METROPOLIS WORKS

UF_6 Conversion

Honeywell

Honeywell Metropolis

- Background
  - Introduction to Honeywell
  - Introduction to Metropolis / Overview of Process
  - Recent Historical Events
- The Case Study
  - Sequence of Events
  - Safety Conscious Work Environment issues involved
  - NRC Actions / Corrective Actions
- Looking Forward
  - Employee Engagement – Honeywell Operating System (HOS)
- Lessons Learned

Honeywell

Who Is Honeywell?

Business Overview

Aerospace

Automation and Control Solutions

Performance Materials and Technologies

Great Positions In Good Industries

Honeywell developed the first autopilot flight controller (1914), first commercial weather radar system (1954), first business jet turbofan engine (1975), and is still the leader in developing revolutionary technology for aerospace today.

Honeywell pioneered automotive turbocharging 60 years ago and remains the industry leader launching, on average, 100 new turbo applications globally each year.

Honeywell is the leader in gas detection, fire systems, personal protective equipment, building controls, home comfort and security, and scanning and mobility.

Honeywell's technology is used to produce 40% of the world's liquefied natural gas, 60% of the world's gasoline, 70% of the world's polyester, and 90% of the world's biodegradable detergents.

Highly Diversified, Technology-Driven Industrial Company

Performance Materials and Technologies

Businesses:

- Honeywell UOP
- Honeywell Process Solutions
- Fluorine Products
- Resins and Chemicals
- Specialty Products

Headquarters:
Morris Plains, N.J.

Technologies:

- Oil and gas process technology, equipment, catalysts, and services
- Industrial automation controls
- Low-global-warming-potential refrigerants
- Specialty films and additives
- Advanced fibers and composites
- Nylon materials and ammonium sulfate fertilizer
- Electronic materials and chemicals

About the Plant

- Built in 1958
- 1,100 acres owned (445 hectares)
  60 acres (24 hectares) are within fence line
- ~260 employees
  (~102 hourly represented by USW)
- 3-year labor agreement ratified on March 27, 2015
- ISO 9001 Certification for UF6 (ISO 9001:2008)
  - Recertification in 2015
- RC 14001 Certification
  - Recertification in 2015
- Federal and state oversight
  - Nuclear Regulatory Commission License (NRC)
  - NPDES Water Permit (IEPA)
  - RCRA Part B Hazardous Waste Permit (IEPA)
  - Title V Air Permits (IEPA)

Honeywell

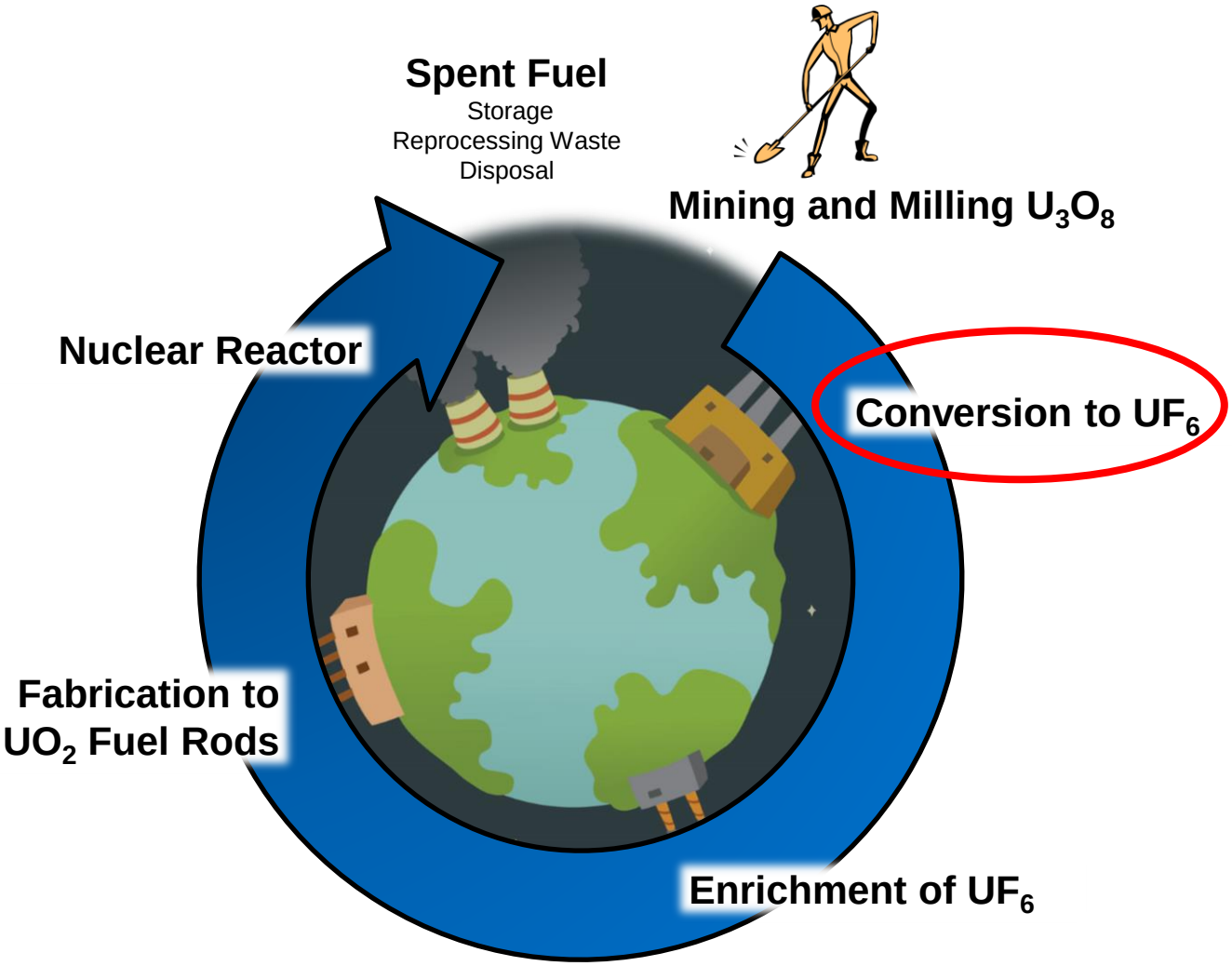
Safety is #1

- Metropolis continues to invest in world-class safety and industrial hygiene equipment.

