ASPASA

Aggregate & Sand Producers Association of Southern Africa

Best Practice Guideline

Safe Maintenance – Quarry Industry in South Africa

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January 2015

Introduction to maintenance

Maintenance can be defined as working on something to keep it in a functioning and safe state and preserving it from failure or decline. The "something" could be workplace, work equipment, or means of transport (e.g. a ship).

- Preventative – or proactive – maintenance is carried out to keep something functional. This type of activity is usually planned and scheduled.
- Corrective – or reactive – maintenance is repairing something to get it working again. This is an unscheduled, unplanned task, usually associated with greater hazards and higher risk levels.

Maintenance is not the exclusive domain of fitters and mechanics. It is the responsibility of almost all workers in the quarry industry.

Workers' health and safety can be affected during the maintenance process, but also by lack of maintenance or inadequate maintenance. Design of equipment and the work area also has a significant impact on the health and safety of workers performing maintenance. The Aspasa ISHE Audit process does pay attention to the issue of maintenance and records kept.

Maintenance work in the quarry industry

Quarrying is a dangerous industry to work in: quarry workers are likely to be killed in an accident at work. The use of large earth-moving vehicles and machines, the handling of explosives and heavy loads, ever-present airborne dust, and simply working on dangerous sites are all aspects of quarrying that increase the risk of both accidents and occupational diseases. Fatalities in the quarrying sector are associated with maintenance work, the use of vehicles and fixed machinery, and falls from height. Many accidents happen during maintenance work and these might affect not only maintenance staff but also other workers on site.

Quarries must be properly inspected and maintained to ensure the health and safety of all workers on site. Maintenance activities at quarries range from the maintenance of machines, equipment and vehicles to keeping of roadways on site in good order, attending to such matters as providing edge protection and securing excavations.

Quarry maintenance workers are exposed to may hazards, including frequent and heavy lifting, noise and vibration, and hazardous substances such as oil, gas, hydraulic fluid, antifreeze and welding fumes. They work in awkward positions and often have to use high-pressure hoses and vessels or work on machines

The nature of their work means that they often have to work unsocial hours or at weekends when normal operations stop. They frequently work under severe time pressure and this, of course, increases the risk of accidents. In addition, maintenance is sometimes outsourced which means that contract workers unfamiliar with the quarry and systems of work may be on-site.

Brief presentation of risks in the sector

The common risks and hazards in quarries for workers involve:

Working on the faces and clearing-up operations: Risks around the faces are related to the instability of the face, loose materials falling from the face, and vehicles driving over the edge of the face due to missing the face protection, because of driver failure or technical problems with the vehicles.

Risks associated with **vehicle operations** include overturning, collision with other vehicles, or workers being crushed or run over by revering vehicles, or falling while entering or leaving the very high cabs of many vehicles used in quarry operations. Accidents may also occur as a result of technical failure such as faulty brakes and steering, ort because of driver misjudgement.

Machinery- related accidents occur as a result of workers becoming trapped or entangled in machinery, or falling from it during maintenance.

Slips, trips and falls occur in almost all workplaces and quarries are no exception. Quarry workers are also at risk of being **struck by falling objects** such as rocks.

Workers at quarries are exposed to hand-arm **vibration** and to whole body vibration. The former is generated by tools such as pneumatic drills and angle grinders. Whole body vibration is caused by quarry vehicles and some fixed plant machinery.

Risks associated with **manual handling** include the moving of heavy quarry equipment, material shovelling of earth and mud, and lifting and carrying heavy stones.

Dust is present at quarries because of the work processes involved, such as mining, cutting, drilling, breaking or crushing of stones. Dust containing crystalline silica can cause silicosis.

Quarrying is a noisy industry. Sources of **noise** include stone crushers, conveyor belts, explosions and engine noise from heavy vehicles. Persistent or sudden noise may lead to hearing loss.

Workers at quarries are exposed to **adverse weather conditions** such as extremes of temperature, humidity, rain and UV radiation.

