

# Facilitating Compliance on the Manufacturing Shop-floor with MES

A PLM Approach to Environmental Compliance

Ed Goldman

Product Marketing, UGS PLM, Tecnomatix

Premium Partners:



Microsoft

# Agenda

- Environmental Compliance Drivers
  - Legislation
  - Business Drivers
  - Common Environmental Issues for High Tech and Electronics
- MES Role in Compliance
  - MES Definition
  - Addressing Shopfloor Compliance issues for High Tech and Electronics
- UGS support for Environmental Compliance

# Environmental Compliance Drivers



- **Extended Producer Responsibility (EPR)** legislation
  - Ensure Reuse, Recycling and Recovery
- **ELV** – End of Life Vehicle Directive
- **Restriction of Hazardous Substances (RoHS)** – Restriction on the use of certain Hazardous Substances
- **Waste of Electric and Electronic Equipment** – Waste of Electric and Electronic Equipment
- Other international and US federal/ state legislation

# RoHS Background

- Restrictions on Hazardous substances in electrical and electronic equipment
- Bans 4 heavy metals and 2 flame retardants in nearly 100% of electrical products by July 2006 into EU member states
- Similar legislation pending in China, Japan and US
- Affects nearly every electronic and electrical equipment manufactured



# RoHS Impact

- All manufactured goods of electrical nature by ANY manufacturer must comply with RoHS, or it cannot be sold in EU – soon worldwide
- Large data aggregation, analysis, and reporting obligations for all manufacturers
- Due Diligence, traceability, change control, etc. all must be implemented



# WEEE Background

- Waste from Electrical and Electronic Equipment Directive
- Goal of reducing electronic waste in landfills
- EU regulations dealing with reducing non recyclable content in electronics
- Producer responsibility
- Mandates reporting of recyclables, consumer cost free take back



# WEEE Impact

- While not prohibiting substances, like RoHS and ELV, significant issues are still prevalent
- Producers must fund collection, treatment, etc.
  - Projections of future cost necessary
- Progressively higher percentages of recyclables mandated
- Significant data aggregation, analysis, and reporting required



# Sony Shock - 2001

## The Cost of “Non-Compliance” within the Supply Chain “The Sony Playstation Story”

**BusinessWeek** online

AUGUST 9, 2005

SPECIAL REPORT: MANUFACTURING TECH

### Europe's Push for Less-Toxic Tech

In Dec 2001 Dutch customs seize 1.3 million Sony Playstation units due to high levels of cadmium

Electronics manufacturers have 12 months to comply with stringent and costly new EU environmental laws. Some may not make it

Given the bare-knuckles competition among video-game console makers, the news was an unwelcome surprise. Just before Christmas, 2001, Sony ([SNE](#)) was stunned to learn that nearly 1.3 million of its best-selling PlayStation 1 game machines had been stopped at the border by Dutch customs agents.

Sony's offense? Cables in the consoles contained levels of cadmium considered unsafe under recent changes to EU environmental laws. Cadmium has been used in electronics companies to boost the performance of cables and batteries. But a growing body of evidence had begun to show that cadmium can accumulate in the environment and cause serious health problems. And the Netherlands wanted no more of it.

**MORE SNAFUS?** In the days following, Sony went into high gear. It had to squelch rumors of a broader recall while simultaneously determining what to do over just was to blame for the slip-up. In the end, the seizure delayed the sale of \$160 million worth of consoles, and \$100 million worth of storage and repacking the goods.

Rare as episodes like this have been, Sony's snafu may foreshadow similar dramas that could unfold on a larger scale across Europe come next July 1. That's when European Union rules come into effect strictly limiting the import of goods containing six key toxins regularly used by electronics manufacturers, including lead and cadmium (see [table below](#)).

Cost is \$160 million in seized goods and missed sales opportunities at start of critical Christmas season shopping

# Recovery now a major part of the Product Lifecycle

bizjournals.com

## Dell boosts recycling goal

Friday, April 7, 4:09 pm ET



Round Rock computer giant Dell Inc. wants to save the world, one recycled computer at a time.

The company is planning to triple the amount of electronics it can recycle by 2009, Dell said in an annual report outlining its environmental goals and achievements.

Dell (NASDAQ: [DELL](#) - [News](#)) and other computer makers have recently been bowing to demands from consumers and environmental groups to safely handle materials from electronics such as cadmium, mercury and lead.

**In the fiscal year ending Feb. 3, Dell said it recovered more than 70 million pounds of used computers, monitors and printers. Dell officials said the goal is to recover 275 million pounds by the end of 2009.**

Dell's updated recycling efforts were issued Wednesday in Oakland, Calif., at an environmental business conference. Dell has been issuing such reports since 1998.

A similar report in March by rival Hewlett-Packard Co. said it had recycled 140 million pounds of computer hardware and printer cartridges, nearly 17 percent more than in 2004, and hopes to recycle 1 billion pounds by the end of 2007.

Only about 11 percent of electronics are recycled, according to the National Safety Council. And state governments are trying to address the growing amount of so-called "e-waste."

Dell fared poorly in a 2001 report by the Computer TakeBack Campaign, which monitors the recycling efforts of the world's computer makers, mainly for its use of prison workers who earned 20 cents to \$1.26 per hour to recycle hardware.

In 2004, Dell and HP both began programs where customers can have their old computers and other electronic gadgets recycled for free.

Published April 7, 2006 by the Austin Business Journal

# Hazardous Material Content (High Tech)

## •Computers

- Harmful Substances: Lead, Mercury, Cadmium, Polybrominated Diphenylethers
- Sources: Circuit Boards, Connectors, Cables

## •CRT Monitors

- Harmful Substances: Lead, Hexavalent Chromium, Barium
- Sources: Glass, Soldering

## •Flat Panel Monitors

- Harmful Substances: Mercury, Lead
- Sources: Light Bulbs, Switches

## • Digital Cameras

- Harmful Substances: Polyvinyl Chloride, Lead Acid, Cadmium, Lithium
- Sources: Casings, Batteries

