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I am looking for a lot of men who have an infinite capacity to **not** know what can't be done.

Henry Ford (1863 - 1947)

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Objectives

- Understand that Lean is a proven improvement method that does not always require large budgets or costly experts.
- See 4 examples of the application of simple Lean methods in the Laboratory environment.
- Appreciate that Lean is a versatile and adaptable set of tools and techniques with specific applicability in the Laboratory.

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5 Principles of Lean

- Observe
- Eliminate Waste
- Standardize
- Solve Problems Systematically
- Keep Learning

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Observe
&
Standardize

Managing Customer Variation
Example: Standardized Submissions

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Observing

Common Attitudes

"We can't control the customer."

"If only the customer could do what we want…"

Understand the current reality

Go to the *Gemba*

Directly observe work

Value the customer/supplier relationship

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Standard Work

The needs of the customer

- Timely services
- Accurate information
- Reasonable price
- Compliant practices

Non-standard submission practices affect ARUP's ability to provide timely, cost effective, compliant and accurate services.

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Standard Work

Definition:
Exception

A submission that is
- incomplete,
- sub-optimal or
- inappropriate

Exception
A specimen for which the desired testing cannot be performed OR cannot be performed without clarification or additional material.

Quality Improvement Team was formed in 1994 to discover methods of ensuring standardized submissions.

FACT
- ARUP is not able to meet a customer's needs or ARUP's corporate goals if a client's exception rate exceeds 3%.
- At the time the team was formed, the overall exception rate was 1.7%.

HOWEVER
- Nearly 20% of ARUP's interfaced/System 2000™ clients had a >3% exception rate.
- New interfaced/System 2000™ clients represented the greatest challenge to standardized submissions.

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The 5 Why's

Why?
Why?
Why?
Why?
Why?

Variation in Laboratory Information Systems

- The LIS needs of all laboratories are not the same
  - The customer base for laboratory services is infinitely variable

Lack of standards in the industry

- Not all laboratories serve the same customer base
  - See above

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Eliminate *Mura*

Managing for Customer Variability

Customers introduce variability through:

- Random arrival times
- Special requests
- Lowered capability
- Lowered effort
- Preference for non-standard methods or products

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Eliminate *Mura*

Responding to *Mura*

Accommodation

High Cost	
•Provide training specialists on-site at the client facility on "go- live" day.	•Provide an ARUP-designed ordering and submission system on site at the client facility to enforce standardization.
Low Cost	
•Create a team relationship with the client to promote standard submission practices.	•Supply clients with checklists and cheat sheets for standard submission requirements.
Uncompromised	Reduced

Service

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Eliminate *Mura*

Responding to *Mura*

Accommodation

High Cost	
Client Support Specialists	System 2000
Low Cost	
Client Site Visits	Specimen Transport Brochure
Uncompromised	Reduced

Service

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Go To The *Gemba*

Method

Schedule a visit from the Client Support Specialist for:

- New interfaces
- New System 2000™
- Clients with >3% exceptions

Prepare an "After Visit" report of observations and outcomes for ARUP staff and management

Monitor exception rates for visited sites

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Go To The *Gemba*

Method

During the Visit:

1. Train on standards
   - Preparing, packaging and shipping
   - Shipping infectious substances
   - Submission requirements and forms
   - Ordering supplies
2. Introduce resources
   - ARUP web and User's Guide
   - ARUP Connect
   - ARUP brochures
3. Assess and address…
   - Interface performance for interfaced clients
   - Customer limitations
   - Courier performance

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Client Support Specialist

Outcome

1994:1.79%

2008:1.84%

1994: 20%

2008: 3%

No Visit: 10%

With Visit: 60%

2008

- The overall exception rate remains stable between 1.7% and 1.9% in the face of continued growth.
- The number of interfaced/System 2000™ clients with >3% exception rate hovers around 3%.

1994 - 2008

- Clients on the >3% list without visits show approx 10% improvement over time.
- Clients on the >3% list with visits show approx 60% improvement over time.

