Improving the Quality of PFMEAs

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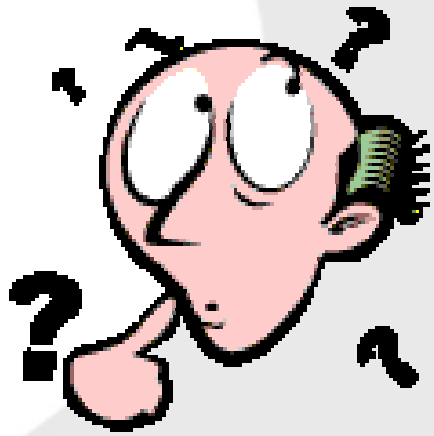
Why am I here today?



Today's Agenda:

1. Introduction
2. Brief Background
3. Common Errors in PFMEAs
4. Supplier PFMEA Audit
5. Questions

Current Paradigm

FMEA

- Taken lightly
  - … "Selective" products/processes chosen
  - … Based on opinion
  - … All "magically" below the RPN cut-off
- Too late
  - … Error/Mistake proofing window long gone
  - … Rarely validated with field results

"Paper exercise done when pushed"

New Paradigm

FMEA *Drives*

- Error/Mistake Proofing
- Process Control Plans
- Maintenance Plans

- Taken seriously
  - … All critical and new products/processes
  - … Data driven
  - … Roll-up RPN values (Green Y philosophy)
- Early
  - … Completed while design is still fluid
  - … "Living" document

"Ensures our products and processes are robust"

What are some common errors?

1. Not started because production equipment not operational.
2. Looking only at RPNs when prioritizing Recommended Actions.
3. Not following minimum guidelines for Severity rankings.
4. RPN below "target level" and no further action needed.
5. Filled out using ONLY references to other documents.

What are some common errors?

6. Effects of Failure not "Customer" effects.
7. Not distinguishing between types of controls.
8. Inconsistency in Severity or Detection rankings.
9. Detection ranking too low.
10. Insufficient Controls for Severity rankings of 8, 9 or 10.

PFMEA not started because production equipment not operational

- Minimum documents required to start a PFMEA:
  - Process Flow Chart
  - Risk Assessment
  - Work Instructions

- The PFMEA should be updated later with findings from trial/pilot runs.

Looking only at the RPN's when prioritizing Recommended Actions

Process Function / Requirements	Potential Failure Mode	Potential Effect(s) of Failure	Sev	Class	Potential Cause(s) / Mechanism(s) of Failure	Occur	Current Process Controls Prevention	Current Process Controls Detection	Detect	RPN
OP:20	great (greater than x criteria	Fracture of wheel-does not meet FMVSS requirements	10		Hydrogen Supersaturation due toexcessive weight melt temperature.	2	Automated Temperature Controls in melt furnace	Strip charting and SPC	6	120
OP:170	Surface contami not com removed	Unacceptable Appearance noticed by most customers	4		Contamination in Rinse Water	5	Periodic exchange of DI water-once per shift	100% visual inspection at Op. 180	8	160

- For Severity, OP. 20 is much more critical than OP. 170.
- The RPN number suggests OP. 170 is a higher priority.
- What would be the results of a quality spill for OP. 20 vs. OP. 170?

Not following minimum guidelines for Severity rankings

- Misidentifying "Potential Effects of Failure" can make establishing meaningful Severity rankings difficult.
- "Legal" concerns sometimes drive lower rankings.
- Note: If the severity received a ranking of 9 or 10, it is important to include a Customer- or Supplier-specific safety symbol to highlight its significance.

RPN below "target level" and no further action needed

Detect	RPN	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
				Action Results	Sev	Occ	Det	RPN
2	24	N/R						
2	36	N/R						
4	42	N/R						

- PFMEA is a continuous improvement tool and a living document.
- Reducing occurrence should continue to be a goal long after error- or mistake-proofing has been implemented.

Filled out using ONLY references to other documents

Potential Cause(s) / Mechanism(s) of Failure	Occur	Current Process Controls Prevention	Current Process Controls Detection	Detect
Too Small Shot Blast Media Used	3	W.I. 483-11-04	Form F-19.78	2
Tool Wear	3	W.I. 483-11-04	Form F-19.78	2

Advantage

- This is great for TS/QS documentation purposes.
- Modification not required when document changes.

Disadvantages

- Impossible to assess appropriateness of Detection rankings without referenced documents.
- Encourages "check-the-box" mentality.

