

From Notification to Clean Up: Improving Water Intrusion Mitigation Efforts through Application of an Emergency Management Framework

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Disclosures

- We have nothing to disclose.

Objectives



Describe the different types of responses to water intrusions based on their scale



Use focused communication methods to notify key stakeholders of water intrusions



Apply the focused communication method to a real-life scenario



Apply the framework to other environmental emergencies

Common Water Intrusion Culprits

- Toilet overflow
- Leaking/burst pipes
- Condensation leaks
- Fire suppression system malfunction
- Roof leaks
- Construction errors

Water Intrusion Risks



May create an environment favorable for fungal growth if not swiftly mitigated



Fungal growth post-water intrusion has been linked to healthcare-associated fungal infections



Disruption in healthcare facility operations (procedure cancellation; department closures)



Damage to patient care equipment and/or supplies

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Damage to patient care equipment and/or supplies



A delay in response can make all of these worse!

Water Intrusion Response is Based on Type and Quantity of Water, Location, and Material Affected

Water Type

- Clean
- Gray
- Black

Location

- Common areas (no immunocompromised persons; general public has access)
- Sensitive areas (occupied by higher risk individuals due to age, procedural history, immunosuppression, chronic illness; areas where procedures are performed)

Material

- Drywall/wallboard
- Ceiling tiles
- Plaster
- Upholstery
- Carpet

General Remediation Strategies

Guided by Infection Control Risk Assessment

01

Remove the moisture source

- Sometimes easier said than done!



02

Contain the area (if indicated)



03

Facilitate drying

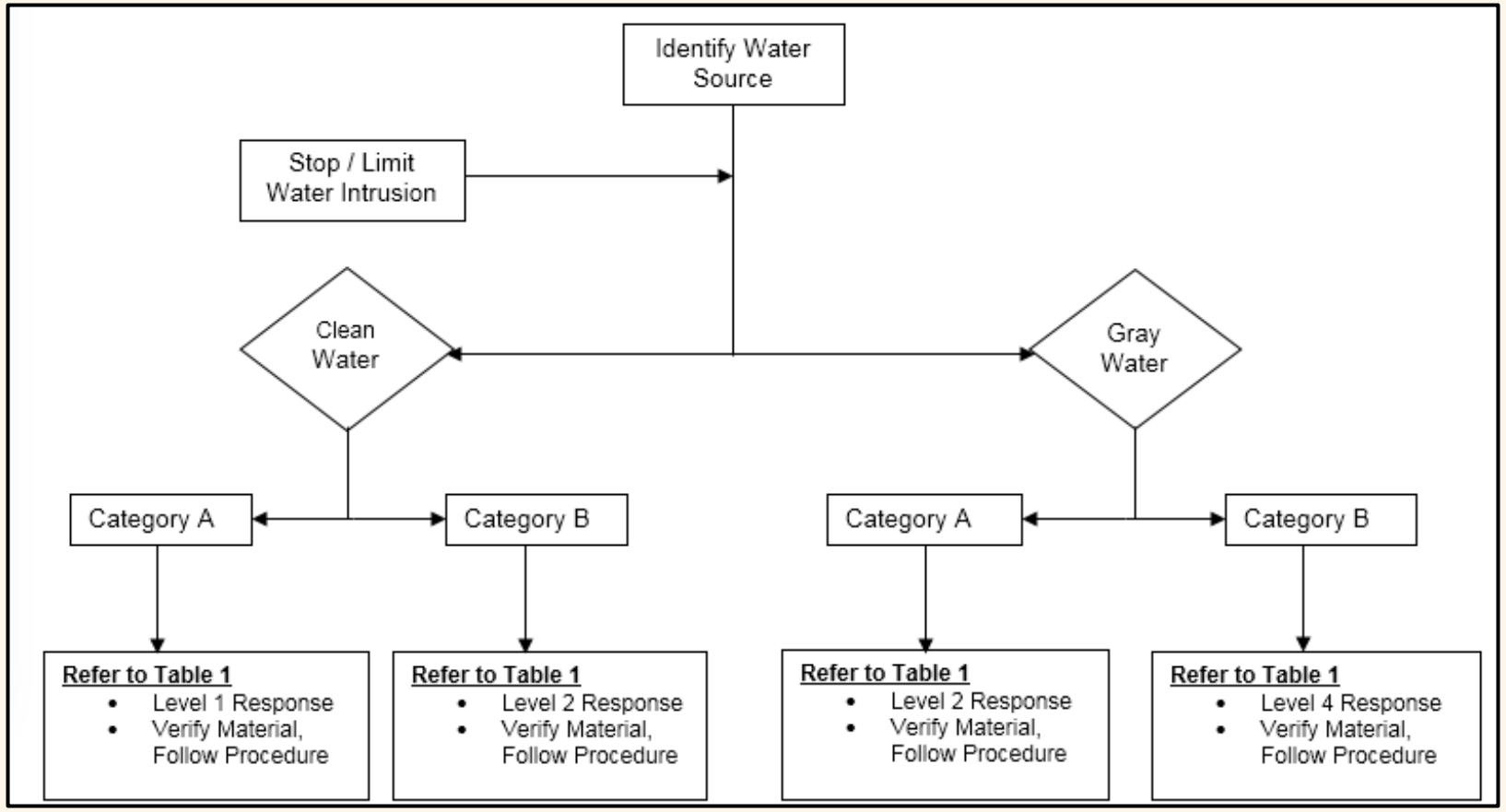


04

Remove materials that cannot be adequately dried/remediated

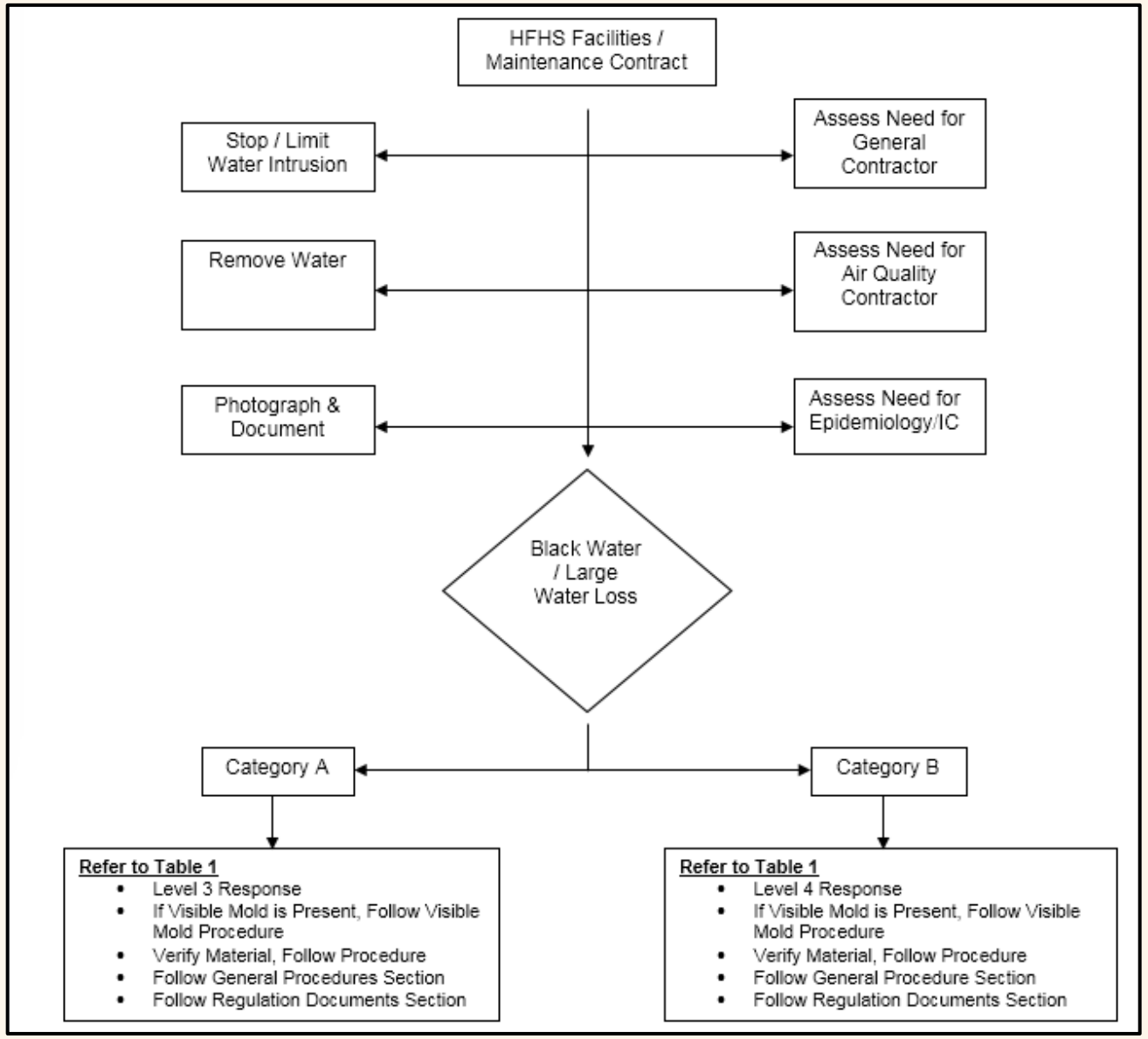


Response to Small, Manageable Clean or Gray Water Losses



Note: Category A corresponds to “common” areas; Category B corresponds to “sensitive” areas

Response to Larger Water Losses / Black Water Losses / Visible Mold



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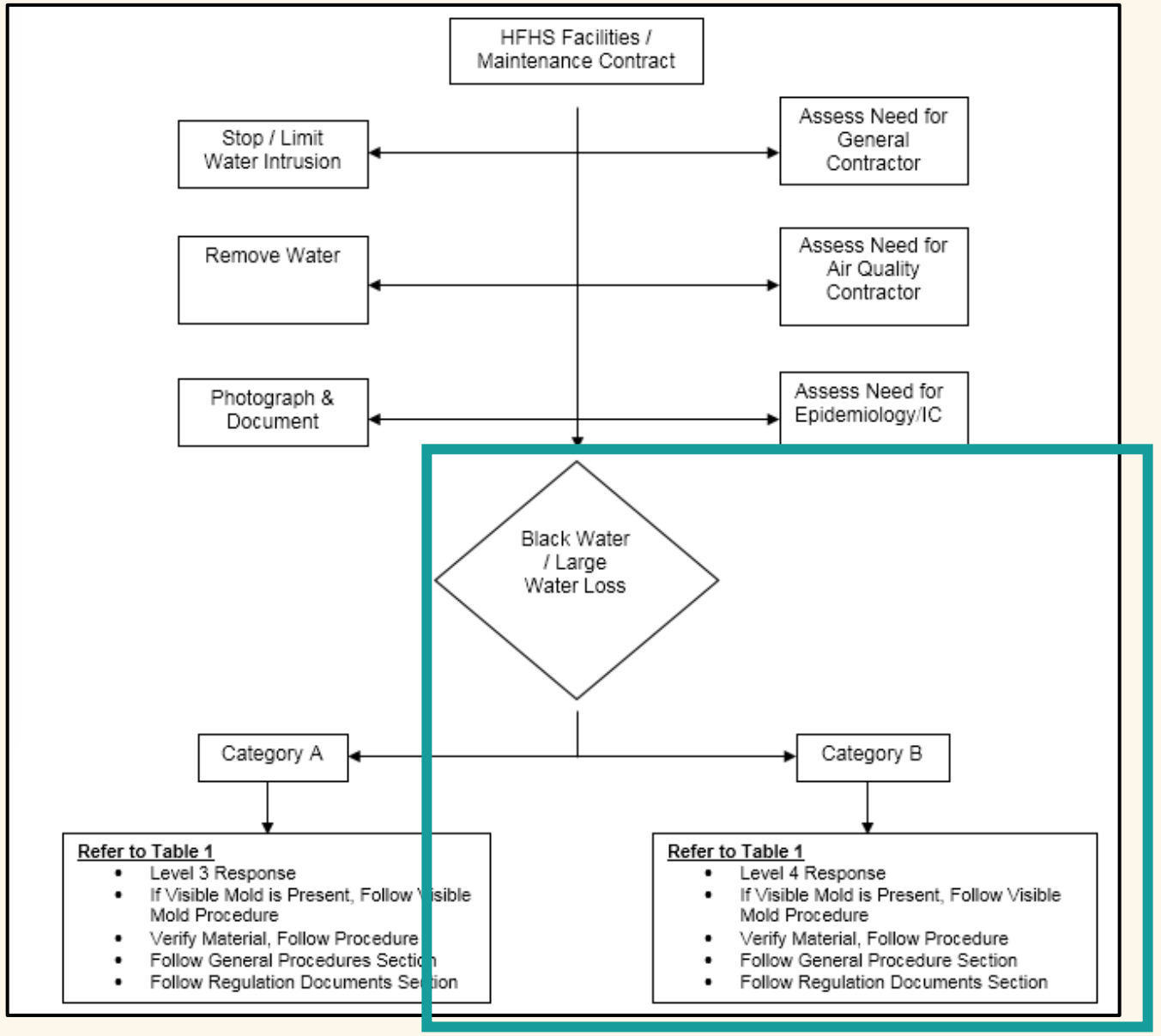