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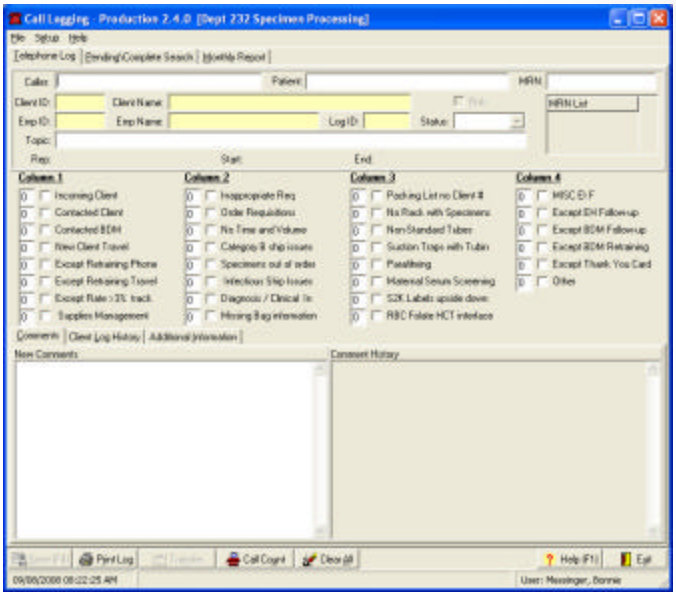
Kaizen



Never assume the current reality will be the future reality.

Monitor and improve continuously.

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Elimination of Waste
&
Standardization

Building Increased Capacity

Example: Special Chemistry Laboratory Re-design

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Elimination of Waste

Common Attitudes

"We don't have enough room"

"We need it just-in-case…."

"We put it there because that's where we had room"

Understand the principles of Lean to recognize inefficiency.

Adopt the belief of continuous improvement.

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Elimination of Waste

Understanding Human Nature

We will fill the space that is given to us.

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Elimination of Waste

Waste

- Motion
- Inventory
- Overproduction
- Errors
- Defects
- Waiting
- Transportation
- Employee Knowledge

Recognize our Inefficiencies

- Travel time for supplies
- Equipment Setup
- Traffic Flow
- Bench top organization and space
- Limited growth potential

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Future Space Needs

Establish better traffic flow in the lab

Increase space for new equipment and validation

Improve communication

Improve organization

Design a lab on a strong foundation

- On-time
- Productivity
- Safety
- Quality

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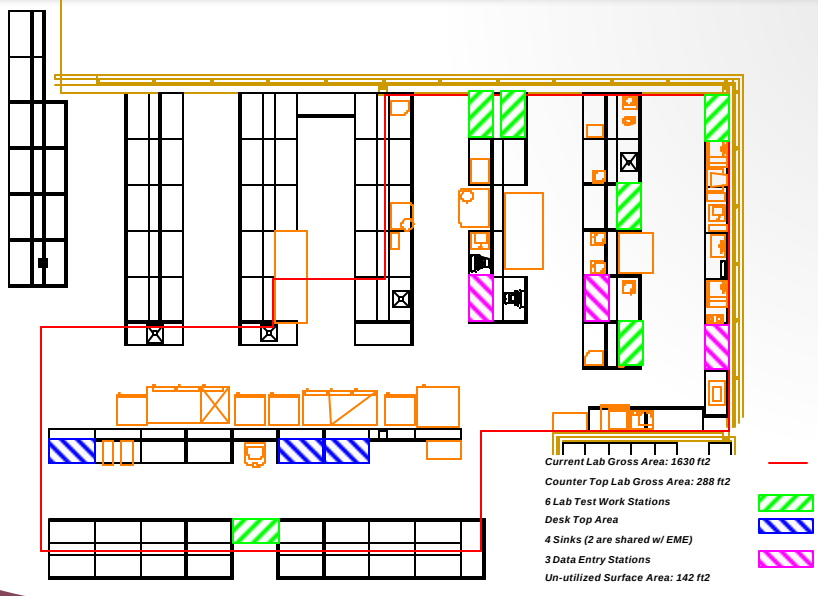
Baseline