Special risks and hazards related to maintenance at quarries

Hazards related to maintenance of quarry sites

- When maintain **faces and roadways** workers at quarries are exposed to hazards such as:
  - Noise from machinery and equipment;
  - Dust, from activities such as drilling, blasting, and crushing, and from vehicle operations;
  - Falling objects, such as rocks;
  - Slips, trips and falls from height;
  - Collision of maintenance vehicles;
  - Maintenance vehicles falling over unstable and unsafe edges;
  - Uneven terrain causing unpredictable movement of vehicles'
  - Revering vehicles.

Hazards related to maintenance of mineral mining machines

The maintenance of and repairs to rock drills, heavy earth-moving vehicles, wheel-loaders and caterpillars, conveyor belts, stone crushers and screening plants pose a great many hazards to the workers involved in these tasks.

- Workers maintaining and repairing **rock drills** are at risk of:
  - Slips, trips and falls from rock drill when entering the machine;
  - Being injured by the drill rod or entangled in its mechanism;
  - The adverse effects of the noise and dust created by the drill.
- Hazards associated with the maintenance and repair of stone crushers and other processing plants include:
- Moving parts of machinery, such as the rotors of the blow bar crusher or flywheel of the crusher
  - Working in awkward positions;
  - Electrical hazards caused by improper insulation of electrical components;
  - Dust and noise.

Conveyor belts pose a great hazard to workers involved in maintenance. Because too much production time would be lost closing down the machines, maintenance often has been carried out while the belts are still running.

- Risks associated with the maintenance and repair of conveyor belts include:
  - Being injured by running conveyor belts or when the belt starts up unexpectedly;
  - Falling from elevated belts;
  - Dust and noise;
- Maintenance and repair work of screening equipment involves high levels of exposure to noise and dust.

Quarrying equipment and machines are extremely dangerous and have to be kept in good working order at all times. The maintenance and servicing of machinery such as conveyor belts and stone crushers has to be carried out by workers specifically assigned to such work, and they must have safe means of access to maintenance operation areas.

A structured approach to maintenance

The focus of this best practice is on preventing harm to workers carrying out maintenance, but it should also be kept in mind that maintenance is essential to protect all workers from accidents and ill-health – lack of maintenance can cause serious and deadly accidents.

Examples of how maintenance can contribute to safe working conditions at quarries:

Maintenance of roads

Where possible, long-term haul roads should have asphalt or concrete paving and all road surfaces should be regularly maintained to ensure vehicles can be used safely. Roads mustn't be pot-holed or otherwise in bad condition and they should also be kept free of dust by regular wetting.

Maintenance of edge protection and safety banks

Many accidents at quarries happen as a result of inadequate, or lack o, edge protection, safety banks or barriers. Road side safety banks are essential safety features at quarries. They can effectively reduce the number of accidents involving quarry vehicles. Safety banks deteriorate due to weathering and the traffic and they should be regularly inspected and maintained.

Maintenance of vehicles – brake maintenance

Many transport accidents at quarries occur due to faulty brakes. Quarry vehicles operate in extreme working environment and under difficult conditions and this should be taken into account when setting up frequency of brake maintenance schedules. Daily checks should be carried out by the drivers and regular maintenance of the whole braking system should be done according to manufacturer's recommendations.

Dust control – maintenance of dust extraction equipment and air filters

Dust poses a potential health risk to quarry workers. Dust is generated by drilling and sawing, by blasting and excavation operations as well as by haulage. There should be control measures in place to prevent dust reaching levels that could cause harm. Drilling machines should have adequate dust extraction equipment and air filtration systems. Regular maintenance of the systems is essential to ensure that they are effective.

The risk of maintenance work can be minimises or even eliminated through good design and maintainability of the plant and machinery, availability of the right tools for the job and by ensuring that workers have the relevant safety information for the equipment they are working on from the supplier or manufacturer.

