SupplyVelocity®

CASE STUDY

Quality Improvement & COPQ

Chemical Mfg.

PROBLEM / CHALLENGE

This chemical manufacturer had grown quickly but had numerous 'hidden factory' quality problems. The CEO believed the defects (internal and customer returns) and other mistakes such as order entry and shipping errors creating excess cost and lost sales.

They were ISO 9001 certified but quality was a chemistry (lab) function, not a way to identify, quantify and reduce defects or errors.

COST OF POOR QUALITY (COPQ)

The cost of poor quality quantifies the obvious (such as rework and replacement) and costs that are less obvious such as discussion and resolution of the problem. We call these 'above the water line' and 'below the water line' costs. An important aspect of quality improvement is to quantify the cost of defects and mistakes.

QUALITY IMPROVEMENT AND PROJECT COPQ DETAILS

- **Created a 'sense of urgency' and immediate analysis of all defects and other mistakes affecting internal and external quality**
  - o Set up 30 minute root cause analysis meetings the next day after a defect or mistake that affected quality was discovered
  - o Invited cross functional team (purchasing, production, lab, finance)
  - o Made sure the operator (production or warehouse) or customer service rep participated

- **Determined root cause of all defects and mistakes**
  - o Used fishbone diagram in every meeting to brainstorm root cause (see page 2)
  - o Every defect or mistake was assigned a root cause including 'unknown'

- **Created a big-picture view of quality**
  - o Internal: in-process product corrections, defective product
  - o External: shipped the wrong quantity or wrong product, or to the wrong location

- **Quantified the cost of poor quality**
  - o Each defect and mistake type went through a cost-of-poor quality quantification analysis

ROOT CAUSE ANALYSIS OF DEFECTS AND CUSTOMER RETURNS

| Batch Ticket #	Non-Conformance #	Date	Bad Batch Date	Operator	Formula	Business Area	Quanti... (#s)	Issue Type	Notes	Status	Root Cause
64322	3230	04/12/24 12:39 PM	04/12/24	Gerson A	A-30000	FS	21,270	Bad Batch	Incorrect Processing	Closed	Procedure
64337	3228	04/15/24 12:35 PM	04/15/24	Kyle Do	0-B-30000-S30	CC	4,550	Bad Batch	Inventory Scheduling Error	Closed	Inventory Availab
63465	3195	05/08/24 8:55 AM	03/11/24	Dakota	3-30000	CC	1,356	Bad Pack	Batch was packed and shipped to Customer. Customer reported "trash" in the material. Batch Packer did not properly filter material when packing.	Closed	Production Equip
64115	3217	05/08/24 9:07 AM	04/03/24	Kyle Ke	0-A-30000	HC	5,000	Bad Batch	Off-Spec Raw Material. Material from COIM was bad. Since we're no longer getting material from COIM, the issue is closed.	Closed	Raw Material Issu of Spec
64605	3251	05/08/24 9:19 AM	05/02/24	Jeff Hev	1-30000	CC	1,780	Bad Batch	Off-Spec Raw Material. Material was off-color / out of spec. Identified potential error with the raw material going into the batch.	Closed	Raw Material Issu of Spec
64924	3257	05/08/24 9:19 AM	05/07/24	Jeremy	3-30000	HC	2,740	Bad Batch	Poor Wash Out. DBE from the previous cleanout was still in the vessel.	Closed	Procedure
64317	3243	05/08/24 9:35 AM	04/24/24	AJ Talki	32-B-30000	CC	13,400	Bad Batch	Could not determine the exact root cause of the bad batch, but we identified problems with the formula / process.	Closed	Raw Material Issu of Spec
65238	3272	06/03/24 8:23 AM	05/16/24	Derrik M	ANS-A-30000	IP	225	Bad Batch	Old GOLIVE lot was stored in the heat room for a year then went into the batch. Too old & improper storage!	Open	Raw Material Issu of Spec
65138	3283	06/03/24 8:37 AM	05/16/24	Derrik N	3	Intermediate	450	Bad Batch	Moisture was too high. Potential issue with the raw material & potential issue with the processing (did not remix under nitrogen or under a lid!).	Closed	Operator Error
65507	3305	06/07/24 1:59 PM	06/04/24	Derrik M.	A-30000	FS	445	Bad Batch	Batch maker used a tote stored outside to transfer the RA2-200 from the bulk tank to the open-top vessel. Believed that moisture from the tote contaminated the raw material, which led to low NCO, high viscosity. Material started to foam in vessel - sign of high moisture.	Closed	Procedure

