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<b>DIESEL ENGINE EXHAUST EMISSIONS (DEEE) IN THE RAILWAY SECTOR</b>					
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<b>Keywords</b>		DEEE EXHAUST EMISSIONS DIESEL ENGINE			
<b>Summary</b>		This RIG summarises the current evidence base on health risks associated with exposure to diesel engine exhaust emissions (DEEE) and advises inspectors about action to take in securing compliance with the Control of Substances Hazardous to Health Regulations 2002 (COSHH) (as amended) in respect of exposure to DEEE in the railway operating environment.			
<b>Original consultation</b>		HSE - policy, occupational hygiene, and medical specialists Rail Operators teams – Gerald Kerr; Don Wilson RPP rail vehicles team - Phil Sharpe Network Rail Division - Paul Appleton; Jenny Lopez Rail Policy - Dawn Russell			
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**Detail**

**INTRODUCTION**

1 Diesel engines are in widespread use in the railway industry. Most obviously as diesel traction, but other sources such as diesel generators and diesel-powered plant and equipment are commonly used in depots and at maintenance/renewal worksites, including tunnels. Diesel engine exhaust emissions (DEEE) are recognised as a ‘definite’ human carcinogen for lung cancer by the International Agency for Research in Cancer (IARC). DEEE is hazardous to health and needs to be controlled under the Control of Substances Hazardous to Health Regulations (COSHH) 2002.

2 This RIG supplements (but does not replace) existing HSE guidance on this subject:

- [HSG 187 Control of diesel engine exhaust emissions in the workplace](#); and
- [OC 292/2 Diesel engine exhaust emissions](#).

3

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**KEY LEGAL REQUIREMENTS**

4 The key legal duty to prevent or adequately control DEEE exposure applies to passenger or freight operators (for station and depot operation), and to infrastructure managers and contractors (in stations and on work sites, particularly in tunnels). Those supplying diesel-powered equipment for use in the railway environment, as well as rolling stock leasing companies also have relevant legal duties (summarised in paragraphs 7-8).

5 Rail duty holders need to consider the design, supply and procurement of suitable plant and equipment, as well as the specific requirements under COSHH for assessment and control of exposure to DEEE. Where employers share a workplace, for example at a station or work site, the duty to co-operate under Regulation 11 of the Management of Health, Safety at Work Regulations 1999 also applies. Sources of DEEE fume from outside the railway, for example from

station taxi ranks, food outlets, or adjacent construction plant, may need to be considered in this context, particularly if the exhaust generated is in a restricted space.

6 The duty on employers to ensure that DEEE exposures are adequately controlled under COSHH Regulation 3 also extends to non-employees (including members of the public) who may be affected by the work, *so far as is reasonably practicable*. However, the short duration of exposure for passengers and the public using stations should act to minimise any significant risk from DEEE exposure in these groups. Arrangements to support passengers who request assistance at stations should consider how best to minimise exposure to DEEE among more vulnerable groups, for example by reducing waiting times on enclosed diesel platforms where trains may be idling. An overall strategy for managing DEEE exposures should be set out as part of duty holders' safety management system, and referenced in their Safety Authorisations/Certificates.

7 Most new diesel traction vehicles for mainline use are authorised under the Railway Interoperability Regulations 2011 (RIR2011) as amended. A technical file submitted under these regulations sets out how the rail vehicle has demonstrated compliance with relevant European directives and standards. This would include demonstrating compliance with emission of gaseous and particulate pollutants from internal combustion engines installed in non-road mobile machinery (see EU directive 97/68/EC dated 16/12/97 and as amended subsequently), however enforcement is the responsibility of DfT rather than ORR. This directive has set increasingly tighter controls on emission levels from new engines and has restrictions on replacement engines for existing vehicles. Inspectors should discuss any potential issues around authorisation or compliance with the Rail Vehicles Team.

8 There is also a duty on those leasing existing diesel powered rail vehicles to train operators to ensure that equipment they supply is, so far as is reasonably practicable, without risk to health under Section 6 of the Health and Safety at Work Act 1974. Though they do not supply the diesel fuel, rolling stock companies have an obligation to ensure that equipment supplied either has fitted, or is capable of having fitted, the necessary reasonably practicable controls to ensure compliance with COSHH, and to give information about maintenance requirements that will ensure exposure to DEEE is minimised. Inspectors should discuss compliance issues around rail vehicle supply, including any proposed technical modifications, with the Rail Vehicles Team.

