Neutral Citation Number: [2018] EWHC 687 (QB)

Case No: TLQ17/0043

IN THE HIGH COURT OF JUSTICE
QUEEN'S BENCH DIVISION

Royal Courts of Justice
Strand, London, WC2A 2LL

Date: 28/03/2018

Before:

THE HON. MRS JUSTICE NICOLA DAVIES DBE

- -

Between:

CHRISTOPHER GOLDSCHEIDER	**Claimant**
- and -	
THE ROYAL OPERA HOUSE COVENT GARDEN FOUNDATION	**Defendant**

- -
- -

Theo Huckle QC and Jonathan Clarke (instructed by **Fry Law**) for the **Claimant**
David Platt QC and Alexander Macpherson (instructed by **BLM Law**) for the **Defendant**

Hearing dates: 30 January to 7 February and 9 February 2018

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Judgment Approved

Mrs Justice Nicola Davies:

Introduction

1. The claimant brings his claim for damages for personal injury, loss and damage sustained during the course of his employment at the defendant's Royal Opera House ("ROH") in Covent Garden, London, on Saturday 1 September 2012. The claimant, a professional viola player employed in the orchestra at the ROH, was seated directly in front of the brass section of the orchestra during a rehearsal of Wagner's Ring Cycle on Saturday afternoon 1 September 2012. The claimant alleges that during the afternoon rehearsal he was exposed to noise levels which created a risk to and resulted in injury to his hearing, namely acoustic shock. He continues to suffer from injury which has prevented his return to music.

2. The Particulars of Claim plead breaches of the defendant's obligations under the Control of Noise at Work Regulations 2005 ("the 2005 Regulations") which came into force generally on 6 April 2006. A dispensation, granted to the music and entertainment sectors, resulted in the Regulations coming into force in these sectors on 6 April 2008. Since 1 October 2013 breach of the statutory duties set out in the 2005 Regulations does not in itself give rise to a civil liability for an employer in breach of its obligations pursuant to the Regulations, although liability at common law may still arise. Breaches of other regulations are alleged together with a failure to comply with common law duties. It is the claimant's contention that breach of the 2005 Regulations is at the heart of this case.

3. In the Particulars of Claim the case is pleaded as follows:

> "2. In the course of his employment in the said workplace, the Claimant was exposed to noise (namely the music played by the orchestra and its members) at such frequencies and of such intensity and duration as was likely to be, and which was, injurious to his hearing.
>
> Particulars of noise exposure
>
> In the afternoon of Friday 31 August 2012 and all day on Saturday 1 September 2012, the orchestra (including the claimant) were in the orchestra pit rehearsing Richard Wagner's 'Die Walküre'. As a result of the way that the conductor (at all material times acting in the course of his employment by the Defendant) arranged the orchestra, the Claimant was positioned immediately in front of a group of about 18 to 20 brass players. As a result of the sound level at which the orchestra was directed to play and the length of time for which it was directed to do so, the Claimant was likely to be and was exposed to noise at a level which reached or exceeded 87 dB(A), alternatively 85 dB(A), alternatively 80 dB(A) when averaged over 8 hours (or for substantial periods of time) and/or which reached or exceeded a peak sound pressure level of 140 dB(C), alternatively 137 dB(C), alternatively 135 dB(C).

> The Claimant was provided with and was wearing hearing protection. However, it was insufficient to prevent his exposure to a harmful amount of noise."

4. Breaches of the 2005 Regulations are pleaded. They allege:

   i) A failure to make a suitable and sufficient assessment of the risk to the health and safety of the claimant from noise (Regulation 5(1));

   ii) Failure to eliminate, at source, the risk to the claimant's hearing posed by his noise exposure, or, if that was not reasonably practicable, to reduce that risk to as low as reasonably practicable (Regulation 6(1);

   iii) Although the claimant was likely to be exposed to noise at or above an upper exposure action value ("EAV") (namely 85 dB(A)Lepd) or a peak sound pressure of 137 dB(C), failure to reduce his noise exposure to as low a level as reasonably practicable by establishing and implementing a program of organisational and technical measures, other than the provision of personal hearing protectors (Regulations 6(2));

   iv) Failure to ensure that the claimant was not exposed to noise which, despite the attenuation afforded by personal hearing protectors, exceeded an exposure limit value (namely 87 dB(A)Lepd) or a peak sound pressure of 140 dB(C) (Regulation 6(4));

   v) As the orchestra pit was in a place where the claimant was likely to be exposed to noise at or above an upper EAV (85 dB(A)Lepd) or peak sound pressure of 137 dB(C), failure to ensure that the orchestra pit was designated a Hearing Protection Zone, demarcated and identified by appropriate signage and the claimant was not to enter without wearing suitable personal hearing protectors (Regulation 7(3));

   vi) Failure to ensure that the hearing protection provided to the claimant was fully and properly used (Regulation 8);

   vii) Failure to provide the claimant with suitable and sufficient information, instruction and training (Regulation 10).

5. The defendant denies the alleged breaches of the 2005 Regulations. Insofar as it was unable to eliminate the noise at source all reasonable practicable steps were taken to reduce noise exposure to a low level. Reliance is placed upon section 1 of the Compensation Act 2006 ("the 2006 Act"), namely:

> "1. Deterrent effect of potential liability
>
> A court considering a claim in negligence or breach of statutory duty may, in determining whether the defendant should have taken particular steps to meet a standard of care (whether by taking precautions against a risk or otherwise), have regard to whether a requirement to take those steps might—

> (a) prevent a desirable activity from being undertaken at all, to a particular extent or in a particular way, or
>
> (b) discourage persons from undertaking functions in connection with a desirable activity."

The noise produced by the professional orchestra is not a by-product of its activities, it is the product. Safety standards to be imposed upon it must take into account the aesthetic and technical demands to which the defendant and its players are subject by the nature of their enterprise. The defendant has taken all reasonably practicable steps to reduce the risk of injury, it should not be required to take further steps as these would unreasonably compromise the output of the orchestra. The defendant's orchestra performs in the orchestral pit at the ROH which forms an integral part of an historic Grade A listed auditorium. This adds to the practical difficulties in increasing the amount of space available to its players. Contributory negligence is alleged. Medical causation is denied. In its Defence the defendant denies the existence of acoustic shock as a medically diagnosable condition.

6. On 11 November 2016 Master McCloud directed a trial of the preliminary issues of breach of duty and causation of injury.

7. The Control of Noise at Work Regulations 2005:

> "**2. Interpretation**
>
> (1) In these Regulations –
>
> … "noise" means any audible sound; …
>
> **3. Application**
>
> (1) These Regulations shall have effect with a view to protecting persons against risk to their health and safety arising from exposure to noise at work.
>
> (2) Where a duty is placed by these Regulations on an employer in respect of his employees, the employer shall, so far as is reasonably practicable, be under a like duty in respect of any other person at work who may be affected by the work carried out by the employer except that the duties of the employer…
>
> …
>
> **4. Exposure limit values and action values**
>
> (1) The lower EAVs are—
>
> (a) a daily or weekly personal noise exposure of 80 dB (A-weighted); and
>
> (b) a peak sound pressure of 135 dB (C-weighted).

