

The

Manufacturing Game®

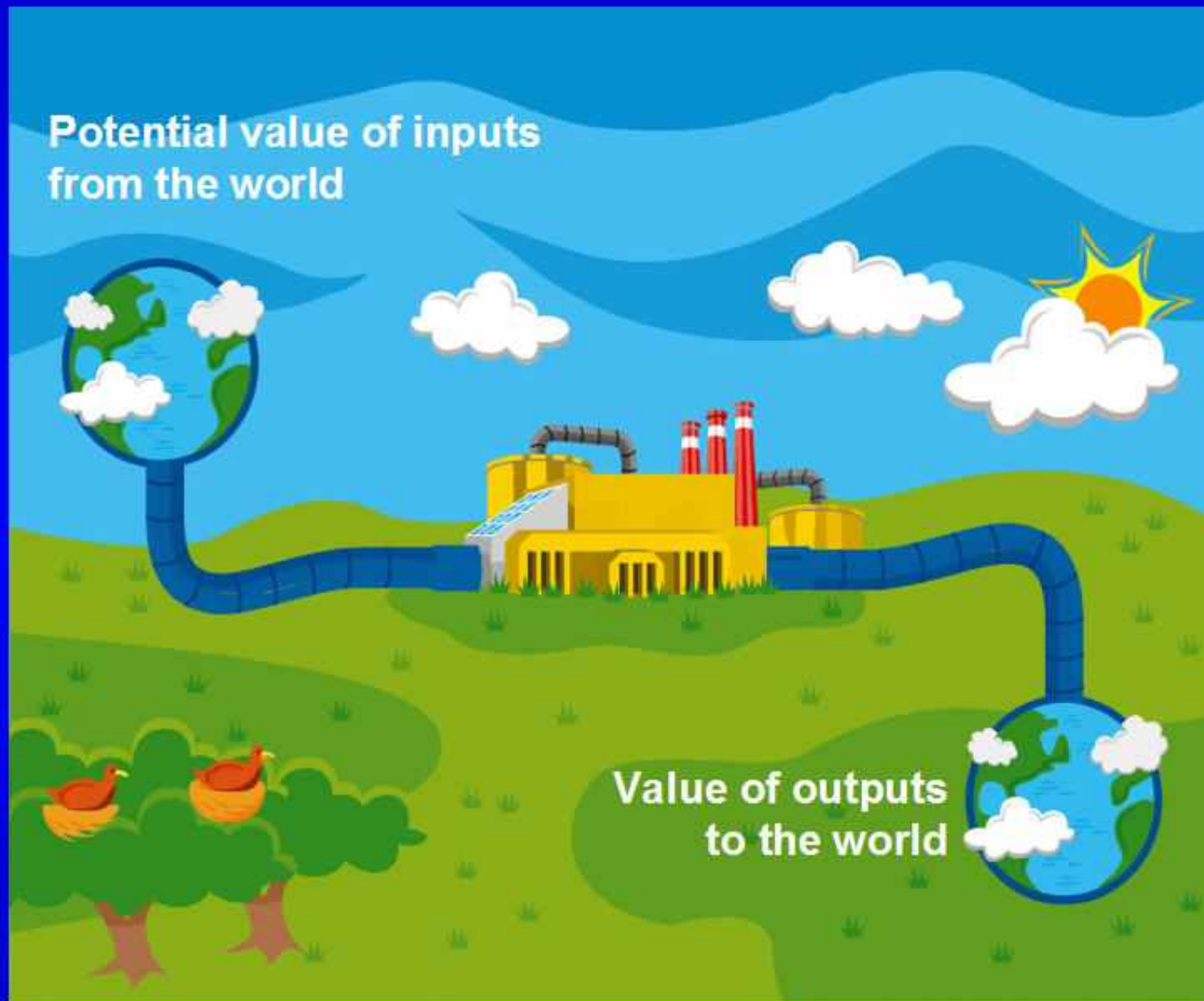


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revised 3/1/01

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How does your asset add value?

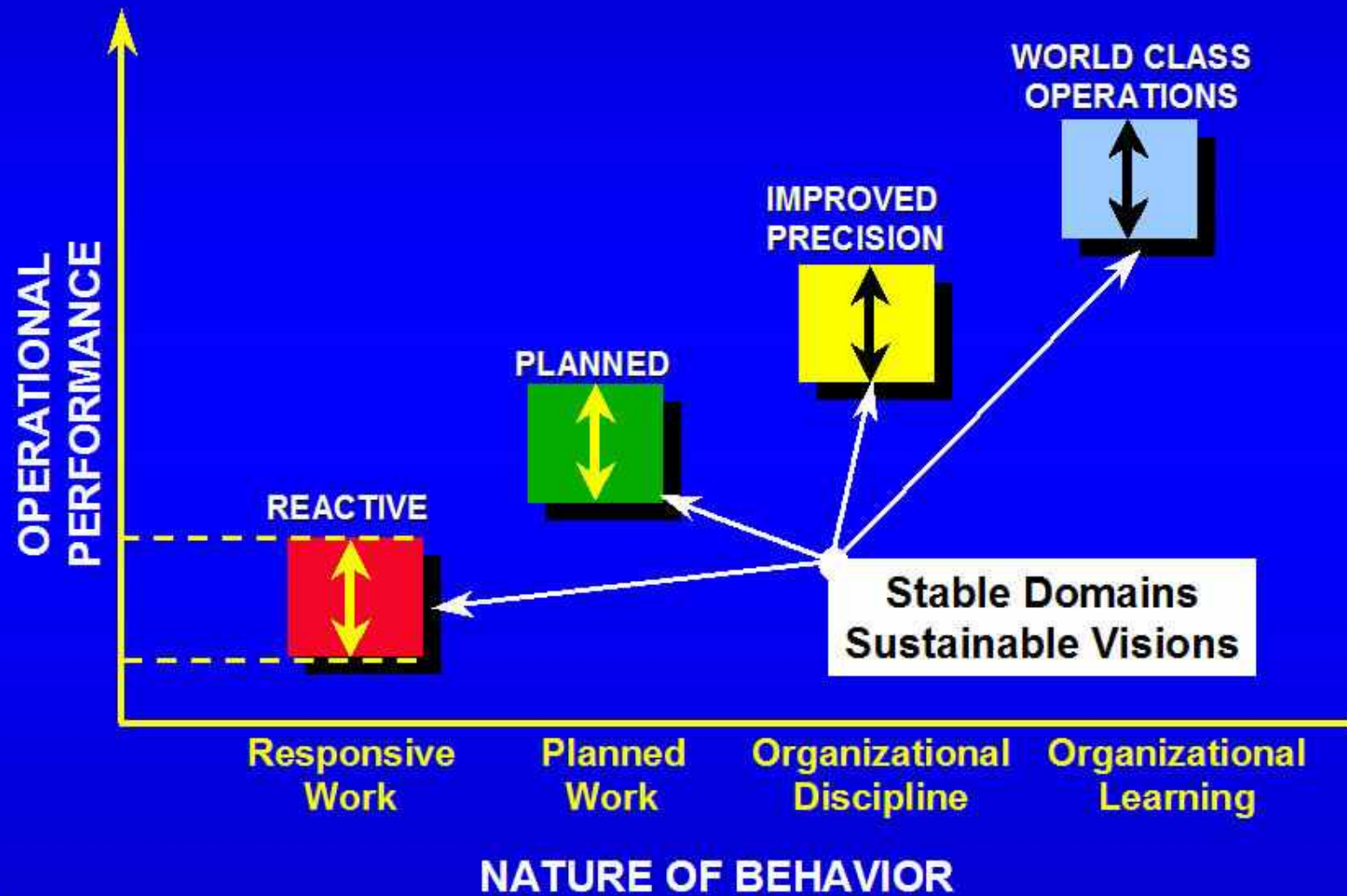


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Four stable operating domains