- We work closely with the community through the Community Advisory Panel and are proud of our role in the future of the Metropolis area.

Honeywell

Nuclear Fuel Cycle



Honeywell

Uranium Hexafluoride Process

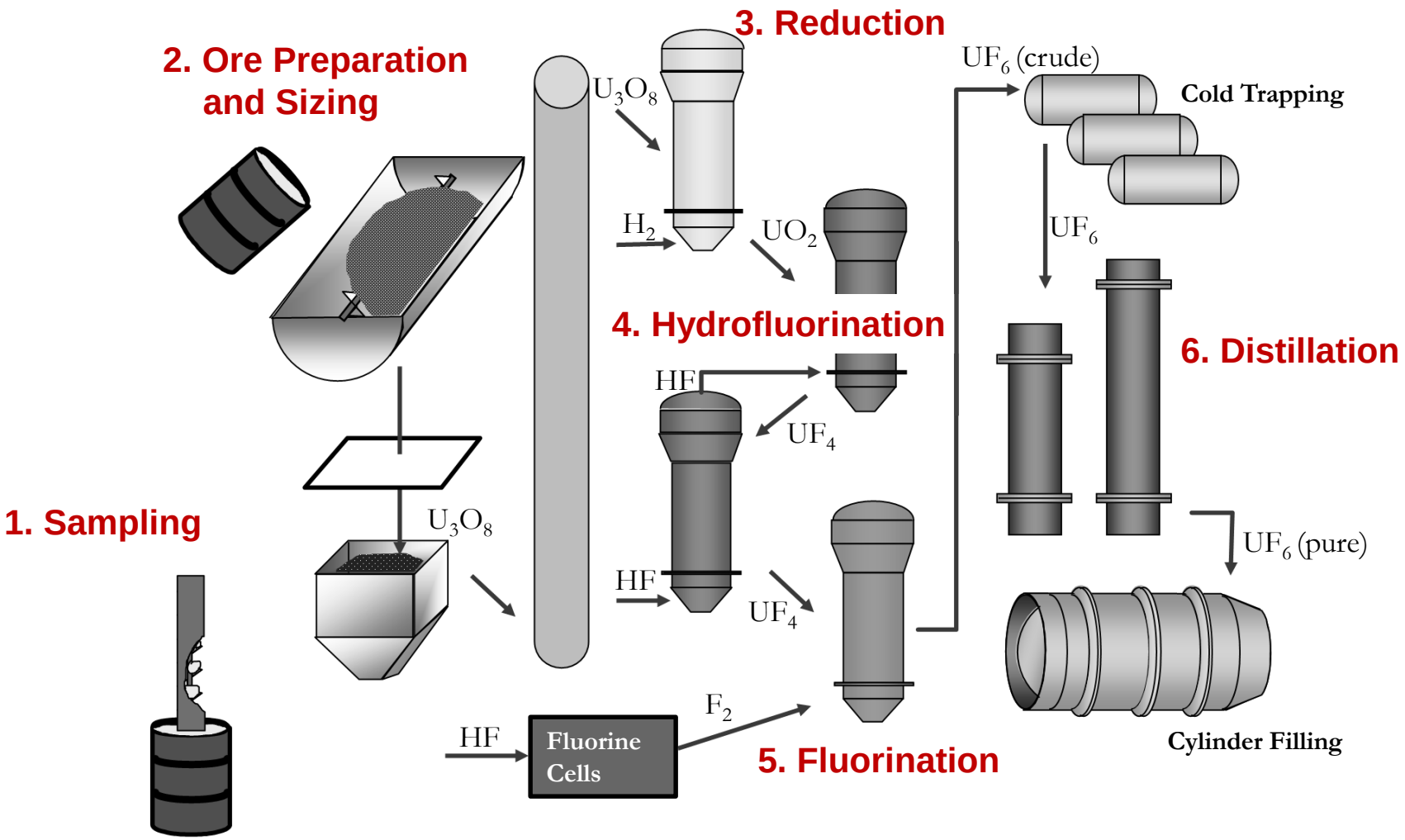
Drums of uranium ore concentrate

Cylinders of <u>ultra-pure</u> UF_6

Honeywell

Metropolis Works Fluoride Volatility Process

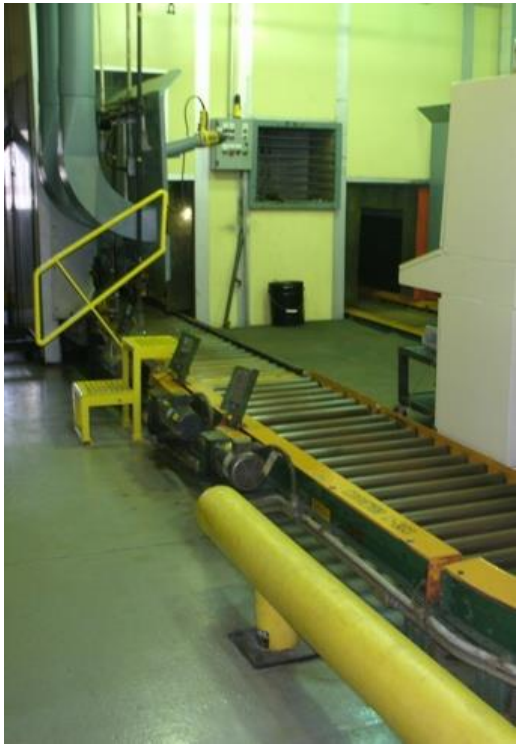
Design Overview



Honeywell

Auger Sampling System

Within the sampling process the UOC drums are precisely weighed and a random, statistically representative 0.5% sample is taken from each drum in a given lot. Per procedure, these samples are blended, split, ground and dried.