(2) The upper EAVs are—

(a) a daily or weekly personal noise exposure of 85 dB (A-weighted); and

(b) a peak sound pressure of 137 dB (C-weighted).

(3) The exposure limit values are—

(a) a daily or weekly personal noise exposure of 87 dB (A-weighted); and

(b) a peak sound pressure of 140 dB (C-weighted).

(4) Where the exposure of an employee to noise varies markedly from day to day, an employer may use weekly personal noise exposure in place of daily personal noise exposure for the purpose of compliance with these Regulations.

(5) In applying the exposure limit values in paragraph (3), but not in applying the lower and upper exposure action values in paragraphs (1) and (2), account shall be taken of the protection given to the employee by any personal hearing protectors provided by the employer in accordance with regulation 7(2).

5. Assessment of the risk to health and safety created by exposure to noise at the workplace

(1) An employer who carries out work which is liable to expose any employees to noise at or above a lower EAV shall make a suitable and sufficient assessment of the risk from that noise to the health and safety of those employees, and the risk assessment shall identify the measures which need to be taken to meet the requirements of these Regulations.

(2) In conducting the risk assessment, the employer shall assess the levels of noise to which workers are exposed by means of—

(a) observation of specific working practices;

(b) reference to relevant information on the probable levels of noise corresponding to any equipment used in the particular working conditions; and

(c) if necessary, measurement of the level of noise to which his employees are likely to be exposed,

and the employer shall assess whether any employees are likely to be exposed to noise at or above a lower EAV, an upper EAV, or an exposure limit value.

(3) The risk assessment shall include consideration of —

(a) the level, type and duration of exposure, including any exposure to peak sound pressure;

(b) the effects of exposure to noise on employees or groups of employees whose health is at particular risk from such exposure;

(c) so far as is practicable, any effects on the health and safety of employees resulting from the interaction between noise and the use of ototoxic substances at work, or between noise and vibration;

(d) any indirect effects on the health and safety of employees resulting from the interaction between noise and audible warning signals or other sounds that need to be audible in order to reduce risk at work;

(e) any information provided by the manufacturers of work equipment;

(f) the availability of alternative equipment designed to reduce the emission of noise;

(g) any extension of exposure to noise at the workplace beyond normal working hours, including exposure in rest facilities supervised by the employer;

(h) appropriate information obtained following health surveillance, including, where possible, published information; and

(i) the availability of personal hearing protectors with adequate attenuation characteristics.

(4) The risk assessment shall be reviewed regularly, and forthwith if—

(a) there is reason to suspect that the risk assessment is no longer valid; or

(b) there has been a significant change in the work to which the assessment relates,

and where, as a result of the review, changes to the risk assessment are required, those changes shall be made.

(5) The employees concerned or their representatives shall be consulted on the assessment of risk under the provisions of this regulation.

(6) The employer shall record—

(a) the significant findings of the risk assessment as soon as is practicable after the risk assessment is made or changed; and

(b) the measures which he has taken and which he intends to take to meet the requirements of regulations 6, 7 and 10.

6. Elimination or control of exposure to noise at the workplace

(1) The employer shall ensure that risk from the exposure of his employees to noise is either eliminated at source or, where this is not reasonably practicable, reduced to as low a level as is reasonably practicable.

(2) If any employee is likely to be exposed to noise at or above an upper EAV, the employer shall reduce exposure to as low a level as is reasonably practicable by establishing and implementing a programme of organisational and technical measures, excluding the provision of personal hearing protectors, which is appropriate to the activity.

(3) The actions taken by the employer in compliance with paragraphs (1) and (2) shall be based on the general principles of prevention set out in Schedule 1 to the Management of Health and Safety Regulations 1999(1) and shall include consideration of—

(a) other working methods which reduce exposure to noise;

(b) choice of appropriate work equipment emitting the least possible noise, taking account of the work to be done;

(c) the design and layout of workplaces, work stations and rest facilities;

(d) suitable and sufficient information and training for employees, such that work equipment may be used correctly, in order to minimise their exposure to noise;

(e) reduction of noise by technical means;

(f) appropriate maintenance programmes for work equipment, the workplace and workplace systems;

(g) limitation of the duration and intensity of exposure to noise; and

(h) appropriate work schedules with adequate rest periods.

(4) The employer shall—

(a) ensure that his employees are not exposed to noise above an exposure limit value; or

(b) if an exposure limit value is exceeded forthwith—

(i) reduce exposure to noise to below the exposure limit value;

(ii)identify the reason for that exposure limit value being exceeded; and

(iii) modify the organisational and technical measures taken in accordance with paragraphs (1) and (2) and regulations 7 and 8(1) to prevent it being exceeded again.

…

(7) The employees concerned or their representatives shall be consulted on the measures to be taken to meet the requirements of this regulation.

7. Hearing Protection

(1) Without prejudice to the provisions of regulation 6, an employer who carries out work which is likely to expose any employees to noise at or above a lower EAV shall make personal hearing protectors available upon request to any employee who is so exposed.

(2) Without prejudice to the provisions of regulation 6, if an employer is unable by other means to reduce the levels of noise to which an employee is likely to be exposed to below an upper EAV, he shall provide personal hearing protectors to any employee who is so exposed.

(3) If in any area of the workplace under the control of the employer an employee is likely to be exposed to noise at or above an upper EAV for any reason the employer shall ensure that—

(a) the area is designated a Hearing Protection Zone;

(b) the area is demarcated and identified by means of the sign specified for the purpose of indicating that ear protection must be worn in paragraph 3.3 of Part II of Schedule 1 to the Health and Safety (Safety Signs and Signals) Regulations 1996(1); and

(c) access to the area is restricted where this is practicable and the risk from exposure justifies it,

and shall ensure so far as is reasonably practicable that no employee enters that area unless that employee is wearing personal hearing protectors.

(4) Any personal hearing protectors made available or provided under paragraphs (1) or (2) of this regulation shall be selected by the employer—

(a) so as to eliminate the risk to hearing or to reduce the risk to as low a level as is reasonably practicable; and

(b) after consultation with the employees concerned or their representatives

8. Maintenance and use of equipment

(1) The employer shall—

(a) ensure so far as is practicable that anything provided by him in compliance with his duties under these Regulations to or for the benefit of an employee, other than personal hearing protectors provided under regulation 7(1), is fully and properly used; and

(b) ensure that anything provided by him in compliance with his duties under these Regulations is maintained in an efficient state, in efficient working order and in good repair.

(2) Every employee shall—

(a) make full and proper use of personal hearing protectors provided to him by his employer in compliance with regulation 7(2) and of any other control measures provided by his employer in compliance with his duties under these Regulations; and

(b) if he discovers any defect in any personal hearing protectors or other control measures as specified in sub-paragraph (a) report it to his employer as soon as is practicable.

9. Health Surveillance

(1) If the risk assessment indicates that there is a risk to the health of his employees who are, or are liable to be, exposed to noise, the employer shall ensure that such employees are placed under suitable health surveillance, which shall include testing of their hearing.

(2) The employer shall ensure that a health record in respect of each of his employees who undergoes health surveillance in

accordance with paragraph (1) is made and maintained and that the record or a copy thereof is kept available in a suitable form.

