2011 EFCOG

Putting Spokes in the Wheel:

Understanding Feedback and Improvement

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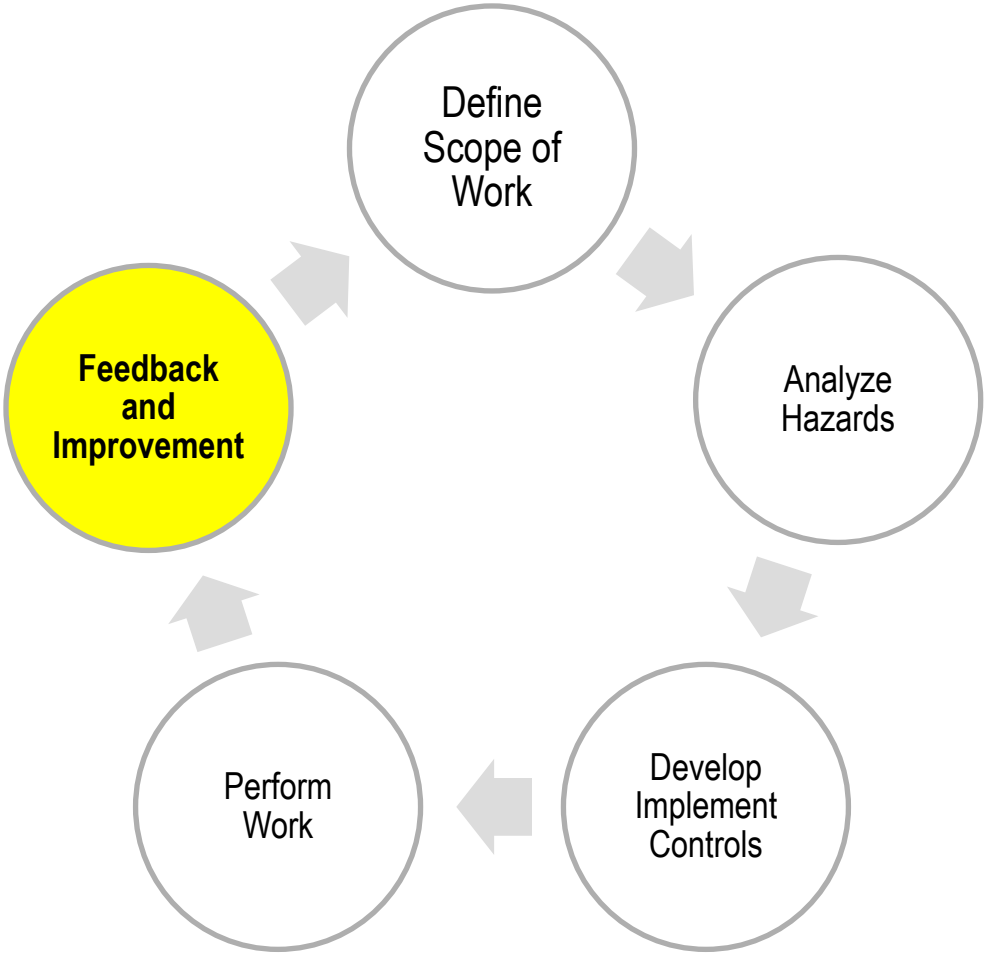
The Wheel as We Know It

