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RESPIRABLE CRYSTALLINE SILICA IN THE RAIL SECTOR

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Summary	This RIG advises inspectors/inspector assistants on the legal framework and action to take in securing compliance with the Control of Substances Hazardous to Health Regulations (COSHH) for exposures to respirable crystalline silica in railway settings, including rail ballast handling and rail property maintenance and refurbishment tasks.
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Subsequent consultation (reviews only)	

Detail

INTRODUCTION

1 Occupational exposure to respirable crystalline silica (RCS) is a major cause of lung disease, including silicosis, chronic obstructive pulmonary disease (COPD) and lung cancer. RCS exposure is also linked to kidney disease, and arthritis. ORR has identified occupational respiratory disease, including exposure to RCS, as a strategic priority arising from our evidence-based Better Health is Happening review. HSE has included RCS as a key priority in its 2017 Health and Work Strategy for occupational lung disease. In 2016, ORR signed a cross industry commitment to raise awareness of, and take action against, harmful exposures to RCS, in support of the IOSH No Time to Lose (NTTL) campaign on silica. HSE, Network Rail, Crossrail, and Unite the union, amongst others, have also pledged support.

2 This internal ORR guidance captures key findings from our inspection work and engagement with industry groups on RCS management, and signposts inspectors to guidance on compliance with COSHH for RCS. It focuses mainly on those processes unique to the rail industry, namely mechanised ballast handling at ballast stock piles/aggregate handling depots (AHDs) and during track renewals. However, the same principles of risk management apply to other rail work activities where RCS exposure is foreseeable, including construction type tasks in property maintenance and refurbishment.

3

Data on ill health from RCS

4 There are currently no reliable data on the incidence of silica related disease specifically for the GB rail industry. Latest HSE data for all industry sectors show between 10 and 20 annual deaths from silicosis over the last 10 years (with 10 deaths in 2014) and around 40 new silicosis cases assessed for Industrial Injuries Disablement Benefit during 2013-15. Under HSE disease reporting schemes, specialist chest doctors identified over 50 estimated new cases of silicosis in both 2014 and 2015.

HSE analysis suggests that the incidence of silicosis could however be much higher than recorded in the available statistics.

5 RCS is recognised as a category 1 (definite) human carcinogen by the International Agency for Research in Cancer (IARC) for lung cancer. HSE research on the GB occupational cancer burden estimated almost 600 construction worker deaths each year based on past exposures to silica.

Key legal duties:

6 RCS is a substance hazardous to health under COSHH. It has a long-term Workplace Exposure Limit (WEL) of 0.1 mg/m^3 8-hour Time Weighted Average (TWA) as listed in HSE publication EH40/2005. The RCS WEL is not a 'safe' level and ill health effects can still occur below it. Duty holders will need to assess the risk from RCS exposures and control those exposures to as far below the WEL as is reasonably practicable, applying the well-established principles of good control practice under COSHH.

7 As RCS is not formally classified as a carcinogen under the harmonised EU Classification, Labelling and Packaging (CLP) Regulations, the specific requirements for control of carcinogens under COSHH do not apply. However, the COSHH Approved Code of Practice (ACoP) and guidance L5 clearly support the need for a high standard of control and an active precautionary policy for RCS.

8 COSHH Regulation 7(7) requires employers to implement the principles of good control practice, which include controlling exposure by measures that are proportionate to the health risk. The COSHH ACoP (paragraph 58) states that the risk assessment should consider the additional requirement regarding substances known, or suspected to be carcinogens, where there is a more compelling reason for the employer to substitute a less toxic alternative. Where this is not reasonably practicable, adequate procedures, training, instruction and supervision should ensure that the exposure level is reduced to as low a level as is reasonably practicable (ALARP).

9 Plant and equipment suppliers have duties under Section 6 of the Health and Safety at Work Act 1974, and under the Supply of Machinery (Safety) Regulations 1992 as amended to design and construct their products to minimise risks from exposure to hazardous substances, including RCS.

