

# **PROBLEMS AND SOLUTIONS OF WASTE HANDLING PRACTICES AT RED MEAT ABATTOIRS IN THE FREE STATE PROVINCE, SOUTH AFRICA**

**H.A. ROBERTS AND L. DE JAGER**

## **ABSTRACT**

The waste management practices used at red-meat abattoirs in the Free State province for disposal of condemned products generated in abattoirs and the problems associated with the different waste disposal methods were investigated. Problems caused by various products generated at abattoirs, such as abattoir waste water, blood, stomach contents, manure, whole carcasses, fetuses and all products unsuitable for human consumption requiring disposal were identified. Recommended solutions took into account the most effective handling manner, causing minimum environmental pollution, reducing any health risks to communities, and converting condemned products into value-added by-products by changing certain waste management processes/strategies. The handling of waste, specifically of condemned products, at 78 red meat abattoirs was analysed.

**Keywords:** red meat abattoirs, waste disposal methods, waste management, condemned products, by-products.

## **1. INTRODUCTION**

Industries in all spheres of production contribute to waste generation. Abattoirs are one of the industries that contribute to the problem of possible food-borne diseases and potential health hazards associated with food, especially with regard to meat (Bradshaw, Southwood and Warner, 1992:183; Nemerow and Dasgupta, 1991:284). As part of their service to the industry and the public, abattoirs perform meat inspections to ensure that only meat and meat products suitable for human consumption are approved and supplied to farmers, butcheries and supermarkets (Van Zyl, 1995:76). As a result of such meat inspections, some meat, meat trimmings, and sometimes organs and carcasses are condemned (declared unfit for human consumption) and have to be disposed of.

Animal waste may be defined as "carcasses or parts of animals, including products of animal origin not intended for direct human consumption" (Steffen, Robertson and Kirsten Inc., 1989:23). Inedible offal includes skin, ears, gall bladder, foetus (unborn animals), hair, hooves, snout and horns (Van Zyl, 1995:87). Waste generated by abattoirs includes condemned organs and carcasses, blood, hides, paunch content and carcass trimmings (Steffen, Robertson and Kirsten Inc., 1989:23; Patkie, Subramaniam, Kumar and Patil, 2000:826).

Current economic conditions in South Africa force under-privileged communities to "scavenge" or seek for any possible source of food. Some of the sites frequented are landfill sites, dumping grounds and disposal sites used by abattoirs (Derbyshire, 2003).

Condemned products and carcasses, if not properly disposed of, may end up being eaten by "scavengers" or persons living off refuse sites: this could create significant health problems which could lead to disease and death. Although condemned products are not suitable for human consumption, certain products could be re-used or may be of some use to the poor after having been subjected to alternative processing methods.

## **2. METHOD**

The handling of waste, specifically of condemned products, at 78 red meat abattoirs in the Free State Province, which included low throughput and high throughput, was analyzed. In the Red Meat Regulations, framed under section 22 of the Meat Safety Act, Act 40 of 2000, (South Africa, 2000) a "unit" is specified in relation to a quantity standard for determining throughput for red meat (South Africa, 2000:3). Data were collected by administration of questionnaires to management and workers, interviews and observations, was analysed using Statistical Analysis System (SAS/STAT, 1990).

## **3. WASTE MANAGEMENT PRACTICES USED**

Seventy four managers and forty four workers reported on various disposal methods which were used to dispose of condemned products (Figure 1). Burying and burning were the most common disposal methods reported. In many cases a combination of disposal methods were applied (Figure 1). Some products, for example stomach contents, were buried, while condemned organs were burnt and whole condemned carcasses and unborn foetuses were fed to vultures. Respondents could select more than one option. In their responses managers indicated more options, thus more combinations of disposal methods, than the workers did. High throughput abattoirs (Grade A) disposed of all their condemned products by processing them into by-products.

