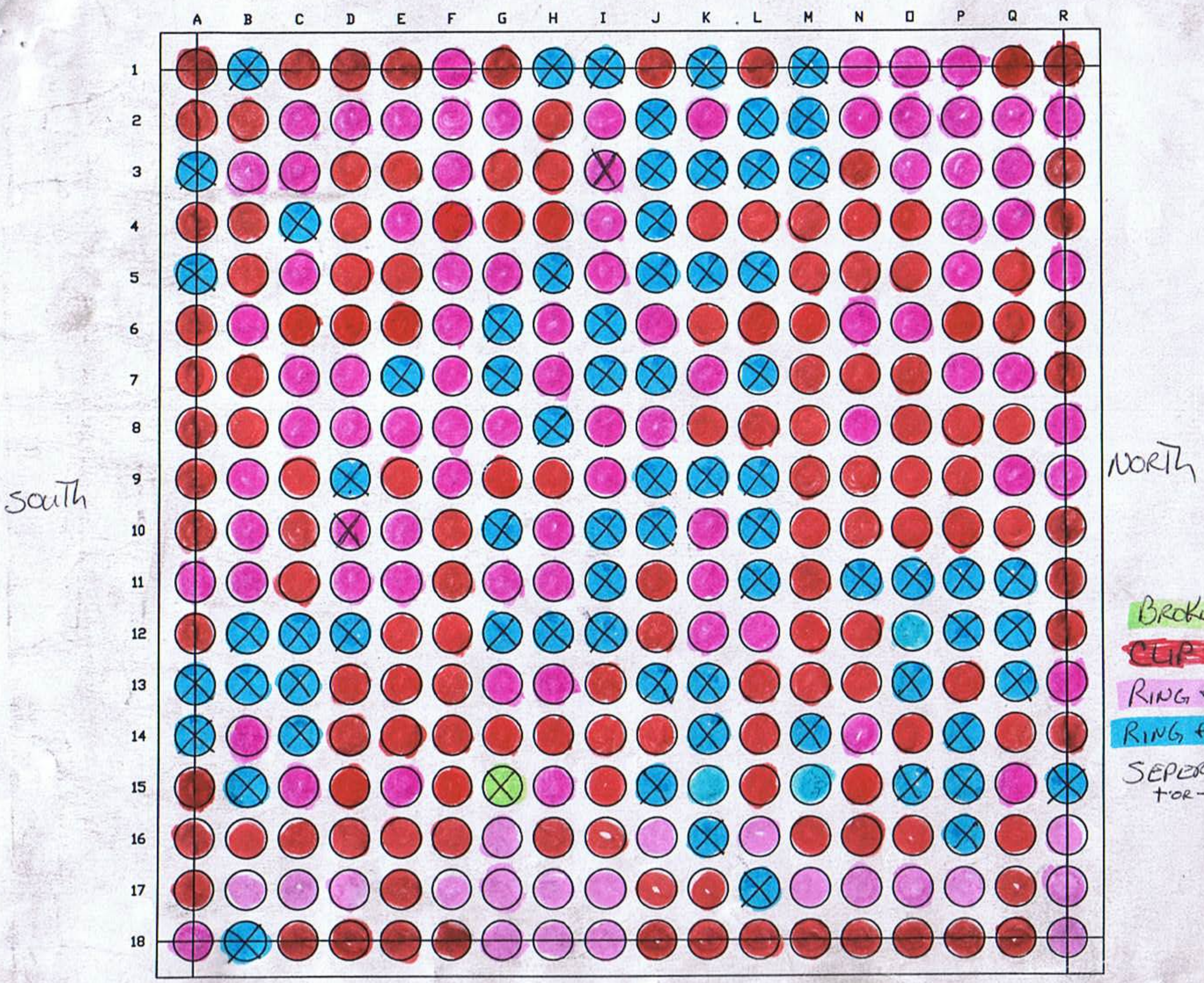
The two mercury CEMs continue to function with very little maintenance required. Upgrades to the software and hardware were conducted this quarter. The Hydra was delivered to Presque Isle and when installed will allow operators to switch and sample flue gas from Units 7, 8, or 9.

A Mercury Quality Index apparatus was designed and fabricated in 1Q06. Testing on the apparatus was performed this quarter and will continue into next quarter.

The project team is actively involved in a number of reporting and technology transfer activities, including tours of the facility at Presque Isle.

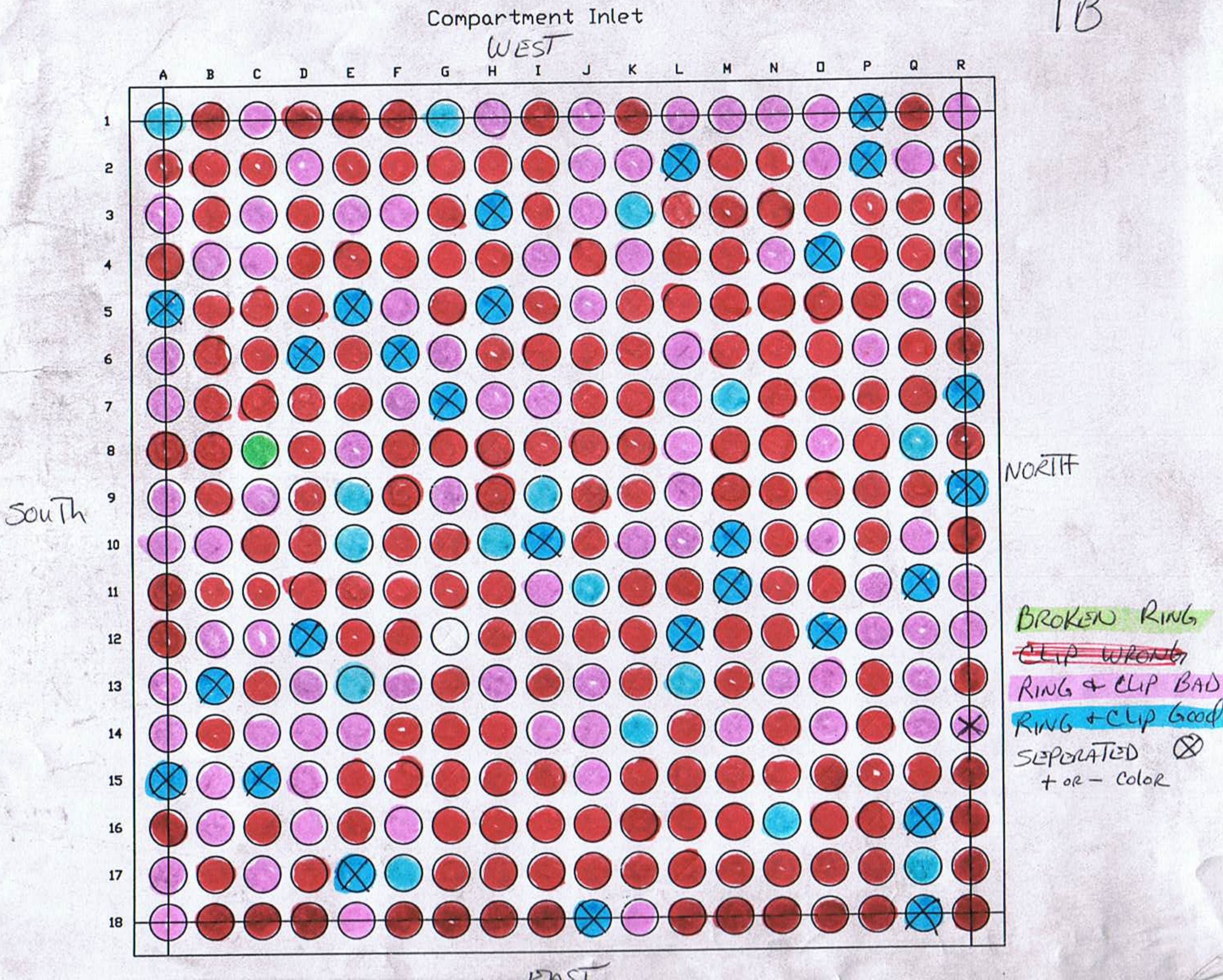
1A

Compartment Inlet
WEST



BROKEN RING
CLIP WRONG
RING + CLIP BAD
RING + CLIP GOOD.
SEPERATED ⊗
+OR- COLOR

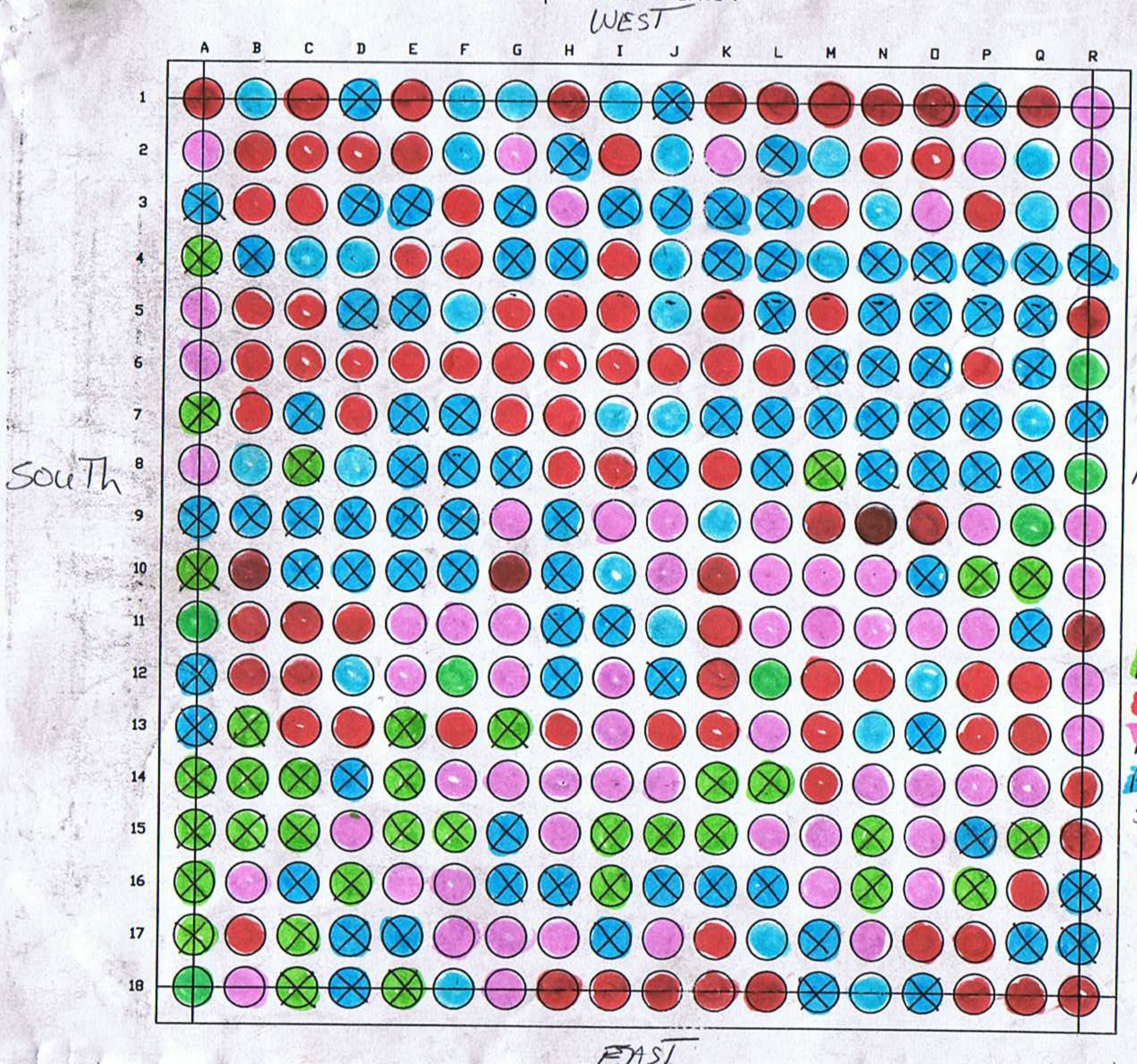
1B



Compartment Inlet
WEST
A B C D E F G H I J K L M N O P Q R
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
SOUTH
NORTH
BROKEN RING
CLIP WRONG
RING & CLIP BAD
RING & CLIP GOOD
SEPORATED ⊗
+ or − COLOR

2A

Compartment Inlet



A3 (pink) NOT BLUE
R-4 (green)