Assessing RCS exposure (COSHH Regulation 6):

10 COSHH Regulation 6 requires railway employers to carry out a suitable and sufficient assessment of the risks from exposure to RCS arising from their work. Rail employers and workers may not always recognise that the RCS WEL of 0.1mg/m^3 is 40 times lower than that the 4mg/m^3 exposure level for general respirable dust specified under COSHH. As respirable silica dust cannot easily be seen under normal lighting conditions, the

absence of a visible dust cloud is not a reliable indicator that control is adequate. However, if the larger airborne dust particles are clearly visible this suggests that control of the smaller respirable fraction may be inadequate.

11 The silica content in common building materials and rail ballast is variable but can be significant: typical estimates are sandstone (70-90%); concrete and mortar (25-70%); tile (30-45%); granite ballast (20-45%); and brick (up to 30%). It may not always be straightforward to estimate the silica content for a specific material, as for example ballast may come from more than one quarry and/or Aggregate Handling Depot (AHD), and so the risk assessment should be based on the worst case scenario (the high end of known silica content) unless there is evidence otherwise.

12 **Risk assessments for ballast handling:** The mainline Ballast Dust Working Group (BDWG) of Network Rail (NR) and their external supply chain has driven considerable improvements in the assessment and control of RCS in mainline ballast handling. Sharing of exposure monitoring data by BDWG members has resulted in a better (although not complete) understanding of the risk from specific ballast handling tasks.

13 Two RSSB research reports produced for the BDWG by HSL provide insight into risk assessment and control for RCS in ballast handling. A review of BDWG RCS exposure data during railway ballast handling identifies gaps in the existing RCS exposure monitoring dataset, and suggests a prioritised programme for further monitoring, with conventional track renewals as the initial priority. RCS exposure measurement is challenging and occupational hygiene expertise is generally required: HSL has therefore included in the RSSB report guidance on a specification for the procurement of occupational hygiene services for RCS exposure monitoring and analysis. A second report, based on site visits by an HSL occupational hygienist, identifies areas for improvement in current controls for high output and conventional track renewals.

14 The desktop review of BDWG RCS exposure data during railway ballast handling concluded that there was insufficient monitoring data available for most ballast handling tasks to inform a suitable and sufficient risk assessment. Although the majority of the BDWG sampling results for ballast handling activities were below half the RCS WEL, a relatively small number of personal monitoring results at between 0.06mg/m^3 and 0.16mg/m^3 8 hour TWA suggest the potential for significant exposure during some tasks**.** These potentially higher risk tasks included operation of medium and high output Ballast Cleaning Systems or BCS (MOBC/HOBC), particularly at clamp 2 and cutter bar positions, as well as staff working alongside; triple wackers; dozers; and ballast regulators. Work on ballasted track in areas of restricted natural ventilation such as tunnels, steep cuttings, or under enclosed station canopies, are also likely to be higher risk, although this was not captured in the BDWG sampling data.

15 Following the HSL desktop review, NR carried out further RCS monitoring on operation of its BCS and Track Relaying Systems (TRS) in Autumn 2016. The results again showed significant variability in exposure for the same tasks across different shifts, and demonstrated the potential for significant ballast dust generation even in the damp conditions prevailing during the Autumn sampling period. The highest risk activity was the BCS clamp 2 operator (5 samples above 0.05mg/m^3 and up to the WEL). Results for other tasks were more variable but suggested the potential for significant exposures at other positions alongside the BCS (including COSS, works manager, engineer and BCS operators). Monitoring on TRS again showed variability in results but potential for significant exposures at the D75 cutter bar and P95 track renewal train.

16 Some of the sampling results above half the WEL are single samples, with others for the same job role much lower. However, the known variability in exposures driven by the weather, ballast quality, task duration, working methods, and possibly individual behaviour, suggest that a precautionary approach to identifying potentially higher risk tasks is appropriate until a wider dataset for workers carrying out similar activities is available. A programme of additional BDWG monitoring for RCS in conventional track renewals has been agreed for Summer 2017.