(3) The employer shall—

(a) on reasonable notice being given, allow an employee access to his personal health record; and

(b) provide the enforcing authority with copies of such health records as it may require.

(4) Where, as a result of health surveillance, an employee is found to have identifiable hearing damage the employer shall ensure that the employee is examined by a doctor and, if the doctor or any specialist to whom the doctor considers it necessary to refer the employee considers that the damage is likely to be the result of exposure to noise, the employer shall—

(a) ensure that a suitably qualified person informs the employee accordingly;

(b) review the risk assessment;

(c) review any measure taken to comply with regulations 6, 7 and 8, taking into account any advice given by a doctor or occupational health professional, or by the enforcing authority;

(d) consider assigning the employee to alternative work where there is no risk from further exposure to noise, taking into account any advice given by a doctor or occupational health professional; and

(e) ensure continued health surveillance and provide for a review of the health of any other employee who has been similarly exposed.

(5) An employee to whom this regulation applies shall, when required by his employer and at the cost of his employer, present himself during his working hours for such health surveillance procedures as may be required for the purposes of paragraph (1).

10. Information, instruction and training

(1) Where his employees are exposed to noise which is likely to be at or above a lower EAV, the employer shall provide those employees and their representatives with suitable and sufficient information, instruction and training.

> (2) Without prejudice to the generality of paragraph (1), the information, instruction and training provided under that paragraph shall include—
>
> (a) the nature of risks from exposure to noise;
>
> (b) the organisational and technical measures taken in order to comply with the requirements of regulation 6;
>
> (c) the exposure limit values and upper and lower exposure action values set out in regulation 4;
>
> (d) the significant findings of the risk assessment, including any measurements taken, with an explanation of those findings;
>
> (e) the availability and provision of personal hearing protectors under regulation 7 and their correct use in accordance with regulation 8(2);
>
> (f) why and how to detect and report signs of hearing damage;
>
> (g) the entitlement to health surveillance under regulation 9 and its purposes;
>
> (h) safe working practices to minimise exposure to noise; and
>
> (i) the collective results of any health surveillance undertaken in accordance with regulation 9 in a form calculated to prevent those results from being identified as relating to a particular person.
>
> (3) The information, instruction and training required by paragraph (1) shall be updated to take account of significant changes in the type of work carried out or the working methods used by the employer.
>
> (4) The employer shall ensure that any person, whether or not his employee, who carries out work in connection with the employer's duties under these Regulations has suitable and sufficient information, instruction and training."

Noise

8. Noise is generated by pressure levels in the air. The frequency at which the levels occur is expressed in cycles-per-seconds or kilohertz ("kHz"). Noise may consist of a single frequency but most noise consists of simultaneous sounds at different frequencies. The doubling of the frequency of sound alters the pitch by one octave, thus 2 kHz is an octave higher than 1 kHz. The loudness of a noise depends on the sound pressure level of the energy producing it. The level is measured in decibels

("dB"). The dB scale is logarithmic so that each 3 dB increase involves a doubling of the sound energy. The human ear is more sensitive to noise at some frequencies than at others. The sound pressure level across a range of frequencies is commonly expressed by a weighted measurement described as dB(A). Sound pressure levels do not equate to the level of noise as it is perceived by the hearer. The hearer will not perceive a doubled sound pressure level as a doubling of loudness.

9. The noise to which the human ear is exposed generally fluctuates over any given period of time. The average noise over a period of time is described as the equivalent continuous sound pressure level designated as "Leq", thus a person may be exposed to 90 dB(A)Leq over a period, being exposed to different sound pressure levels at different times during the period. To identify a unit of noise exposure the level of noise experienced during a working day of eight hours is calculated. This sound level is described as dB(A)Lepd or the average daily noise exposure level. Exposure at a given dB(A)Lepd for a year gives a noise emission level ("NIL") which will build up slowly with further years' exposure.

10. The outer ear funnels sound towards the eardrum which converts the sound pressure variations into mechanical vibrations. The vibrations are conveyed by the middle ear to the cochlear which analyses and amplifies the sound and translates the vibrations into nerve impulses which are transmitted to the brain's auditory nerve, thus producing the perception of sound. Hair cells in the cochlear play a vital part in this process. Noise-induced hearing loss is the result of damage to the hair cells resulting from exposure to noise over time. Noise-induced hearing loss affecting the cochlear is known as sensorineural, this is to be contrasted with conductive hearing loss which results in a decline in the function of the outer or middle ear.

Noise levels

11. During the afternoon rehearsal at the ROH on Saturday 1 September 2012 the noise levels were measured and recorded. The measurements relied upon by the claimant as representing exposure to noise levels which gave rise to a substantial risk of injury are as follows:

    i) The average noise level to which the claimant was exposed during the three hours, 15 minutes and 24 seconds representing the total measuring period was 91.8 dB(A)Leq;

    ii) At such a level the "lower EAV" (an eight-hour average of 80 dB(A)Lepd ignoring the effects of personal hearing protectors) was reached within 0.52 hours;

    iii) The "upper EAV" (an eight-hour average of 85 dB(A) Lepd ignoring the effects of personal hearing protectors) was reached within 1.6 hours;

    iv) The "exposure limit value" (an eight-hour average of 87 dB(A) Lepd taking into the effects of personal hearing protectors worn) would have been reached within 2.64 hours if no personal hearing protectors had been worn.

    v) The average exposure during the two hours and 58 minutes measurement period between the cursors was 92.2 dB(A)Leq;

vi) The lower EAV was reached within 0.477 hours;

vii) The upper EAV was reached within 1.52 hours;

viii) The exposure limit value would have been reached within 2.41 hours if no personal hearing protection was worn.

These figures do not take account of the exposure during the morning rehearsal, each rehearsal lasted three hours.

Evidence

12. Mr Goldscheider is aged 45, a professional musician, he began playing the violin at the age of 5 and the viola from about 21. He studied in Prague and the UK. In 2002 he joined the viola section of the orchestra of the ROH as number eleven viola, he was promoted to number six. Mr Goldscheider remained at the ROH until July 2014. He was unable to continue working because of the injuries he suffered at work in September 2012.

13. In March/April members of the orchestra would be given an advance schedule of rehearsals and productions for the forthcoming season. Each member of the orchestra would have a buddy, a player in the same section who would sit at or near the desk of his buddy. Together they would choose the productions in which each would take part, one would choose one opera, the buddy would choose another. In identifying an opera it was difficult to consider information about noise as it was an arbitrary system.

Hearing protection

14. The ROH had provided the claimant with custom moulded earplugs shortly after he joined in 2002. They were fitted by a specialist in Harley Street, 9 dB filters were agreed to provide sufficient attenuation for his work at the ROH. Hanging at the entrance to the orchestra pit were foam earplugs which provide up to 28 dB of attenuation. The claimant kept a pair of the foam earplugs in his viola case or pocket so he could put them on if required. For short bursts of noise from nearby instruments the 28 dB earplugs provide better protection than the 9s. The 28s made it difficult to hear other instruments, particularly in quiet passages, instructions from the conductor and his own instrument. The claimant did not regularly use the 9 dB earplugs as they did not offer sufficient protection when the music was very loud.