Honeywell

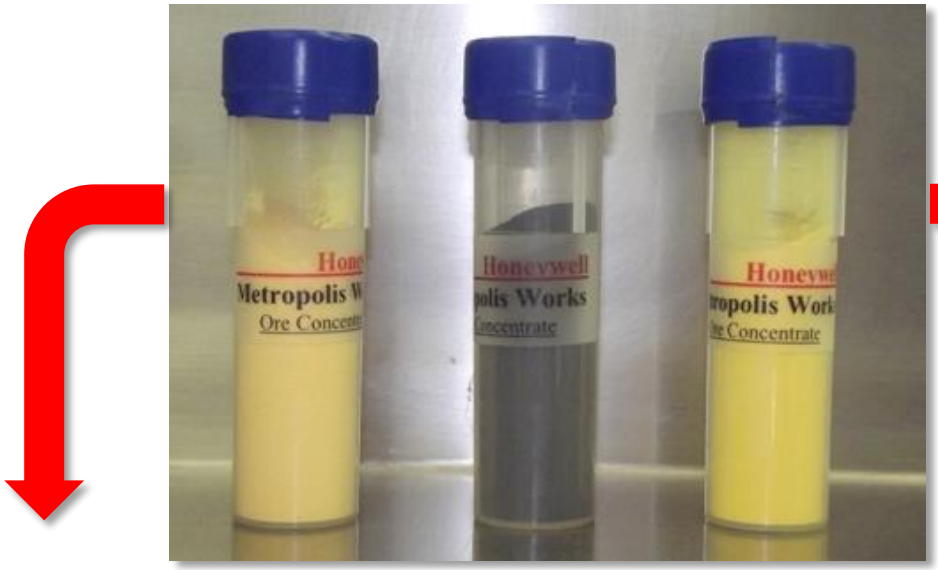
Lab Analysis

Metropolis employs precise analytical methods to determine the Uranium and impurity content in all incoming ore. In-process analysis is also completed on a 24/7 basis to ensure we produce the highest quality UF_6 in the world.

Honeywell

Ore Preparation

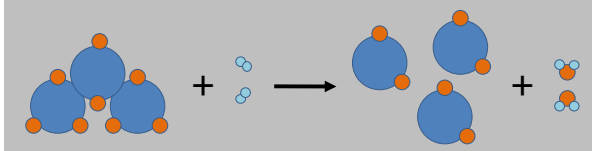
This step ensures that concentrates have the optimum particle size and density necessary for fluid bed operations.



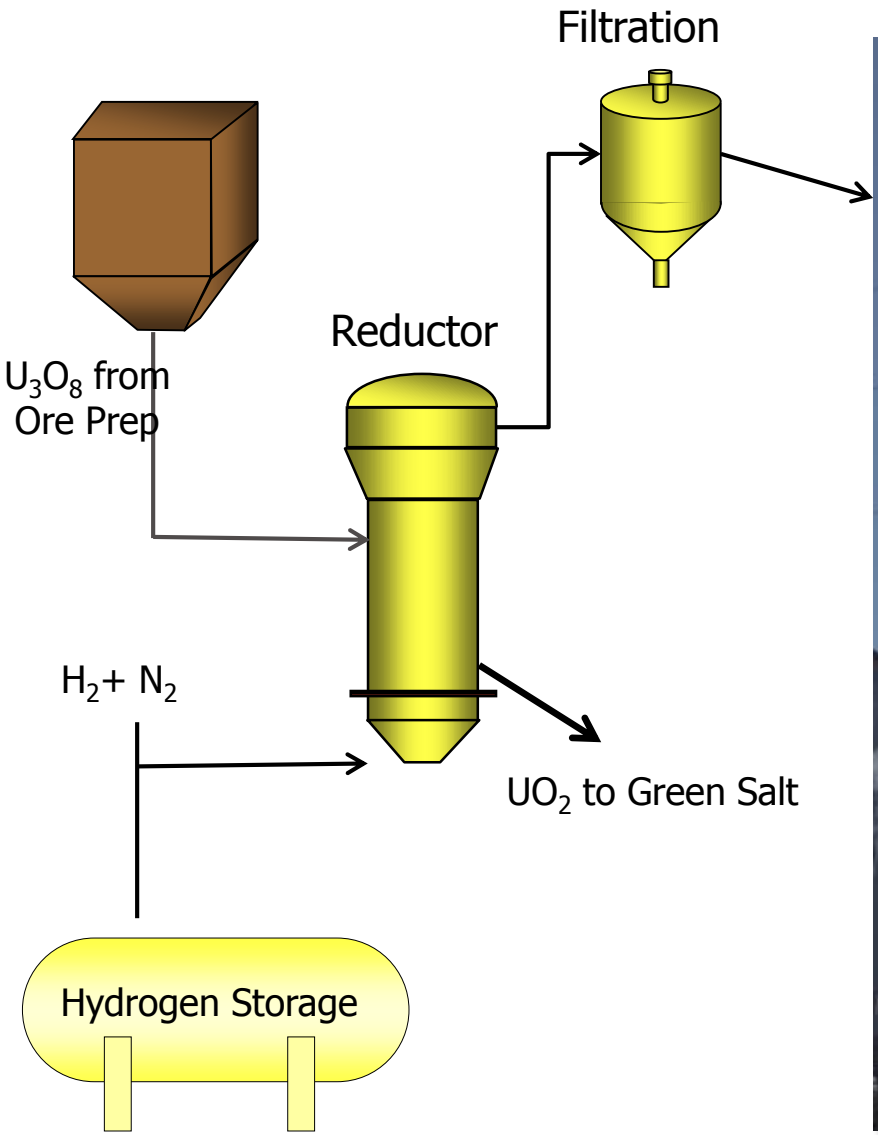
Honeywell

Reduction

During this stage, uranium ore concentrates are converted to UO_2 and impurities are removed from the system in a waste gas stream.