A variety of disposal methods are used in combination with burying the condemned products. However, Figure 1 clearly depicts that burying is the most common disposal method for condemned products, as respondents of all abattoirs (high and low throughput) reported a high percentage of burying taking place.

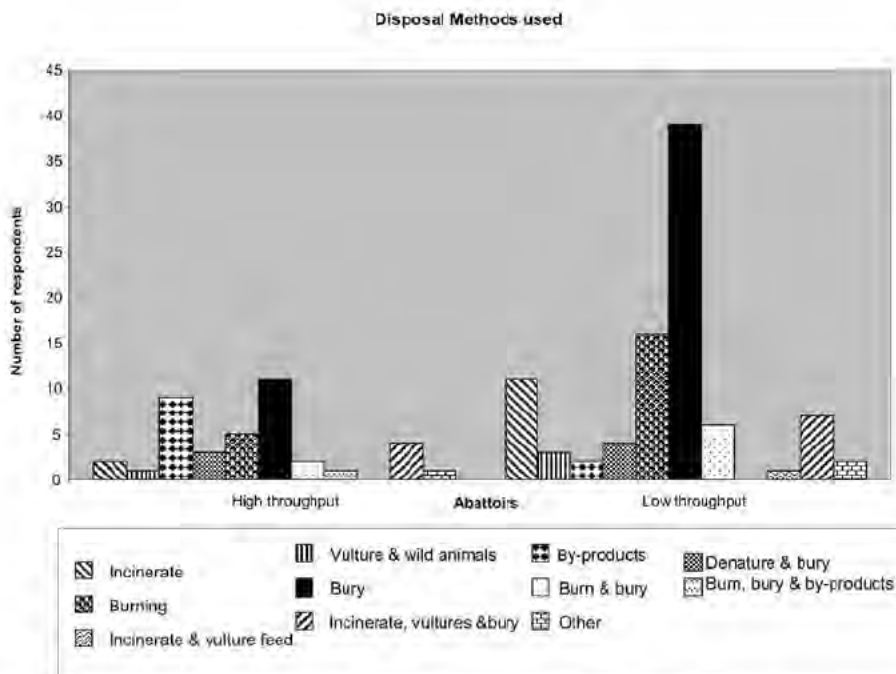


Figure 1: Disposal methods used: High and low throughput abattoirs

#### 4. PROBLEMS ASSOCIATED WITH CONDEMNED PRODUCTS

Responses from management and workers identified the condemned products which would require disposal as blood, trimmed off-cuts, whole condemned carcasses, waste water, stomach contents and unborn calves (foetuses). These products were disposed of as either liquid waste, which were mainly blood and waste water (section 4.1) or solid waste (section 4.2), which included bones, hooves, foetuses, whole carcasses, trimmed off-cuts.

##### 4.1 Liquid Waste

Large amounts of blood and waste water are generated at abattoirs. At A grade abattoirs (high throughput) water usage varied between 60 000 to 841 000 liters daily. According to the Environmental Protection Agency (2001:2); UNEP (1997:19) and Kelly (1976:118), various substances may be present in waste water disposed from abattoirs, for example organic material, including nitrogen, bacterial pathogens (salmonella and shigella), parasite eggs and amoebic cysts. Adeleye and Adebisi (2003:309) also found *B. cereus*, *E. coli*, *S. aureus*, *S. lactis*, *P. vulgaris*, *S. typhi* and *P. aeruginosa* in the abattoir discharge.

The method currently used at 33 of the abattoirs in the Free State, South Africa, for the disposal of blood, where the blood is allowed to run into the municipal drainage systems, coincides with the disposal method used in European Union countries before the outbreak of BSE. Problems similar to those found in European Union countries and other countries world-wide, for example blockages of municipal drainage systems and bad odours, were evident. At 13 of the smaller abattoirs in the study, of which a large component is located on farms, most blood is allowed to run off onto fields or is used in gardens.