15. The claimant would wear earplugs if he believed the music was too loud for safety or comfort or if loud music was coming up. He had no means of assessing if the earplugs were effective. He did not remember wearing earplugs through an entire performance. He did not remember any discussion about the wearing of earplugs with Sally Mitchell, Orchestra Administrative Director.

16. The practice of the claimant's colleagues in the ROH varied, many did not wear earplugs, some wore them throughout. Many members of the orchestra would mark up their music with earplug signs to indicate where the noisy sections would occur and would take turns inserting earplugs in anticipation of those sections. The claimant adopted this practice. However, the claimant, like many members of the

orchestra, did not have his own written musical part, it would be left on the lectern in front of the desk at which the player sat.

The incident

17. The 2012/13 season was to open with Wagner's Ring Cycle conducted by the Musical Director, Sir Antonio Pappano. The claimant signed up for the Cycle. Included in the advance schedule were notes relating to individual performances and rehearsals. The notes in respect of Das Rheingold and Die Walküre gave no indication of noise levels. If the ROH had previously taken sound measurements from a performance of the opera, this data would be included in the advance notification of the schedules.

18. Rehearsals commenced upon the orchestra's return from the summer break on Thursday 30 August 2012. The first rehearsal was "Das Rheingold". On 31 August they rehearsed Das Rheingold in the morning, Die Walküre in the afternoon. The rehearsals took place in the orchestra pit of the ROH. The claimant had previously played in three productions of Die Walküre at the ROH. He was aware that it has some particularly loud sections but did not accept that he knew the opera well. The problem which arose was not Die Walküre, it was the seating. He sat in the second desk of the violas at position four for Das Rheingold, in the third desk, position five for Die Walküre. In this position he was immediately in front of the trumpets.

19. In his witness statement dated 24 August 2015 the claimant stated that the seating for the Die Walküre production was new. When he returned after lunch for the Die Walküre rehearsal on 31 August the layout of the orchestra was different from that of the morning. The viola section was seated in front of the whole brass section which comprised 18 brass instruments, four trumpets, four trombones, nine French horns and one tuba. They were located immediately behind the claimant with hardly any space between them. The claimant had not anticipated this configuration. He had previously played in the ROH's production of the Ring Cycle in 2005 and 2007 and could tell from the layout that the rehearsal was going to be noisy, as it proved to be, although not as loud as the next day.

20. Contrary to his written statement, in his evidence to the Court, the claimant accepted that the configuration of the orchestra including the position of the brass instruments was the same in rehearsals for Das Rheingold and Die Walküre. He did not accept that the level of noise was the same, the Das Rheingold rehearsal was quieter. He said it must be the effect, it was unusual to sit all the brass together, that had not been done in the 2007 production. Sitting in the second desk the noise from the brass would not have been as loud as when he moved to the third desk.

21. The claimant said that everyone knows about the pit and the layout, it is not safe seating for the number of players. It was not uncommon for musicians in the orchestra to complain about noise levels. As the seating for rehearsals was new no advance noise data was available. Players would know if it was going to be noisy only when they had played it in rehearsal and thus could mark the music, they were just starting the rehearsals.

22. The afternoon rehearsal on 31 August 2012 was loud. On the following morning the claimant thought he would experiment by continuously wearing his 9 dB earplugs. Within three seconds of entering the pit for the warm up prior to the start of rehearsal

the claimant realised the earplugs were ineffective so he switched to the 28s before the start of the rehearsal. He used them during those parts of the rehearsal when he felt he needed them but even then the noise was overwhelming. Having played in orchestras throughout his professional life the claimant was used to noise but the sensation from so many brass instruments playing directly behind him, in a confined area, at the same time at different frequencies and volumes, created a wall of sound which was completely different to anything he had previously experienced. The lack of space and the proximity of the trumpets to the claimant's ears meant that he was in the brass section's "direct line of fire". It was excruciatingly loud and painful. His right ear was particularly painful because the Principal trumpet was directed at that side of his head. The Principal is the predominant player of the trumpets, playing at a higher frequency and making a very powerful sound, two trumpets were to his left, one to his right. The noise gradually increased during Saturday morning. The claimant felt weird, overwhelmed and confused but finished the session. The earplugs were ineffective to protect him from the noise. At lunch he complained to colleagues about the noise, they complained to management.

23. As a result of the complaint, personal noise dosemeters were attached to various musicians including one to the claimant's right shoulder. Noise measurements were taken during the afternoon rehearsal. Following the afternoon session the claimant went home and began to experience further pain in both his ears, particularly on the right side, together with increasing dizziness. In the following days he was very unwell, his symptoms worsened, he became dizzier, the pain increased. The claimant had not experienced such ear pain, he did not know what had happened and felt confused. It felt like a brick behind his right ear. He was unable to attend work on the Monday. On 4 September 2012 he attended his GP who diagnosed acoustic trauma and prescribed pseudoephedrine, treatment for eustachian tubes, and Prochlorperazine to assist with the nausea and vertigo.

24. On 5 September 2015 the claimant met with Miss Ruby Grierson, the Occupational Health Advisor at the ROH. She performed an audiogram which noted a significant deterioration in the high frequencies in his right ear adding to an existing deficit. Ms Grierson referred the claimant to Mr John Rubin, a Consultant at the Royal National Throat, Nose and Ear Hospital in London (RNTNEH). On 6 September the claimant was seen by Mr Rubin who diagnosed cochlear irritation and presumed acoustic trauma. An audiogram performed on that day confirmed high frequency hearing loss. Mr Rubin prescribed a high dose of oral steroids in an attempt to retrieve the claimant's sudden hearing loss and placed him on relative bed rest. Over the following days the claimant felt very unwell, his symptoms worsened. He saw Mr Rubin on 10 September when a further hearing test confirmed the high frequency hearing loss. The claimant had become very sensitive to high frequency sounds. Mr Rubin advised him to stay in a quiet environment because he thought that any further exposure to noise would worsen the claimant's condition.

25. On 5 September 2012 the claimant was invited by the ROH orchestra management team to a meeting. As far as he could recall present were Sally Mitchell, Matthew Downes, various members of the orchestra, including Ian Balmain, the section principal trumpet, and Angela Bonetti, another viola player. They discussed the seating/noise in the Die Walküre production. The orchestra members said that the current seating arrangements were unworkable because of the sheer volume of noise

produced by the entire brass section sitting in one place. During the meeting the management team disclosed the noise measurement readings taken on the afternoon of 1 September. These were:

Rehearsal from 14:00-17:00 on 1 September 2012	**Badge Number**	**Leq in dB(A)**	**Lepd**
Viola Desk 1 No 2	(2725)	88	84
Viola Desk 2 No 4	(2724)	87	83
Viola Desk 3 No 6	(2718)	91	87
Viola Desk 3 No 5	(2726)	92	88
Viola Desk 4 No 7	(2722)	86	82
Viola Desk 5 No 10	(2719)	92	88
Trumpet 1	(2721)	93	89

Rehearsal from 11:00-14:00 on 11 September 2012	**Badge Number**	**Leq in dB(A)**	**Lepd**
Viola Desk 1 No 2	(2718)	82	78
Viola Desk 2 No 4	(2719)	82	78
Viola Desk 3 No 6	(2721)	83	79
Viola Desk 5 No 9	(2722)	81	77
Viola Desk 5 No 10	(2724)	83	79
Viola Desk 4 No 8	(2725)	82	78
Trumpet 1	(2726)	86	82

The claimant was at viola desk 3 no 5. Mr Downes agreed that the tabulated "Lepd" figures do not take into account other noise exposure during that day, and in particular the first rehearsal in the morning; he said that the Lepd figure of 88 reflected only one

session. The figure which represents two sessions is 91, this is the figure which should have been in the table.