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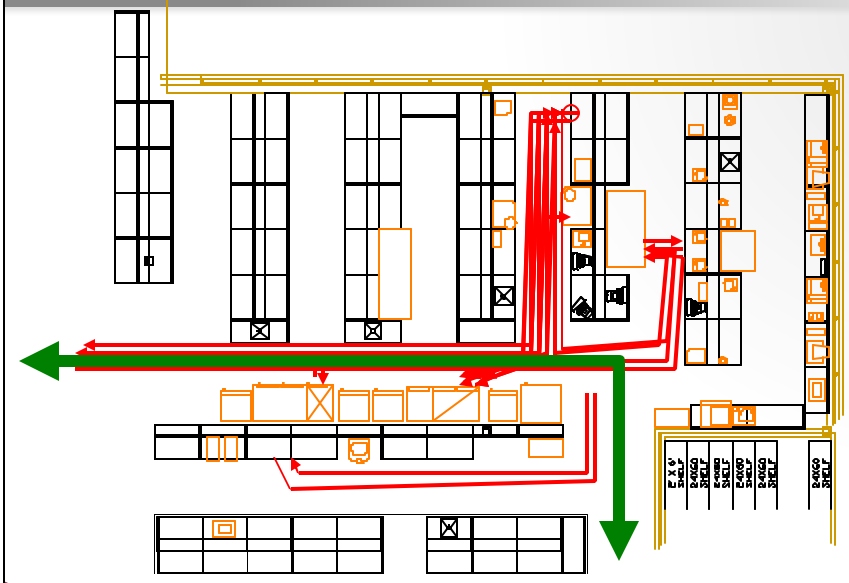
Traffic Flow



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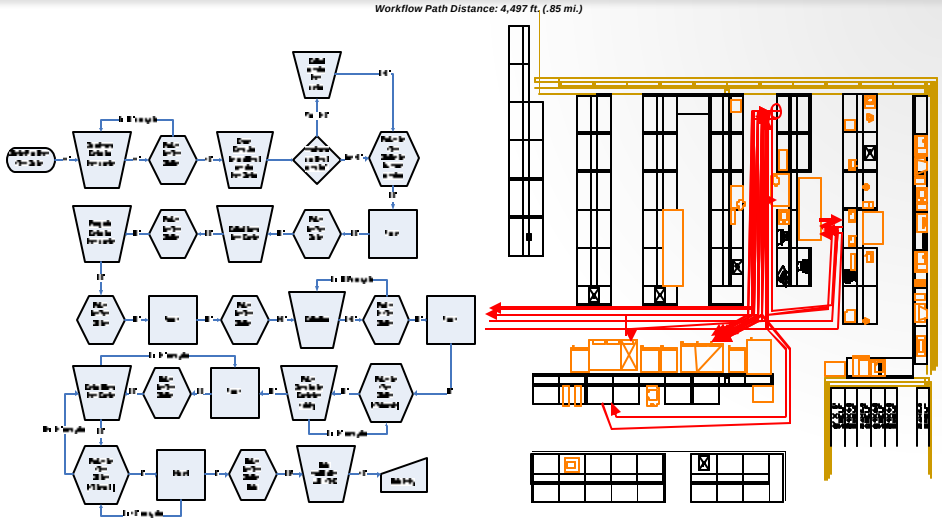
Flow & Spaghetti Diagrams



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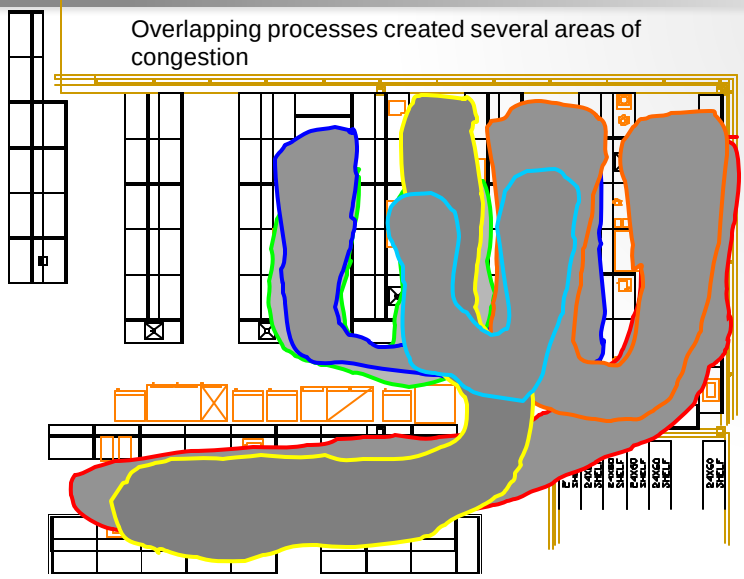
Spatial Analysis

Overlapping processes created several areas of congestion



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Elimination of Waste

Look for the low hanging fruit

Team discovered the location of shared equipment has caused inefficient flow and traffic congestion.

Technicians always traveled to other aisles for equipment or supplies and even for data entry tasks.