The extensive amounts of waste water generated at local abattoirs are also reflected in other countries as a problem. Van Zyl (1995:27) reported that in 1994 the red meat abattoirs in South Africa used about 0,5% of the national industrial water consumption. The costs of purifying such waste water are borne by the abattoirs in these countries, whereas in the Free State Province, they are generally absorbed by the municipalities and local authorities and supplied as part of the service to industry.

Waste water was mainly disposed of into the municipal sewage systems or allowed to run onto the fields. Many of the low throughput abattoirs (especially E Grade) are situated on farms and they dispose of their waste water by allowing it to run onto the fields or by collecting it in closed systems such as tanks, and then spraying it onto the farm soil. At 11 abattoirs the waste water was collected in closed systems but mostly ended up at municipalities. The disposal of waste water into French drains or oxidation ponds was limited as only 11 abattoirs used these systems.

## **4.2 Solid waste**

A variety of sources of solid waste can be found in abattoirs. Some of these sources include the animal holding areas, slaughterhouse and processing areas, waste treatment plants and pieces of hides or skins, condemned carcasses and carcass parts (EPA: 2001:3). Adeyemo (2002:23) and Thassitou and Arvanitoyannis (2001:193) list similar solid waste products generated in abattoirs which were also identified in the study. Adeyemo (2002:23) lists condemned meat, undigested stomach contents, bones, horns, hair and unborn animals as solid waste generated at abattoirs. Thassitou and Arvanitoyannis (2001:193) have also included intestines and portions of meat or bones which are processed and used as animal feed when solid waste is described.

Management and workers in the study indicated that stomach contents were buried at 27 abattoirs (Figure 2). Other processes which are also used quite extensively are the scattering of stomach contents on fields or being transported to municipal landfill sites and then buried.

## Disposal of stomach contents

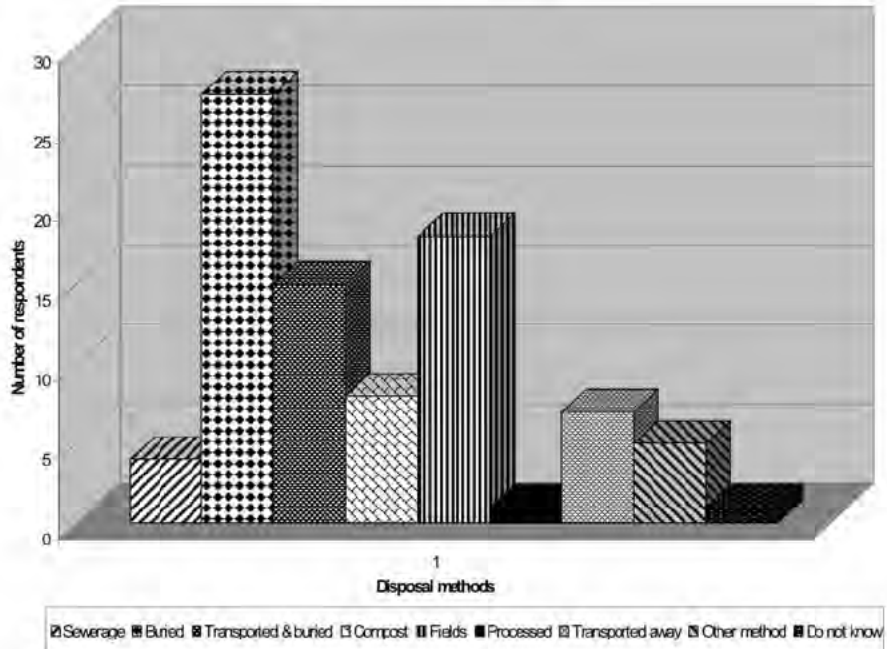


Figure 2: Disposal of stomach contents

The Australian-Environmental Protection Agency (AU-EPA, 2001) recommends that the paunch content ought to be processed into compost. In the Free State Province it is evident that only small amounts of compost are produced (Figure 2).