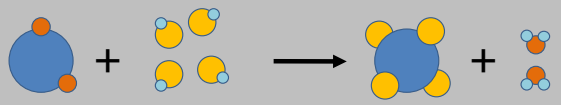
$$U_3O_8 + 2H_2 \rightarrow 3UO_2 + 2H_2O$$



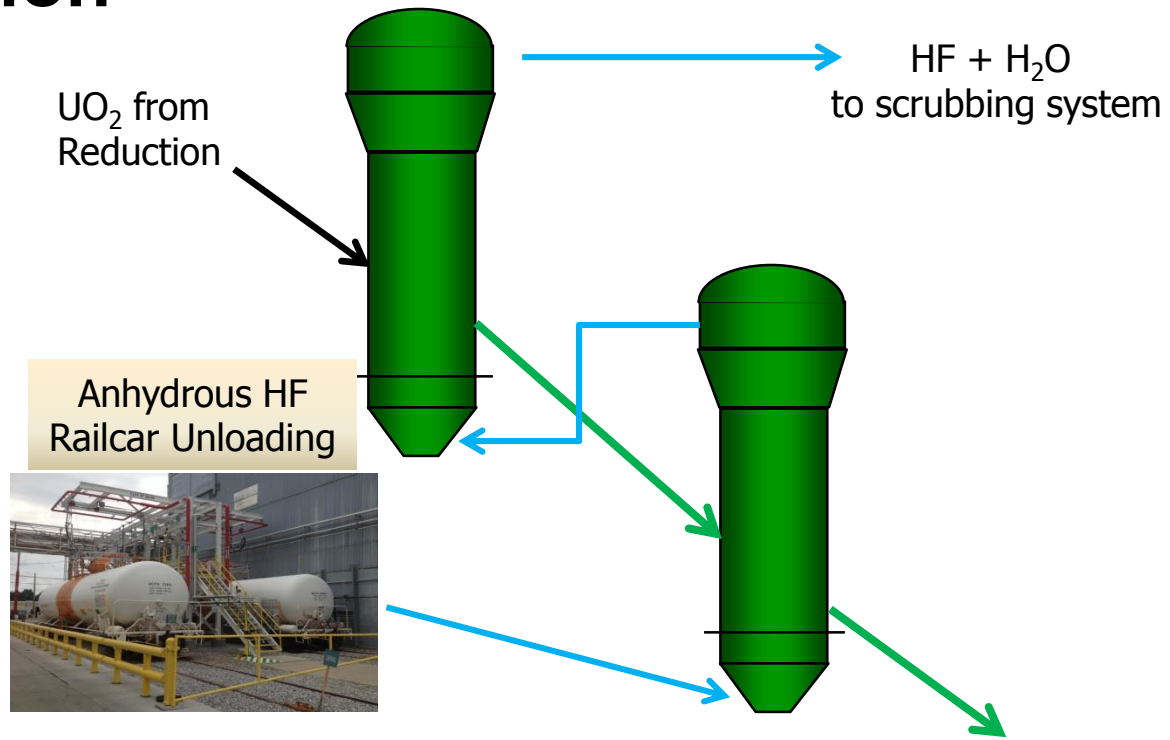
Honeywell

Hydrofluorination

UO_2 is converted into UF_4 intermediate, and <u>additional impurities are removed</u>.



$$UO_2 + 4HF \rightarrow UF_4 + 2H_2O$$

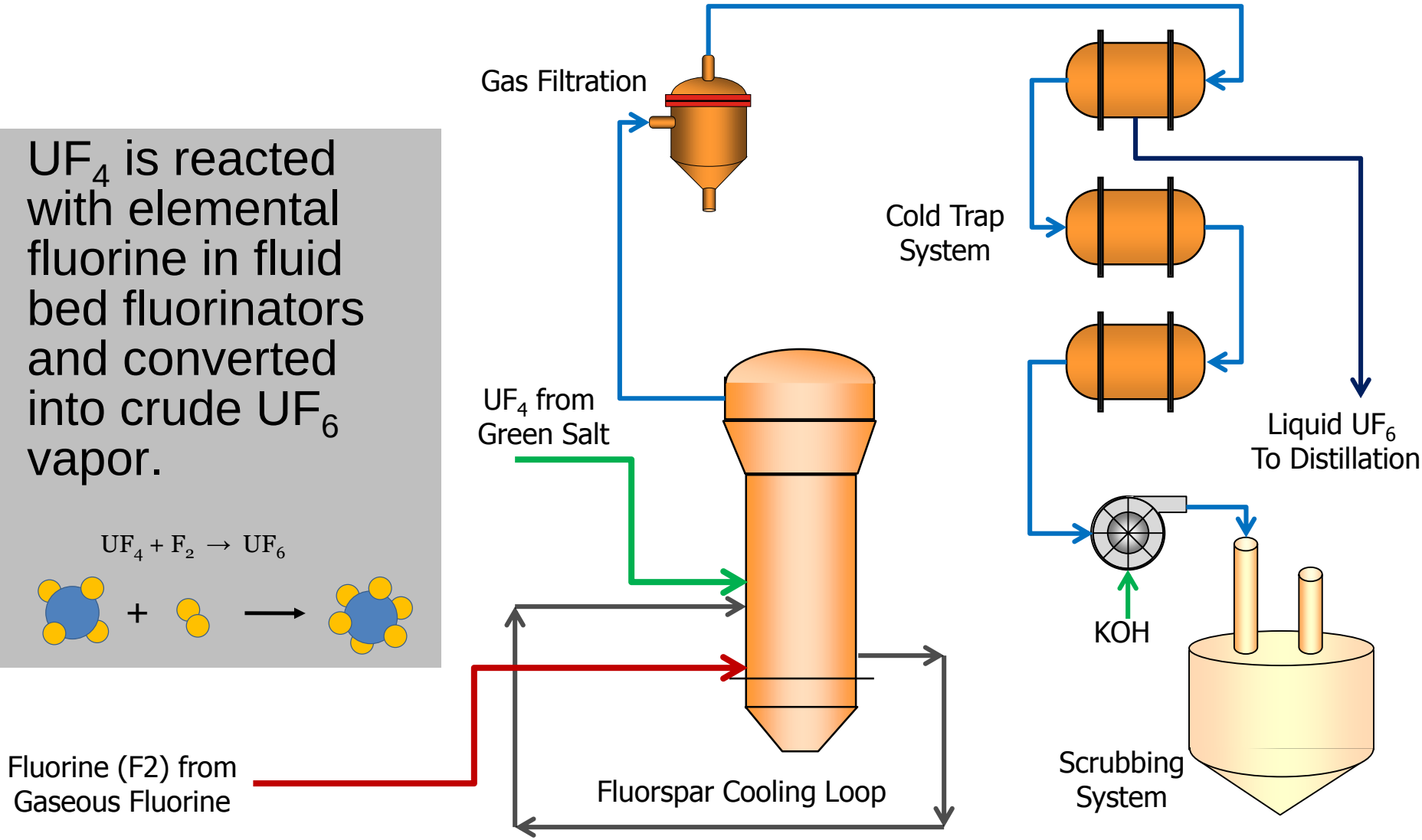


Honeywell

Fluorination

UF_4 is reacted with elemental fluorine in fluid bed fluorinators and converted into crude UF_6 vapor.