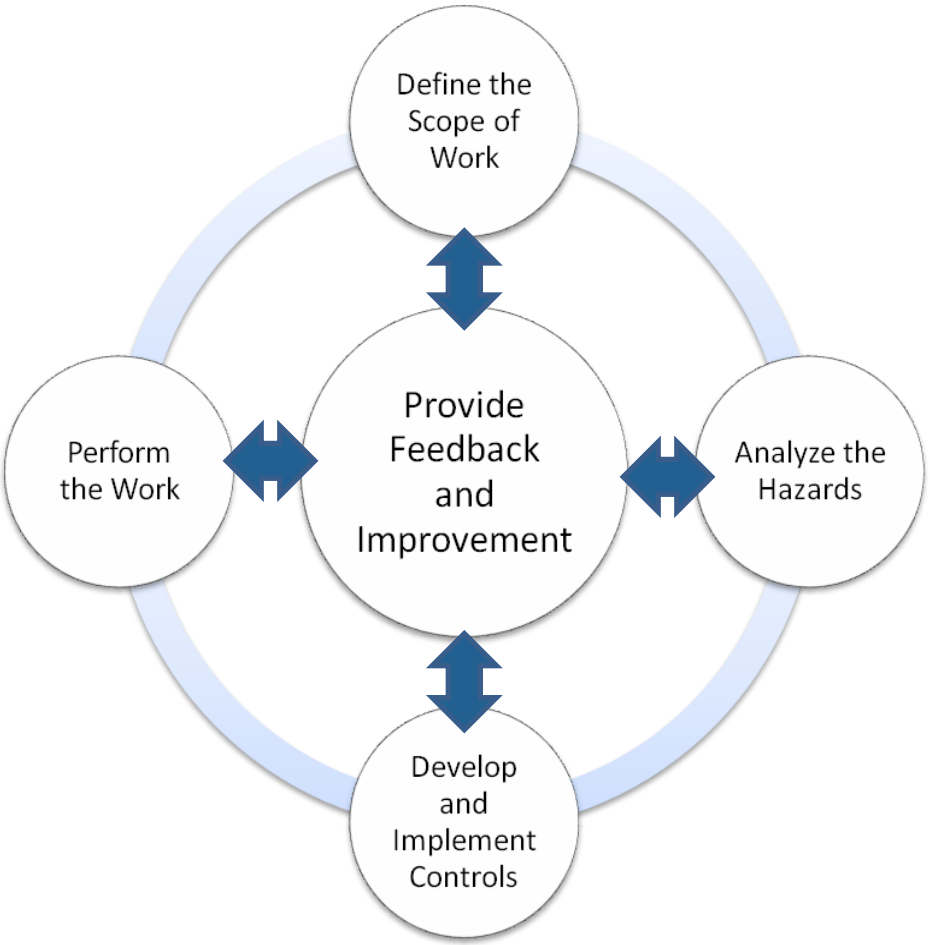


Key Definitions

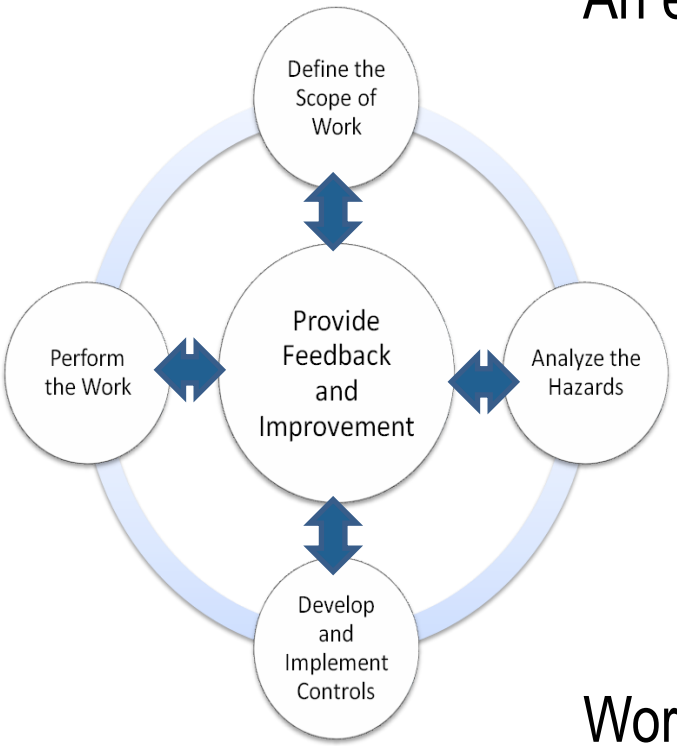
- **Feedback** – Return a portion of output to the input in order to correct, control, or modify the output.

- **Improvement** – Raise a process to a higher or more desirable condition. Make better.