## •Cellphones

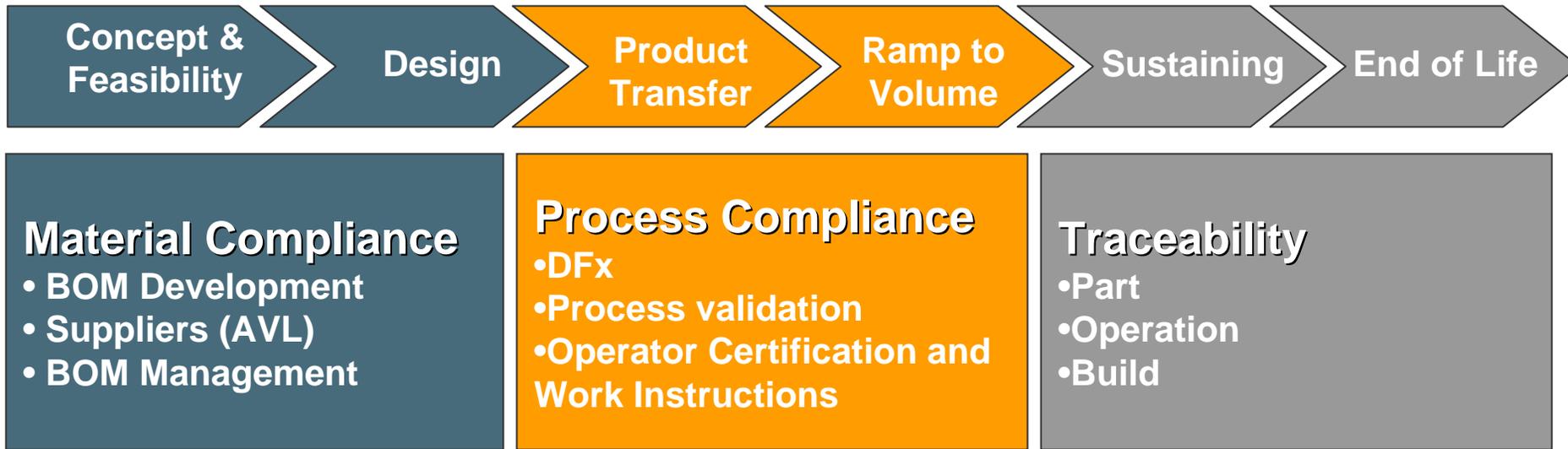
- Harmful Substances: Antimony Arsenic, Lead, Beryllium, Cadmium, Copper, Zinc
- Sources: Batteries, Circuit Boards

## •Digital Music Players

- Harmful Substances: Arsenic, Lead, Cadmium
- Sources: Batteries, Circuit Boards



# PLM view of Environmental Compliance



Design → Execution → Declaration

• BOM data mining & aggregation – pulling BOM material and substance data from various systems (PLM, ERP, MES, SCM, etc.)  
• Compliance Validation

• Design, manage and document compliant processes  
• Control manufacturing processes to eliminate risk of contamination

• Facilitate compliance declaration with complete process genealogy & traceability

# MES is Fundamental to Compliance Strategies

“With more than 50% of planned orders between now and the end of 2005 requiring compliant parts, manufacturers must take action now to safely error-proof their processes while transitioning inventories and demonstrating compliance. ***MES applications that were previously viewed as nice-to-have for competitive advantage are rapidly becoming requisites for survival.***”



***Simon Jacobson***

 **AMR Research**

**“MES – A must for ROHS and WEEE Compliance”**

# Compliance Requirements on the shopfloor

## Needs

- ▶ *How to facilitate proof of compliance on the shop-floor?*
- ▶ *How to control processes to avoid risk of contamination?*
- ▶ *How to minimize impact to production quality during migration to compliant manufacturing?*



# Keys to Manufacturing Compliance on the Shopfloor

## Six Areas of Execution → Keys to Manufacturing Compliance

1. Addressing the Part Numbering Confusion
2. Inventory Management and Control
3. Change Management
4. Process Verification and Monitoring
5. Quality and Reliability Assurance
6. Traceability and Compliance Declaration

# 1. Eliminating the Part Number Confusion

- **Situation:**

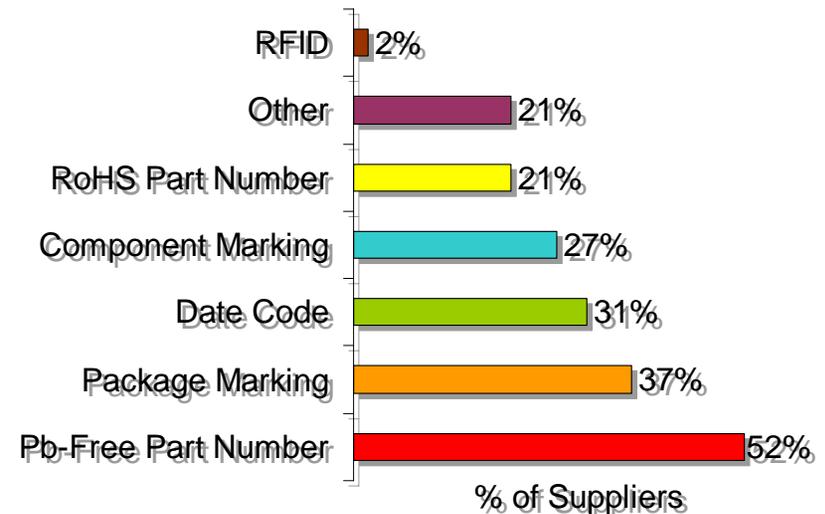
- ~50% of vendors do not plan on assigning unique part numbers to lead-free parts

- **Problem:**

- Expensive to upgrade enterprise systems to create unique part numbers

- **Solution:**

- Insulate your expensive Enterprise systems with a simple “Component Decoder” at the shop floor Level



# 2. Inventory Management and Control

- **Situation:**

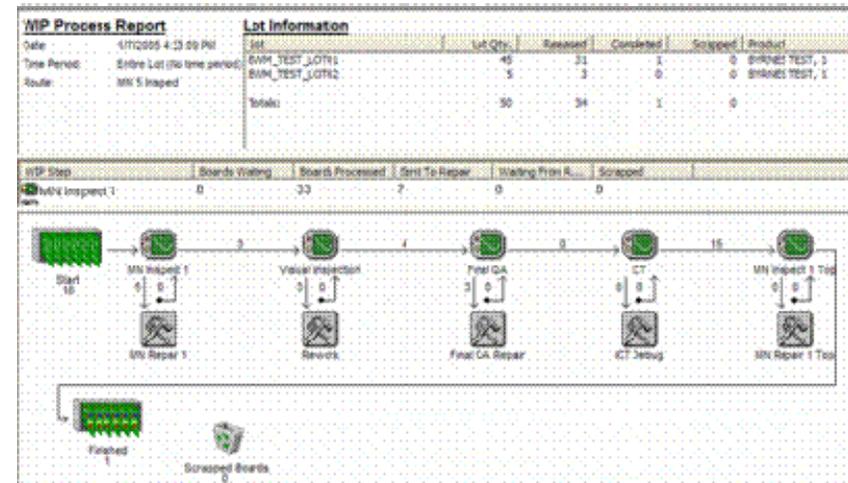
- Leading up to July 2006, the lead-based inventory needs to be used up

- **Problem:**

- Physical inventory counting and MRP reconciliation burden
- Re-layout of shop floor to prevent Cross Contamination of material

- **Solution:**

- Real-time Material release, usage and Expiry Alerts to set priority on the use of inventory
- Reserve material for consumption to specific orders, customers, product versions, lines etc..