### **RISK BASED APPROACH TO DEEE**

9 DEEE is a complex mixture of particulates, gases and vapours produced as by-products when diesel-fuelled engines are in operation. The DEEE mixture varies with the type, age, condition and operating temperature of the diesel engine, and with the composition of the fuel

itself. There is no Workplace Exposure Limit (WEL) for DEEE, as there are insufficient data to establish a clear, reliable threshold for all the potential health effects.

10 Exposure to DEEE can cause a range of respiratory problems, including, in some cases, lung cancer. It can cause respiratory irritation and may cause or exacerbate asthma. DEEE can also produce eye irritation and may cause bladder cancer. There may also be an increase in cardiovascular risks, including cardiovascular mortality.

11 While many of the gases produced are known respiratory irritants, it is the particulates (unburnt carbon or soot), which adsorb organic substances including polycyclic aromatic hydrocarbons (PAHs), which are recognised as being more harmful to health. Available evidence suggests that PAHs may be a key element in the carcinogenic health effects.

12 DEEE is hazardous to health as defined under COSHH. As DEEE is process generated, it is not classified as a carcinogen under the harmonised EU Classification Labelling and Packaging Legislation (CLP). As a result it does not trigger the specific requirements for control of carcinogens under COSHH Regulations 7(5), 7(7), and Appendix 1 to COSHH, including the duty to reduce exposures to as low as is reasonably practicable (ALARP).

13 However, the COSHH principles of good control practice, principle (c) require that exposure to a hazardous substance should be controlled by measures that are *proportionate to the health risk*. Inspectors should note that paragraph 58 of the guidance to the COSHH Approved Code of Practice (ACoP) 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 ALARP.

14 ORR and HSE policy is that duty holders should consider all the weight of evidence available (including the IARC classification and known carcinogenic risk from PAHs present in DEEE) in assessing the risk, and adopt a robust precautionary approach in controlling DEEE exposure as a whole, to reduce the risk of harm. The guidance to the [COSHH ACoP](#) (paragraph 24) supports this approach by advising that an active precautionary policy should be adopted by employers for the prevention and control of exposure to suspect carcinogens.

### **ASSESSING DEEE EXPOSURE**

15 COSHH Regulation 6 requires railway employers to carry out a

suitable and sufficient assessment of the risks from exposure to DEEE. Employers should seek to reduce exposures to DEEE, and [HSG 187](#) provides a useful reference guide in Table 2 on how to gauge low, medium and high exposures to DEEE based on visible smoke and soot, complaints of irritancy, and measured levels of carbon dioxide (CO<sub>2</sub>).

16 There is no DEEE WEL, but there are WELS for various constituents including carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), and formaldehyde. New WELs for nitrogen monoxide (NO) of 2ppm, and for nitrogen dioxide (NO<sub>2</sub>) of 0.5ppm 8 hour TWA, with a 15 minute short term limit of 1ppm for NO<sub>2</sub>, are due to come into force in GB in August 2018, as well as reductions in both the long and short term WELs for CO. [EH40](#) recommends that, for those substances where no short term exposure limit is specified, a figure of three times the long term limit be used as a guideline for controlling short-term peaks in exposure.

17 Historically, HSE carried out a programme of monitoring for occupational DEEE exposures, which included a number of railway depots and stations. Sampling included constituent gases such as carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), oxides of nitrogen (NO<sub>x</sub>) and aldehydes, as well as particulates including respirable dust, organic carbon (OC), elemental carbon (EC), and total carbon (OC and EC combined). The HSE technical development survey found railway exposures similar to those where forklift trucks are used in warehousing, and towards the upper range of typical workplace exposures. Further details on HSE's Technical Development Survey on DEEE are summarised in [OC 292/2](#).

18 Monitoring results provided to ORR by individual rail duty holders show a variable picture across rail depots and major stations, but provide evidence of the potential for high short-term exposures to some constituent gases, particularly nitrogen monoxide (NO) and nitrogen dioxide (NO<sub>2</sub>), and to elemental carbon.

