Table 1: Process Failure Mode and Effects Analysis (FMEA)

FMEA Type: Process		Project Name/Description: Pencil							Date: February 10, 2015					
Responsibility/Function: to make a black mark						Prepared By: Kate Gilland								
Process FMEA (Function/ Requirements)	Potential Failure Mode	Potential Effect(s) of Failure	Sev	Potential Cause(s)/ Mechanism(s) of Failure	Occur	Current Controls Detection	Detec	RPN	Recommended Actions	SEV	OCCUR	DETEC	RPN
To make a mark	Makes no mark	-loss of primary function -customer very dissatisfied	8	-graphite missing in pencil - wooden outside doesn't properly expose graphite	4	-test station for marking	3	96	-have mid-procedure check station after graphite installation to make sure it was installed correctly	8	2	3	48
Marks a black color	Mark is not black in color	-customer dissatisfied; expecting black -reduced level of primary function	7	-bad graphite mixture -human error with mixture	3	-test station for marking	6	126	-check graphite mixture before it is inserted into wooden casing -make sure test section is color sensitive if it is a machine	7	2	2	28
Intermittenly fails to mark	Marks intermittenly	-operable but inconvenient	5	-graphite not installed correctly -bad graphite mixture	7	-test station for marking	8	280	-check graphite mixture before it is inserted into wooden casing -test the final product for a long enough time to account for intermitten marks	5	4	5	100

Table 2: Severity Evaluation Criterion

Effect	Customer Effect	Manufacturing/Assembly Effect	Ranking

Harzardous without warnig	Very high severity when a potential failure mode affects safe operations and/or involves noncompliance with government regulation without warning.	Or may endanger operator without warning.	10
Hazardous with warning	Very high severity when a potential failure mode affects safe operations and/or involves noncompliance with government regulation with warning.	Or may endanger operator with warning.	9
Very high	Item inoperable (loss of primary function).	Or 100% of product may have to be scrapped, or item repaired in repair department with a repair time greater than one hour.	8
High	Item inoperable but at a reduced level of performance. Customer very dissatisfied.	Or product may have to be sorted and a portion (less than 100%) scrapped, or item repaired in repair department with a repair time between a half-hour and an hour.	7
Moderate	Item operable but comfort/convenience item inoperable. Customer dissatisfied.	Or a portion (less than 100%) of the product may have to be scrapped with no sorting, or item repaired in repair department with a repair time less than a half-hour.	6
Low	Item operable but comfort/convenience item inoperable at reduced level of performance.	Or 100% of product may have to be reworked, or item repaired off-line but does not go to repair department.	5
Very low	Item does not conform. Defect noticed by greater than 75% of customers.	Or the product may have to be sorted, with no scrap, and a portion (less than 100%) reworked.	4
Minor	Item does not conform. Defect noticed by 50% of customers.	Or a portion (less than 100%) of the product may have to be reworked, with no scrap, on-line but out-of-station.	3
Very minor	Item does not conform. Defect noticed by less than 25% of customers.	Or a portion (less than 100%) of the product may have to be reworked, with no scrap, on-line but in-station.	2
None	No discernible effect.	Or slight inconvenience to operation or operator, or no effect.	1

Table 3: Occurrence Evaluation Criterion

Probability	Likely Failure Rates	Ranking
Very high: Persistent failures	≥ 100 per thousand items	10
	50 per thousand items	9
High: Frequent failures	20 per thousand items	8
	10 per thousand items	7
Moderate: Occasional failures	5 per thousand items	6
	2 per thousand items	5

	1 per thousand items	4
Low: Relatively few failures	0.5 per thousand items	3
	0.1 per thousand items	2
Remote: Failure unlikely	≤ 0.01 per thousand items	1

Table 4: Detection Evaluation Criterion

Detection	Criteria	Suggestion Range of Detection Methods	Ranking
Almost impossible	Absolute certainty of no detection	Cannot detect or is not checked	10
Very remote	Controls will probably not detect	Control is achieved with indirect or random checks only	9
Remote	Controls have poor chance of detection	Control is achieved with visual inspection only	8
Very low	Controls have poor chance of detection	Control is achieved with double visual inspection only	7
Low	Controls may detect.	Control is achieved with charting methods, such as SPC (Statistical Process Control)	6
Moderate	Controls may detect.	Control is based on variable gauging after parts have left the station, or Go/No Go gauging performed on 100% of the parts after parts have left the station.	5
Moderately high	Controls have a good chance to detect.	Error detection in subsequent operations, OR gauging performed on setup and first-piece check (for setup causes only)	4
High	Controls have a good chance to detect.	Error detection in-station, or error detection in subsequent operations by multiple layers of acceptance: supply, select, install, verify. Cannot accept discrepant part.	3
Very high	Controls almost certain to detect.	Error detection in-station (automatic gauging with automatic stop feature). Cannot pass discrepant part.	2
Very high	Controls certain to detect.	Discrepant parts cannot be made because item has been error-proofed by process/product design	1