## 5. RECOMMENDED SOLUTIONS ASSOCIATED WITH CONDEMNED PRODUCTS:

Solutions and recommendations to improve current waste handling practices should take into account the most effective handling method. This should cause minimum environmental pollution, reduce any health risks to communities, and convert condemned products into value-added by-products by changing certain waste management processes/strategies.

### 5.1 Liquid waste

#### 5.1.1 Blood disposal

Currently the blood generated in 29 abattoirs is washed away with the waste water. More hygienic, and less contaminated, blood could be collected for use in

by-product processing by the installation of sieves for the collection of hairs and bristles, meat scraps and other wastes washed over the slaughter floors with the blood water. Regular cleaning of sieves would be necessary (Koenig and Yiu, 1999:385).

In the processing and disposal of blood, it may be necessary to adopt measures which are not very costly. The drying of the blood could be done by constructing a metal plate on a conveyor system which simultaneously dries the blood and removes it to a suitable area for further processing. Alternatively, a conveyor made up of linked metal trays, like devices used in bakery ovens could be used to dry the blood (Pretorius, 2004).

### **5.1.2 Waste water**

Waste water should be treated and re-introduced into the system for cleaning purposes. In circumstances where adequate funding is available, a three pond system could be built for the treatment of the waste water. In other cases, where financial constraints exist, the process could be constructed on small scale. Certain factors will have to be taken into consideration, namely that the system will require a site-specific design and it should be constructed in such a way that failures will not occur.

## **5.2 Solid waste**

### **5.2.1 Stomach content**

The conversion of stomach contents and manure into compost is becoming increasingly popular in overseas countries, because of the continuous escalating disposal costs. This waste handling process could be a feasible means of disposing of some of the waste generated at red meat abattoirs in South Africa. Composting can be done with very little extra cost, when the open dumping or natural composting method is used. Other options include vermiculture and windrows. The operation of windrows could prove to be more costly at the outset, but the profits made would compensate for the expense and it would eventually pay for itself in return. When the windrows are situated on farms where the abattoirs are located, the existing farm equipment could be used.

### **5.2.2 Condemned products**

Rendering of condemned products into by-products (for example bone meal, blood meal and carcass meal) could be a feasible option. In the production of by-products it would be possible to start off on a small scale and to determine what the most successful and cost effective methods would be for each product before too much money is invested in the process.



## **6. CONCLUSIONS**

Some of the waste disposal methods used in European Union countries to manage and dispose of some of the condemned products was also observed, to a lesser extent, in the Free State Province. These include landspreading, incineration, landfilling and rendering. In some countries, for example Germany, as part of the EU regulations, no landspreading may take place, without pre-treatment.

The condemned products identified which could be developed to the financial benefit for the abattoir and the farmer included blood, waste water purified and used for cleaning purposes, liquid fertiliser resulting from the purifying of the water and adding effective micro-organisms, and fertiliser produced by processing stomach contents and manure into compost.

Furthermore, it is important that alternative uses be sought for by-products as in the near future, the use of bone meal, carcass meal and blood meal might be restricted, because of the fear of diseases spreading, as in the case in the European Union countries. Presently rendering of condemned products may provide financial benefits if bone meal, carcass meal and blood meal can be produced by crushing and treating the condemned and waste products. These products could be sold for the production of fertilizer and animal feed. The hooves could be removed and sold to veterinary practices and farmers markets or flea markets (abattoirs situated on farms) as pet treats. Horns could be collected and sold for production of ornaments as well as the production of peptone and single-cell proteins which could be used in human food and animal feed (Kurbanoglu and Kurbanoglu, 2002:202; Kurbanoglu and Algur, 2002:125). An investigation of use of blood generated in abattoirs for human consumption and medical/veterinary is proposed.

The economic status of some of the less advantaged people in the country may be improved if waste management strategies are adopted to maximise the use of these products for financial benefit.

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