THE MODEL OF AN EFFECTIVE PUBLIC COMMUNICATION IN REMEDIATION OF ACID TAR DUMP: CASE OF PESNISKI DVOR

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SUMMARY: The presenting paper maps the problem of communication in hazardous and industrial waste management and discusses the model of successful waste management with the support of communication strategy. The case of remediation of acid tar dump explains the necessity to accommodate the rising democratic expectation of public participation in deliberations over the incineration waste policy. Accordingly the transparency of the process with the dissemination of results is an important element in the successful model of hazardous waste management. The technical elements of the process are discussed with the explanation of successful communication strategy. Technological process includes digging out of acid tar and contaminated soil, the solidification of the acid tar, purification of the gas and the revitalization of the dumping site. According to the environmental impact assessment the following environmental parameters were dealt with: air, soil, water, noise, electromagnetic radiation, waste, nature, cultural heritage and landscape.

1. INTRODUCTION

The public communication about the waste management, particularly hazardous waste, has often been excluded from policy processes. People's responses to different risks are determined by psychological factors and technical information would rarely have a very strong impact to people's reaction. Awareness and understanding of public concerns must be the basis of an effective risk management strategy. (Frewer, 2004)

In oil refinement process, based on the treatment with sulphuric acid, a bituminous residue, called acid tar, is formed. With such a treatment, linear paraffin molecules (desired fraction) are divided from undesired additions (aromatics, iso-paraffines, heterocyclic compounds). Acid tar is a mixture of liquid, paste-like and solid hydrocarbons, containing free and bound sulphuric acid. (Nanut, 2010)

The laboratory analyses of the acid tar from dumping site in Pesniski Dvor are shown in Table 1.

Table 1 - Laboratory analyses of the acid tar (Lipovsek 2007)

EWC	19 11 02*		PCB	< 1 mg/kg
Dry Substance(105^{o}C)	cca. 90%		Organic Cl	< 0,6%
Inorganic	10-20%		Pb	1-6 g/kg
Density	1,1-1,3t/m^{3}		Zn	1.000 mg/kg
Flash Point	195^{o}C		Cu	100 mg/kg
Caloric Value	Approx. 25MJ/kg		Cd	1-5 mg/kg
Sulphur (s)	8-10%		B	100 mg/kg

The first research objective was to analyse the results of the technology solution for the acid tar remediation in Pesniski Dvor during the whole process. The remediation of the dumping site of the acid tar at Pesniski Dvor includes the preparation works, excavation of the acid tar and contaminated soil, process of the solidification and energy recovery of the solidificate, recycling of the contaminated soil into construction materials, dismantling of the technological equipment and removal of the objects and revitalisation of the dumping site.

The second research objective was to analyse the public participation and integrating environmental monitoring results in effective public communication. Public participated in the complete process of the remediation of the disposal site of acid tar in Pesniski Dvor from the obtaining of the construction and environmental permit until the end of project activities and revitalisation of the disposal site. The project activities and objectives were transparent and all the monitoring results were published.

The third research objective was to examine the appropriate communication tool for presentation of acid tar remediation to broad audience and to design the model that can be implemented in the Balkan area. Public concerns influence consumer behaviours, citizens' support of environment pressure groups, and political preferences of voters during elections. Therefore, the effective risk communication and successful communication to broader public should be the priority in hazardous waste management. The model of acid tar remediation in Pesniski dvor explained the importance of dissemination of results. Moreover, the research and the explanation of the remediation with the audiovisual product resulted in the positive attitude toward the waste management.

2. MODEL OF WASTE MANAGEMENT: CASE STUDY OF PESNISKI DVOR

2.1. Technological solution for the remediation of acid tar in Pesniski Dvor

The main criteria for selecting the technological solution for acid tar remediation was the sustainability of the technology. Due to this criteria different technological solutions were examined. The technology was approved by the investor and the Ministry of Environment in Slovenia. The chosen technology had the minimal environmental impact during the construction of the equipment for the solidification on site, operating and dismantling of the equipment.

