The role of trade unions in promoting safer machinery

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European Trade Union Institute (ETUI)

6th Atlantic Alliance Conference: Global Initiatives on Safety and Health
Outline

- The context
- The problem
- Possible solutions
- The ETUI questions
The context - 1

The Single Market

Product Directives

Social Directives
Work equipment **design** is covered by directive 98/37, with obligations on manufacturers;

Work equipment **use** is covered by directive 89/655 (minimum standard) which defines employers’ obligation
Machinery Regulation management

Notified Bodies
BUSINESS EUROPE

cen CENELEC

ORGALIME
NORM APME

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ANEC

Commission

Working Group “Machinery”

Member States

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Machinery Standardisation management

Notified Bodies

Technical Committee
TC 114 Safety of Machinery
The context

The problem:
  - The large number of severe accidents that are occurring

Possible solutions

The ETUI questions
Equipment Design

Machines provide the mining industry, greatly reducing manual labor and providing efficient production. Machines are also the direct or indirect cause of a significant number of injuries and fatalities. Miners interact with a wide assortment of machinery and tools in the course of their work. The interaction issue for consideration in the proper design of the human machine systems such as control layouts, proper visual and auditory presentation of information to the worker, and design of equipment for ease of maintenance. Recent years have seen a rapid growth in the development of new mining technologies, such as remote control, continuous haulage, automated equipment, etc. These new technologies introduce the potential for new health and safety risks.

The work in this topic area is supported by the NIOSH Mining Ergonomics and Machine Safety programs. See the NIOSH Mining Products page for software, guides, training materials or other items related to this topic.

Equipment Design Spotlights

Operating Speed Assessments of Underground Mining Equipment (PDF, 570 KB, 2010-02)
This publication details the results of NIOSH studies to examine operating speeds based on usage and seam height. The data obtained in these studies revealed a complex interaction of factors that affect the risk of shock-by-accidents when miners operate mining machines in an underground mining environment.

Visual Performance for Trip Hazard Detection When Using Incandescent and LED Miners Cap Lamps (PDF, 155 KB, 2010-04)
This NIOSH study determined if new LED-based cap lamb technology has an impact on visual performance in the context of detecting trip hazards for the visual environment of an underground coal mine.

Overviews

Mine Power Systems (PDF, 20024 KB, 1998)
This U.S. Bureau of Mines publication presents a comprehensive review of mine electrical power-system theory and practice. It discusses fundamental theory and the vital aspects to be considered in planning and designing mine electrical power systems.

Data & statistics

What Causes Equipment Accidents? (HTML, 1997)
This article presents statistics on mining equipment accidents and summarizes accident causes and design recommendations.

Measurement & analysis

Acceleration and GPS Data Monitor Truck-Haulage Jolts (PDF, 784 KB, 2000)
This paper discusses the application of global positioning system (GPS) data, accelerometers, and camera procedures to verify feedback about equipment operations and identify the
West Virginia Office of Miners’ Health Safety and Training

Safety Topics and Information

Abstracts of recent fatal mining accidents

Injury Statistics

Miner Certification Information

Mountaineer Guardian Safety Awards

Mine Rescue Contests and Team Training

Operation of Man Trips at Surface Mines
  (Power Point Presentation)

Pure Water for Well Plugging

River Loadout Safety

Developing a Comprehensive Emergency Plan for Underground Mines

David McAteer Report on Mine Health Safety and Training

WV Joint Accident Prevention Team

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## Metal and Nonmetal Mine Fatalities

<table>
<thead>
<tr>
<th>Year</th>
<th>Reports Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>Preliminary Accident Reports, Fatalgrams and Investigation Reports</td>
</tr>
<tr>
<td>2009</td>
<td>Fatalgrams and Investigation Reports</td>
</tr>
<tr>
<td>2008</td>
<td>Fatalgrams and Investigation Reports</td>
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<tr>
<td>2007</td>
<td>Fatalgrams and Investigation Reports</td>
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<tr>
<td>1996</td>
<td>Fatal Alert Bulletins and Investigation Reports</td>
</tr>
</tbody>
</table>
Equipment Safety and Health Concerns

Equipment Related Accidents

The following pages contain equipment-related accident data from 1995 - 2009. Searches can be done for a particular year or by listed equipment type, which then are linked to fatalgrams and accident reports. Our goal is to educate equipment operators and the mining community about the hazards associated with operating a specific type of equipment.

Use this option if you want to view information for a particular equipment type for a particular year.

| Select Equipment Type | Conveyor | Year of Accident | 1995 | Get Information |

Use this option if you want to view information for "All Years" for a particular equipment type.

| Select Equipment Type | Conveyor | Get Information |

Use this option if you want to view information for "All Equipment" for a particular year.

| Year of Accident | 1995 | Get Information |
Fatalities by Classification

- Machinery: 25%
- Fall of Person: 13%
- Fall of Roof: 6%
- Falling Material: 19%
- Electrical: 6%
- Powered Haulage: 31%
The complexity of the work system

The space

The equipment

The organization

The environment
Leading causes classification

- Integration: 30%
- Design: 40%
- Training: 30%
Root causes

- Poor original design or redesign
- Control-display layout
- Inadequate ingress/egress design
- Exposed sharp surfaces or pinch points
- Unguarded moving parts
- Restricted visibility
Outline