17 **Risk assessments for non-ballast handling activities**: The potential for significant RCS exposures in other rail activities should not be overlooked. Rail workers can be exposed to RCS when carrying out construction type tasks during maintenance work both on and off track. Examples include cutting of concrete troughing or paving; during manual ballast digging and repacking of rail joints; but also at stations, depots and other buildings where property maintenance and refurbishment work may be under way. Experience from the construction industry suggests that tasks involving cutting, chasing, drilling, grinding and any resultant sweeping of concrete, stone, aggregate, brick, tiles, or cement/mortar can potentially expose workers to high silica dust levels, significantly in excess of the WEL of 0.1mg/m^3. Use of hand held saws for cutting concrete blocks/bricks (even outdoors); use of scabblers, grinders, hand held breakers, or dry coring of concrete without dust controls; and dry sweeping indoors can all potentially produce exposure levels of multiple times the WEL.

18 On London Underground Ltd (LUL) sub-surface lines, manual breaking out of concrete chairs, pit blocks or sleepers can potentially generate high RCS dust levels. It may be reasonably practicable to substitute hand breakers for remote controlled breakers, or use hydraulic concrete bursting techniques to reduce RCS exposures.

19 Other rail industry tasks which may require a risk assessment for potential RCS exposures include the cleaning and grinding of sand-based mould residue following aluminothermic rail welding, and filling/cleaning of rolling stock sanding equipment. Current knowledge suggests that these are likely to be lower risk activities. Some limited exposure monitoring data

for dust and fume in cleaning and grinding of rail welds suggests RCS exposures below half WEL, but with evidence of elevated levels of inhalable and respirable dust and of some gaseous components including nitrous oxides.

Prevention and control of RCS exposure (COSHH regulation 7)

20 Our inspection work suggests that although awareness of the hazards to health from work with RCS has improved markedly, there remain weaknesses in control, with over reliance on respiratory protective equipment (RPE) particularly in mainline track renewals. While improved engineering control has been achieved in Network Rail High Output track renewals, there appears less appetite for improved engineering control among users (contractors) and suppliers of plant for conventional track renewals (e.g. side tippers, autoballasters, dozers, excavators, ballast brushes) an area where we want to see an escalation in pace.

21 Where prevention, preferably by means of elimination or substitution, is not reasonably practicable, adequate control should be achieved using the hierarchy of control measures specified in COSHH regulation 7(3) **in the priority order stated**. Inspectors should look for a planned programme of short and longer-term measures to manage RCS exposure, which include consideration of the control measures set out below:

22 **Elimination (COSHH Regulation 7(1))**: Inspectors should reinforce the importance of health by design in driving improved management of RCS exposure. New items of plant and equipment should be designed to minimise release of RCS. Existing standard BS EN 14033-3:2009 for railbound construction and maintenance machines requires ballast-handling machines to be equipped with dust suppression (e.g. water sprays, vacuum cleaners) and operator cabs to be fitted with particle filters to prevent dust ingress. NR's new BCS5 system introduced in 2017 is fitted with both, and exposure monitoring is planned once trials are completed to assess the impact on RCS exposures.

23 Innovations in the design of high-pressure nozzles to deliver a fine aerosol significantly reduces the volume of water required, meaning that fitting of water spray systems to dampen dust should increasingly become reasonably practicable out on track.

24 Recent efforts by infrastructure managers (NR Route Services and LUL) to further reduce dust in the ballast entering the supply chain include: improving quality control at quarries and ballast stockpiles; monitoring the proportion of fine dust (fines) in supplied ballast to ensure it is within acceptable limits; consideration to tightening the engineering specification for ballast to reduce permissible fines; and use of dedicated wagons to minimise contamination between clean and dirty ballast.

