

ENVIRONMENTAL ANALYSIS OVER THE SWEDISH DEMILITARIZATION INDUSTRY

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ABSTRACT

A close examination of Swedish ammunition disposal reveals, among other things, that the use of resources and energy, not the least in connection with transportation, seems to be an often neglected environmental impact issue. Being international in nature, the problems connected with these issues can be solved only by international co-operation.

The Swedish Defense Material Administration (FMV) is a state agency that can influence consideration given to environmental issues. In connection with tender inquiries on open ammunition disposal, FMV can define a number of environment-related demands. One such demand has been studied at Mälardalen University. It was found that the environmental aspects of transportation are as a rule neglected in an overall assessment. Road transportation of ammunition as well as handling at the disposal site are indeed important issues of the entire disposal process.

Today's main reason for the ammunition industry to pay due attention to the eventual disposal process, is that recovery of materials in connection with ammunition disposal considerably reduces the environmental impact. Furthermore, doing business with recovered materials is a profitable side effect. Another side effect of careful planning of this type of processing is the positive influence on human health and biological diversity.

INTRODUCTION

This paper is a result of a undergraduate thesis project done in co-operation between Mälardalen University and KCEM. The purpose is to describe recycling and destruction of ammunition in Sweden and how the environment is effected by this. Environmental concern in industrial processes, including the ammunition industry, is a high priority today. The purpose was also to find the most important parts in the process cycle concerning environmental assessment and sustainable development.

Swedish ammunition is phased out when for some reason it has become unsafe to use. Defects from production can be the cause but most commonly it is when ammunition has been stored for a long time and gone out of use due to safety reasons. Most of the ammunition stored in Sweden today is more than 50 years old. Dumping in lakes and open burning have been common methods for disposal of ammunition through time. Dumping has been

prohibited since 1971 and there is likely to be a prohibition against open burning as well. (Hörnström, 1996)

When analyzing the environmental assessment of a product, it is important to study its complete lifecycle including energy consumption and impact on nature related to transportation. The different steps are unequally important depending on the design of the process steps. One basic idea could be that the relevance of the improvement depends on the use of fossil fuel and discharge of globally effecting pollutants.

RECYCLING OF AMMUNITION IN SWEDEN

The only company recycling ammunition in Sweden is Vingåkersverken. Most of almost all the ammunition arriving at Vingåkersverken is recycled or destroyed. Recycle of material is the primary method in Vingåkersverken. This not only offers avoidance of the toxic flue gas, which results from incineration, but also allows reuse of resources which otherwise would have been lost. Today, reuse of material is the most acceptable method for recycling of ammunition but some parts of ammunition is still combusted when there is no known profitable way to reuse it. For sea mines and other large items, the most important step in the recycling process is open burning of left over explosives. This is the only step in the end of life cycle of ammunition where the material is not reused. This step is considered a problem at Vingåkersverken (Timner, 030520).

TNT is an environmental problem. Samples in the area surrounding Vigåkersverken show signs of TNT. However these levels are under the guidelines set by The Swedish Environment Protection Board. This shows that the purification is effective in the water treatment process of the out going water from the process of melting TNT.

The environment is also effected by the use of energy. Vingåkersverken uses oil as an energy source for all its processes. Oil is a fossil fuel. The increased use of fossil fuel over the world has led to a discussion on how to replace it with other more sustainable fuels.

The discharges from open burning of left over explosives in the ammunition have been valued as the most significant of the steps of recycling in Vingåkersverken.

THE COST OF ENVIRONMENT PROBLEMS

The Swedish government has established that the environmental problems are expensive for Sweden. These costs are represented by worse human health and biological diversity but also concrete costs like production losses and waste of material. Every step of the lifecycle involves use of resources which can be minimized with recycling and development of markets of reused products and material. (SNV 5177, 2001) The government asks in a proposition (2000/10:130) for a method of evaluating the environmental costs together with the social and economical issues and suggests three strategies. One of these means a more efficient use of energy, resources and transportation which aims to contribute the achievement of the goals for acidification, eutrophication, fresh air and climate.

AMMUNITION AS HAZARDOUS WASTE

The view of waste is two sided. Waste is balancing on the edge between being an environmental problem and a resource where the technical development is crucial. The Swedish Environment Protection Board has in report 5225 put the responsibility for the different parts of the lifecycle on the different actors. The government has the overall responsibility for leading the country towards sustainability within production and consumption. Use of resources is considered the main problem because it gives rise to

discharges of heavy metals and influence on flora and fauna. The Swedish Environment Protection Board has also agreed that the transportation of goods has a significant part in a products lifecycle and advocates this trend must be broken through a co-operative work between different countries. In the report, The Swedish Environment Protection Board suggests that the status of the environmental questions in EU are raised to the same level as the free trade. (SNV 5225, 2002)

Economical means of control is a way for authorities to give signals to the surrounding community that environmental concern is important. With help from the law, authorities can control the power of the market to influence the actors in favor for the environment. Taxes or requirements for technical improvements like catalytic converters in cars are examples of this. Companies with high environmental performance can influence their suppliers and cooperation partners with higher demands. Swedish Defense Material Administration is a state agency with a high responsibility for the signals given to surrounding actors. They have in their purchases very large possibility to influence the environmental concern within the framework for disposal of old ammunition. In one of the enquiries a formula was formed to illustrate the connection between price and environmental concern. They have weighted the environmental concern as 60 % of the total judgment and the price as 40 %. In this case environmental concern means material reuse (Anbudsinfordran FMV, 20020715). While costs in transportation is included in the price section, no concern is taken for transportation in the environmental part of the formula.