DEFECTS: anything that erodes value, reduces production, compromises HSE, or creates waste



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Each domain manages defects differently





Reactive Domain



Characteristics

“Don’t fix it if it ain’t broke”

“Run it hard and fix it fast”

Conflicts, turf, safety problems, environmental releases

Crisis management, overtime heroes

No time for sharing or learning - just fight today’s problems

Maintenance costs are 25% higher than world class



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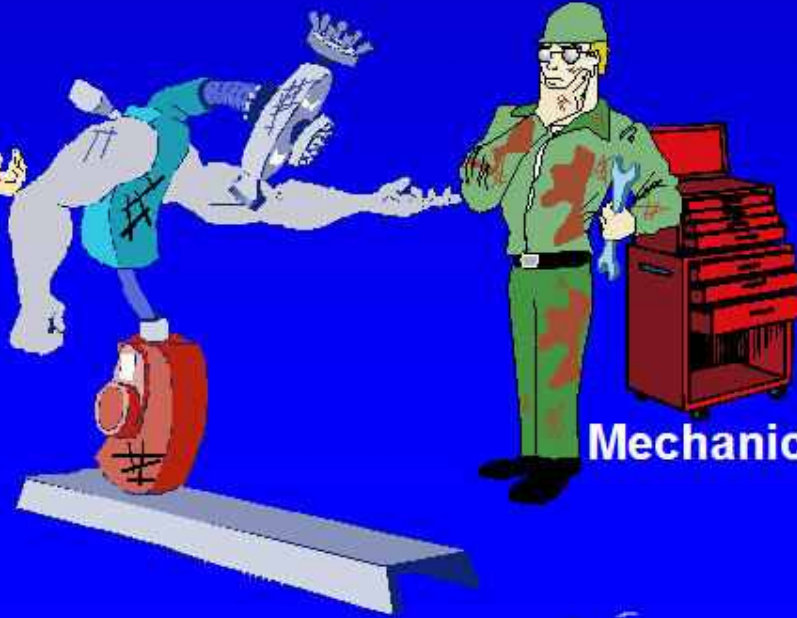
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Reactive Domain

Operator



Mechanic



Business Leader



Customer



Stores Attendant

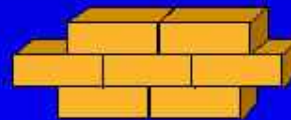
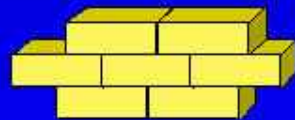


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Good Practices Are the Barriers to Bugs



Characteristics

Good practices are the "bricks" that we use to build the protective walls

Knowing good practices doesn't mean people will use them

Behaviors may still be fundamentally reactive

Coordination of effort / synergy may not exist



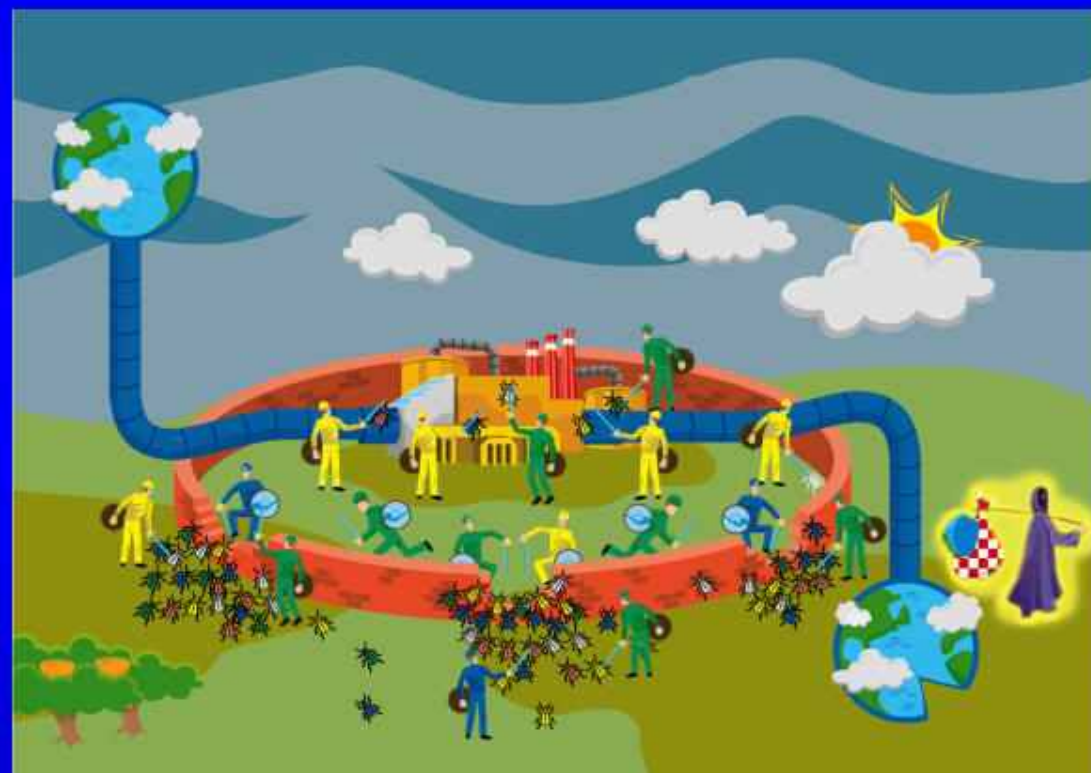
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Planned Domain



Characteristics

Enough resources,
deployed in the right
place, at the right time

Planning is the goal -
Inspect, predict,
prevent, plan and
schedule

Still too many defects
from operations,
design, and raw
materials

Maintenance costs are
10% higher than world
class, but 15% lower
than reactive domain



Improved Precision Domain



Characteristics

Defect elimination

Fortifying the walls,
and mending the holes

Eliminate 90% to 98%
of failures

Cross functional

Maintenance costs
are world class

TPM and RCM

Improved Precision Domain



Reliability goes up while costs go down



Year	# Repairs	Repair Cost
1991	643	\$2,250,500
1992	599	\$2,096,500
1993	599	\$2,096,500
1994	545	\$1,907,500
1995	355	\$1,242,500
1996	221	\$773,500
1997	168	\$588,000
1998	131	\$458,000



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World Class Domain



Characteristics

Everything in precision domain PLUS:

