

ASSESSMENT OF GOOD ENVIRONMENTAL PRACTICES IN ABATTOIRS

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ABSTRACT

As abattoirs may have a very significant negative impact on the environment, the aim of this study was to assess the implementation of their Good Environmental Practices related to the usage of energy, usage of water, waste management and waste water management. Questionnaires were developed and Good Environmental Practices were assessed through interviewing of the abattoirs management responsible for environmental issues and through on-site checks in seven abattoirs on the territory of Autonomous Province of Vojvodina. Good Environmental Practices in the usage of energy, usage of water, waste management and waste water management were on average implemented in 81.4, 48.6, 94.3 and 74.3%, respectively, with significant differences between abattoirs. The study is useful as a basis for discussion in order to improve environmental practices in abattoirs. Both meat industry and public would benefit from implementation of Environmental Management System in meat industry sector.

Keywords: *abattoir, environment, energy, water, waste*

INTRODUCTION

Meat industry is considered as an important pollutant of the environment. The conversion of animal into meat in abattoirs inevitably leads to the production of significant quantities of waste. This waste must be carefully managed and disposed of to avoid creating a nuisance or pollution hazard, and to minimize disposal costs. With increasingly strict standards and restrictions being imposed on how wastes can be disposed of, and on the levels of pollutants considered acceptable in the receiving environment, meat industry face the challenge of improving waste management practices in a cost-effective way (Oostrom, 2001).

However, the impact of abattoirs and meat industry as a whole on the environment is much wider than just the issue of animal by-products and wastes. Other aspects of the environmental impact include high usage of energy and water resources, release of undesirable/harmful gases and oxygen usage during wastes breakdown (Arvanitoyannis *et al.*, 2008).

The widespread acceptance of the eco-efficiency concept by the industrial sector shows the increase of general awareness to reduce resource consumption and consequently improve environmental performance (Schmidheiny, 1992; Magueijo *et al.*, 2010). The main environmental aspects associated with animal slaughtering and carcass dressing in abattoirs include water and energy consumption, discharge of solid waste and waste water (IFC, 2007; IPPC, 2006). In order to reduce the overall environment impact of the meat industry, including abattoirs, the first step is to consider the current level of implementation of Good Environmental Practices (GEP). Therefore, the objective of this study was to assess practices related to the usage of energy, usage of water, waste management and waste water management in abattoirs.

MATERIAL AND METHODS

Table 1. Questionnaire on energy efficiency and water efficiency best practices

Question number	Energy efficiency	Water efficiency
1	The building has solid walls or cavity walls?	Abattoir uses chillers, cooling towers or air-cooled equipment?
2	The roof is properly insulated?	Abattoir reuses condensate?
3	All walls are insulated?	Abattoir has installed timers to automatically shut off water flow when water is not required, such as at the end of a production cycle?
4	Doors/windows are kept closed during heating and cooling season?	Abattoir has pressure-reducing devices installed on equipment that does not require high pressure?
5	Thermostats for the heating working are set to the right temperature?	Abattoir has process equipment reuse water (closed loop) or use reclaimed water from other parts of the facility?
6	All steam and hot water piping are insulated?	Abattoir has systems in place to capture and reuse rain water and storm water for landscaping or for other uses (e.g., cooling tower make-up, process water, or dust suppression)?
7	All cooling devices are set for the right temperature?	Abattoir has improved rinsing techniques used (counter-current systems, sequential use from high to lower quality needs, conductivity flow controls, improved spray nozzles/pressure rinsing, fog rinsing, etc.)?
8	Ventilation equipment is switched off by timers?	Abattoir uses detergents that can easily be removed with small quantities of water?
9	Space heating is controlled by a sophisticated system programmed for weekends and holidays?	Spent rinse-water is being reclaimed and reused for lower-grade processes or for other facility applications?
10	There is a programmable lighting control (photo- sensors, time switches, etc.) for control of indoor and outdoor lighting?	Process cleaning or facility cleaning have been replaced with waterless techniques (i.e., using pressurized air to clean products or containers, sweeping debris off the floor) where possible?

Table 2. Questionnaire on waste management and waste water management best practices

Question number	Waste management	Waste water management
1	Abattoir has a Waste Management plan?	Abattoir has a sewage system in place?
2	Abattoir has a register of all types of waste?	Abattoir has a licence for release of waste water?
3	Abattoir has contract with waste operators for all types of waste?	Abattoir regularly analyses the effluent?
4	Abattoir has a designated place for organic waste (including organs, fat or lard, skin, feet, abdominal and intestinal contents, bone and blood)?	Abattoir has an agreement for disposal of effluent?
5	Organic waste is secured from unintended use?	Abattoir uses biological treatment (aeration tanks / lagoons, or other treatment)?
6	All types of waste have containers that are closed?	Abattoir uses physical treatment (filtration, sedimentation tanks, etc.)?
7	Abattoir has a system to check potential container holes, leaks or damages?	Abattoir uses chemical treatment (pH adjustment, neutralization, disinfection, etc.)?
8	All liquid wastes in a container are inside an impermeable bund (or other appropriate secondary container)?	There is no untreated waste water in the plant (storm water, etc.)?
9	Abattoir has waste transfer notes every time someone else takes waste away from your site?	No incidents / emergencies recorded related to waste water release?
10	Different categories of ABP are separated and labelled to avoid contamination?	Abattoir has an emergency response plan in case of waste water accident?