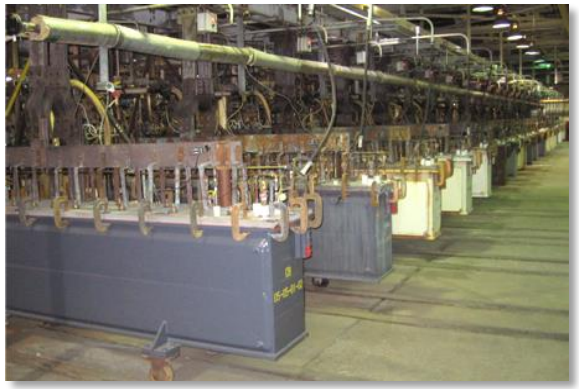
$$UF_4 + F_2 \rightarrow UF_6$$

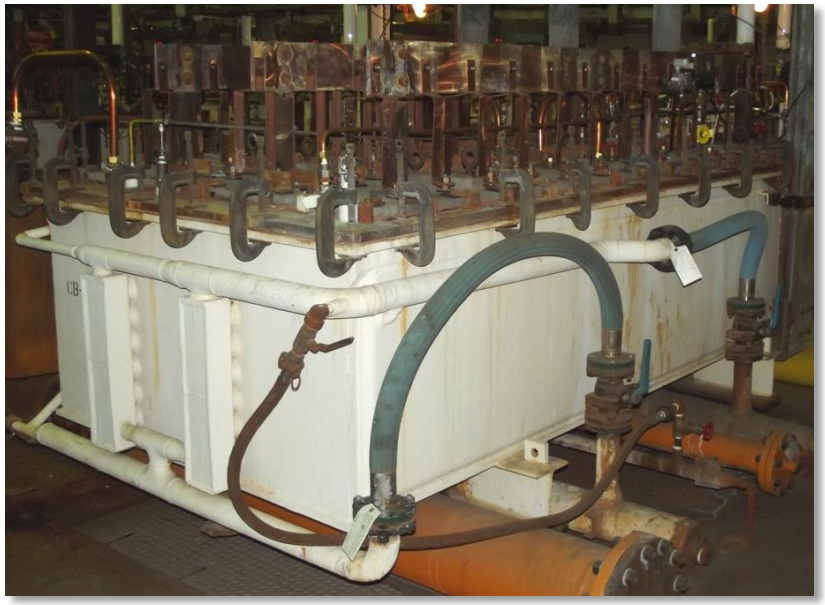


Honeywell

Gaseous Fluorine Process

Metropolis Works boasts the largest gaseous fluorine capacity in the world. Fluorine is produced by electrolysis of HF in a Potassium Bifluoride substrate. The fluorine is pulled to the Fluorination process under vacuum, increasing the safety of the operation.