25 Concrete troughing manufactured or cut to size off site under controlled conditions can reduce overall RCS exposures.

26 **Substitution (COSHH Regulation 7(2)):** Reasonably practicable solutions already adopted include: replacing use of triple wackers with compaction rollers to consolidate the ballast in conventional track renewals; replacing manual breakers with remote control breakers, or use of hydraulic concrete bursting techniques to break up concrete pit blocks and sleepers on sub-surface lines; and substituting lineside concrete troughing for plastic composite troughing (reducing both manual handling and RCS exposure risks).

27 **Engineering control (COSHH Regulation 7(3)) hierarchy of control):** Systems to dampen dust in the ballast before it leaves for the worksite should now be standard on mainline infrastructure and include: screening and water spray systems at the quarries (mandated in supplier contract specifications); spraying of ballast stockpiles and during ballast loading using either static gantries or mobile tractors and bowsers at NR AHDs, and 'monsoon simulator' spray systems at NR High Output Operating Bases (HOOBs). Where reasonably practicable, ballast wetting should also be used on renewals worksites (e.g. localised misting systems or water cannons) although provision of sufficient water can prove a challenge.

28 NR has completed a programme of retrofitting pressurised cabs to its existing BCS and TRS (including D75 ballast cleaner) fleets, and fitment of water spray systems to cutter head units and MFS ballast wagons is scheduled for completion by end September 2017. As an interim measure, NR has mandated use of powered RPE for all machine operators and those working alongside BCS and D75 machines. High output plant cab operators (BCS OP1 cutter bar, BCS power car, and D75 cab) should no longer need to wear RPE (improving their visibility and communication) following fitment of forced cab ventilation.

29 On its surface line infrastructure, LUL has used vacuum extraction methods to remove old ballast (Tubevac train with vacuum extraction and covered wagons) in suitable locations, and where this is not possible, pre-application of binding agents prior to ballast removal can significantly reduce the generation of dust. Dust from depositing new ballast is minimised by extensive damping prior to unloading, and the routine practice of maintaining low drop heights from excavator buckets.

30 Engineering controls needed for common construction-type tasks (see paragraph 17) are well established, including use of on tool extraction for portable equipment; water sprays to suppress the dust; suitable vacuum cleaners (M tor H type) rather than dry sweeping; in conjunction with suitable P3 standard RPE for higher risk tasks. Existing HSE good practice guidance on control of dust in construction tasks is relevant to the rail sector, for example during property maintenance/refurbishment. New guidance for EU regulators on the expectations on control for common construction tasks should also be useful to inspectors and rail duty holders. This guidance includes risk control sheets specific to common

construction tasks, such as cutting concrete blocks/paving outdoors, chasing out brickwork, and dry sweeping indoors, and provides clear information on the level of control expected.

31 **Organisational control (COSHH Regulation 7(3))**: RCS exposures can be reduced by procedural controls including: minimising excavator bucket drop heights for ballast unloading; keeping non-essential workers clear of dusty areas by enforcing exclusion zones (as a rough rule of thumb a minimum separation distance of 10 metres from a significant source of silica dust in the open, although consideration should be given to visible dust clouds, wind speed and direction); keeping machine cab doors and windows closed (which requires effective communication systems between those inside and outside the cabs); regular cleaning of machine cabs and other work areas using M-type vacuum if possible, or alternatively wet wiping, rather than dry brushing. Better planning of ballast delivery can also help to minimise drying out of wetted ballast wagons stabled prior to a job.

32 **Personal Protective Equipment (PPE) (COSHH Regulation 7(3)):** HSE guidance on selection, use and maintenance of respiratory protective equipment (RPE) applies to the rail industry. RPE should be the last resort, used in conjunction with other controls, rather than the default option and for RCS dust should be to a P3 standard. Tight fitting RPE should be face fit tested for the individual, with written records kept, and workers clean-shaven: HSE research suggests within the 8 hours prior to the work shift as good practice. Where there are good reasons for having a beard (e.g. religious belief) or an adequate face fit cannot be achieved for other reasons (e.g. facial shape or scarring) loose fitting type RPE (powered hood or helmet for example) may be needed. Where workers need to wear RPE continuously for more than an hour, use of a powered respirator will be needed rather than tight fitting disposable types, as the face seal may not be reliable after prolonged use.