The technology for solidification of the acid tar had the capacity of the 10t/h and was installed in the immediate vicinity of the dumping site. The excavated acid tar was delivered to the receiver-mixer, where waste wood, stones and bulky waste were sorted out non-reactive additives (saw dust, coal dust...) were added to the acid tar and the consistence of the mixture was adjusted. The pre-mixture went through the metal separator into the lamella mixer where reactive additives were added and neutralized the acid substances in the mixture. To achieve the best results of the neutralisation it was necessary to have the suitable mixing and exact time. The

type of added reactive additive depends on the analyses of the acid tar, availability, price and distance from the local sources of supply. The mass flow diagram is shown in Figure 1.

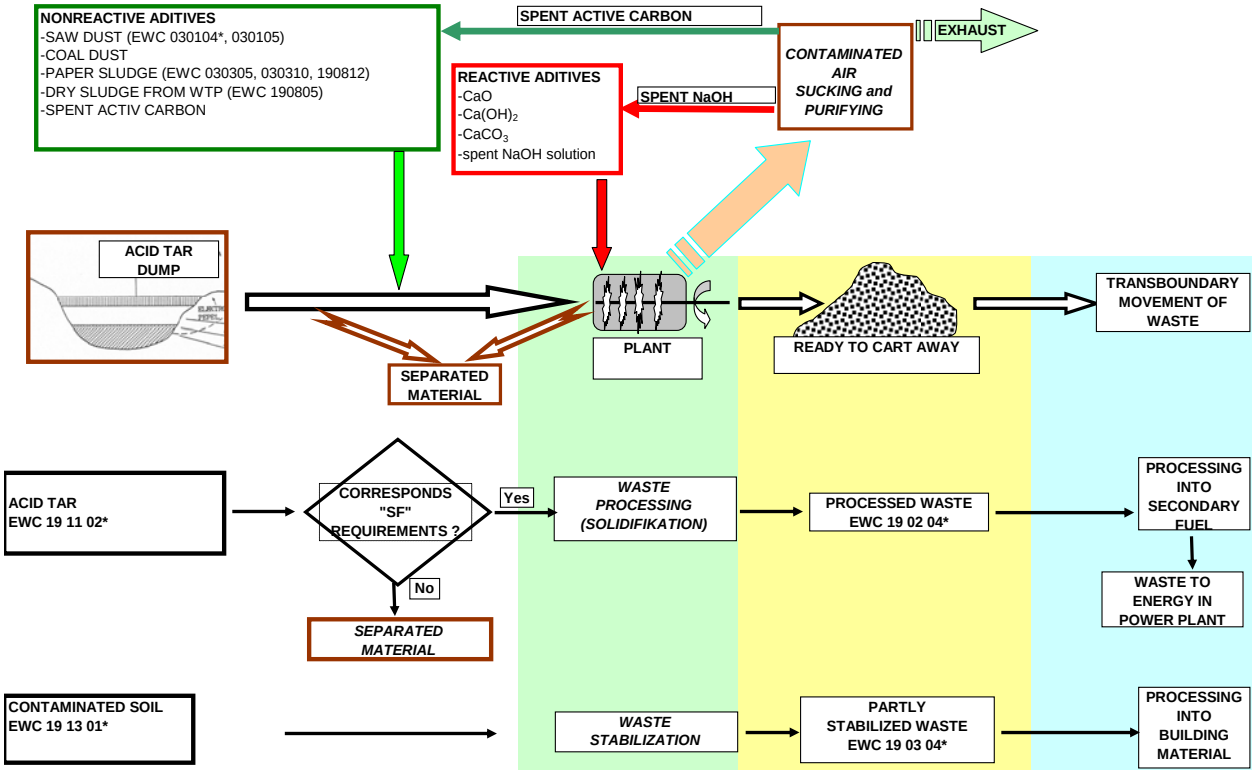

Figure 1. Mass flow diagram (Lipovšek 2007)

At the beginning of the excavation of the acid tar the additional laboratory analyses were carried out. The samples were taken from different depths of the landfill, to obtain the optimum representative sample of acid tar. Laboratory analyses confirmed the results of previous analyses of acid tar, but confirmed also unexpectedly high levels of Pb in acid tar. Such a high content of Pb (up to 15 mg / l), is atypical for acid tar, especially if the results are compared to the other sites with acid tar where in the past the same process and procedure was used and the levels of Pb were significantly lower.

