Exposure to silica and other respirable inhalants from rail ballast materials.

Hydrex (now NDS-Plant)

Hydrex provide tailored support service solutions to the UK rail market with over 25 years' experience in working with major rail contractors. Hydrex can offer:

- Road Rail Vehicle (RRV) supply – as well as the ability to utilise their plant operators licence
- On-track solutions - covering all aspects of track maintenance, renewals, and enhancements
- Off-track civils - including piling, drainage, vegetation clearance, earthworks, and waste management
- Support for overhead line equipment (OLE) and signalling

Silica dust in rail ballast – what is the problem?

Hydrex were alerted by a ballast supplier to the potential for their track workers to be exposed to silica dust and other respirable hazards in the course of their work in moving and handling rail ballast.

What is silica and where can it be found?

Silica is a very common mineral found in sand and rocks such as granite, sandstone, flint and slate, which can be found in ballast. When these rocks are cut, broken, drilled or crushed a fine silica dust can be produced which is hazardous to health when inhaled. Employees who work with these materials are at potential risk of developing silicosis as a result of their exposure to silica

How does it affect health?

Silicosis is a completely preventable but incurable respiratory disease which is, fortunately, now rare in the UK. It is caused by inhaling silica dust (specifically respirable crystalline silica). If this dust is inhaled, small particles of it can become embedded into parts of the lung and cannot be cleared by mucous or coughing. The dust is toxic to the lining of the lungs causing a strong inflammatory reaction. Eventually, this causes the lung tissue to become irreversibly thickened and scarred - a condition known as fibrosis. This scar tissue prevents the lungs from taking in oxygen properly.

Exposure to very high levels of silica can cause disease within a year, but it usually takes at least 10 - 15 years of exposure before symptoms occur. The longer the interval between exposure and the onset of symptoms, the slower the disease tends to progress. All types of silicosis cause damage to the lung tissue.

Symptoms include a cough, which is sometimes dry, fatigue, shortness of breath, chest tightness and pain and loss of appetite. Patients may lose weight, have severe trouble breathing and cough up blood as the disease progresses. People who have silicosis are also

more susceptible to other respiratory diseases such as tuberculosis. There may also be an increased risk of lung cancer in workers who have been exposed to silica.

Sources of silica dust - ballast on the railways

Good ballast materials are angular, crushed, hard stones and rocks, uniformly graded, free of dust and dirt. Ballast can be found made up of materials such as granite, basalt, limestone, slag and gravel. All ballast has to meet the requirements of BS EN 13450 (2005).

One of the main functions of ballast is to retain track position from forces placed upon on the railway track both from the trains and tamping. When silica containing materials are crushed or abraded e.g. during tamping, or stone blowing, there is the risk that silica crystals can be released in a range of sizes. A proportion of them can be sufficiently small that if inhaled they evade the human body's natural air cleaning systems and can therefore penetrate deep into the lung. These respirable crystals are known to present the hazards associated with occupational disease.

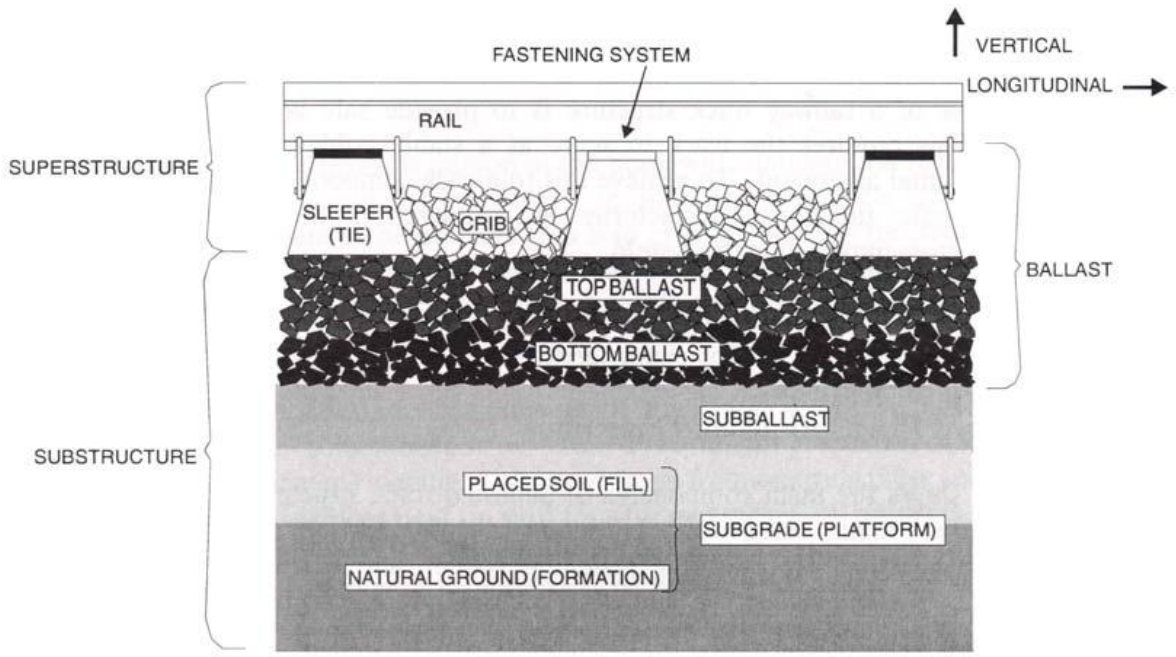

Figure1. Track layout of a typical ballasted track- side view (Selig & Waters, 1994).