The “Spokes” of Feedback and Improvement



The “Spokes” of Feedback and Improvement

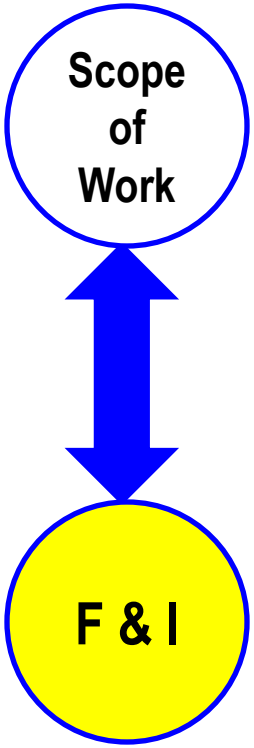


An example of the model:

Work: Provide oxide material by burning metal inside a tube (a standard operation)

Define the Scope of Work

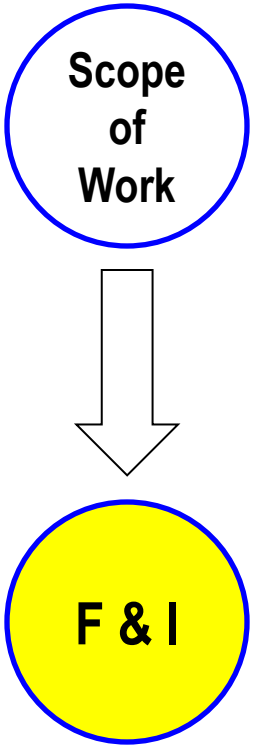
Translate missions into work, requirements, task schedules, and resources



- Project: produce specified amount of oxide
- Manager & WORKER (right and responsibility to participate)
- Project denies recommendation - directs specified amount
- This performance measure/metric will show commitment to continuous improvement ***(or will it?)***

WHAT JUST HAPPENED?

Define the Scope of Work

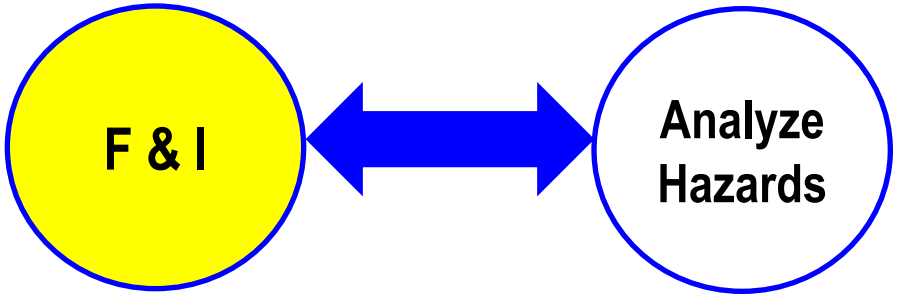


Manager/worker input to defining scope ignored

- Performance measure/metric “forced” on workers
- Lack of successful communication
- DOES NOT show commitment/continuous improvement
- No ownership = worker frustration

Feedback path (two-way arrow) removed!

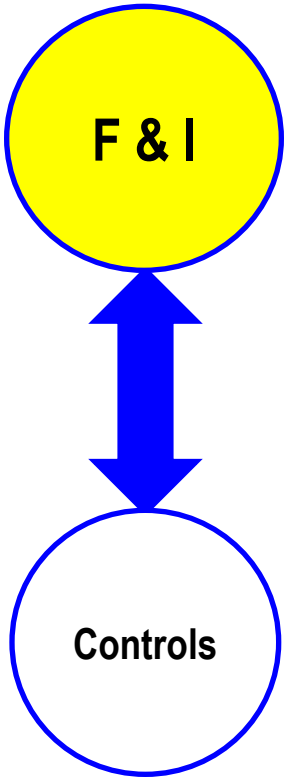
Analyze Hazards



Identify, analyze, and categorize hazards:

- Participation from all involved
- Job-specific hazards
  - Airborne material hazard
  - Hot material and equipment (burning metal in a tube)
  - Direct introduction of oxygen

