Internal Corrosion Monitoring Equipment

EnhanceCo
Internal Corrosion Specialis

37th Annual Meeting

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WHEAT STATE
CORROSION ASSOCIATION
EST. 2022

Why am I doing this?

To develop a representative monitoring program that indicates internal corrosion rates of the system.

“If something is going to happen, it’s going to be in the worst location at the worst possible time.”

Where Do I Begin?

- Regulated or Non-Regulated Line?
- Monitoring Location (Top, Middle, Bottom)
- Material Type (Standard or Specialty Alloy)
- Type of Process Connection: Flanged or Threaded?
- Process Connection Size/Access Valve
- ANSI Rating (150, 300, 600, etc.)
- Size of Pipeline (inches)
- Working PSI/MAOP
- Velocity of Product Line
- Working Temp/Max Temp
- Product Type (Liquids, Gas, other)
- Sweet or Sour Service?

Methods of Monitoring

- Corrosion Coupons
- Retractable Coupon Holders
- Liquid Samplers
- Fixed (Plug Mounted) Coupon Holders
- Electrical Resistance (ER) Probe
- Linear Polarization Resistance (LPR) Probe
- Galvanic Probe
- Pipeline Monitor
- Gas Sampling
- In Line Inspection
- Alternative Methods (Coupled Multi-array Sensor, High Sensitivity ER, etc.)

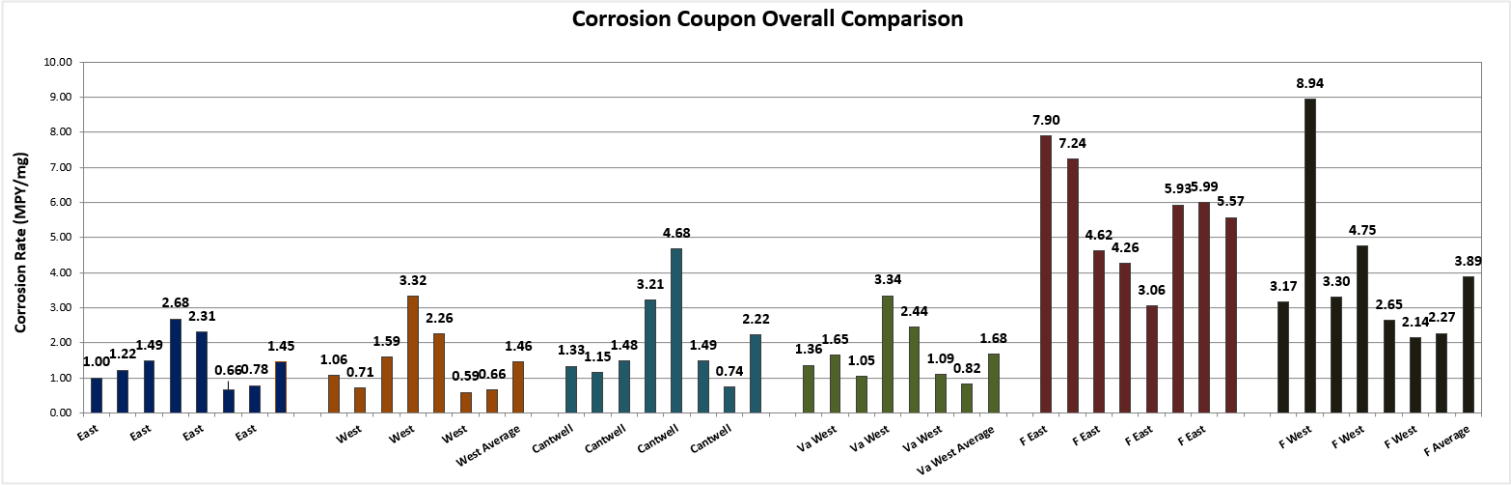
Corrosion Coupons

Advantages

- Easy to Use
- **Allows Examination**
- If located properly, very representative of system
- Inexpensive

Disadvantages

- Long time needed to collect data
- Time consuming
- If not located properly **NOT** representative of system