TRANSPORTATION AND OPEN BURNING OF LEFT OVER EXPLOSIVES

After having studied earlier literature and interviewed experts in the recycling process it was possible to establish that the open burning of explosive contaminated ammunition parts is the step in the recycling process with the highest environmental assessment. This led to a comparison between the open burning and the transportation of goods since the transportations can be expected to have a large environmental assessment. For the comparison, an internet based calculation program developed by the goods transportation industry is used. This model is called NTMcalc and is used by the transportation business to find out the environmental assessment when different alternatives are compared. The model is not based on new fact but is a compilation of data from different actors like for example Volvo LV and Scania (NTM's homepage 030512).

The trucks can take 40 tons but normally around 37-38 tons are loaded on each load. Exceptions are made when the ammunition contains large amounts of explosives or if the store does not contain a full load. (Elfer, 030514). The emissions are allocated on the weight of a sea mine to receive data of emissions from each sea mine to use in the comparison.

Ammunition is transported by truck from the stores all around Sweden. Other means of transportation could give a different result. For instance train is considered a more environmentally friendly option.

One sea mine (F31) is used in this comparison. Note that the section chosen here is 200 km, it is relevant to expect longer distances when ammunition is transported.

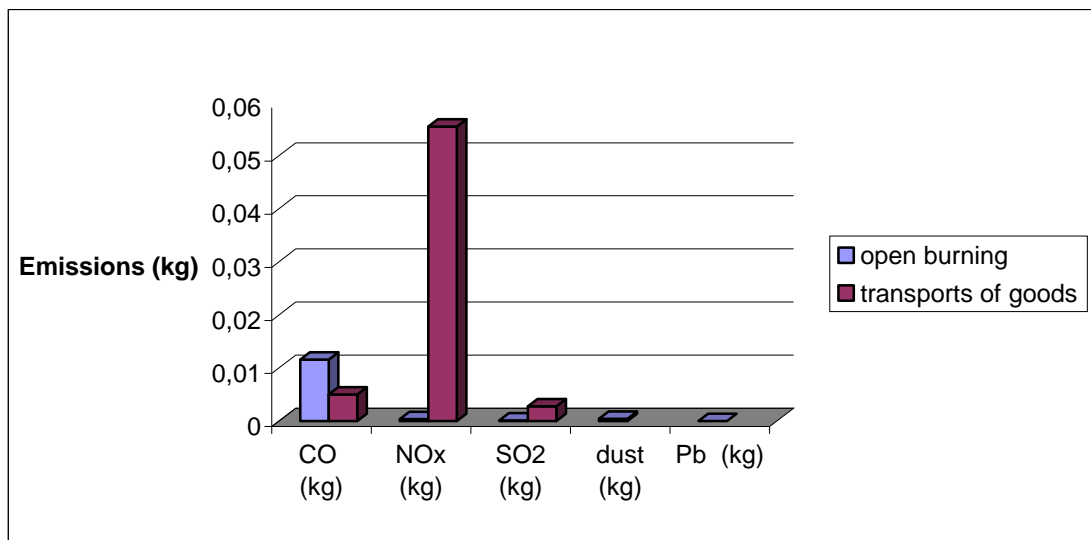


Figure 1. Comparison between open burning of explosives and transportation (200 km) of one sea mine F31.

This comparison (Figure 1) shows the discharges of some substances. The open burning, which is the most critical step in the process of recycling, has smaller discharges compared to transportation of the same mine. Acidic substances are the most obvious impacting in the comparison but it is easy to see that also carbon discharges is important in transportation, especially when the distance is long.

REUSE OF MATERIAL FOR MILITARY PURPOSE

Methods for reuse of material for military purposes have been studied in Sweden. Today all recycling of ammunition is done for the civil market which involves an economical decrease. Military reuse could increase the number of buyers but today the only produced ammunition is from raw materials. No reused material is ordered by the Swedish Defense Material Administration because of problems with quality guarantee. (Hägwall, 2002)

DISCUSSION

The adjustment into a more environmentally acceptable society means that a preventable work has to be done in several areas.

Discussion about an adjustment to a more environmental friendly process will in some cases be about the question of sending material for recycling far away even for a small number of percentage recycling. Transportations with truck means emissions while increased recycling promotes other kinds of sustainability. Valuation, between the environmental assessment in transportations compared to the possible environmental profit in higher percentage reuse of material, is complicated. The first case is about waste and resources while transportations primary influences the climate. These are two environmental effects that can not be compared to one another without making values grounded on subjective opinions (Söderbaum, 1986).

An discussion must be held about the environmental issue. The profit in more environmental preferable solutions in ammunition recycling must not cost to large assessment on the global environment in largely increased discharges of greenhouse effect related gases. One problem is also transportation of old ammunition as hazardous waste because of the risks

it results in. Making an environmental assessment comparing these transportations with the degree of recycling involves a personal judgment which is also subjective.

FUTURE STUDIES

Old ammunition is treated as hazardous waste in Sweden which means handling ammunition has to be done with consideration to the waste laws. This is not necessary the case in all European countries why the regulations in handling ammunition and the guidelines in the processes can be different in different countries. It would be interesting to see if Swedish laws prevent the possibilities to develop Swedish processes or makes it easier.

It is interesting to determine the actual cost of emissions on the environment as production losses, increased corrosion, health effects etc, and we will work on this subject. Alternative, innovative recycling methods and alternative usage of recycled materials is another area of specific interest, to make the recycling as cost effective as possible. Emissions from different destruction processes will also be studied more in detail. System aspects and the lifecycle perspective including factors like considerations of recycling already in design of ammunition is of importance.

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