Cross organizational learning

Breakthrough thinking / radical goals

Seizing new opportunities: growth

Reducing waste

Creating sustainable long term value



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Five Sources of Defects

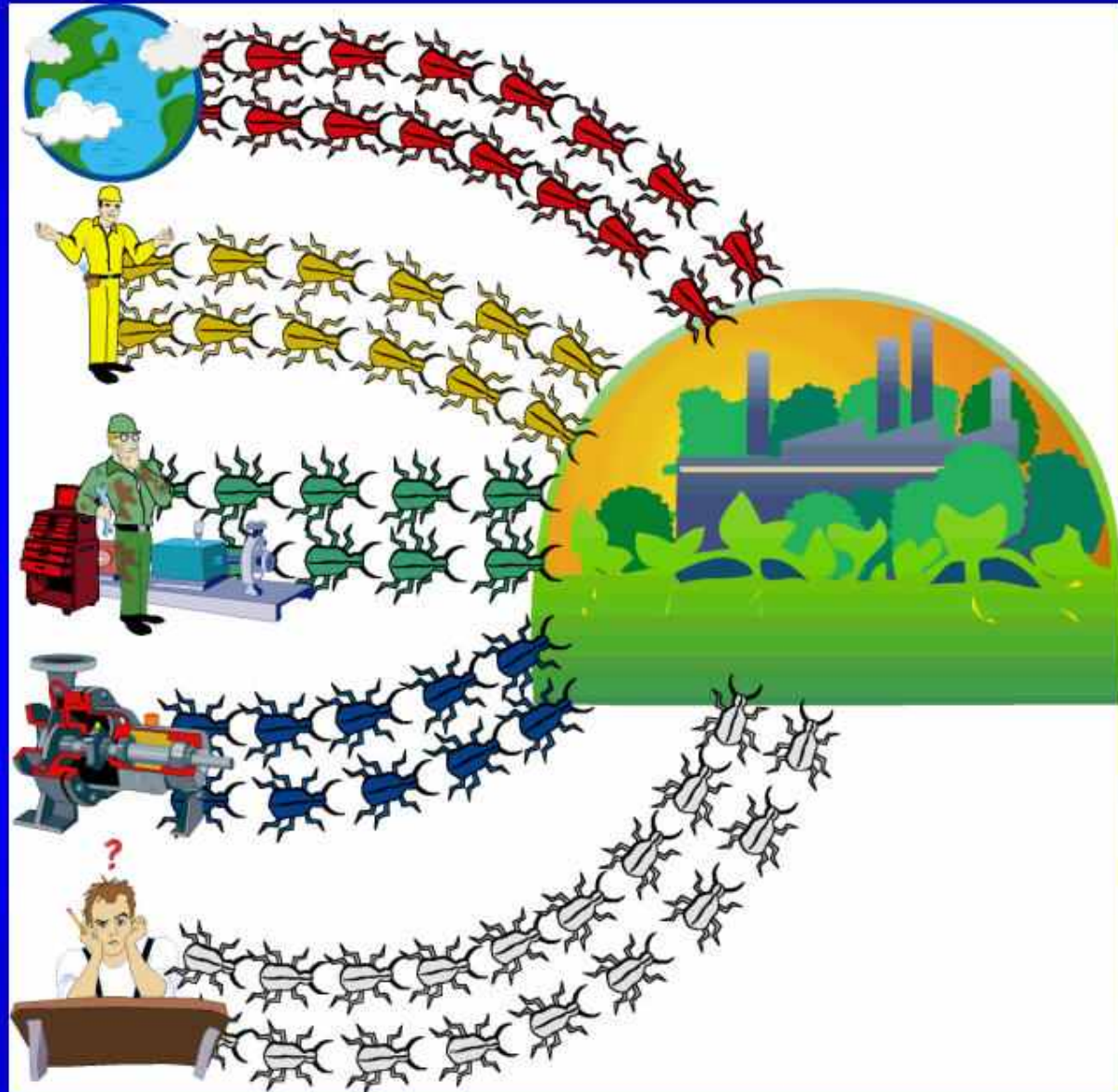
RAW
MATERIALS

OPERATE

WORKMANSHIP

MAINTENANCE
MATERIAL

DESIGN

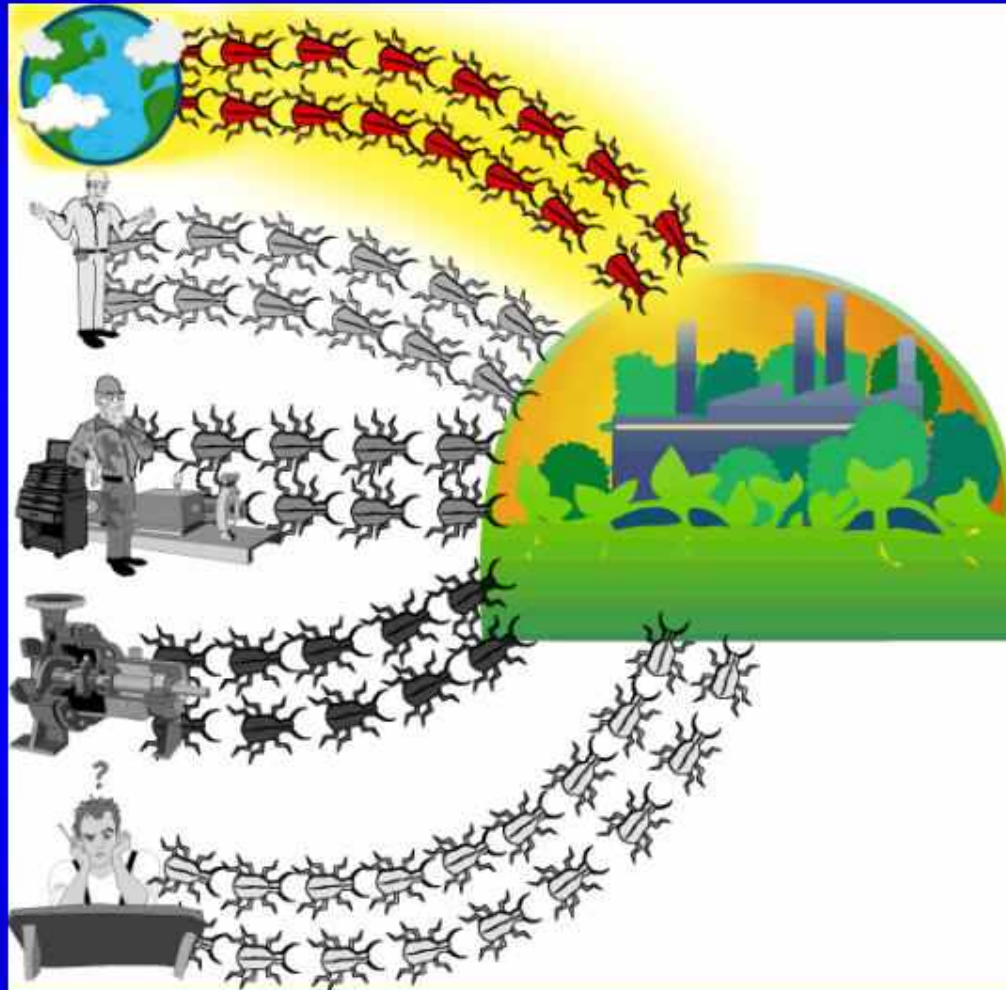


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Defects from Raw Materials



Contaminants / Fouling

Poisons to Catalysts

Corrosive Agents

Off Specification

Unsteady State Flows

Supply Chain Interruption

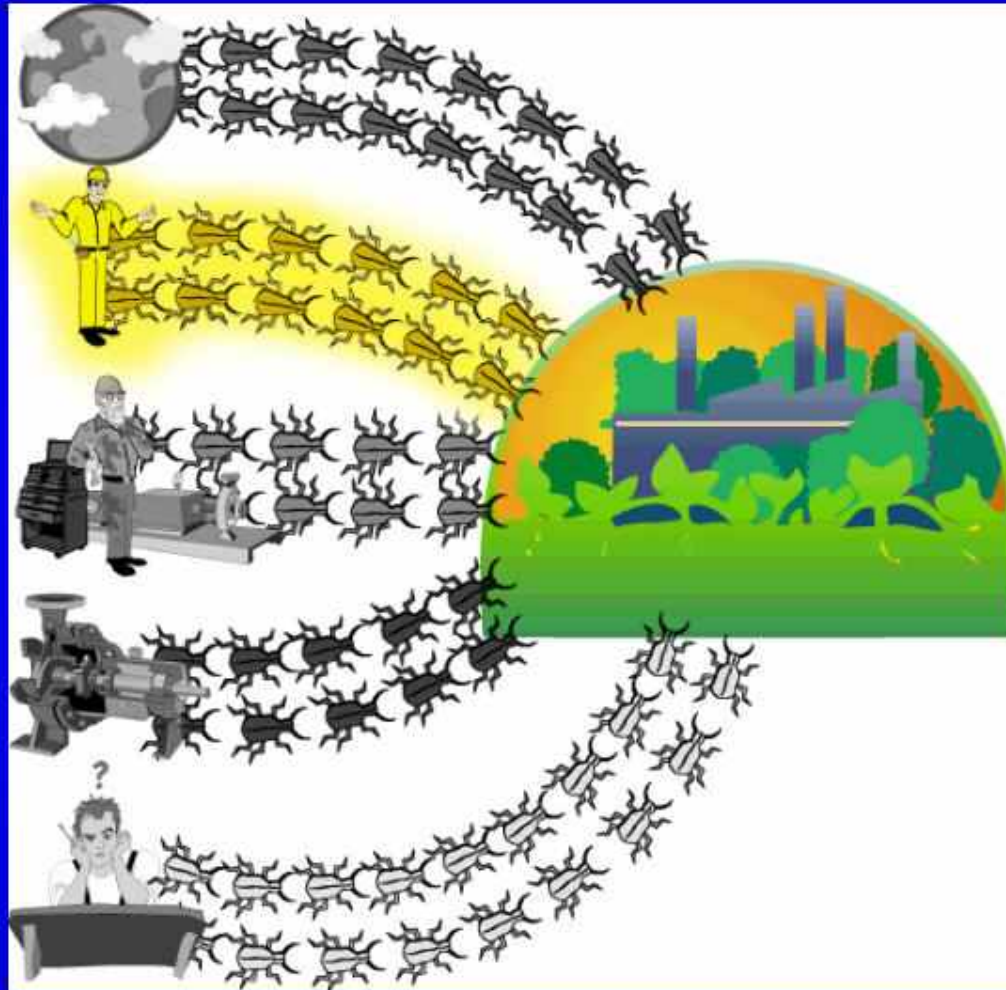


