

Defining Human Error & Its Causal Factors

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Agenda

- # Definition and categories of human error
- # Model of an intolerable adverse effect
- # The four levels of human error
- # Total reliability / quality / safety function
- # Taxonomy of human error causal factors
- # Case study to demonstrate use of the taxonomy
- # Benefits of using the taxonomy
- # Fields of focus for human error prevention

Human Error

Behavior
that is
wholly expected to achieve a desired result
(in accordance with the standard)
but that does not

NOT Human Error

- # Malicious compliance
- # Malicious behavior
- # Good decisions with bad outcomes

Human Error Categorizations

- # Commission or omission human error
- # Timing of the adverse effect of human error
- # Significance of the adverse effect of human error
- # Levels of human error in the sequence
- # Causal factors of human error
- # Fields of focus for human error prevention

Marguglio's Model of an Intolerable Adverse Effect

Hazard with a Potential Intolerable Adverse Effect

Error Level 1: Holes in Barriers to Prevent Initiating Error

Holes in Barriers ALIGNED

Error Level 2: Initiating Error

Error Level 3: Holes in Barriers to Detect Error or Activated Hazard

Holes in Barriers ALIGNED

Lesser chance to mitigate

Error Level 4: Holes in Barriers to Mitigate Effect of Hazard

Holes in Barriers ALIGNED

INTOLERABLE ADVERSE EFFECT!

Feigenbaum's Total Quality Function

Quality of Design	X	X
Quality of Conformance	X	X
	Prevention	Detection & Correction

Marguglio's Adaptation - Total Reliability / Quality / Safety Function

Quality of Design	<p>Admin Process Barriers Tech Process Barriers Equipment Barriers Human Barriers</p>	<p>Admin Process Barriers Tech Process Barriers Equipment Barriers Human Barriers</p>
Quality of Conformance to Design	<p>Admin Process Barriers Tech Process Barriers Equipment Barriers Human Barriers</p>	<p>Admin Process Barriers Tech Process Barriers Equipment Barriers Human Barriers</p>
	Prevention	Detection & Correction

Marguglio's Further Adaptation - Total Reliability / Quality / Safety Function

Quality of Design	Admin Process Bs Tech Process Bs Equip Barriers Human Barriers	Admin Process Bs Tech Process Bs Equip Barriers Human Barriers	Admin Process Bs Tech Process Bs Equip Barriers Human Barriers
Quality of Conformance to Design	Admin Process Bs Tech Process Bs Equip Barriers Human Barriers	Admin Process Bs Tech Process Bs Equip Barriers Human Barriers	Admin Process Bs Tech Process Bs Equip Barriers Human Barriers
	Prevention (Barrier Level 1)	Detection (Barrier Level 2)	Mitigation / Amelioration (Barrier Level 3)

Correction

Marguglio's Final Adaptation - Total Reliability / Quality / Safety Function

Quality of Design	Admin P Barriers Tech P Barriers Equip Barriers Human Barriers	Admin P Barriers Tech P Barriers Equip Barriers Human Barriers	Admin P Barriers Tech P Barriers Equip Barriers Human Barriers
Quality of Conformance to Design	Admin P Barriers Tech P Barriers Equip Barriers Human Barriers	Admin P Barriers Tech P Barriers Equip Barriers Human Barriers	Admin P Barriers Tech P Barriers Equip Barriers Human Barriers
	Prevention (Barrier Level 1)	Detection (Barrier Level 2)	Mitigation / Amelioration (Barrier Level 3)

1. Correction of the problem root cause(s).
2. Determination of the better (e.g., more timely, least expensive) way the problem could have been prevented or detected.
3. Implementation of that better way.



