UDC 614.8.027.1:331.452
DOI: 10.7562/SE2013.3.01.07
Review article
www.safety.ni.ac.rs

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# IMPLEMENTATION OF HEALTH AND SAFETY MANAGEMENT SYSTEM IN AUTOMOTIVE INDUSTRY

**Abstract:** *This work treated the steps for health and safety management implementation, which ensure the increase of responsibility for working environmental with the involvement of employees, customers, governments, capital markets, suppliers.*
*A big step in working environmental increase is systemic approach means using a tool like Healthcare Failure Mode and Effect Analyses (HFMEA), which is a prospective assessment than identify, prevent and improve the process problems before occurring.*

**Key words:** HFMEA, risk, working condition, cause-effect diagram.

## INTRODUCTION

The Failure Modes and Effects Analysis FMEA was use initially for engineering processes in airline and automotive industry.

The main applications were:

- Quality & safety of goods/ services,
- Safety of processes,
- Healthcare application is a recent one.

Systematical analyses of the processes through FMEA have the following benefits:

- Identified the failure mode, effects or results of failures, possible causes of failures,
- Run like an action plan to reduce the failure, which prevent and minimize the possibility of occurrence and minimize the consequence of failures,
- Part of continuous improvement process (CIP),
- Increase effectiveness,
- Increase efficiency,
- Cost avoidance.

## 1. REASONS MODEL OF THE ACCIDENTS

Before starting analyzing the accidents, it is important to understand the mechanism of these.

The main causes of the accidents come from lack of procedures, systemic approach, leadership and management, resources etc.

The main reasons for accidents and the defenses are presented in figure1 [4].

For defenses implementation is needed the involvement of all organizational chain from customer to supplier and to be aware about the entire governmental and specific healthcare requirement.

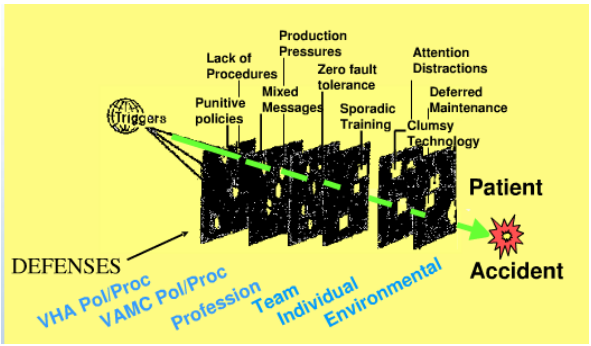


**Figure1.** *Reasons model of accidents*

One of the most complex methods of risk analyses is Healthcare Failure Modes and Effects Analysis (HFMEA).

## 2. THE HEALTHCARE FAILURE MODES AND EFFECTS ANALYSIS APPROACH

The HFMEA is a systematic approached to identify failure modes that could either directly result in, or contribute significantly to, the identified accident scenario by a multi-discipline team familiar with the process and have to follow the next steps:

- Define the topic/ graphically describe a process,
- Establish a multidisciplinary team,
- Analyze the process,
- Identified the risks and strategy for improvement,
- Actions and outcome measures with clear responsible and due date.
- Check and validate the implemented actions,
- Evaluate the effectiveness of implementation.

The champion for action plan implementation has to be the owner of the evaluated area and he is responsible for follow up, until all the actions are closed effective.

The HFMEA is a living document and is working as an action plan.

The failure modes and failure causes are identified initially and are used as the starting point for the FMEA.

Each cause is evaluated for adequate design safety and potential effect on the system. A qualitative risk category is then assigned to each failure cause according to the guidelines given in table 3. This qualitative ranking is determined by considering both the severity and frequency of occurrence.

Critical areas of the process are identified and studied to determine the possibility of a major incident. The management team can then use this information to control the potential risk, and avoid the accident scenario.

The analyses on HFMEA is done base on hazard scoring (HS) which is the multiplication of severity (S) and the probability of occurrence (O) .

$$HS = S^* O \quad (1)$$

The evaluation tables for these characteristics are presented in tables 1 and 2 [4].

**Table 1.** *Severity ranking*

| | |
|---|---|
| **Catastrophic Event**<br><br>(Traditional FMEA Rating of 10 - Failure could cause death or injury) | **Major Event**<br><br>(Traditional FMEA Rating of 7 - Failure causes a high degree of customer dissatisfaction.) |
| **Moderate Event**<br><br>(Traditional FMEA Rating of "4" – Failure can be overcome with modifications to the process or product, but there is minor performance loss.) | **Minor Event**<br><br>(Traditional FMEA Rating of "1"– Failure would not be noticeable to the customer and would not affect delivery of the service or product.) |

The probability ranking is described in table 2.