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Operational Defects



Normal wear and tear

Mis-operation

- errors or omissions
- workforce skills, motivation, or availability

Running outside of specifications

Not learning from failures
(insight and skills)

Using more energy than necessary

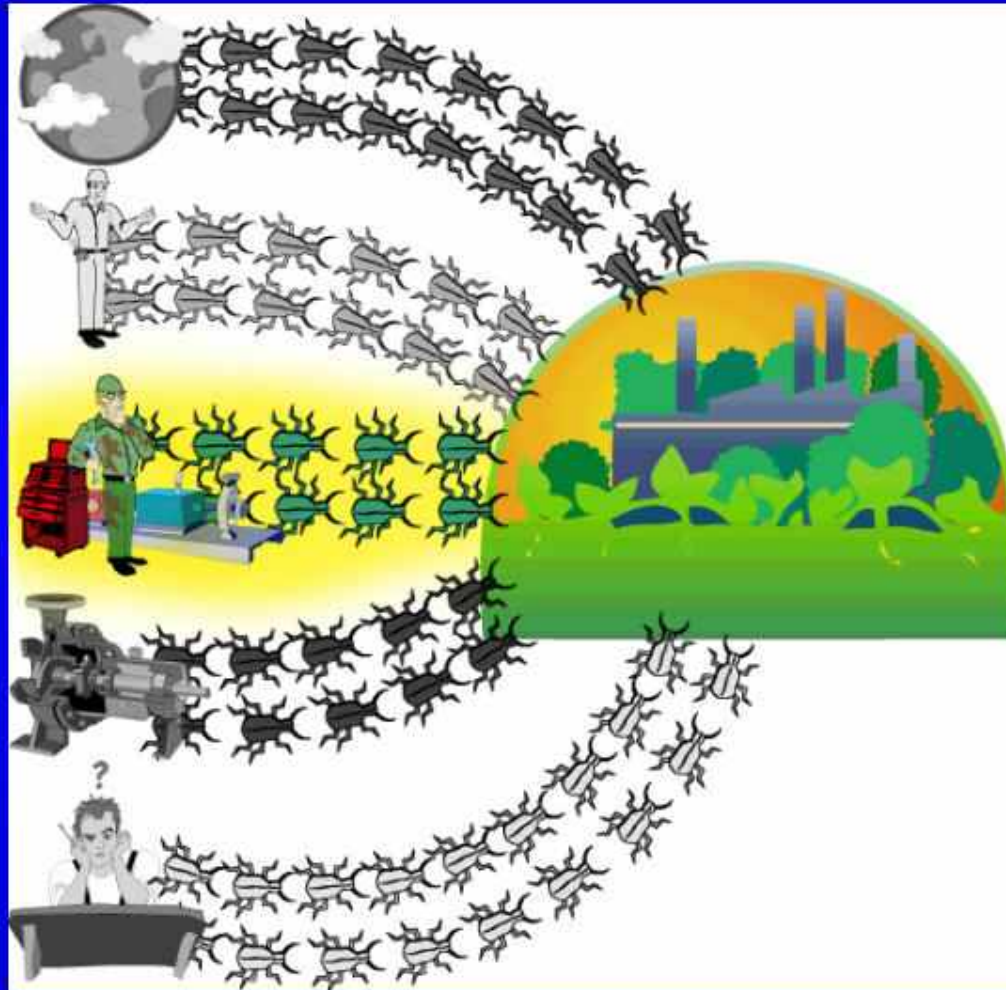


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Defects from Maintenance Workmanship



Needed skills may not be available

Tools, methods, procedures may not be what is needed for the job

The craftsmanship that the mechanics actually use, not what they are capable of doing