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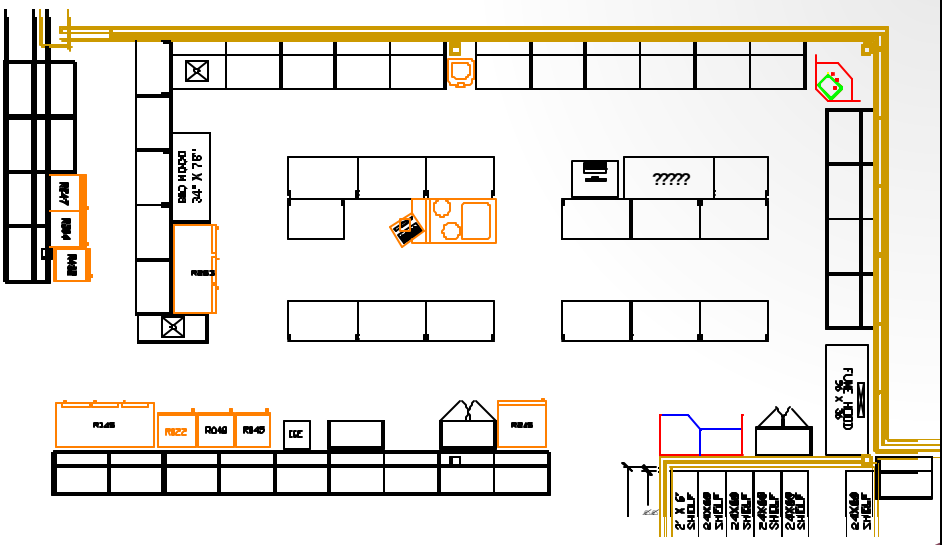
New Spatial Design



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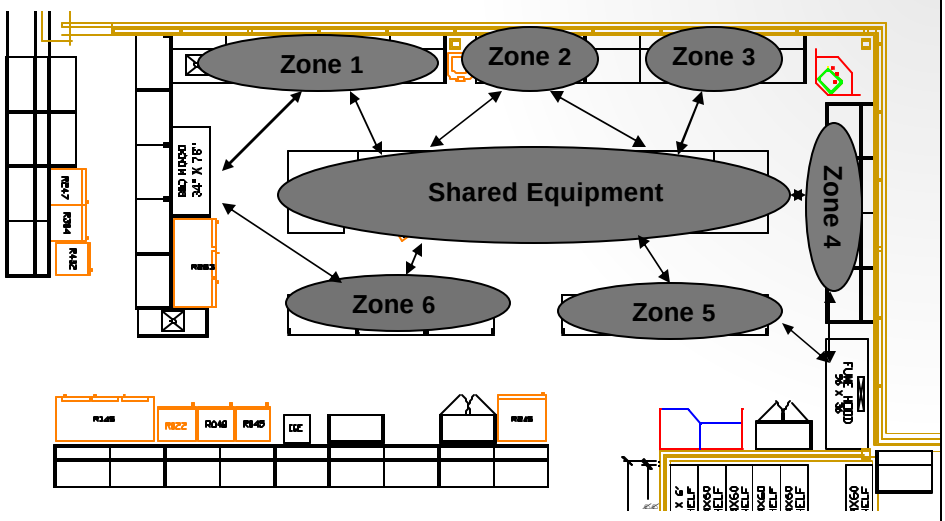
New Spatial Design



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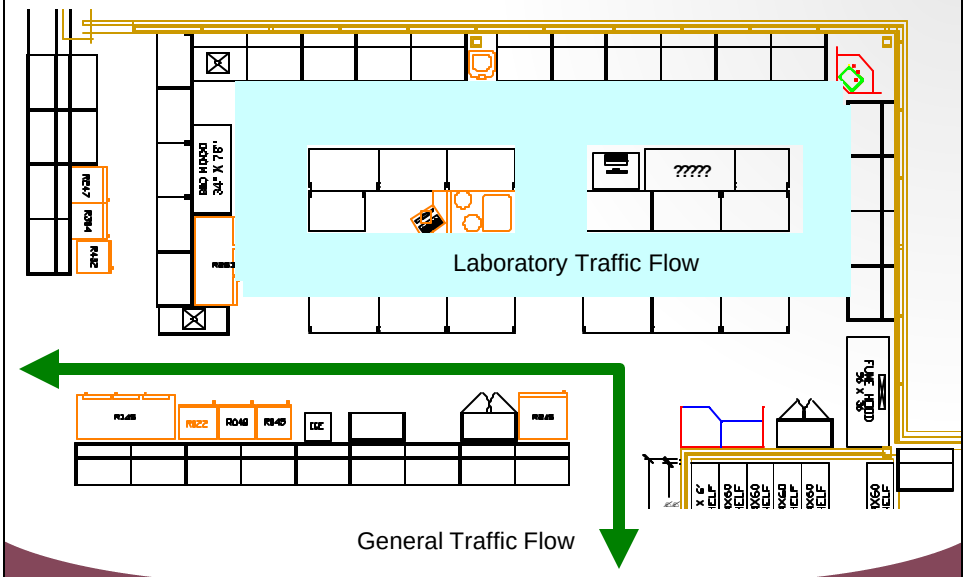
Improved Traffic Flow