26. As a result of the concerns expressed by the members of the orchestra, the measurements taken at the afternoon rehearsal and, in consultation with Sir Anthony Pappano, the orchestra layout was rearranged. Noise measurements taken after the rearrangements show that the noise levels had decreased (paragraph above).

27. It is not uncommon for musicians playing in the orchestra of the ROH to complain about noise levels. Different methods have been used to attempt to reduce noise levels. The difficulty for any member of the orchestra complaining about noise is that people are scared of losing their jobs.

28. Following the incident in September 2012 the claimant attempted to return to work on a number of occasions but found it impossible. If he attempted to sit and play in the orchestra his symptoms worsened. He would feel terribly nauseous, extremely unwell from the pain in his right ear, he felt dizzy and found it difficult to walk. The last time he played in an opera was May 2013. Even practising on his own was difficult because the noise from his own instrument triggered the same symptoms. In his witness statement he states that "almost three years later I am unable to bear being around noise", he struggles to focus when there is background noise.

29. The claimant is no longer able to play in an orchestra by reason of the noise levels. As a result of his sensitivity to noise and other symptoms he is unable to look for alternative work. He now lives a relatively quiet life, he has learnt to avoid the noises which trigger the symptoms, for example the vibrations from a large supermarket fridge, the noise in a restaurant. The claimant and his family have moved to the country to avoid the triggers which cause or exacerbate his symptoms. Now that he knows what causes his symptoms they are not as acute as they were in 2013. His injuries have decimated his professional life and made his partner's professional life very difficult, she is a member of the ROH orchestra. The claimant has been advised by the medical team at the RNTNEH that he will not be able to return to orchestral playing, which was devastating.

Training

30. The claimant attended a Power Point presentation in September 2005 relating to noise but did not remember it. He was told of the benefits of wearing earplugs outside work which would allow his ear to relax. He was aware that excessive noise could damage his hearing. He may have been advised about the effect of wearing earplugs continuously but he did not recall being so advised. Beyond that he had no recollection of any other training or advice given.

31. The claimant was asked about the trace which showed the dosemeter readings from 14:30 to 17:30 on 1 September. The continuous readings show levels between 100 dB and 105 dB between 14:30 and 15:00 hours, there are two readings at 100 dB between 15:15 and 15:30 and a further reading at 100 dB between 17:00 and 17:50. Peak levels are recorded as red dots only above 120 dB. They represent instantaneous peaks. The highest shown was 130.8 dB.

32. The claimant was questioned about the account he gave to Mr Parker, the medical expert instructed on his behalf. Mr Parker records the claimant stating that the noise on 1 September 2012 was measured at 120-130 dB for 20 minutes or so. The claimant said he was referring to the peaks between 14:30 and 15:00. In July 2013 when seen at University College Hospital London the claimant is recorded as identifying the noise as 130 dB and over 110-120 dB for 20 minutes plus. The claimant said that the reference to 130 dB were the peaks. It was suggested to the claimant that he was exaggerating the noise readings to those who were medically assessing him, the claimant disagreed.

33. On 4 September 2012 the claimant saw his GP, he said that the GP diagnosed acoustic trauma. On 6 September 2012 the claimant saw Mr Rubin, a Consultant Otorhinolaryngologist Head and Neck Surgeon. On 14 September 2012 the claimant became very unwell on the tube, he did not know what was happening, he believed he fainted. The claimant contacted Mr Rubin who contacted the Royal Free Hospital. He told the claimant to go to the hospital. The hospital notes record the claimant as complaining of feeling generally unwell for three days, with episodes of dizziness for three days and nausea and vomiting for one day. There is a recorded history of reduced hearing in the right ear and increased sensitivity to sound for two weeks, occurring after a rehearsal. The claimant was seen by an ENT Registrar who recorded that the claimant was a bit dizzy, he did not feel himself. In the right ear there was fullness, slight pain, it records no tinnitus in the ear. Of the symptoms he experienced on the tube that day the claimant said "they became the symptoms I often had when subjected to travel or noise". On 18 October 2012 following a referral by Mr Rubin the claimant was seen by Professor Saeed, Professor of Otology/Neurotology at the RNTNEH.

34. As to the suggestion by Mr Platt QC that his conditions ebb and flow the claimant said that it was not until he left the ROH and was away from noise that he became aware of what was making him ill, he has since managed to control his symptoms. He now lives in a market town, he does not travel on trains and he walks a lot. He has been conditioned to avoid situations which he knows will increase his symptoms. His condition does not ebb and flow.

Mr Ashley Wall

35. For 37 years Mr Wall was a Principal tuba player in the orchestra of the ROH, retiring in 2010. He suffers from tinnitus but does not know whether this is due to the noise levels in the orchestra pit or age. At the ROH he found the noise levels distressing on many occasions. He undertook a hearing test and was advised that he had some hearing loss. The ROH supplied him with a pair of 15 dB earplugs. A good idea in theory but when playing Mr Wall found it impossible to gauge the balance between his own sound and that of those around him. The plugs caused his perception of his sound to be distorted to an unacceptable degree, a recognised phenomenon (occlusion) where the player's skull is in contact with a brass instrument. It was not practicable to wear earplugs 100 per cent of the time if one wanted to perform at the highest levels. He mentioned this problem to the occupational health nurse and informally to management. He felt his concerns would be dismissed on the grounds that having provided the protection the management's obligations were fulfilled.

36. Other measures were taken to reduce noise levels, perspex screens, the fitting of acoustic panels (Baffles) on the walls of the pit. Some players objected to them because they felt they absorbed too much of their individual sound and insisted that some of the panels were removed or adapted by the addition of reflective covers. The Baffles worked well for Mr Wall but not for other players. Mr Wall felt that not enough experimentation had been done, the management seemed to react to the loudest complaint regardless of the effect on the majority.

37. The noise levels at the ROH have increased significantly over the years. The increase in the size of the pit following refurbishment was done to place more players in the pit rather than increase the space for existing players. Symphony orchestras have become more powerful over the last decade due to changes in performance style, more powerful instruments and the demands of international conductors. At the ROH the orchestra used to be specialised as an opera orchestra now it plays like a full-blown modern symphony orchestra.

38. Mr Wall did not deny that management was attempting a collaborative approach with musicians in respect of hearing conservation and were doing all that could be done to control exposure to noise levels and install the best protection.

Ms Sally Mitchell

39. In September 2008 Ms Mitchell joined the ROH as Orchestra Administrative Director, a post she held until recently. Prior to that she worked for the BBC Concert Orchestra as an Orchestra Manager and with the London Symphony Orchestra. She became aware of the issues facing the music industry in relation to noise exposure and reduction when working with the BBC.