Example: Large water loss in critical care unit caused by burst pipe

Note: Category A corresponds to “common” areas; Category B corresponds to “sensitive” areas

Examples of Material Mitigation by Response Level

Material	Level 1	Level 2	Level 3	Level 4	Visible Mold
Wallboard	-If swelled and seams compromised, remove/replace -If no swelling, assess moisture content – dry in place	-If swelled and seams compromised, remove/replace -If no swelling, assess moisture content – dry in place -Remove material not fully dried within 48 hours	-Remove material	-Remove material (establish negative pressure containment)	-Remove material (establish negative pressure containment)
Ceiling tiles	-Discard and replace	-Discard and replace	-Discard and replace	-Discard and replace (establish negative pressure containment)	-Discard and replace (establish negative pressure containment)
Carpet & Backing – dry within 48 hours	-Remove water with extraction system -Reduce ambient humidity levels with dehumidifier -Accelerate drying process with fans	-Remove water with extraction system -Reduce ambient humidity levels with dehumidifier -Accelerate drying process with fans	-Establish negative pressure containment -Remove and discard -Spray floor with antimicrobial solution	-Establish negative pressure containment -Remove and discard -Spray floor with antimicrobial solution	-Establish negative pressure containment -Remove and discard -Spray floor with antimicrobial solution
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Water Intrusion Trends

Frequency

- Despite the 191-bed hospital opening in 2009, braided water lines and corroded pipes above the ceiling were frequently breaking
  - 15 water-related ICRAs in 2025
  - Water intrusions were incorporated into the Infection Prevention Annual Risk Assessment and Infection Prevention and Control Plan beginning in 2026
  - Ranked #9 in Emergency Management Hazard Vulnerability Assessment in 2025 and Ranked #1 in 2026

Notification

- Lacking a reliable process for Infection Prevention to be notified of water intrusions in real time
  - Delayed notification via House Manager email, Safety Huddle, etc.
- Led to response and ICRA delays

Action Needed

- The hospital needed a clear, concise way to notify key stakeholders of water intrusions so that proper mitigation could occur as soon as possible



We Are No Strangers to Water Intrusions











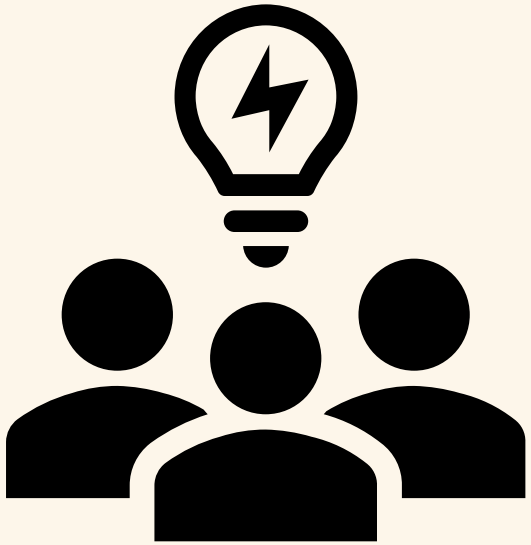


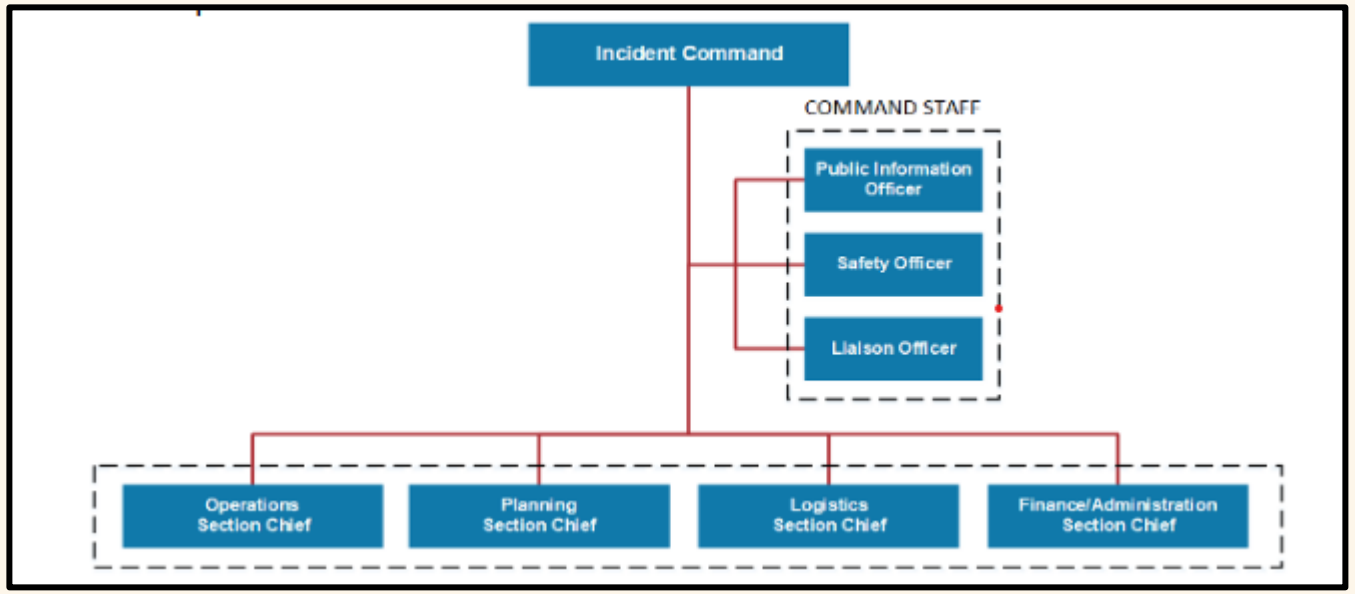
We need a standardized escalation process that would notify the appropriate stakeholders to mitigate water intrusion incidents.



The solution....

We should use the incident command system to escalate water intrusions!



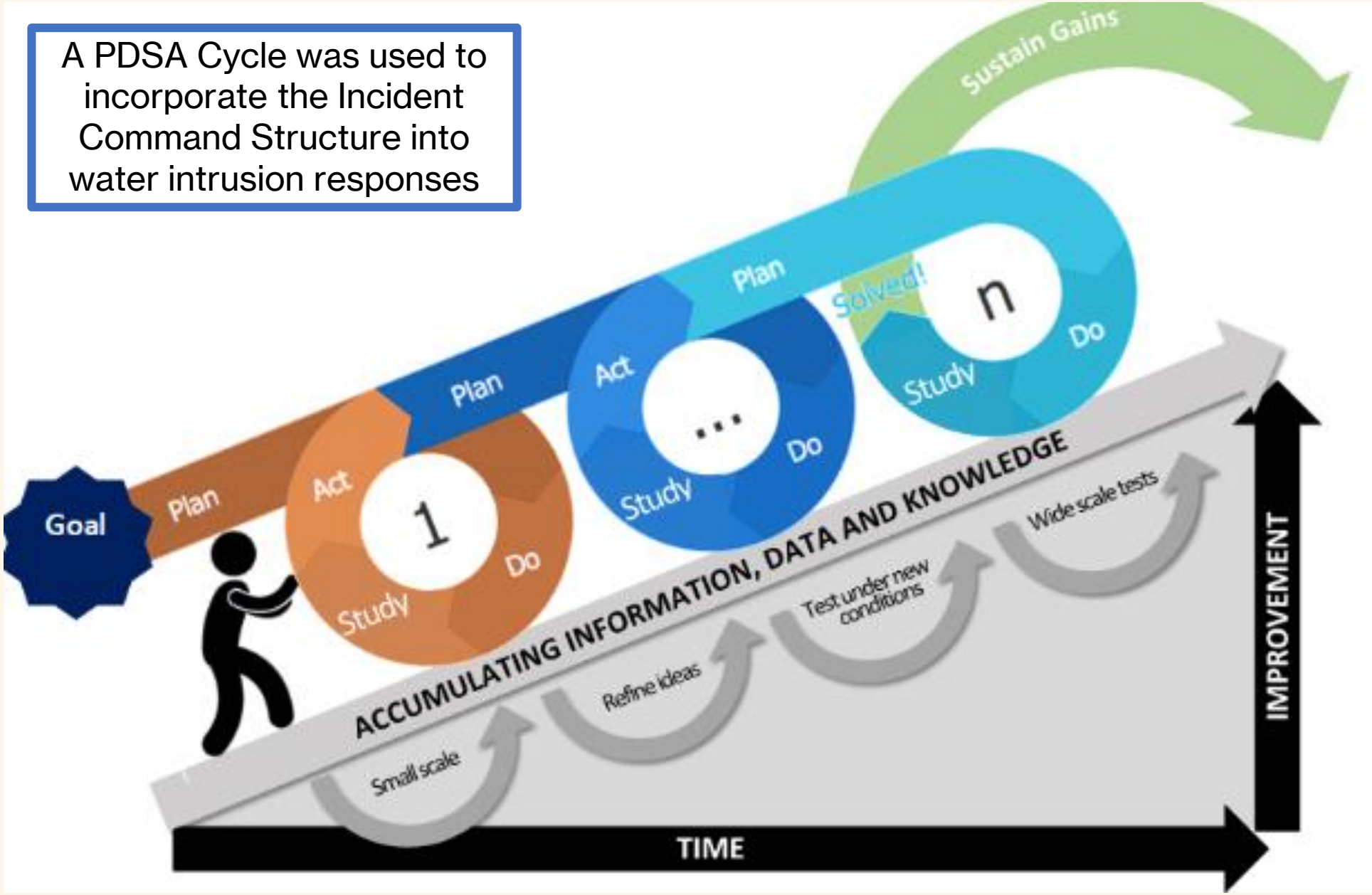


Incident Command System

- A standardized, scalable framework used to command, control, and coordinate emergency responses.
- It has the ability to expand or contract based on the size, scale, and complexity of an incident.
- It can set the framework to establish clear, measurable goals and strategies for follow up documented in an after action report.
- A common misconception: Incident Command should only be used for large scale emergencies.

