Guide 4

FINDING EVENT BLOCKS WITH THE CHANGE TRACKING METHOD

For Use During MES-Based Investigations

Table of Contents

FINDING EBs WITH CTM

A continuing challenge to incident investigators is trying to find data to transform into Event Blocks. One technique is to track changes. To do this, investigators develop a list of sequential changes, identifying what changed and what produced the changes. The latter is used for EBs.

The general Change Tracking Method is to

1. identify what changed first
2. track and list each successive change
3. identify the condition before each change
4. identify the condition after each change
5. define the differences
6. define the effects
7. convert changes to EBs

Procedures for this task are contained in this Guide.

INTRODUCTION

The Change Tracking Method uses the traditional method of difference to identify changes that occur during a process. CTM's primary value is in guiding the <u>thinking</u> required to trace the "change makers" and their actions as the occurrence progresses.

OBJECTIVE

The objective of this Guide is to present ways to identify the changes of state that occurred during an occurrence, and the actors and actions that produced those changes of state.

APPLICABILITY

This change tracking method is applicable during any stage of an investigation, but is most useful during the early stages to help identify the actors about whom the investigator(s) should acquire additional action data. The changes identified should be used to support EB and MES Matrix development.

CAUTION:

Do not use only CTM to describe what happened, <u>because its output format is LINEAR</u>.

DATA REQUIRED

This method requires a cursory awareness of the nature of the occurrence being studied. It also requires a modest understanding of a process's expected operations within which changes of state occurred during the occurrence, and data about the actual state of the system and its environment at the time the occurrence began and ended.

DATA SOURCES

CTM requires concrete observations of, or data from, any person, document or animate or inanimate source, including the description of things remaining after an occurrence. CTM uses direct observation, sequential logic and deductive reasoning from data sources.

DATA PRESENTATION

The work product of the CTM is a list of sequential changes of state that begin with the initial deviation from a normal state of the system. It documents the changes that led to the outcome of interest. A typical format for CTM documentation is shown in Figure 4-1.

Figure 4-1 Change Tracking Matrix Format

WHAT CHANGED	SITUATION NOW	SITUATION EARLIER	WHAT IS DIFFERENCE	WHAT ARE EFFECTS

Use comparisons to identify changes. Begin by considering circumstances when no mishap occurred, and then considering the circumstances present when the mishap occurred. When differences are observed, compare the mishap circumstances with the no-mishap circumstances to isolate changes that had occurred.

EXAMPLE: A container used to store fluids has been functioning without overflowing for years. Today the container overflowed. What changed?

CHANGE TRACKING METHOD

1. Try to identify the actual state of dynamic equilibrium of the system immediately before the occurrence of interest began. That state may be considered the state at a time when the system was functioning normally, or as desired or designed. While functioning normally, the system was probably adjusting continuously to potentially disruptive occurrences, but continuing to function as intended and produce the intended outputs. The changes of interest are any changes to which the system had to react to maintain its dynamic equilibrium, but didn't. These changes may be simple or compound changes, and the time spans involved may be moments or years.

Q: What changed before or around the time the occurrence began?

EXAMPLE: The container was filled with more fluid than usual, and the fluid overflowed. The same quantity of fluid had been piped to the container previously but it hadn't overflowed, because a drain pipe had diverted the excess fluid into a sump. This time it didn't. Thus the change of interest is in the overflow system that did not function as it had previously.

file:///Applications/Investigation%20Catalyst/Investigation%20Catalyst−trial/Tutorial%20Extras/MES_Guides/MESGuide04.html

Page 3 of 5

Figure 4-2 Change Tracking Matrix Example 1

WHAT CHANGED	SITUATION NOW	SITUATION EARLIER	WHAT IS DIFFERENCE	WHAT ARE EFFECTS
?	excess fluid spilled onto ground around container	excess fluid flowed into a sump	Where excess fluid went	undesired spill

2. Any previous or subsequent changes of state leading to or resulting from that change of state are then explored, by naming the person or thing involved, and examining its state during or before the occurrence.

Q: What changed before (after) the first change?

EXAMPLE: As the container was being overfilled, the fluid could not be diverted by the drain pipe because it was partially plugged. Residue was found on the drain pipe walls, reducing its cross-sectional area. The last time spilled fluid was washed off the side of the tank, a new cleaner was used that coagulated and left the residue in the drain pipe. So the excess fluid could not run through the drain at a fast enough rate to keep from overflowing the container. The new cleaner was a "before" change of state, as was the partially plugged pipe. To avert the overflow, an adaptive response (counter-change) had to be initiated but the operators who used the new cleaner were unaware of the change in the drain pipe. The overflow was an "after" change of state around the container that resulted from the earlier changes.

Figure 4-3 Change Tracking Matrix Example 2

WHAT CHANGED	SITUATION NOW	SITUATION EARLIER	WHAT IS DIFFERENCE	WHAT ARE EFFECTS
new cleaner introduced	cleaner created residue	old cleaner left no residue	residue formed in tank	cleaner left residue in drain pipe
residue clogged drain pipe	overflow drain to sump constricted	overflow drain to sump fully open	flow capacity of excess fluid to sump	excess fluid run-off restricted
amount of fluid loaded into container	excess fluid loaded into container	correct amount of fluid loaded into container	amount of fluid loaded into container	excess fluid had to flow someplace after container was full

where excess fluid flowed	flowed onto ground around container	flowed into sump	where fluid went	undesired fluid spill

3. Track and list, in sequence, the changes involved in the occurrence. Start with the first change that was introduced, for which a counter-change was necessary, and then list the subsequent changes that you found.

Q: What were the changes, in the order of their initiation, that may have had a bearing on the occurrence.

EXAMPLE: List changes in Event Block (EB) format, in proper sequence:

1. ? introduced new cleaner

2. Cleaner formed coagulants with fluid residues.

3. Coagulant residues changed pipe flow capacity.

4. Pipe impaired routine overflow protection.

5. Excess fluid overflowed around container.

COMMENTS

Use the results of this change analysis to support EB preparation and modeling of scenario. The change analysis may provide a method of defining what information you should consider with a logic tree or MES Matrix.

CAUTION

THE ABOVE EXAMPLE, WHICH IS TYPICAL, SHOWS HOW ONE TENDS TO TRACE CHANGES IN A LINEAR 'CHAIN-OF-EVENTS' THINKING MODE.

Use MES Matrixes and MES-Trees to avoid this pitfall in all investigations.

For additional discussion of change and change analysis, refer to original work in Johnson, W.G., MORT SAFETY ASSURANCE SYSTEMS, Marcel Dekker, Inc. NY 1980, p 53-72.

Contact Starline | Starline Software Ltd. home page

file:///Applications/Investigation%20Catalyst/Investigation%20Catalyst−trial/Tutorial%20Extras/MES_Guides/MESGuide04.html

Page 5 of 5