Systems often do not allow for the best craftsmanship

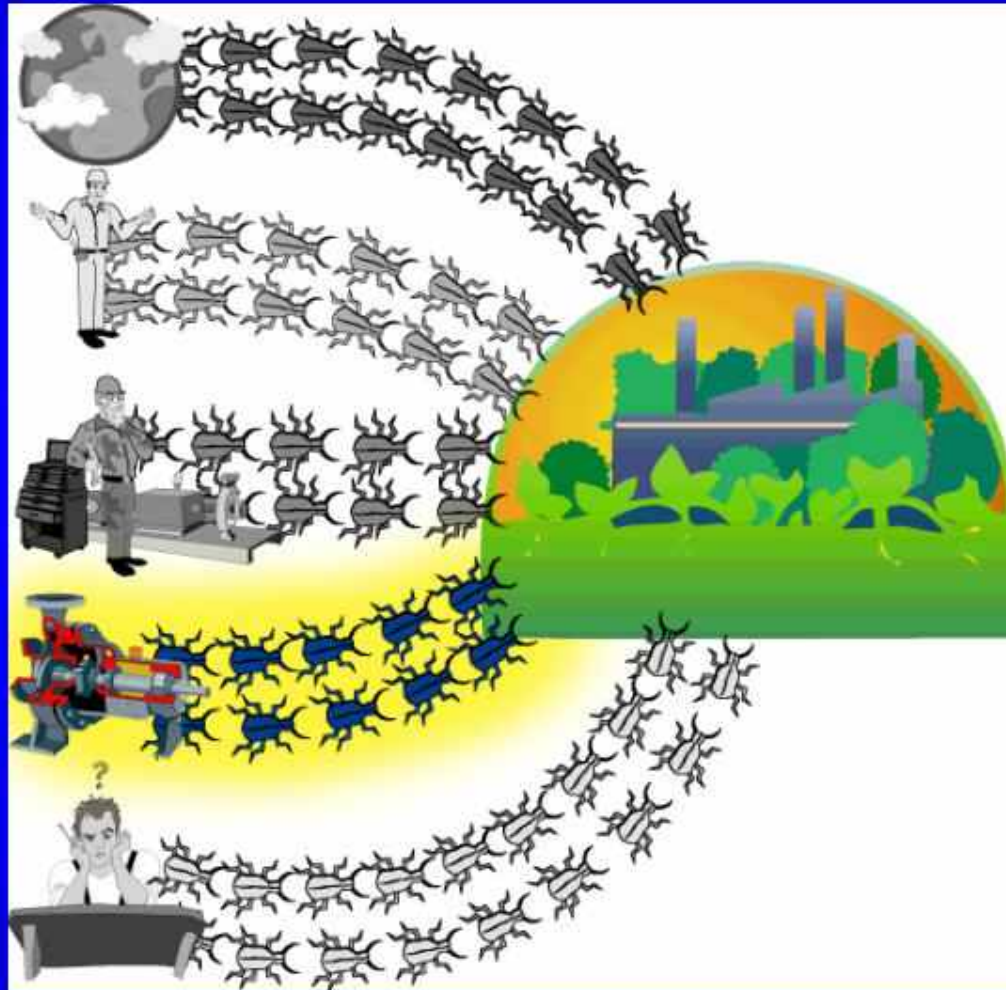


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Defects from Maintenance Materials



**Defects in the
manufacturing of the
parts**

**Defects from improper
transportation**

**Defects from improper
storage**

Management policies

**Parts may not be “fit for
purpose”**

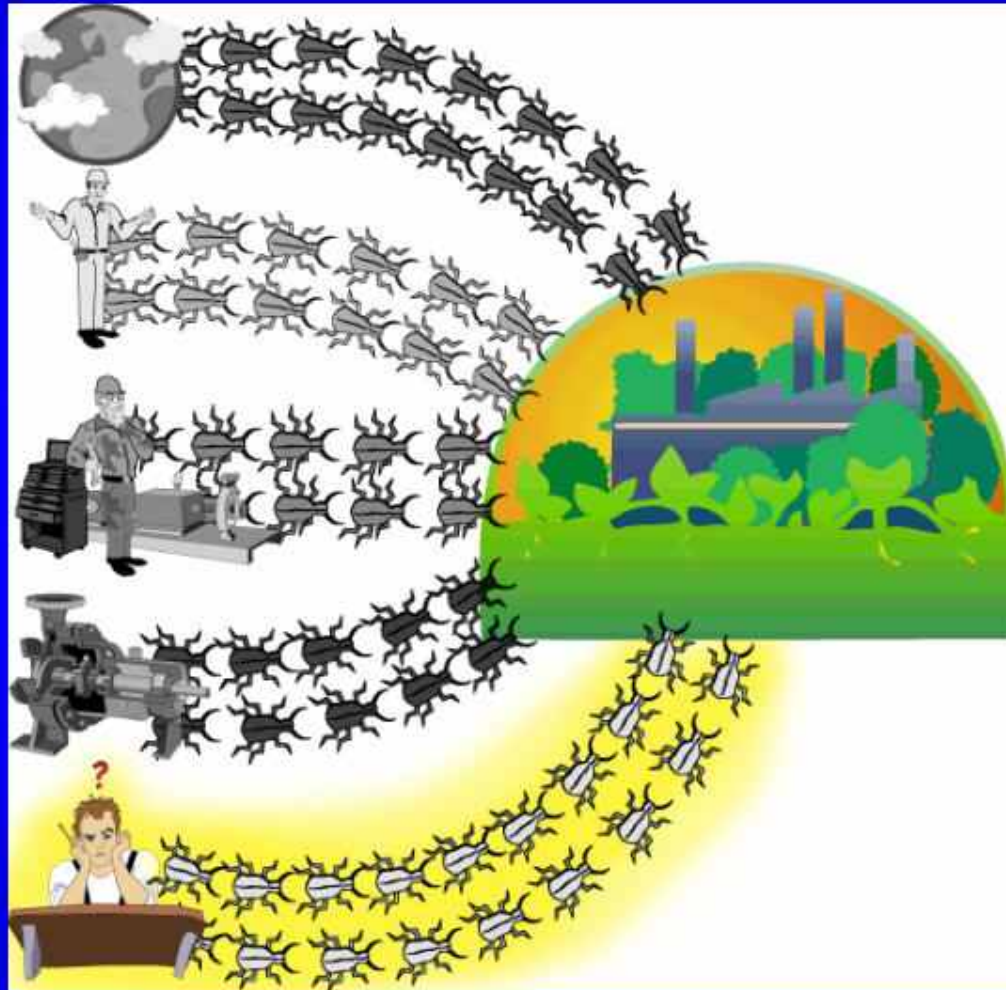


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Defects from Design (of Equipment, Processes, and Practices)



To whatever extent
equipment, processes, and
practices do not meet the
current business needs