40. The orchestra pit at the ROH is a rectangular space located immediately in front of, and at a lower level, than the stage. The open section of the pit measures 17 metres wide by 5.6 metres across and the height is typically set to 2.6 metres. Neither the orchestra nor the singers are electronically amplified, the sound heard by the audience is natural and live. The number and type of instruments and the number of players required vary between productions with an average of 83 to 85 players. Fitting these into the physical space available in the pit often presents a challenge.

41. As Orchestra Administrative Director Ms Mitchell's responsibilities included budgeting, scheduling, personnel issues and health and safety. She led the orchestra management team and managed the permanent members of the orchestra. She worked closely with the Music Directors of the Royal Opera and Royal Ballet. Her overarching responsibility was to ensure that the orchestra of the ROH performed at the highest international standard.

42. Ms Mitchell was not involved in monitoring noise levels in the pit nor planning the pit layout. She did discuss the results of monitoring with the Orchestra Operations Manager and colleagues in the Noise Working Group. She took part in meetings and discussions about the methods the ROH could adopt in order to achieve noise reduction. As to pit planning the health and safety of the orchestra members is of paramount importance. Every effort is made to resolve noise problems for individual players if at all possible. Artistic considerations must also be taken into account dependent on the piece of music, how the composer intended it to be played and the

artistic direction of the conductor. If the lines played by two sections of the orchestra are harmonically dependent, it is beneficial for those sections to sit close to each other so they can hear and take cues from each other. These types of considerations influence the output and quality of the performance at the ROH where the highest of standards are important. Both the Music Director and the orchestra members would be concerned if the quality of a performance might be affected if the pit plan did not cater for the artistic considerations necessary for that piece of music.

43. The ROH had previously instructed consultant engineers and acousticians (Arup) in relation to ways in which it might be possible to reduce noise levels and how these could be implemented without affecting the overall acoustics in the theatre for the audience. Various methods have been tried but there are limits to what the ROH can do. There is concern from orchestra members that noise reduction methods may impact on the subtleties and overall quality of their performance.

44. In 2008 the HSE published a document entitled "Sound Advice: Control of Noise at Work in Music and Entertainment" ("Sound Advice") following consultation and collaboration with members of the Music and Entertainment Sector Working Group. The BBC and ROH were members of the Working Group and contributed to the research and the production of the Guidance. The BBC and the ROH were at the forefront of the debates in the industry about how best to deal with issues of noise, Ms Mitchell was involved in many discussions at the BBC, her predecessor as Orchestra Director at the ROH, Hazel Province, was similarly involved.

45. Sound Advice contains practical guidelines on the control of noise at work in music and entertainment. The aim is to help those in the field control or reduce exposure to noise at work without stopping people from enjoying music. It acknowledged that lowering noise levels is an enormous challenge for an industry whose purpose is the creation of sound for pleasure. Orchestral sound is not an unwanted secondary by-product of a primary process but the product itself. The difficulty for the ROH as opposed to orchestras which perform on the concert platform is that the latter have considerably more options for spacing sections widely apart and for using risers to allow vertical separation between the sections which assist in lowering noise levels. These are impractical in the pit due to space constraints.

46. The recommendations in Sound Advice as to possible ways to reduce noise by physical means were considered by the ROH. Examples of attempts to reduce noise at the ROH are:

    i) Moveable light screens which attach to walls, the idea being that they would absorb some of the sound. Musicians felt they could not judge how loudly they were playing, as a result they played louder to compensate;

    ii) Soft Australian GoodEar acoustic screens, a concave shape which go behind and around the sides of the musician's head. They are large, not transparent, they can obstruct other players' views of the conductor and take up a lot of space between the players which affects the layout of other parts of the pit;

    iii) A3 sized transparent acoustic screens on a stand, positioned between different sections. They are of limited use because they reflect the sound back to the player who is playing into them, thereby increasing the noise exposure;

iv) The most effective and efficient way to reduce overall noise levels is to create space between the sections but this is very difficult in a crowded pit. The ROH has attempted to enlarge the pit by taking out seats in the stall circle and lowering the lifts on which they sit into the pit. This creates significant loss of ticketing to the ROH, in the 2015/16 season the loss was £343,000.

Continuing discussions take place about the possibility of extending the pit into the auditorium however the technical, financial and heritage considerations of such a plan are significant.

47. Orchestra members are on a full-time, first call, non-exclusive contract for 1,000 hours per season. They are required to play 860 hours per annum for the ROH with an option to play additional hours if available. As long as the player prioritises ROH work he/she is free to do additional paid work with other orchestras. Approximately six months before a season commences a provisional schedule is sent to each orchestra member setting out the various productions scheduled for the coming season. Orchestra members work in a buddy system with another member of their section to play their schedules for the coming season, it ensures one or other will be in the pit for each performance. Accompanying the provisional schedule would be a letter. In March 2012 the Orchestra Manager sent the letter which included the following:

> "When looking through the schedule, please try and bear in mind the following points:
>
> 1. Your own personal workload
>
> It may be tempting to work in blocks, but please take a realistic look and consider the effects this will have on you and your buddy in terms of workload and noise exposure. Please also remember to schedule yourselves carefully around the mid-point in the season as this is often when people find themselves very tired.
>
> …
>
> 6. Noise Exposure
>
> For your information we have included noise readings in the Production Book where we have them. As noted these are the average noise exposure if the session is the only one you play in in any given day. Please consider your exposure to noise where possible when planning your season.
>
> For shows where the average noise exposure is over 80 dB we would recommend that you wear hearing protection when possible.
>
> For shows where the average noise exposure is over 85 dB you should wear hearing protection for the whole of the session…"

48. As a result of players self-scheduling it is impossible to keep track of the potential cumulative noise exposure of each individual orchestra member. If an Orchestra Manager has concerns about noise issues she will work with the player and his/her buddy to rearrange the schedule if possible.

49. In 2007/2008 noise meters were used. Each hand held meter has to be pointed and held, the information was not helpful for forward planning. The data from dosemeters proved to be more useful.

50. When Ms Mitchell joined the ROH she held one-to-one meetings with every orchestra member, the purpose being to get to know them, discuss general issues, an opportunity for a player to bring to her attention any issues or concerns they might have. At the meetings they discussed scheduling, pit layout, issues regarding their hearing and the use of earplugs. Ms Mitchell impressed on each individual the importance of issues relating to noise exposure. In her oral evidence she stated that she would have told the musicians, including the claimant, of the need to wear the hearing plugs at all times in order to maximise attenuation. She also urged them to undergo audiometric testing. There was huge resistance from orchestra members to undergo this testing because they were worried about the effect that an adverse hearing test might have on their employment. Following the introduction of the noise Regulations, orchestra members are obliged by the ROH to undergo biannual testing. The hearing test could be done by Ruby Grierson, the ROH's Occupational Health Advisor, or by an external provider of the player's choosing on the condition that the results would be provided to Ms Grierson. No other personnel at the ROH were provided with the results of the hearing tests unless explicit permission was given by orchestra members. Ms Grierson would advise Ms Mitchell on an anonymous basis if there appeared to be a pattern of hearing problems in a particular section of the orchestra. Disciplinary action against several players has been threatened to break down resistance to the testing. Ms Mitchell has also ensured that orchestra members are provided with training and education about noise issues.

