SOUTH EAST EUROPE
Jointly for our common future

Programme co-funded by the EUROPEAN UNION

Recommendations for socially acceptable industry performance.

Activity 3.1
Environmentally friendly extraction practices

Final Version
June 2011

DELIVERABLE SUMMARY	
PROJECT INFORMATION	
Project acronym:	SARMa
Project title:	Sustainable Aggregates Resource Management
Contract number:	SEE/A/151/2.4/X
Starting date:	01.05.2009
Ending date:	31.12.2011
Project website address:	www.sarmaproject.eu
Lead partner organisation:	Geological Survey of Slovenia
Address:	Dimičeva ulica 14, SI-1000 Ljubljana
Project manager:	Slavko V. Šolar
E-mail:	Slavko-Vekoslav.Solar@geo-zs.si
DELIVERABLE INFORMATION	
Title of the deliverable:	Activity 3.1 (Environmentally friendly extraction practices) Recommendations for socially acceptable industry performance
WP/activity related to the deliverable:	WP3 / Activity 3.1
Type (internal or restricted or public):	Public
Location (if relevant):	-
WP leader:	Institute of Geology & Mineral Exploration (IGME), Greece
Activity leader:	Technical University of Crete, Greece
Participating partner(s):	All partners
Authors:	Zach Agioutantis, Andriani Athousaki
E-mail:	zach@mred.tuc.gr
DELIVERY DEADLINES	
Contractual date of delivery to the JTS:	
Actual date of delivery to the JTS:	

Recommendations for socially acceptable industry performance

Air Pollution

Air pollution consists of both particulate matter emissions (dust) and gas emissions. These emissions are generated by the operating equipment at the quarry site and during transport. Best practices should include measures for both groups of pollutants. The operators' main goal should be to maintain clean air standards in order to protect human health and the environment. This goal can be achieved by systematic monitoring and evaluation of particulate matter emissions (dust) and gas.

Recommendations:

1. Install de-dusting systems at dust generating units (i.e. mills, sieves, drills, etc) in order to collect fine waste materials at the source. Also, the conveyor transportation systems should also be covered. The roads of transportation and the pit areas that generate dust should be moistened regularly with water sprinklers.
2. Internal transportation of material should be carried out using hooded conveyors or slightly moistened material. Covered vehicles or other dust suppressing systems should be used for the external transportation of the raw materials.
3. Finally equipment testing should be performed if monitoring reveals that gas or dust emission standards are exceeded.

Blasting

Blasting is a major unit operation in most quarry exploitations. Blasting may produce noise, vibrations as well as fly rock. It may also raise the operational cost if not properly performed. Operators should be advised and reminded that this procedure can and must be performed safely and by taking precautions to minimize the environmental impact.

Recommendations

1. An efficient and safe blasting plan be developed in order to reduce flyrock and reduce the cost of blasting and loading.
2. Sequential blasting should be applied in order to reduce vibrations. Modern technology (i.e. NONEL caps) can be utilized to reduce noise.
3. Monitoring records of vibration and noise generated should be maintained.

Conservation

Nature conservation refers to the active management of the Earth's natural resources, plants, animals and environment, in order to ensure their preservation and appropriate use (http://www.agriculturedictionary.com/definition/nature-conservation.html). Nature conservation is a general term that encompasses issues related to Ecology and Biodiversity. Ecology is the branch of science that studies the distribution and abundance of living organisms, and the interactions between organisms and their environment. The

environment of an organism includes both its physical habitat, which can be described as the sum of local abiotic factors like climate and geology, as well as the other organisms that share its habitat. The term was coined in 1866 by the German biologist Ernst Haeckel from the Greek oikos meaning "household" and logos meaning "science:" the "study of the household of nature" (Wordiq.com). According to Jones and Stokes Associates (1987) "*Natural diversity, is synonymous with biological diversity... To the scientist, natural diversity has a variety of meanings. These include: 1) the number of different native species and individuals that live in a habitat or geographical area; 2) the variety of different habitats within an area; 3) the variety of interactions that occur between different species in a habitat; and 4) the range of genetic variation among individuals within a species.*"

The protection of local habitats and species is of great importance to nature and people. Hence, operators should be advised to take actions to minimize the environmental impact. Such actions should included in the Environmental Impact Assessment Study (submitted by the operator) and the Environmental Conditions as set out by the regulating authorities.

Recommendations - general

1. The Environmental Impact Assessment (EIA) documents should include a global overview of all issues pertaining to nature conservation, taking into account the welfare of local natural systems. Also, systematic monitoring of air, water, and soil quality as well as of noise and vibration levels should be performed.