33 The use of tight fitting P3 standard RPE (mainly disposable types) on mainline track renewals sites has improved significantly, but ensuring that track workers are clean shaven remains a challenge. On NR renewals sites, workers should routinely be asked to show suitable RPE to P3 standard and (if tight fitting) checks that they are clean-shaven, as part of the site access control safety briefing conversation. Arrangements should be in place for non-compliances to be reported as Close Calls and for NR managers to redeploy or stand down such workers. On core High Output renewals sites shaving facilities should be available at the Site Access Control (SAC).

34 Lack of compatibility between RPE and other protective equipment (e.g. safety glasses) and with radio communications equipment, particularly use of boom mikes, are known issues in the rail sector. These are being addressed but progress in some areas is slow. The use of throat mikes as an alternative to boom mikes, or powered RPE with an integral microphone and head torch have been successfully trialled for higher risk

track renewals tasks. NR is planning for these to be rolled out across High Output during 2017 and inspectors should encourage this.

35 Secondary exposure to RCS from disturbing any settled dust on work wear and in vehicles/cabs, although likely to be low risk, should be minimised so far as is reasonable practicable by good housekeeping. Machine cabs and company vehicles should be cleaned using vacuum or wet methods to minimise accumulation of dust, with written records kept (preferably inside machine cabs). Regular professional laundering of operators' overalls (as identified in the NR High Output risk assessment for ballast cleaners) will also minimise secondary exposure. Use of disposable (high visibility orange) overalls has been trialled as good practice on some higher risk jobs but these may not prove cost effective in all cases. Adequate procedures and instructions to workers on how to remove contaminated overalls should be in place to minimise RCS exposure.

Use and maintenance of controls (COSHH Regulations 8 and 9)

36 Ensuring (under Regulation 8) that RCS controls are properly used remains a challenge, particularly on multi-contractor work sites where proper supervision is essential. Regulation 9 requires all engineering controls for RCS to be subject to planned preventive maintenance to ensure that they continue to work effectively, and records kept to support monitoring and assurance. Examples include maintenance of cab door/window seals; spray heads/nozzles and pumps on water spray systems; on-tool extraction units; dust filters in vehicle cabs and M-type vacuum cleaners; and general ventilation fans for work in enclosed areas. Local exhaust ventilation (LEV) requires thorough examination and testing every 14 months, with written records kept; we would also expect to see evidence of interim checks to ensure continued control. NR High Output expects maintenance records to be kept inside the operating cabs on HOBC and TRS machines. Effective maintenance is also important for those processes and equipment which indirectly affect RCS exposures, for example communications equipment used by machine operators (so that there is no need to open doors/windows); maintenance of ballast stock piles in AHDs to clear accumulation of fines from the base; and periodic draining of lagoons used for ballast wetting.

37 All RPE should be checked before each use and (except for single use disposable types) be subject to thorough maintenance, examination, and test at least once a month, with written records kept. For RPE used only occasionally every three months should be adequate, in addition to pre-use checks. More detailed advice is on HSE's web site.

Exposure monitoring (COSHH Regulation 10)

38 The HSL review of RCS exposure monitoring data during rail ballast handling, collected by BDWG members between 2010 and 2015, concluded that there was sufficient data to demonstrate that RCS

exposures during bulk loading/unloading of ballast at NR's AHDs are adequately controlled, and recommended reassurance monitoring every two years to demonstrate on-going adequacy of control, should there be no process change.