“Designed to specs” is not
sufficient if the business
needs have changed

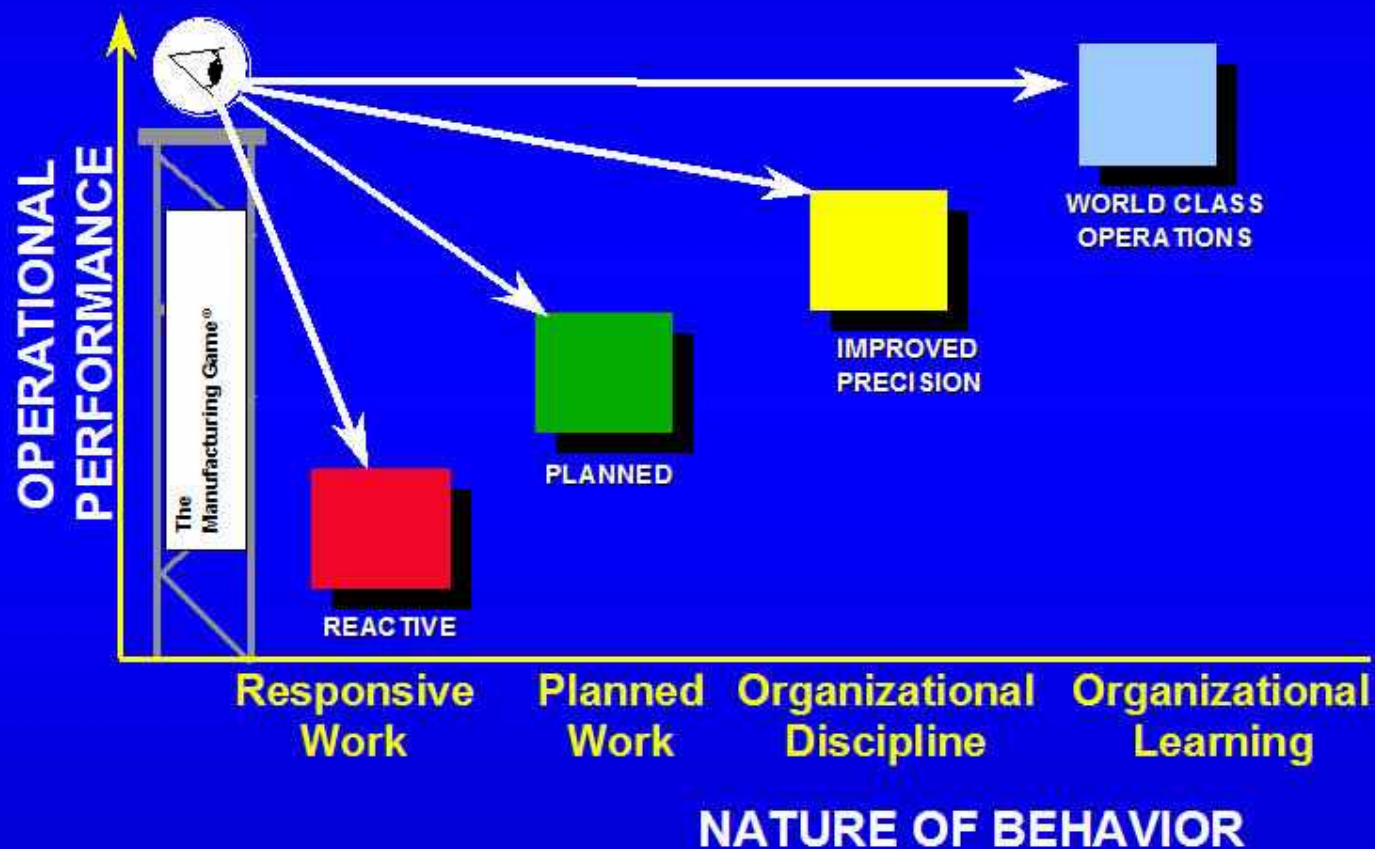


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The Manufacturing Game® View

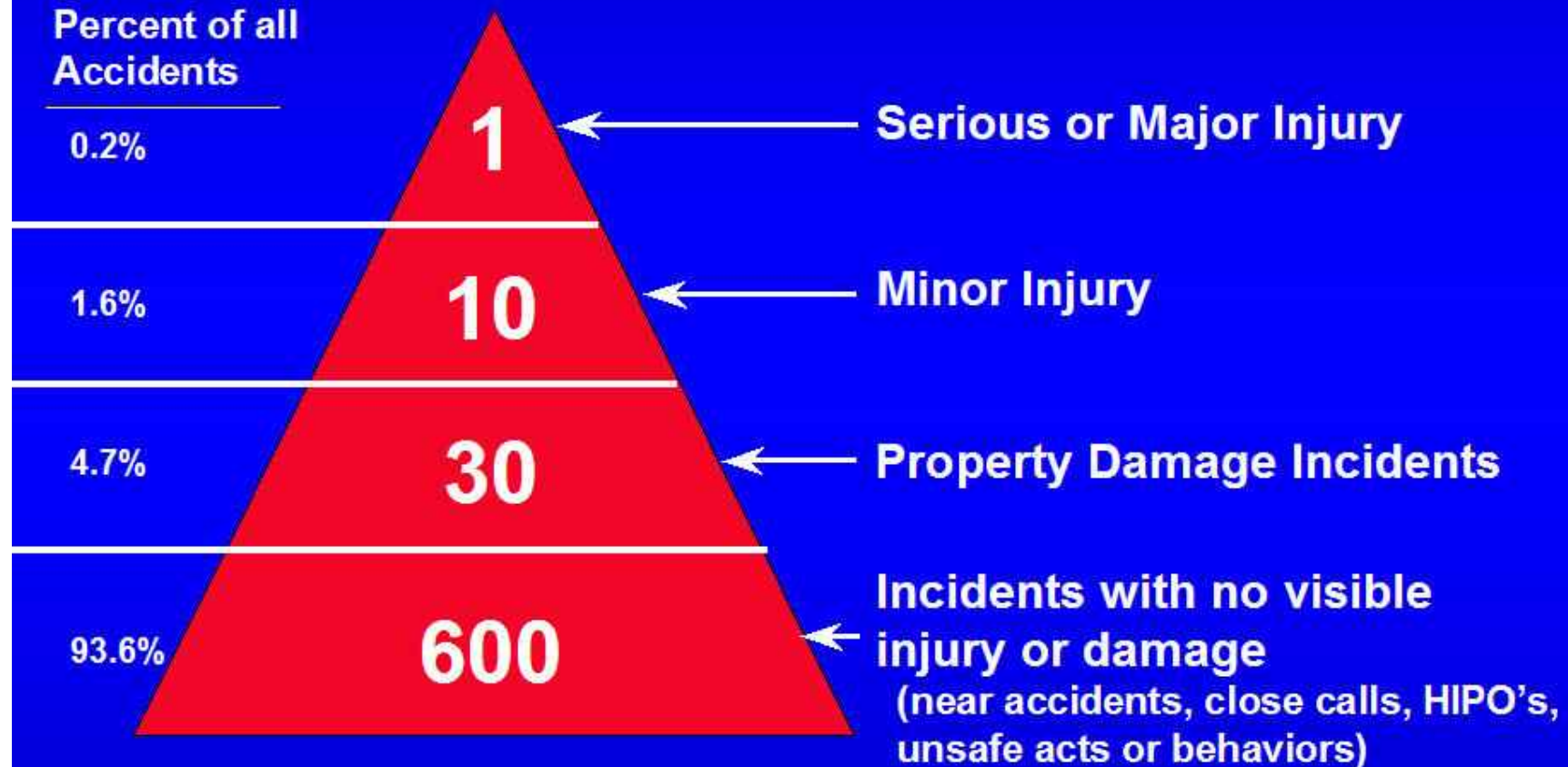


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Safety: Control of Accidental Loss