19 Elemental carbon (EC) is generally considered a reliable marker for DEEE exposure, particularly the particulate element, as it is only produced in significant quantities by diesel engines (petrol engines produce very little). A reference value of 0.1mg/m<sup>3</sup> for EC has been used by HSE as indicative of 'high' EC exposure; this guidance limit aligns with the German TRK exposure limit of 0.1mg/m<sup>3</sup>. Levels of respirable dust will almost always be found to be below the 4mg/m<sup>3</sup> 8 hour time weighted average (TWA) concentration referenced in COSHH as hazardous to health. However, as respirable dust is easily measured it can give a useful initial pointer for particulate exposures, including EC, to allow further monitoring to be focused in the highest risk areas.

20 Measuring gaseous components of DEEE is also useful in

assessing exposure and adequacy of control. It is not possible to establish how far controlling exposure to the individual gaseous components to below their WELs will control the carcinogenic risk. However reducing levels of these components at the workplace should reduce exposures to DEEE in general, and thereby the carcinogenic risk. As measurement of CO<sub>2</sub> is relatively easy and inexpensive, it will often be a useful first step in any assessment of DEEE exposure. Levels above 1000ppm CO<sub>2</sub> can often indicate faulty poorly designed or maintained control systems.

21 With the recent increase in public concern around air quality, particularly NO<sub>x</sub> emissions from diesel vehicles, static monitoring for NO, NO<sub>2</sub> and particulates for comparison with EU air quality standards (see paragraphs 36-38) has been carried out at some major railway stations. Legal advice obtained by one major duty holder suggests, however, that environmental air quality standards only apply to outside ambient air and enclosed railway stations are therefore not strictly within scope. Although not required inside station buildings, data from static continuous monitoring against EU air quality standards can potentially be useful to rail duty holders in understanding sources, fluctuations, and movement of fume through enclosed stations. Current [RSSB research](#) to monitor and model pollution in enclosed railway stations should ultimately support improved risk assessment and control.

22 Available data suggests that early morning/late evening movement of diesel rolling stock to/from station platforms, and extended train idling can contribute to high short term peaks in NO and NO<sub>2</sub> on enclosed platforms. Inspectors should note that results of static monitoring for comparison with air quality standards cannot be used directly to assess occupational DEEE exposures. However such data may be helpful in identifying peak emissions and trends in levels of DEEE constituents such as NO<sub>2</sub>, to help target more detailed assessment of occupational exposures under COSHH.

23 DEEE exposures in rail depots, stations and tunnels can be influenced by a number of key factors, which should be considered as part of a suitable and sufficient COSHH assessment, including identifying locations where exposure monitoring may be appropriate:

- The building geometry, particularly the extent to which the location is enclosed, restricting the general ventilation (for example low enclosed roof spans, underground platforms, 'enclosed' escalators and stairway from platforms to concourses, and length of tunnels);
- Building heating systems, for example in maintenance depots where heaters positioned above shed doors can potentially disrupt air flows creating localised pockets of fume

- The extent to which fluctuating weather conditions will affect likely exposures (e.g. 'wind tunnel' effects on enclosed platforms; cold still weather causing fume to sink);
- Frequency of use by diesel traction stock, which is highly variable across the rail network;
- Length of time spent at the location with engines 'idling' or under test;
- Age of stock;
- Maintenance of stock; and
- The standard of ventilation (natural and/or mechanical) - its design, use and maintenance.

24 Inspectors should note that track access agreements can be renewed or amended to allow train operators to vary the services they run. These could result in diesel stock being introduced to new stations where there was none before, or service frequencies being increased. Any such changes should be reflected in a revised COSHH assessment and package of enhanced controls where necessary.

25 At many railway locations where DEEE exposure is likely to occur, the factors to be considered in the risk assessment and the implementation of controls will be matters for joint resolution between duty holders. Inspectors should be mindful of Regulation 11 of the Management of Health and Safety at Work Regulations 1999 as a means of securing the necessary co-operation to achieve compliance.

## **PREVENTION AND CONTROL MEASURES**

26 Where prevention, preferably by means of 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*. We expect to see a planned programme of short and longer term measures to manage DEEE exposure which include consideration of the following:

### **26.1 Prevention - Regulation 7(1)**

- A policy of progressive replacement by electric (where infrastructure configuration permits) or latest emission standard compliant diesel traction, where diesel stock is identified as particularly contributing to DEEE exposure (or a policy of tackling emissions reduction on existing vehicles by means of engine replacement);
- Design of 'fuel saving' train management software to reduce the use of engines when stationary;
- Software modifications to initiate phased automatic engine shut

down of diesel multiple unit vehicles on removal of the driver's key, where design permits, to reduce idling times;

- Consideration to fitment of auto engine stop start (AESS) technology to automatically stop the locomotive engine when idling. Trials by freight operators have shown that this has the potential to reduce the level of emissions, while at the same time increase locomotive reliability;
- In depots, consideration of whether engines need to be run while the fault/repair in question is dealt with; and
- Use of electric or compressed air 'shore supplies' to eliminate load on engines running a train management system (TMS) where design permits, or in depots for vehicles under test.