**Table 2.** *Probability of occurrence ranking*

| |
|---|
| **Frequent -** Likely to occur immediately or within a short period (may happen several times in one year)<br>**Occasional -** Probably will occur (may happen several times in 1 to 2 years)<br>**Uncommon -** Possible to occur (may happen sometime in 2 to 5 years)<br>**Remote -** Unlikely to occur (may happen sometime in 5 to 30 years) |

Base on characteristics score the hazard scoring matrix is presented in table 3.

**Table 3.** *Hazard scoring matrix*

| **Probability** | **Severity of effect** | | | |
|---|---|---|---|---|
| Frequent | 16 | 12 | 8 | 4 |
| Occasional | 12 | 9 | 6 | 3 |
| Uncommon | 8 | 6 | 4 | 2 |
| Remote | 4 | 3 | 2 | 1 |

All rates of hazard scoring bigger than 8 must to be immediately treated in problem solving meeting.

The complete evaluation is given by criticality index (CI), which is similar with risk priority number (RPN) and is determined with formula 2:

$$CI = HS^* O = S^* O^* D \quad (2)$$

Where:

S = severity of effects rating score

O = frequency of occurrence ranking score

D = probability of detection ranking score.

The tree decision and prioritization flow diagram of the HFMEA is presented in figure 2.

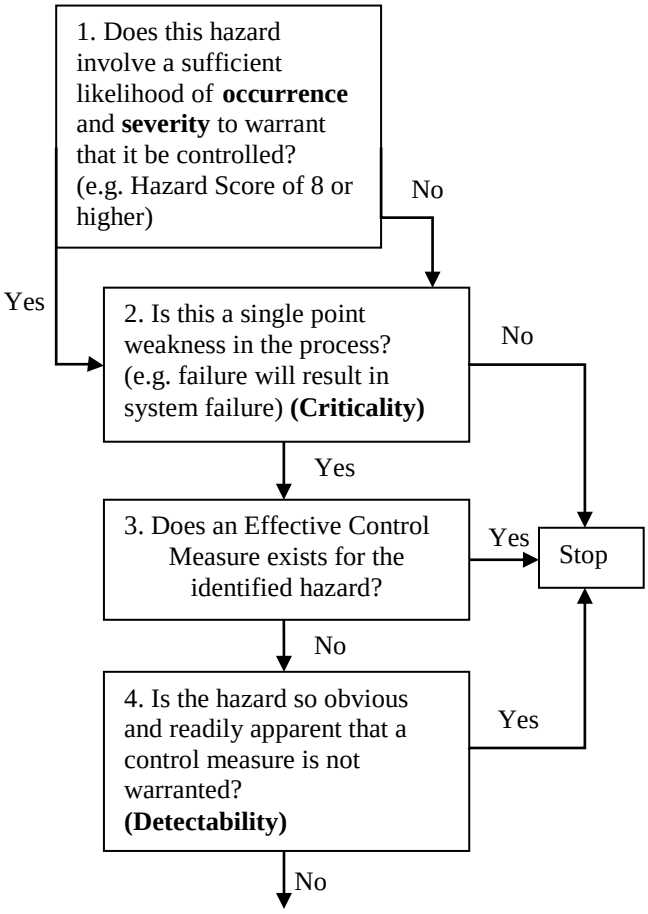


**Figure 2.** *Tree decision flow*

For kick off the HFMEA session it's used the worksheet presented in fig.3 for purpose and team defining.

During HFMEA session the moderator is guiding the team using the form presented in figure 4.

**Healthcare FMEA Process Steps 1 and 2**

**Step 1**. Select the process you want to examine.
Define the scope (Be specific and include a clear definition of the process or product to be studied).

*This HFMEA™ is focused on* _____

**Step 2**. Assemble the Team

HFMEA Number _____

Date Started _____ Date to be Completed _____

Team Members 1. _____ 4. _____

2. _____ 5. _____

3. _____ 6. _____

Team Leader _____

Are all affected areas represented? YES NO

Are different levels and types of knowledge represented on the team? YES NO

Who will take minutes and maintain records? _____

**Figure 3.** *Kick off HFMEA meeting*

| HFMEA Subprocess Step Title and Number | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HFMEA Step 3 - Hazard Analysis | | | | | | | | | HFMEA Step 4 - Identify Actions and Outcomes | | | | | |
| | | Scoring | | | Decision Tree Analysis | | | | | | | | | |
| Failure Mode: First Evaluate failure mode before determining potential causes | Potential Causes | Severity | Probability | Hazard Score (HC) | Single Point Weakness? | Existing Control Measure ? | Detectability | Criticality Index | Action Type (Control, Accept, Eliminate) | Actions or Rationale for Stopping | Outcome Measure | Person Responsible | Management Concurrence |
| | → | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

**Figure 4.** *HFMEA form*

During session it is used the step 3 from the head of figure 4 for decision according to decision flow from fig.2 and step 4 to full in action plan.