39 The review suggested that additional RCS monitoring data are needed to inform a suitable and sufficient COSHH assessment for activities at NR's HOOBs, as well as plant cleaning and maintenance activities at both AHDs and HOOBs. It also identified the need for further RCS exposure monitoring data to adequately assess the risk from mechanised track renewals activities, particularly for conventional track renewal tasks including ballast brushing; wackers; automated tamping; and ballast regulation. NR has committed to carry out further monitoring at its HOOBs, including for cleaning and maintenance tasks, as well as on its high output BCS and TRS fleet once the retro fitment of dust suppression is complete in Autumn 2017. NR is working with BDWG members to deliver a planned programme of RCS exposure monitoring for conventional track renewals to be complete by Autumn 2017. Contractors who are not BDWG members should be encouraged (but not compelled) to share their RCS exposure monitoring data with the group to provide the widest pool of data to inform risk assessment and control.

40 Some BDWG contractors have carried out additional RCS sampling outside the BDWG framework agreement, including trialling use of trained in-house staff to fit the RCS sampling equipment on site, which is then securely sent to accredited occupational hygiene laboratories for analysis. HSL has advised the BDWG that this is acceptable in principle as long as the rail company staff have been properly trained in the storage, handling and fitting of appropriate sampling equipment, which has been selected and calibrated by a competent person (usually an occupational hygienist). Recording the working conditions at the time, particularly the weather (rain, wind direction and strength) and the task duration, will help in assessing whether the RCS sampling results are representative of 'typical' exposures. Further good practice guidance on the requirements for RCS sampling and analysis, and on the additional information needed to put the sampling results into proper context, can be found in the RSSB report.

41 Exposure monitoring for RCS during common construction type tasks in property maintenance and refurbishment should not be necessary solely in order to demonstrate risk, as the potential for RCS exposures above the WEL is well established, reflected in HSE and EU labour inspectors guidance. Rather, exposure monitoring for construction type tasks (see paragraphs 17 and 30) should focus on demonstrating the effectiveness of the control measures.

Health surveillance (COSHH Regulation 11)

42 Regulation 11 of COSHH requires that 'where it is appropriate' employees be placed under 'suitable' health surveillance to allow early identification of any adverse health effects and to prompt improvement in

existing control measures. The decision as to whether health surveillance is appropriate is informed by three criteria: is there an identifiable disease related to exposure; is there a reasonable likelihood of the disease occurring under the particular conditions of work; and are there valid (and low risk) techniques for detecting the disease. For RCS, the evidence on risk of disease (silicosis, COPD and lung cancer in the long term) is established; and there are valid disease detection techniques including lung function testing for COPD and chest x-rays for silicosis.

43 The judgement as to the likelihood of the disease occurring under the particular conditions of work should be informed by the COSHH assessment. Factors to consider will include the likely level and duration of exposure; evidence of disease in the industry; and importantly the robustness of the controls, including maintenance of risk control measures and monitoring and assurance arrangements. HSE has published relevant guidance G404 Health surveillance for those exposed to RCS, as well as more detailed HSE supplementary guidance to G404 published in January 2016 specifically for occupational health professionals on a health surveillance programme for RCS. This advises health surveillance as appropriate where workers are '*regularly exposed'* to RCS and where there is a '*reasonable likelihood'* that silicosis may occur. HSE is looking to provide greater clarity around how to judge when there is 'a reasonable likelihood of disease occurring', and therefore when health surveillance might be appropriate for RCS.

44 ORR considers a precautionary approach to the provision of RCS health surveillance to be currently justified based on: the highly variable nature of RCS exposures particularly in track renewals, heavily influenced by the weather and variable ballast quality; long exposure history for many rail workers; the current heavy reliance on RPE as a primary control (RPE is particularly prone to failure if not fitted and maintained correctly, including failure to be clean shaven); and the lack of sufficient reliable RCS sampling data for potentially 'dusty' tasks, particularly in conventional track renewals.