According to the results of the laboratory analyses the solidification process was partly adjusted and the high levels of lead in solidificate requested additional preparation of final product before energy utilization. Total extracted quantities of acid tar were 18.200 tonnes. Actual quantities were slightly higher than the estimated quantities. (17.500 tonnes of acid tar).

Excavation of acid tar was carried out under the water layer in thickness of approximately 1-2 m. In this way, the water layer provides measures to reduce SO2 emissions from landfills.

In the disposal site was approximately 400-600 m3 of the water layer. The water layer slowly declined during the excavation of acid tar, partly due to the integration of water into the finished product. The rest of the water was taken to incineration plant and part to an appropriate water treatment plant.

Immediately after excavation of acid tar and solidification, the removal of contaminated soil was followed. The depth of contaminated soil increased in relation to the depth of the landfill. In

preliminary phase was estimated that the quantities of the contaminated soil were 7000t, but the actual quantities were 10.000t, which represents a difference of approx. 40%.

After completing the excavation and removal of contaminated soil on the deepest part of the dumping site the additional contaminated soil was detected.

To determine the scope, quality and quantity of additional contaminated soil rough measurements on the ground were made. Based on the measurements and laboratory analyses it was found that the soil (pH = 1) contained up to 15% free sulphuric acid, but it did not contain hydrocarbons nor heavy metals. The estimated quantity was about 3000-4500 t.

The study regarding the removal of the additional contaminated soil was made by the contractual monitor. After considering all possible aspects and side effects the decision was made that the soil would be fully removed and transported to the final recovery. Total quantity of the additional contaminated soil was 4.600 t.

2.2. Monitoring

Before the rehabilitation air quality measurements and wind measurements were performed. During a rehabilitation and carried out the measurements of the emissions in the air (the nearest dwelling house) on-line throughout the rehabilitation process for the gas (SO2 and SO3) and dust particles (mineral oil, PAHs, dust particles and other additives CaO, dust solidificate), measurements were also available to the public via the Internet.

During the excavation and solidification of acid tar the concentrations of SO2 occasionally increased in the air. In three cases, there has been a critical emission levels (due to the outbreak of pockets of SO2 on the site, and in one case, while an outbreak of SO2 in the combination with the weather conditions). The critical value exceeded only a very short period of time and was immediately limited with the working activities on site (Hidrooprema 2009)

Noise emissions were measured at the time of the maximum activities on the site of rehabilitation and never exceed the permitted noise levels in accordance with legislation. Working hours on site were limited (between 6 and 18 hour) - valid for all days of the week except Sunday. The transport was mainly carried outonly between Monday and Friday.

The measurement of the impacts on the river Gačnik were done in the first month of remediation (excavation of acid tar and solidification process) and were regularly performed in 14 -day intervals. During the whole process of the remediation the oil or higher level of acid were not detected. Sometimes peak levels of suphate up to 1000mg/l. were detected. The acidification of groundwater and mineral oil were observed. The higher levels of sulphate were detected in samples taken close to the disposal site. The sulphate will appear in the ground water for some more years, but it is expected that it will not influence the groundwater near river Gačnik.

Acid tar was processed in a neutral stable form and then transported to further processing where it is processed (process R3) in the secondary energy source suitable for co-incineration plants or in power station(process R1).

Contaminated soil was pre-treated with reactive additives (Ca (OH) 2, CaCO3), if it was necessary. Then it was transported for further recovery (cross-border shipment), and was recycled into building materials.

Limit parameter for the classification of "acid tar waste" or "contaminated soil with acid tar" was the content of ash. If the ash content was > 40% the waste had EWC 190304 *, which was sent for the recovery into building materials, if ash content was <40%, then the waste had EWC 190204 *, and was sent to the recovery into the secondary fuel.