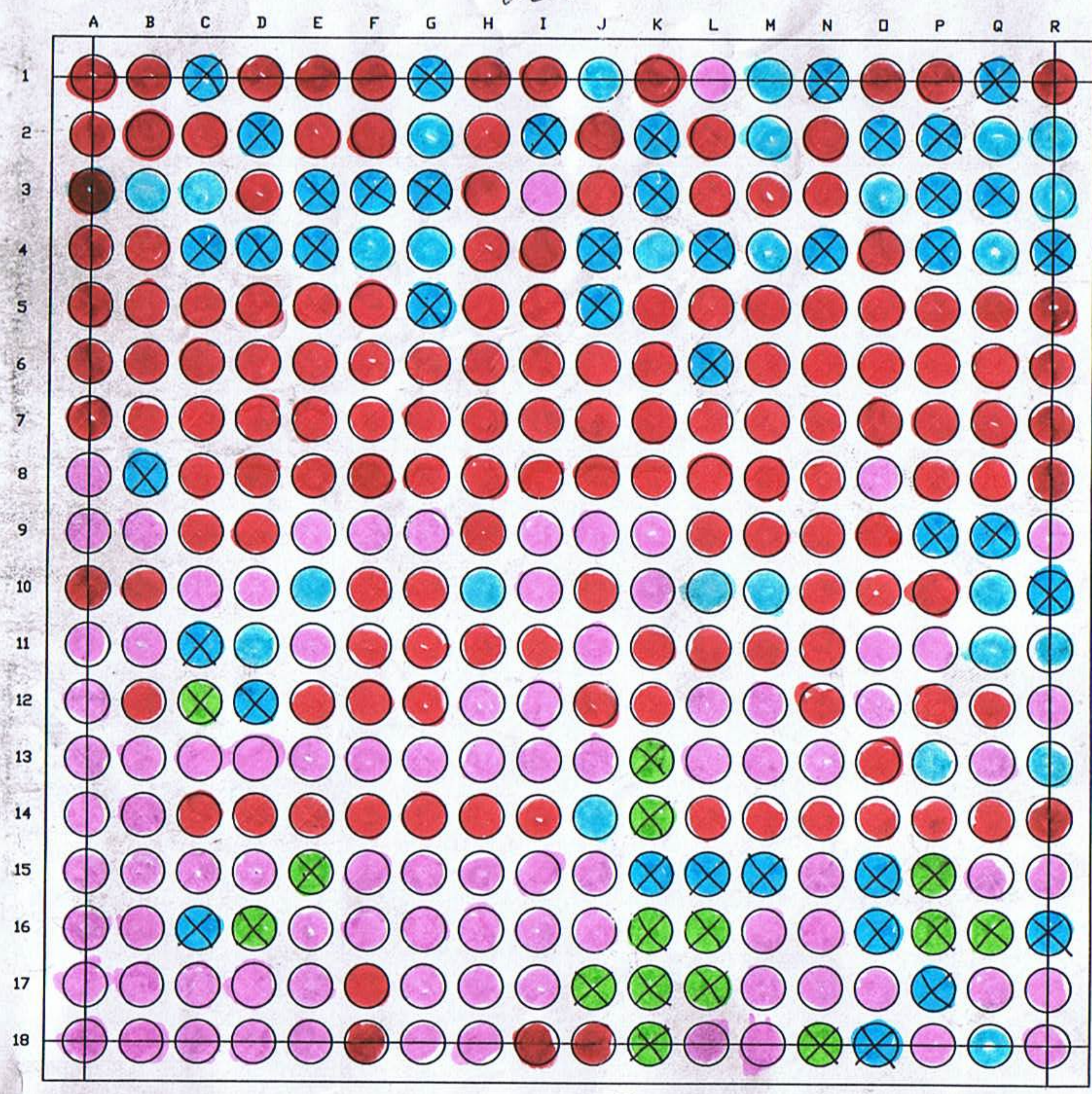
BROKE RING
CLIP WRONG
RING + CLIP BAD
RING + CLIP GOOD
SEPERATED ⊗ + OR – COLOR

2B

Compartment Inlet

WEST

SOUTH



NORTH

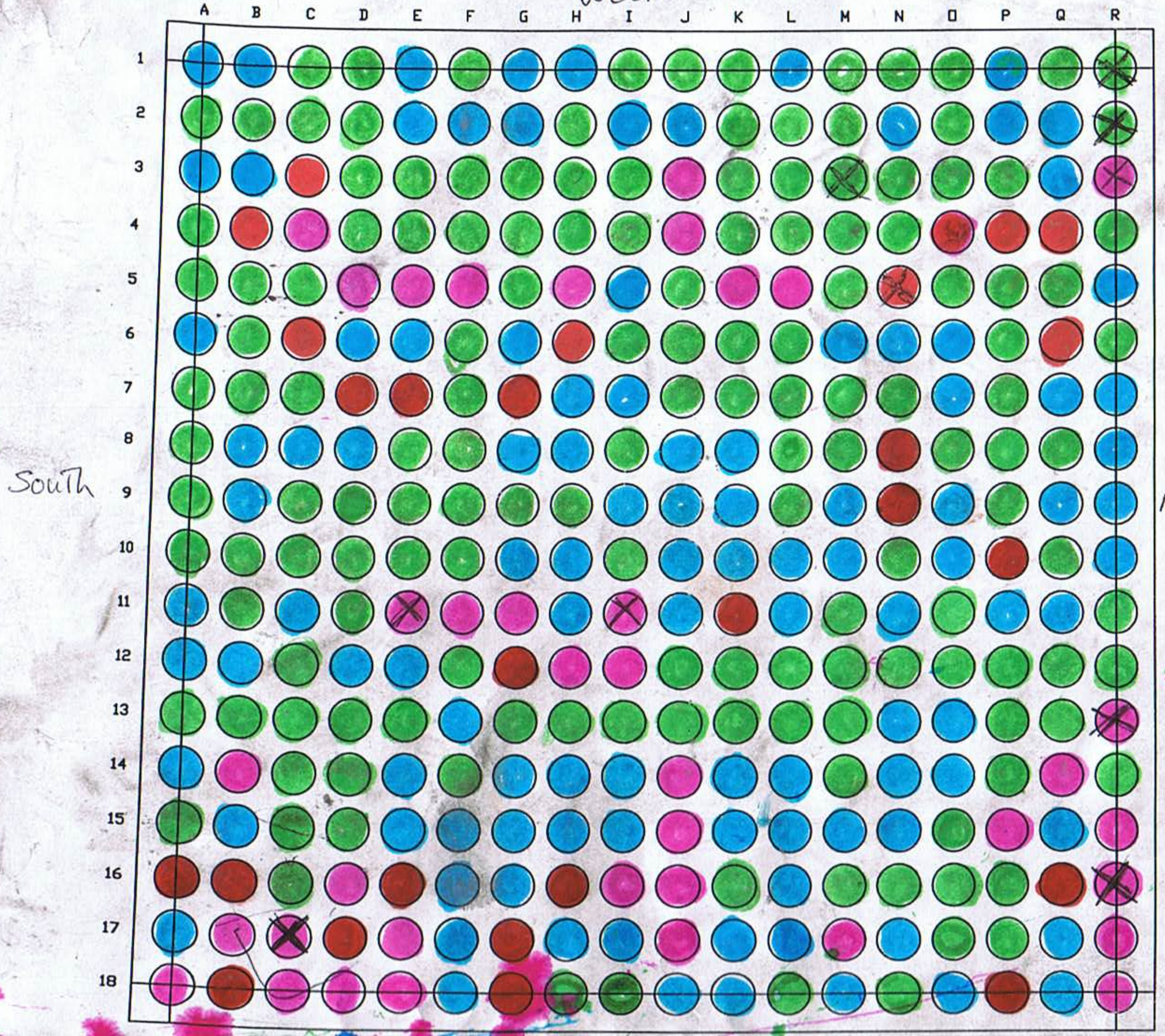
EAST

BROKE RING
CLIP WRONG
RING + CLIP BAD
RING + CLIP GOOD
SEPERATED ⊗
+ or – color

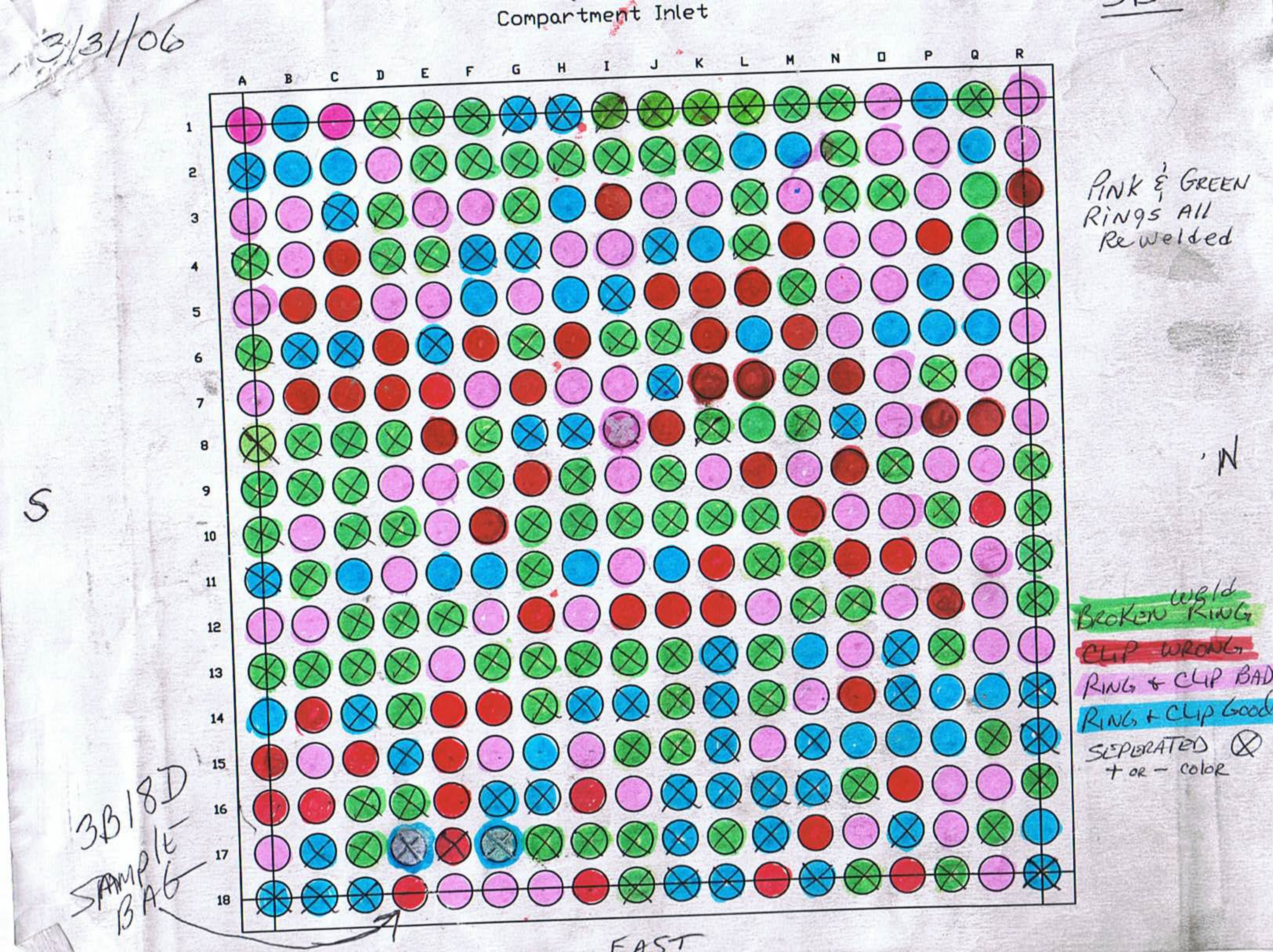
3A

Compartment Inlet

WEST



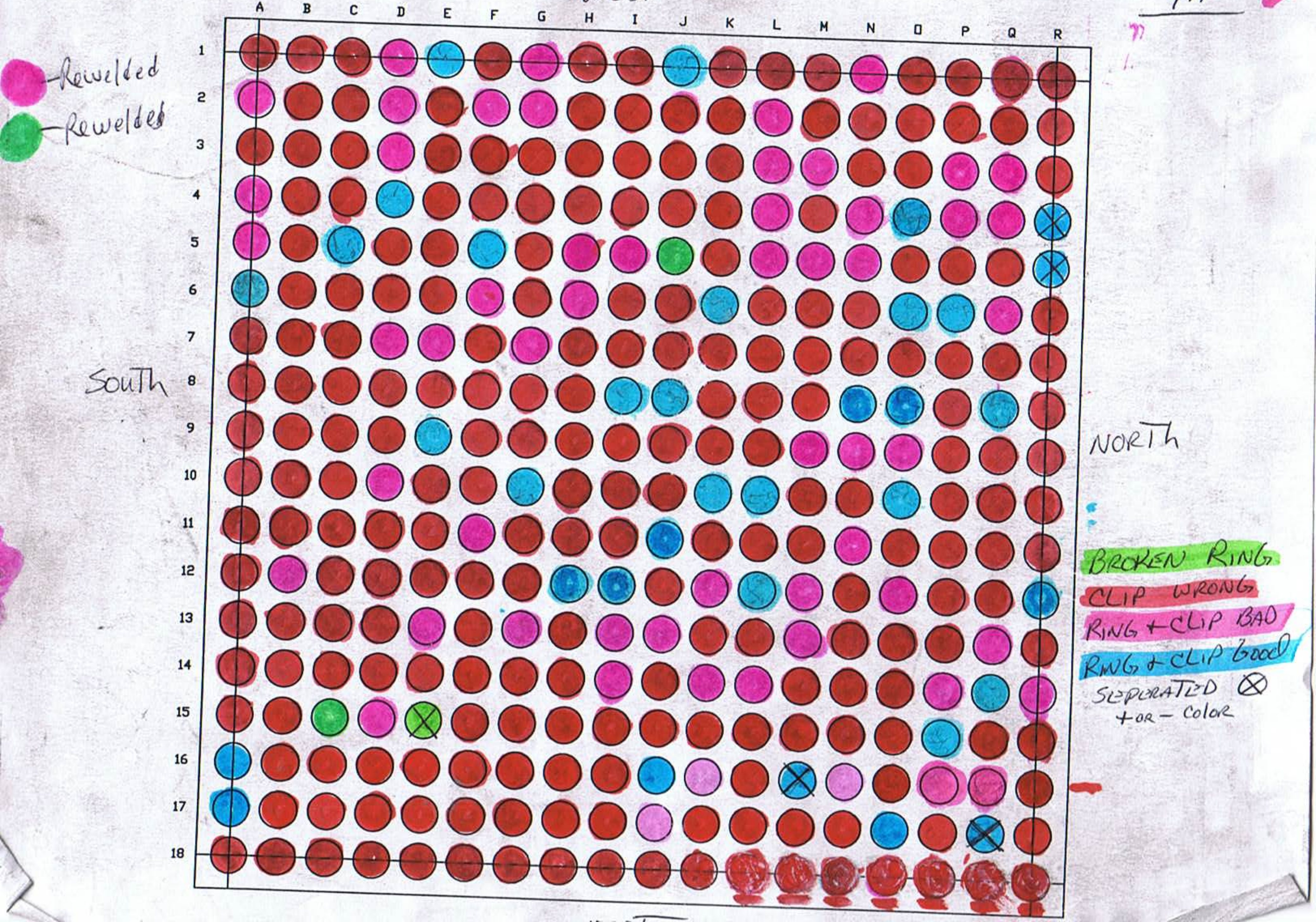
Weld
BROKEN RING
~~CLIP WRONG~~
RING + CLIP BAD
RING + CLIP Good
SEPERATED ⊗
+ OR − COLOR


3/31/06
Compartment Inlet
A B C D E F G H I J K L M N O P Q R
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
S
N
EAST
3B18D
SAMPLE BAG
Pink & Green Rings All Rewelded
Broken Ring weld
Clip Wrong
Ring + Clip Bad
Ring + Clip Good
Seperated ⊗ + or – color

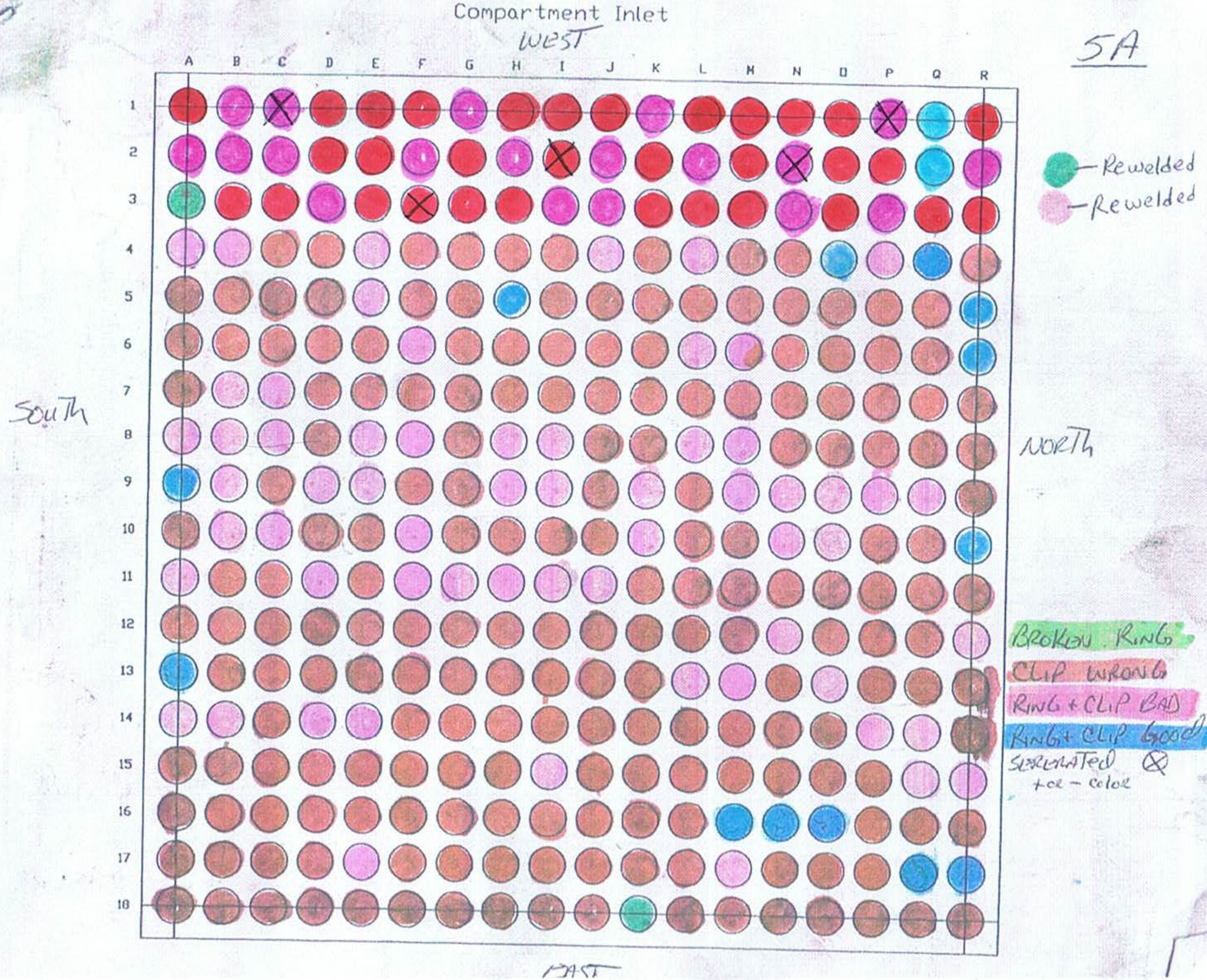
4A

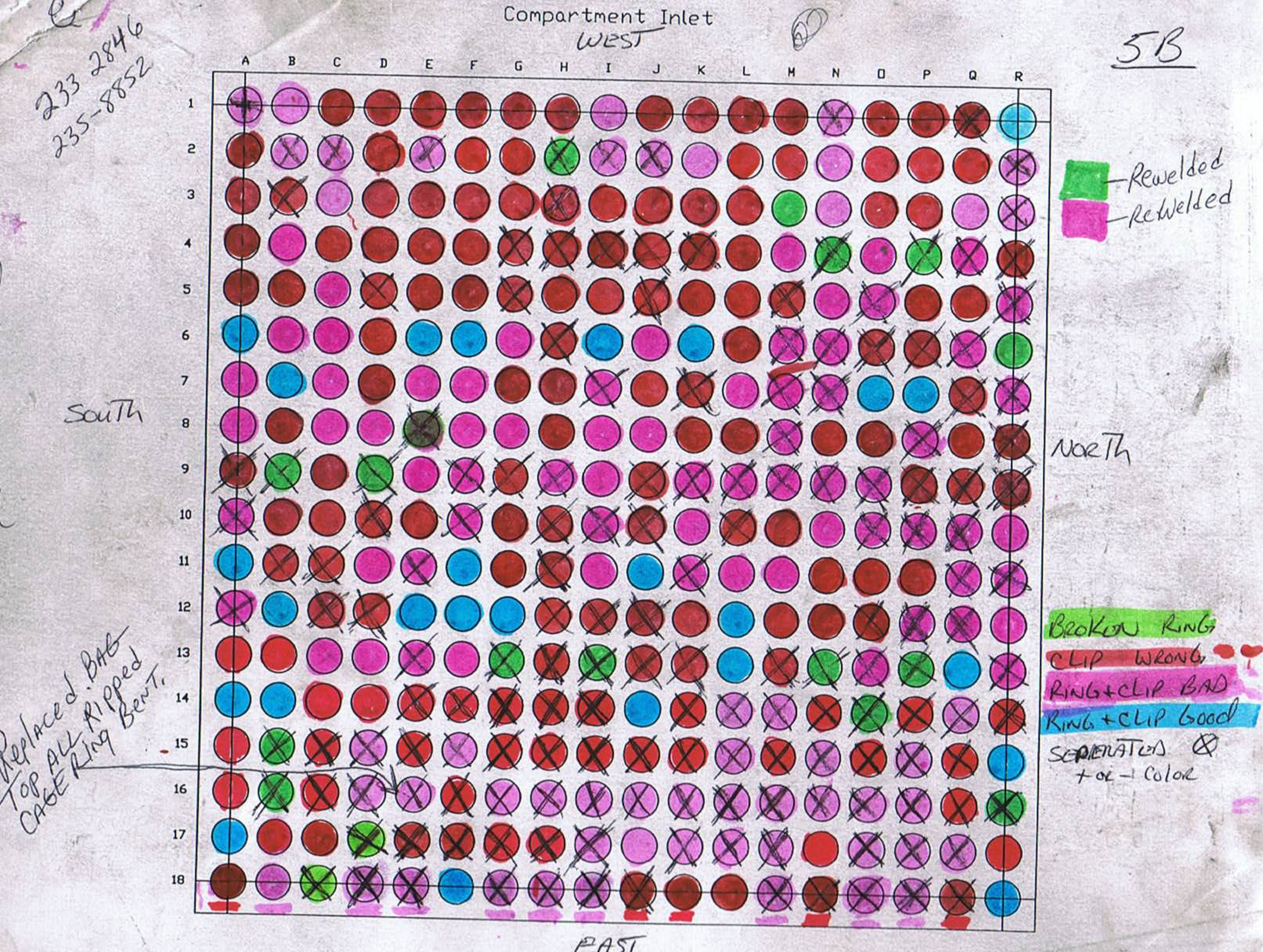
Compartment Inlet

WEST



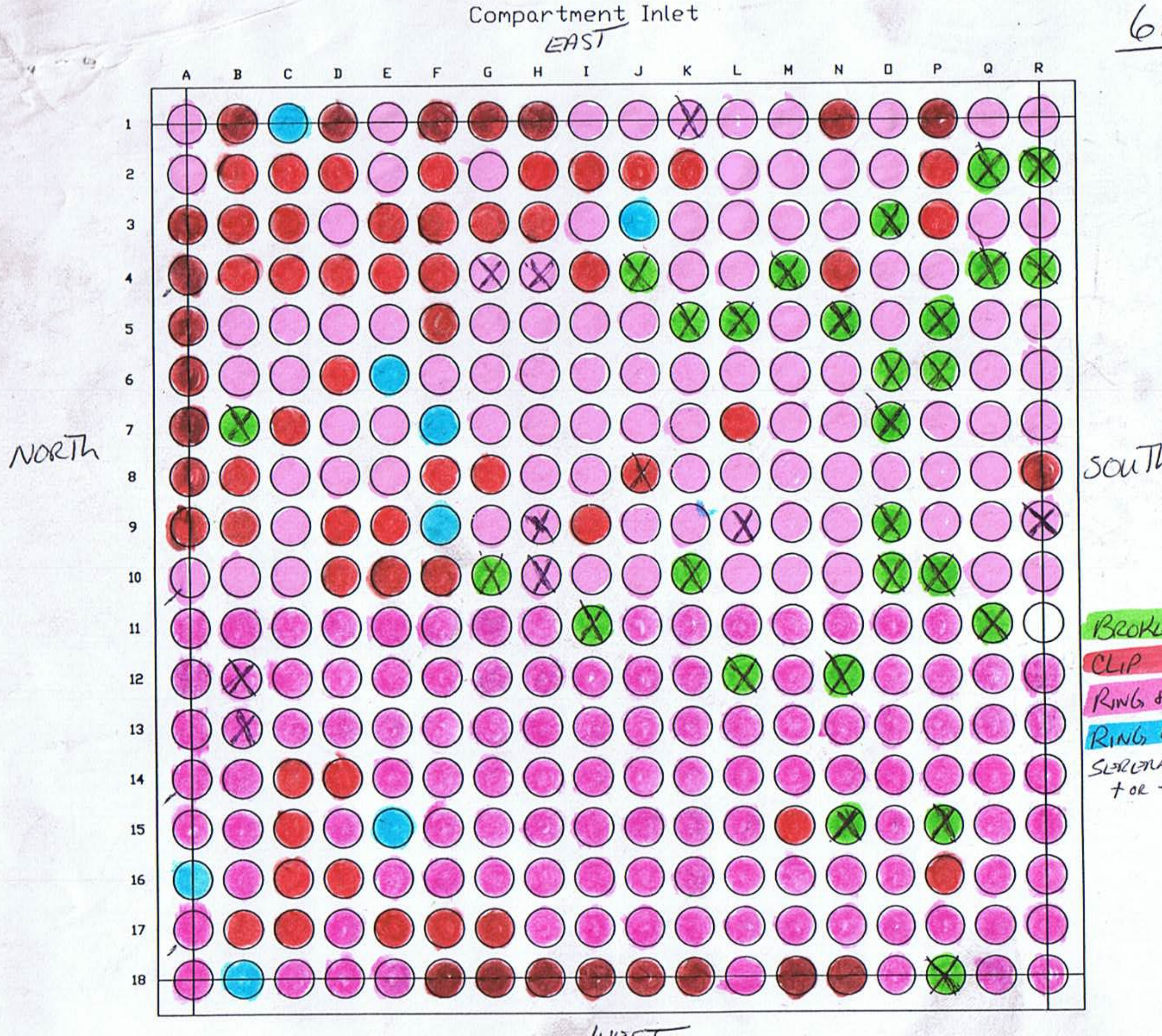

Compartment Inlet
WEST
4B
A B C D E F G H I J K L M N O P Q R
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
SOUTH
NORTH
EAST
Blue & Green with X Pulled Before & Welde
BROKEN RING
CLIP WRONG
RING & CLIP BAD
RING & CLIP GOOD
SEPERATED ⊗ TOR - COLOR