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Standardization & 5s

5S Tool

Before

After

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Standardization & 5s

5S Tool

Before

After

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Standardization & 5s

5S Tool

Before

After

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Validation

Process Flow	• Reduced distanced traveled by average 31% per test • Standardized traffic flow inside and outside of lab area
Space Utilization	• Reduced footprint by 10% • Gained 17% more bench top area • Added additional workstation for new test mix and equipment • Created space for new chemistry analyzer during validation

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Standardization

Building Increased Capacity

Example: Specimen Processing Workstations Re-design

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Standardization

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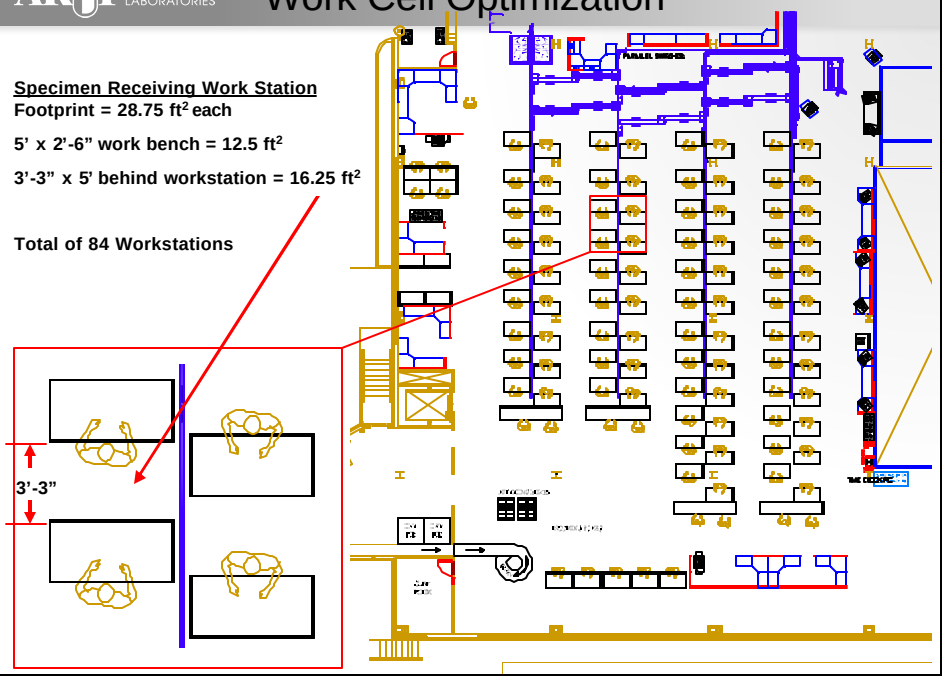
Work Cell Optimization

