Methodically Tracking Down Cleanliness Related Failures

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Outline

- Introduction
- Initial Questions to Ask
- Defining Process and End-Use Elements - Method
  - To better understand failure cause and residue origins.
- Residue Overview – Usual Suspects
- Analytical Techniques to Use
- What should I provide in addition to the failure?

Introduction

- Field Failures are inevitable!
  - Results can be mechanical, electrical, chemical
- Cleanliness related failures can be among the most difficult to diagnose.
  - Multiple residues and sources of introduction
  - The end use environment is variable
  - Most FA studies only involve the failures not known good items for comparison
- Provide a methodology that can be used to backtrack from a field failure to the true root cause
  - What information to gather before calling your friendly test lab professional

Initial Questions To Ask

- Is this a one time failure or broad based?
- Is the failure tied to a known or identified event?
  - Example: hurricane blew in, hydraulic fluid spill
- Did the assemblies in question receive standard processing or a “special” process?
  - Engineering units, non-standard rework methods
- Is this a field failure or a test failure?
- What is the field history of the unit(s)?

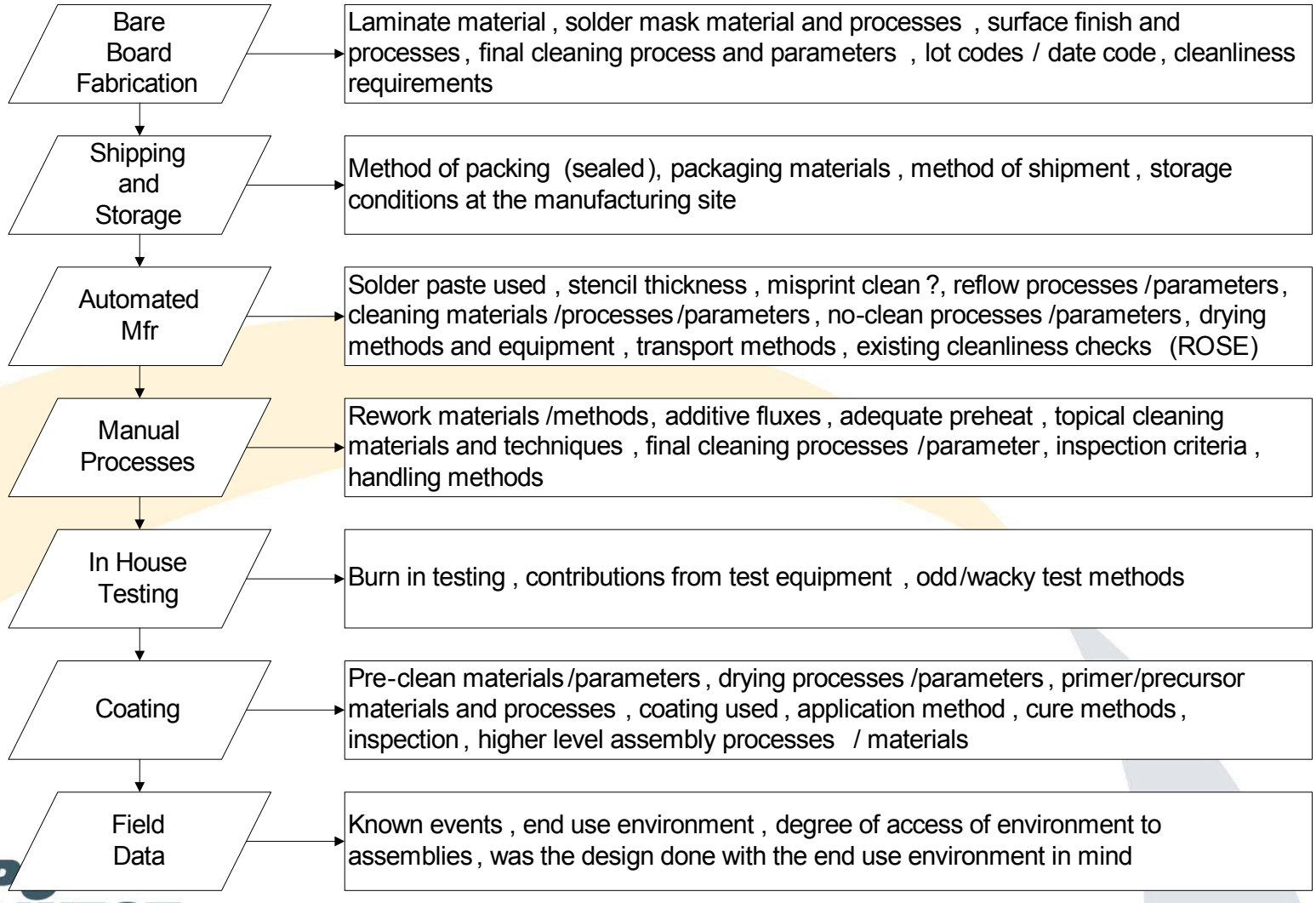
Initial Questions To Ask

- Is the manufacturing process I think was used the manufacturing process that was actually used?
- Does the onset of field failures correlate to a change in materials, manufacturing process or change in supplier?
- What are my material sets?
  - Laminate, mask, surface finish
  - Residues come from materials, from processes, from the end use environment, and from raccoons

Back Tracking with Residues

- Walk backward from the field
- What residues may have come from:
  - The end use environment (the field)
  - Shipping
  - Final Assembly and Test
  - Rework and Repair Operations
  - Automated Assembly Centers
  - The components
  - The bare boards

Walk the Process



Elements of A Good Analysis

- Identifying the “True” Root Cause
  - Not only requires testing the failed unit(s), but defining how the problem came about in the first place.
