Occupational Risk Assessment Method for Food Industry

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Abstract. The paper describes a method for assessing occupational risks at food processing facilities in Altai Krai; it defines a risk assessment procedure that takes into account the event probability and the severity of its consequences to be tracked and monitored; the paper also assesses the controls in place and outlines the additional controls that could be of use. The proposed method has been tested at a food processing facility in Altai Krai.

1. Introduction. Relevance
Reducing occupational injury rates and morbidity is a priority for the today’s food industry [13]. Doing so is imperative today, as more and more companies implement integrated management systems that rely upon a risk management approach among other things [17].

2. Theory
Risk management is defined as a systematic effort to prevent the deterioration of working conditions and to ensure personnel’s well-being [16].

Common hazard identification algorithms are well-known and outlined in international standards, see OHSAS 18001:2007 Occupational Health and Safety Management System; OHSAS 18002:2008 Occupational Health and Safety Management System. Guidelines for the Implementation; GOST R 12.0.010-2009 Occupational Safety Standards. Occupational Health and Safety Management System. Risk Identification and Assessment; and GOST R ISO/IEC 31010-2011 Risk Management. Risk Assessment Methods [20].

3. Applicability of the Results
The research effort drew upon the standards above and produced an analysis of an Altai Krai-based food processing facility, whose product line included butter, cheese, and other foods.

Analysis followed the procedure shown in Figure 1.
Figure 1. Occupational risk assessment procedure for a food processing facility.

The first step was to identify the factors that necessitated an assessment of risks pertaining to butter and cheese production; analyze the product storage, packaging, package delivery, and finished product shipment processes; identify the employees to be involved in risk assessment. For consistency, meetings pertaining to the effort were held regularly on a weekly basis, each lasting two to three hours.

The next step was to identify the hazards that could arise from performing a specific operation on a specific site.

Meanwhile, the research team outlined the hazard identification checklists, each point corresponding to a specific hazard, whether identified (‘checked’) or not before and/or during the audit.

![Risk Assessment Matrix](image-url)

**Figure 2.** Risk assessment matrix.

The Risk Assessment Group had to walk through all the units and yards of the facility to take pictures of any site of operation such as work at height to receive or pump milk, washing the milk tank in closed and crammed space, pipe CIP, or any other work that is not safe from emergency; highlight the hazardous locations (any crossing of car and pedestrian traffic, loading docks, warehouses with...
combustibles, any machinery or unit that could be a source of ignition, etc.). The audit results were reported in the Risk Assessment Protocol.

Hazard identification was followed by risk assessment [10]. The proposed risk assessment method was based on a 5x5 matrix that effectively multiplied the event probability by its severity score, see Figure 2.

Occupational risk management requires quantifying the risks. The risk structure comprises two basic components common to all kinds of hazard:

- the severity of consequences (damage);
- the probability (a qualitative assessment of event probability) [20].

Probability depends on the occurrence rates, the impact factors, and on the previously collected data. Probability depends on the future event probability for any risk factor occurrence. The future event probability is predictable on the basis of previously reported data and is affected by the preventive measures and controls in place.

Severity is determined by the pre-determined severity of consequences, see the 5x5 matrix in Figure 3.

| Score | Severity of injury |
|-------|--------------------|
| 5     | Emergency          |
|       | Death              |
| 4     | High               |
|       | Amputation, a third-degree burn, a chronic disease, disability |
|       | Requires urgent medical attention Considerable loss of time |
| 3     | Moderate           |
|       | Bone fracture, soft-tissue rupture or severe sprain, a second-degree burn, a grave disease, moderate soft-tissue sprain, a first-degree burn, severe cut or abrasion |
| 2     | Low                |
|       | Minor soft-tissue sprain, cut, burn or abrasion that might require medical attention. Might be subject to reporting but entails no time loss |
| 1     | Minor              |
|       | A slight irritation. Medical attention unnecessary. Does not require reporting nor entails loss of time |

**Figure 3.** Severity of injury in an event.

Once the risks have been assessed with no account of controls, describe the technical and organizational controls that are in place as of assessing the risks. Example: the milk receiver maintenance platform is at height; it has a 1.1 meters high fence, a 0.5 meters high intermediate fence, and toe boards. The ladder has railing at 0.9 m, the steps are comfortable for climbing, are sufficiently wide, and have yellow-and-black signal strips on the edges.

First, describe the technical controls following the management hierarchy: analyze measures for total elimination of the risk (i.e. prohibiting any work at height near the food tank inlet), then test the feasibility of mounting a fence, a barrier, trays, or local ventilation systems; marking the site; insulating the pipes; upgrading the wastewater treatment plants, etc.

Further, analyze the organizational controls, which should include special training and briefing, use of safe methods and techniques, behavioral audits and examinations, testing the equipment before the
shift starts, maintenance, technical verification, checking whether there are evacuation plans in place, training the personnel to evacuate, safety permits, re-scheduling, etc.

Finally, pay attention to the necessary personal protective equipment (PPE) and specify the PPE types that might be needed, i.e. respiratory masks to protect against dust and aerosols (ABE filters), earplugs to reduce the noise by 20 dB, etc.

After the existing controls have been identified, reassess the risks. If the risks are outside the green zone, develop additional controls following the same hierarchy.

The last step is to assess the controls, which can be done either before or after implementing additional controls. Controls are deemed efficient if the risk level is within the green zone. If the retrofitted platform for working at height to receive milk or a new ladder is not safe, the controls are inefficient; repeat the algorithm.

4. Conclusions
Thus, the research team has created and tested an occupational risk assessment method for food industry, which comprises such steps as creating a risk assessment panel, identifying the risks, analyzing and reporting the risks, devising corrective action to nullify or minimize the risk probability.

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