Retractable Coupon Holders

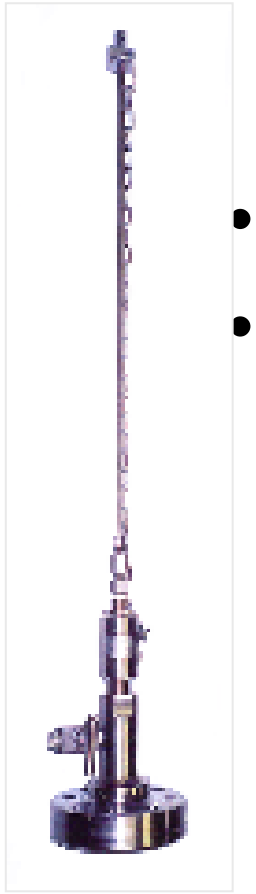
Advantages

Provide a safe and easy method of inserting and removing coupons from systems under pressure

Rugged stainless steel construction, bleed valves, safety chains and triple safety locks provide operator and pipeline safety while eliminating the possibility of over withdrawal.

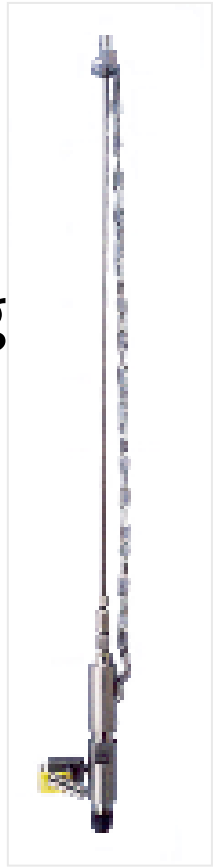
Can be hand inserted in low-pressure systems or used with EnhanceCo Retrieval Tools at higher pressures.

These tools allow you to insert and withdraw coupons without disturbing or shutting down the system.



Disadvantages

- Retractable Coupon Holders need to be retracted during pigging operations
- Removal
- Non-continuous reading



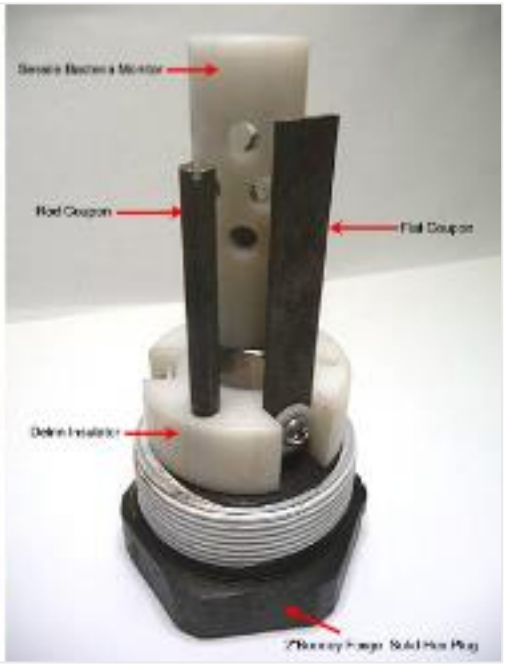
Liquid Samplers

Advantages

- Low Spot to collect water
- Don’t have to shut in the system
- Liquid Samples, Bacteria and Co ocation

Disadvantages

- No Flow
- Easy to fill with solids
- Can have exposure to fluids



Fixed (Plug Mounted) Coupon Holder

Advantages

- Simple and easy to use
- Low cost

Disadvantages

- Locations can be limited
- Shut down of system required
- Depressurization is required

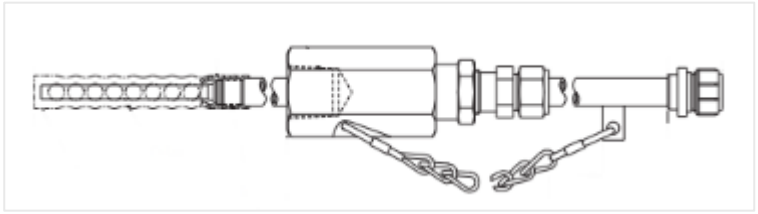
Electrical Resistance Probes

Advantages

- Great for Monitoring General Corrosion
- Reduces Personnel Exposure to Pressures and Product
- Allows for Continuous Monitoring