After implemented measures counter the criticality index CI (figure 4) is evaluated again by all multidisciplinary team to see if the risk decrease.

To have effectiveness implementation, during HFMEA analyses is important to define the real root causes.

The diagram cause –effect (Ishikawa or fish bon) used by the team can detect all the causes taken in consideration all the process influences according to figure 5.

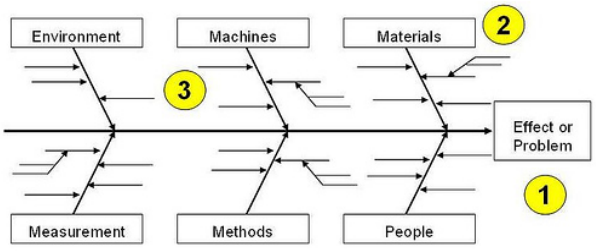


**Figure 5.** *Classical cause –effect diagram*

During the analyze it is possible to find out several causes per each bone, which can be more deep analyze in the problem solving meeting using the same diagram according to figure 5.

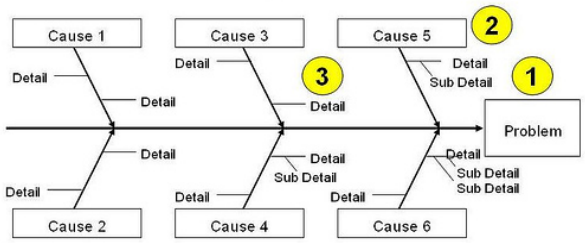


**Figure 5.** *Cause –effect diagram*

The HFMEA is treated from design phase until the start of production phase and is continuously updated.

Part of safety management system implementation is the working condition, which means design the right ergonomic workplace to avoid future professional diseases. In production are working different kind of people: man, female, tall, shot, slim, fat etc.

Ergonomics is the study of designing equipment and devices that fit the human body, its movements, and its cognitive abilities.

Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.

Ergonomics is employed to fulfill the two goals of health and productivity. It is relevant in the design of such things as safe furniture and easy-to-use interfaces to machines. Proper ergonomic design is necessary to prevent repetitive strain injuries, which can develop over time and can lead to long-term disability.

In the next pictures are presented the most often working positions implemented in production area with the right dimension [1]:

- Sitting position is presented in figure 6.

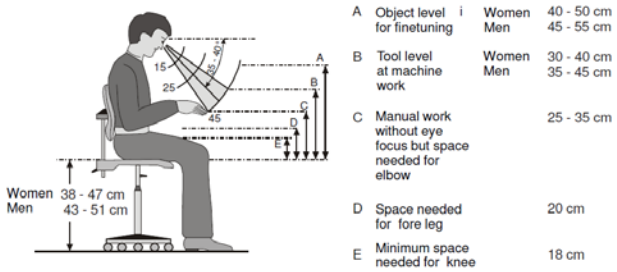


**Figure 6.** *Sitting position dimensions*

- Cut through grasping area at the table level is presented in figure 7.

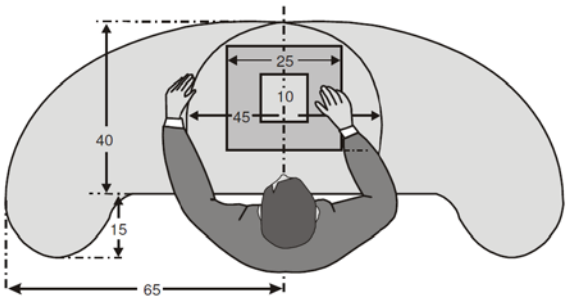


**Figure 7.** *Cut through grasping area at the table level*

- Space for leg action is represented in figure 8.

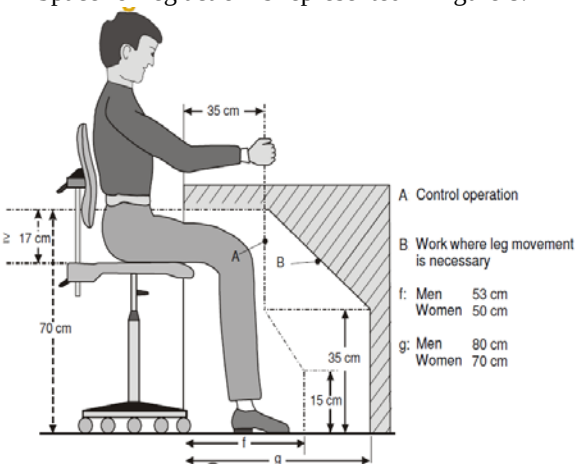


**Figure 8.** *Space length action*

- Work level stand up position is presented in fig. 9.