Hearing protection

51. From 2006 personalised hearing protection was made available for orchestra members, they were encouraged to wear the earplugs. Initially it was met with resistance and is still unpopular with some. Players worry that wearing earplugs will affect the quality of their individual performance and that of the orchestra as a whole. Players have expressed concerns that earplugs prevent them from hearing their own playing and that of players around them. The inability to hear properly affects the subtleties and nuances which are fundamental to the ability of a professional musician to play at the highest standards. Some orchestra members, particularly Principal players responsible for solo lines, do not wish to wear hearing protection so that they can hear their own playing. The design of earplugs makes it easier for string players to adapt to wearing them. The wind and brass players often suffer from occlusion when wearing earplugs. They report that the earplugs currently available prevent them from assessing the quality and dynamics of the sound they are producing.

52. When they begin employment at the ROH, orchestra members are recommended by occupational health to be fitted for personally moulded earplugs from Harley Street Hearing. These are paid for by the ROH. Alternatives provided by Ms Mitchell were earplugs from America and universal fit ER20s. EAR foam earplugs are located in a

box at the door to the pit for any orchestra member to pick up on their way in. It is extremely difficult to enforce the wearing of hearing protection. Even checking each individual as they enter and exit the pit cannot prevent plugs subsequently being removed. Ms Mitchell's view was that players should be treated as adults and left to take responsibility for making their own decisions about when to wear earplugs. Only they can take into account the musical contribution they are expected to make for different productions.

53. In order to improve the resistance of the orchestra to the wearing of earplugs and audiometry Ms Mitchell tried to develop a collaborative approach of working with them. One element was not to state that the wearing of earplugs was compulsory but to allow the musicians the option to wear the earplugs when they thought necessary given their knowledge of music and the understanding of the pieces they would be playing. It worked infinitely better. Ms Mitchell tried to encourage the players to wear the earplugs away from the ROH in order to come to terms with wearing of earplugs when working in the orchestra. In Sound Advice the HSE stated "The use of hearing protection should not be made compulsory where the law does not require it. It is bad practice to have a 'blanket' approach to hearing protection; it is better to target its use and encourage people to wear it only where they need to." Ms Mitchell said that the ROH complimented that advice, individuals may need hearing protection when others may not. The 9 dB earplugs were those recommended by the team at the ROH to string players because if there was too much overprotection of the ears the players would take the earplugs out.

54. In January and June 2010 Ms Mitchell records meetings with the claimant at which they discussed injuries he sustained in a motorcycle accident. In the June meeting Ms Mitchell notes conversations about seeing Ruby Grierson regarding moulded earplugs, ER20 earplugs were given to the claimant for him to try, he said he would see Ruby Grierson for a hearing test. At that meeting Ms Mitchell and the claimant spoke about noise at the ROH in general terms.

The claimant

55. The claimant was given training and education in the potential dangers of exposure to excessive noise and noise reduction methods including the need to wear hearing protection. The claimant's personnel file provided the following information:

    i) August 2005. A notice was placed on the orchestra notice board reminding players how to obtain earplugs and/or specialist advice on noise protection.

    ii) 20 September 2005. The claimant attended a health and safety presentation which included a PowerPoint presentation about noise and the new Regulations.

    iii) 31 August 2006. The claimant attended a health and wellbeing workshop organised for the players, a group discussion with Ruby Grierson in which players were encouraged to share their experiences of using different noise reduction methods and to air any difficulties they might be experiencing. A note of the workshop includes the claimant commenting that the smaller screens appear to be more effective for him and the people around him.

Discussion was noted concerning the confidentiality of hearing tests, the use of screens and earplugs.

iv) 29 August 2007. All orchestra members were sent an email by Ms Mitchell's predecessor in relation to the new Sound Advice HSE website which contained practical information and advice in relation to controlling noise at work. Members were invited to comment on the contents of the website which was to be discussed at workshops which the claimant would have attended.

v) 24 August 2010. A health and safety newsletter was given to all orchestra members at the start of the new season. As to hearing tests it is stated:

> "Thank you to those players who have been for a hearing test since the reminder letters were sent out by Helen last season. If you have been unable to attend up to now, could you please contact Ruby as soon as possible … to arrange a mutually convenient time for you to have your test. …under the Control of Noise at Work Regulations 2005 the ROH is obliged to carry out health surveillance where there is a risk to the health of employees. And under the same Regulations all employees are obliged to make themselves available for said health surveillance. The ROH has undertaken to test all relevant employees every two years and we therefore need all of you to be tested before X Christmas 2010."

vi) Information was given as to the three types of earplugs provided by the ROH, namely personalised moulded earplugs, ER20s and EAR express. Details of the earplugs and their attenuation properties were provided as was the means of obtaining them.

vii) September 2011. All ROH players were emailed the link to "Music, Noise and Hearing: a Guide for Musicians" which was published on the internet by the BBC following input from a cross-industry group including Ms Mitchell.

56. In her meetings with the claimant and when he attended audiometric testing with Ruby Grierson in January 2004 and June 2010 the importance of wearing hearing protection was discussed with him and he was encouraged to use it. The ROH had an annual health and safety training session which the players had to attend.

The incident

57. On Saturday 1 September 2012 Ms Mitchell received an email from Matt Downes in which he said that the back desks of the violas had been finding the sound levels very high in the Ring rehearsals as they were located near to the trumpets. He was carrying out sound level testing that afternoon and was considering alternative seating arrangements but wanted to set up a meeting on Monday 3 September 2012. Ms Mitchell attended the meeting with Matt Downes, the Principal trumpet player, the Principal viola player and other members of the viola section. They discussed the noise issues which the viola section had experienced. They produced a revised pit plan aimed at reducing noise levels which split the French horns and the brass section,

moving the horns to the opposite side of the pit, an enormous artistic compromise, which was implemented before the rehearsal on 4 September.

58. The claimant provided a GP medical certificate from 3 September 2012 until 4 February 2013. The claimant's injury was taken extremely seriously, all were concerned for his welfare. Ruby Grierson arranged for the claimant to be seen by an ENT Consultant, Mr Rubins. When on sick leave the claimant was in close contact with Ms Mitchell, the acting Orchestra Manager and Ruby Grierson. On 4 January 2013 Ms Mitchell and the claimant discussed the hearing protection the claimant had been wearing during the rehearsals. He said that he did not use his personalised earplugs because they were very hard to put in and take out, he could not hear the conductor when he was not facing him, he found it impossible to work with the earplugs. This was the first time the claimant had raised this with Ms Mitchell, had she known that he was having difficulties she could have arranged for him to have his earplugs reviewed. The claimant said he did wear the earplug kept by the pit door but sometimes he just put his fingers in his ears. No screen was in place as there was no space for a screen between the claimant and the trumpets. The claimant said the trumpets had previously resisted the use of screens because of the amount of sound they reflected back.

59. Following the claimant's incident on 1 September 2012 an incident investigation was carried out by Guy Lunn, the ROH's interim Health and Safety Advisor. It records that:

> "[The claimant's] desk partner wore personalised earplugs with 25 dB inserts throughout the entire rehearsal and performance period of the Ring. On 1 September she said the noise was unbearably loud even with her very heavy duty plugs in. Following the two rehearsals that day she felt physically sick and found that her hearing was affected. She because (sic) much more sensitive to noise for a number of weeks after these rehearsals. She did say, though, that the creation of the one metre gap between the brass and the back desk of the violas where she was sitting led to a definite decrease in the noise level …."