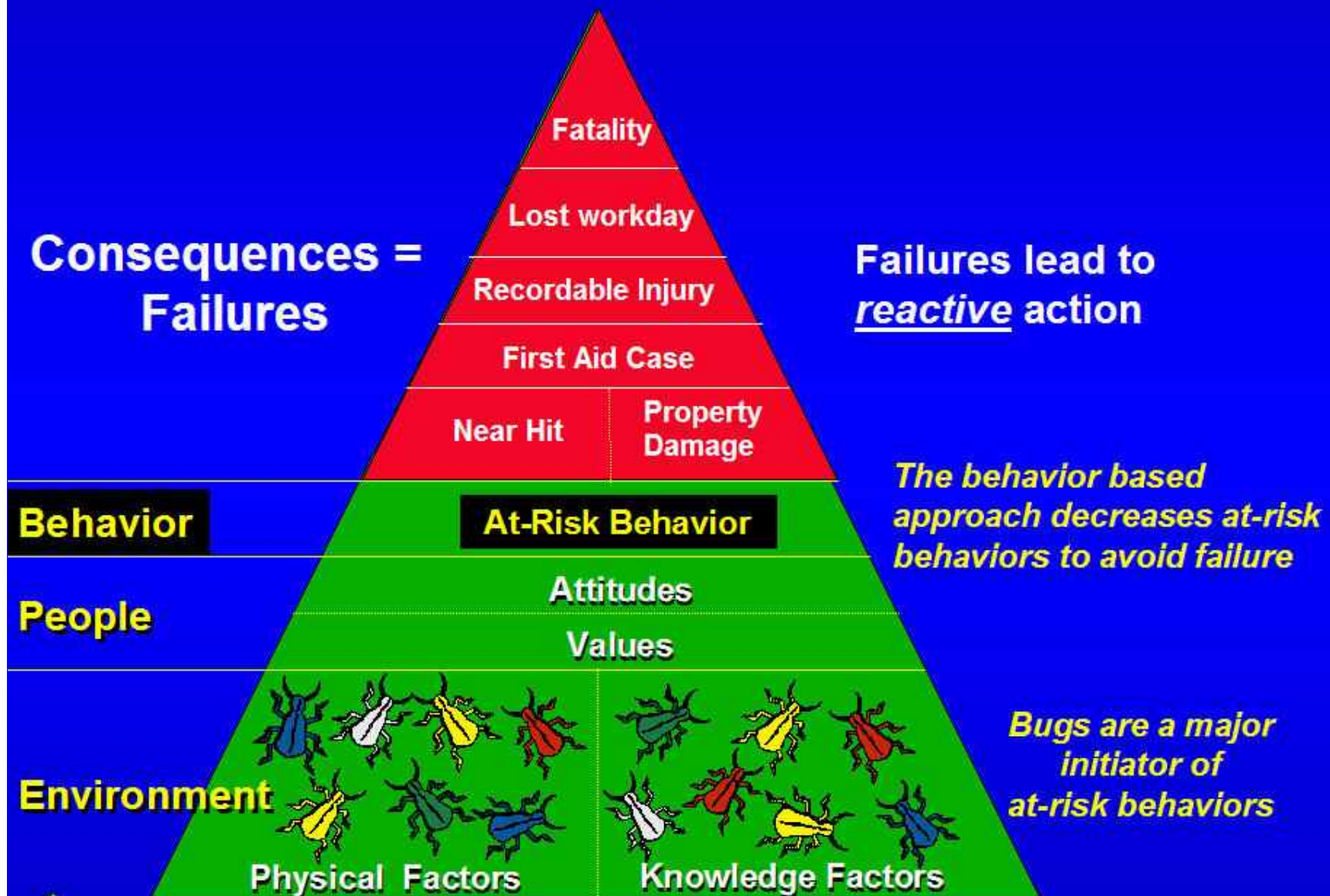


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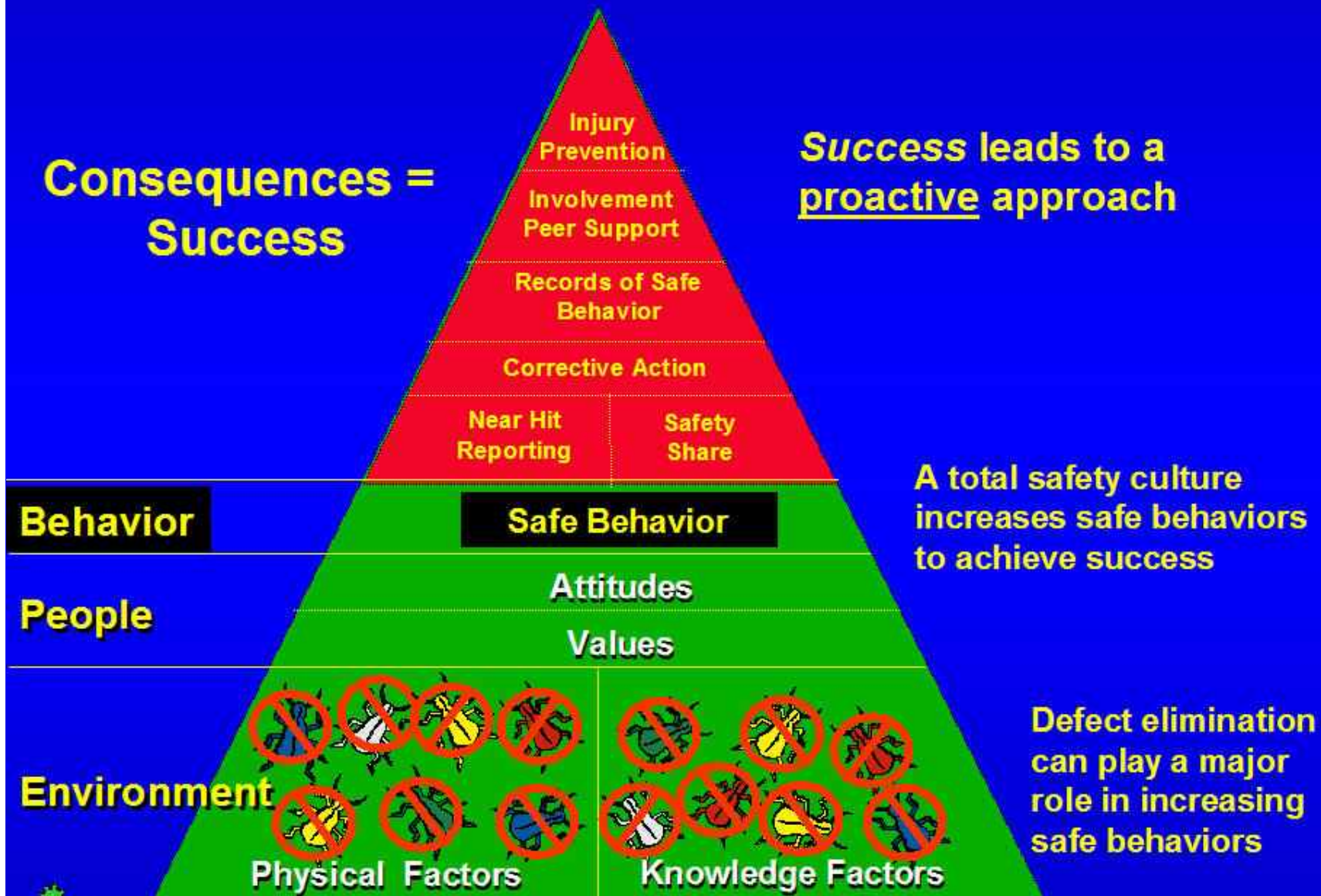
Behavior Based Safety



Focus on success, not just failures

**Consequences =
Success**

**Success leads to a
proactive approach**



Why is deep engagement required?

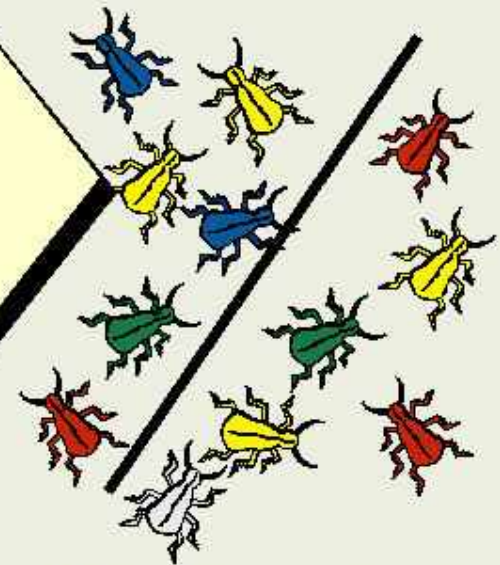
Every incident implies
thousands of defects



*Reducing incidents significantly
requires the elimination of a huge
number of defects*