Compartment Inlet
WEST
5A
A B C D E F G H I J K L M N O P Q R
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
SOUTH
NORTH
EAST
Rewelded
Rewelded
BROKEN RING
CLIP WRONG
RING + CLIP BAD
RING + CLIP GOOD
SEGREGATED
+ or - color



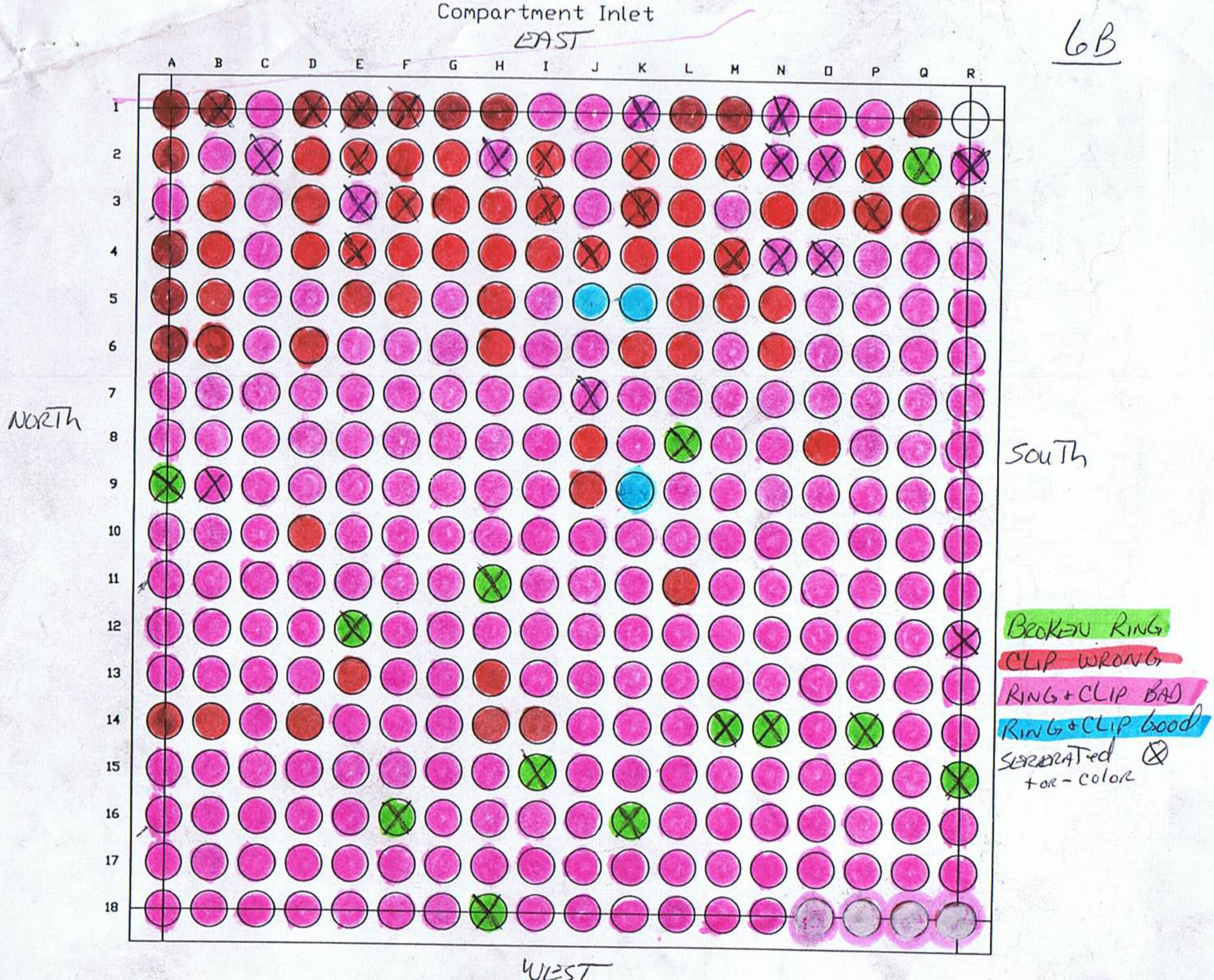
Compartment Inlet
WEST
5B
233 2846
235-8852
A B C D E F G H I J K L M N O P Q R
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
SOUTH
NORTH
EAST
Rewelded
ReWelded
BROKEN RING
CLIP WRONG
RING+CLIP BAD
RING+CLIP Good
SEPERATED ⊗ + or - Color
Replaced BAG
TOP ALL RIPPED
CAGE RING Bent.

6A



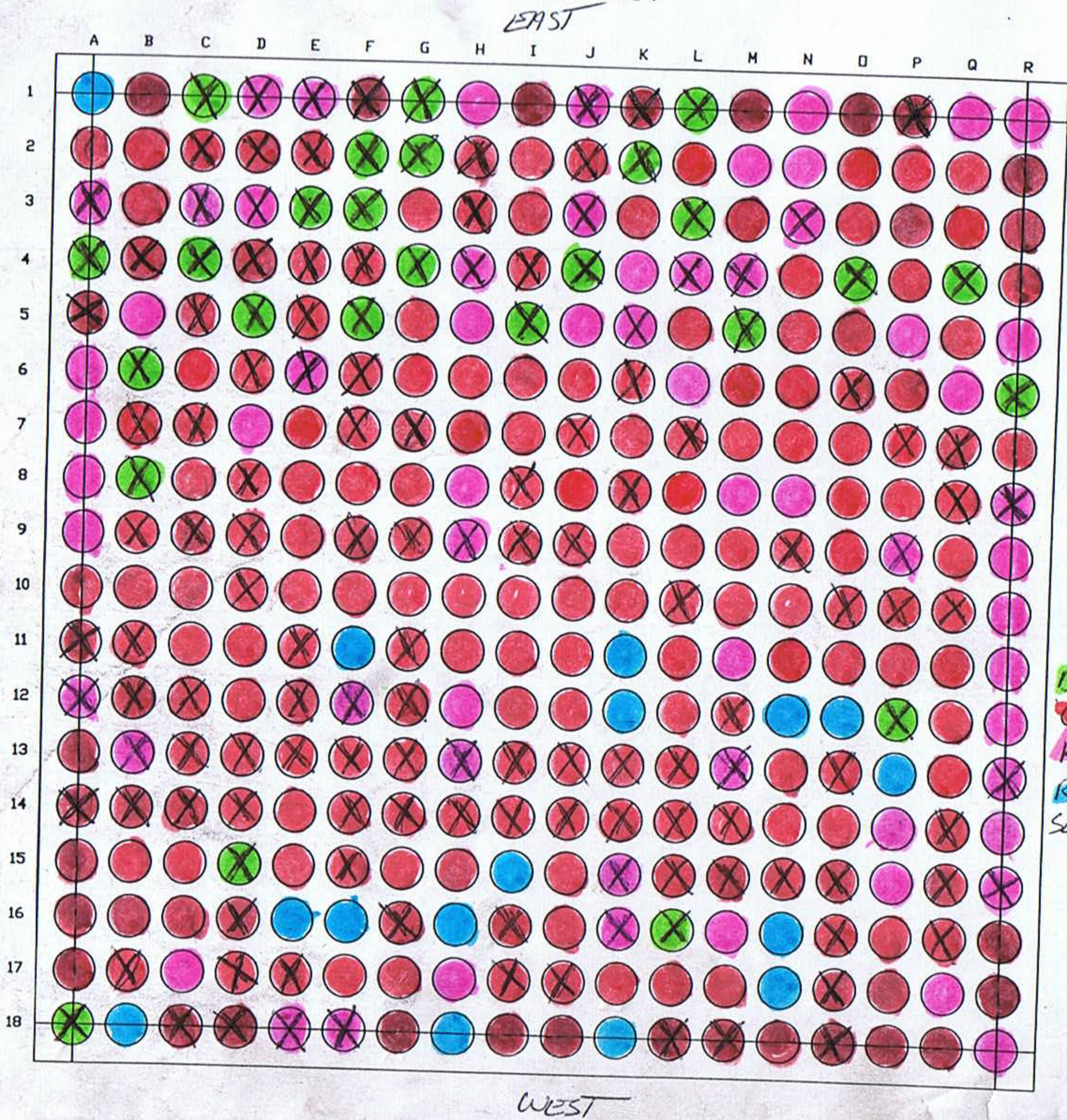
BROKEN RING
CLIP WRONG
RING & CLIP BAD
RING & CLIP GOOD
SEGREGATED ⊗
+ OR - COLOR

6B


Compartment Inlet
EAST
A B C D E F G H I J K L M N O P Q R
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
NORTH
SOUTH
WEST
BROKEN RING
CLIP WRONG
RING + CLIP BAD
RING + CLIP GOOD
SEPARATED ⊗
+ or - color

7A

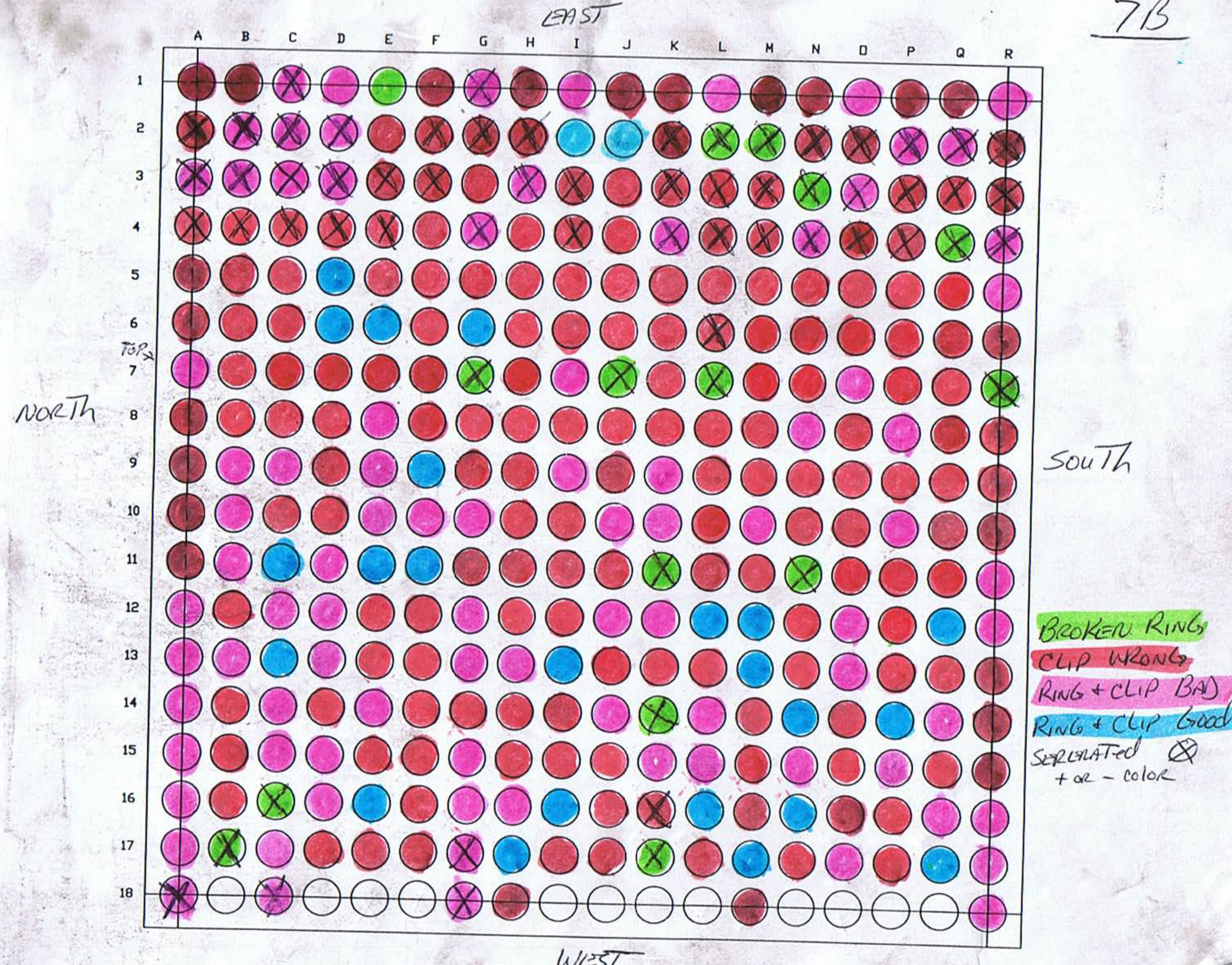
Compartment Inlet



BROKEN RING
CLIP WRONG
RING + CLIP BAD
RING + CLIP GOOD
SEPERATED ⊗
+ OR - COLOR

7B

Compartment Inlet



8A

Compartment Inlet

WHITE COULDN'T GET CAGE OUT.