The study included seven abattoirs (red or poultry meat, industrial or small-scale companies) on the territory of the Autonomous Province of Vojvodina, Serbia. The abattoirs were visited and environmental management officers were interviewed according to the questionnaires presented in Table 1 and Table 2. Each GEP aspect consisted of ten questions and the answers were "yes" or "no". Following the interviews, on-site checks of each answer were performed in abattoirs. Results were expressed as averages with standard deviations of positive answers for each group of questions.

RESULTS AND DISCUSSION

The levels of implementation of Good Environmental Practices in the abattoirs are shown in Table 3. Evidently, the best implemented practices are related to waste management - the fact that six out of ten issues were completely covered in each abattoir mainly contributed to this finding. On the other hand, water efficiency practices were poorly implemented, i.e. in less than one half of investigated abattoirs and mostly due to non-practising of water recycling. In between, energy efficiency practices and waste water management practices were implemented in roughly four-fifths and three-quarters, respectively.

Table 3. Implementation of Good Environmental Practices in abattoirs

Question Number	Energy efficiency	Water efficiency	Waste management	Waste water management
1	100	100	100	100
2	100	42,8	100	85,7
3	100	85,7	100	85,7
4	100	71,4	100	57,1
5	100	14,2	100	57,1
6	85,7	14,2	85,7	85,7
7	100	42,8	85,7	57,1
8	57,1	100	85,7	100
9	28,5	0	85,7	28,5
10	42,8	14,2	100	85,7
Mean ± SD	81,4 ± 27,8	48,6 ± 38,2	94,3 ± 7,4	74,3 ± 23,2

Energy and water are consumed in all stages of slaughter and carcass dressing in abattoirs, from the moment of live animals receiving in lairage, until the chilling of final carcasses. In developed countries, both energy and water efficiency in abattoirs are at much higher level, i.e. above 90%. In these countries, on average, 2,2 m³ and 2,5 m³ of potable water is consumed to produce one tone of beef and pork meat, respectively, and up to 9 m³ of water is consumed for production of one tone of poultry meat. With respect to energy consumption, 180 kWh are used to produce one tone of beef, while 300 kWh and 350 kWh are spent for one tone of pork and poultry meat, respectively (Buncic, 2006). Hence, it is a bit surprising that good practices in the usage of energy and particularly on the usage of water are not implemented at higher levels since the savings of these resources, besides reducing the impact on the environment, would consequently increase the economic benefits for the industry.

Production of large quantities of waste is unavoidable in meat industry. Solid waste includes parts of animals such as inedible offal, detained meat, gut content, hair, feathers, etc. These materials are treated, disposed of or processed and re-used in many different sectors, including the cosmetic, pharmaceutical, as well as being used for feed and fertilizer industry (Prieto *et Garcia-Lopez*, 2014). The largest part of water consumed in slaughter and carcass dressing operations (e.g., cleaning and/or sterilization of working surfaces and equipment, pig and poultry carcass washing or chilling of poultry carcasses) ends as waste water. Waste water, treated or untreated, is usually disposed into municipal drainage

systems or used for irrigation. Solid waste and waste water from abattoirs potentially contains numerous chemical contaminants as well as biological human and/or animal health hazards (Buncic, 2006). Therefore, implementation of proper waste management plays an important role not only for the environmental, but for the public protection in general.

In Serbia, only abattoirs with a production capacity exceeding 50 tons of meat per day are legally required to carry out an expert assessment of environmental impact (RS, 2010). However, the majority of meat production is carried out in medium and small abattoirs that are not obliged to properly assess environmental impacts and usually fail to follow proper environmental practices. To accomplish this, plant management and staff must be motivated with clear presentation of their potential benefits (Oostorm, 2001; Barsel *et al.*, 2002; Djekic *et al.*, 2014). All plant inputs (i.e. water and energy) should be measured, at multiple points of each operation, to gain quantitative data on plant consumption. The outputs (i.e. waste) of each plant should be determined in a similar manner and results of abattoirs' input–output obtained need to be communicated effectively by both the companies and regulators. These data would enable effective analysis of technologies and techniques used, and subsequently the introduction of cleaner technologies that use fewer resources.

Saving energy contributes to a more efficient production, increases competitiveness, enhances innovative capacity and allows industries to respond to environmental requirements imposed by law, market and society in general (EIA, 2013). Appropriate environmental management should be one of the priorities of the meat industry - in addition to meeting legal requirements, consumers better accept environmentally friendly processes and products (Kimitaka, 2010; Gomez *et Rodriguez*, 2011).

CONCLUSIONS

In terms of the implementation of Good Environmental Practices in Serbian abattoirs, waste management practices were assessed as being the most thoroughly implemented, while the water efficiency practices were assessed as being the one which were mostly poorly implemented. Therefore, it appears that more needs to be done by meat industry to implement appropriate environmental protection measures. This way, the meat industry would accomplish the legal norms, increase the reputation at consumers and provide economic benefits with rational use of resources. The study is useful as a basis for discussion in order to improve environmental practices in abattoirs although wider spectrum of data is necessary to motivate meat industry and to foster appropriate environmental control by the authorities.

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