2.3. Communication model for acid tar remediation

In Maribor the re-refining of the used motor oils with the process of treatment with concentrated sulfuric acid was done. Refinery disposed the acid tar, which is the residue after the treatment with sulfuric acid since 1967 in landfill in Pesniski dvor. The landfill was built in accordance to the applicable regulations and permits of the competent administrative authorities in 1966, an operating permit was issued in 1967. The refinery disposed the acid tar until the year 1983. Since then, the old abandoned landfill is a burden, which represented a significant risk for the environment and required the intervention for the remediation

The information about technical risks alone does not form the basis for coherent management policy that is also acceptable by consumers. Researchers as Slovic (Slovic, 2000) has consistently demonstrated that factors such as whether a risk is perceived to be involuntary, potentially catastrophic, or uncontrolled are more important determinants of public response that technical risk information alone. Risk communication and waste management must also take into account of societal concerns and values. Risk perception also has a direct impact on how citizens respond to risk management activities. It is public concerns and attitudes that have direct consequences for human health, food safely and security, economic expansion and international regulation. (Frewer, 2004, Petts, 2004))

Moreover, the level of social responsibility of waste industry is becoming the priority issue in democratic modern world. In modern democracy citizens should be educated and included in political process. The criteria for democratic political process (Dahl, 1998) are effectiveness of participation, voting equality, control over the agenda, equal opportunity and most important enlightened understanding. To realize all the steps of democratic political process, education and awareness of citizens has to be considered. The awareness about the environmental issues is high on the agenda of modern global and national political processes.

Best practices in risk communication encompass developing ways to communicate these to broader public. Institutions and organisations must consider how to develop and maintain public confidence in risk management practices. Trust and confidence is particularly important under circumstances where people feel that they have very little personal control over their personal exposure to potential hazards. This was the case with public perception of the case of Pesniski dvor where local community opposed to any waste management industry in the area. Accordingly, the principle of N.I.M.B.Y (not in my backyard) is widely accommodated in the perception of citizens when issue of waste management is discussed. In the local communities in Slovenia the rebellion towards any waste management practice came from citizens, particularly after the early 90s when political system with new national state developed. The political democratic development of new government supported any public debate regarding the economic, political and environmental issues.

It is important to communicate the uncertainty about the risk with the explicit and understandable way that is focused on the information needs of target audiences. There is little evidence that elite groups in the scientific and policy community have underestimated the ability of non-experts to understand uncertainty. (Frewer et al, 2002)

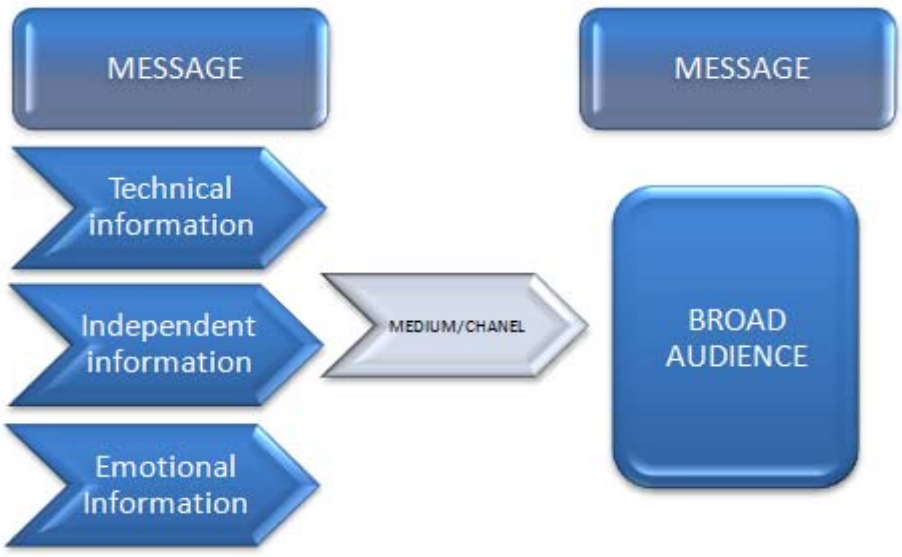

Figure 2. Model of communication in documentary case of acid tar

The non-experts need the communication in the way to establish trustworthiness and certainty about the waste management. For the successful communication of this matter the appropriate tool of communication should be chosen. For the case of Pesniski Dvor the audiovisual documentary (Zavrl, Zilic, 2008) was chosen as a tool of communication. The documentary film covered all the stages of remediation. Research behind the documentary film included interviews with experts from different companies, experts from independent and governmental institutions, local inhabitants and opinion makers from the region.