  - Analyzing the failed units alone may not provide sufficient data to correlate to a corresponding cause (i.e. only half of the puzzle).
  - Passing the buck (not my fault)
  - You have to have a point of reference (known good)

Where Your Lab Dude Enters In

- Understanding the sources and typical values of residues and where they arise in the life of the product
  - A lab professional is part chemist, part materials scientist, part process engineer, part Labrador retriever, part Sherlock Holmes
  - Know what residues most often come from what materials or what manufacturing step in the operation
  - Know what test methods produce what results and what test approaches are not value added
  - BUT, we all need good data to provide good analyses

The Usual Suspects

- Chloride: In sufficient quantities (varies by design, end use application, etc.) can cause leakage currents in low levels to metal migration in higher concentrations. Has numerous origins from incoming boards, components, fluxes, outside environment.

- Bromide: Primarily when coming from a flux can lead to electrochemical events. Bromide as a result of fire retardant is typically benign.

The Usual Suspects

- Sulfate: Causes corrosion and electrical leakage. Can come from numerous sources.

- Weak Organic Acids (WOA's): Primarily lead to electrical leakage currents. Over forty materials classified as WOA's available for flux formulators to use. Can come from board fabrication as well. Does not come from the field.

- Particulate Matter (Crud)

Analytical Techniques To Use

- ROSE Testing
  - Basically meaningless
- Ion Chromatography (IC) - preferred
  - Optimum for ionic residues
- Fourier Transform Infrared Spectroscopy (FTIR)
  - Good for evaluating organic materials
- Scanning Electron Microscopy with Energy Dispersive X-ray (SEM / EDX)
  - Ideal for elemental analysis
  - Often mistakes elements from the materials with residues from the manufacturing process

Additional Items to Consider

- There are additional items that should be considered as part of the FA test matrix. These would include:
- Bare Boards
  - Preferably from the same date code as the failed unit. However, not always available.
- Components
- Soldering Materials
- Cleaning Chemistry / Rinse Water – If Used.
- MSDS Sheets on all materials.

Questions?