# 3. Change Management

- **Situation:**  
Shop floor will see a dramatic increase in Change Orders to replace Obsolete Lead Based Components
- **Problem:**  
Tracking and implementing waves of changes without compromising throughput, cost and quality
- **Solution:**  
Single system to:
  - Apply unit level effectivity
  - Assess impact on parts, WIP, Finished product
  - Enforce Rework rules
  - Document the History
  - Improve process

The image shows two overlapping windows from a software application. The top window is titled 'Manage Product Definitions' and contains a table of products and their revisions. The bottom window is a detailed view of a specific revision.

Product	Revision
JD_BDX	8
JD_BDX	9
JR-TEST-01	
JR_PCB1	
MN ASCOM	1
MN BDX TEST	1
MN CONDUCTA	1
MN FISHER	1
MN FISHER	2
MN FISHER	3
MN FISHER	4
MN FISHER	5
MN FISHER	6
MN NO SUB	1
MN ONF SIIR	1

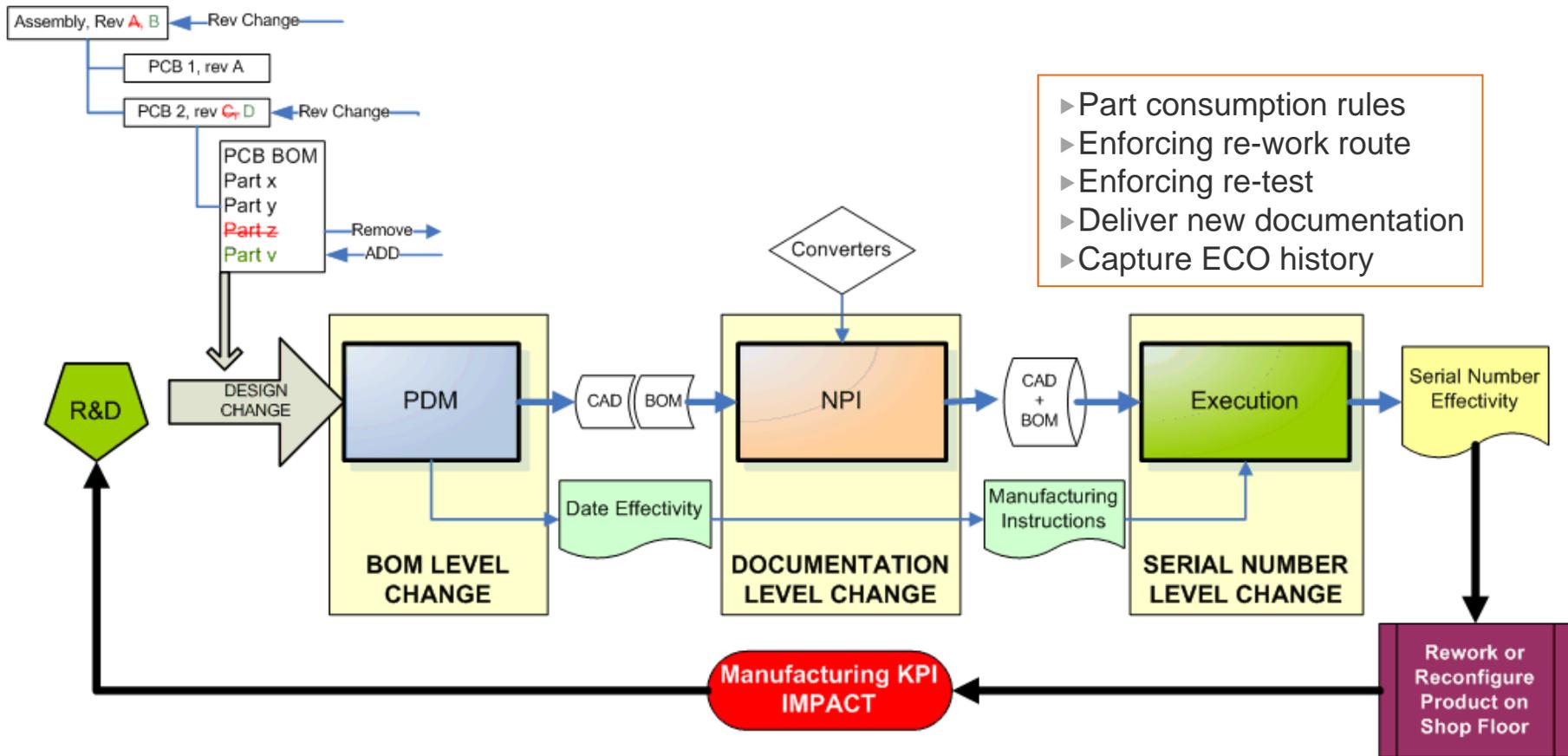
**Product Details:**

- Type: PCB
- Effectivity Dates: Start: , End:
- Serialization: Possible
- Create Date: 6/22/2004 2:19:52 PM
- Closed Date: n/a
- Default Line: MN Assignment
- Default Route: MN - RC1, I1, I2, RC2
- Default Build Process: All Parts
- PCB Options: Folder: \\US-po-wsqssq\QualityProducts\JOB 8; Job: \\US-PO-WSSYRIUS\UCWJOBS\fisher,; Schematic: ; Document:

**Revision Details:**

- Revision: 7
- Description: ECO'd from revision 1
- Serialized:  Always  Optional  Never