Effects of Failure not "Customer" effects

Process Function / Requirements	Potential Failure Mode	Potential Effect(s) of Failure	Sev
OP. 210 Valve Hole Deburr/ Burr Free	Burrs	Excessive scrap/ downtime	7
OP. 220 Punch Hole/Hole Diameter 10.0 mm +/-0.2	Hole Diameter >10.2 mm.	Bolt loose	5

- Consider what would happen if there were NO CONTROLS!
- "Scrap/downtime" are true, but are not what the "Customer" would notice or experience.
- Think of what the customer would notice/experience if the "Bolt" was "loose."

Not distinguishing between types of controls

- Prevention affects ONLY Occurrence rankings.
- Detection affects ONLY Detection rankings.
- Not knowing the difference often leads to incorrect Detection rankings.
- When using 2nd edition FMEA Manual form, Controls must be labeled (P) for Prevention and (D) for Detection.
- 3rd edition form has two separate columns for Prevention and Detection Controls.

Inconsistency in Severity or Detection rankings

Current Process Controls Prevention	Current Process Controls Detection	Detection
Standardized work instructions	Final Functional Testing Machine	3
Standardized work instructions	Final Functional Testing Machine	2

- Final Functional Testing is called out as both a 3 and 2. Why?
- Clarify/be more specific if Control is truly different.

Detection ranking too low

Process Function / Requirements	Potential Failure Mode	Potential Effect(s) of Failure	Sev	Class	Potential Cause(s) / Mechanism(s) of Failure	Occur	Current Process Controls Prevention	Current Process Controls Detection	Detect
OP. 210 Valve Hole deburr/all burrs removed	Not all burrs removed.	Flat tire-Value Stem cut during tire mounting.	7		Operator did not remove all burrs-insufficient lighting.	4	Standardized Work Instructions	100%Visual Inspection at Op. 220.	3

- In this example, the Detection Controls are 100% visual inspection.
- The Detection ranking should be an 8, not 3.

Insufficient Controls for Severity rankings of 8, 9 or 10

Process Function / Requirements	Potential Failure Mode	Potential Effect(s) of Failure	Sev	Class	Potential Cause(s) / Mechanism(s) of Failure	Occur	Current Process Controls Prevention	Current Process Controls Detection	Detect	RPN
OP:20 Aluminum Melt/Gas Porosity not to exceed x criteria	Gas Poros great (gre criteria	Fracture of wheel-does not meet FMVSS requirements	10		Hydrogen Supersaturation due toexcessive weight melt temperature.	2	Automated Temperature Controls in melt furnace	Strip charting and SPC	6	120

- A non-conformance for OP. 20 can result in a Field Campaign/Recall.
- While SPC is good at detecting trends, it cannot detect with much certainty a single, random non-conformance.
- Error/Mistake-proofing must be implemented (Detection ranking of 3 or less) for Severity rankings of 9 or 10.
- Limit Detection ranking to no greater than 4 for Severity ranking of 8.

Supplier PFMEA Audit

What is the Audit?

- An objective tool to evaluate the quality of the PFMEA

Why was the Audit Form Created?

- Previous process involved individuals applying their own criteria for determining what made a "good" vs. "bad" PFMEA (often inconsistent and confusing).
- PFMEA best practices were not being shared.
- Needed to find a way to accelerate PFMEA improvement.

Who will use the Audit?

- **Suppliers** (self-assessment)
- **Customers** (evaluate Supplier PFMEA submissions)

What can the audit do?

- The form is really **2-in-1** and has the flexibility to be used:
  - by those **creating or developing** the PFMEA (supplier manufacturing engineer, design engineer, quality engineer, etc.), or
  - by those conducting a "**3rd party" audit** of the PFMEA (supplier or customer corporate quality function, etc.)

What are some of the things the audit form can help detect?