#### **26.2 Substitution - Regulation 7(2)**

- Use of Ultra Low Sulphur Diesel (ULSD) including bio-diesel blends;

#### **26.3 Control - work processes, systems and engineering controls - Regulation 7(3)(a)**

- Adequate maintenance and management of traction/rolling stock to minimise emissions;
- Robust enforcement of an effective idling time policy at stations, which will need to be reflected in crew diagrams, service routines and catering provision;
- 'Country end only' running at terminus stations and/or single bank running;
- In depots, consideration of whether engines can be run for shorter periods for the fault/repair in question to be dealt with;
- Reducing unnecessary revving of engines (engines working under high load generate higher proportions of EC);
- Use of 'shore supplies' to reduce load on engines running a TMS.

#### **26.4 Control - at source by local exhaust ventilation (LEV), general ventilation, and organisational control measures - Regulation 7(3)(b)**

- Effective mechanical ventilation where fume is not easily or quickly cleared. The operation and/or speed of ventilation fans (usually in the roof) are commonly linked to timers or to sensors at platform level (also see paragraph 29) with continuous running at times of peak DEEE production;



- Consideration to fitting of exhaust removal systems to stationary trains (especially in depots), or organisational arrangements to ensure trains stop with engine exhausts within the effective swept area of a fixed LEV system (particularly relevant at stations);
- Improved general ventilation, with sufficient permanent make-up air. In depots in particular, reliance on general ventilation may not be adequate, as much of the make-up air is provided by open doorways, which tend to be shut in winter, causing DEEE to accumulate;
- Job rotation to reduce exposure, for example despatch and gate line staff; and
- Information, instruction and training to staff in both the hazards of DEEE and the implementation of control measures to avoid or minimise exposure.

#### **26.5 Maintenance, examination and testing of control measures - Regulation 9**

- Arrangements for regular maintenance, examination and testing of control measures to comply with COSHH Regulation 9 requirements, including engineering controls, respiratory protective equipment (RPE), and working procedures. Historically we have found arrangements for thorough examination and test of mechanical ventilation fans and LEV to be generally poor in stations and depots. Personnel engaged to carry out the required examination and testing under COSHH Regulation 9 need to be competent. The [British Occupational Hygiene Society](#), for example, have a scheme of proficiency modules for different elements of LEV and the [Institution of Local Exhaust Ventilation Engineers](#) have a competency scheme for their members.

27 Achieving prevention or adequate control will often be a matter of employers at a particular location, for example, train operating companies (TOCs) and the station operators, working together and sharing the findings of assessments in order to make informed decisions about which (further) control measures to adopt.

28 The reasonable practicability of control measures will need careful consideration. Some TOCs are now demonstrating a proactive approach by working with their rolling stock leasing companies to explore retro fitment of selective catalyst reduction technology to reduce NO<sub>x</sub> emissions on diesel fleets. Major engine overhaul or refurbishments provide an opportunity to see where improvements to DEEE emissions can be made, and should be considered as part of an active precautionary approach.

29 Fume extraction systems within stations in particular require careful design. Where ventilation fan speeds are linked to CO<sub>2</sub> sensors, careful calibration and assurance monitoring is needed to ensure that DEEE exposures are adequately controlled at platform level. Extensive monitoring at one major station where roof level ventilation fans were designed to activate at 1000ppm CO<sub>2</sub>, found little correlation between the levels of CO<sub>2</sub> and NO<sub>x</sub> at platform level. Design changes were made to trigger the roof fans at lower CO<sub>2</sub> levels and platform level NO<sub>x</sub> sensors are to be installed as an additional measure in this case. Consideration of the impact of prevailing winds on ventilation systems is also important to ensure that the system works with, rather than against, such effects, for example by installing bi-directional fans.