- The context
- The problem
- Possible solutions
- The ETUI questions
Possible solutions

Basic design concepts & principles to be applied to all machinery

Design guidance on safety aspects applicable to a wide range of machinery

Design guidance applicable to a particular machine or group of machines
The message of EN ISO 12100

What can go wrong? → Hazard Identification

How bad? → Severity Modelling

How often? → Frequency Estimation

So what? → Risk Evaluation

What do I do? → Risk Control & Reduction
The designer shall identify hazards taking into account the following:

a) **human interaction** during the whole life cycle of the machine;
b) possible states of the machine (...)
c) unintended behaviour of the operator or reasonably foreseeable misuse of the machine, for example:
   1. loss of control of the machine by the operator (especially for hand-held or mobile machines);
   2. reflex behaviour of a person in case of malfunction, incident or failure during the use of the machine;
   3. behaviour resulting from lack of concentration or carelessness;
   4. behaviour resulting from taking the "line of least resistance" in carrying out a task;
   5. behaviour resulting from pressures to keep the machine running in all circumstances;
Human factors

Human factors can affect risk and shall be taken into account in the risk estimation. This includes, for example:

1. interaction of person(s) with the machinery including correction of malfunction;

2. interaction between persons;

3. stress related aspects;

4. ergonomic aspects;

5. capacity of persons to be aware of risks in a given situation depending on their training, experience and ability;

6. fatigue aspects;

7. aspects of limited abilities (for example due to disability, age).
Inherently safe design measures - Observing ergonomic principles

1. Ergonomic principles shall be taken into account in designing machinery to reduce mental or physical stress and strain of the operator. These principles shall be considered when allocating functions to operator and machine (degree of automation) in the basic design. It also improves the performance and reliability of the operation and hence it reduces the probability of errors at all stages of machine use.

2. Account shall be taken of body sizes likely to be found in the intended user population, strengths and postures, movement amplitudes, frequency of cyclic actions.

3. All elements of the "operator-machine" interface such as controls, signalling or data display elements, shall be designed to be easily understood so that clear and unambiguous interaction between the operator and the machine is possible.
Feedback in action

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# Workgroups management sheet

**Work phase:**________________________

<table>
<thead>
<tr>
<th>Order of tasks</th>
<th>Operating Procedure</th>
<th>Competence</th>
<th>Hazards/Risks</th>
<th>Suggestions for prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Description of the procedure for carrying out the tasks listed with information on the <strong>equipment</strong> used, <strong>safety devices</strong> and <strong>personal protective equipment (PPE).</strong></td>
<td>Information about the competence required for optimum execution of task (use of <strong>equipment, materials, procedure</strong> etc. and information about the instruction handbook).</td>
<td>Factors that represent a hazard as regards the machinery itself, equipment, safety devices, surrounding conditions (e.g. microclimate, dust, lighting or layout), fatigue and organisational factors (frequency, shifts etc.).</td>
<td>Notes on how to prevent the hazards identified and information on training, the instruction handbook, safety devices, procedure, PPE, etc.</td>
</tr>
</tbody>
</table>
Since ten years, ETUI uses an ergonomic method to collect the machinery operators knowledge and experience. This knowledge is then elaborated and communicated to Employers, Designers, Authorities.

The input into DESIGN is made via Standardization

This method is called Feedback
National Standardization Bodies (NSBs) are the gateway to participate in Standardization … therefore, the first ‘channel’ to bring workers’ knowledge into the standard is through each NSB.
Neglecting human-machine compatibility requires the greatest investment in operator training, and operator training is the less reliable line of defense against unwanted events. A “new deal” must be set up to bring ergonomics closer to machinery manufacturers.

How to design a system where the field experience (either coming from OHS bodies, final users, inspectors, market surveillance authorities) is centralized and elaborated in order to be shared with INDUSTRY?

One possible model: collecting data from the field with adequate tools like FEEDBACK®, elaborating this data, and making it available to Designers.
Questions to the Panel

► What would be the most useful ways to have **risk assessment** integrating users’ knowledge with machinery?

► How to avoid that cheaper machinery are sold incomplete, with essential safety devices offered as an **optional** extra?

► How to make sure that the R.A. done by Manufacturers and Employers **converge** and complement each other?
About ETUI

Introduction

This topic aims to provide background information about legislation and standardisation, relating to the safe design of machinery, together with the revision process of four basic technical documents, around which the ETUI has been trying to promote and coordinate a trade union front both at national and European level. It also gives guidance on how to intervene in the production of machinery standards. In providing this information, the ETUI has benefited from the contribution of Jean-Paul Lacrosse and Paul Makin, two experts who have been deeply involved in the work since the birth of the machinery standardisation programme back to 1985.

When the ETUC established the European Trade Union Technical Bureau for Health and Safety (now Health & Safety Department of the ETUI) at the end of 1985, one key objective was to promote a high level of health and safety in Europe in view of the drive to complete the Single Market by 1992. In 1985, the principles of the New Approach to technical harmonisation and standards were laid down by the Council Resolution of 7 May 1985, on a new approach to technical harmonisation and standards (OJEC, L160 of 4 June 1985), which moved away from the concept of directives that included detailed technical specifications. According to the Resolution,


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