Modern aspects of occupational safety at meat industry enterprises

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Keywords:

Safety
Work
Injuries
Risk
Accident

Article history:

Received 04.05.2014
Received in revised form 16.07.2014
Accepted 02.09.2014

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Abstract

Introduction. Analyzing causes of injury on Meat Processing Plants give an opportunity to create reasonable and effective ways of prevention and decreasing risks of workers injuries.

Methods and materials. The method of an accidental statistical analysis is used during the studies to define general traumatical tendencies in the meat industry of Ukraine which happened within 2003 – 2013 years as well as the method of a priori ranking factors on the results of the expert survey.

Results and discussion. The stage of industrial injuries in the meat industry of Ukraine during 2003-2013 is analyzed. The results of the analysis of the distribution of occupational injuries from machinery, equipment, vehicles, devices the usage of which led to the accident are presented. Identified the most common traumatic factors and jobs | in the meat industry of Ukraine. Found the most traumatic situations in the meat industry due to imperfect safety guard in moving parts of equipment (26%), lack of blocking devices of drive stationary equipment (9%), and engine malfunction (3%).

Conclusion. Results of research can be used in improving management decisions projects that can provide safe working conditions on meat processing plants.

Introduction

Despite overall tendency of decreasing number of accidents in the Ukrainian food industry, generally the average level of accidents and occupational injuries still is extremely high.

Only during 2003-13 years there were injured over 9.86 thousands of people in the food industry. The 633 of them died [*Koshil O.G., Kostrovenko L.N. (2014), Statistical bulletin. Accidents at workplace in 2003 – 2013, State Statistic Committee of Ukraine, 2004 - 2014*].

The result of researching showed the meat industry is one of the most dangerous and traumatic among observed industries.

The study of the conditions and safety, as well as other potential causes and circumstances of occupational injuries in the meat processing industry of AIC will give a chance to develop reasonable and effective ways of preventing and reducing the risk of injury to workers in the sector.

Aim: to provide an analysis for discovering potential reasons and sources of occupational injuries of the meat industry workers.

Objects of researching: conditions of work in the meat processing industry during 2003-13 period.

Material and methods

The research is based on the example of Ukraine meat industry of different capacities.

Occupational injuries are investigated. Industrial accident is the phenomenon which is characterized by mixture of on-work industrial injuries and accidents.

The research is made with the help of using the method of industrial accidents statistical analysis occurred in meat industry enterprises of Ukraine during 2003-2013 to define general traumatical tendencies in the meat industry of Ukraine as well as the method of a priori ranking factors on the results of the expert survey.

Results and discussions

For the analysis and assessment of safety in the meat industry due to incompletely statistics in the field of agriculture about factors that affect the safety it's reasonably to use the method of expert estimations. The reliability of peer review is based on the assumption that in the case of coordination of experts' estimation the reliability is guaranteed [1].

Usage of peer review assumes that the opinion of the expert group is more reliable than the opinion of individual experts [1-2]. The method of collective peer review was very widespread and is commonly used to transfer the experience of leading experts in almost all fields of knowledge and production [1-2].

The three groups of experts took part in research: representatives of labor services and engineering and technical personnel of enterprises of the meat industry, scientific workers of universities and research institutes.

Total number of involved experts – 25 people. To avoid false data it was provided anonymity, but it was taken into account the data that characterize the age, experience, position and education.

Based on the analysis of regulations by the form of H-1 and 7-THB were developed questionnaire survey for experts.

Based on the method of peer review in accordance with the requirements [1-2] the performed data processing by method of a priori ranking factors in the following order:

1. The results of peer review data are presented in a matrix of rank.

Matrix of results of expert evaluation indicators

Experts	**Factors**				
	$\mathbf{X_1}$	$\mathbf{X_2}$	**…**	**…**	$\mathbf{X_i}$
1	a_{11}	a_{12}	…	…	a_{1i}
2	a_{21}	a_{22}	…	…	a_{2i}
j	a_{j1}	a_{j2}	…	…	a_{ji}

2. Calculates the sum of ranks for factors

$$\left(\sum_{1}^{m} a_{ij}\right)$$

where a_{ij} – rank of each i –factor of j – experiment; m – number of experts; n – number of factors.