30 Minimising the length of time engines may spend idling prior to the start of a journey or during a prolonged stop at a station is an essential control, and there is some evidence that idling time policies (for example '10 minute rule' for HSTs) are not always strictly adhered to. An apparent increase in idling time is likely to be due, in part, to the operation of train management systems, some of whose functions are potentially safety-critical, such as fire detection systems and door opening/closing. For some diesel vehicles, software modifications for phased automatic engine shutdown may be reasonably practicable, for example current trials on selective automatic engine shutdown after 7-10 minutes and power sharing between power vehicles on Voyager fleets when idling in stations. Where idling time policies act to limit or prevent passenger access to the train until shortly before departure, care is needed to ensure this does not lead to an increased risk of overcrowding on the concourse, or slips and trips as people rush to board the train. Though idling time as a control measure should not be considered in isolation, there should be careful consideration of the likely effect of any relaxation of it in the overall package of measures taken to control DEEE exposure.

31 It may be possible to reduce the need for engine running by temporary use of platform-based (or depot) shore supplies. These are essentially an electrical hook-up (or alternatively compressed air supply), which requires access at track level. They can be used to power certain functions, but considerations of reasonable practicability again need to be made. For example, shore supply connections differ around the country, and some types of rolling stock (for example Virgin Voyagers) are equipped to run off such supplies connected coach by coach, not from a single point supply. Where modifications to train or shore power supply systems are required to allow increased use of shore supplies, they may not therefore be reasonably practicable if other (safety) risks are thereby increased. However, where a compatible facility exists, operators will need to consider its use as part of a package of risk reduction measures.

32 DEEE exposure in depots may be significant, particularly where repairs or tests with engines running are carried out with employees

adjacent to or beneath the engine(s), for example in pits. The approach to assessment and control here should be rigorous: reliance on axial fans for air movement along the shed and opening shed-end doors to improve through ventilation may well be insufficient in the context of an active precautionary approach. Measures such as eliminating the need for, or minimising, engine running; portable or fixed LEV systems; and minimising numbers exposed by good job planning and segregation of the work will need to be actively considered.

33 Fitment of DEEE gas sensors in the roof and at working level, including in inspection pits (we are aware of use of CO and NO<sub>x</sub> sensors in some depots), or track vibration sensors to detect when engines are running, linked directly to the shed extraction systems, may be reasonably practicable design options. Procedures to ensure correct positioning of train exhausts relative to overhead extraction systems is particularly important. Any assumptions used in the design of depot fume extraction systems need to be realistic and reflect the influence of the weather, for example cold weather causing rising fumes to sink, and the impact of localised space heaters on movement of fume. Where shed doors are likely to remain open in warm weather, any cross winds can disrupt upward convection.

34 In the context of tunnel working, not all of the controls discussed so far will be reasonably practicable or appropriate, though sound assessment and control using the hierarchy of measures set out in COSHH are critical in what may be a poorly ventilated space. It is now common practice in mainline railway renewals and construction work for banks of ventilation fans to be installed at the tunnel entrance to improve through airflow. The COSHH assessment will need to consider where peak exposures to DEEE are likely to occur (e.g. movement of DEEE gases for work in a tunnel crown compared with at track level) and the need for forced ventilation and other controls. Use of continuous DEEE gas monitors and alarms on renewals plant in underground tunnels has shown the potential for high short-term peaks in NO in particular (there is no short-term exposure limit) but with 8-hour TWA exposures adequately controlled by use of ventilation fans. For short duration exposures, where engineering control is not reasonably practicable, suitable RPE will be needed for tunnel working.

35 Wherever reasonably practicable, air tools supplied from a compressor sited outside the tunnel should be used in substitution for diesel-driven equipment. [HSG 187](#) give guidance on siting of locomotives and plant outside tunnels to allow dispersion of DEEE emissions by natural ventilation; siting of generators downwind of worksites; and use of LEV. If locomotives cannot be sited outside the tunnel, active consideration should be given to uncoupling them from equipment and wagons once these have been hauled into position, or shutting off engines while the locomotive remains in the tunnel. Although service trains are unlikely to be using tunnels when possession work is underway in them, where this is unavoidable, work

planning and proper communication with signallers should seek to ensure as far as possible that they are not held at signals in the tunnel.