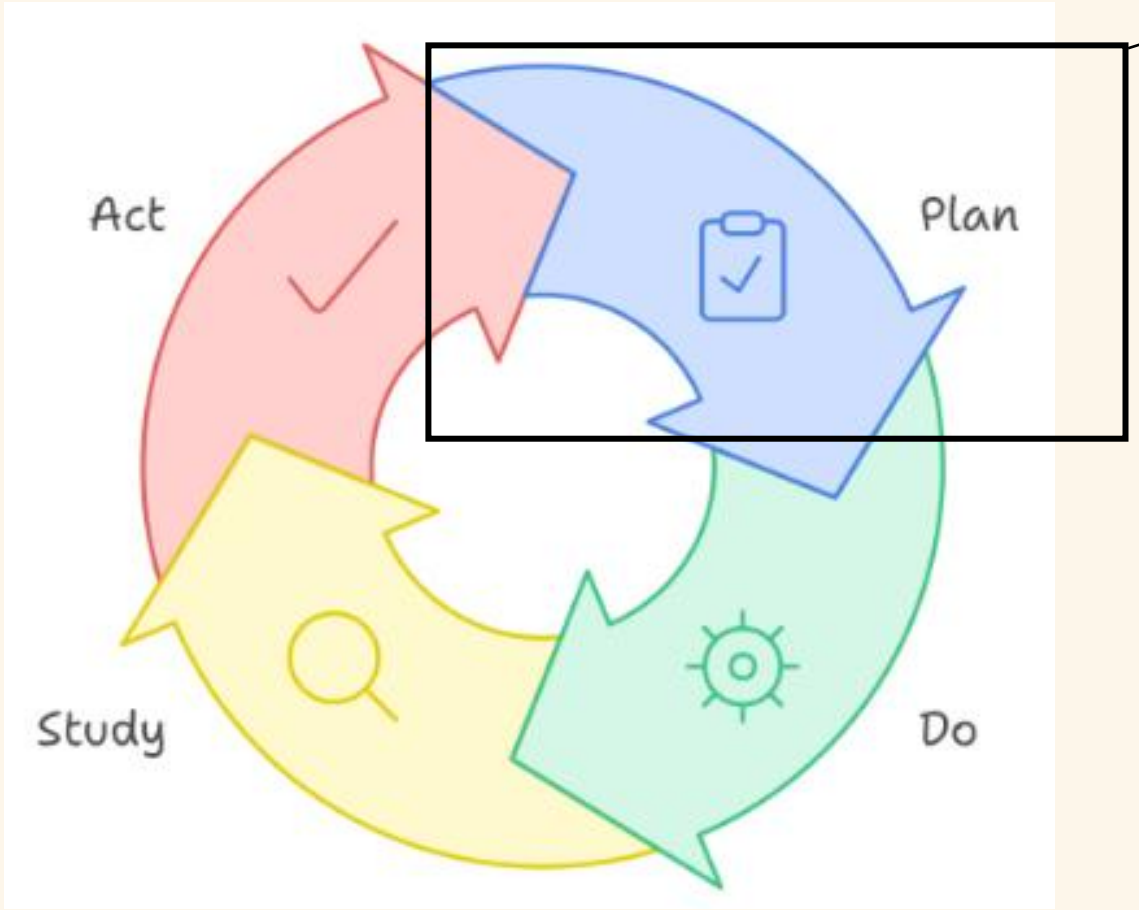

Infection
Prevention
Emergency
Management

A PDSA Cycle was used to incorporate the Incident Command Structure into water intrusion responses




ROUND
1

Step 1: Plan



Plan



Define the goal

- Immediate escalation of active water intrusions to appropriate stakeholders to mitigate risk to patients/staff as well as cost of repairs.

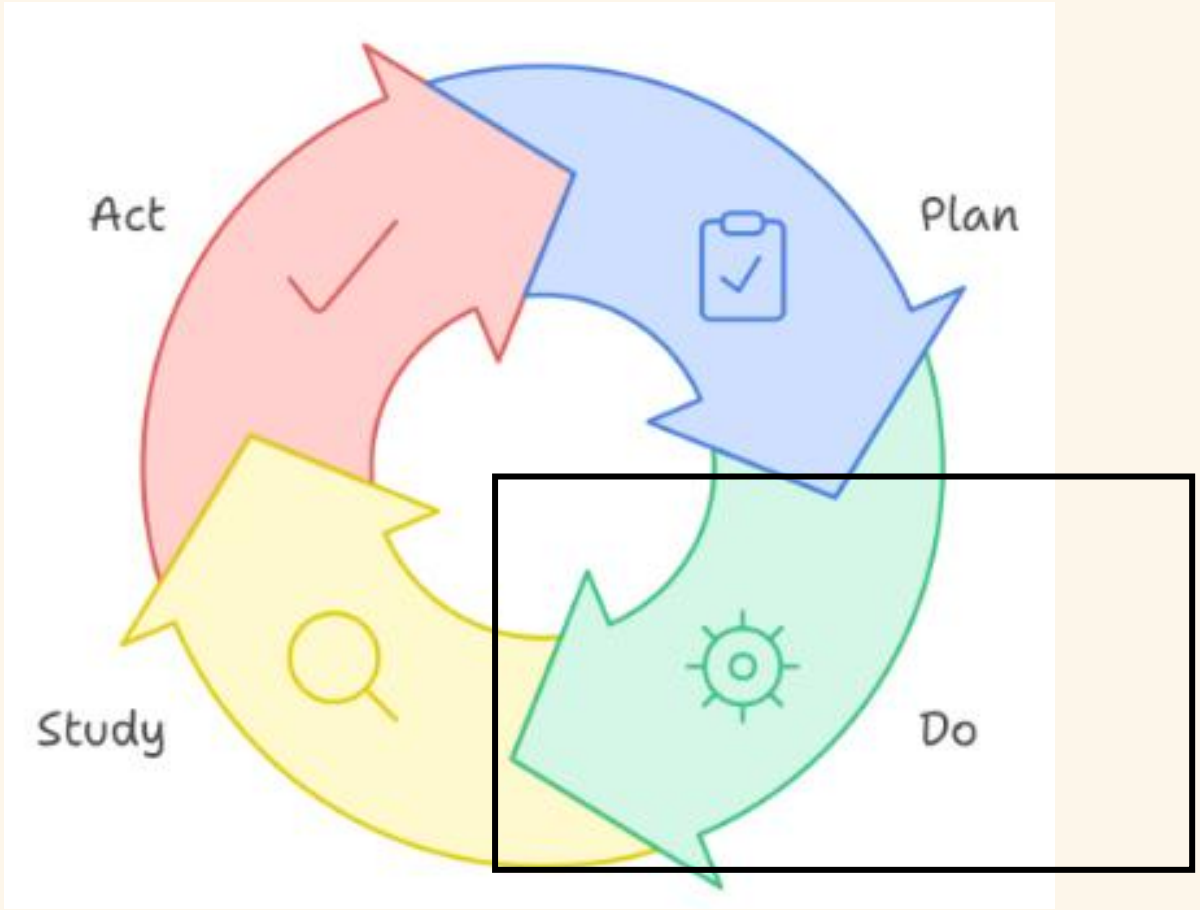
Understand our current process and gaps

- Water intrusions were escalated up to Facilities. Facilities focused on repair work without further escalation.
- Infection Control and Emergency Management were not notified until after the event had occurred and repairs were well underway.
  - This led to ICRA gaps, lack of infection control guidance, and lack of escalation for extensive water damage in a timely fashion.

Determine appropriate stakeholders

Develop an improved process

- Utilize Emergency Management Incident Command structure to escalate water intrusion concerns.

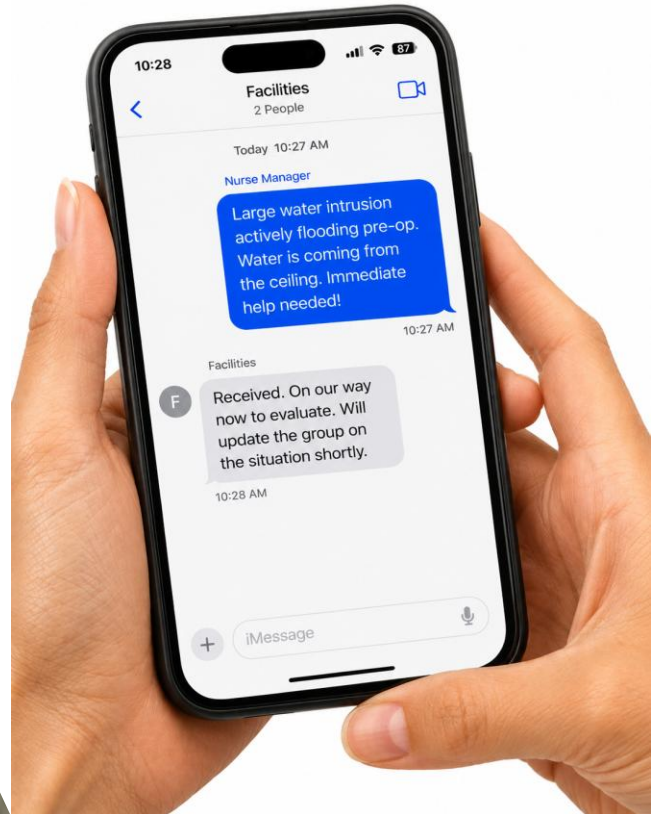


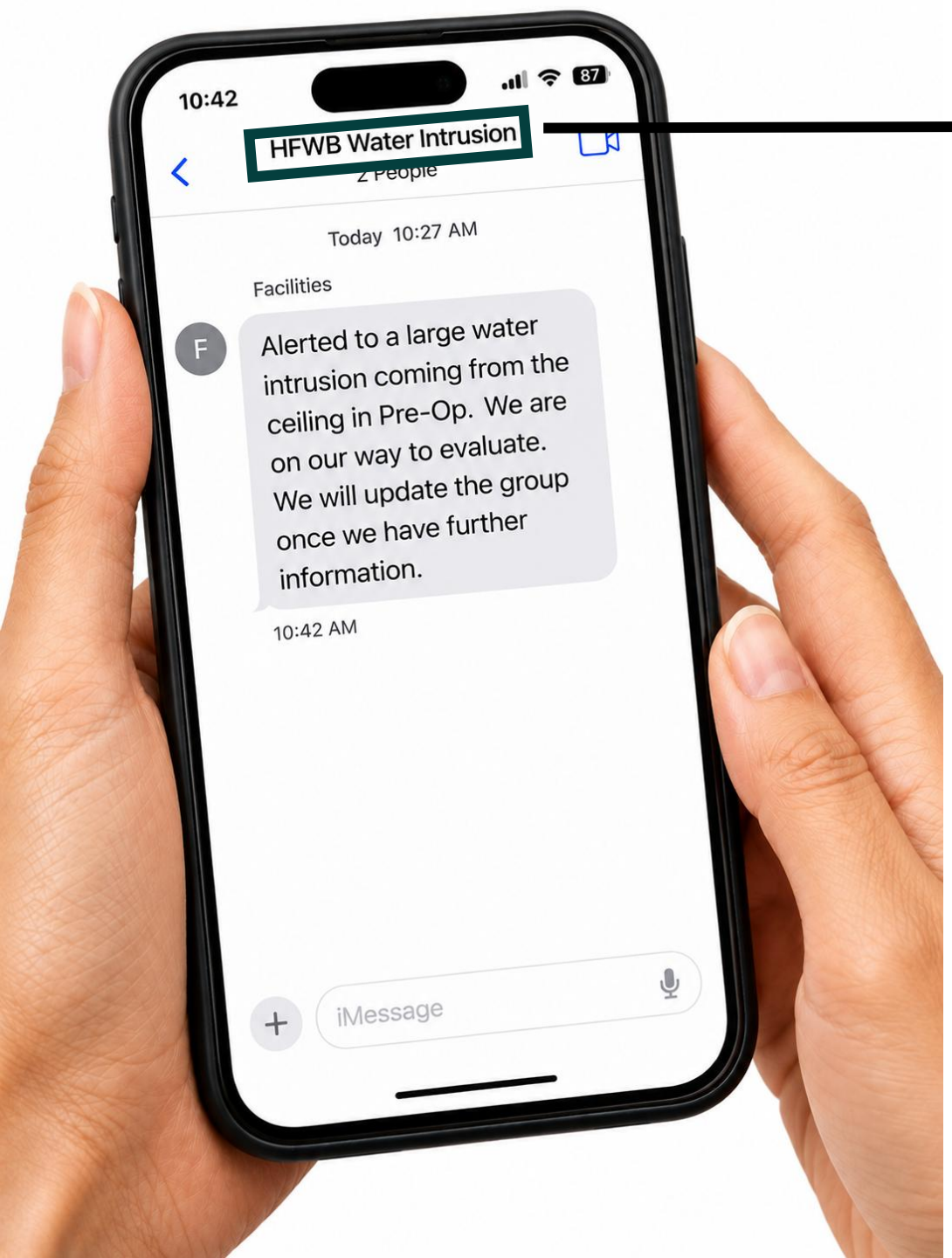
Step 2: Do

Day Process






10:28
87
Facilities
2 People
Today 10:27 AM
Nurse Manager
Large water intrusion actively flooding pre-op. Water is coming from the ceiling. Immediate help needed!
10:27 AM
Facilities
F
Received. On our way now to evaluate. Will update the group on the situation shortly.
10:28 AM
iMessage