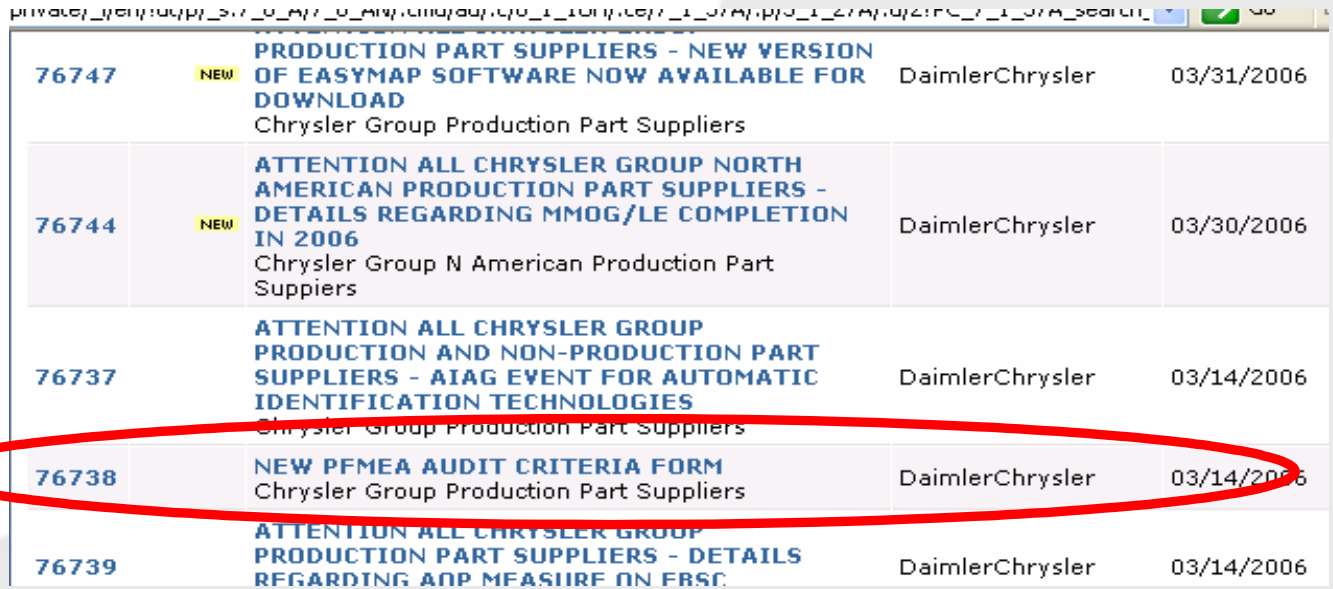
- It can help detect whether:
  - a cross-functional team provided input during the creation of the PFMEA
  - the probability of occurrence was created using real world data
  - previous internal or external rejects were included
  - the DFMEA was referenced/used in the creation of the PFMEA

How do you use the Audit form?

- The use of the form is straight forward:
  - If you are **creating or developing** (or wish to do a "deep dive" into the data behind the PFMEA), answer **ALL questions** on the form.
  - If you are conducting a "**3rd party" audit** of a PFMEA, answer only those **questions not shaded/italicized.**

Where can I find the Audit form?

- Go to Covisint and log in.
- Go to DaimlerChrysler page.
- Go to bulletin 76738.



76747	NEW	PRODUCTION PART SUPPLIERS - NEW VERSION OF EASYMAP SOFTWARE NOW AVAILABLE FOR DOWNLOAD Chrysler Group Production Part Suppliers	DaimlerChrysler	03/31/2006
76744	NEW	ATTENTION ALL CHRYSLER GROUP NORTH AMERICAN PRODUCTION PART SUPPLIERS - DETAILS REGARDING MMOG/LE COMPLETION IN 2006 Chrysler Group N American Production Part Suppiers	DaimlerChrysler	03/30/2006
76737		ATTENTION ALL CHRYSLER GROUP PRODUCTION AND NON-PRODUCTION PART SUPPLIERS - AIAG EVENT FOR AUTOMATIC IDENTIFICATION TECHNOLOGIES Chrysler Group Production Part Suppliers	DaimlerChrysler	03/14/2006
76738		NEW PFMEA AUDIT CRITERIA FORM Chrysler Group Production Part Suppliers	DaimlerChrysler	03/14/2006
76739		ATTENTION ALL CHRYSLER GROUP PRODUCTION PART SUPPLIERS - DETAILS REGARDING AQP MEASURE ON EBSC	DaimlerChrysler	03/14/2006

Supplier Process FMEA: Audit Summary

	MY/Program				
	Name of Component, Sub-System or System:				
	Part Number(s)				
	Responsible Supplier:				
	Responsible Supplier Quality Specialist:				
	Name of Auditor:				
	Date Reviewed:				
	Original ASQP Specialist Opinion in Powerway.com (circle one):	Green	Yellow	Red	None
	Original Supplier Opinion in Powerway.com (circle one):	Green	Yellow	Red	None
	Date of PFMEA (Original or Rev. Level):				

