HAZOP

Δρ. Ιωάννης Μ. Δόκας

Επίκουρος Καθηγητής

Εργαστήριο Οργάνωσης και Προγραμματισμού

Τμήμα Πολιτικών Μηχανικών ΔΠΘ

HAZARD AND OPERABILITY METHOD

Τεχνική για τον εντοπισμό δυνητικών κινδύνων σε ένα σύστημα και τον εντοπισμό προβλημάτων λειτουργικότητας που ενδέχεται να οδηγήσουν σε ελλαττωματικά προϊόντα και διεργασίες.

Υποθέτει ότι τα συμβάντα κινδύνου προκαλούνται από αποκλίσεις από σχεδιασμού ή λειτουργίας.

Η διαδικασία αναγνώριση αποκλίσεων υποβοηθείται με τη χρήση «λέξεων οδηγών».

Οι λέξεις οδηγοί έχουν στόχο την καθοδήγηση και διέγερση της φαντασίας της ομάδας κατά τη διερεύνηση ενδεχόμενων αποκλίσεων.

Ποιοτική ανάλυση

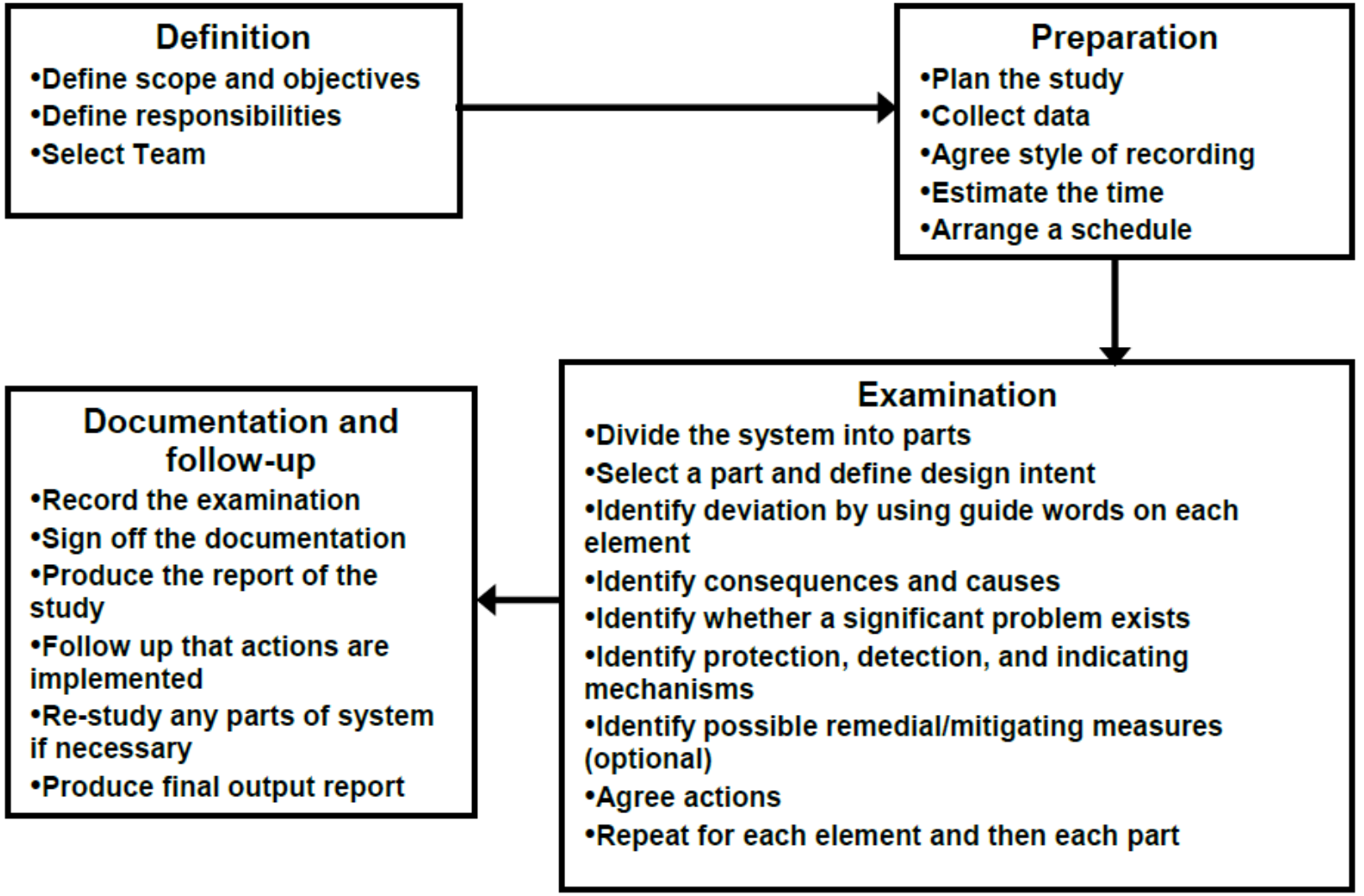
HAZARD AND OPERABILITY METHOD

ΠΙΘΑΝΟΙ ΚΙΝΔΥΝΟΙ ΚΑΙ ΕΝΔΕΧΟΜΕΝΑ ΠΡΟΒΛΗΜΑΤΑ ΟΙ ΚΑΙ ΣΥΝΕΠΕΙΕΣ ΤΟΥΣ

ΑΠΟΚΛΙΣΕΙΣ ΤΗΣ ΥΦΙΣΤΑΜΕΝΗΣ ΑΠΟ ΜΙΑ ΕΠΙΘΥΜΗΤΗ ΚΑΙ ΙΔΑΝΙΚΗ ΚΑΤΑΣΤΑΣΗ

ΥΦΙΣΤΑΜΕΝΑ ΠΡΟΒΛΗΜΑΤΑ ΛΕΙΤΟΥΡΓΙΚΟΤΗΤΑΣ

ΒΗΜΑΤΑ HAZOP



Πηγή: http://pqri.org/wp-content/uploads/2015/08/pdf/HAZOP_Training_Guide.pdf

ΛΕΞΕΙΣ - ΟΔΗΓΟΙ

Λέξη οδηγός (Guide Word)	Σημασία λέξης οδηγού
No or not	Έλλειψη
More	Περισσότερο
Less	Λιγότερο
As well as	Επιπρόσθετα
Part of	Μερικώς
Reverse	Απόκλιση/αντίθετο
Other than	Αντικατάσταση
Early	Νωρίτερα
Late	Καθυστερημένα
Before	Νωρίτερα από τη συνήθη σειρά
After	Αργότερα από τη συνήθη σειρά

ΦΟΡΜΑ ΑΝΑΦΟΡΑΣ HAZOP

No.	Guide Word	Element	Deviation	Possible Causes	Consequences	Safeguards	Comments	Actions Required	Actions Assigned to
Assign each entry a unique tracking number	Insert deviation guide word used	Describe what the guide word pertains to (material, process step, etc.)	Describe the deviation	Describe how the deviation may occur	Describe what may happen if the deviation occurs	List controls (preventive or reactive) that reduce deviation likelihood or severity	Capture key relevant rationale, assumptions, data, etc.	Identify any hazard mitigation or control actions required	Record who is responsible for actions
Examples from Cleaning Agent Deviations that were used to explain HAZOP Guide Words									
1	No	Cleaning Agent	No detergent added during cleaning cycle	Detergent supply reservoir empty	Residues not effectively removed, leaving system in an unclean state	Technicians check detergent reservoir before every cycle	Assumes technicians can reliably estimate volume visually	Consider alarm for low detergent reservoir level	Engineer