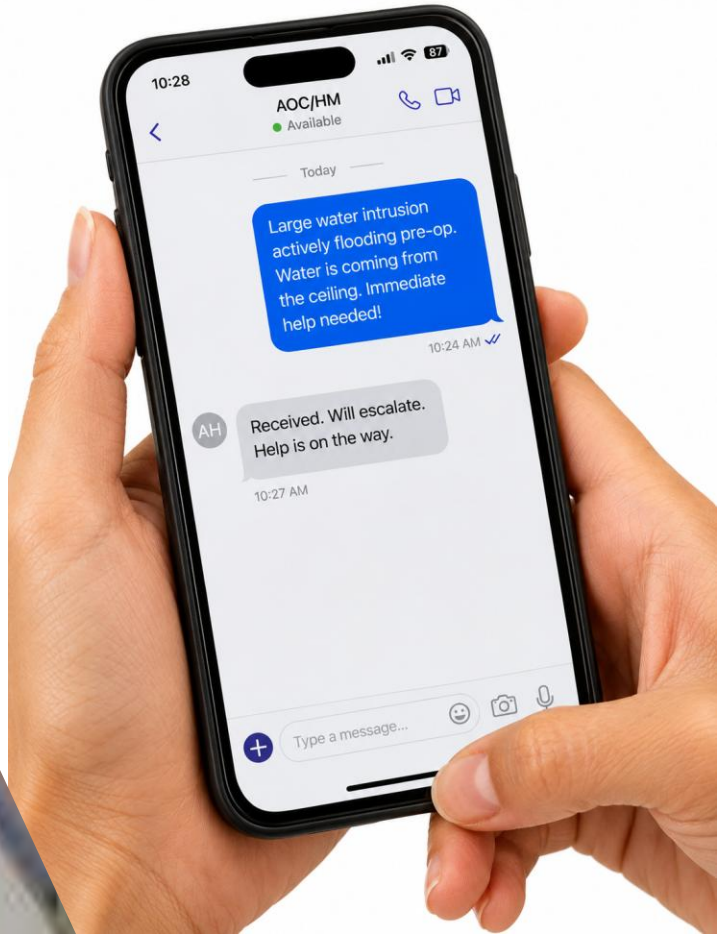


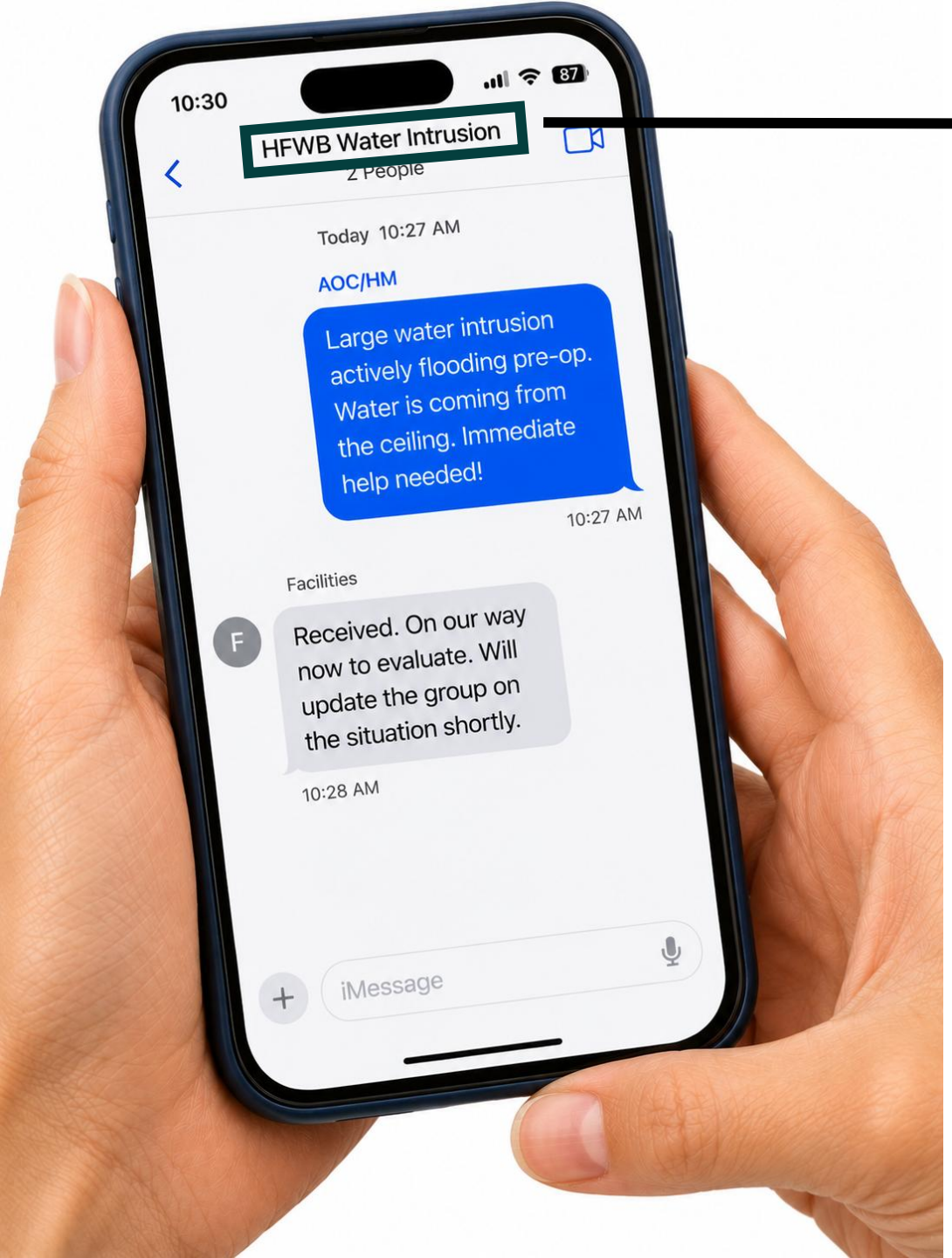
HFWB Water Intrusion Escalation Group Included:

- House Manager (HM)
- Infection Prevention and Control
- Facilities
- Emergency Manager
- Pharmacy
- EVS
- Inpatient Nurse Managers
- Ancillary Nurse Managers

Night Process







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- Ancillary Nurse Managers

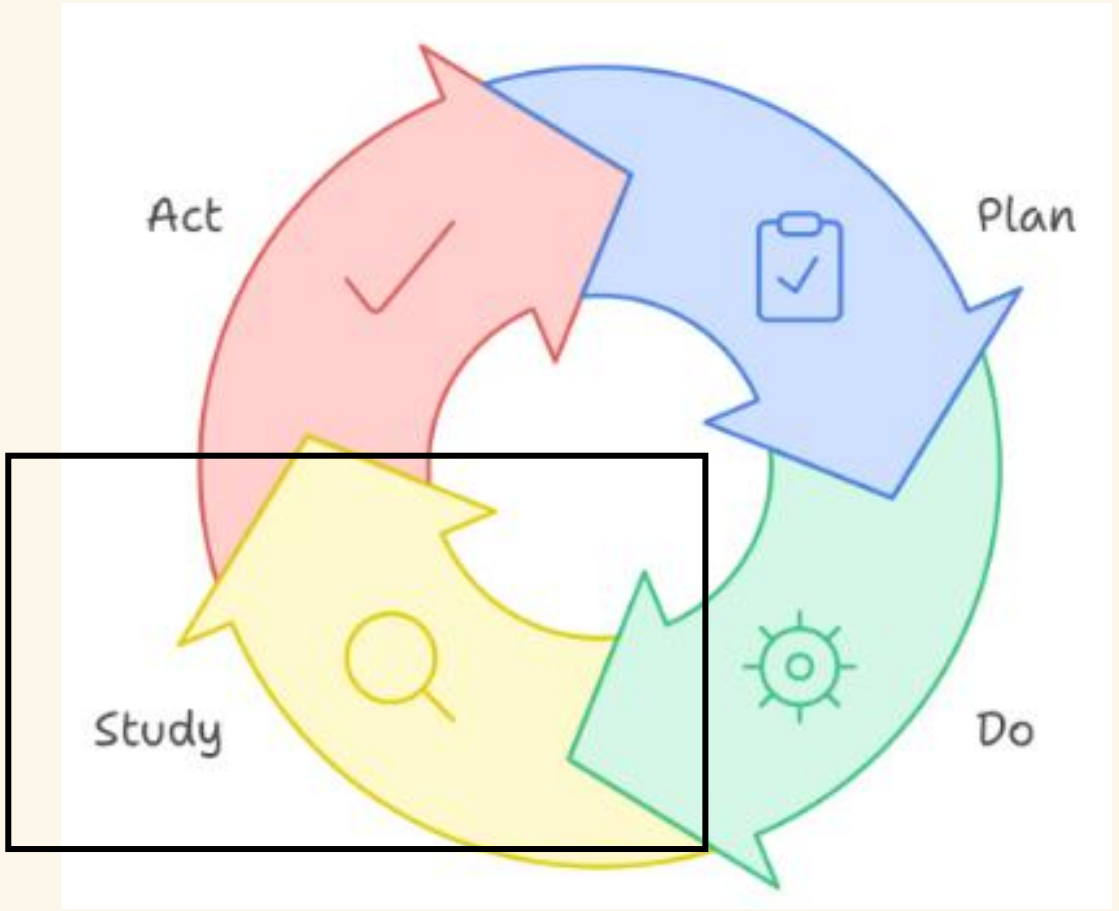
Following Initial Escalation Message…

Expectation:

- Only need to know information sent to the group.
- Small, focused incident command necessity determined following scope of intrusion was outlined by facilities.
- Only escalating emergent water intrusions.



Step 3: Study



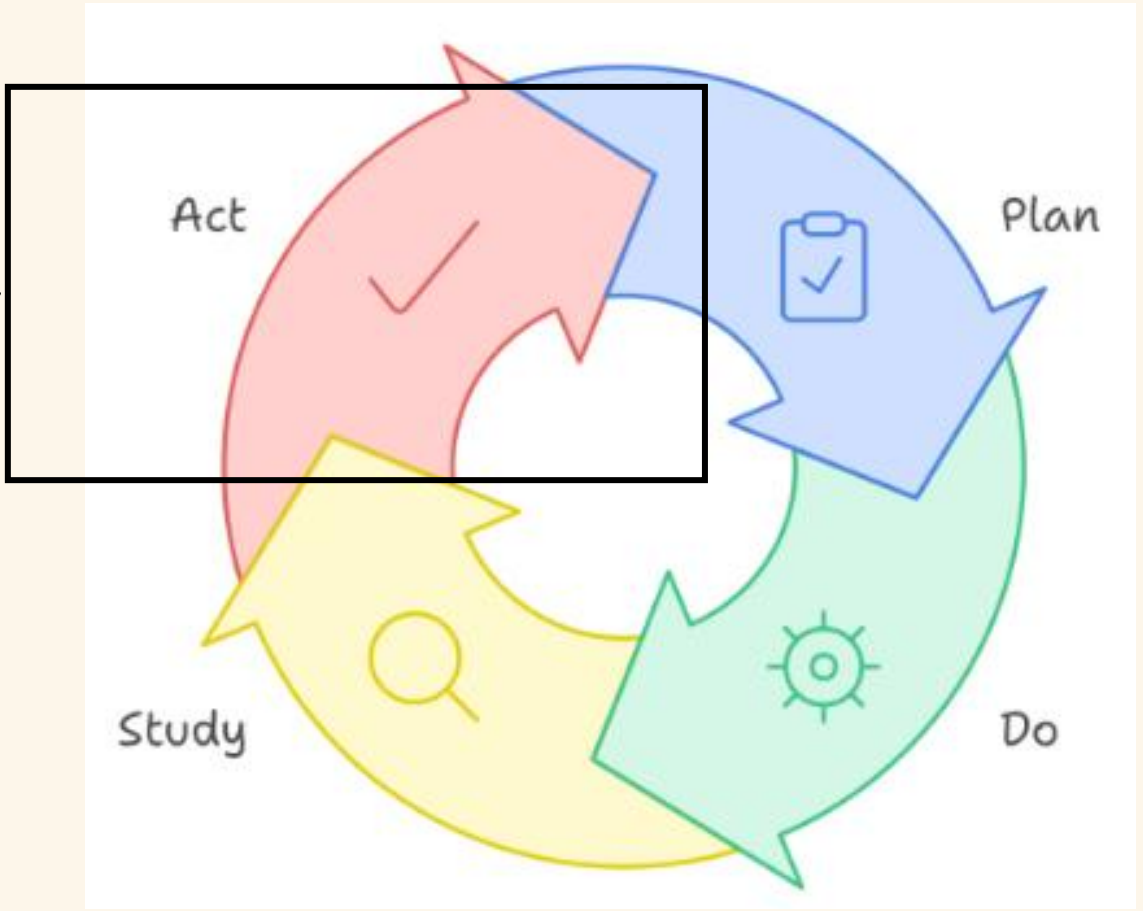
Following Initial Escalation Message...

Reality:

- Immediate bombardment of messages to facilities and unnecessary messages leading to notification fatigue.
- Delay in initiating an incident command or a breakdown in communication leading to no incident command.
- Escalating all water intrusions.