3. Determination of the average amount of ranks:

$$\frac{\sum_{1}^{n}\sum_{1}^{m} a_{ij}}{n}.$$

4. Calculated deviation from the average amount of ranks:

$$\Delta i = \sum_{1}^{m} a_{ij} - \frac{\sum_{1}^{n}\sum_{1}^{m} a_{ij}}{n}$$

5. Identifying squares of deviations from the average sum of ranks, i.e. the sum of squares of deviations:

$$s = \sum_{1}^{m} (\Delta i)^2$$

6. These data allow us to build high priori chart ranks, after assessing the degree of agreement opinions of the group of experts on the importance of selected factors on the coefficient of concordance (agreement), ω:

$$\omega = \frac{12s}{m^2(n^3 - n) - m\sum_{1}^{m} T_j}$$

where $T_j = \sum (t_j^3 - t_j)$;

t_j – number of equal ranks in j-ranking.

7. Testing conditions agreement of expert opinion:

$\omega = 1$ – evaluation of all experts are the same;

$\omega = 0$ – experts gave different results and views.

8. Valuing coefficient of concordance was carried out on the criterion $\chi 2$-distribution with the number of degrees of freedom f=n–1.

The value of $\chi 2$-criterion was got according to formula:

$$\chi^2 = \frac{12s}{mn(n+1) - \frac{1}{n-1}\sum_{1}^{m} T_j}$$

The hypothesis about the availability of coordination of expert opinion may be accepted, if the given number of degrees of freedom tabular $\chi 2$ value less than estimated for the 5% level of local importance.

Thus, the weight of each factor and the consistency of experts' opinions are determined during the process of peer review.

Research of sanitation has showed that the level of whole-body vibration does not meet 15% of the surveyed jobs, meteorological parameters do not meet the requirements in 35% of cases, the noise level – in 13% of cases, the results of measurements of artificial and natural light – in 37 % of cases. Provision of household premises employees does not

exceed 75%, in 48% cases there are no showers and rest rooms do not meet the requirements of room for meals in the enterprises. Mandatory medical examinations in 50% of cases not carried out in full and only formally [3].

At the place where the accident occurred, the most traumatic is the main production workshops – (58%), auxiliary production workshops – (21%), area of enterprises – (11%), vehicles – (13%).

The study shows that 83% of accidents occur during day shifts. The reason is that the maximum number of workers in the first shift at work performs the greatest amount of work with the slaughtering, processing carcasses deboned meat. The maximum number of accidents (25% of the total) occurs at second and third hours from the beginning of the day shift.

The distribution of occupational injuries according to types of traumatic factors is presented in table 1.

The most common traumatic factor in the meat industry is that workers often were injured by objects, parts that move, rotate (production equipment), including manual labor equipment such as knives, saws etc. The injury of workers by conveyors and conveyor elements is 26% of the total cases.

Table 1

The distribution of occupational injuries according to types of traumatic factors in the meat industry of Ukraine, 2003–2013

Traumatic factor	Percentage
Injury by objects, parts that move, rotate (production equipment), including manual labor equipment such as knives, saws etc	21
Fall from the height	14
Transport accidents	12
Injury as result of explosions: tanks of fuel lubricants, pressure vessels, steam and water heating boilers, fires	10
Injury due to a fall, collapse items, meat carcasses	5
Injury by plant vehicles	5
Hazardous and toxic substances poisoning	5
Injury by conveyor elements	5
Burns from hot water and steam	4
Injury by chemical solutions during processing equipment	3
Injury as a result of the collapse of building structures	3
Injury by electrical current	3
Effects of Ionizing radiation	1
Hypothermia	1
Other	8

Approximately 30% of accidents are not associated with the use of machines and equipment: falls, fires, collapses of building structures, tanks explosions of fuel and lubricants, the effect of chemical solutions during processing of equipment.

Road traffic accidents and injury by factory transport represents 19% of all occupational injuries.

Approximately 5% of the cases are poisoning by harmful and toxic substances and burns: hot water, steam.

Especially traumatic types of work are: transportation, loading and unloading, repair and maintenance of machinery and equipment.

Distribution of occupational injuries by occupation (for the most hazardous occupations) is presented in table 2.