Disadvantages

- Difficult to use in a system with solids
- Doesn't detect pitting very well
- Requires additional equipment to retrieve data
- Data acquisition requires a power source (battery or 4-20 mA connection)

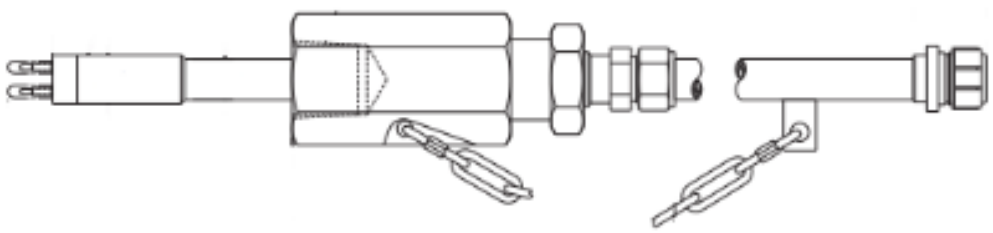


https://www.alspi.com/er4100.pdf

Linear Polarization Resistance (LPR) Probe

Advantages

- Detects Fluctuations
- Directly gives an instantaneous Corrosion Rate in mils per year (MPY)
- Can be used to indicate pitting



https://www.alspi.com/lp4000.pdf

Disadvantages

Difficult to use in a system with solids

Requires additional equipment to retrieve data

Data acquisition requires a power source (battery or 4-20 mA connection)

Limited to electrolytically conducting liquids

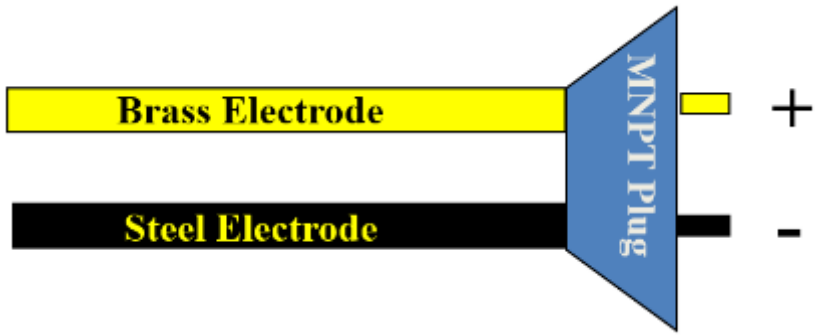
Galvanic Probe

Advantages

- Easy to use
- See changes rapidly
- Excellent for detecting Oxygen ingress
- Easy to maintain and very field friendly

Disadvantages

- Does NOT give corrosion rate
- Elements can become fouled
- Data needs some interpretation