Recommendation - details

- Oil residues should be collected and delivered to the supplier for treatment.
- The size of the impacted area should be kept as small as possible, and vehicle traffic should be restricted only on designated paths. This will minimize the labour and financial costs required for quarry reclamation.
- Local wildlife populations should be studied in order to understand issues related to threatened or endangered species in the region. Areas not in use should be replanted, especially the sides of haul roads. Sediment and other contaminants should be removed from the water before reuse or reintroduction into natural waterways.
- If surface water diversion is necessary, it is recommended to ensure that downstream ecosystems, residential areas, and water supplies are not affected.
- Removal of native vegetation should be minimized since plants contribute to soil stability and overall ecosystem health. Topsoil and maximum existing vegetation coverage should be maintained in any areas that are not in use
- Contoured, low-gradient drains and channels, as well as retention ponds should be constructed in order to slow down storm water runoff.
- A series of ponds may also be used to remove sediment and other contaminants from the water before reuse or reintroduction into natural waterways.
- The topsoil removed during the operational stages should be preserved for later use during reclamation.
- Measure should be taken to maintain the groundwater resources and their quality since groundwater is important for the local populations.

Noise Reduction

Noise in quarrying usually comes from two major sources: Machinery (stationary, i.e. crushers, or moving i.e. trucks) and blasting. Hence, it is necessary to design a sound blasting plan in order to minimize the need for secondary blasting. Whenever it is not possible to avoid noise generation, it is very important to design for good noise control at the planning stage.

Recommendations

1. Regular monitoring of the noise should be performed. Noise levels should be compared with current legislation or site-specific environmental guidelines. Also, it is recommended to install noise suppression systems, to use appropriate blasting technique(s) or blasting material.
2. The construction of new roads to bypass residential areas should be considered.

Planning and Design

Planning usually refers to two major phases: Planning for operations and planning for close and post-closure conditions. Planning for operations involves a detailed plan for both aggregate extraction and for the execution of the environmental controls during the operation phase. At the same time, planning for closure and post-closure addresses both the operation and the post-operation phases. Sustainable quarrying is always based on effective and efficient plan(s) that are followed during the operation and also provide the basis for closure activities.

Recommendations

1. Planning should be integral for operations and closure. Critical stages for land management should be identified and a continuous interaction between the economic component and the environmental and social component (as explained below) should be implemented. Furthermore, it is recommended that plans be adequately discussed with local stakeholders prior to implementation. Finally, it is important that once approved, plans should be followed in detail. This is especially true for closure and restoration plans.
2. Options for the future employability of local employees following the quarry's closure should be considered since the quarries' employees often come from the local population

Quarry Fines and Waste

All industrial, mining and quarrying operations produce waste. In the case of quarrying operations waste belongs to two major categories: a) Waste rock that is usually inert material, but it may be produced in very large quantities and b) Other waste that is mostly petroleum based (fuels, lubricants, tires, plastics, containers, etc). Quarry operators should always try to minimize fines and waste and to utilize them (i.e. reuse) if possible. This rationale should be applied both during the operation and during the closure phases. Proper blasting techniques should be used to optimize the size distribution of the aggregates produced.

Recommendations

1. A plan should be developed targeting the minimization or reuse of quarry waste and fines. Such a plan should include approaches to:
    a) to re-use quarry fines for remediation or as backfill material
    b) to develop mixtures and by-products with or without commercial value
    c) to return silts to water bodies (if appropriate).
2. Best practices for handling other waste should be followed. Procedures should be developed to collect discharged oil and deliver it for treatment, to recycle wrapping materials, containers and tires, and in general for taking waste management measures. Such measures are well developed in other (heavy) industries.
3. The construction of a recycling centre in the vicinity of the quarry should be investigated given the fact that quarries in general produce considerable amounts of waste. Operations research analysis can be applied to select an optimum site for the centre's location.
4. Upon closure, the quarry site should be cleared of any materials that would not naturally occur in the area. This task is facilitated if best practices are maintained throughout the life of the quarry. Scrap stone can be sold, used as refill or landscaping, crushed for other applications (e.g., concrete production), or otherwise handled in a socially and environmentally responsible manner.

Restoration

Planning for closure and restoration is related to operational planning. Reclamation includes the notions of restoration and rehabilitation of visual and other disturbances in the landscape. The restoration of the affected area and its rehabilitation is a procedure that begins before closure and extends to post-closure. This is a very important phase since public perception of the quarry operation usually focuses on the restoration plans. Quarry visibility is usually an issue when the quarry is close to an urban area or when it is close to a major transport route. Abandoned quarries negatively impact on the public image of quarry operators. There are many examples of abandoned quarries that have defaced beautiful landscapes. In order to achieve a sustainable reclaimed or restored area the operator should apply reclamation measures that extend beyond the legislation provisions and minimum requirements.