Table 2

Distribution of occupational injuries by occupation in the meat industry of Ukraine, 2003–2013

Occupational groups	Percentage
Driver	16
Livestock killer	16
Loader	12
Locksmith	12
Meat handler	12
Carcass handler	8
Meat workshop operator	8
Boiler room operator	5
Watcher	3
Engineer	3
Other	5

It was found ten occupational groups where was recorded the greatest risk of traumatic situations: drivers (16%), livestock killer (16%), loaders (12%), locksmiths (12%), meat handlers (12%), carcass handlers (8 %), meat workshop operator (8%), boiler room operator (5%), watchers (3%) and engineers (3%).

For localization of injuries, according to anthropological data in the meat industry it must be noted a large number of upper extremity injuries – 50% of all injuries. Approximately 20% are broken bones of the skeleton, lower extremities, and 10% for head injury. Mechanical injury were received by about 90% were workers, burns – 10%.

Also was admitted contribution of number of injuries according to the length of work in enterprises of the Ukrainian food industry: 20 years or more (24%), 10 to 15 years (12%), from 5 to 10 years (11%), between 1 and 5 years (25%) 1 year (28%). This can be explained solely by psychological factors in accidents; young workers (5 years of experience) are not experienced in carrying out hazardous work. Employees with experience of 5 to 20 years have more experience and therefore they are more cautious when performing dangerous work. For workers with experience of over 20 years of performing their assigned work partly accompanied by an extremely negative factor "addiction" to the risks and hyperbole own experience of "standard situations" in their work.

Consideration of the distribution of accidents by age showed that most injuries are received by workers of the age to 40 – 63% of all injuries.

Technological equipment of most meat processing plants is obsolete and physically lost time warranty. Much of the equipment used at slaughter and processing of livestock, performs its technological features, but has virtually no defense mechanisms.

In 23% of hard character accidents the main reason is usage of faulty technique. Traumatic situation caused by the imperfection of protective fencing equipment of moving parts (26%), lack of blocking devices of stationary machines drives (9%), engine failure (3%).

Distribution of occupational injuries according to the most traumatic equipment for meat processing industry is presented in table 3.

Table 3

The distribution of machinery, equipment, vehicles, machinery, vehicles, the usage of which has led to an accident in the meat industry of Ukraine, 2003–2013

Source of accident	Percentage
Steam and hot-water boilers	25
Conveyors	22
Equipment for the primary processing of livestock	17
Forcemeat mixers	10
Pumping stations	8
Electrically heated equipment	5
Lines of sausage production	5
Machines for meat dumplings production	5
Other	3

As it is seen from the table 3, the most dangerous equipment are: steam and hot-water boilers, conveyors of different types, equipment for the primary processing of livestock, forcemeat mixers, pumping stations, machines for meat dumplings production, lines of sausage production etc. The poor organization of the labor process was named as the main reason of great number of injuries (over 69%) [*Koshil O.G. Statistical bulletin. Accidents at workplace in 2003 – 2013 / Koshil O.G., Kostrovenko L.N. -K. : State Statistic Committee of Ukraine, 2004 - 2014*]: lack of discipline and control over the performance of work by the supervisor (35%), access to work without appropriate training on health and safety (14%), access to the work without proper training (5%).

Other organizational reasons include: the work at premises and production facilities that do not comply to with building regulations; lack of personal protective equipment, lack of necessary documentation (instructions for safety, outfits, tolerances, etc), and lack of work mechanization. Also it is found that 20% of the victims were in a state of alcohol intoxication.

Conclusions

The calculation of indicators of occupational injuries by peer review and analysis of statistical data in the form of acts H-1 and 7тнв that took place in the meat industry for the period 2003...13, to determine the most important factors associated with the causes, sources and circumstances of accidents cases almost by all classifiers.

The most common traumatic factor in the meat industry is damage done by objects, parts that move, rotate (production equipment), including manual labor equipment such as knives, saws, this factor creates 21% of total cases.

Were found ten occupational groups where was recorded the greatest risk of traumatic situations and types of injuries received by employees of the meat industry.

A distribution of machinery, equipment, vehicles, machinery, vehicles, the usage of which has led to an accident in the meat industry in Ukraine for the period 2003...13 years.

Found that most of the traumatic situation in the meat industry are caused by moving parts equipment and lack of safety gears (26%), lack of blocking devices of stationary machines drives (9%), engine failure (3%).

Therefore, further important step in prevention of occupational injuries in the meat industry will be constructive development of protective fencing and locking devices equipment. Modeling of traumatic situations in the workplaces of meat processing plants.

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