Human Error Causal Factor Taxonomies

Taxonomy – Human Error

Classified By Type of Causal Factor

- # Rule-based
- # Knowledge-based
- # Skill-based

Marguglio's Taxonomy – Human Error Classified By Type of Causal Factor

- # Knowledge-based
- # Cognition-based
- # Value-based
- # Error-inducing Condition-based
- # Reflexive-based
- # Skill-based
- # Lapse-based

Knowledge-based Error

Error based on behavior absent the receipt of the knowledge of the requirement, expectation or need

Cognition-based Error

Error based on behavior absent the ability to process the knowledge (memorize, understand, apply, analyze, synthesize or evaluate)

Value-based Error

Error based on behavior absent the acceptance of the requirement, expectation or need

Error-Inducing Condition-based Error

Error based on behavior absent the recognition of the error-inducing condition or absent appropriate behavior to counteract the condition

Reflexive-based Error

Error based on behavior absent
conservative judgment in making an
immediate response to a stimulus

Skill-based Error

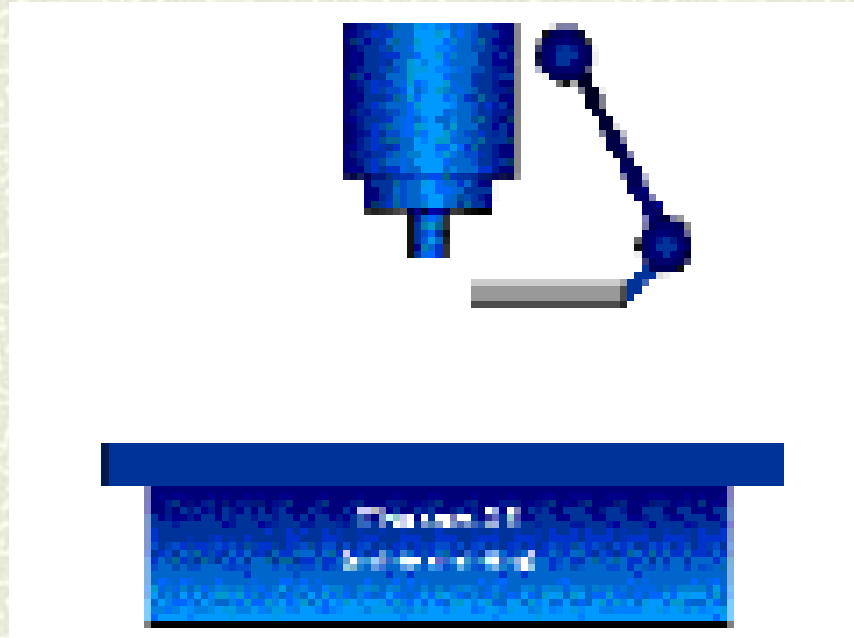
Error based on behavior absent manual dexterity

Lapse-based Error

Error based on behavior absent attention

Case Study - Therac-25

Scenario



Case Study - Therac-25

Human Error Causal Factors at work:

- # Operator
- # Patient
- # Hospital – Training and Radiology
- # Manufacturer – Design Team & Design Management
- # Interface – Hospital & Manufacturer

Benefits

- # Consider Marguglio's taxonomy of human error causal factors in:
 - # Design of processes and hardware;
 - # Performance of root cause analyses.

Marguglio's Four Fields of Focus for Human Error Prevention

Concern:

Hazards

Response:

- Implement techniques by which to recognize hazards.
- Eliminate hazards.
- Create barriers to prevent errors that activate hazards, detect activated hazards, and mitigate the effects of hazards.
- Implement techniques by which to make barriers effective.

Marguglio's Four Fields of Focus for Human Error Prevention (Cont'd)

Concern:

Error-inducing conditions and error-likely situations

Response:

- Recognize error-inducing conditions and error-likely situations.
- Eliminate these conditions and situations.
- Practice behaviors by which to counteract error-inducing conditions and error-likely situations.

Marguglio's Four Fields of Focus for Human Error Prevention (Cont'd)

Concern:

Inappropriate risk-taking

Response:

- Recognize the behaviors that lead to non-conservative decision-making.
- Practice behaviors that lead to conservative decision-making.

Marguglio's Four Fields of Focus for Human Error Prevention (Cont'd)

Concern:

Recurrence of past errors

Response:

- Implement a field observation and coaching system.
- Implement a problem reporting, root cause analysis, and preventive corrective action system.
- Establish appropriate measures of performance.

Thank You

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