Step 4: Act



Problems Identified

Too many cooks in the kitchen

- Consolidate notification group to key decision makers

Clarification needed on what types of messages are appropriate for the group

- Ex. “Thank you” is polite, but unnecessary

Need defined water intrusions to escalate

Utilize group when:

- Water is extensive, pooling, or not controlled
- Water intrusion affects multiple areas
- Drywall is getting wet
- High risk areas are involved (Main OR, LDRP OR, SPD, IR, Cath Lab, etc.)
- Dirty water has been identified

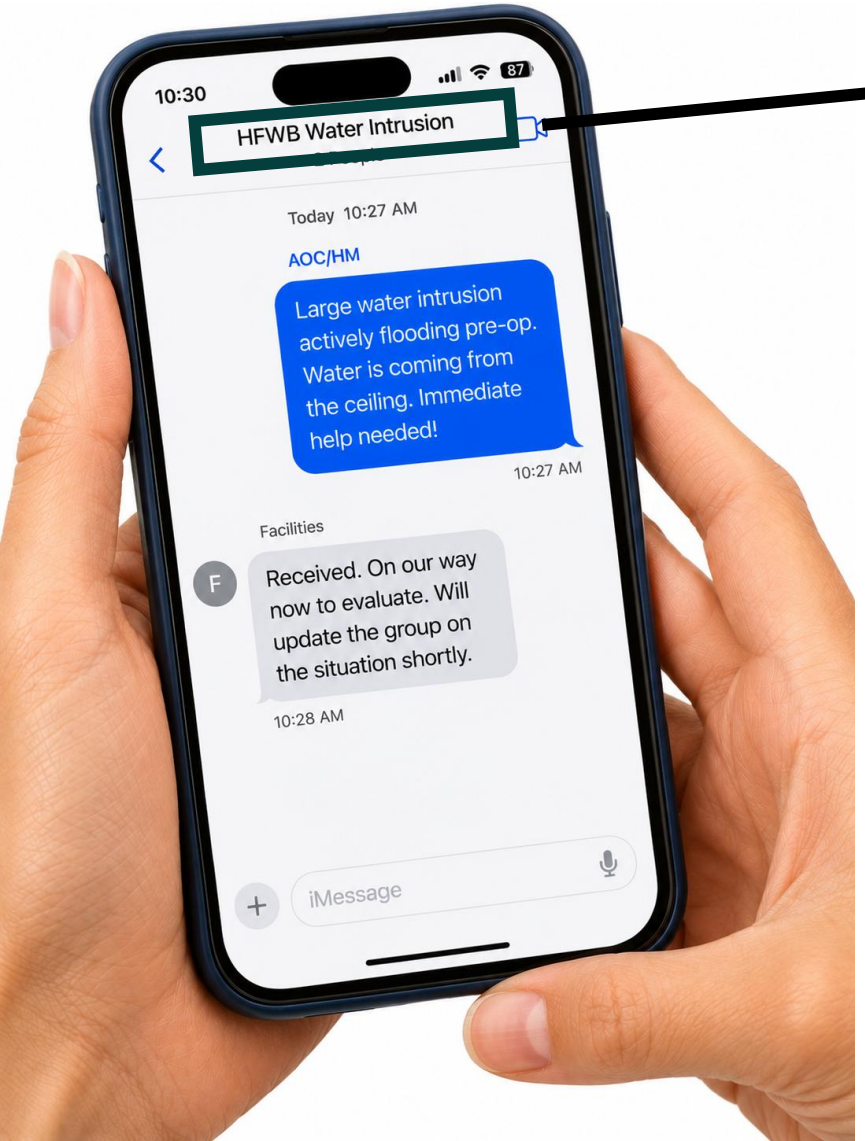
Do not utilize group when:

- Only 1-2 stained/wet ceiling tiles identified
- Minor plumbing issue isolated to small area (ex. toilet overflow contained to single restroom)




ROUND 2

Revise the Water Intrusion Escalation Group



REVISED HFWB Water Intrusion Escalation Group Included:

- House Manager (HM)
- Infection Prevention and Control
- Facilities
- Emergency Management

Plan:

- Reconvene workgroup to discuss changes to our escalation process and escalation group.
- Disseminate education.
- Plan an Emergency Management drill.
  - This was to ensure education was appropriately disseminated and events are escalated both appropriately and in a timely manner.

Do:

- Conduct Emergency Management drill.
  - Goal: Quick response time with escalation to small scale incident command.

Study:

- Success of Emergency Management drill.
- Confirm appropriate escalation process with next few water intrusions.

Act:

- Continue follow up with workgroup as needed.

HFWB EM Water Intrusion Group in Action



The Wake-Up Call No One Asked For

4:45am — OR staff informs House Manager that water is leaking from ceiling in hallway adjacent to OR 12

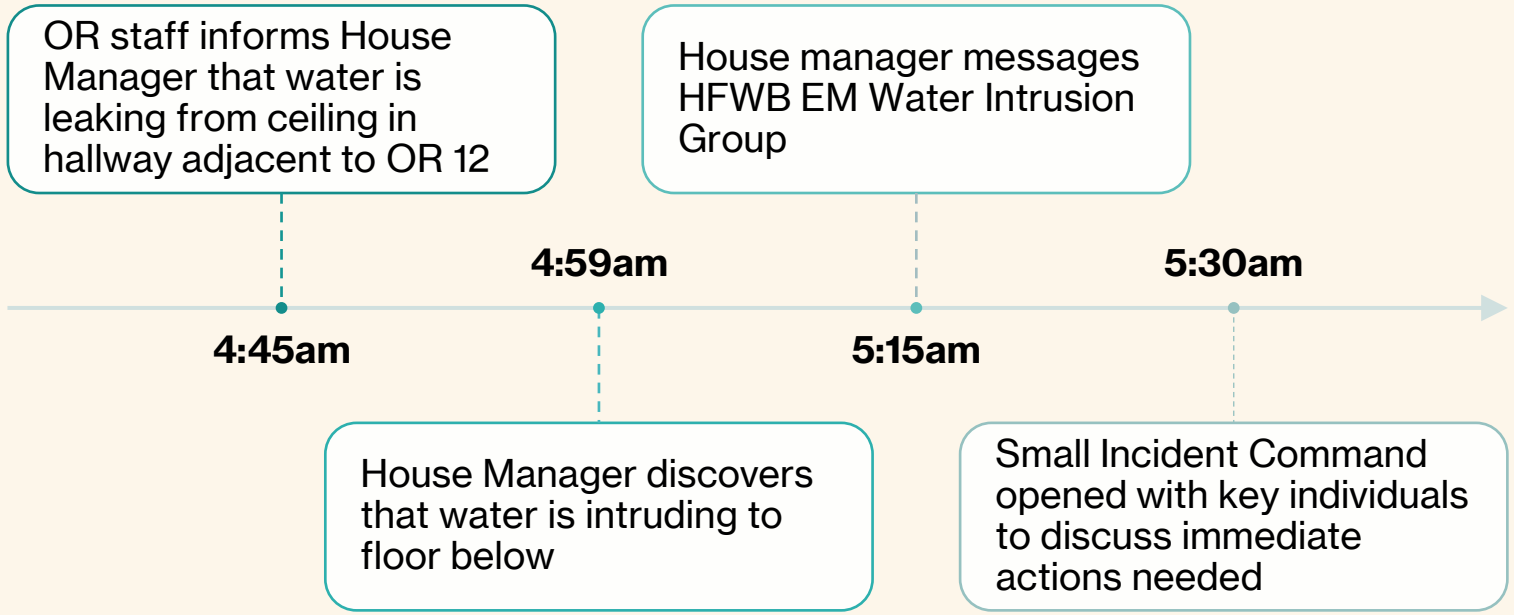
4:59am — House Manager discovers that water is intruding to floor below

5:15am — House Manager messages HFWB EM Water Intrusion Group

5:30am — Small Incident Command opened with key individuals to discuss immediate actions needed



The Wake-Up Call No One Asked For



Incident Command Team

- Emergency Management
- Surgical Services
- Radiology (MRI)
- Infection Prevention
- Administrator on Call

What We Knew

- Water leaking into:
  - Orthopedic surgery clean core
  - Two orthopedic operating rooms
  - MRI and Non-Invasive Cardiology on floor below

- "The area has been dammed" with blankets

- Culprit: Heating hot water pipe with ¼ inch hole in mega press fitting



What We Knew

- Water leaking into:
  - Orthopedic surgery clean core
  - Two orthopedic operating rooms
  - MRI and Non-Invasive Cardiology on floor below

- "The area has been dammed" with blankets

- Culprit: Heating hot water pipe with ¼ inch hole in mega press fitting



Joint Commission is expected to walk through the door within the next few hours for our triennial survey.


THIS IS FINE.

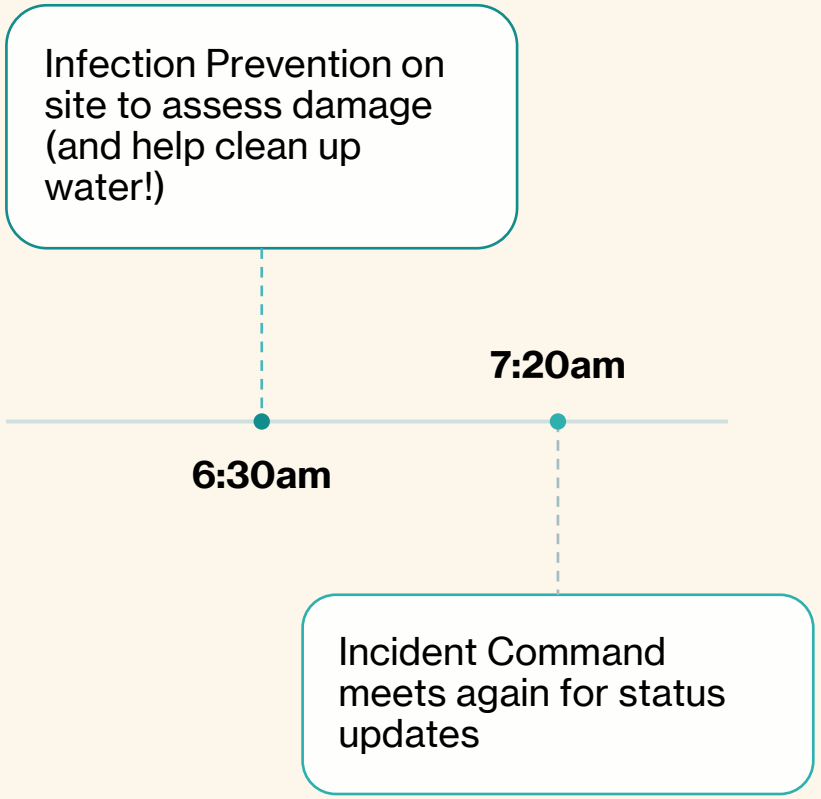
Operation Dry the OR

Infection Prevention on site to assess damage (and help clean up water!)

6:30am



Operation Dry the OR



Immediate actions discussed

- Stop the source of the water
- Remove water
- Discuss ICRA measures
- Determine what is wet/additional damage
- Reschedule patients impacted by closed rooms/departments

Operation Dry the OR

Infection Prevention on site to assess damage (and help clean up water!)

ICRA issued by Infection Prevention

7:20am

6:30am

7:30am

Incident Command meets again for status updates

Infection Control Risk Assessment (ICRA) Form

HENRY FORD HEALTH

Campus/Location:	Project Title:
Project Scope:	
Contractor Manager/Superintendent:	Project Manager:
Construction Company:	Projected Start Date/Estimated Duration:

ICRA form is valid until construction is complete, or a change in work scope is submitted

Select Type	CONSTRUCTION ACTIVITY	Select Highest Risk	INFECTION CONTROL RISK GROUP
	Type A: Inspection and noninvasive activities		Group 1: Low Risk
	Type B: Small scale, short duration activities that create minimal dust		Group 2: Medium Risk
	Type C: Moderate to high dust generation or requires demolition/removal of fixed building components/ assemblies		Group 3: High Risk
	Type D: Major demolition and construction projects		Group 4: Highest Risk
Rationale:		Rationale:	

Construction Activity/Infection Control Matrix

Construction Activity → Risk Group ↓	Type A	Type B	Type C	Type D
Low	Level I	Level II	Level II	Level III*
Medium	Level I	Level II	Level III*	Level IV
High	Level I	Level III	Level IV	Level V
Highest	Level III	Level IV	Level V	Level V

Environmental conditions that could affect human health, such as sewage, mold, asbestos, gray water and black water will require Class of Precautions IV for LOW and MEDIUM Risk Groups and Class of Precautions V for HIGH and HIGHEST Risk Groups.