BROKEN RING

CLIP WRONG

RING + CLIP BAD

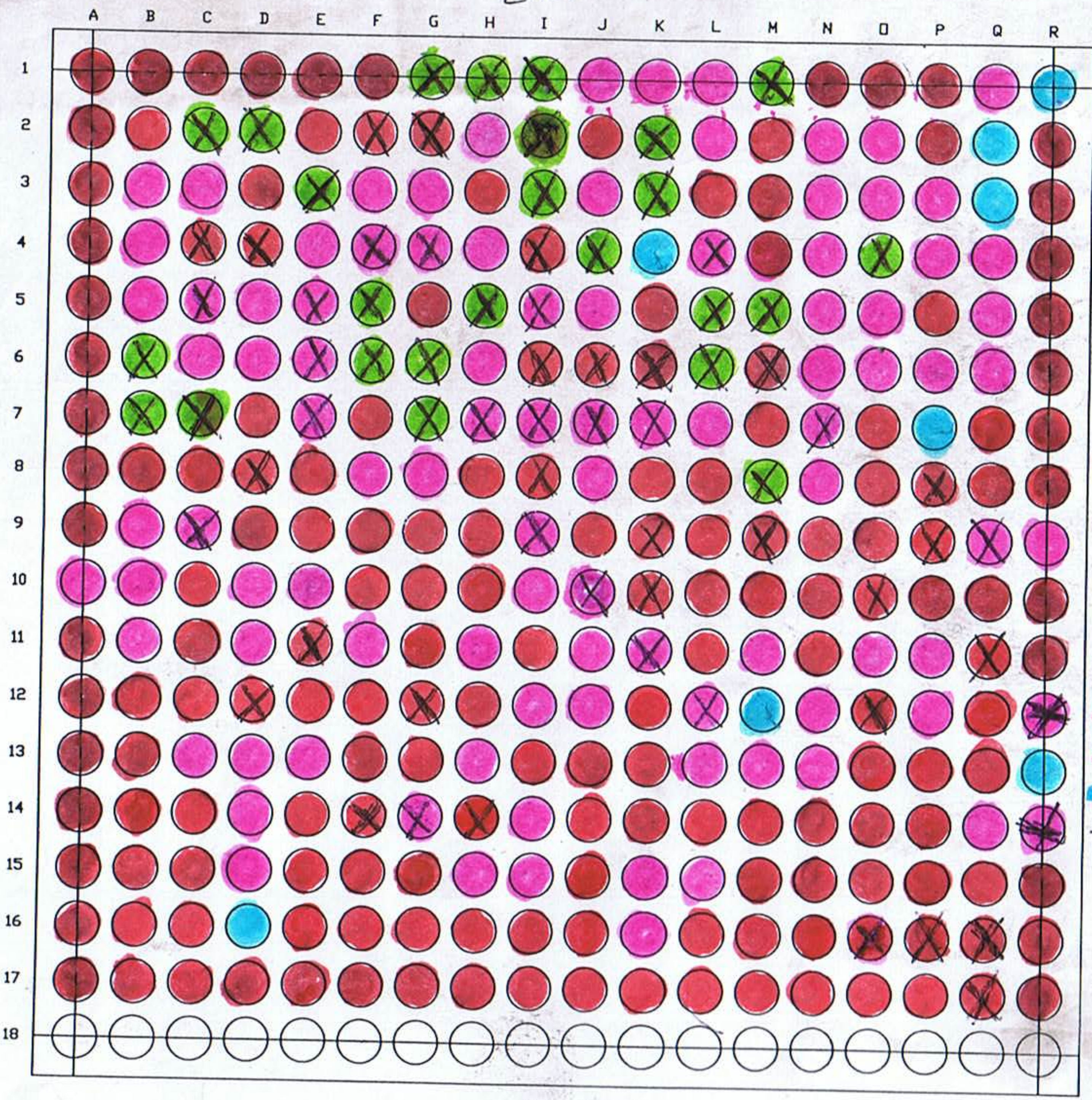
RING + CLIP GOOD

SEPERATED ⊗ + OR − COLOR

8B

Compartment Inlet

EAST



NORTH

SOUTH

WEST

BROKEN RING

CLIP WRONG

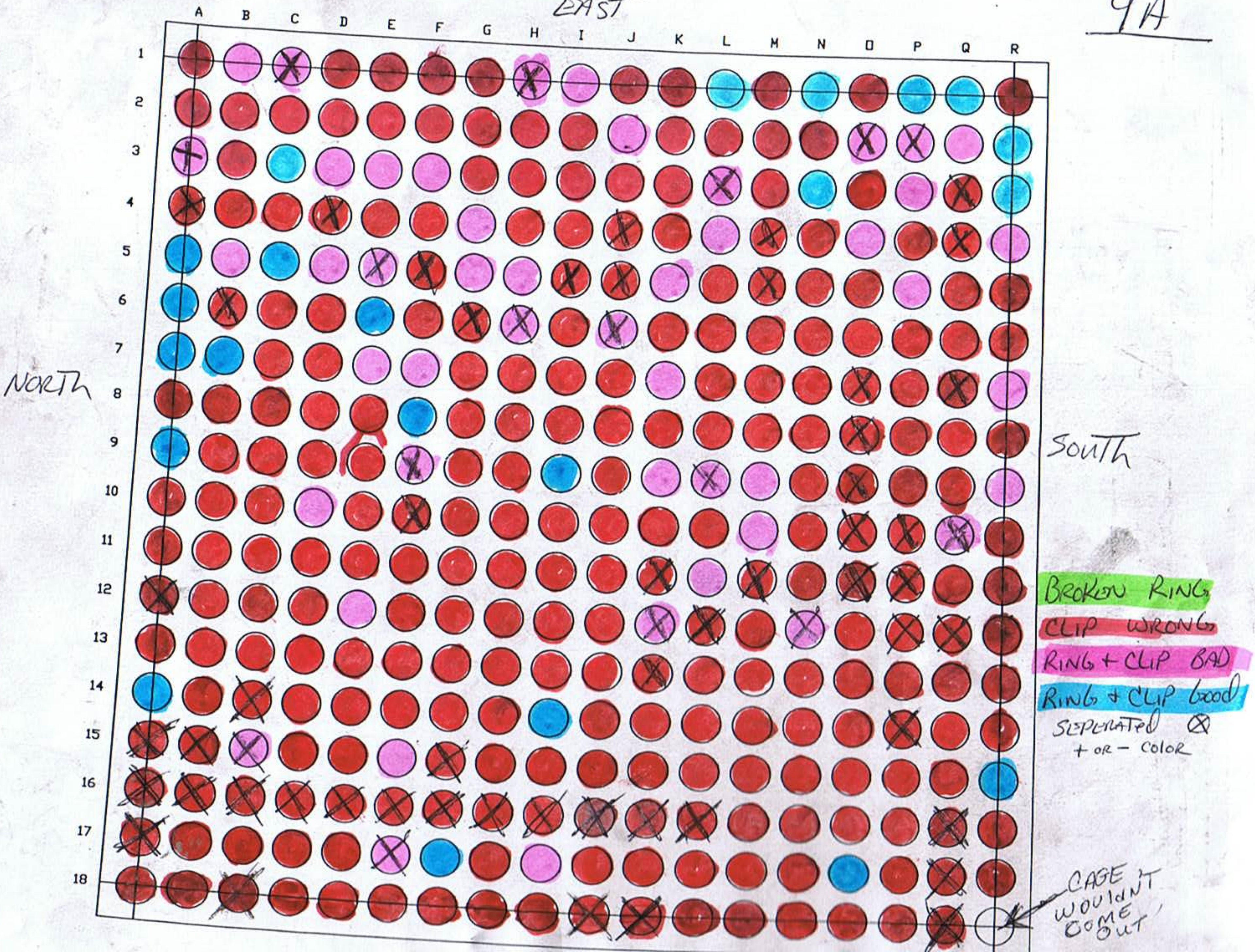
RING + CLIP BAD

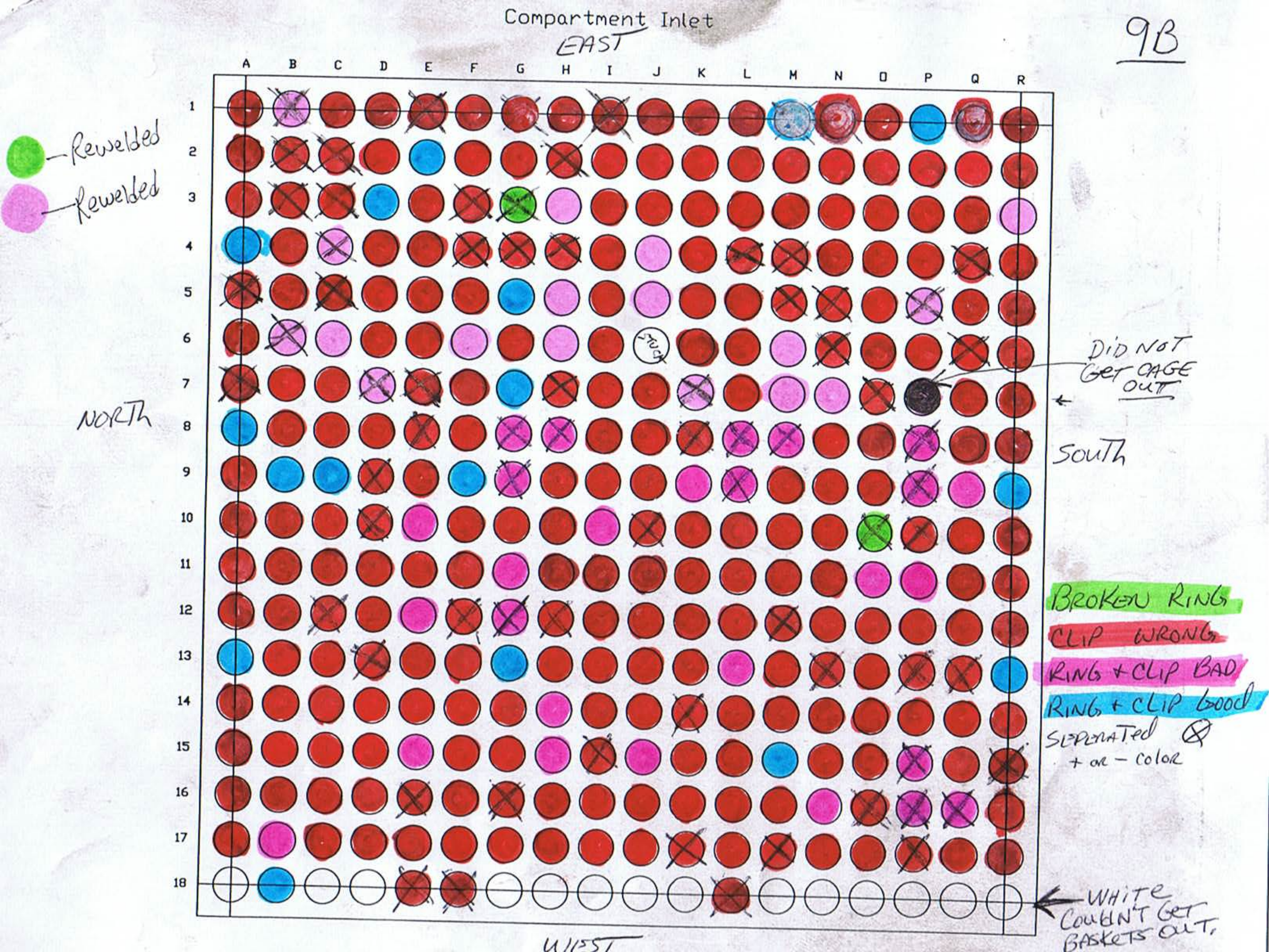
RING + CLIP GOOD

SEPERATED ⊗ + or − color

9A

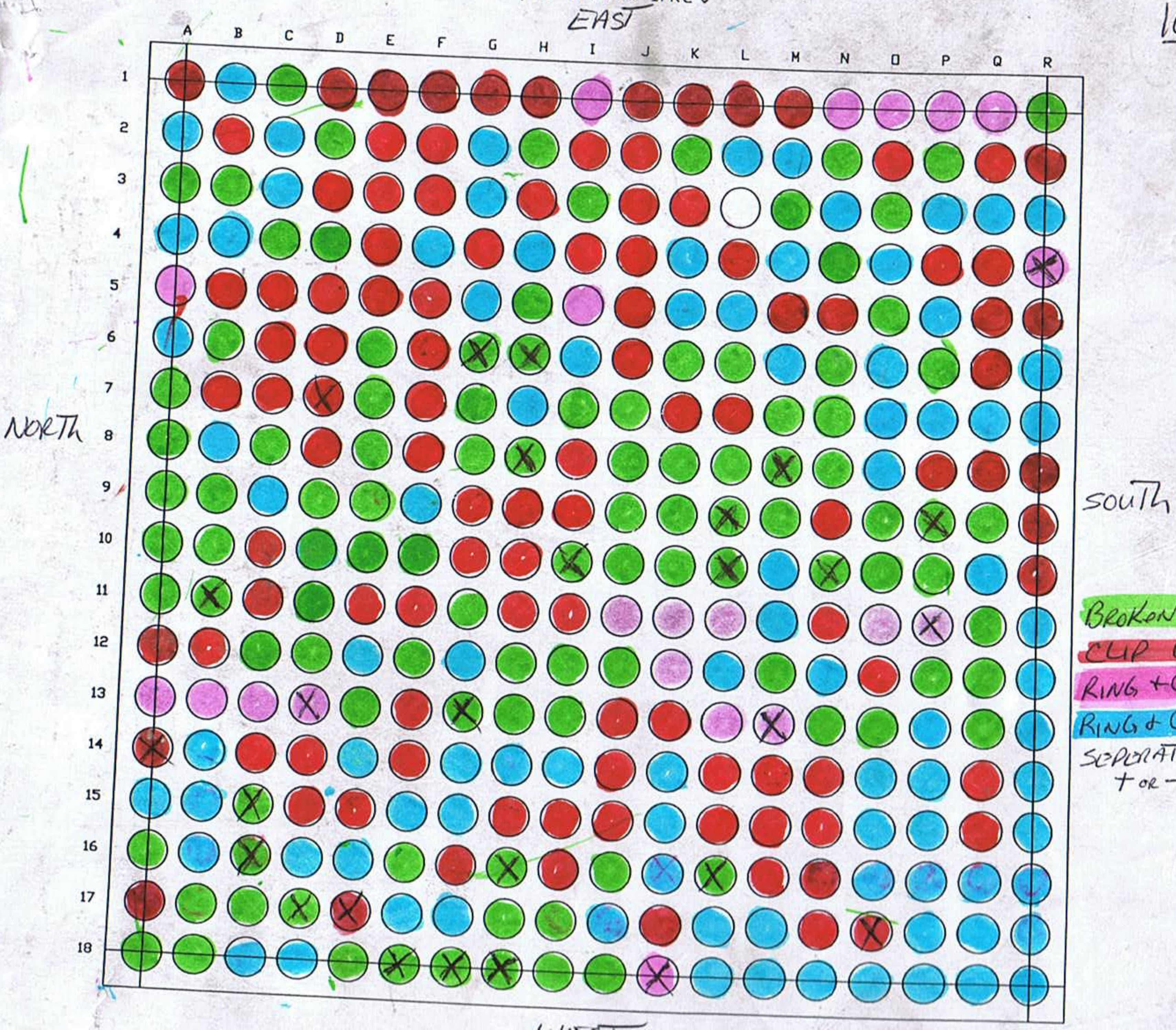
Compartment Inlet



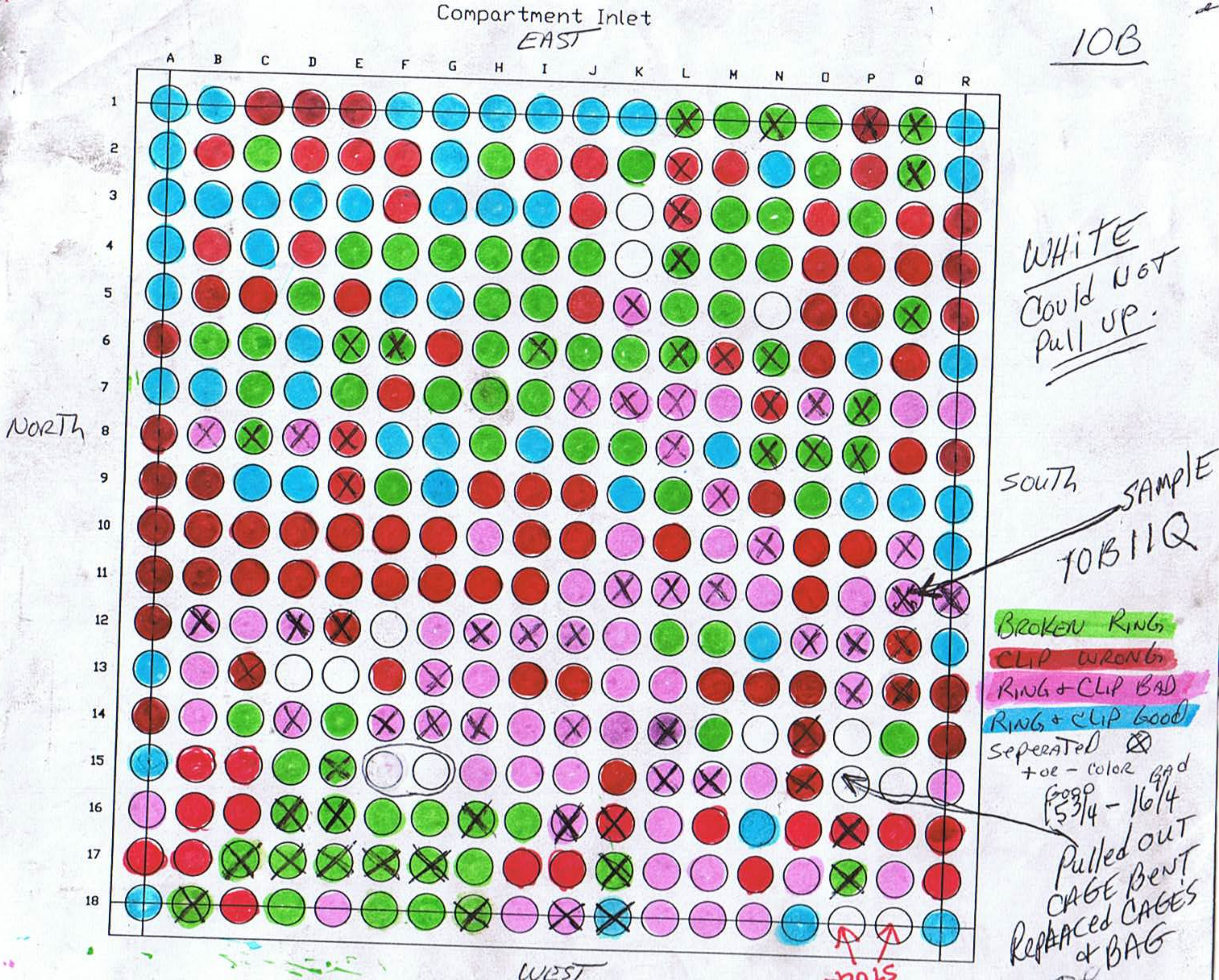

9B
Compartment Inlet
EAST
WEST
NORTH
SOUTH
A B C D E F G H I J K L M N O P Q R
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Rewelded
Rewelded
STUCK
DID NOT GET CAGE OUT
BROKEN RING
CLIP WRONG
RING + CLIP BAD
RING + CLIP GOOD
SEPERATED ⊗ + or − color
WHITE COULDN'T GET BASKETS OUT.

Compartment Inlet

10A



BROKEN RING
CLIP WRONG
RING + CLIP BAD
RING + CLIP GOOD
SEPERATED ⊗
+ or − color


Compartment Inlet
EAST
10B
NORTH
SOUTH
WEST
A B C D E F G H I J K L M N O P Q R
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
WHITE
Could NOT
pull up.
SAMPLE
10B11Q
BROKEN RING
CLIP WRONG
RING + CLIP BAD
RING + CLIP GOOD
SEPERATED ⊗
+OE - color
GOOD 53/4 - BAD 16/4
Pulled out
CAGE Bent
RePLACED CAGES
& BAG

Environmental Consultant Company

PREPARED FOR:

WE Energies
Marquette, MI
June 9, 2006
TLN 478 K

Environmental Consultant Company

...dedicated to filtration science

Laboratory Address:
2501 W. Behrend Drive, Suite 51
Phoenix, Arizona 85027
Telephone: 623-582-5155
Fax# 623-581-9264

Mailing Address:
P.O. Box 42537
Phoenix, Arizona 85080
e-mail: ecc@bagtest.com
website: www.bagtest.com

June 9, 2006
TLN 478K

Report
WE Energies

Reference: Presque Isle Power Plant

One pulse jet bag was submitted for testing and evaluation.

The bag was identified as follows:

3B18D

The bag was placed in service in the fall of 2005 for a 12/05 startup.

Attached are the results of evaluation.

The ash cake as received is of a very non agglomerated structure with low retained weight levels.

Photo A is a view of the low retained ash cake.

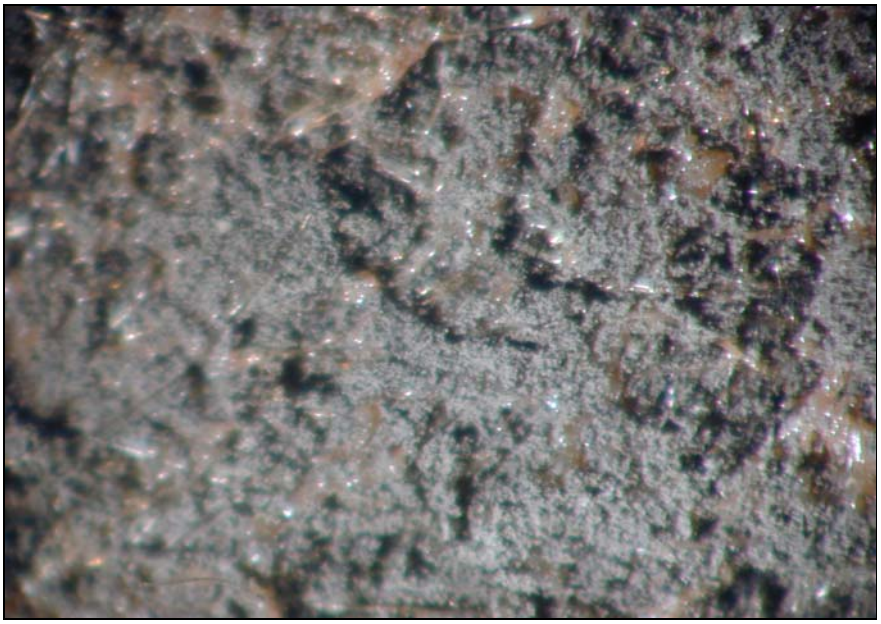


Photo A

The resulting air permeability both as received and after pulse input generate good high levels of acceptances.