Maintenance of the plant is fundamental to the safe operation of a quarry. Inspection and maintenance of the whole quarry, its plant and electrical equipment, must be carried out regularly by competent persons. Guidelines should be set out to what should be maintained and how often. Adequate safety equipment must be in good working order and ready for use at all times.

Good maintenance management helps ensure safe maintenance work. A comprehensive approach to maintenance has five basic rules:

1. Good maintenance starts with planning. A maintenance plan for the quarry should be designed to include;
   - Roads
   - Vehicles
   - Machinery guards
   - Safety devices
   - Electrical equipment
   - Pressurised systems

- Roadways and edge protection
- Excavation, tips and lagoons
- Buildings
- Barriers around quarry
- Any equipment used in shot-firing operations

A risk assessment has to be carried out and its results should be included in the plan. There are various guidelines for carrying out risk assessments at quarries.

To be safe, workers must understand the plant environment, the safety instructions and the hazards associated with their tasks. The maintenance plan should ensure that enough competent people are appointed to perform each task and that they are given enough time to do the job safely.

1. Work has to be performed safely. Quarries are very dangerous places and safe working procedures are absolutely vital. These include:

   - Securing work area;
   - Following safety systems of work that have been developed in the planning stage;
   - Carrying out maintenance work only when a machine has been stopped and, when this is not possible, making sure that protective measures are taken;
   - Installing safety signs whenever a hazard or danger cannot be avoided or reduced in some other way;
   - Ensuring that there is safe access to and exit from all work areas.

   The cleaning or maintaining of running machinery and the unexpected start-up of equipment has caused many serious injuries and fatalities in quarries. Many of these accidents could have been prevented if the machines had been stopped or protected against unexpected start-up.

2. It has to be ensured that **appropriate tools and equipment, including PPE, are available and used.** Heavy loads, danger of rock slides, a ;loud and dusty environment mean that all workers at quarries need personal protective equipment such a head, foot and hand protection, respirators and hearing protection.

   Maintenance workers may carry out tasks in places that are not normally workstations. As a result they may need specific equipment and appropriate tools. Safety helmets must be worn in areas where overhead hazards exist, or while working with drilling, excavating or hazardous plant or equipment. Safety footwear with steel caps must be worn by all workers on site, and suitable gloves should be available when heavy loads such as stone blocks need to be handled.

   Grinding, drilling, welding or working near crushers may cause eye injuries and eye protection must be worn. Ear protection is necessary when working with or near vehicles, quarry machines or other quarry equipment. Respiratory protection (e.g. dust mask, fume mask) is needed is areas where workers are exposed to dust or dangerous airborne fumes or particles, such as those in exhaust fumes

   Use of safety harness protection when going at height may also be necessary during quarry maintenance work

3. **Work as planned.** Workers involved in maintenance must be properly informed about the task in hand, the results of the risk assessment for the task, the chain of command and any procedures that will be used while the task is carried out, including the procedure for reporting problems. Where maintenance at quarries is carried out by sub-contractors, this is particularly important.

   The plan should then be followed and no worker should improvise or take shortcuts

Best practice for safe maintenance work:

- Establish safe working procedures, incorporating manufacturer's recommendations, to ensure that workers are not exposed to hazards when carrying out maintenance or repair.
- Ensure that all workers are trained in establishing safe working procedures and that they follow them.
- Before beginning work, clear the area of trip and fall hazards.
- Provide safe access to all work areas.
- Lock and tag electrical equipment and secure mobile equipment before repair work begins.
- Use appropriate fall protection where there is danger of falling.
- Stay focused, for your own safety and for the safety of your fellow workers.

4. **Final Check**. When maintenance task has been completed, workers need to check whether they have left the item in a safe and functioning condition. The functional capability of the plant, machines or equipment has to be tested and all protective guards and mechanisms have be reinstated.

The maintenance task is finished once the work is signed out and the plant, equipment or machine is unlocked