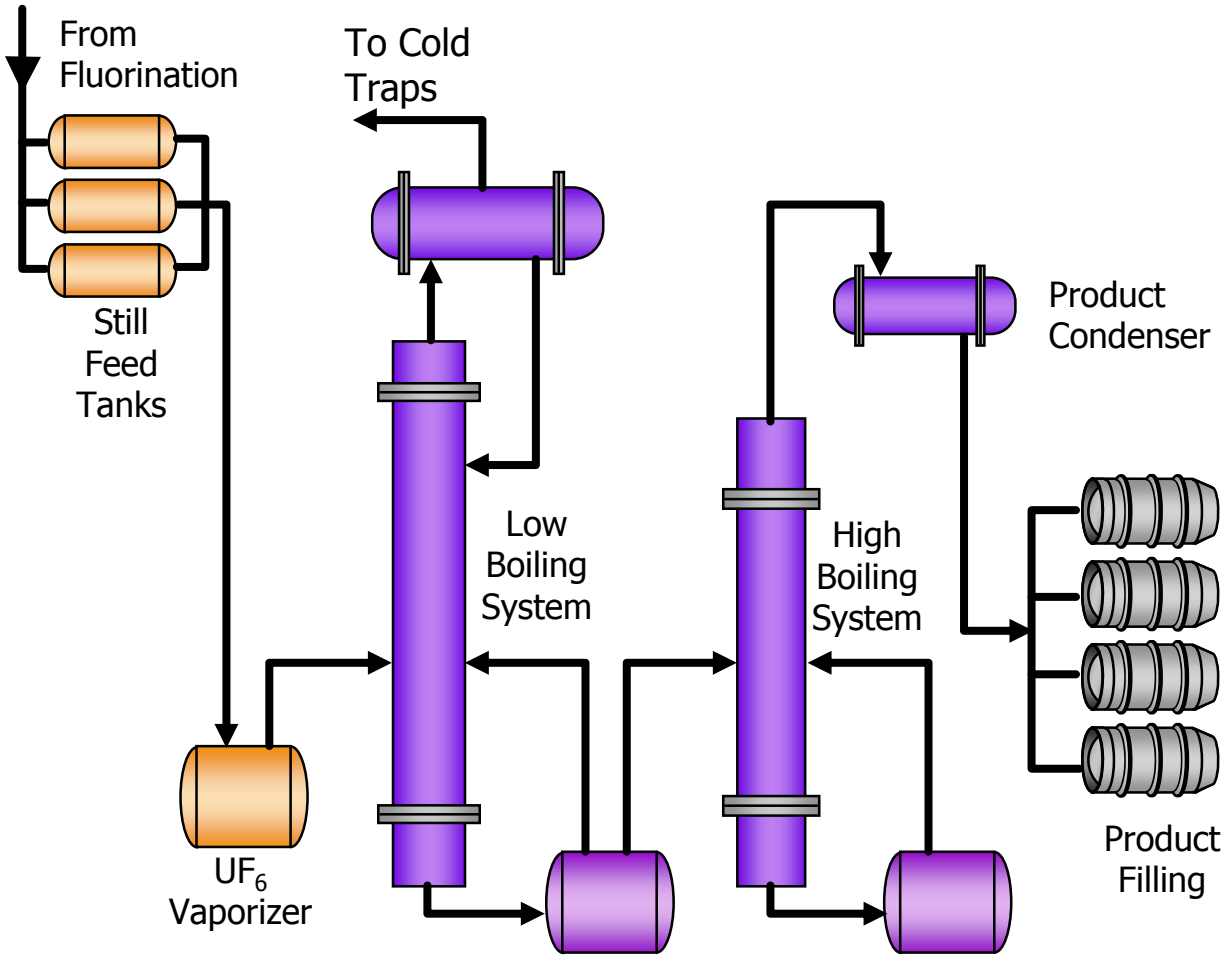




Honeywell

Distillation

UF_6 from the fluorination step is purified in a two-stage distillation system. This proprietary and exclusive feature of the Metropolis plant allows us to produce UF_6 at 99.99% or higher purity levels.



Honeywell

Controls

Metropolis employs Honeywell's Experion® DCS control systems in all our key process units. Security and process cameras employ Honeywell's EBI (Enterprise Building Integrator) package.

Honeywell

Recent Historical Events

- July 2010 – Lockout #1 of union workforce
  - Multiple issues on the table
  - Honeywell plan to move several activities previously performed by the union workforce to contracted services
    - Includes “Laundry services” and Janitorial
    - Laundry services include washing of clothing (coveralls) and Personal Protective Equipment (respirators, chemical suits, etc)
    - The laundry activities managed by the site Health, Safety, and Environmental (HSE) team
    - For reference – all contractors on site have a single point of contact with local Honeywell individual. The contact person is known as the “HDR = Honeywell Designated Representative”
- September 2011 – Lockout #1 ends – union workforce returns to work
- May 2012 – MTW begins Annual Shutdown (ASD)
  - Contract services workforce in place – laundry and janitorial included
  - Capital improvement projects conducted by contract workforce
  - Intention and plan is to restart plant in June following completion of ASD

Recent Historical Events

- June/July 2012 – MTW informed of results of “Post Fukushima” inspection by NRC
  - Region has potential for significant seismic event - (New Madrid Seismic Zone)
  - Plant remains shutdown (does not restart following ASD)
  - Significant capital improvement program to strengthen and upgrade infrastructure of plant to mitigate seismic risk
  - Due to plant shutdown (no production), some union, salaried, and contract workers are laid off while projects proceed
- August 2013 – Plant restarts following completion of “seismic upgrades”
- August 2014 – Lockout #2 begins
- March 2015 – Lockout #2 ends
  - Union workforce returns to work
  - Plant has been in operation since

The Case Study

- June 2012
  - Contract employee dismissed from Laundry position due to poor performance
  - Several instances of inadequate or improper cleaning of some PPE had been investigated
  - The contract firm did their own evaluation and determined that the contract employee in question was not performing the work at an acceptable level
- March 2013
  - Contractor firm had received a choice letter from NRC regarding the use of Alternate Dispute Resolution (ADR)
  - The case appeared to involve the termination of June 2012
  - Allegation that the employee had been terminated as retaliation for raising a Fitness For Duty concern about the employees supervisor
    - Allegation that the supervisor was observed with alcohol on breath during work hours
  - The Honeywell HDR was not aware of the allegation, or the choice letter offered to the contractor firm
  - Honeywell is made aware of the choice letter after the fact, but not named in any manner

The Case Study

- Honeywell completed internal review of circumstances
  - Justification existed for contractor to terminate employee for poor performance
    - Multiple failures to follow procedures that led to at least two minor injuries
    - But, contractor documentation and communication regarding basis for termination was poor
  - Honeywell responsible for the actions of contracting firms
    - Honeywell relied on contractors to maintain SCWE
    - But, contractor did not have full grasp of SCWE and employee protection obligations
- Honeywell identified areas for improvement
  - Honeywell oversight of contractors
  - Training of contractors and contractor employees on SCWE and employee protection
  - Contractor employee processes for identifying and communicating safety concerns

The Case Study

- May 2013 through May 2014
  - NRC conducts an investigation (Office of Investigations, OI)
  - Several Honeywell employees are interviewed
- 26 September, 2014
  - NRC issues choice letter indicating an apparent violation of 10 CFR 40.7 – *"Employee Protection"*
  - Honeywell chooses to use the ADR option
- 9 December, 2014
  - ADR session in Rockville, MD (NRC HQ)
  - Result of ADR session is a Confirmatory Order (CO)
- 11 March, 2015
  - NRC formally issues Confirmatory Order
  - Applies to
    - Honeywell Metropolis – UF6 production
    - Honeywell St. Charles, Illinois – smoke and carbon monoxide detectors
    - Honeywell Olathe, Kansas – avionics

The Case Study

- Four basic elements of the Confirmatory Order
  - Communication
    - Letters, all-hands meetings, posters/wallet cards
    - HON representative speak at a public forum regarding SCWE
  - Training
    - Training on SCWE and Honeywell policy regarding employee protection
  - Work Processes
    - Methods to capture and communicate SCWE concerns
    - SCWE elements included in contract language with contractor firms
  - Policy Guidance
    - Review and update Honeywell SCWE policy and incorporate NRC key elements
- Critical component of the Confirmatory Order
    - During the ADR process , ***Honeywell neither admitted nor denied that a violation occurred***. This Confirmatory Order therefore should not be used as evidence that a violation in fact occurred or that Honeywell agrees that a violation occurred. The NRC will refrain from issuing a Notice of Violation or proposing a civil penalty for all matters discussed in the NRC's letter of September 26, 2014 (EA-14-114). ***(emphasis added)***

The Case Study

- Actions planned – Communications
  - Site wide communication (letter) to all employees regarding SCWE
  - “all hands” meetings
  - Posters, fliers, and other visuals
  - Pocket cards with avenues for presenting SCWE issues
  - Presentation at a public forum (this meeting)

- Actions completed - Communications
  - Communications letter and all hands meetings completed
  - Posters, fliers and other visuals distributed site-wide
  - Pocket card listing all available avenues for raising safety concern