45 Inspectors should note that following the HSE supplementary guidance to G404 on an example of an RCS health surveillance programme is good practice but not a legal requirement. Duty holders may want to consult with occupational health professionals on the need and extent of any RCS health surveillance on a case-by-case basis. However, where a duty holder decides not to provide a health surveillance programme for RCS exposed workers, they should be able to justify and demonstrate to ORR that there is not a reasonable likelihood of those workers developing respiratory disease. Inspectors may want to seek specialist medical advice in assessing the adequacy of a duty holder's RCS health surveillance programme: please consult ORR's occupational programme manager for further advice.

46 Network Rail has introduced a new respiratory health surveillance

standard NR/L2/OHS/157 'Health surveillance for silica and asbestos and the management of diagnosed occupational respiratory conditions', applicable to NR and its contractors with a compliance date of 3 June 2017. Under this standard, referral of employees for RCS health surveillance is most likely to apply to those regularly working in known higher risk activities in, for example, track renewals and construction type tasks.

47 Under the Network Rail standard, workers who are referred for RCS health surveillance will undergo lung function testing and complete a respiratory questionnaire annually. Those workers with over 15 years occupational exposure to silica will additionally be referred for chest x-rays, repeated every 3 years. Abnormal lung function test results would also trigger further investigation, which might also include chest x-ray. The 15-year exposure 'trigger' for provision of chest x-rays, repeated every 3 years thereafter, aligns with the HSE supplementary guidance to G404. Network Rail High Output has issued questionnaires to its staff to identify at risk individuals including those with 15 years+ exposure to RCS at work. Advice regarding the management of workers identified as having RCS related disease is also outlined in HSE supplementary guidance to G404. We have advised Network Rail that their health surveillance standard is a good starting point but that it may need to be reviewed in the light of emerging evidence and/or further guidance from HSE (see paragraph 43).

Training and supervision (COSHH Regulation 12)

48 Basic awareness of the risk from RCS is now included in the Industry Common Induction e-learning package which is mandatory for all Sentinel cardholders. BDWG training resources for rail managers and front line staff have also contributed to better awareness among group members. Recent inspection work suggests that, although awareness of RCS has improved overall, poor site supervision (particularly on multi-contractor work sites) and a focus on operational delivery means that accepted control standards are not always robustly implemented in practice.

49 Network Rail has recently developed an interactive e-learning package for both RPE users and its in-house face fit testers, accessed via their internal Oracle database. Module 1 comprises awareness training for all those exposed to respiratory hazards; with module 2 for those required to wear RPE, including the need for face fit testing (FFT). Completion of modules 1 and 2, including FFT where required, will result in an RPE competency showing on Sentinel. NR will require its in-house face fit testers to complete modules 1-3, plus attend a practical fitting workshop, to achieve RPE-T competency on Sentinel. Completion of RPE e-learning for those roles identified at risk will be phased, with existing RPE users captured as their FFT needs repeating (e.g. every three years or if any changes to the face or mask worn).

Enforcement guidance

50 When considering whether the principles of good control practice under COSHH have been properly applied, inspectors will need to consider the reasonable practicability of controls to reduce RCS exposure. Prevention and improved plant design should be given proper consideration in the first instance, and may form part of a longer-term plan. In the short term, improvements to both operational and engineering controls, with RPE an interim additional measure, may provide a reasonably practicable means of ensuring adequate control and compliance.

51 HSE has produced guidance on the application of the enforcement management model (EMM) to health risks, and on its application to hazardous substances. HSE's enforcement guidance on the management of construction dust including RCS is also directly relevant.

52 Regular exposures to RCS without the appropriate controls can result in serious irreversible disease, so the consequence under the EMM is *serious health effect***,** which is comparable with risk of serious personal injury. The benchmark standard set is *nil or negligible risk* of a serious ill health effect which can be achieved by applying the COSHH principles of good control practice including engineering and procedural controls, provision and use of suitable RPE, suitable instruction, training and supervision, and health surveillance where appropriate. The likelihood of serious ill health occurring from RCS exposure will vary depending on the nature and pattern of the exposure, as well as how robust and reliable the risk controls are. The risk will be greater for those regularly exposed for prolonged periods, although some short duration tasks that can give very high peak exposures also present a risk, and should be adequately controlled. Reliance on RPE as a primary control can also increase the likelihood of harm, as it is inherently less reliable than engineering controls.