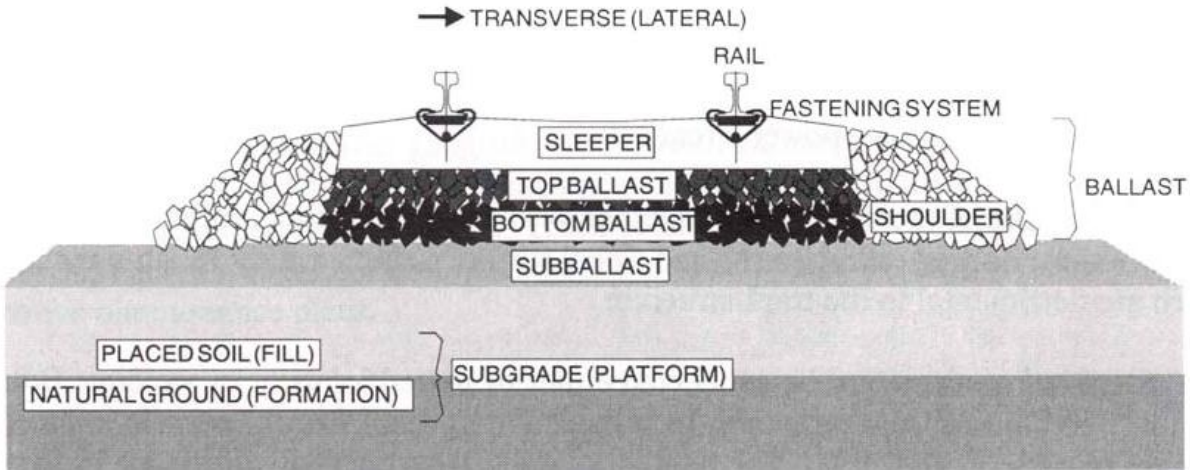

Figure2. Track layout of a typical ballasted track –cross section (Selig & Waters, 1994)

Exposure to ballast dust can occur during the removal of the old ballast and the dropping and profiling of the new ballast on to the track. Older ballast removed from the track bed is normally worn and may be contaminated with oil, meaning that dust levels are generally low. The new ballast removed from wagons and spread onto the track may produce larger amounts of dust, dependent on whether the ballast is dry and how much is being used.

Hydrex response –assessing workers' exposure by dust monitoring

Hydrex was keen to be proactive and minimise any of the associated health risks to their employees from ballast handling, such as silicosis. They undertook a risk assessment and requested atmospheric dust sampling to be undertaken at trackside locations in order to assess the extent of employees' exposure to dust, including respirable silica, and to confirm the adequacy of controls. Atmospheric dust monitoring was conducted by an accredited agency at theTarmac Bescot recycling site in July 2010 and Hydrex ballast work site in Crewe on in June 2011. Each sampling exercise involved 4 employees (engineers and plant machine drivers) and dust samples collected were analysed for total inhalable and respirable dust, as well as for metal contamination and silica content. A further survey for atmospheric dust monitoring was carried out at the Atherton, Manchester site in August 2011 during the track works involving scarifying the surface (skim digging of ballast).

Results

The sampling results for all three sites for total inhalable and respirable dust were within the relevant workplace exposure limits (WELs). The analysis of the filters for silica and metal contamination were all well below the workplace exposure limits. However it was noted that damp weather conditions prior to and on the night of monitoring at Atherton were such that dust production would be likely to be much reduced.

Employee exposure to silica dust was controlled by use of respiratory protective equipment (RPE) as well as air conditioning in the machine drivers' cabs[1].

Future actions

Hydrex plan to continue to monitor dust exposures from ballast handling, with additional sampling surveys to be arranged during dry spells when dust levels may be higher.

The business benefits of managing exposure to silica in ballast dust

This case study clearly shows the importance of a proactive approach to managing all potential significant health risks, in order to safeguard railway workers from ill health and ensure legal compliance. It may also serve to reduce the risk of litigation and the significant associated costs. A substantial claim has been settled recently to cover the cost of an employee diagnosed with silicosis to cover his lost earnings and also provide for his care when the condition deteriorates.

According to Ian Bailey, an industrial injury lawyer with Irwin Mitchell in Leeds, there are now less than 100 new cases of silicosis being diagnosed each year, but this is still far too many. This is still 100 workers whose lives are being ruined because proper precautions were not taken to minimise the risk of exposure.

References:

EH40 Workplace Exposure Limits 2005 Health and Safety Executive

Wee Loon Lim**:** 2004 Mechanics of Railway Ballast Behaviour

[1] ORR footnote: Under the COSHH Regulations priority should be given to provision of engineering and technical controls before relying on RPE. Where RPE is needed to control residual risk it should provide adequate protection and be compatible with the requirements of the work including other protective equipment. Where exposures to respirable silica are significant (over half the WEL) RPE to FFP3 standard will generally be appropriate – guidance publication HSG 53 provides further guidance on RPE selection.