Communications include several methods

The Case Study

- Actions planned – Training
  - Review existing SCWE training and revise as necessary
  - Initial SCWE training; include case study review and role playing
  - Include SCWE items in monthly safety training at least 2X in any 12 months
  - Ensure SCWE training is included in new employee and new supervisor training

- Actions completed - Training
  - Training packages updated and revised
  - Initial SCWE training completed for all employees, including returning union employees
  - Monthly training and new employee / new supervisor training requirements updated

Training updated and delivered

The Case Study

- Actions planned – Work Process
  - Modify internal incident tracking and corrective action (ITCA) system to capture SCWE items and inform management
  - Include contract language in agreements with contractors to clarify contractor obligations to comply with the NRC Employee Protection Rule (10 CFR 40.7)
  - Certification from contract firm that “adverse” action taken toward any contract employee was not for any reasons prohibited by 10 CFR 40.7
  - Modify HDR procedure to require HDR’s to periodically enquire about any SCWE concerns raised to the contractor firm
  - Honeywell to implement a procedure for behavioral observation process

- Actions completed – Work Process
  - ITCA process now captures SCWE items – to date >45 collected since start in June 2015
  - SCWE items reviewed weekly by leadership team; closure includes direct feedback with individual bringing up issue
  - Contract language updated; HDR procedure updated
  - Behavioral observations included in path forward

The Case Study

- Actions Planned – Policy Guidance
  - Review and update as appropriate the Honeywell SCWE policy to account for applicable aspects of the NRC Safety Culture Policy

- This action item is complete

The Case Study

- NRC completed second OI investigation in November 2015
  - Involved a “failure to hire” same individual from earlier investigation
  - At time of failure to hire, neither Honeywell nor contractor were aware of the NRC’s findings from previous case

- NRC refrained from taking enforcement action against Honeywell
  - Same protected activities, roughly the same period of time, and involving the same individuals
  - Violation occurred prior to issuance or implementation of Confirmatory Order
  - Confirmatory Order was tailored to address the same root causes

- Honeywell agrees that corrective actions underway or completed will resolve issues identified in second investigation

Honeywell Operating System (HOS)

"Continuous improvement is at the core of our operating system. The concept is that today has to be better than yesterday, and tomorrow has to be better than today. Standardized work is how managers and employees should operate. It is the foundation for continuous improvement."

- Dave Cope, vice president, HOS and Quality

- HOS, one of our Enablers, is an operational excellence initiative launched in 2004 to improve the capabilities of our manufacturing sites.
- It is an integrated system built on a strong Six Sigma foundation to drive sustainable safety, quality, delivery, cost, and inventory improvements.
- HOS includes a focus on standardized work, rapid problem solving, continuous improvement, and knowledge sharing across Honeywell.

HOS Metrics in Manufacturing Environments

1. Health, safety and environmental management systems assessment scores — continuous improvement in comprehensive audit scores.
2. Defects in Parts Per Million (PPM) — reducing the number of defects that occur in the product or delivery.
3. On Time To Request (OTTR) — decreasing the amount of time between the point of order and delivery of finished goods to a customer.

Honeywell

Six Sigma Foundation

Vision / Mission

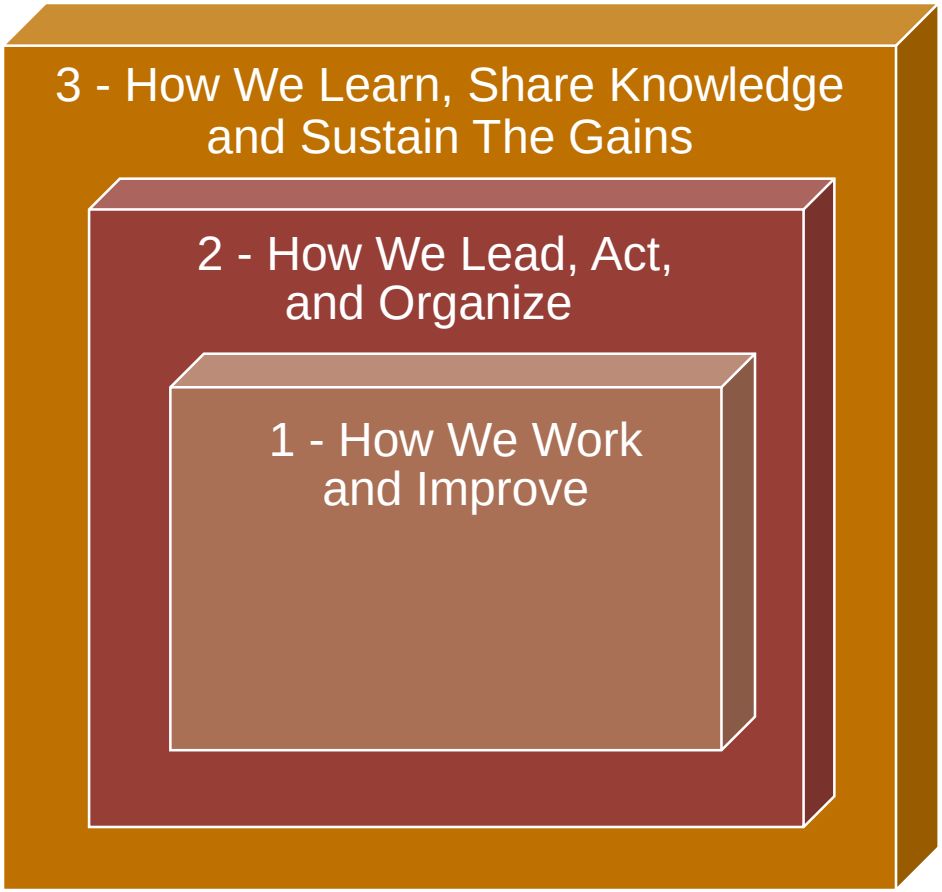
Integrated System Built on Six Sigma Foundation to Drive Sustainable Safety, Quality, Delivery, Cost, and Inventory Improvement In Our Operations

- A broad application of Lean and Six Sigma tools against a construct of:
  - Cleanliness; orderliness; visual management
  - Standardized work; rapid problem solving
  - Continuous improvement through employee engagement
- Organization Development focus ensures sustainability
- Critical to helping us stay ahead of our competition
- Makes us a better competitor so we win more business