Pipeline Monitor

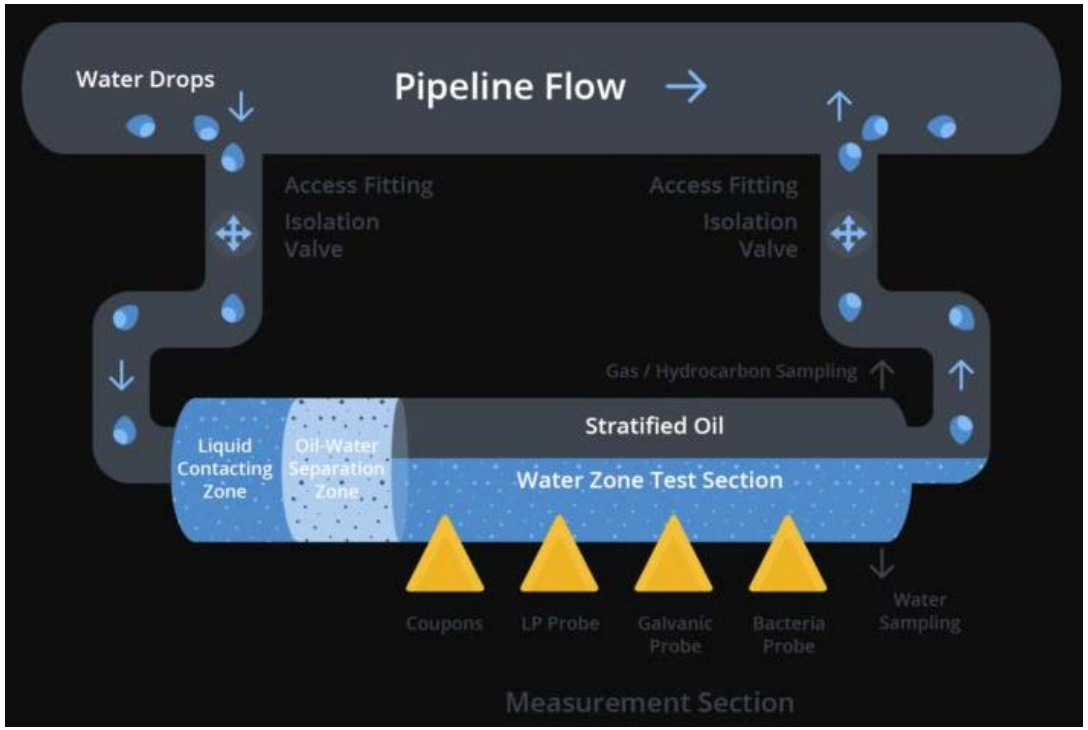
Advantages

- It allows the use of multiple methods in one location
- It creates a worst- case scenario in an accessible location
- Provides data on how potentially corrosive the system could be.
- Provides a method of monitoring product quality

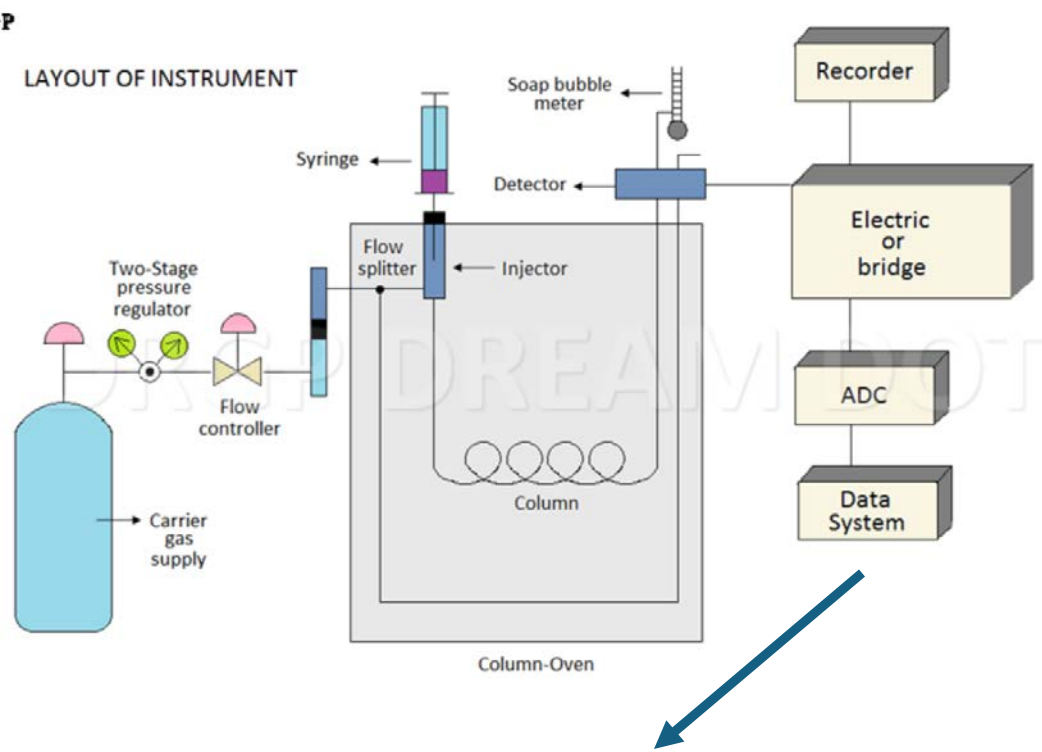
Disadvantages

- Usually require Management of Change (MOC) in order to be installed
- Requires maintenance to ensure representative data is being collected
- Requires an understanding of the system