For an asset
with 6,500
work orders
in a year

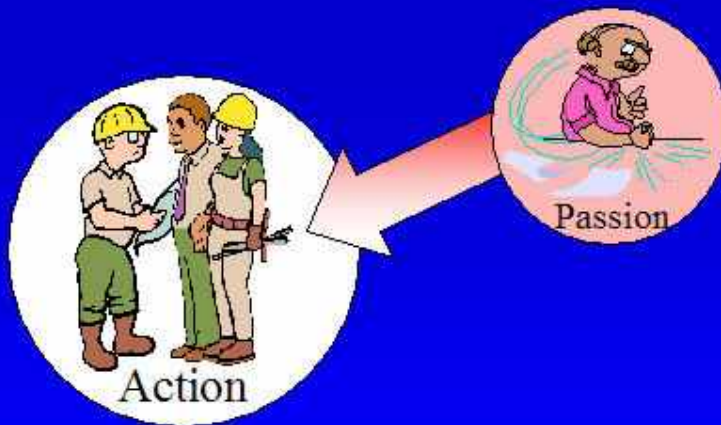
20,000 defects



**10,000 defects must
be eliminated to
reduce the incident
rate by 50%**

Many action teams working simultaneously require processes to align everyone

- Too many teams can lead to chaos
- *Simple decision rules*
 - “No harm to people or the environment”
 - “Don’t just fix it, improve it”



Three Leadership Processes need to come together for on-the-job actions to succeed



Executive Leadership deals with allocation of resources.



Operational Leadership deals with the allocation of people's time.



Network Leadership deals with finding and sorting out ideas.



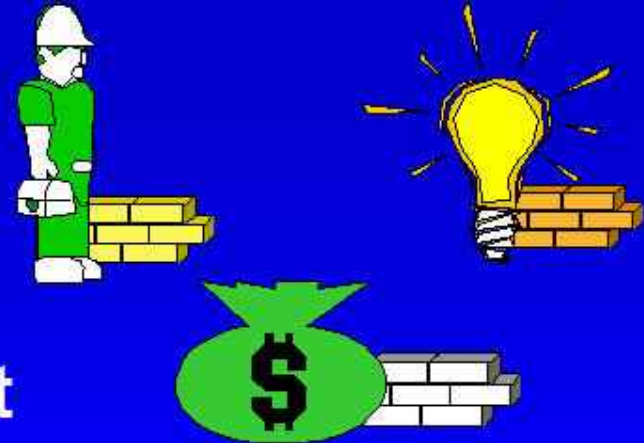
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A Forum helps to...

- Stop the action to reflect
- Build shared awareness
- Connect results to actions
- Articulate actionable simple decision rules
- Create a path forward

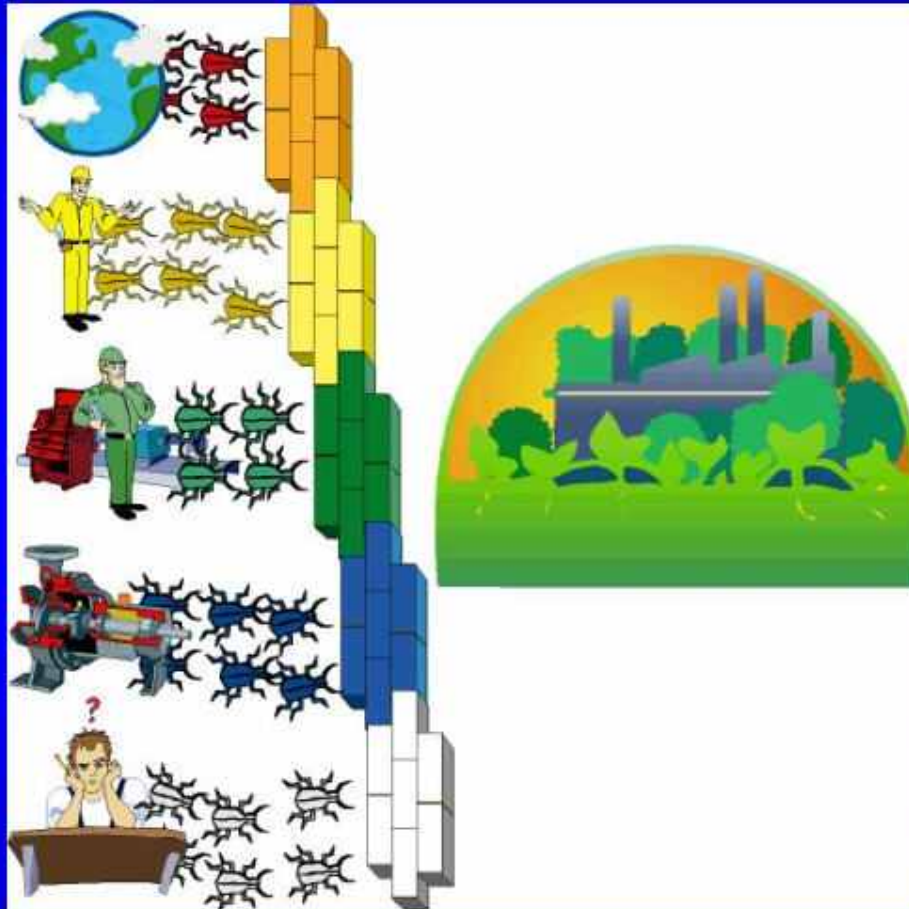


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Stopping Defects at the Source



Discuss key performance indicators

What gaps are still important?

Benchmark data says 95% efficiency is possible (19)

Need to get to only 2 bugs per week to reach 19

What new "bricks" do you need to get to 19?



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Action Plan



System to be improved: Recurring Failure of ZFC6 Control Valve

Action	Purpose	By who	By when
Look up past work orders	to identify people to interview	Sarah	8/2/06
Interview Operations	to determine possible causes	Tony	8/15/06
Interview E & I	to determine possible causes	William	8/15/06
Collect data on loop instruments	to find possible solutions	William	8/15/06
Group meeting in control room / field visit	to find possible solutions	Shelby	8/2/06

Results



Un-insulated piping near control valve

Actuator temperature was 155°F and the digital positioner temperature was 175°F.

According to vendor literature, the continuous upper end operating temperature for the digital positioner is 140°F.

After insulation installed, positioner temperature an acceptable 130°F.

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E & I had just changed out the positioner on the valve...
problem solved

Team located new positioner on a hot oil line (approximately 620°F) that the team noticed was only partially insulated.

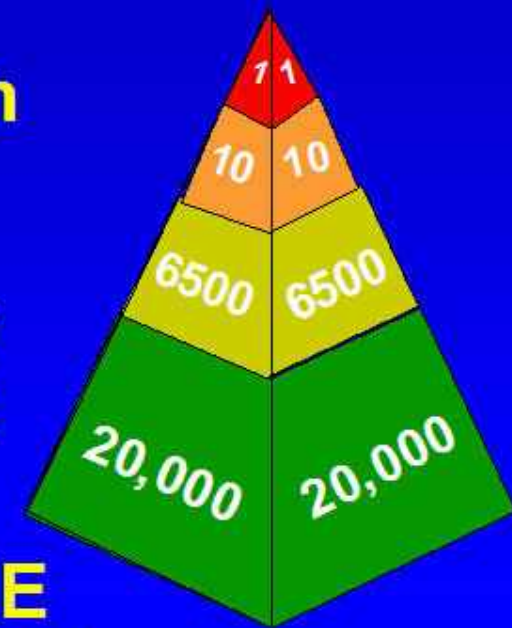


After insulation of piping complete



**Defect Elimination
is the key**

**There are 10's of
1000's of defects**



Engage EVERYONE

**Build understanding & enthusiasm
Then put it to use - IMMEDIATELY**





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