CAUSE & EFFECT – ROOT CAUSE ANALYSIS
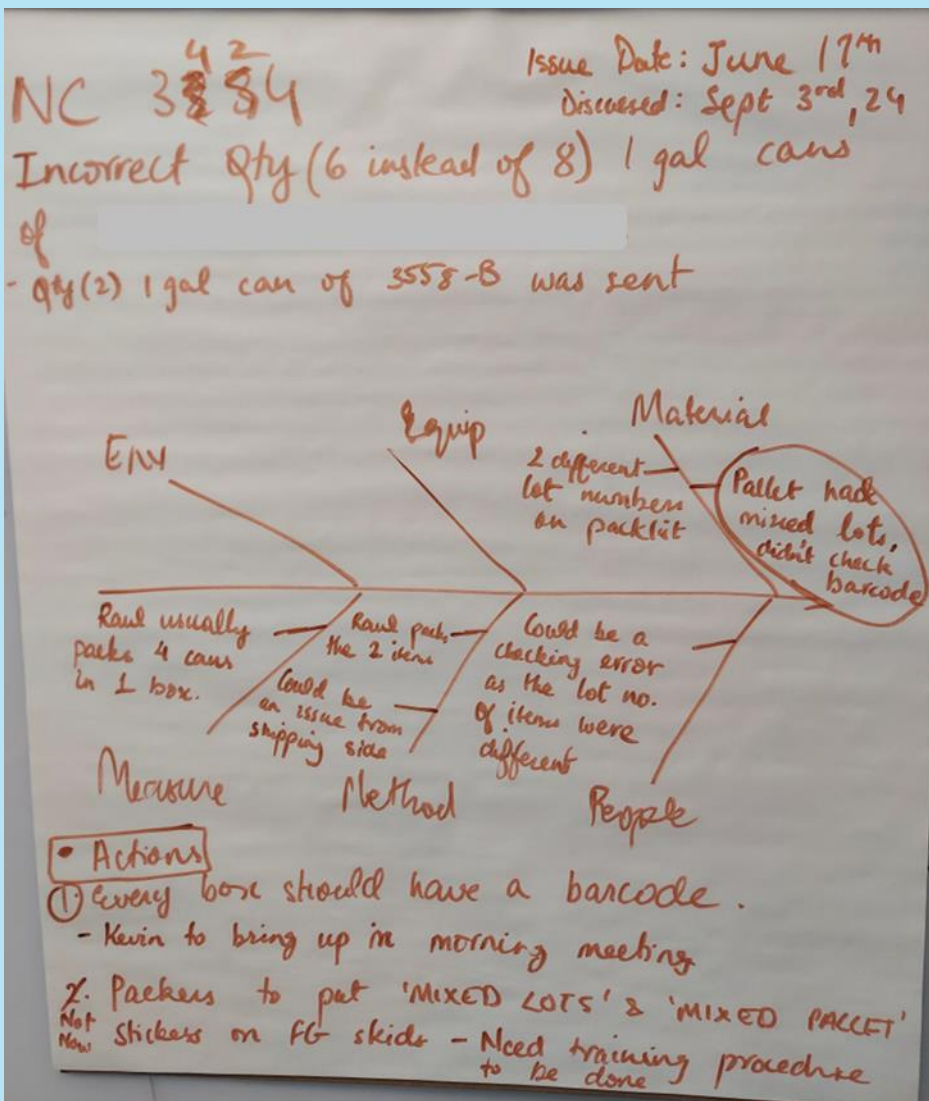
ROOT CAUSE DATA CAPTURE

- **Every defect is logged in a Smartsheet**
  - Non-conformance number
  - Date
  - Operator who caused the defect
  - Product
  - Quantity
  - Root cause
  - Follow-up action items open or close status

- **Example Cause & Effect Diagram**
  - Use the standard 6 possible cause categories to initiate brainstorm
    - Environment
    - Equipment
    - Material
    - Measurement
    - Method
    - People

- **Likely Cause**
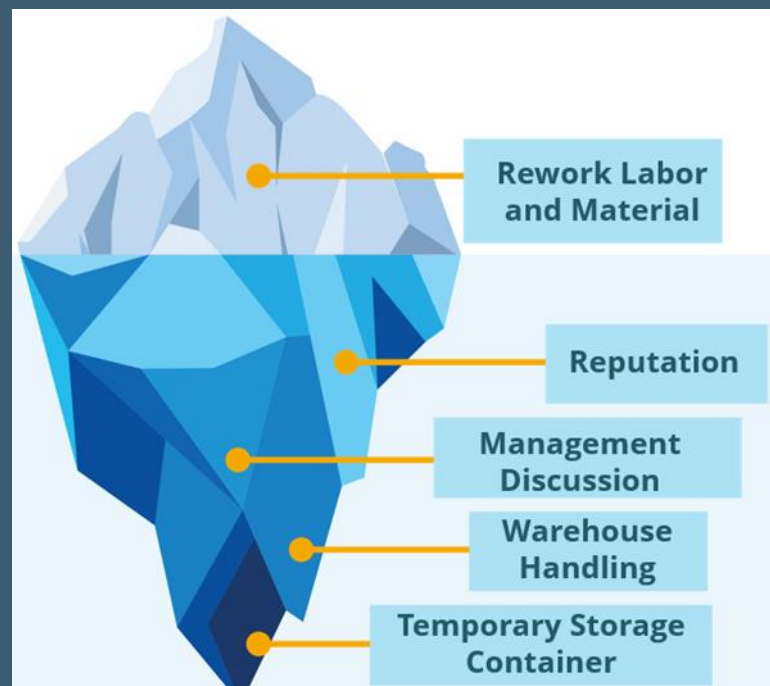 - The team determined that the pallet having different products caused the mis-shipment