These flows were evident in full length profile.

The media is at very good overall collection characteristics again in full profile.

Cross sectionals **Photo B** (top) **Photo C** (middle) and **Photo D** (bottom) reveal the ash collection occurring within the minimal depths of the collection surface.

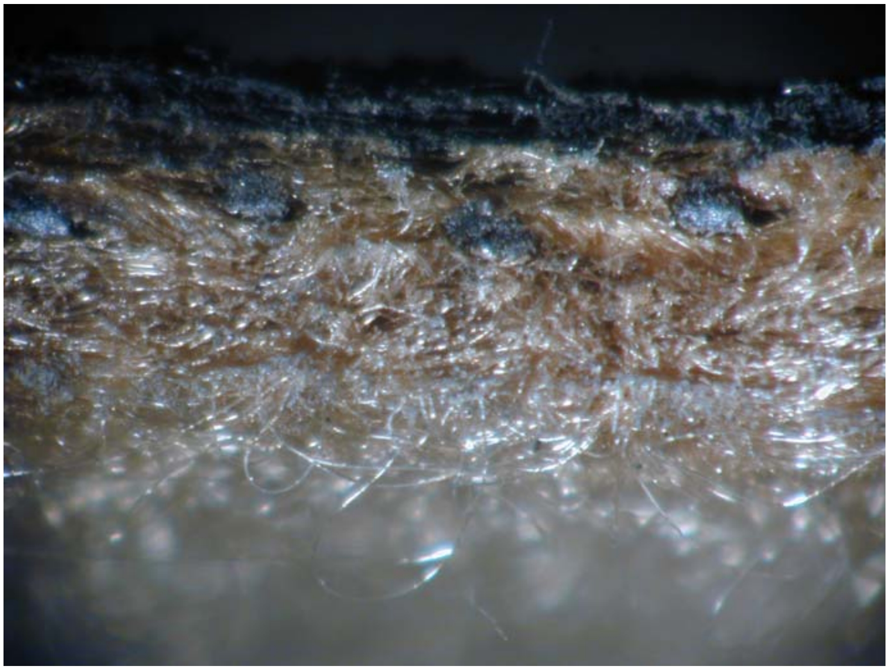


Photo B

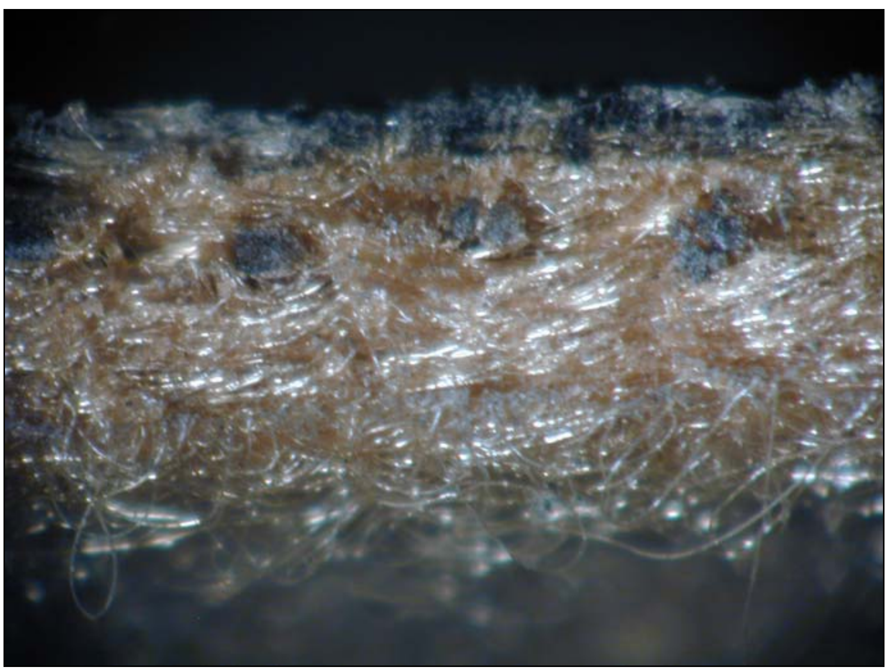


Photo C

Photo D

There is no evidence of any fine micron penetration/ leakage through.

The snap band was fully seated with no leakage present.

The strengths, both mullen burst and tensile, considering the limited service use, are at slightly abnormal reductions.

The flex endurances also exhibit slight abnormal reduction levels for the limited service use.

The Ryton PPS did exhibit altered solubility viscosity indicative of thermal oxidation in addition to nominal service use fatigue.

The level of deterioration is rated at 20% termination.

prepared for: **WE ENERGIES**

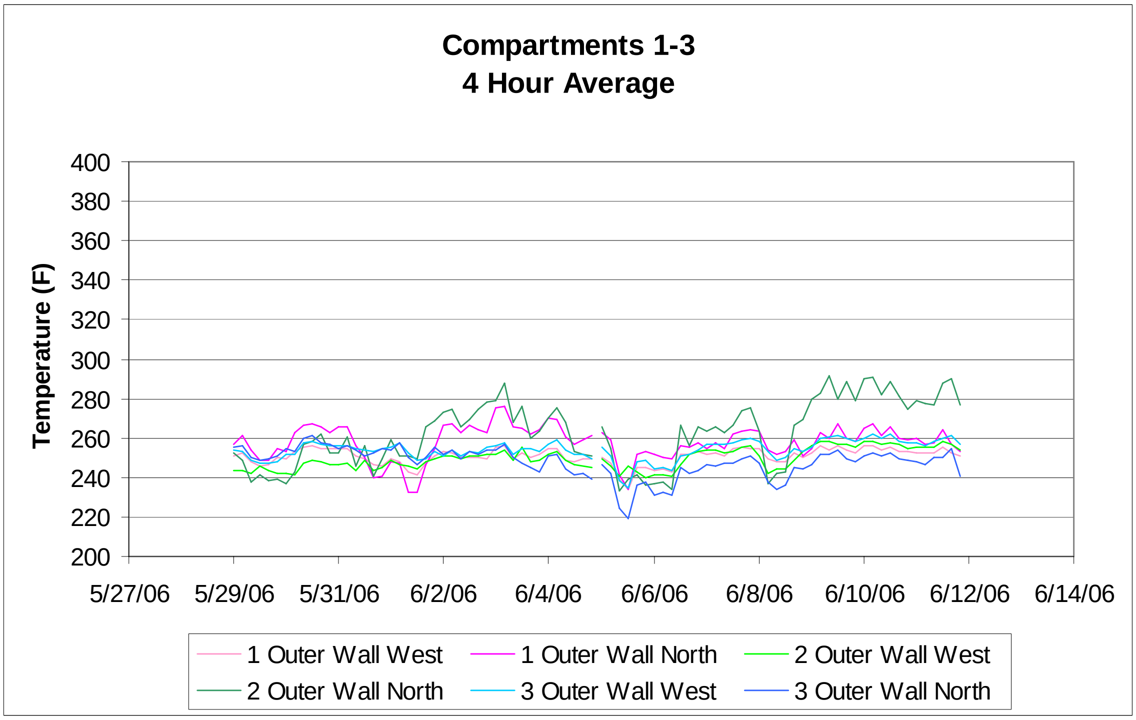
Date : **6/9/2006**
TLN : **478K**

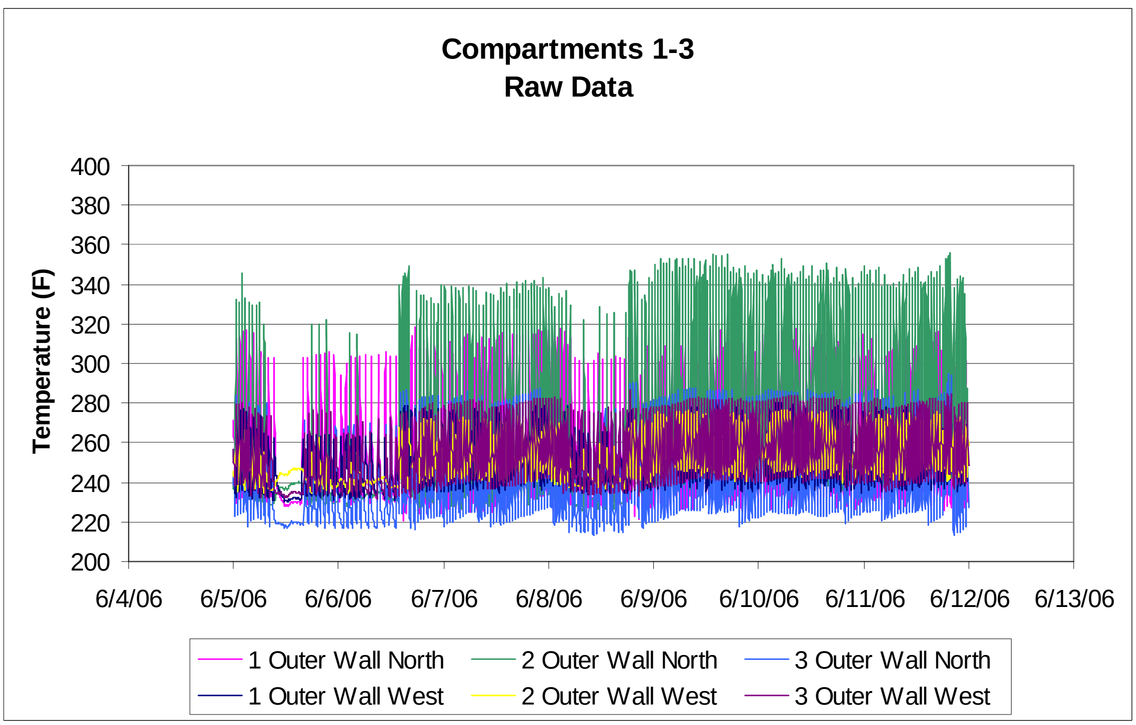
Identification: **3B-18D**
Fiber Content: **RYTON**
Fabric Construction: **NEEDLED**
Weave: **Pw**
Count: **24x14**
Yarn System- Warp/Length: **SPUN**
Filling Width: **SPUN**
Avg. Weight [oz/sq yd]: **17.95**
Thickness [inches]: **.084**
Density Factor: **0.165**
Treatment- Physical Type: **SINGE**
Chemical Type: **NONE**
% Ignition Loss [LOI]:
500° F/1 Hour: **NA**
1150° F/1 Hour: **NA**
% Extractable Matter: **SULPHATES**
Acid Alkaline [PH]: **7.40**

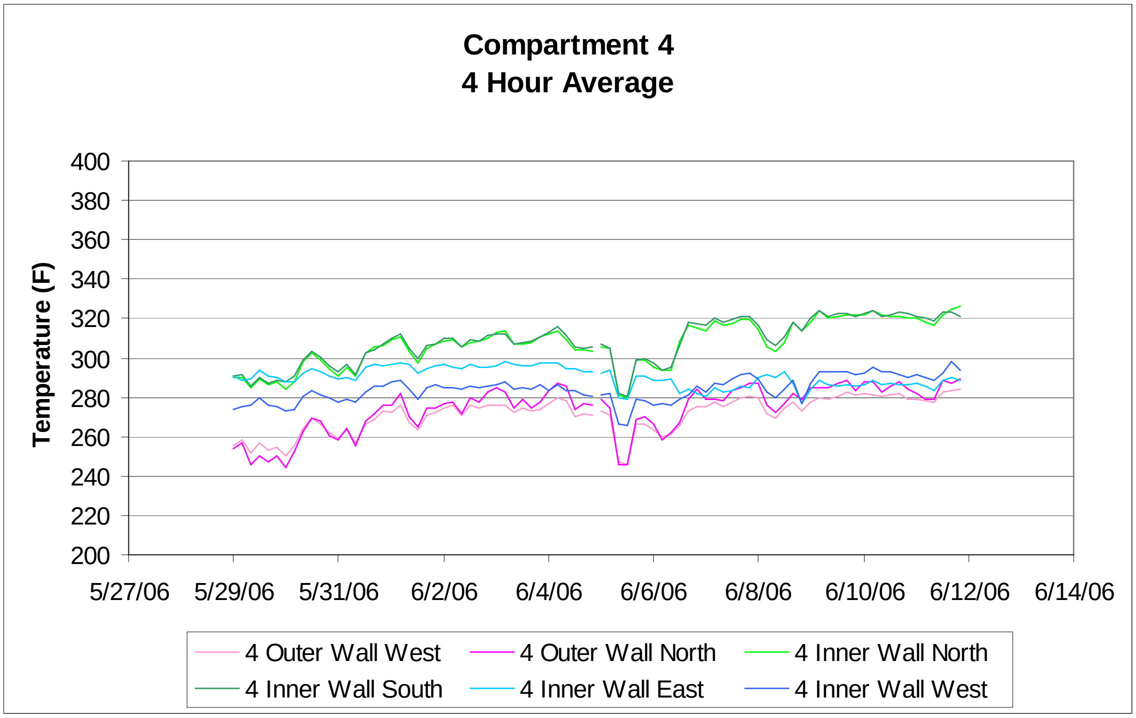
Fabrication ====>
Seaming: **FUSED**
Hardware: **SS**
Cuffing: **LOCK**
Sewing Thread: **E GLASS**
Ring Cover: **NONE**
Fabrication Rating: **GOOD**

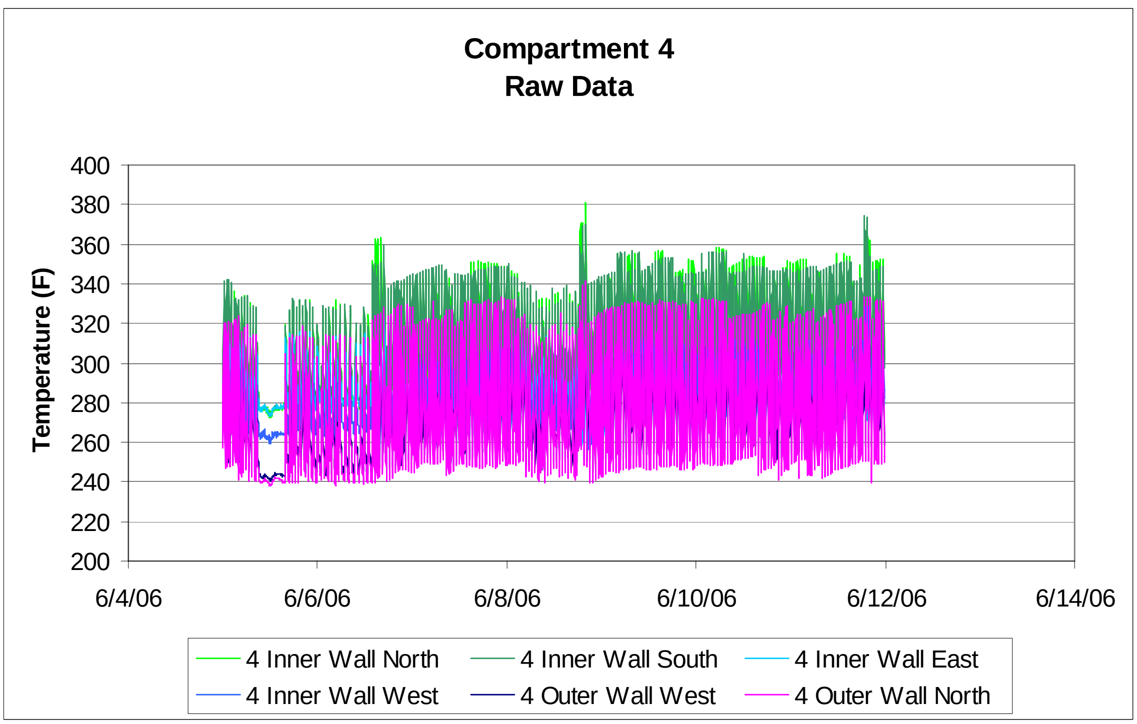
-PROFILE DATA-		Top	Center	Bottom
Weight (oz/sq yd)	As Received	19.15	19.29	19.40
	Cleaned	19.12	19.39	19.56
	Cleaned (Washed)	17.87	17.94	18.05
Permeability CFM/sq ft @ .5" H2O	As Received	8.9	8.8	8.6
	Cleaned	12.1	11.9	10.7
	Cleaned (Washed)	24.5	23.8	23.5
Breaking Strength lbs/inch	Warp/Length	169	174	175
	Filling/Width	242	252	254
Breaking Strength Percent Loss	Warp/Length	15.50%	13.00%	12.50%
	Filling/Width	19.33%	16.00%	15.33%
Mullen Burst (lbs/sq inch)		441	447	451
Mullen Burst (percent Loss)		19.82%	18.73%	18.00%
Flex Cycles (MIT Method)	Warp	5000	5000	5000
	Fill	5000	5000	5000
Flex Cycles Percent Loss	Warp	15%	15%	10%
	Fill	20%	15%	15%
Other Testing				