*Type C [Medium Risk groups] and Type D [Low Risk Groups] work areas [Class III precautions] that cannot be sealed and completely isolated from occupied patient care spaces should be elevated to include negative air exhaust requirements as listed in Class IV Precautions.

Operation Dry the OR

Infection Prevention on site to assess damage (and help clean up water!)

6:30am

7:20am

Incident Command meets again for status updates

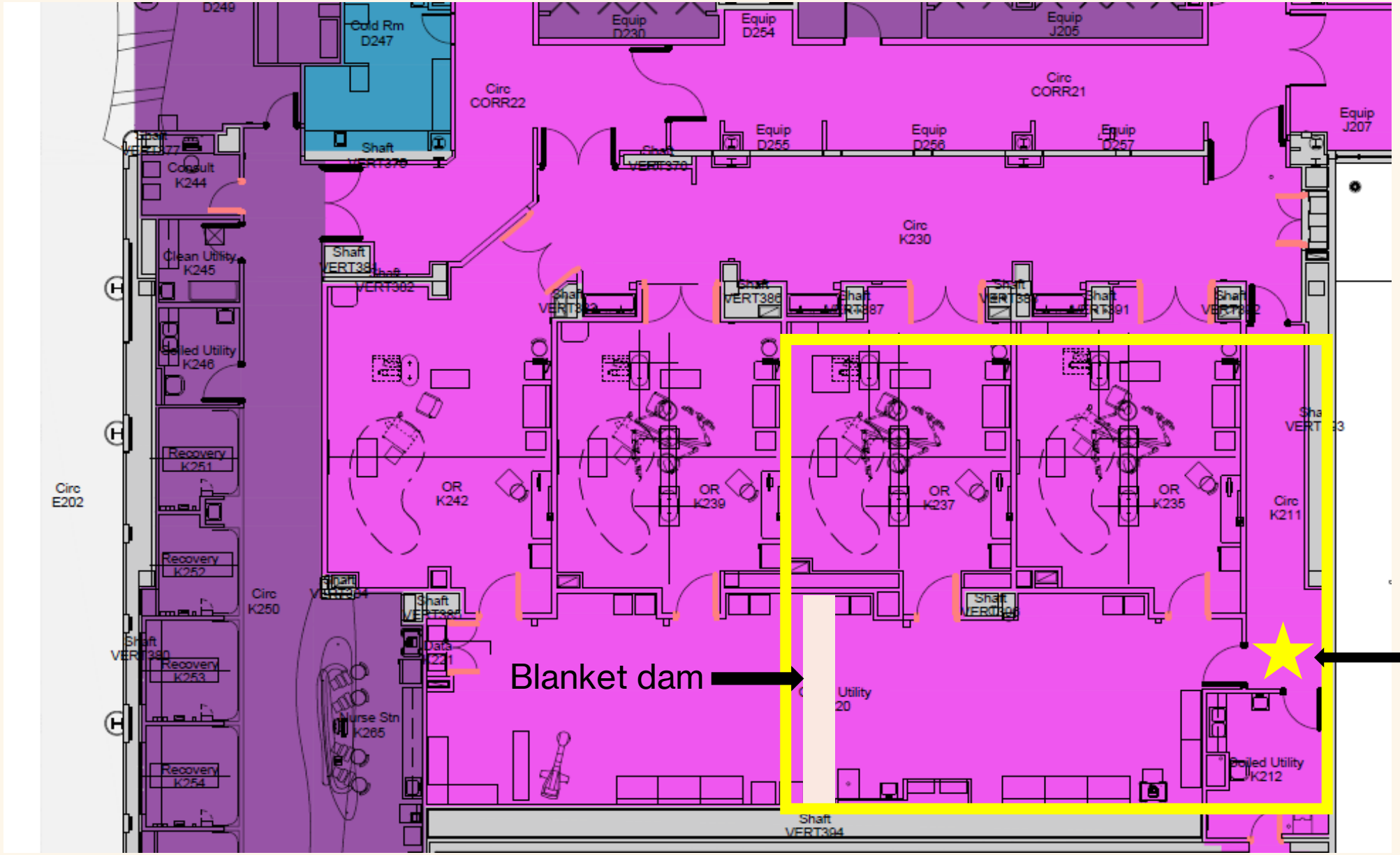
ICRA issued by Infection Prevention

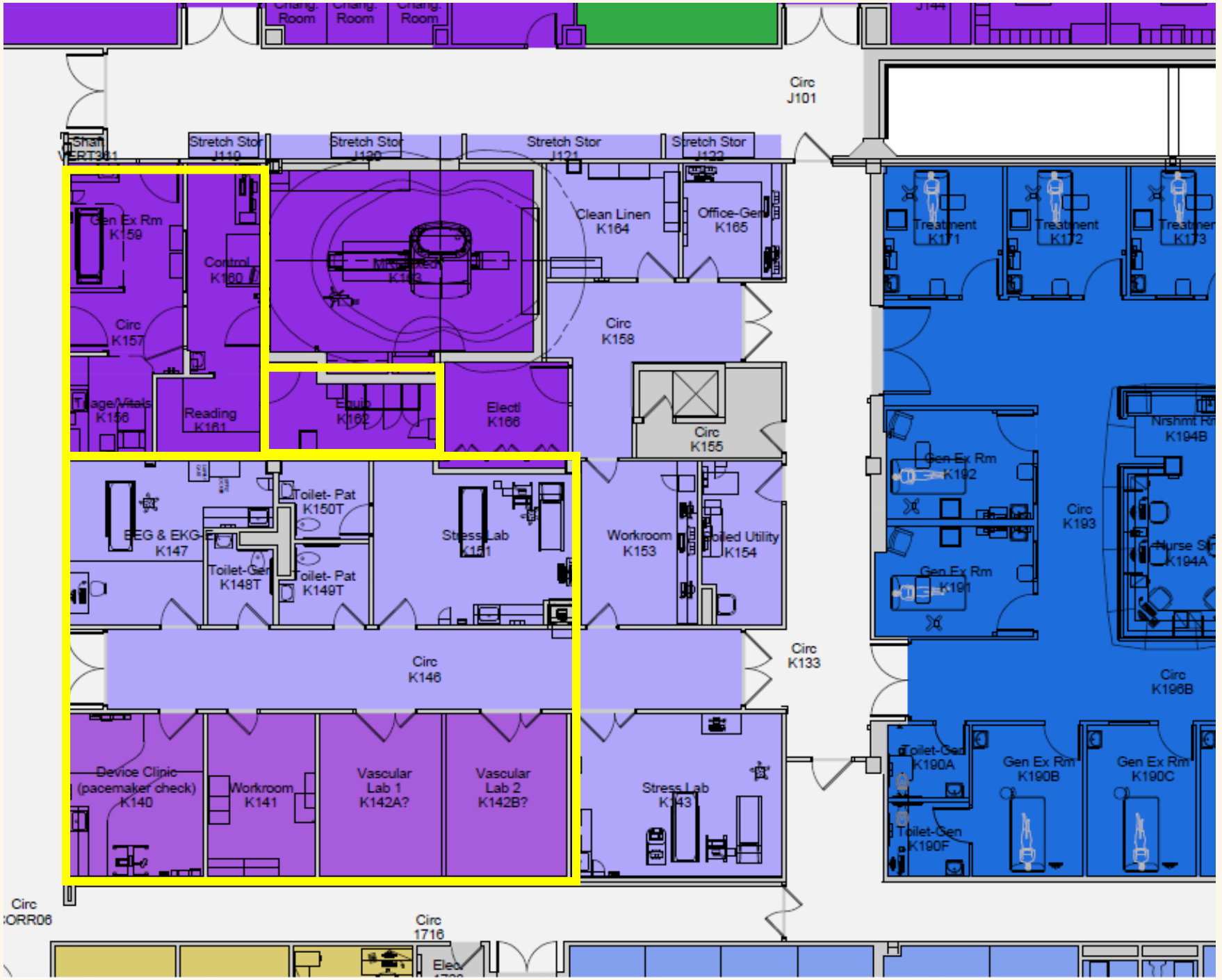
7:30am

7:40am

Joint Commission surveyors arrive for Triennial Survey




Blanket dam
Leak origin
Circ CORR22
Circ CORR21
Circ K230
Circ E202
Circ K250
Circ K211
OR K242
OR K239
OR K237
OR K235
Equip D230
Equip D254
Equip J205
Equip J207
Equip D255
Equip D256
Equip D257
Cold Rm D247
Consult K244
Clean Utility K245
Soiled Utility K246
Recovery K251
Recovery K252
Recovery K253
Recovery K254
Nurse Stn K265
Boiled Utility K212
Shaft VERT394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K160
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K157
Triage/Vitals
K156
Reading
K161
Clean Linen
K164
Office-Gen
K165
Circ
K158
Equip
K162
Electl
K166
Circ
K155
Treatment
K171
Treatment
K172
Treatment
K173
Gen Ex Rm
K192
Circ
K193
Gen Ex Rm
K191
Nrshmt Rm
K194B
Nurse Sta
K194A
Circ
K196B
Toilet- Pat
K150T
EEG & EKG-Ec
K147
Toilet-Gen
K148T
Toilet- Pat
K149T
Stress Lab
K151
Workroom
K153
Soiled Utility
K154
Circ
K146
Circ
K133
Device Clinic
(pacemaker check)
K140
Workroom
K141
Vascular
Lab 1
K142A?
Vascular
Lab 2
K142B?
Stress Lab
K143
Toilet-Gen
K190A
Gen Ex Rm
K190B
Gen Ex Rm
K190C
Toilet-Gen
K190F
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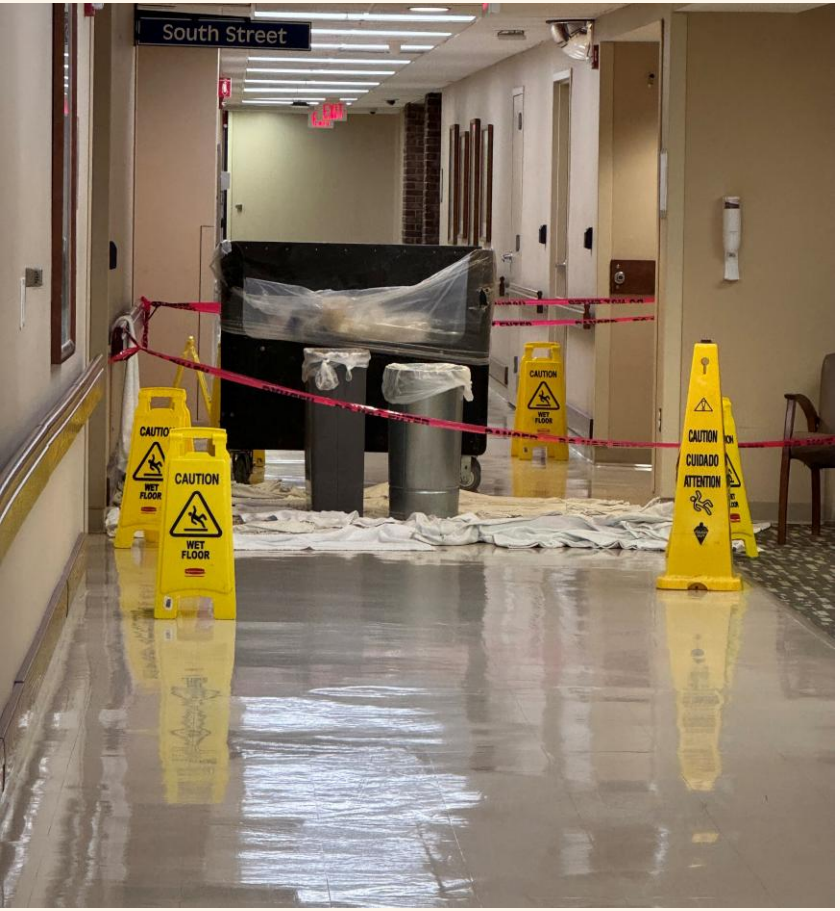
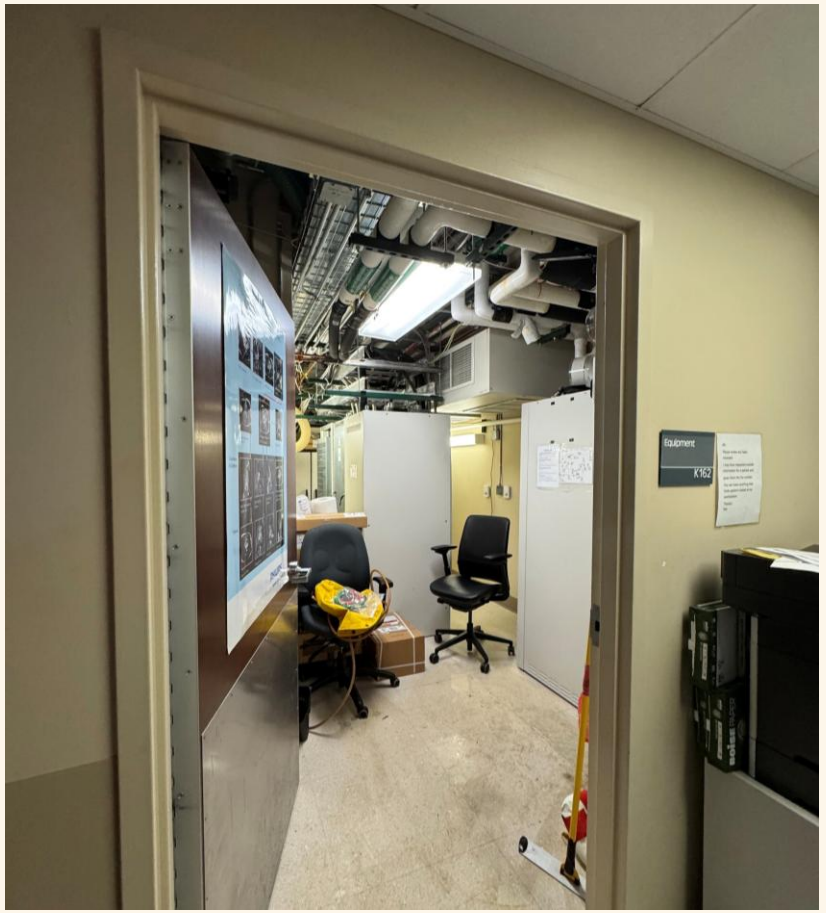
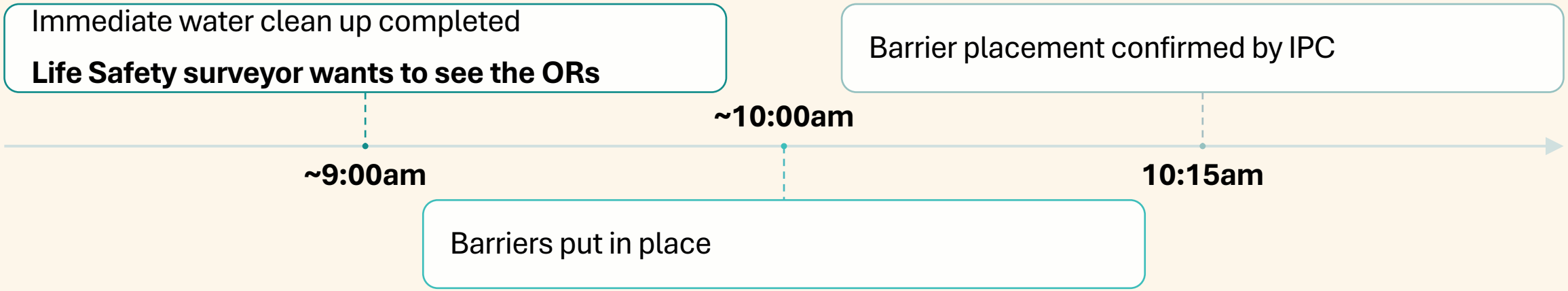
1716