PARETO ANALYSIS OF DEFECTIVE PRODUCT

Bad Batch Root Causes
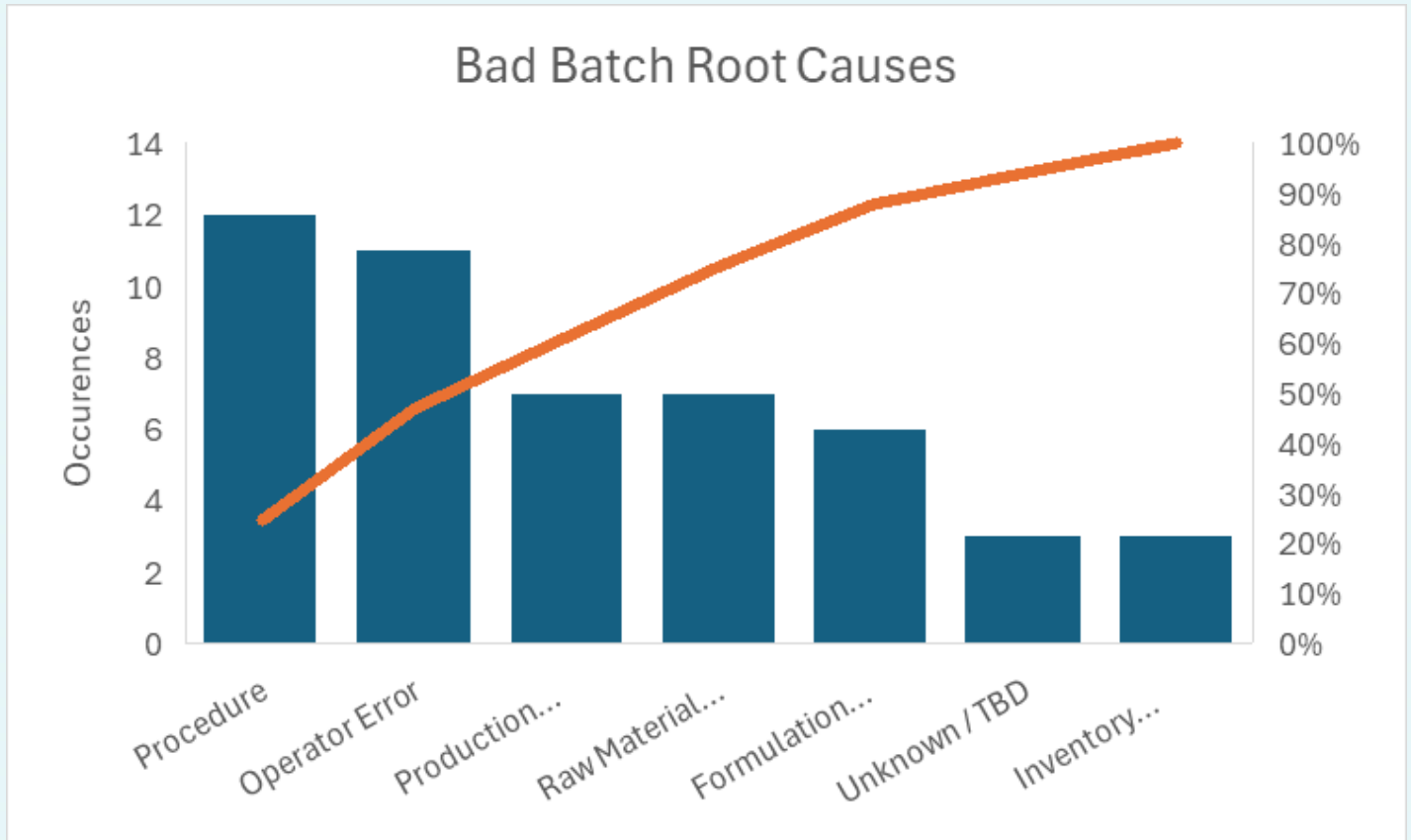
PARETO ANALYSIS OF DEFECTS

- **Procedure**
  - Work instructions are incorrect or vague

- **Operator Error**
  - Operator (can be production operator, warehouse person, customer service representative) made a mistake

- **Production Equipment**
  - Equipment either malfunctioned or was not capable of achieving process specifications

- **Raw Material**
  - Defect caused by materials or components out-of-specification

- **Unknown**
  - In the 30 minute meeting or after 30 days of additional review, the team cannot determine a likely cause

VISIBLE AND HIDDEN COSTS

Rework Labor and Material

Reputation

Management Discussion

Warehouse Handling

Temporary Storage Container

RESULTS

- **Defective Manufactured Product**
  - Decreased from 5.5 per month to 2.5
  - Annualized savings of $300,000

- **First pass yield**
  - Increased from 91.5% to 95.7%

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