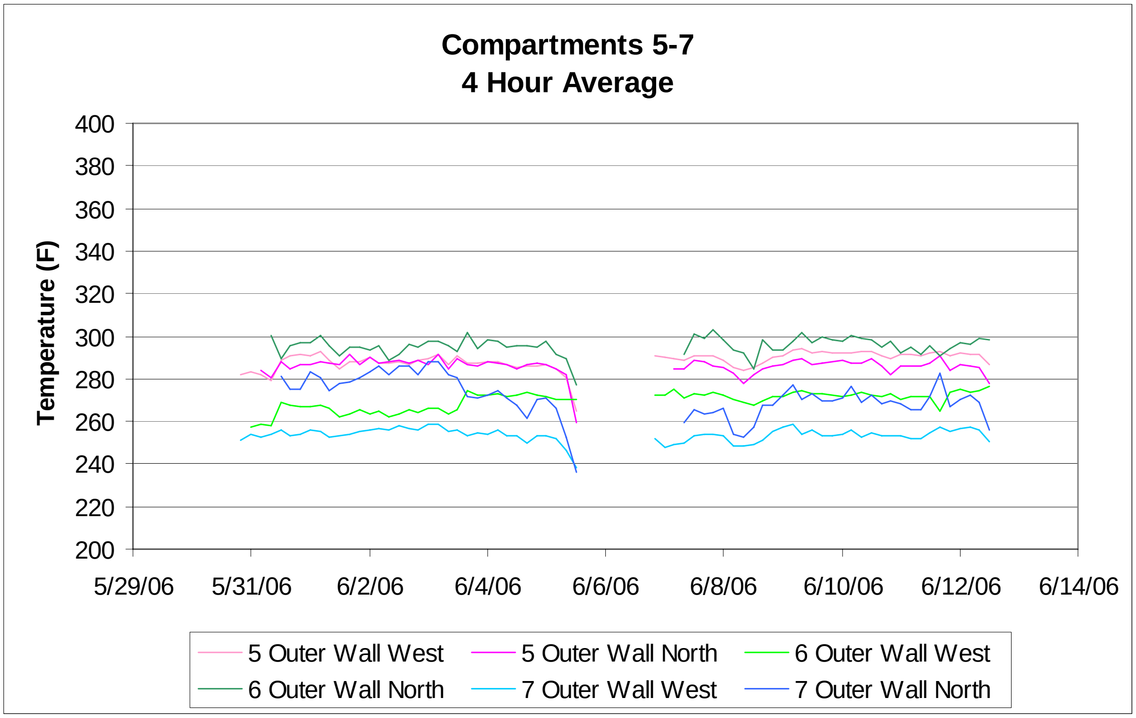
Weeks of May 29 and June 5

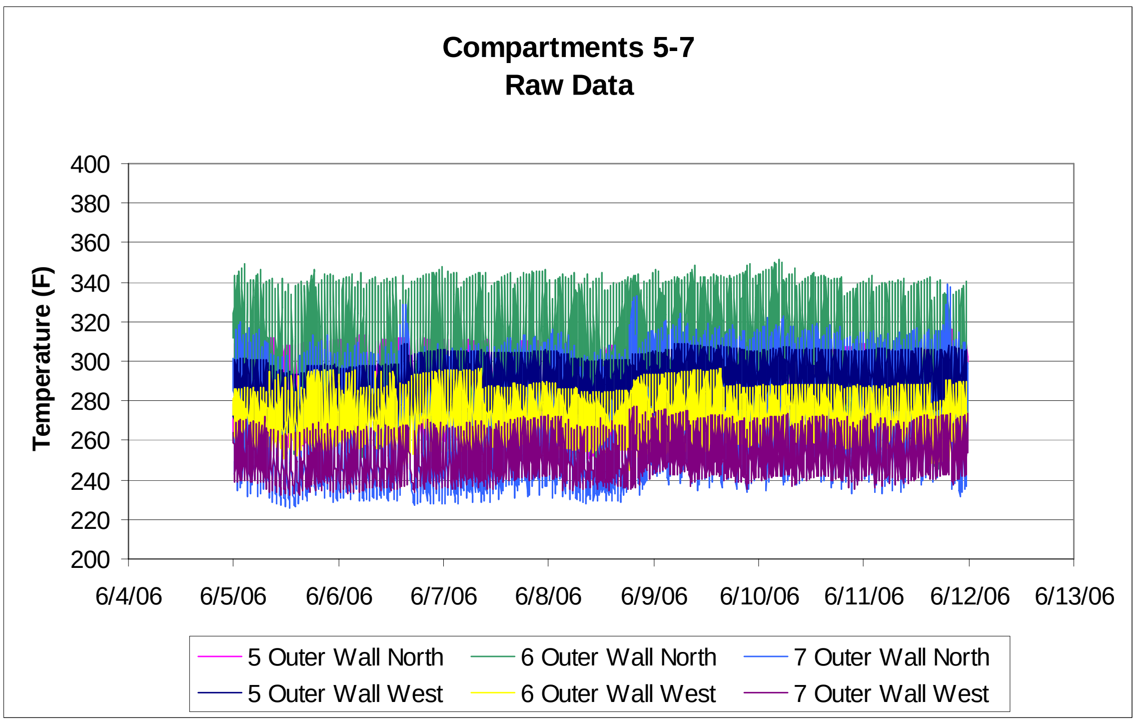


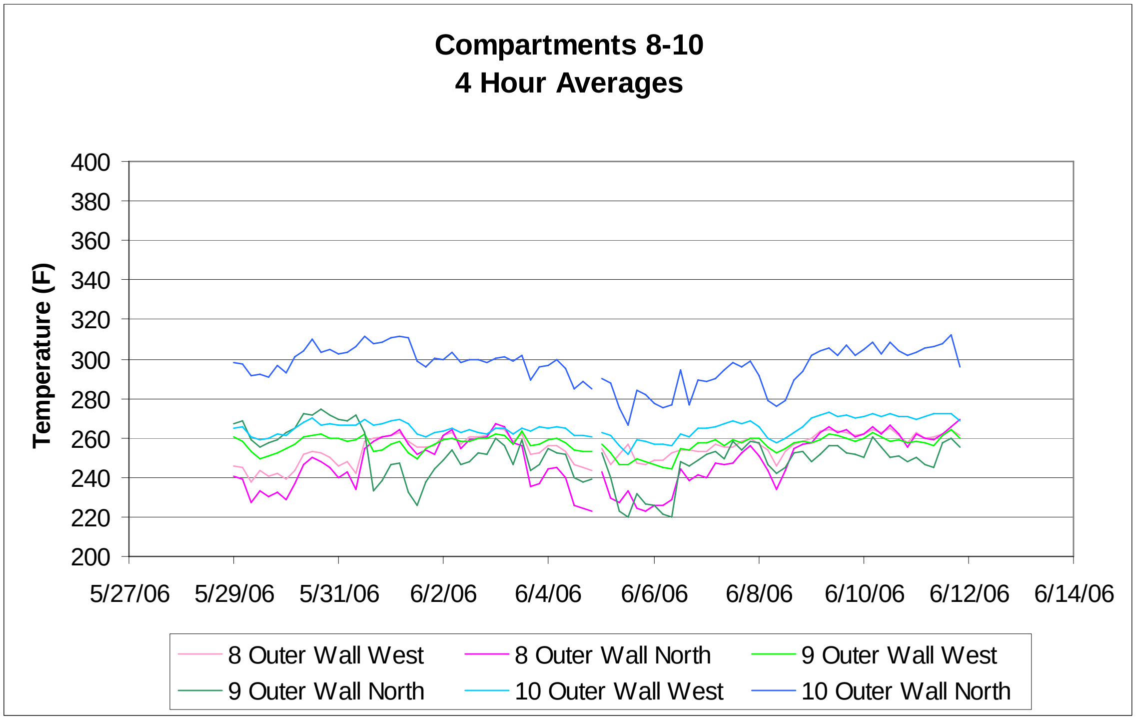


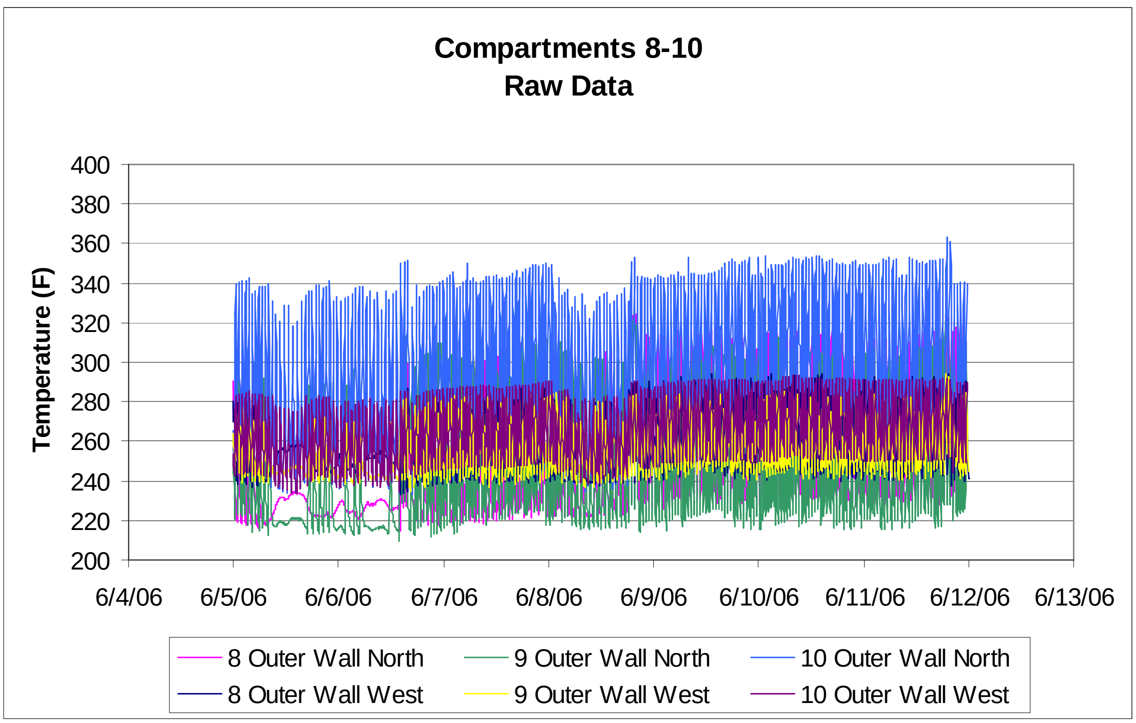

Compartment 4
4 Hour Average
Temperature (F)
400
380
360
340
320
300
280
260
240
220
200
5/27/06
5/29/06
5/31/06
6/2/06
6/4/06
6/6/06
6/8/06
6/10/06
6/12/06
6/14/06
4 Outer Wall West
4 Outer Wall North
4 Inner Wall North
4 Inner Wall South
4 Inner Wall East
4 Inner Wall West


Compartment 4
Raw Data
Temperature (F)
400
380
360
340
320
300
280
260
240
220
200
6/4/06
6/6/06
6/8/06
6/10/06
6/12/06
6/14/06
4 Inner Wall North
4 Inner Wall South
4 Inner Wall East
4 Inner Wall West
4 Outer Wall West
4 Outer Wall North

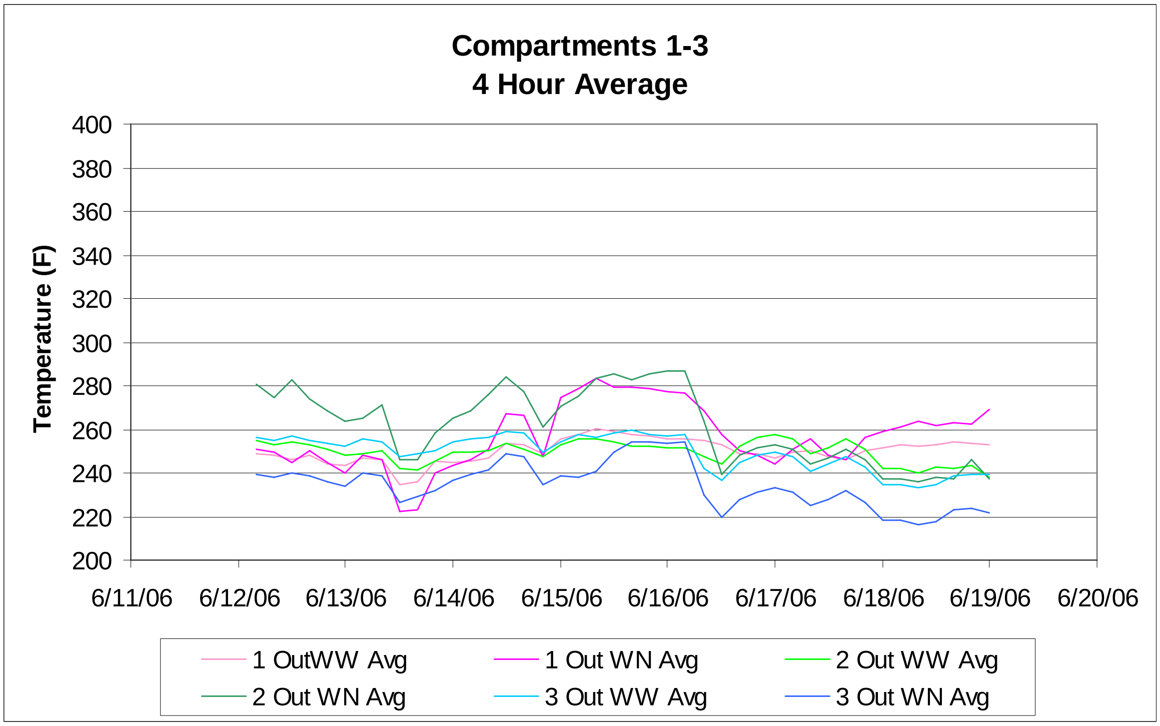

Compartments 5-7
4 Hour Average
Temperature (F)
400
380
360
340
320
300
280
260
240
220
200
5/29/06
5/31/06
6/2/06
6/4/06
6/6/06
6/8/06
6/10/06
6/12/06
6/14/06
5 Outer Wall West
5 Outer Wall North
6 Outer Wall West
6 Outer Wall North
7 Outer Wall West
7 Outer Wall North

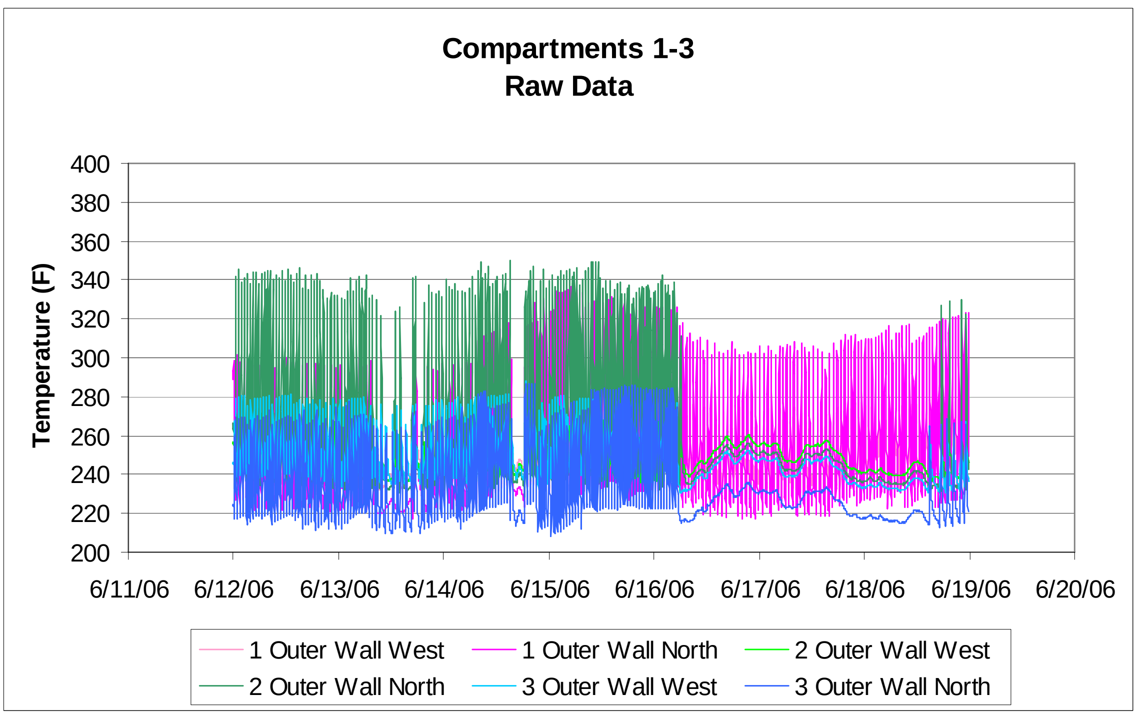

Compartments 5-7
Raw Data
Temperature (F)
400
380
360
340
320
300
280
260
240
220
200
6/4/06
6/5/06
6/6/06
6/7/06
6/8/06
6/9/06
6/10/06
6/11/06
6/12/06
6/13/06
5 Outer Wall North
6 Outer Wall North
7 Outer Wall North
5 Outer Wall West
6 Outer Wall West
7 Outer Wall West

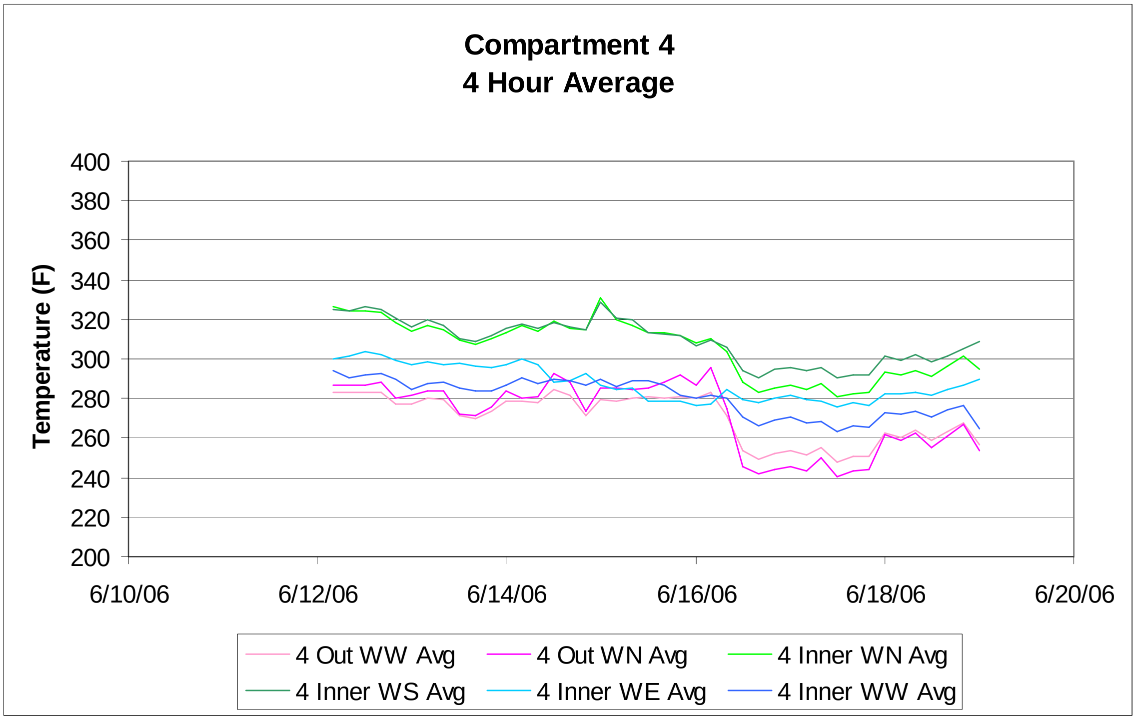

Compartments 8-10
4 Hour Averages
Temperature (F)
400
380
360
340
320
300
280
260
240
220
200
5/27/06
5/29/06
5/31/06
6/2/06
6/4/06
6/6/06
6/8/06
6/10/06
6/12/06
6/14/06
8 Outer Wall West
8 Outer Wall North
9 Outer Wall West
9 Outer Wall North
10 Outer Wall West
10 Outer Wall North