South Street
CAUTION
WET FLOOR
CAUTION
CUIDADO
ATTENTION


Equipment
K162

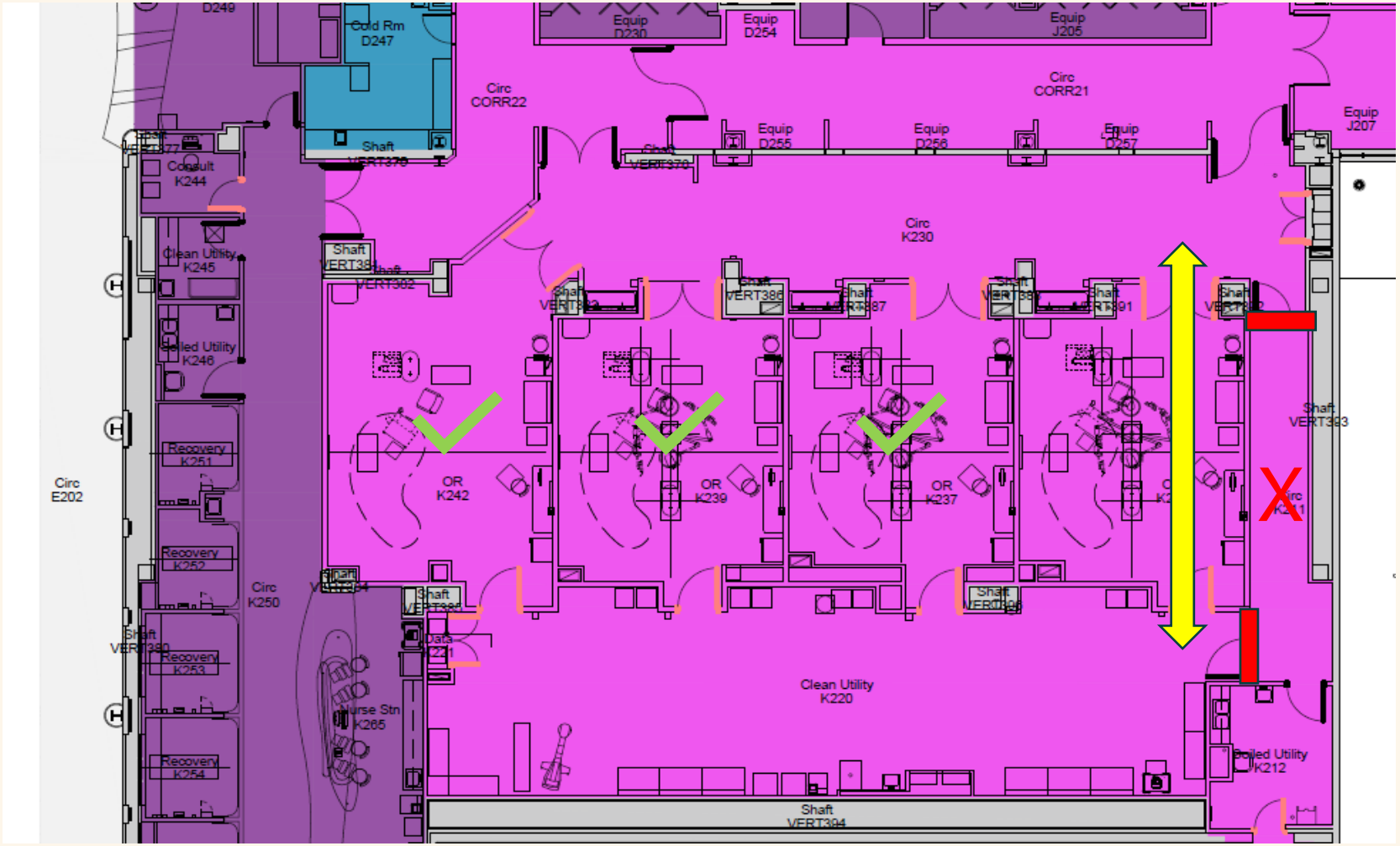


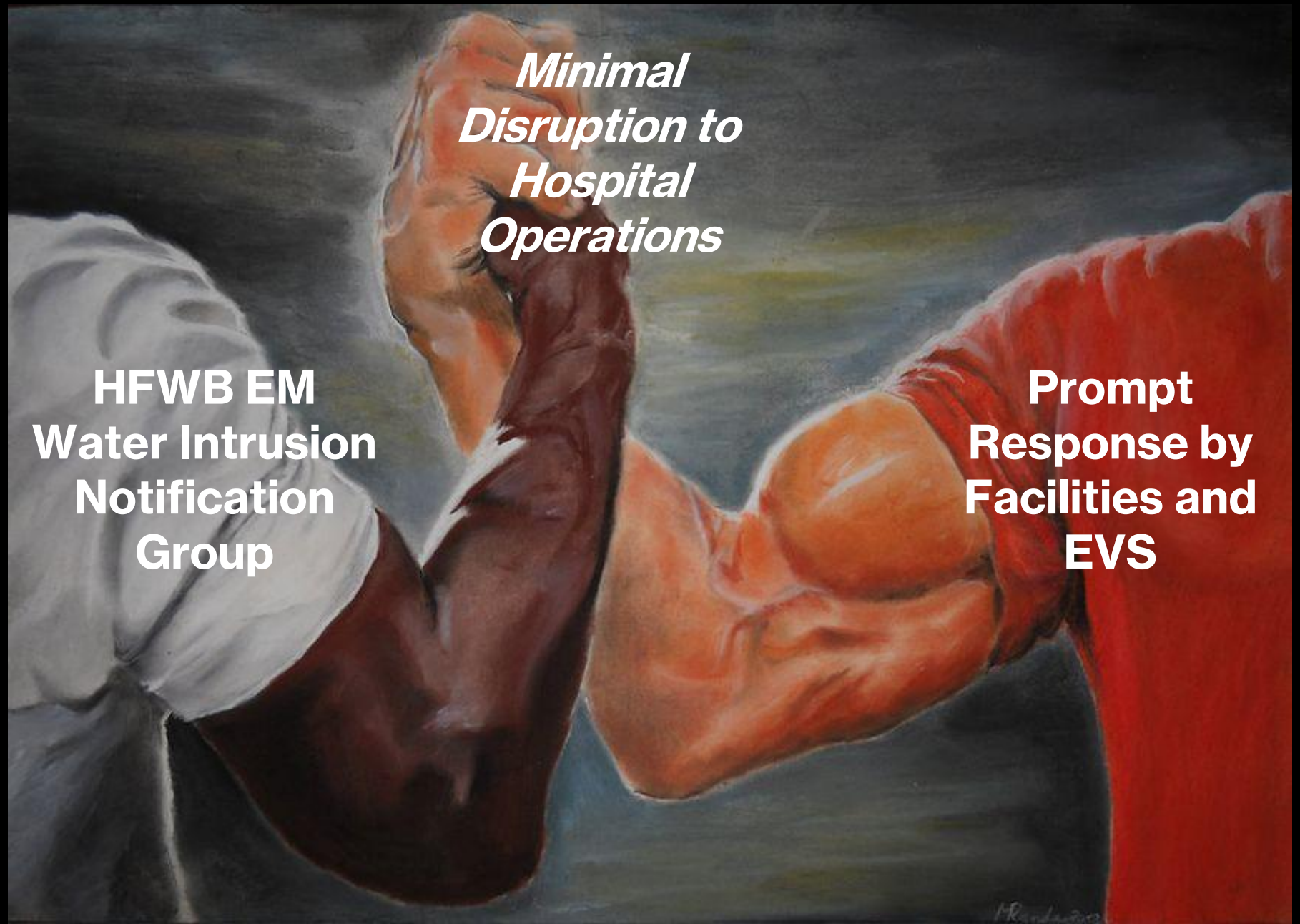
A Tale of Barriers



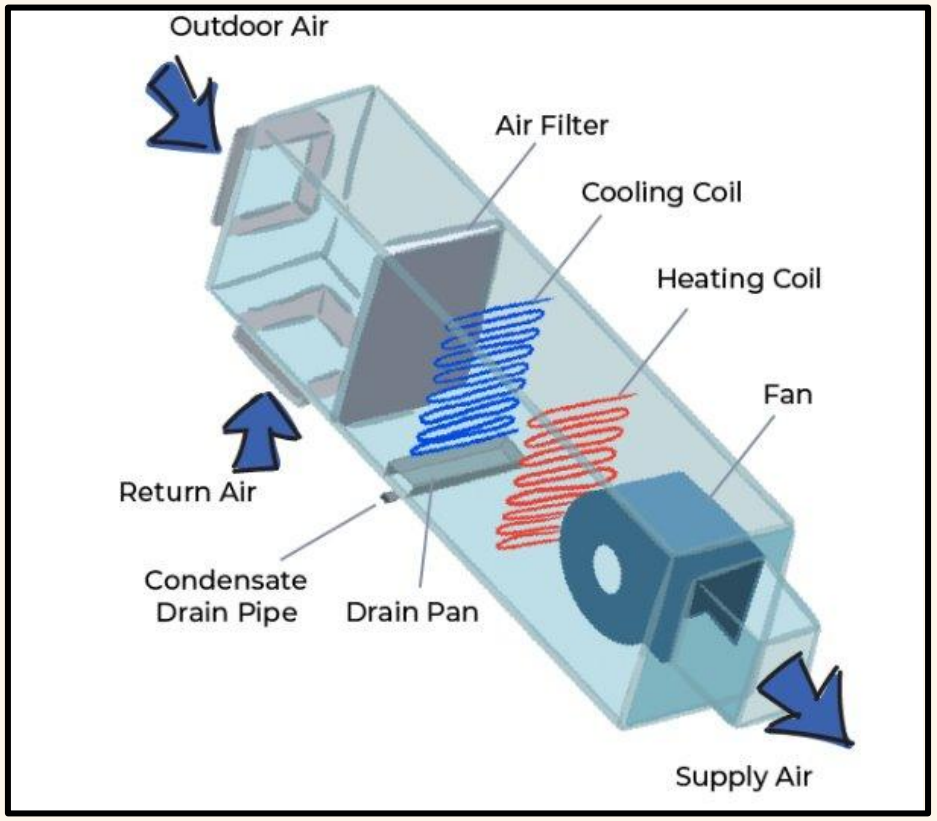
Response

- Operating Room
  - Hallway where leak began closed off for repairs
  - Affected material included only ceiling tiles
  - 3 of 4 ORs safe to use by 12pm
- MRI/Surrounding Hallway
  - MRI down for several weeks
  - Drywall remediation required