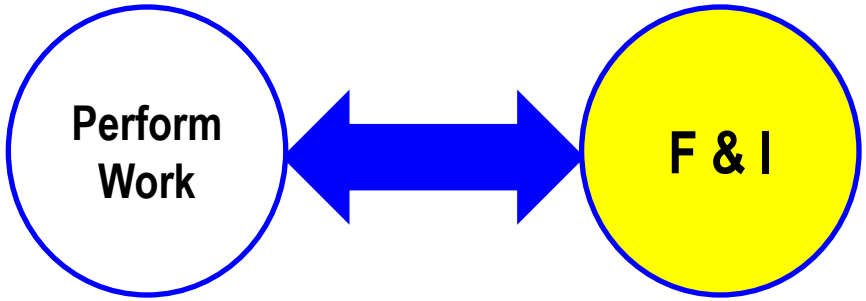
Develop and Implement Controls



Implement controls tailored to work scope

- Airborne material hazard
  - Ventilation hood
  - Lid on tube
  - Respirator
- Hot material/equipment (burning metal to oxidize)
  - Cooling coils around pipe
  - Delta-T instrument
- Introduction of oxygen
  - Throttle valve with flow meter
- Formal Technical Procedure

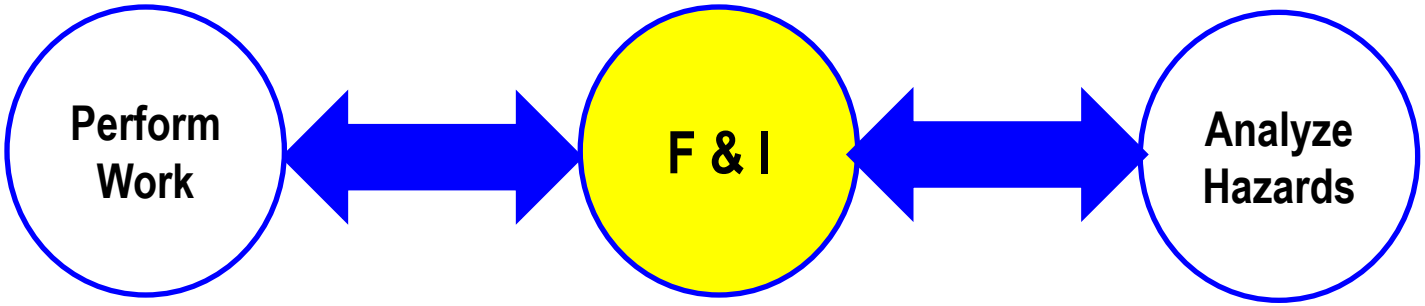
Perform the Work



Do work within controls and requirements

- Training/pre-job briefings
- Manager work start approval (facility conditions)
- Step-by-step performance of technical procedures
- **Suspend/Stop Work Authority**

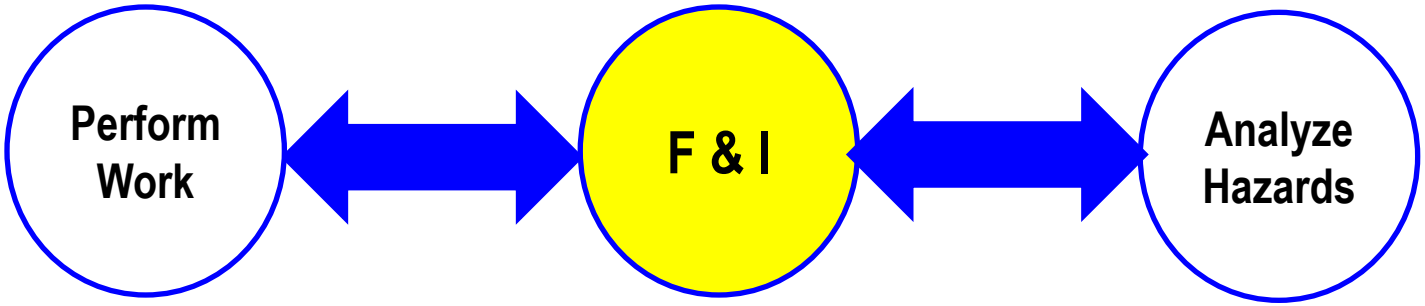
Work and Hazards



Produce oxide within controls and requirements

- Perform step-by-step technical procedure
  - WORKERS feedback - tube looks orange
  - Suspend Work
- Engineers analyze "*newly identified*" potential hazard
  - Thermal imaging on tube surface
  - Result - no new hazard exists (temperature OK)
  - Back to work (meet production needs)