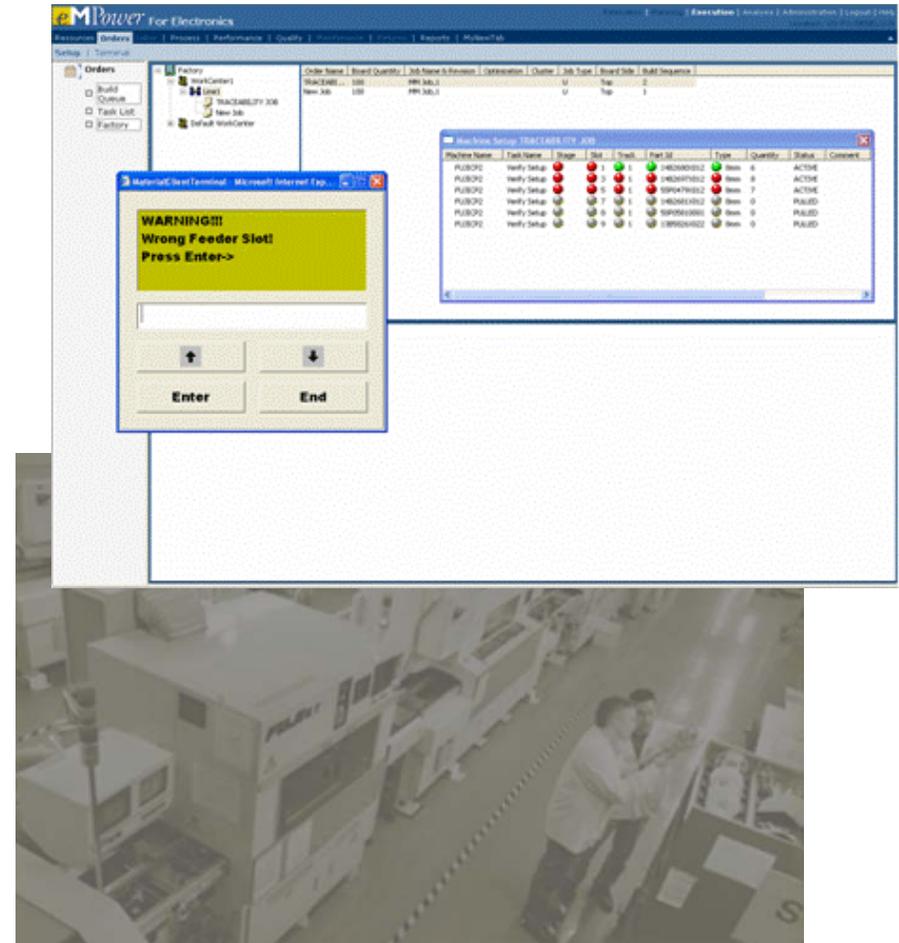
# Impact of Changes on Execution



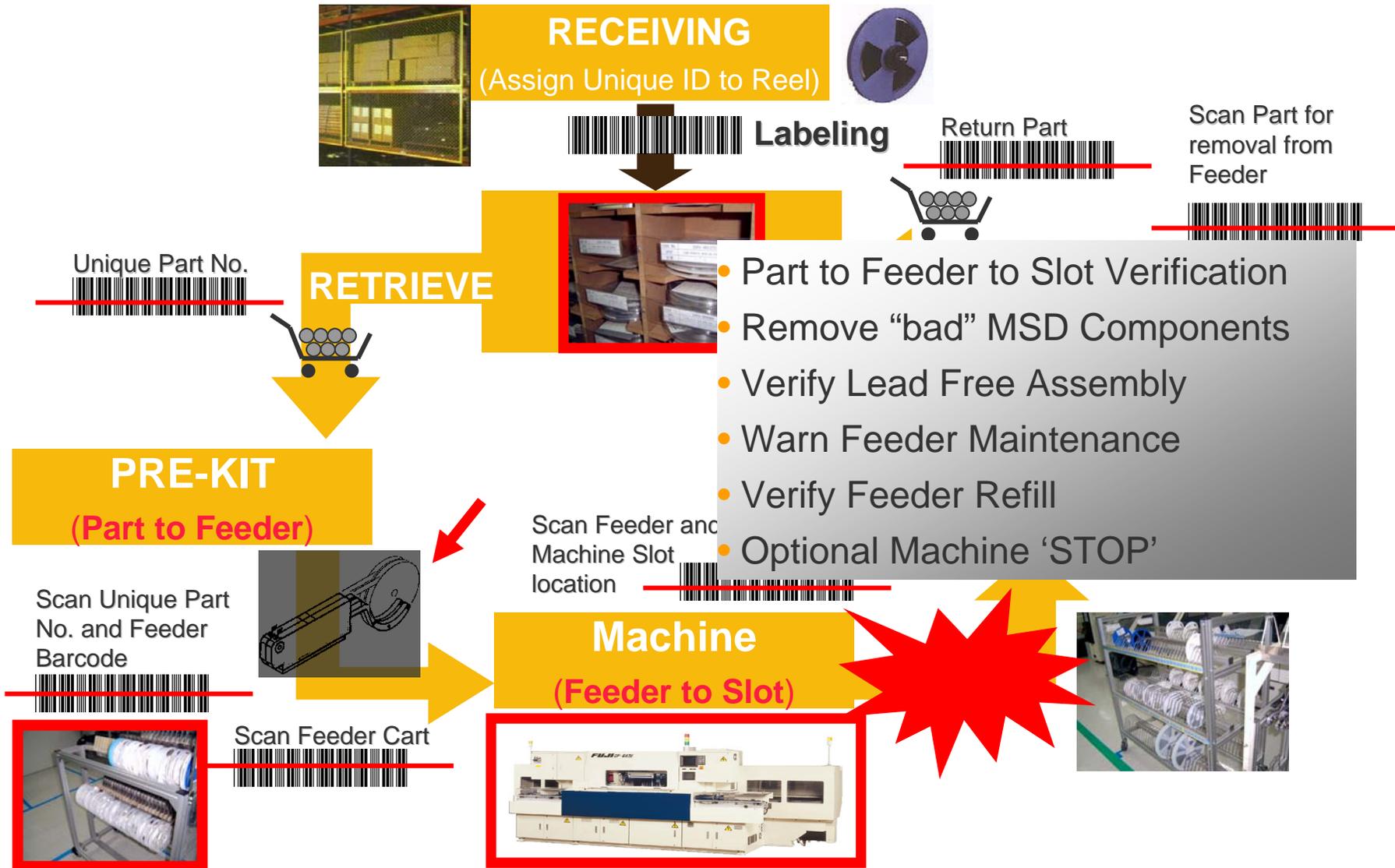
- ▶ Impacts:
  - ▶ Delivery
  - ▶ Inventory
  - ▶ Throughput

# 4. Process Verification and Monitoring

- **Situation:**  
Process verification done manually or supported by stand-alone systems
- **Problem:**  
How do you prevent mistakes before they occur
  - Wrong part placements
  - Repair processes
  - Operator training
- **Solution:**  
In-Process verification that applies part, process and resource usage rules