### **MONITORING (COSHH REGULATION 10) AND LINKS TO AIR QUALITY STANDARDS**

36 Exposure monitoring for DEEE, both personal and/or static, may form part of the overall COSHH assessment. It should also be considered where there is evidence that control measures may have deteriorated (e.g. as a result of a complaint of ill health effects or irritancy), or as a check that the control measures introduced remain effective by testing compliance with relevant WELs. It will be the responsibility of the premises operator (at stations, Network Rail or the TOC which is the 'station facility owner') to do this, sharing monitoring results with other duty holders regularly working on the premises. Individual employers within shared premises remain responsible for assessing and managing risks to their own staff.

37 Inspectors should be aware that there is an Air Quality Standard (AQS) for public places, using PM<sub>10</sub> and PM<sub>2.5</sub> particulates in DEEE, as well as NO and NO<sub>2</sub> levels as key markers (but note paragraph 21 on application only to ambient air but not inside stations). The Department for Environment Food and Rural Affairs ([DEFRA](#)), which sets the AQS, uses static monitoring to measure PM<sub>10</sub> levels in ambient air, with the AQS enforced by Local Authority air quality teams (usually Environmental Health departments). There is no clear relationship between the AQS for PM<sub>10</sub> and possible health effects arising from occupational exposures to DEEE. However, information from AQS monitoring exercises may be helpful as part of a wider monitoring regime, as 'crude' indicators of standards and performance of controls. Inspectors should refer complaints alleging nuisance from DEEE to the relevant Local Authority once it has been established that preventive measures and controls identified by a suitable and sufficient COSHH assessment have been implemented.

38 Inspectors should be aware of EC directives (see paragraph 7) which set limits on emissions from engines. DEEE emissions, specifically CO, NO<sub>x</sub>, unburnt hydrocarbons and particulate matter, are regulated under the non-road mobile machinery regulations (NRMM), for diesel engines brought into service from 2006. These standards are intended to limit emissions to the environment, and are not designed with control of worker personal exposure in mind. In theory, it is possible to link emission rates to personal exposure quantities, but the number of variables involved makes this a complex task. Assertions from TOCs that their engines meet the EC directives should therefore not be relied on as an indicator that compliance with COSHH Regulation 7 has been achieved. It is possible, however, to model in general terms the correlation between reductions in emission rates and exposures, and data of this sort from TOCs could be acceptable as a coarse indicator of exposures trending in the right direction, though it

would not be a substitute for a detailed, site-specific assessment of exposures.

### **HEALTH SURVEILLANCE (COSHH REGULATION 11)**

39 Health surveillance should always be risk-based, and a suitable and sufficient risk assessment should identify where health surveillance is required to detect early signs of ill health due to DEEE exposure.

[Guidance on occupational health surveillance](#) is available from HSE.

40 Where health surveillance is performed for DEEE exposed workers, it could include assessments such as respiratory symptom questionnaires and lung function testing. Routine use of chest x-rays for DEEE exposed workers is not recommended, although the need for any further investigations will be for the occupational health professional to determine on a case-by-case basis in the light of individual health surveillance findings. Exposed workers should be advised to stop smoking.

### **ACTION BY INSPECTORS**

41 Inspectors are asked to note and implement the advice in this RIG. It is important that Inspectors act in a co-ordinated way to enforce requirements at multi-duty holder sites such as stations or renewals sites. Implementation of a sound package of control measures by a TOC in respect of its traction can be undone if, for example, LEV at a major station is poorly designed or sited, not maintained or simply not switched on. In this example, action against the station facility owner (as defined by Station Access Conditions as set by ORR) or Network Rail (if it is the station operator) would be appropriate.

42 When considering whether the hierarchy of control under COSHH has been properly applied, inspectors will need to consider the reasonable practicability of controls to reduce DEEE exposure. Prevention (e.g. by engine changes) and substitution 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, including provision and maintenance of adequate mechanical ventilation systems, may provide reasonably practicable means of ensuring adequate control and compliance.

43 Under the [Enforcement Management Model](#) (EMM) 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. When considering enforcement action in respect of assessment or control of DEEE, Inspectors should consult the relevant HSE [guidance on applying the EMM specifically to health risks](#). HSE has also produced additional guidance on considering the [health effects of specific hazardous substances when applying the EMM](#). Appendix 1 to this guidance suggests the most credible health

outcomes for DEEE exposure as chronic lung disease/cancer, a serious/significant health effect under EMM.

**Action**  
(optional)

Inspectors to note and follow the advice above on securing legal compliance in respect of rail worker exposure to DEEE.