Recommendations

1. Local stakeholders should be involved in the restoration planning phase as well as the restoration monitoring and after care.
2. Restoration should be performed by planting suitable species, by utilizing either the topsoil removed during the initial development of the quarry or topsoil imported from other areas, by tending to the restoration of natural features (i.e. streams, etc) and by ensuring that there is no residual contamination.
3. During the reclamation phase the compaction of the soil should be tested. Highly compacted soil may present barriers to root penetration and reduce the water permeability. In addition, the use of fertilizers to increase the concentration of soil nutrients should be considered.

4. Closure planners should explore land utilization possibilities by creating new geomorphological features, such as lakes (in the case of deep quarries with impermeable bottoms), sports facilities or recreational parks, or wetlands, or a combination of the above, it is recommended that.
5. Planted species should be as close as possible to the original species. Plant nurseries may be developed during the life time of the quarry to facilitate the restoration phase with local species.
6. Regular monitoring of wildlife, in particular the pollinating agents (i.e., birds and insects) that play a crucial role in the development of forests, is necessary to ensure the long-term stability and health of the ecosystem, Introduction of new forms of wildlife, especially non-native species, should be avoided since it may lead to de-stabilization of the ecosystem.
7. Since planning for closure and restoration from the beginning of an operation makes the process easier, restoration plans should be completed as soon as possible. Under such plans, waste should be removed as it is created (and not left in piles), excavation should be planned so that topography restoration is simplified, new soil should be composted, and existing plant species should be documented for more successful replanting.
8. Visual impacts should be avoided during operations (if possible), quarried areas be partially restored (i.e. by plantation of endemic or other species) during operations to minimize impact, and the quarry be progressively exploited to avoid the simultaneous exposure of all open faces.

Social Issues and Community

Identifying stakeholders' values, interests, goals and the scale at which they apply is the first step in resolving the complex situations that impact a country's ability to maintain a secure material supply and achieve other policy goals. The scale of interest is a consideration in such situations due to fact that benefits and costs accrue to different parties in different regions (Šolar et al., 2009).

Recommendations

1. The most important issue is ensuring that operators respect the local communities
2. Efficient communication practices between stakeholders are desirable not only during the phase of issuing permits but also during the operation phase of a quarry. In recent years there has been an increased involvement of the local communities in the decision process for new and existing quarries. The application of Sustainable Development practices that are being developed in many sectors of industry and administration should be discussed to decide on their suitability.
3. Corporate Social Responsibility (CSR) strengthens ties and support better relationships with the local community, generates a corporate culture that promotes sound environmental policies among employees and helps to develop a safety-conscious workplace.
4. Frequent and sustained communication should be established between stakeholders (i.e. operators, local community and authorities). This can be implemented through a series of meetings, workshops, public reports, leaflets, posters, and other events such as school excursions. The importance of quarry operations to the benefit of the general public should be stressed whenever possible.

Transport and Traffic

Transporting aggregates over a distance of 30 to 50 km can double the price of the raw material. As a result, aggregates have a narrow economic transportation radius, which can lead to the presence of extraction sites near urban areas (Šolar et al, 2009). This is desirable from the financial standpoint, but it may raise social issues due to the environmental disturbances generated. In addition, transportation may affect the fauna and flora in sensitive areas (i.e. Natura 2000 or protected areas). Operators should minimize the impact of aggregate transportation on the wildlife and on people and local communities, i.e. they should minimize their environmental transportation footprint.

Recommendations

1. Impacts to wildlife should be minimized by using alternate routes or by implementing noise suppression and dust suppression procedures.
2. Impacts to residential areas should be minimized by transporting aggregates at off-peak hours or specific hours of the day and by banning night transport. The trucks could also be equipped with advanced technological aids, such as GPS devices, which can help locate traffic jams even during off-peak hours, for example due to accidents.

Water

Water is a major component in all surface operations. Water interacts with quarrying either as surface runoff or as part of a water body near the operation or even during the operation, e.g., in the case of dredging. Water quality can be degraded due to spills (related to the operation) and to gradual leakage (i.e. petroleum products). Operators must ensure that their activity does not disrupt water reserves and does not cause water contamination.

Recommendations

1. The quality of both surface and ground water related to the operation should be monitored regularly by means of water quality (permanent) measurement stations. These stations can provide advance warnings in case of water contamination.
2. Water protective structures should be put in place (i.e. impermeable barriers to prevent leaks in the ground water, impermeable geotextiles to cover the equipment maintenance area, etc).
3. Hydrogeological studies should be conducted to monitor changes in water quality based on the station measurements and provide feedback to the operator regarding potential deviations from acceptable contamination levels.