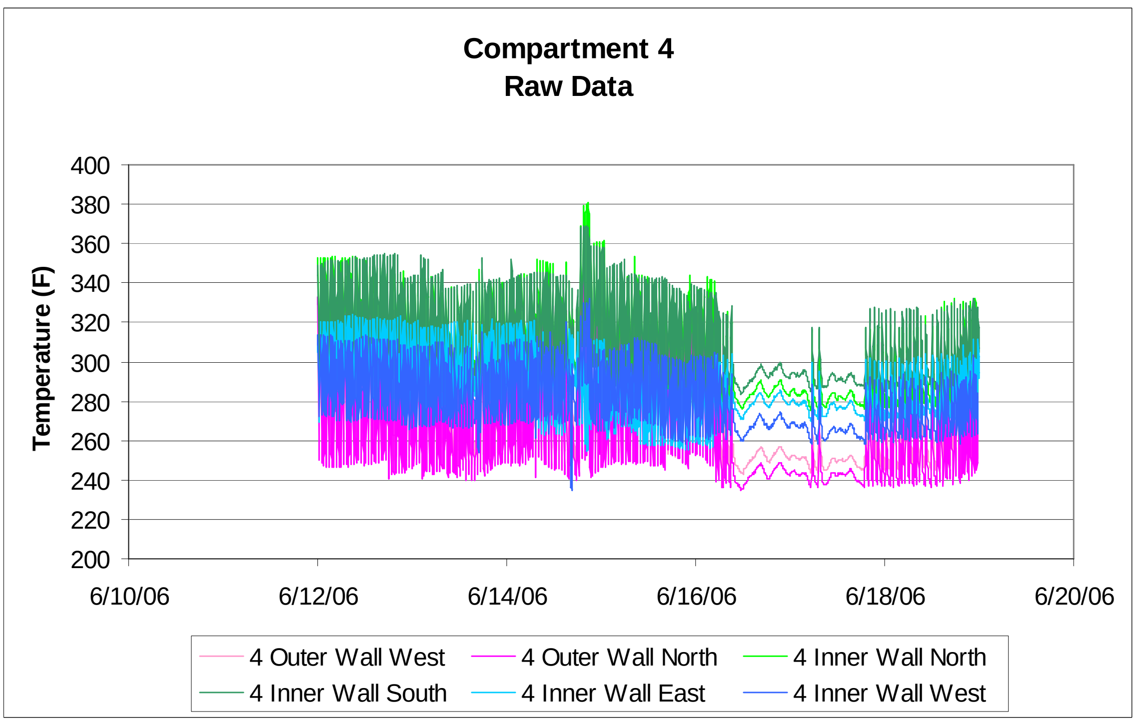

Compartments 8-10
Raw Data
Temperature (F)
400
380
360
340
320
300
280
260
240
220
200
6/4/06
6/5/06
6/6/06
6/7/06
6/8/06
6/9/06
6/10/06
6/11/06
6/12/06
6/13/06
8 Outer Wall North
9 Outer Wall North
10 Outer Wall North
8 Outer Wall West
9 Outer Wall West
10 Outer Wall West

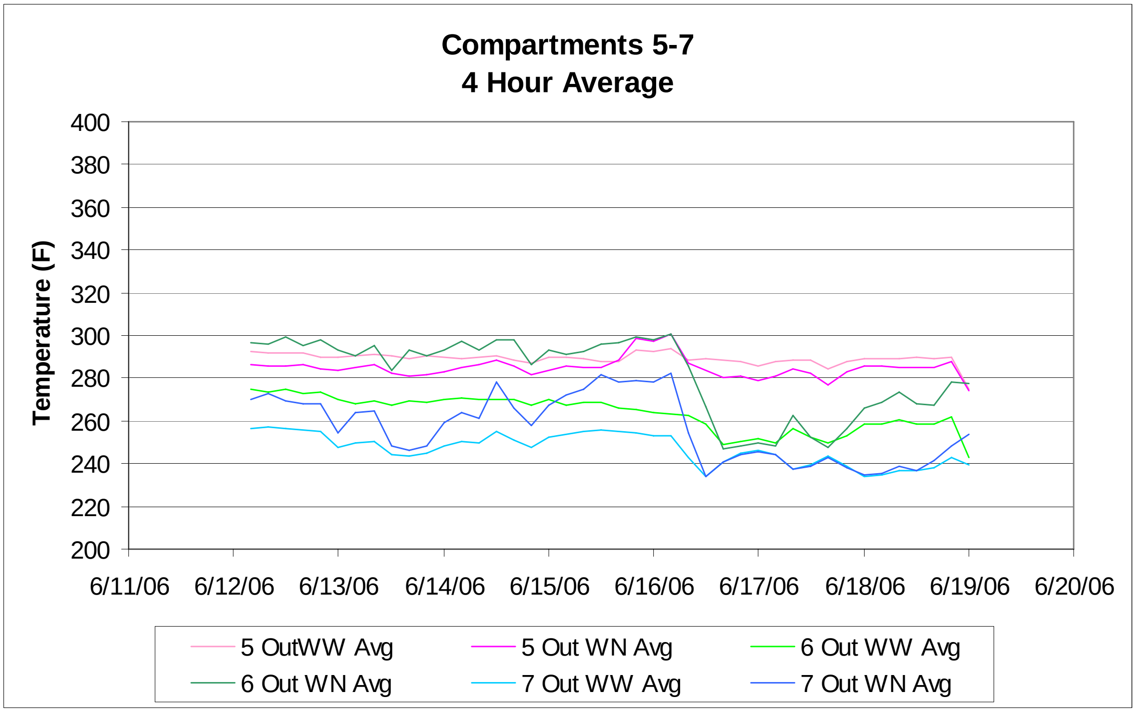
Week of June 12



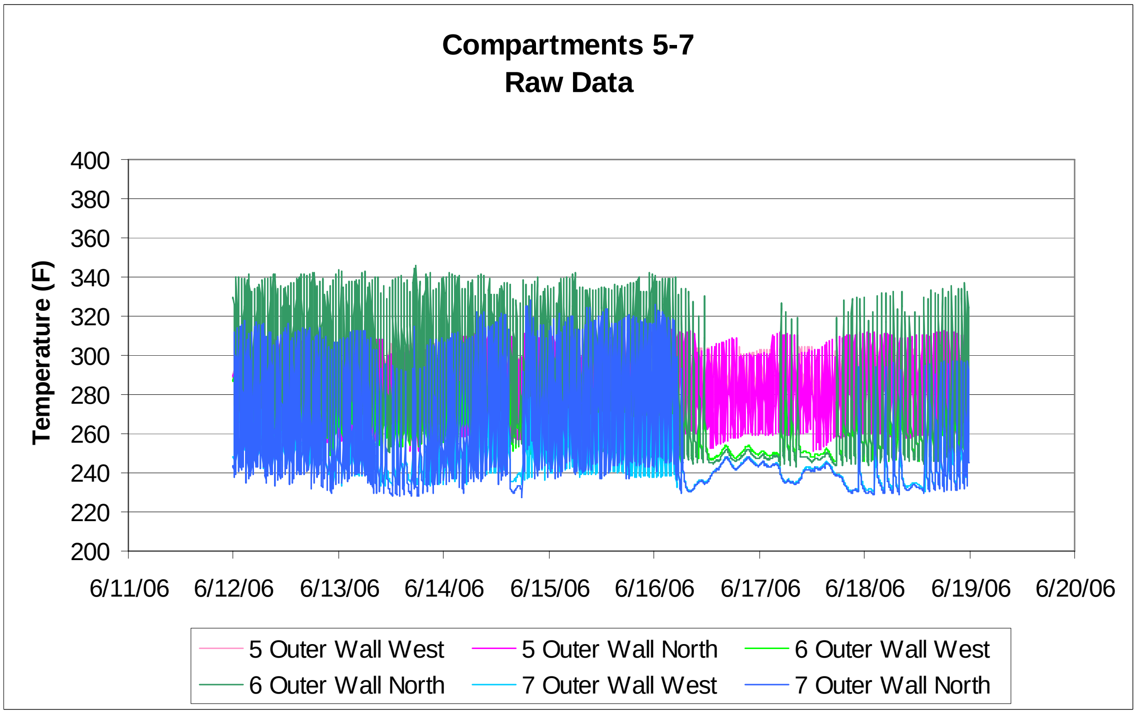



Compartment 4
4 Hour Average
Temperature (F)
400
380
360
340
320
300
280
260
240
220
200
6/10/06
6/12/06
6/14/06
6/16/06
6/18/06
6/20/06
4 Out WW Avg
4 Out WN Avg
4 Inner WN Avg
4 Inner WS Avg
4 Inner WE Avg
4 Inner WW Avg

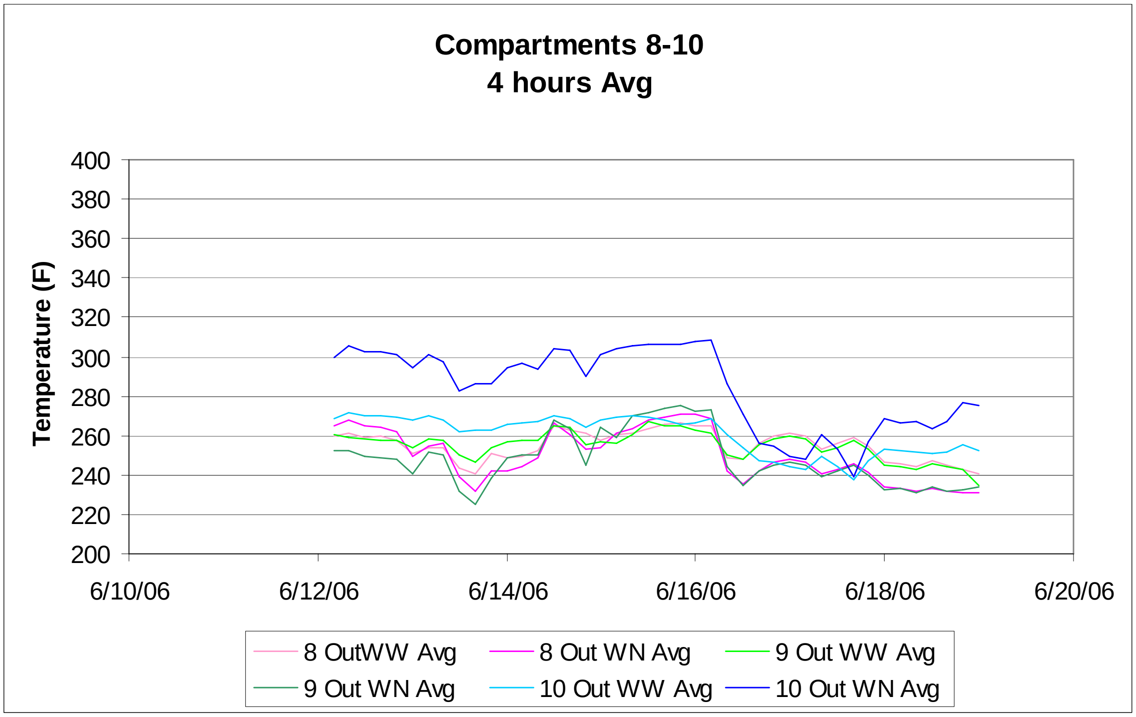

Compartment 4
Raw Data
Temperature (F)
400
380
360
340
320
300
280
260
240
220
200
6/10/06
6/12/06
6/14/06
6/16/06
6/18/06
6/20/06
4 Outer Wall West
4 Outer Wall North
4 Inner Wall North
4 Inner Wall South
4 Inner Wall East
4 Inner Wall West

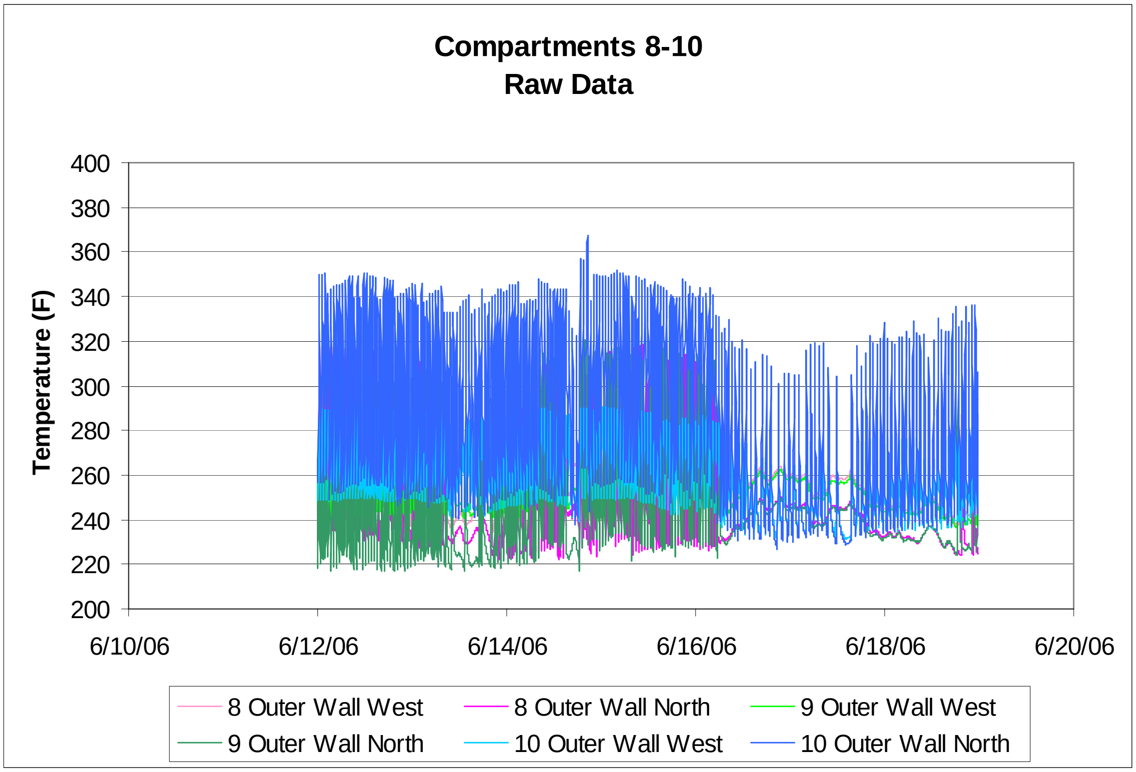


Compartments 5-7
4 Hour Average
Temperature (F)
400
380
360
340
320
300
280
260
240
220
200
6/11/06
6/12/06
6/13/06
6/14/06
6/15/06
6/16/06
6/17/06
6/18/06
6/19/06
6/20/06
5 OutWW Avg
5 Out WN Avg
6 Out WW Avg
6 Out WN Avg
7 Out WW Avg
7 Out WN Avg

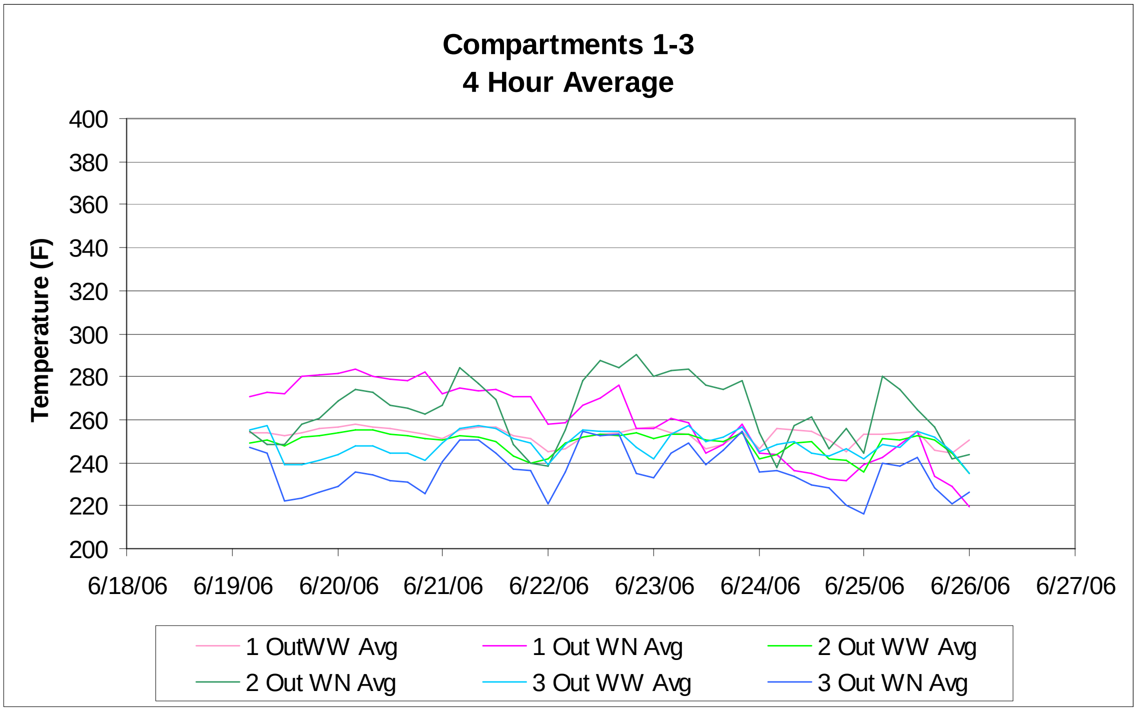


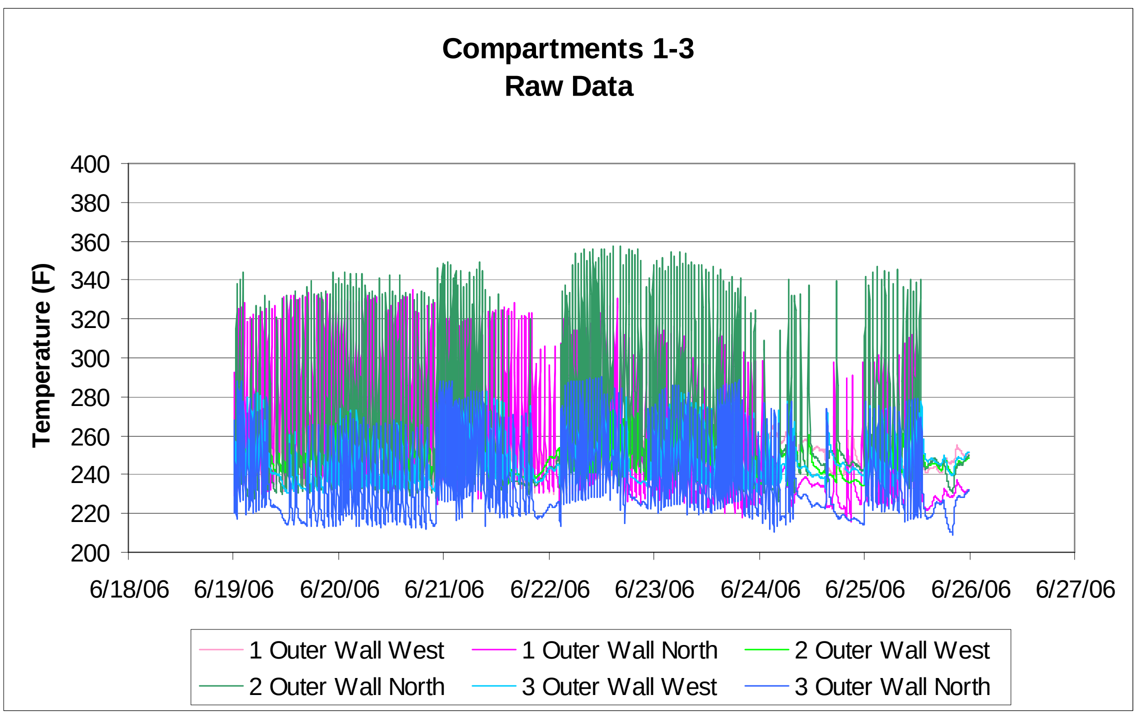
Compartments 5-7
Raw Data
Temperature (F)
400
380
360
340
320
300
280
260
240
220
200
6/11/06
6/12/06
6/13/06
6/14/06
6/15/06
6/16/06
6/17/06
6/18/06
6/19/06
6/20/06
5 Outer Wall West
5 Outer Wall North
6 Outer Wall West
6 Outer Wall North
7 Outer Wall West
7 Outer Wall North