# Example: In-Process Verification

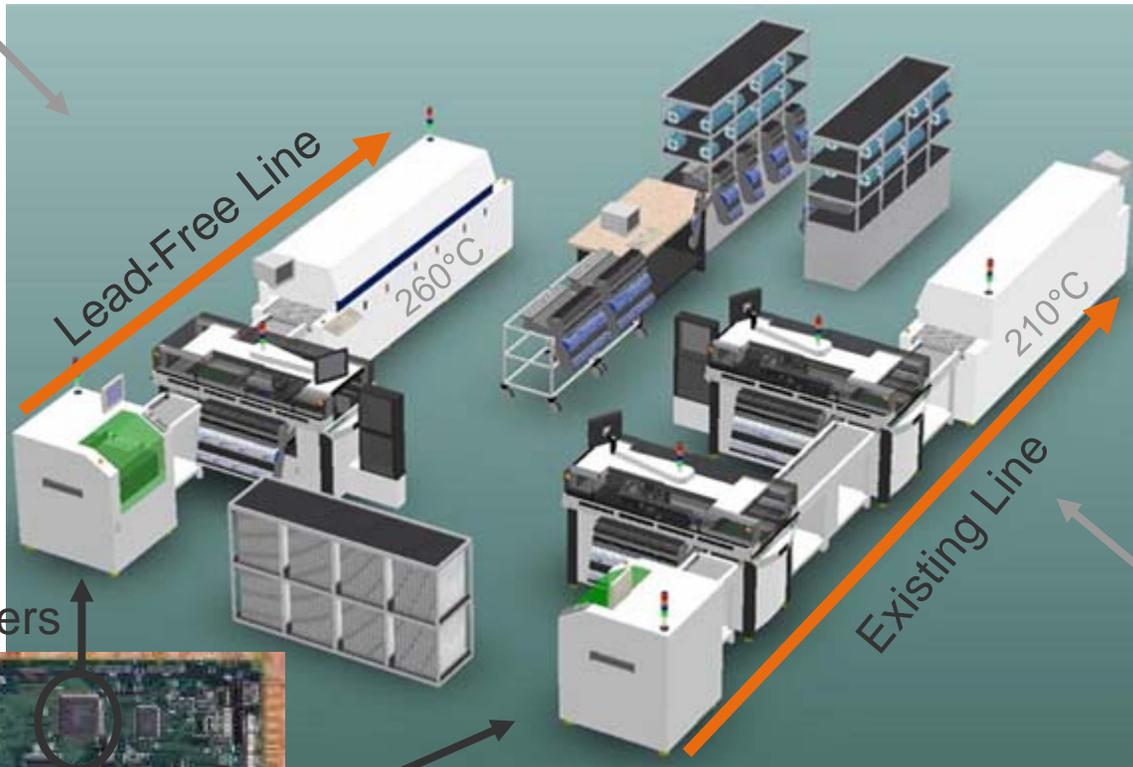


# Matching Components to Processes



**BGA**

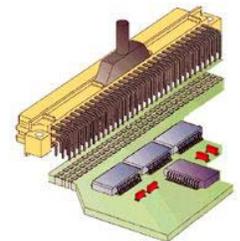
RoHS Compliant  
260° C Only



All Suppliers



Supplier X only

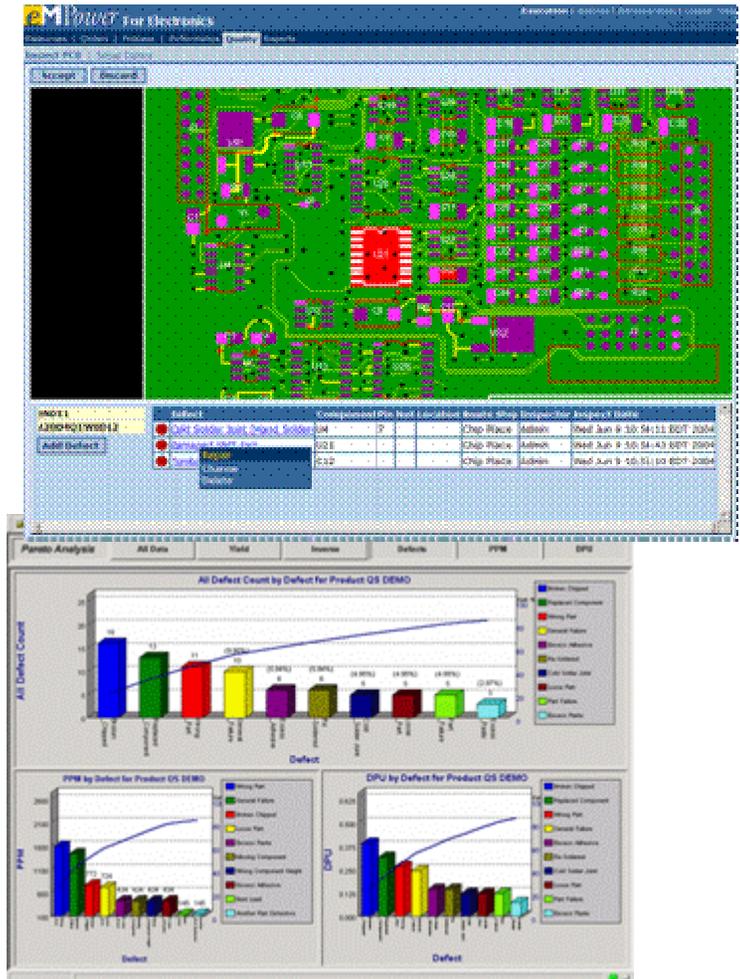


**Connectors**

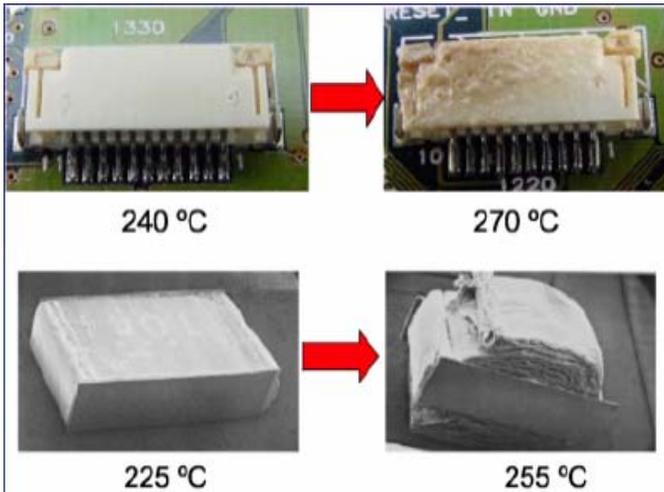
RoHS Compliant  
210° C Only

# 5. Quality and Reliability Assurance

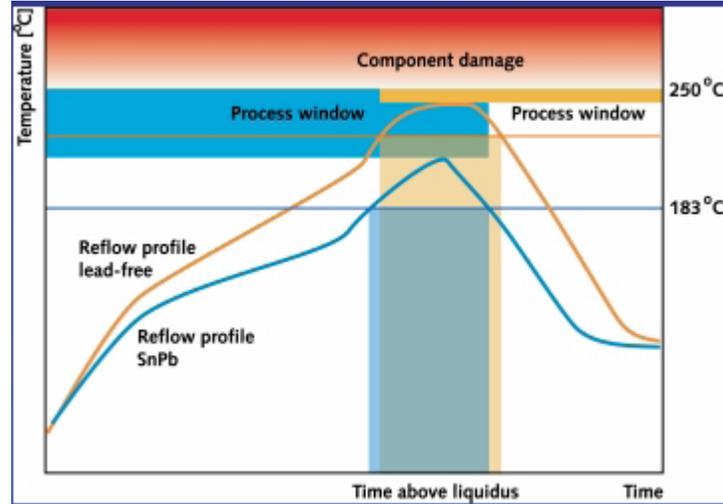
- Situation:  
New processes, new metallurgy
- Problem:  
Maintain quality and build in reliability without affecting Key performance measures
- Solution:
  - Establish process baseline
  - Single-click comparisons between lead-based and lead-free production metrics
  - Drill down to Root cause of defects to enable Process Improvements



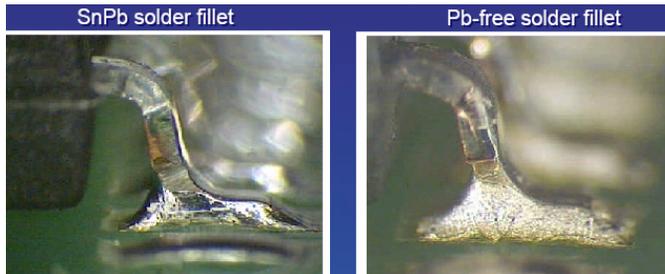
# Effects of Change in Process Parameters



Process Compatibility



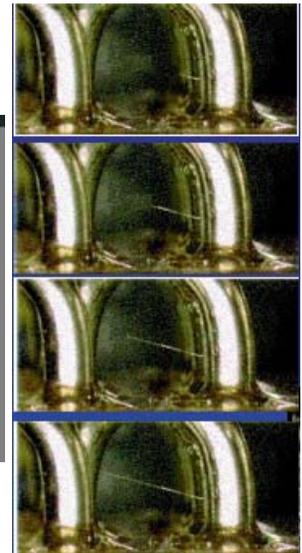
Process Parameter Change



Change in Inspection Standards



Tin Whiskers = Serious Reliability Concern



# 6. Traceability and Compliance Declaration

## ▪ Situation:

- Self-Declaration implied after Deadline

## ▪ Problem:

- How much documentation is adequate?  
Is my production history fully traceable?

## ▪ Solution:

- Complete History of components, processes and products in a single system
- All you need for Self-Declaration
- Tailored to meet and pass RoHS audits
  - Keep up with Industry Standards