Pipeline Monitor



Gas Sampling



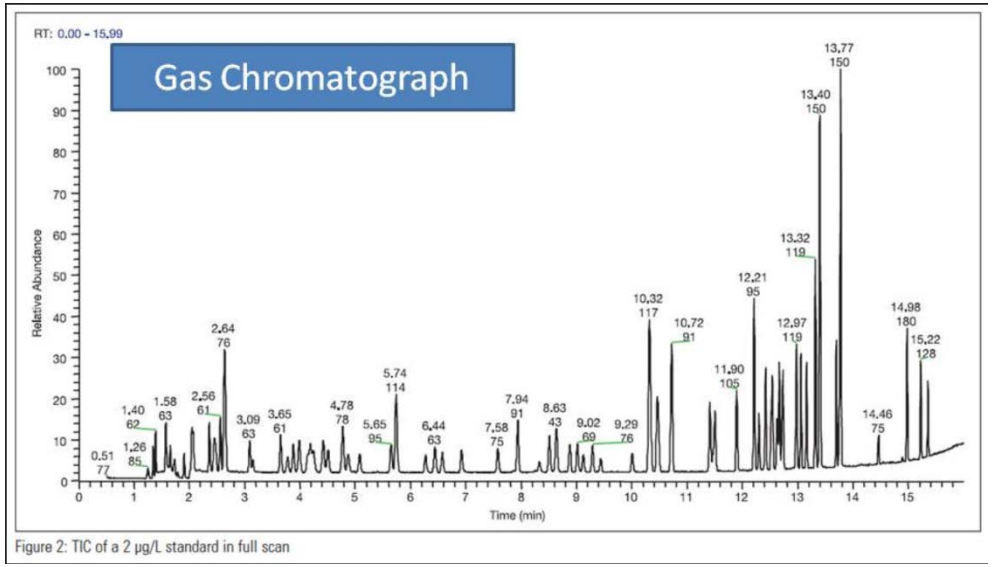
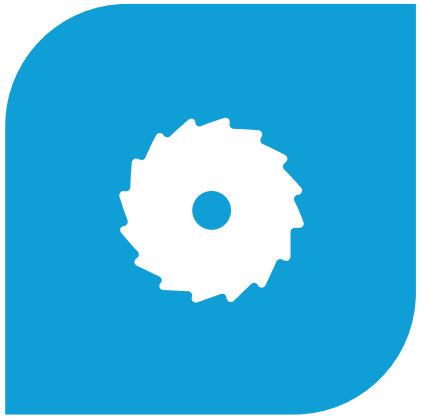