Overall Rating:	**"X"**	
Header Overall: "Yes"_____ "No"_____		**Header "Yes" overall and no more than three sections "E/I" overall = "Green"**
Number of non-Header sections (2 through 13) not ok:_____		**Neither "Green" nor "Red" criteria met = "Yellow"**
		Six or more non-Header sections "No" overall = "Red"

1	**Does the Header Contain Adequate Information ?**	**Yes**	**E/I**	**No**	**N/A**	**Auditor Comments**
1a	Name of Vehicle(s)/Program(s) included?		-		-	
1b	Model Year of Program(s) included?		-		-	
1c	Name of Supplier included?		-		-	
1d	Part Number and Description included?		-		-	
1e	Core Team includes (as a minimum) from DCX: Supplier Quality representative and design-responsible Engineer and from Supplier: Quality Engineer, Plant Mfg. Engineer, Production representative? Names and title or area of responsibility are included? Note: Phone #'s recommended, but not mandatory for this audit.		-		-	
1f	Key Date Shown is PPDC date (new business sourced prior to PPDC) or does not exceed PPAP date (new business sourced after PPDC or non-CDS programs)? Note: PPDC date is same as Gate EF date.		-		-	
1g	FMEA Date (Orig.) is shown?		-		-	
1h	FMEA "(Rev.)" date within past 60 days? Note: "N/A" if "(Orig.)" date is within 60		-		-	

Note 1: "E/I" = only minor "E"xceptions or requirement "I"nconsistently applied (approx. 25% or less) and correction still required.

Note 2: Do not have a given issue negatively affect more than one question.

Note 3: Questions in italics (shaded) are designed to aid those on the core team to create/evaluate the PFMEA more in depth. They are not required to be answered by those conducting "3rd Party" audits.

2	*General Requirements for all PFMEAs*	*Yes*	*E/I*	*No*	*N/A*	*Auditor Comments*
2a	*All process steps included in the Process Flow Diagram and Work Instructions have been included in the PFMEA or a risk assessment was done and only medium/high risk steps have been included?*				-	
2c	*A review of all Safety Office Campaign and Yard Hold records was done and all relevant issues are included in the PFMEA? Notes: 1) DCC Supplier Quality Specialist/Engineer to provide response. 2) If no relevant Campaigns or Yard Holds, answer "Yes."*				-	
2d	*All internal nonconformances over the past 6 months minimum caused by the existing or a surrogate process have been included in the PFMEA?*				-	
2e	*All external (customer) nonconformances over the past 12 months minimum caused by the existing or a surrogate process have been included in the PFMEA?*				-	
2f	*All else ok (no other issues)?*				-	
	If all answers "Yes," check "Yes." If one or more "No," check "No." Otherwise, "E/I."				-	

3	**Is the Process Function/Requirements Column Adequate?**	**Yes**	**E/I**	**No**	**N/A**	**Auditor Comments**
3a	Each operation is (briefly) described using a verb/noun (bend tube, apply primer, pierce hole, etc.), rather than just numbered? Note: Noun not required if implied (i.e., "heat treat" alone vs. "heat treat bolt" is acceptable if there is only one component being heat treated).				-	
3b	Requirements of part/process included or implied (bend angle within design limits, minimum primer thickness, hole diameter within spec. limits, flatness of surface within spec. limits, length of tube 25mm. +/- 2, etc.)? Note: Including spec. values (25 mm. +/- 2) recommended, but not required for this audit.				-	
3c	All else ok (no other issues)?				-	
	If all answers "Yes," check "Yes." If one or more "No," check "No." Otherwise, "E/I."				-	

Supplier PFMEA Audit Summary - Page 2

4	**Potential Failure Modes Column Adequate?**	**Yes**	**E/I**	**No**	**N/A**
4a	Failure Modes specific and written as a negative outcome of "Requirements" ("bend angle too great" vs. "bend angle not to spec.", "hole dia. too big" vs. "hole dia. incorrect", "surface too rough" vs. "surface roughness out of spec.", "primer				-