Specimen Receiving Work Station
Footprint = 28.75 ft² each

5' x 2'-6" work bench = 12.5 ft²

3'-3" x 5' behind workstation = 16.25 ft²

Total of 84 Workstations



Work Cell Optimization

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Work Cell Optimization

Specimen Receiving Work Station

Back to Back workstations, two techs utilized shared space behind work stations

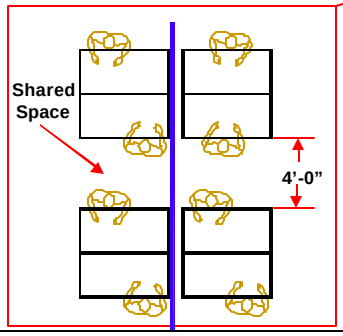
Footprint = 28.75 ft²

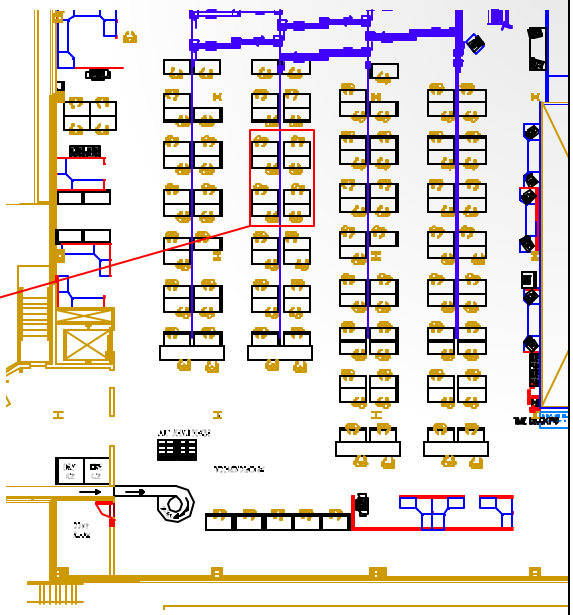
5' x 2'-6" work bench = 12.5 ft²

4' x 5' behind workstation = 20 ft²

Total of 103 workstations (19 additional)

22% Increase





Solve Problems Systematically
&
Keep Learning

Eliminating Error
Example: Calculi Handling

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Solve Problems Systematically

Common Attitudes	
"The issue is too complex to solve."	See problems as opportunities
"We know what's wrong and can fix it with enough resources."	Probe deeper; ask, "Why?"
	Immediately respond to process failures
"We will never reach 0 errors."	Stick with the problem until it is solved
	Be suspicious of success

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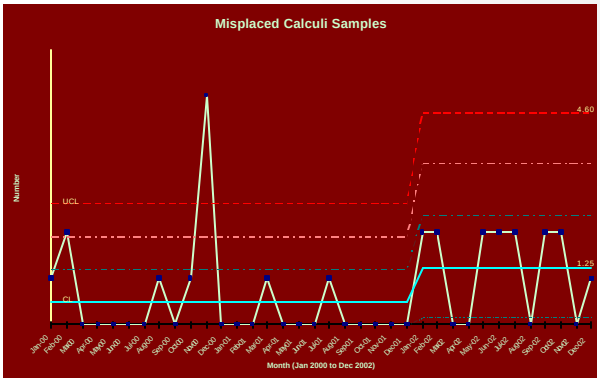
Failure Modes Analysis

Perhaps the history of the errors of mankind, all things considered, is more valuable and interesting than that of their discoveries. Truth is uniform and narrow; it constantly exists, and does not seem to require so much an active energy, as a passive aptitude of the soul in order to encounter it. But error is endlessly diversified; it has no reality, but is the pure and simple creation of the mind that invents it. In this field the soul has room enough to expand herself, to display all her boundless faculties, and all her beautiful and interesting extravagancies and absurdities.

Benjamin Franklin

Review of misplaced sample data from 2002 showed an increase in the number of calculi samples misplaced.

A team was formed to conduct a Failure Modes and Effects Analysis.



Failure Modes Analysis

Five steps with failure potential:

- Submission
- Transport
- Processing
- Delivery
- Analysis

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Failure Modes Analysis

Submission Failures

- 80-90% of the calculi samples are sent in nonstandard tubes or materials.
- Samples may be folded into paper towels, gauze or Kleenex and discarded as waste.
- Samples may be free-floating in transport bags; these may be overlooked and discarded with the bag; clients are notified that a sample was not received.
- Samples may be in urine containers with urine and mistaken for an inappropriate sample type.

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Failure Modes Analysis

Processing and Delivery Failures

- Non-standard specimen containers lead to non-standard storage practices. Workspace did not have a place for holding non-standard containers.
- Storage bins were not sized for the volume of samples received.
- Samples for delivery were transferred from one bin to another multiple times.
- Storage bins had openings large enough for sample bags, with free-floating samples or samples folded into tissue, to slip out of the bin.

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Failure Modes Analysis

Preparation and Analysis Failures

- When received in Utah's dry climate, calculi samples became statically charged.
- Charged particles "jumped" off the weighing boat when placed on the balance.
- "Jumping" stones often fell to the floor where the variegated color of the tile matched the various colors of stones.
- Small stones on the variegated tile could not be located.