53 Applying the principles in HSE's enforcement guidance for RCS in construction suggests that, where there is regular RCS exposure, indicative likelihoods under EMM are: *probable* for exposures in multiples of the WEL; *possible* for exposures around the WEL; and *remote* for exposures around half the WEL. In determining the risk gap, the single casualty table of the EMM should be used but inspectors will still need to take into account numbers exposed to the risk as part of a proportionate enforcement response. The standards for RCS control are mainly *established* (e.g. HSE guidance on construction dust; HSE health surveillance guidance for RCS) but those specifically for rail ballast handling on track and at AHDs put forward by the BDWG and in RSSB research are *interpretative.*

54 Inspectors should give priority to minimising the risk (i.e. control) over arrangements for managing the symptoms (i.e. health surveillance), and focus on those tasks where inadequate control can result in an *extreme or substantial* risk gap under the EMM. However, where there is evidence of

ill health related to RCS exposure, inspectors should make enquiries and take action as necessary. Some construction type tasks such as cutting concrete kerbs/flags, abrasive blasting of concrete or pneumatic breaking in an enclosed space can produce very high RCS exposures if no effective controls are applied (giving a *probable* likelihood) and the risk gap is likely to be *extreme*. Ballast handling tasks in tunnels or other areas of restricted ventilation could also result in high exposures if no effective controls are applied (*probable* likelihood), again giving an *extreme* risk gap. Inspectors should deal with these as a priority to ensure extreme risk is controlled (e.g. consider need for a Prohibition Notice). Appendix 3 to the HSE construction dust guidance provides more detail on IEE for construction tasks.

55 It is more difficult to provide an enforcement steer for ballast handling in track renewals work, which is highly variable in nature and duration and heavily influenced by ballast quality and weather conditions. The currently available exposure monitoring data for mechanised track renewals suggests a likelihood of *possible* for the highest risk tasks (exposures at the WEL) towards *remote* for those tasks with potential for significant exposures (around half WEL). However, it can be difficult to make a numerical distinction between a possible and a remote likelihood given the known variability in RCS exposures even for the same task. A precautionary approach in line with COSHH would suggest a *possible* likelihood and *substantial* risk gap for mechanised track renewals. Confidence in 'typical' RCS exposure levels for ballast handling tasks should increase as more exposure monitoring data is obtained. The on-going improvements in engineering control on NR's BCS and TRS fleet should reduce the likelihood of harm under EMM to the cab operators and staff working alongside, but this has yet to be fully demonstrated by exposure monitoring results.

56 In many cases the Initial Enforcement Expectation (IEE) for ballast handling tasks carried on outdoors is most likely to be an Improvement Notice. Strategic and duty holder factors should be applied to inform enforcement decisions as normal. Inspectors should take account of previous ORR advice given to duty holders on RCS control: for NR High Output and many of its principal contractors, this will be substantial. In line with a precautionary approach for suspect carcinogens under COSHH, where there are no/ ineffective technical or operational controls for RCS dust, inspectors should look to secure the urgent provision of suitable RPE for those working near sources of RCS dust (for track renewals anyone within the ballast handling exclusion zone), as an absolute minimum, and give consideration to enforcement of improved control using technical and organisational means.

57 For lower risk ballast handling tasks, where there is good evidence that exposures are consistently controlled to significantly below 50% WEL but more can still reasonably be done to further improve control, the IEE might be written advice.

Action required:	**Action required**: Inspectors/Inspector Assistants to note and follow the advice above on securing legal compliance in respect of worker exposure to RCS