Honeywell

The Honeywell Operating System

The HOS can be described in terms of three key capabilities:



Honeywell

Key Capabilities of the Honeywell Operating System

How We Work and Improve

- Make Problems Visual
- “Go & See”
- Waste Elimination
- Fix Root Causes
- Kaizen
- Stabilize, Connect and Standardize our Processes

3 - How We Learn, Share Knowledge and Sustain The Gains

2 - How We Lead, Act, and Organize

Key Capabilities of the Honeywell Operating System

How We Lead, Act, and Organize

- Leadership Standardized Work
- Management's sole purpose is to enable success
- Leaders coach and mentor for results
- Integrate the Health, Safety, & Environmental Management System and Quality System

High Performance Management System

A high performance management system begins with Leadership Standardized Work

Daily

- Ensure standardized work is being followed
- Engage all employees through kaizen and tiered accountability meetings
- Listen, learn and teach

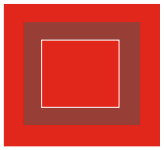
Monthly

- Systemic improvement
- Share knowledge across the business

Quarterly

- Assess
- Reflect
- Act

Safety, Quality, Delivery, Cost, Inventory



How We Lead,
Act And Organize

Honeywell

HOS -- An Enabling Structure

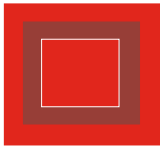
Characteristics

- Teams “own” the process
- Decision-making is driven to the shop floor
- Management and support functions enable shop-floor success
- Span of control allows for coaching

Outcomes

- Employees are involved, engaged and informed
- Clear roles, accountability and linkages
- Everyone learns from each other
- Rapid improvement and elimination of defects

Employee Involvement Is The Key To Success



How We Lead,
Act And Organize

Honeywell

Honeywell Metropolis

- Employee Engagement Through Communication And Tiered Accountability and Kaizen

Tier 1

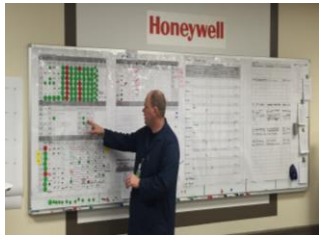
Team Leaders
Operators
7:00 a.m. – 7:10 a.m.

Tier 2

Supervisors
Team Leaders
7:50 a.m. – 8:00 a.m.

Tier 3

Value Stream Manager
Direct Report People
Support People
8:30 a.m. – 8:45 a.m.



Tier 4

Site Leader
Site Steering Team
9:00 a.m. – 9:15 a.m.

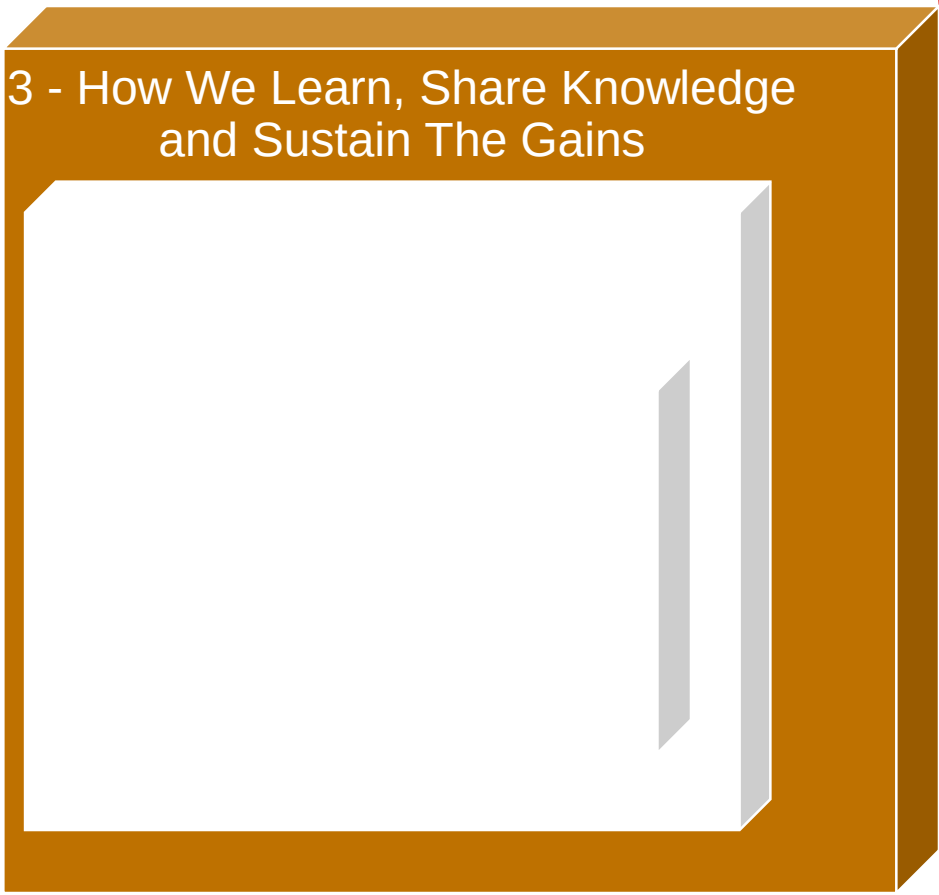
Kaizen Ideas Board

Honeywell

Key Capabilities of the Honeywell Operating System

How We Learn, Share Knowledge, and Sustain The Gains

- Train all leaders through “go and do” and OJT
- Establish tiered accountability meetings and deploy Leadership Standardized Work
- Knowledge Sharing
- Strategy Deployment



- *A Self-Perpetuating System Based on Leadership Capability and Process Excellence*

Honeywell

Lessons Learned

- Responsibility to manage an effective SCWE process cannot be entirely delegated/deferred to a contract company
  - Honeywell responsible for the actions of the contracting firms with respect to SCWE
- Contract language should be specific on requirements for contracting company to manage a SCWE
- Work processes for identifying and communicating concerns need to be self-sufficient….can't have distractions be a reason for taking eye off the process
- Employee engagement and reinforcement of mechanisms for addressing concerns
  - Address issues in timely manner
  - Always have a questioning attitude
  - Take all concerns seriously, don't ignore
  - Communications and work processes are key to sustainability