2	Other than	Cleaning Agent	Wrong detergent used	Technician retrieves wrong detergent from warehouse	Incorrect detergent may be ineffective at removing residues, leaving system in an unclean state	Cleaning log requires verification of proper detergent use. Detergent is labeled.	Many different detergent containers look alike	Ensure technician training addresses detergent selection	Trainer

Πηγή: http://pqri.org/wp-content/uploads/2015/08/pdf/HAZOP_Training_Guide.pdf

HAZOP WORKSHEET					
Guide word	Deviation	Possible cause	Consequence	Action taken	Action required
NO	No Flow	1. Hose pipe block. 2. Shut off valve closed. 3. Pump problem.	1. Pump cavitations and vibration. 2. Possibility of air entry.	Nothing special	1. Line should be provided with sight glass. 2. Hose pipe end should be kept plugged with stopper.
LESS	Less Flow	1. Strainer chocked. 2.Partial blockage	Process disturbance	Nothing special	1. The strainer should be cleaned periodically. 2. Check list ensure that all valves in the line are open.
MORE	More Flow	1. Excessive differential pressure 2.Pump surging	1. Excessive static electricity charge may ignite the leak gas	Flanges provided with jumper	1. Conductivity of the hose should be checked up periodically. 2. Earth resistance of line should be checked up. 3. Ensure that jumpers are provided in all the flanges. 4. Proper bonding of union joints should be ensured.
MORE	More pressure	Due to thermal expansion of liquid trapped between any two valve	Pressurization and subsequence bursting of the line		1. pressure indicators should be provided.
AS WELL AS	Leakage	Leakage from flare, Union joints, hose	Spillage and Possibility of fire	Single valve isolation provided	1.Two isolation valve should be provided in each cold flare line. 2. The cold flare lines should be protected against breaking in stormy weather. 3. Union joints should be replaced by flange joints. 4. Hose should be tested after every three months to ensure that it bears a pressure of 37.5Kg/cm2.

Πηγή: **Sandeep Yadav (2015), Risk Assessment (HAZOP Study) Method for Decanting LPG From Dispatching Unit to Road Tanker, IJSTE - International Journal of Science Technology & Engineering, Volume 1, Issue 11** ISSN (online): 2349-784X

Εκπαιδευτικό εργαλείο
https://cbe.ust.hk/hazop/4round/