The screenshot displays the eMpower For Electronics software interface. The top window shows a 'Component Traceability Report' for a specific part number (RECT2012040\_N) dated 4/4/2004. The report includes a table of operations with columns for Task, Date, Date Code, Vendor Name, Order, Machine, Slot, and Reel ID. Below the report is a 'User Reel Information' table with columns for Reel Barcode, SAP Mat. Row, Inspect Lot, Trans. Order, Package Size, FIFO Create, Exp. Date, JEDEC, Mat. Prop., and Info1-Info8.

The bottom window shows a 'Resources' list with columns for Reel Barcode, Customer Id, and Qty. A 'Edit Part' dialog box is open, showing fields for Barcode, Quantity Remaining, Thread Loss Quantity, Vendor Id, Location Barcode, Date Code, Feeder Type, Status, and Total Quantity.

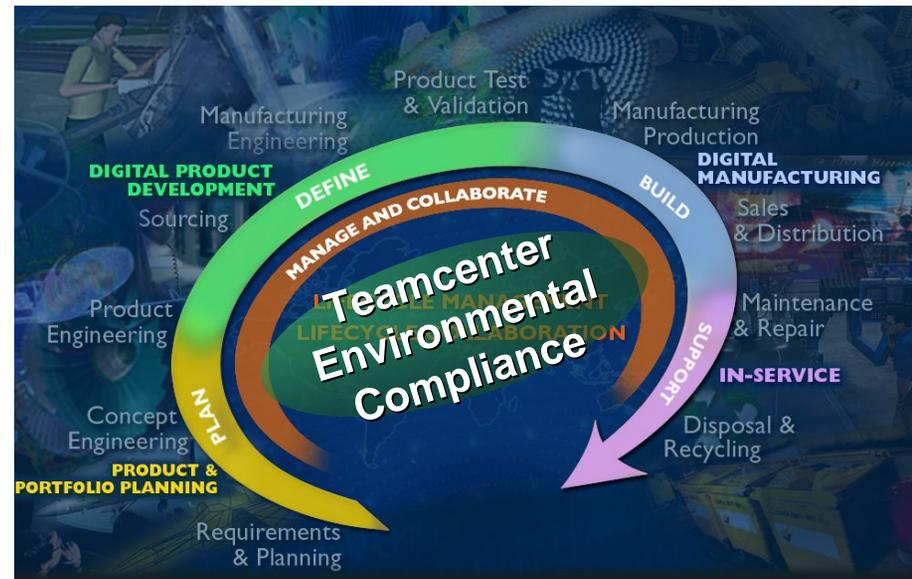
Task	Date	Date Code	Vendor Name	Order	Machine	Slot	Reel ID
Retrieve Parts	10/15/2003 19:38:57	10-15-03-J001	RECT PARTS	Trace-2	CP3		TR0001
Retrieve Parts	10/15/2003 19:41:11	10-15-03-J001	RECT PARTS	Trace-2	CP3		TR0001
Retrieve Parts	10/15/2003 19:46:28	10-15-03-J001	RECT PARTS	Trace-2	CP3		TR0001
Retrieve Parts	10/15/2003 19:48:03	10-15-03-J001	RECT PARTS	Trace-2	CP3		TR0001
Retrieve Parts	10/15/2003 19:53:12	10-15-03-J001	RECT PARTS	Trace-2	CP3		TR0001
Load Parts	10/15/2003 20:01:39	10-15-03-J001	RECT PARTS	Trace-2	CP3		TR0001
Load Feeders	10/15/2003 20:02:48	10-15-03-J001	RECT PARTS	Trace-2	CP3	1	TR0001