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Focus on Variation

Response to Variation

- Accept: Recognize the potential for failure and design the process for detection and intervention.
- Control: Identify the potential and design for error-free performance.
- Eliminate: Remove the error potential.

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Poke-Yoke

Submission Failures

- Accept: Track and address problematic submission practices through Client Support Specialists.
- Control: Design workstations and delivery bins for non-standard containers.

Processing and Delivery Failures

- Eliminate: Replace folding bins with intact bins. Provide additional bins so pick-ups consist of removing full bins and replacing them with empty bins (no more transfers of specimens).
- Control: Dedicate staff members to delivering specimens before the bins are full.

Preparation and Analysis Failures

- Control: Cover bench tops with anti-static mats. Replace the variegated tile with a color of tile that is high-contrast with common stone colors.

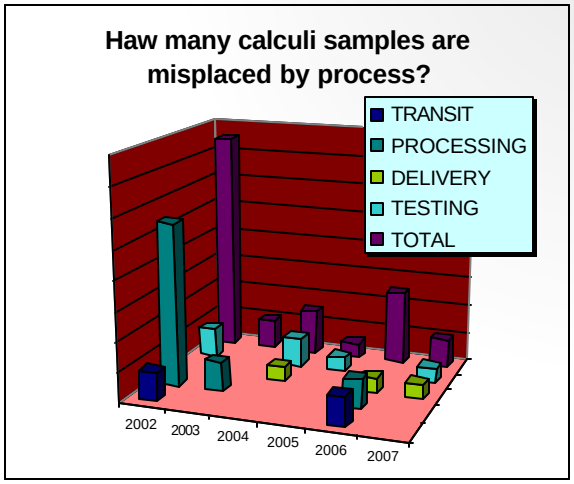
Validation

Bins replaced

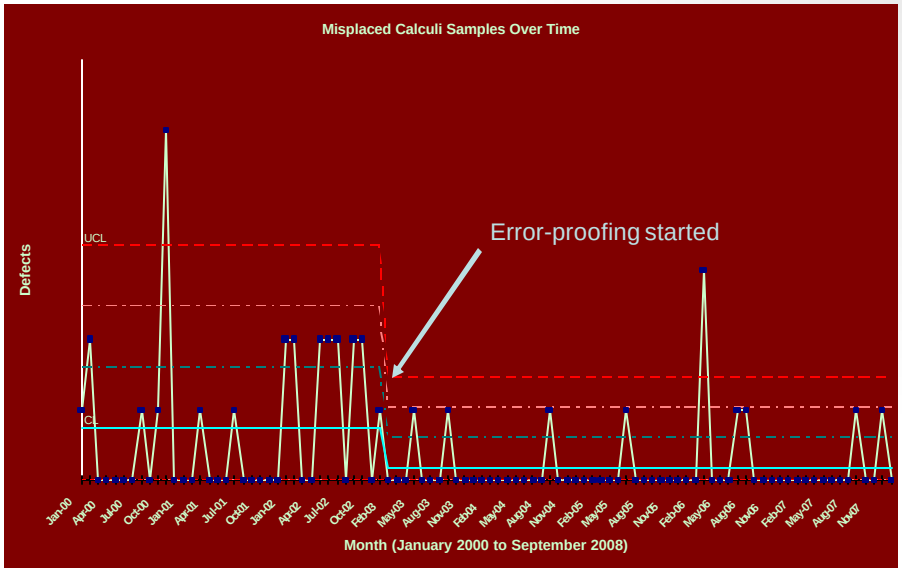
Anti-static Mats and Blue Tile

Processing Stations Redesigned

Direct Delivery



Validation



Keep Learning

See problems as opportunities

Probe deeper; ask, “Why?”