Figure 2: TIC of a 2 µg/L standard in full scan

Direct Measurements

IN LINE INSPECTIONS

ULTRASONIC THICKNESS INSPECTIONS



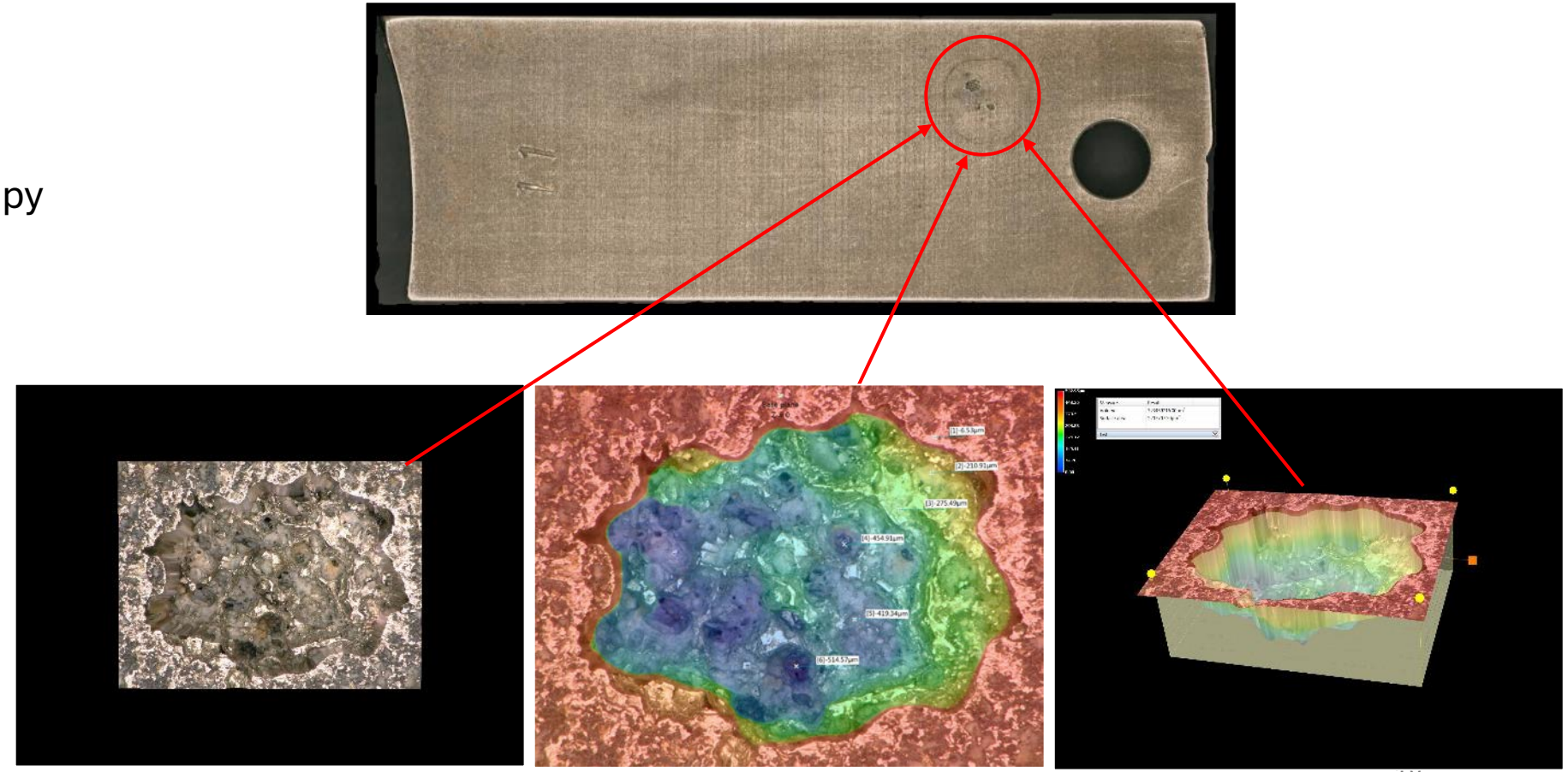
CUT OUTS AND TIE INS

In Line Inspection

Things to Watch Out For....

Additional Alternative Methods

- Coupled Multi-Array Sensor (CMAS)
- High Sensitivity ER
- Ultrasonic Thickness
- Structured Light Microscopy
- SEM/EDS
- XRD/XRF
- Field Water Chemistry



Structured Light Microscopy

Conclusions

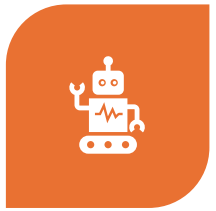
LOCATION, LOCATION, LOCATION!

USE APPROPRIATE TOOLS

USE MULTIPLE TECHNIQUES

MAINTAIN OUTSTANDING RECORDS

LOOK FOR TRENDS, EXCURSIONS AND UPSETS



UNDERSTAND THE SYSTEM!

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Questions?

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