The audiovisual product could describe the best practices in the way that are successfully perceived from broader public (Figure 2). The situation of the audiovisual viewer is paradoxical. There is a sense in which person is living in two places, and sometimes two times, at once – in the world in which he is physically situated and the world that documentary presents to him (Scannell 1991). The media with the sound and the picture could bring the waste management closer to the individual. The best practices in waste management described in journals are well perceived by experts; however the broader public could get closer to the issues with the (media) product that better appeals to the emotions. The medium for communication that has strong effect is television/screen where picture and sound bring the "reality" to the audience.

3. Discussion

The final result of the acid tar remediation in Pesniski Door was excavation and recovery of all acid tar, contaminated soil, the removal of complete facility used for the processing of acid tar and re-cultivation of the area.

The results of the environmental impact assesment before the remediation showed very high risk of the pollution of the soil and ground water near the dumping site.The acid tar remediation was successfully finished due to the effective technological solution that limited any possible negative impact on the environment.

The results of the monitoring during the remediation process showed the increased values of the emissions of SO_2. Three times the emissions reached the critical limit values but only for the very short time due to the weather conditions. The results of the measurements of the

concentration of sulphates reached peak value of 1000mg/l. The monitoring of the groundwater was on three measurement stations G3, G15 and G9 on different locations. The measurement station G15 was located on the shore of the dumping site which showed the increased value of the sulphates. On the measurement station G3 located near the river Gačnik the sulphates were not detected.

After the completing of the acid tar remediation the monitoring of the ground water on measurement stations G3, G15 and G9 will be performed another two years. It is expected that sulphates will be detected for several years on location G3 but will gradually decrease. The resulting public enlightenment regarding risk issues could resolve some problems of technology acceptance (Hilgartner, 1990). Woolgar (1996) has discussed the ways in which science and social world are often viewed as independent of each other, one result being the discounting of social factors. This separation (Frewer, 2004) produced the decline in public confidence in risk management practices that became the focus of regulatory concern in the 1980s and 1990s.

Communication is a two way process and organisations need to learn how to internalise public views and societal values into the process of hazardous waste management. The documentary about the hazardous waste management in the case of acid tar remediation tried to explain the process of waste management that leads to revitalization of local area. The sound, picture and interviews with independent experts and non-experts combined the successful way of persuasion in the documentary film. The successful waste management method was accompanied with the suitable communication tool as it was shown in the case of acid tar remediation in Pesniski Dvor. The goal of documentary was the development of the effective message for the broad public.

4. Conclusions

The conclusions and recommendations of this paper arise from an examination of the waste management, environmental impact and impact of public concerns about waste management in Slovenia. The model of waste management in Pesniski dvori explains the good practice of hazardous waste management. The model of acid tart management in Pesniški brings the sustainable development of the nature. The reference model of waste management could be applied into the countries of Balkan region; however the special circumstances of the local area should be taken into account. The elements of the model that comprise of modern technological process, transparency with monitoring and film documentary as a main communication tool are important elements in the suggested model of waste management. The suggested model of acid tar remediation is successful business model that Gorenje-Surovina tries to apply into the area of Balkan region.

The results of the acid tar remediation in Pesniski Dvor was complete remediation and revitalisation of the old disposal site which previously presented high environmental risk for the nature and humans. During the process of remediation 18.200t of acid tar, 14.600t of contaminated soil and 600 m^3 of the waste water from the disposal site was neutralised and recovered. The quality of the nature in Pesniski Dvor increased and the old dumping site is well integrated with the surrounding forest and meadows.

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