Immediately respond to process failures

Stick with the problem until it is solved
Be suspicious of success

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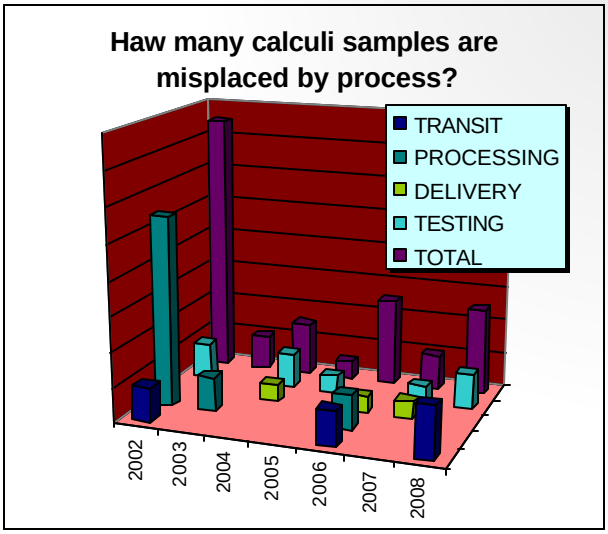
Keep Learning

Testing Location Moved

Use of Anti-static Mats Discontinued

Methods of handling incoming shipments changed



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Keep Learning

Quality as a Complex Adaptive System

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Complex Adaptive Systems

Change Concepts

- Eliminate waste
- Improve workflow
- Optimize efficiency
- Change work environment
- Focus on time
- Focus on variation
- Error proof processes
- Focus on product/service
- Improve supplier/customer interface

- Collection of individual agents
- Free to act in ways that are not always predictable whose
- Actions are interconnected (one agent's actions changes the context for other agents)

Relatively simple rules can lead to complex, emergent, innovative system behavior.

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The Change Imperative

Life is pretty simple: You do some stuff. Most fails. Some works. You do more of what works. If it works big, others quickly copy it. Then you do something else. The trick is the doing something else.

Leonardo da Vinci

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The Change Imperative

Never Rest!

Evolution is not a force,
but a process;
not a cause,
but a law.

Systematic Quality

Basic principles

- Simple rules; cultural norms
- Administrators as drivers of culture and recognition

Holistic quality

- Embracing who we are and planning for who we will be

Collegial relationships

- Customers and suppliers as partners

Organizational learning

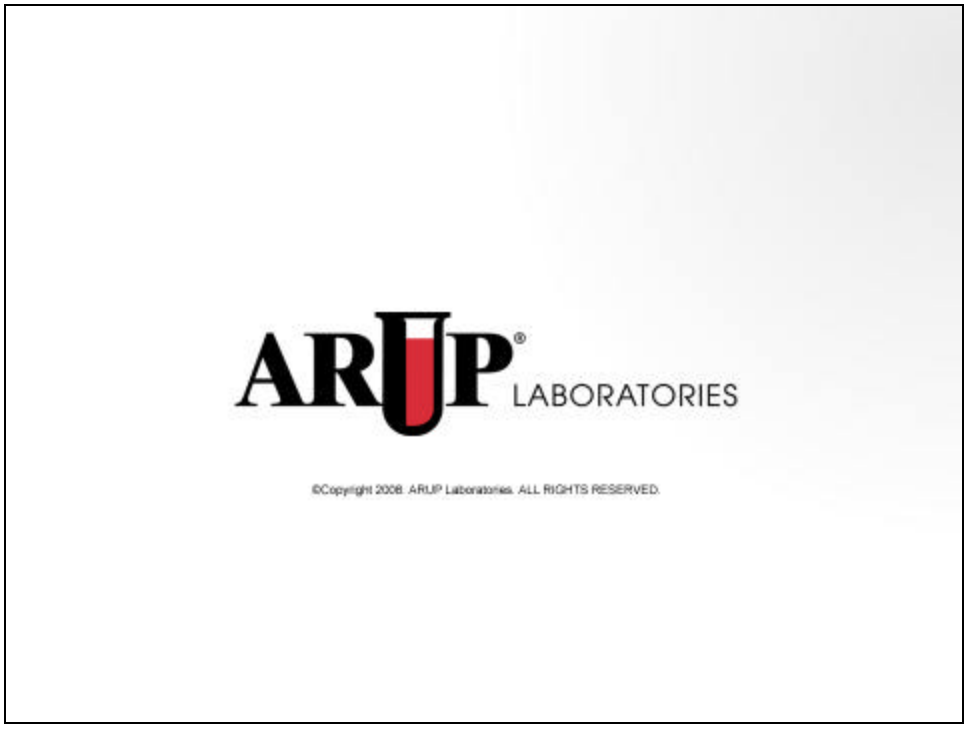
- Mistakes as opportunities
- Opening the organization to growth

Empowered Teams

- Front line champions

Right is right because it works.
If it's not working, it's wrong.

My Mom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