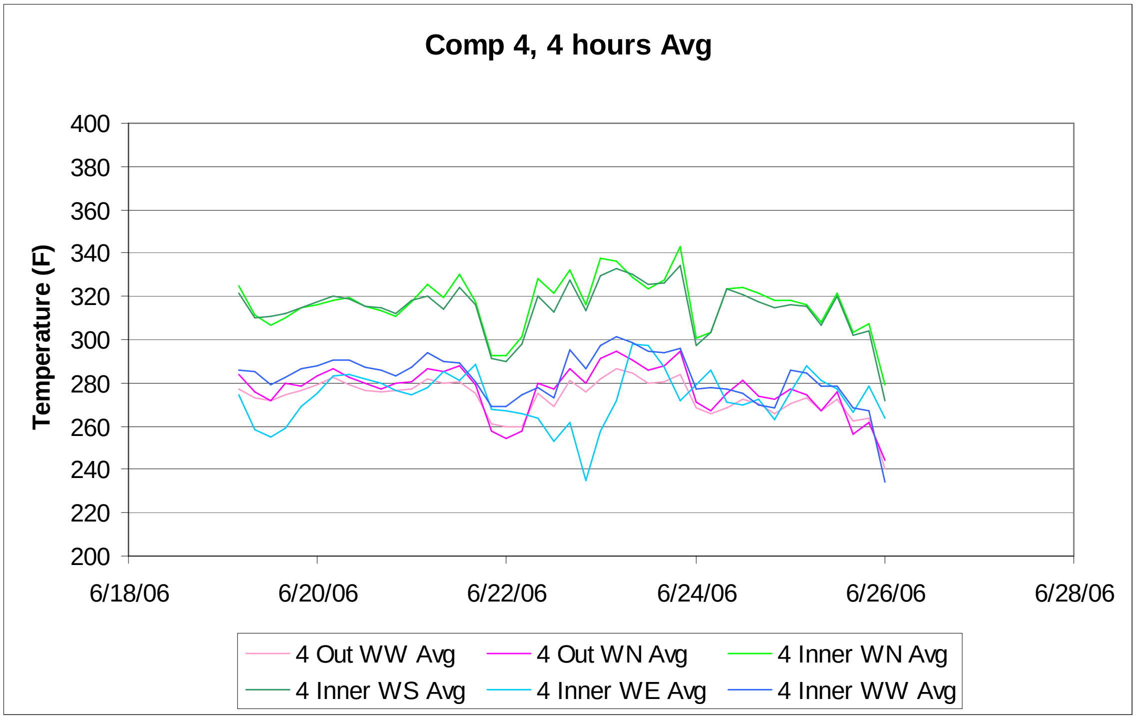

Compartments 8-10
4 hours Avg
Temperature (F)
400
380
360
340
320
300
280
260
240
220
200
6/10/06
6/12/06
6/14/06
6/16/06
6/18/06
6/20/06
8 OutWW Avg
8 Out WN Avg
9 Out WW Avg
9 Out WN Avg
10 Out WW Avg
10 Out WN Avg

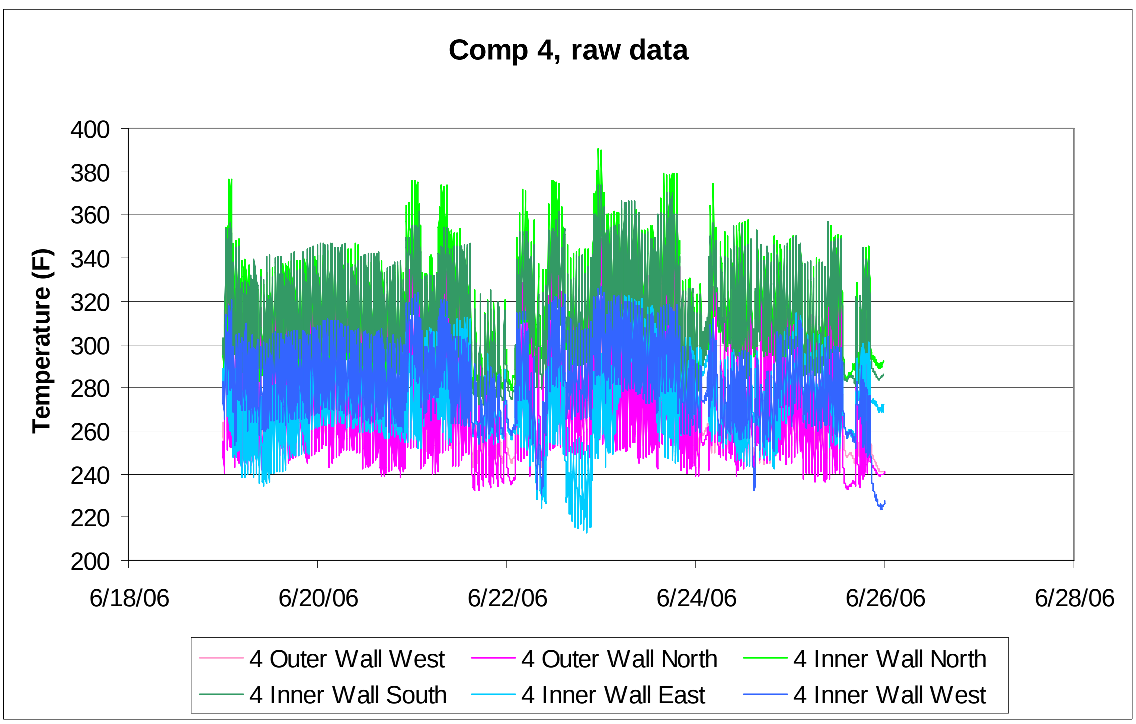

Compartments 8-10
Raw Data
Temperature (F)
400
380
360
340
320
300
280
260
240
220
200
6/10/06
6/12/06
6/14/06
6/16/06
6/18/06
6/20/06
8 Outer Wall West
8 Outer Wall North
9 Outer Wall West
9 Outer Wall North
10 Outer Wall West
10 Outer Wall North

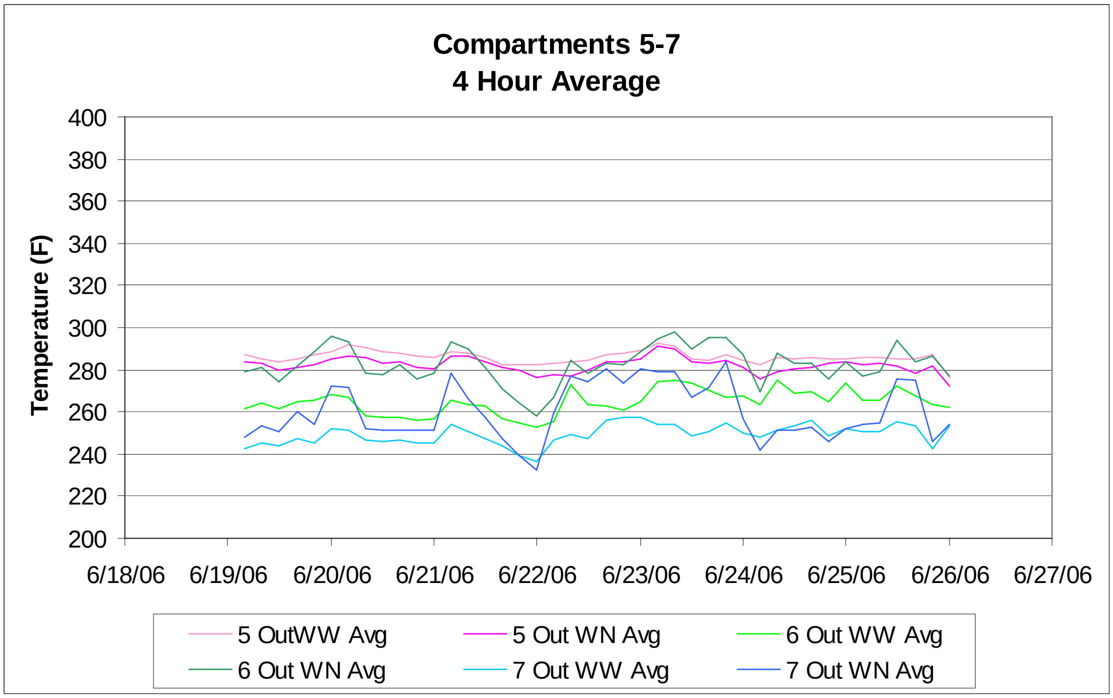
Week of June 19

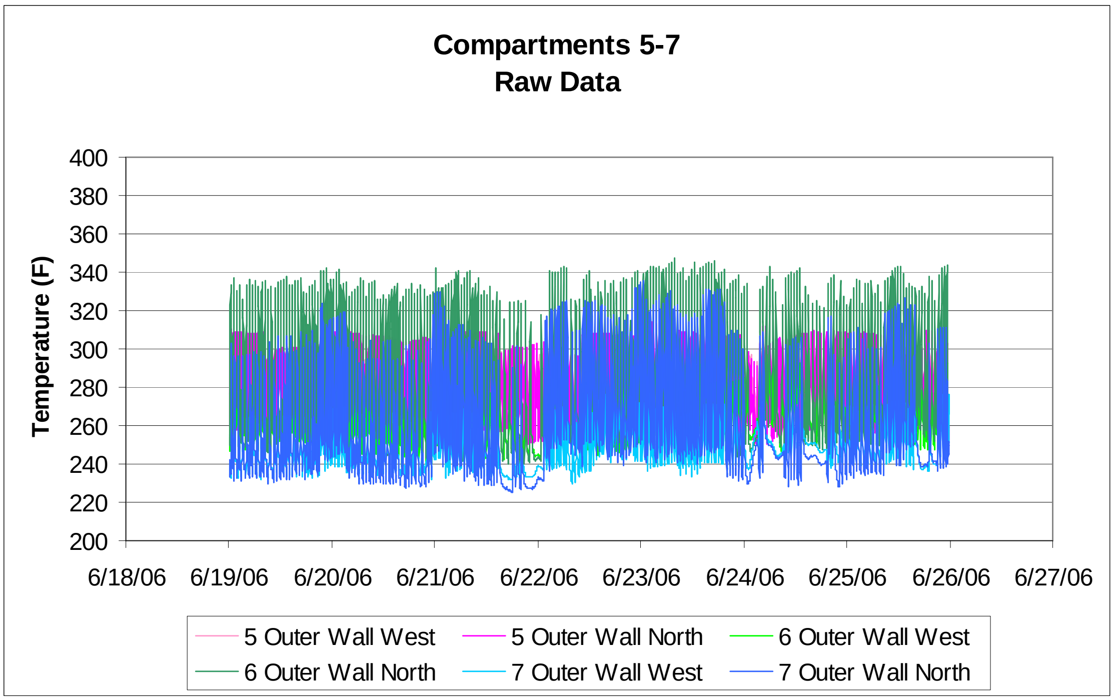


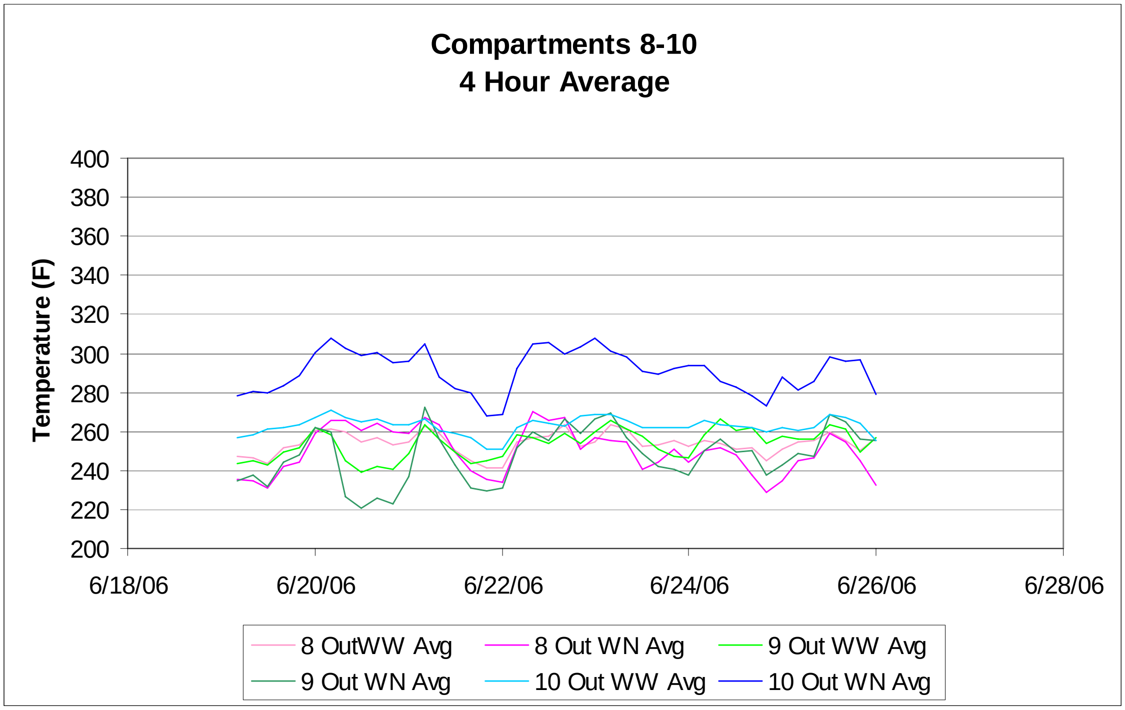


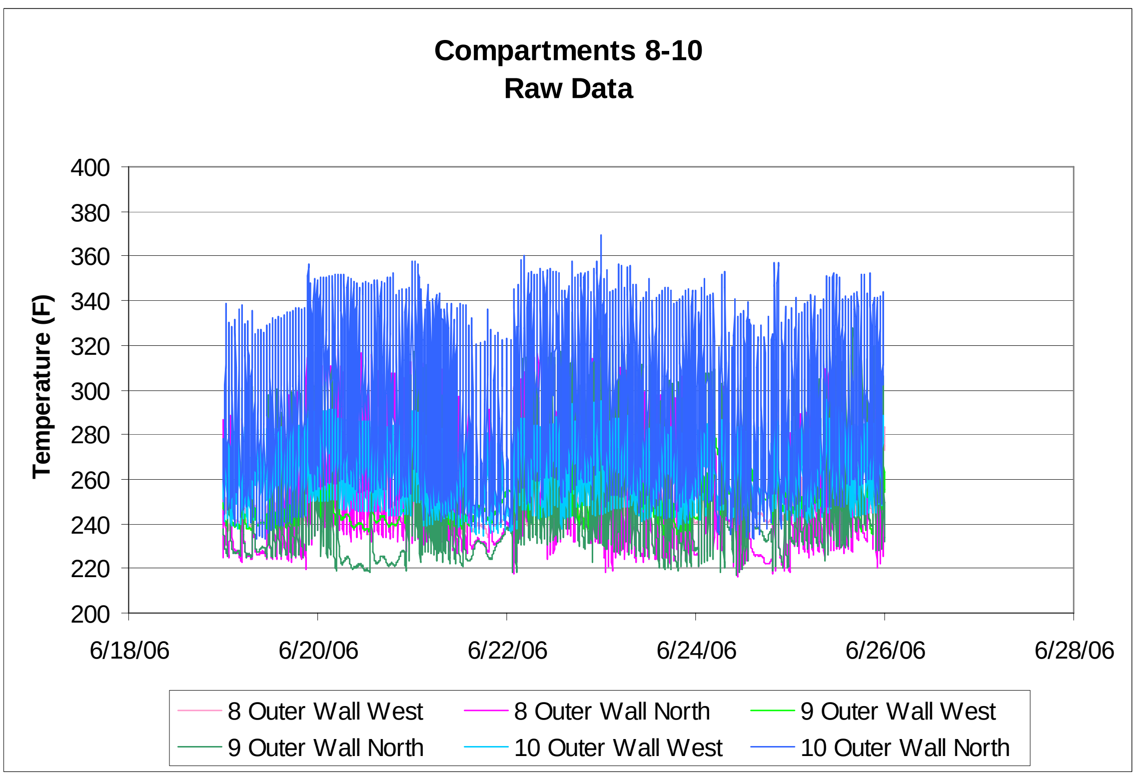

Comp 4, 4 hours Avg
Temperature (F)
400
380
360
340
320
300
280
260
240
220
200
6/18/06
6/20/06
6/22/06
6/24/06
6/26/06
6/28/06
4 Out WW Avg
4 Out WN Avg
4 Inner WN Avg
4 Inner WS Avg
4 Inner WE Avg
4 Inner WW Avg


Comp 4, raw data
Temperature (F)
400
380
360
340
320
300
280
260
240
220
200
6/18/06
6/20/06
6/22/06
6/24/06
6/26/06
6/28/06
4 Outer Wall West
4 Outer Wall North
4 Inner Wall North
4 Inner Wall South
4 Inner Wall East
4 Inner Wall West


Compartments 5-7
4 Hour Average
Temperature (F)
400
380
360
340
320
300
280
260
240
220
200
6/18/06
6/19/06
6/20/06
6/21/06
6/22/06
6/23/06
6/24/06
6/25/06
6/26/06
6/27/06
5 OutWW Avg
5 Out WN Avg
6 Out WW Avg
6 Out WN Avg
7 Out WW Avg
7 Out WN Avg


Compartments 5-7
Raw Data
Temperature (F)
400
380
360
340
320
300
280
260
240
220
200
6/18/06
6/19/06
6/20/06
6/21/06
6/22/06
6/23/06
6/24/06
6/25/06
6/26/06
6/27/06
5 Outer Wall West
5 Outer Wall North
6 Outer Wall West
6 Outer Wall North
7 Outer Wall West
7 Outer Wall North


Compartments 8-10
4 Hour Average
Temperature (F)
400
380
360
340
320
300
280
260
240
220
200
6/18/06
6/20/06
6/22/06
6/24/06
6/26/06
6/28/06
8 OutWW Avg
8 Out WN Avg
9 Out WW Avg
9 Out WN Avg
10 Out WW Avg
10 Out WN Avg


Compartments 8-10
Raw Data
Temperature (F)
400
380
360
340
320
300
280
260
240
220
200
6/18/06
6/20/06
6/22/06
6/24/06
6/26/06
6/28/06
8 Outer Wall West
8 Outer Wall North
9 Outer Wall West
9 Outer Wall North
10 Outer Wall West
10 Outer Wall North