Supplier PFMEA Audit Summary - Page 2

	Potential Failure Modes Column Adequate?	**Yes**	**E/I**	**No**	**N/A**	
4a	Failure Modes specific and written as a negative outcome of "Requirements" ("bend angle too great" vs. "bend angle not to spec.", "hole dia. too big" vs. "hole dia. incorrect", "surface too rough" vs. "surface roughness out of spec.", "primer too thin" vs. "primer thickness incorrect", "tube too long" vs. "tube length incorrect")?				-	
4c	*All applicable Failure Modes from the DFMEA have been included in the PFMEA? Notes: 1) If Failure Mode description is not acceptable, do not include. 2) If no DFMEA exists, mark "N/A."*					
4d	All else ok (no other issues)?				-	
	If all answers "Yes" or "N/A" check "Yes." If one or more "No," check "No." Otherwise, "E/I."				-	

	Potential Effects of Failure Column Adequate?	**Yes**	**E/I**	**No**	**N/A**	**Auditor Comments**
5a	Effects written in terms of what customer (downstream process or end user) will notice/experience ("unable to assemble" or "bsr" not just "scrap" or "FTC")? Note: This is a description of what would happen if there were no controls from operation being analyzed through end user (i.e., no inspection, poke yokes, vehicle audits, etc.).				-	
5b	*Customer Engineering provided input on Effects?*				-	
5c	*Receiving manufacturing plant provided input on Effects?*				-	
5d	*All applicable Effects from the DFMEA have been included in the PFMEA? Notes: 1) If Effects description is not acceptable, do not include. 2) If no DFMEA exists, mark "N/A."*					
5e	All else ok (no other issues)?				-	
	If all answers "Yes" or "N/A" check "Yes." If one or more "No," check "No." Otherwise, "E/I."				-	

	Severity	**Yes**	**E/I**	**No**	**N/A**	**Auditor Comments**
6a	Severity rankings not *underrated* based on AIAG Manual criteria? Note: Overrating not recommended, but not requirement for this audit.				-	
6b	Severity rankings identical for identical Potential Effects?				-	
6c	*All applicable Severity rankings from the DFMEA have been included in the PFMEA? Notes: 1) If rankings not acceptable, do not include. 2) If no DFMEA exists, mark "N/A."*					
6d	All else ok (no other issues)?				-	

7	Class	Yes	E/I	No	N/A	Auditor Comments
7a	Safety classification symbol (DCX's or Supplier's) present for all Severity 9 or 10?					
7b	Critical/key classification symbol (DCX's or Supplier's) present for all Severity 8?					
7c	*Classification symbols for Severity 7 or below for the same Effect on the DFMEA have been included in the PFMEA? Note: If no DFMEA exists, mark, "N/A."*					
7d	All else ok (no other issues)?				-	
	If all answers "Yes" or "N/A" check "Yes." If one or more "No," check "No." Otherwise, "E/I."				-	

8	Potential Causes Column Adequate?	Yes	E/I	No	N/A	Auditor Comments
8a	Descriptions specific? Note: 1) "Incorrect set-up", "improper cooling", etc. must be replaced by or include specific description of what was "incorrect" (temp. set too high) or "improper" (time too short). 2) Replace "operator error" with "operator installed widget upside down."					
8b	All else ok (no other issues)?				-	
	If all answers "Yes" or "N/A" check "Yes." If one or more "No," check "No." Otherwise, "E/I."				-	

9	Occurrence	Yes	E/I	No	N/A	Auditor Comments
9a	One Occurrence ranking for each cause ("worn/broken tool" must have two separate rankings)?				-	
9b	*Internal (past 6 months minimum) and external (past 12 months minimum) nonconformance data from the existing or a surrogate process were used to determine Occurrence rankings?*				-	
9c	*Occurrence rankings are 2 or greater unless Potential Cause has **never** been shown to create Failure Mode?*					
9d	All else ok (no other issues)?				-	
	If all answers "Yes," check "Yes." If one or more "No," check "No." Otherwise, "E/I."				-	

Supplier PFMEA Audit Summary - Page 3

10	Current Controls Column Adequate?	Yes	E/I	No	N/A	Auditor Comments
10a	Controls correctly identified as either Detection ("D") (Mistake Proof, 100% visual insp., etc.) or Prevention ("P") (visual aids, training, PM, etc.) controls? Note: 1) separate set-up process (prev.) from 1st piece inspect. (det.). 2) Error-Proofing is preventive (can't make), but may be listed as "P" or "D" or both.				-	
10b	Controls are adequately explained and do not just reference a document number?				-	
10c	All else ok (no other issues)?				-	

Questions?