Work and Hazards



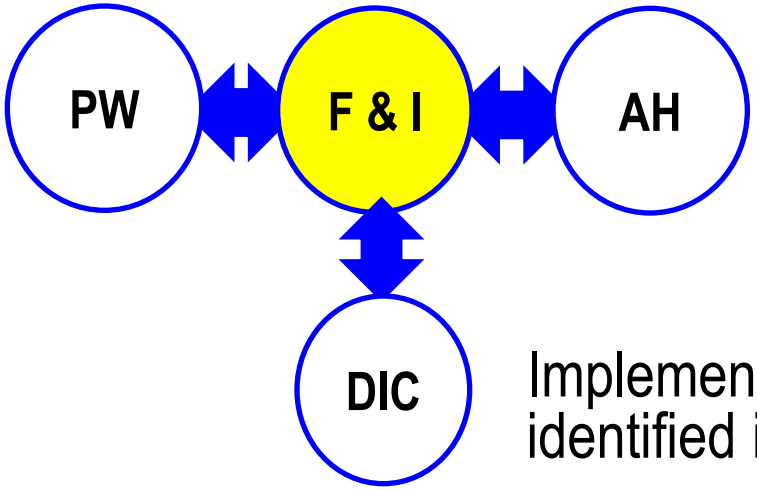
Executing procedure step-by-step AGAIN

- WORKERS Feedback (peers) tube still glows orange
- Hot material **burns through** tube**!!!**

WORKERS analyze NEW hazard (takes < 5 seconds)

- Metal tube red hot
- Process material burning outside system
- **Workers Suspend/Stop Work!**

Work/Hazards/Controls



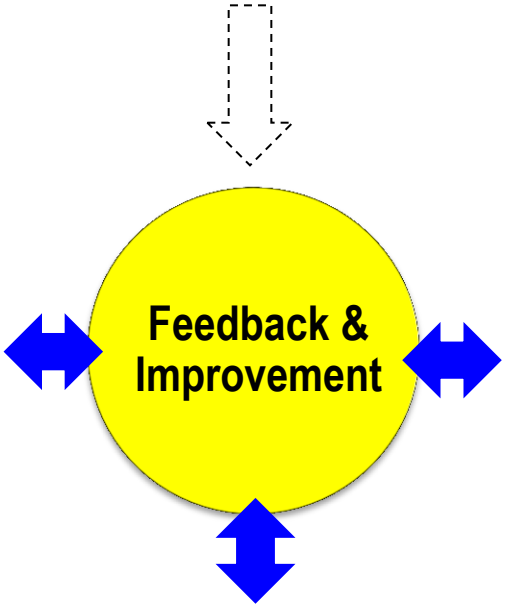
Implement controls to mitigate risk of hazards identified in ***new analysis***

Local scope of work changed (metal fire)

- Provide for **safety** of workers
  - Shut off oxygen
  - Evacuate area
  - Flow down controls directly into work

WORKER involvement/ownership???

The STAR of the Show



Gather feedback on effectiveness of controls, conduct work, identify continuous improvements

- Worker involvement at all levels (Maybe?)
- Unexpected events = new controls (now!)
- Post-job debriefings
- Occurrence Reports/Lessons Learned
- Continuous improvement at all levels

A hard way to gain experience!

Resolving the Problem

Engineered Controls:

Development Engineer Input –

Decrease O_2 introduction rate - Order of Magnitude

Redesign –

New throttle valve/flow meter

Installation –

Reconfigure piping for ease of operations (ergonomics)

Operations –

Low delta-T across cooling coils

Operator comment – “best oxide we have seen”

Conclusion: The Spokes of the ISM Wheel