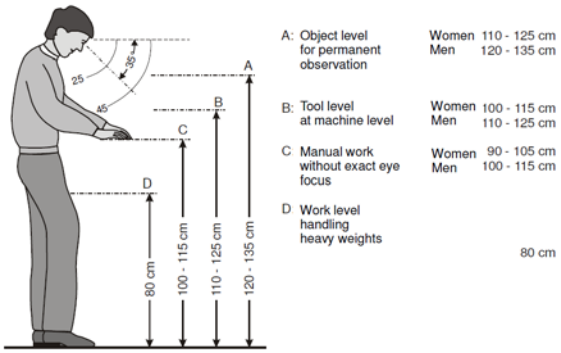


**Figure 9.** *Stand up position work level*

- The correct body position – figure 10.

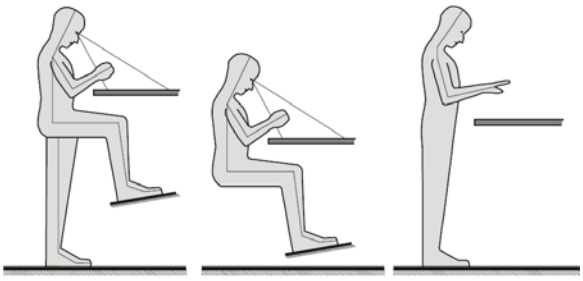

**Figure 10.** *The correct body position*

The factors which are important from ergonomics are:

- Force of working,
- Posture of body,
- Frequency of movement.

The ergonomic approach has to be part of healthcare program which have to be done continuous according to the cycle presented in picture 11.

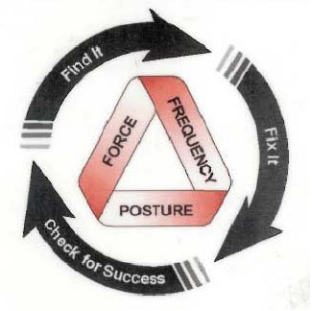


**Figure 11.** *Continuous ergonomic cycle*

## CONCLUSION

HFMEA is a systematic method of identifying and preventing injuries before they occur.

It is very important to run HFMEA with a multidisciplinary team to find out the real root causes and to implement efficient the measurements.

Safety and healthcare is a responsibility of all people into the organization and also in the product chain from the customers to the suppliers. The HFMEA have to be kick off from the design phase, so that to take in consideration all the risks and to design the work places in the ergonomic way.

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## ACKNOWLEDGEMENTS

This paper is part of PhD ongoing work "Studies and Researches about High Frequency Welding of the Polymers" at the Technical University "POLITEHNICA" from Timisoara.
This work was a guiding line used for cell design of High Frequency Welding.

## BIOGRAPHY

**Nicolaie Varzaru** was born in Prunisor, Mehedinti, a small village in Romania, in 1969.
He obtained B.Sc. in Mechanics, Welding Technologies and Equipments, at Technical University "POLITEHNICA" from Timisoara in 1994. He obtained M.Sc. in Mechanics at Technical University "POLITEHNICA" from Timisoara. He is currently working on his PhD degree in the research area of high frequency welding of the polymers at Technical University "POLITEHNICA" from Timisoara.He is working as Business Unit Manager at TRW Timisoara, Romania. As professional background, he had 4 years experience in metallic construction and 11 years in automotive industry.

# PRIMENA SISTEMA UPRAVLJANJA ZA ZDRAV I BEZBEDAN RAD U AUTOMOBILSKOJ INDUSTRIJI

**Nicolaie Varzaru, Ion Mitelea**

**Rezime:** *Ovaj rad se odnosi na redosled koraka pri implementaciji sistema upravljanja za zdrav i bezbedan rad, kojim se obezbeđuje povećanje odgovornosti za radno okruženje, uz učešće zaposlenih, potrošača, vlade, tržišta kapitala i dobavljača. Veliki korak u unapređenju radnog okruženja je sistemski pristup, primenom metode kao što je Zdravstvena analiza načina i efekata otkaza (HFMEA), koja predstavlja alat za anticipaciju i procenu, a kojom se identifikuju, sprečavaju i rešavaju problemi u procesu pre nego što do njih dođe.*

**Ključne reči:** HFMEA, rizik, radni uslovi, uzročno-posledični dijagram.