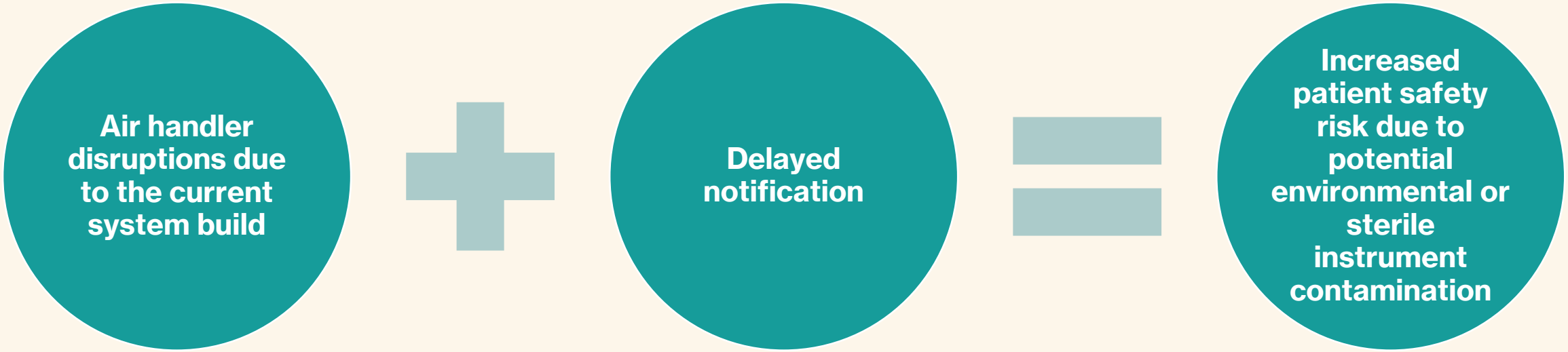

Minimal Disruption to Hospital Operations
HFWB EM Water Intrusion Notification Group
Prompt Response by Facilities and EVS


Are there other applications for the Emergency Management framework in IP-related environmental emergencies?



How about air handler disruptions!

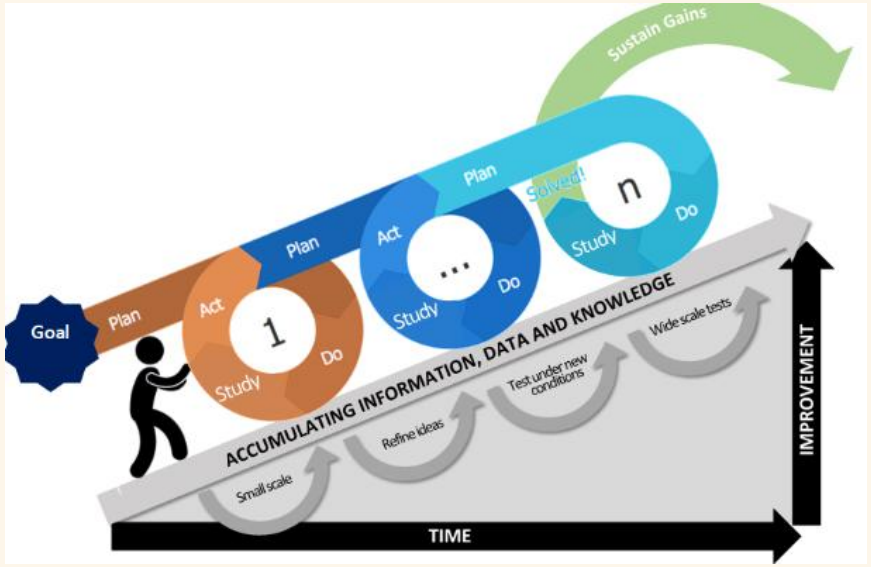
Summary


Air handler disruptions due to the current system build
Delayed notification
Increased patient safety risk due to potential environmental or sterile instrument contamination

Multiple PDSA Cycles Were Completed

In summary...

- A separate notification group was created to escalate air handler disruptions consisting of key decision makers.
- Emergency Management drills were conducted within each high-risk area to ensure there were no gaps in our escalation process.
- Education was created and disseminated on our escalation process from ELT to frontline staff.
- Educational binders were created for each high-risk area with step-by-step instructions on what to do in the event of a temperature/humidity excursion within our high-risk areas.
- The process is revisited as needed, such as when a breakdown in communication occurs or incident command hot wash identifies potential gaps.



Temperature and Humidity Out of Range? – Step by Step Guidance for High-Risk Areas

HENRY FORD HEALTH

Air handlers, chillers or the buildings automated monitoring system may malfunction or undergo maintenance from time to time. During these instances, this document will serve as a guide for chain of communication and next steps to ensure the safety of our patients as well as the sterility of our environment and supplies.

Weekday Process

1. If temp and/or humidity begins to go out of range (refer to the Tip Sheet for Humidity and Temperature Failures – Risk Matrix), notify your area's leadership.
    - Your area's leadership will then reach out to engineering at or the facilities shift phone . If no answer from engineering, contact Matt Todorov If no answer from Matt, contact Tom Mahoney at .
    - Area's leadership team will then await a call from Emergency Management or an incident command call if needed.
2. Begin logging hourly temp and humidity until your area's leadership confirms all systems are fixed, back online, and operational. **These logs should be kept for 3 years according to our policies and regulatory requirements**
3. Your area's leadership will coordinate with you and your fellow team members to determine the following questions. Leadership team, be prepared to answer these questions when Emergency Management reaches out and/or during the incident command call.
    - Is it temperature and/or humidity that is out of range?
    - How long has temperature and/or humidity been out of range?
    - What is the temperature and/or humidity trend look like?
    - Has manual recording of temperature and humidity been initiated?
    - What actions are going to be taken by your team currently and looking ahead (i.e., moving sterile supplies, cancelling cases, etc.)
4. Continue alerting your leadership team to any issues that come up during this time (i.e., walls are beginning to sweat, water intrusions, etc.) as well as hourly temp and humidity readings until the all clear is given by your leadership team.

Weeknight/Weekend (Off Shift) Process

1. If temp and/or humidity begins to go out of range (refer to the Tip Sheet for Humidity and Temperature Failures – Risk Matrix), notify the House Manager at 3p-7a Monday-Friday and all-day Saturday and Sunday.

    - The House Manager will then send a HALO to HFWB EM Air Handler Disruption to open up a communication platform for the key decision makers. Following initiation of the HALO group, reach out to Tom Mahoney at to ensure awareness of the issue. If no answer from Tom, contact Matt Todorov .. If needed, engineering can be contacted at or call the facilities shift phone at .

    - Your area's leadership will be notified via HALO by the House Manager. If an incident command will be established, that will be relayed in the HALO message sent to the affected areas.

2. Begin logging hourly temp and humidity until your area's leadership confirms all systems are fixed, back online, and operational. **These logs should be kept for 3 years according to our policies and regulatory requirements**

3. Your area's leadership will coordinate with you and your fellow team members to determine the following questions. Leadership team, be prepared to answer these questions and report back to Emergency Management and/or during the incident command call.

    - Is it temperature and/or humidity that is out of range?
    - How long has temperature and/or humidity been out of range?
    - What is the temperature and/or humidity trend look like?
    - Has manual recording of temperature and humidity been initiated?
    - What actions are going to be taken by your team currently and looking ahead (i.e., moving sterile supplies, cancelling cases, etc.)

4. Continue alerting your leadership team to any issues that come up during this time (i.e., walls are beginning to sweat, water intrusions, etc.) as well as hourly temp and humidity readings until the all clear is given by your leadership team.

HENRY FORD HEALTH

Tip Sheet for Humidity and Temperature Failures– Risk Matrix

- Humidity and temperature fluctuation during power outages or HVAC failures can compromise patient care
- The amount of time passed without temperature and humidity control poses risk to patients
- Refer to the grids below for general guidance on response times to correct temperature and humidity issues as it relates to patient infection risk, risk to clinical supplies and sterile instruments, and risk to clinical equipment
- **In the event of an unexpected temperature/humidity fluctuation, immediately contact your site-specific leadership and Infection Prevention & Control team for next steps**
- **If unexpected temperature/humidity fluctuations are sustained for the length of time described in the tables below, ensure an RL is filed with the appropriate location and information.**

Risk of Patient Infection During a Procedure

Relative Humidity Level	Temperature (°F)		
	High (>75)	OK (68-75)	Low (<68)
High (>60)	<2 hours**	<2 hours**	<2 hours**
OK (30-60)	4-8 hours*	Perfect Conditions	4-8 hours*
Low (<30)	24 hours	24 hours	<2 hours

- ***** EVS or other designated team members must terminally clean if temp/humidity fluctuation lasts 2 hours or more. If less than 2 hours, contact infection control to determine if damp dusting or terminal cleaning is required. This will be determined on a case-by-case basis.***
- ****Contact Infection Control to determine if damp dusting or terminal cleaning is required. This will be determined on a case-by-case basis.***

Risk to Clinical Supplies and Sterile Instruments

Relative Humidity Level	Temperature (°F)		
	High (>78)	OK (68-78)	Low (<68)
High (>60)	<2 hours	4-8 hours	<2 hours
OK (20-60)	24 hours	Perfect Conditions	24 hours
Low (<20)	24 hours	24 hours	24 hours

Risk to Clinical Equipment (includes lab equipment)

Relative Humidity Level	Temperature (°F)		
	High (>80)	OK (65-80)	Low (<65)
High (>60)	4-8 hours	4-8 hours	4-8 hours
OK (20-60)	24 hours	Perfect Conditions	24 hours
Low (<20)	<2 hours	<2 hours	<2 hours

Key Reminders:

- If you are unsure of your area's temperature/humidity conditions but perceive them to be off, contact your local Facilities team for an assessment.
- Do not use any supplies/linen/instruments that have visible signs of moisture or if the area temperature/humidity exceeds the max limit per the product label/IFU. Sequester these items from use and allow Supply Chain to assess.
- For questions about equipment or equipment that appears to have damage related to temperature/humidity, reach out to Clinical Engineering (i.e. Trimedx) for guidance and assessment.

Current State of Our Escalation Groups

- Still in use!

- Occasionally requires group etiquette reminders
  - Messages that are deemed necessary
  - Intrusions that should vs. should not be escalated

- Finding out “long after the fact” generally now a thing of the past



In Conclusion



Environmental emergencies require Infection Prevention support to mitigate patient and staff risks as well as restoration costs.



An incident command structure is not just for high level emergencies; it can be adapted to small scale events.



Utilizing quailty improvement frameworks (such as a PDSA cycle) help identify the root cause of process failures and may take many attempts to perfect.



Communication and teamwork is key!

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Special Thank Yous

- Facilities Team
  - Mike Twigg, Matt Todorov
- Emergency Manager
  - Rick Oxie
- Procedural Area Leaders
  - Jim Snyder, Katie Younce, Becca LaTour
- Environmental Services Leaders
  - Djella Dushaj
  - Rhonda Ross
- Pharmacy Leaders
  - Michelle Atie, Eric Szydlowski
- House Manager Team

Questions?