Reel Barcode	SAP Mat. Row	Inspect Lot	Trans. Order	Package Size	FIFO Create	Exp. Date	JEDEC	Mat. Prop.	Info1	Info2	Info3	Info4	Info5	Info6	Info7	Info8
--------------	--------------	-------------	--------------	--------------	-------------	-----------	-------	------------	-------	-------	-------	-------	-------	-------	-------	-------

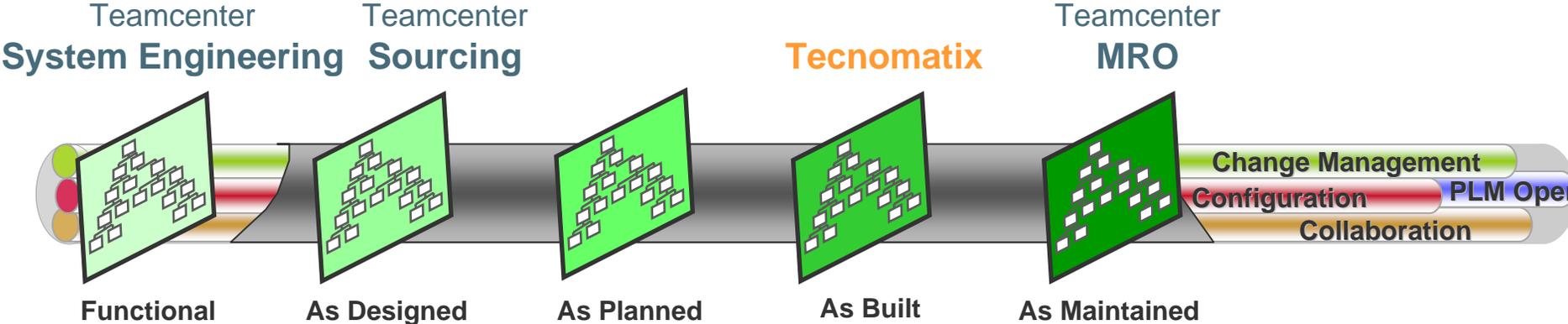
Reel Barcode	Customer Id	Qty
AC435991	A0361412	12
AC435992	A0666072	C1
AC435993	A0618994	31
AC435994	A0666136	12
AC435995	A0952876	C1
AC435996	A0600797	M
AC435997	A0676113	V2
AC435998	A0675321	12
AC435999	A0675321	12
AC436000	A0319223	C1
AC435901	A0382362	V3
AC435902	A0322517	12
AC435903	A0280994	M
AC435904	A0602391	12
AC435905	A0622011	C1
AC435906	A0609005	12
AC435907	A0609005	12
AC435908	A0378908	12
AC435909	A0378742	C1
AC435910	A0667120	RP
AC435911	A0614349	C1
AC435912	A0628972	C1
AC435913	A0601827	RP
AC435914	A0379619	C1
AC435915	A0361412	12
AC435916	A0315313	RP
AC435917	A0382343	Z
AC435918	A0382323	S2

# Teamcenter Environmental Compliance Solution Positioning

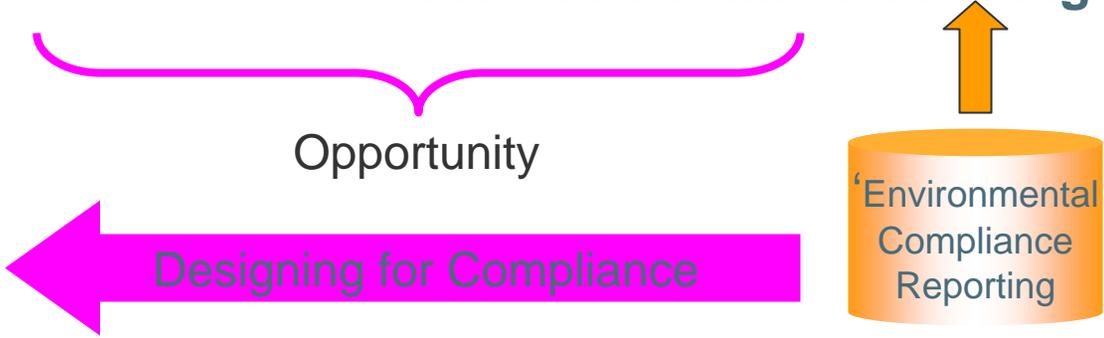
- **FOR** Electronics and Automotive companies
- **WHO** want an Off the shelf solution that offers a complete set of functionality to **analyze and track compliance at the substance, material, part and product level**
- **TO** efficiently manage the data **collection and reporting process**
- **AND** easily integrate into their existing supply chain, design and manufacturing systems
- The implementation of Teamcenter Compliance Solution in an organization **maximizes the visibility of compliance information** to all stages of the product lifecycle and thus minimizes the risk and costs associated with non-compliance.



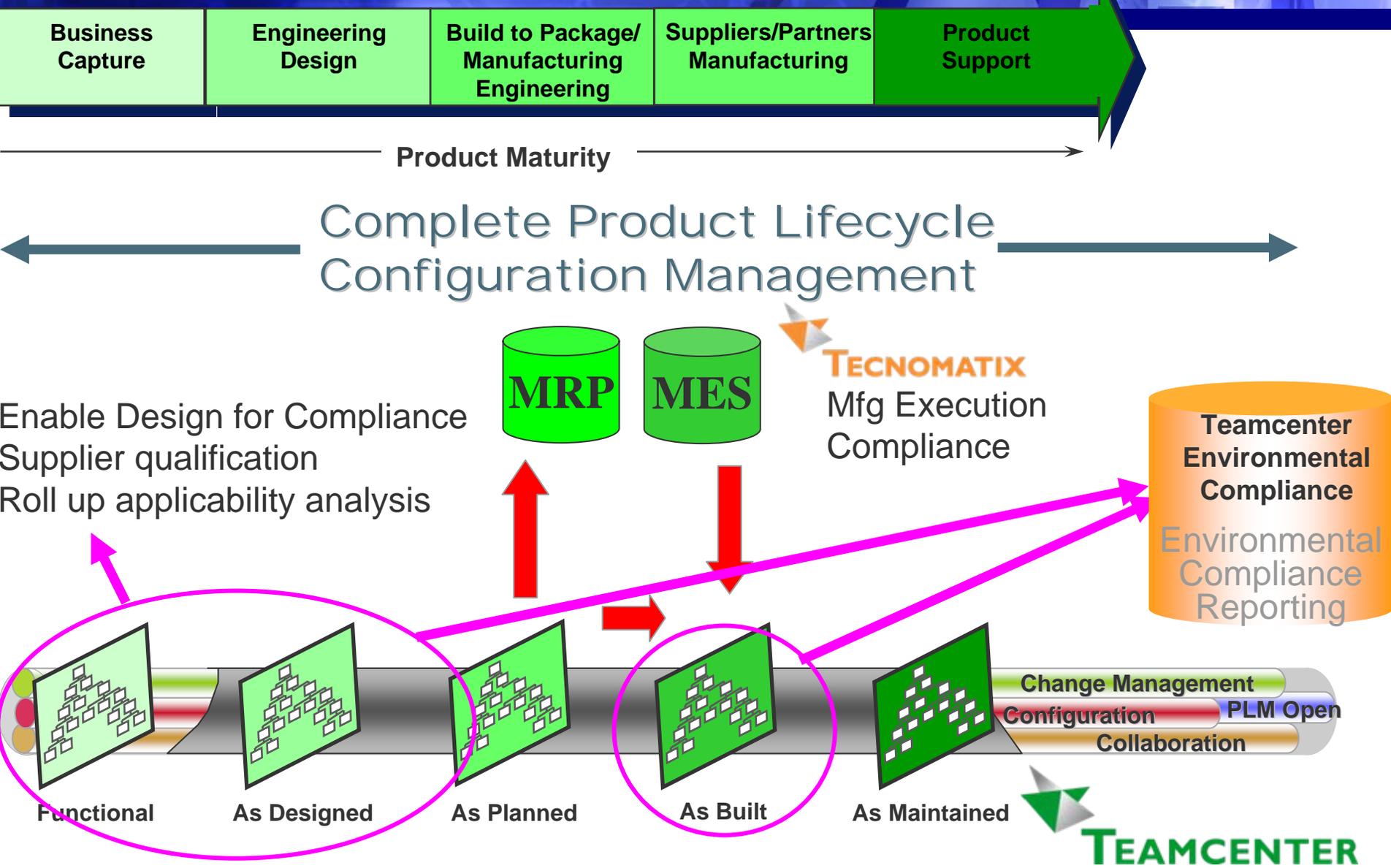
# Compliance – a PLM Issue



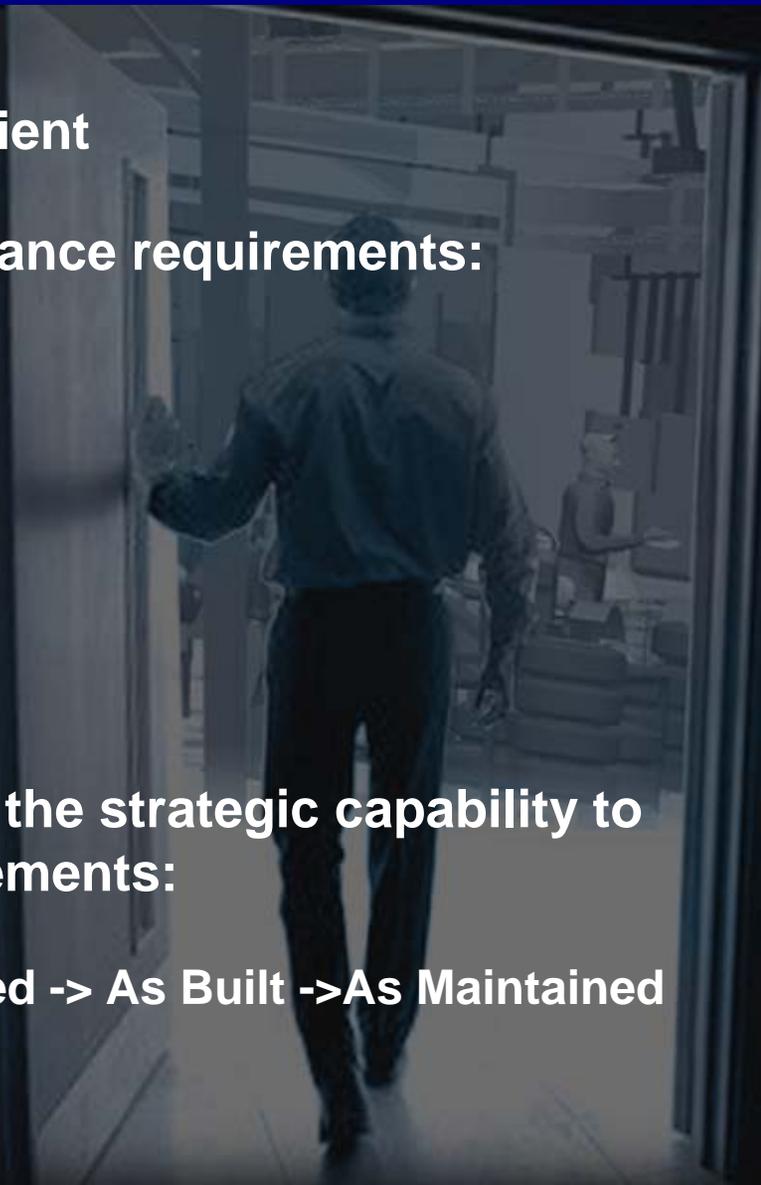
## Teamcenter Manufacturing Backbone



# Teamcenter Environmental Compliance Support



# Summary

- ✓ **Design for compliance alone is insufficient**
  - ✓ **MES is a critical enabler of core compliance requirements:**
    - ✓ **Process Control**
    - ✓ **Traceability**
    - ✓ **Audit trail for Compliance Declaration**
    - ✓ **Enterprise Integration**
  - ✓ **A PLM approach offers manufacturers the strategic capability to cover all aspects of compliance requirements:**
    - ✓ **Functional -> As Designed -> As Planned -> As Built ->As Maintained**
- 
- A person in a light-colored shirt and dark trousers is walking away from the camera down a brightly lit factory hallway. The hallway has large windows on the right side, and the floor is polished and reflective. In the background, there are industrial machines and equipment.

Thank You

[www.ugs.com/tecnomatix](http://www.ugs.com/tecnomatix)

Premium Partners:



Microsoft