60. In November 2013 Ms Mitchell produced a document entitled "Noise responsibilities. Summary of the current position" for her executive colleagues. It included the following:

> "• No distinction is made in the Noise Regulations between the noise generated as a by-product of industrial processes, and sound that is deliberately created for enjoyment and entertainment.
>
> • In practice the HSE has agreed that as long as we show we are doing everything we can to lower sound levels and where possible mitigate their effect, they will turn their attention to other H&S issues.

> • We are taking our responsibilities as employers very seriously but are unable to:
>
> ◦ Ensure the legal limits on noise exposure are not exceeded
>
> ◦ Monitor the daily exposure of each individual player
>
> ◦ Fulfil our legal duty to ensure earplugs are used by players likely to be exposed above the Upper EAV (UEAV)
>
> • There is a very high likelihood we will be sued for personal injury by one of the players currently off sick with noise related problems. He would not, however, be able to argue all the liability is on our side.
>
> • The players' attitude to their responsibilities is improving but we are still working with some who are reluctant to keep their audiometry up to date.
>
> • Although top of the range ear plugs are made available, they are not fit for purpose for the wind and brass in particular. We are taking advantage of technological advancement where possible but the use of plugs is patchy at best.
>
> • Some players are reluctant to admit they have any noise related problem and put themselves at risk as a result.
>
> • The artistically independent RO & RB are unable to plan their productions together. Simultaneous multiple loud productions increase the chance of more players being overexposed.
>
> • Double ballet days are a particular challenge as we have insufficient players to field two different orchestras on the same day.
>
> • The open part of the pit is too small but members of the ongoing Pit Review Group (Hazel, Sally, Stefano) have agreed it is structurally impossible to remove the stage overhang.
>
> • Expanding the pit into the auditorium would give us significant financial and planning problems with no guarantee noise levels would reduce to those required by the Noise Regulations. The impact on the acoustics of the auditorium could also be adverse…"

The fourth bullet point refers to the claimant. Ms Mitchell said she has never understood why the claimant returned to the rehearsal when he was suffering from what he described. Common sense would have been to remove himself from the rehearsal. The claimant would have received a sympathetic hearing from the managers. It is not unusual for a player to leave a rehearsal, arrangements would be made to ensure the player was well enough to go home, a taxi would be offered or an

offer to send the player to A&E. The staff are used to dealing with people who are unwell.

61. From early-2015 Ms Mitchell asked for noise levels to be measured on every production. In 2018 the ROH takes far more noise measurements than in 2012. Obtaining the basic data was important for all in order to assess the noise issue. The ROH still does not monitor rehearsals as one rehearsal does not capture the sound levels of a performance.

62. On 12 October 2016 Arup produced an acoustic review of the orchestra pit at the ROH. It records that Arup Acoustics had previously provided guidance of the use of sound absorbing panels during meetings with the ROH between December 2011 and January 2012 and states:

> "Options for increasing the size of the pit were undertaken by a Pit Review Group during the 12/13 season. We understand that this was done purely from a cost and planning perspective with no acoustic analysis. The conclusions from this review were as follows:
>
> - Expanding the pit into the auditorium would require minimum three-month shut down, will affect stage-pit balance and will give no guarantee that noise levels will be reduced.
>
> - The stage overhang cannot be removed as it is an integral part of the structure which holds up the stage.
>
> - Absorbing the corridor behind the pit may cause issues with access to existing services and will trap more players beneath the overhang.
>
> Whilst these options were rejected three years ago the ROH is now willing to reconsider if there are any merits in them in terms of sound level reduction for the orchestra."

The conclusions of the 2016 review included the following:

> "Whilst the ROH has a clear and detailed strategy in place for controlling sound level exposure to the musicians in the pit, some are still exposed to high levels, exceeding the Upper EAV as defined in the *Control of Noise at Work Regulations* (2005).
>
> This investigation has confirmed through measurement, study and modelling that musicians positioned under an overhand are exposed to sound levels which are up to 3dB higher than they would be if they were in the open.
>
> Expanding the pit into the corridor behind, whilst providing greater separation between the musicians will result in more

> players sitting under an overhang. This must be avoided and therefore this is not an appropriate course of action.
>
> Removing the overhang can potentially provide a reduction in level of 1-2dB for the players below the overhang. This is a small but useful reduction for the players most at risk, but the works and results of such an action would be structurally and artistically challenging.
>
> Based on this study, the most beneficial modification to the pit in terms of helping to reduce sound levels would be to expand the pit into the auditorium by at least 2 rows. This would allow the entire orchestra to sit out in the open, resulting in a reduction in sound level of up to 2dB for some key players who are normally positioned under or near the overhang."

63. Arup met with Sir Antonio Pappano in June 2016. In the course of the meeting he commented that pit orchestras in general have played increasingly louder over the last 20 years.

64. Of the recommendations made by Arup in 2012/13 the technical director at the ROH was clear, the stage would fall down if the overhang was removed. The Director of Operations had previously been in Copenhagen where the pit had been expanded, the net effect was found to be nil. Ms Mitchell said that the project had failed at the financial fence, it was not taken forward to enable a full assessment to be done. Any project would mean the closure of the ROH for a minimum of five to six months, they employ in the order of 1,000 people and would have no income. This would have a radical impact on how the ROH would operate in that period.

65. In attempting to find a balance between artistic considerations and health and safety the ROH tries to get the best balance but it is very difficult. It is an iterative evolving process. When different modes were trialled to reduce noise they would be moved around and measurements would be taken. The ROH had been working seriously on the issue of noise for many years, they had not stopped. Some players were over the noise levels and as productions involved loud pieces the ROH would have to accept that and do what was reasonably practicable to reduce noise levels. Ms Mitchell said they needed "to do anything we possibly could" in this area.

Mr Matthew Downes

66. In 2008 Mr Downes joined the ROH as Deputy Orchestra Operations Manager. In January 2009 he became Orchestra Operations Manager, a post he held until December 2014 when he joined Welsh National Opera as Orchestra Manager. As Orchestra Operations Manager he was responsible for the physical logistics of running the orchestra, setting up the pit and its layout, moving the orchestra, organising staging and equipment, the health and safety considerations and surveillance relevant to those tasks. The ROH had a Health and Safety Manager who advises on health and safety.

67. The orchestra pit at the ROH was built in the nineteenth century and offers less flexibility than more modern buildings. There is a large overhang section below the

stage which forms part of the pit, it cannot be moved which causes difficulty adapting the layout of the orchestra. In the late 1990s renovation works were carried out to the pit, seating was removed from the lower sides of the auditorium just above the pit in order to fit two moveable platforms which can be raised and lowered on a lift as required in order to create more space in the pit for performances requiring a very large orchestra.

68. Prior to a production Mr Downes would create the first draft of the orchestra pit layout with the conductor. The proposed pit plan would be posted on the orchestra notice board for musicians to review. Any comments or requirements would be considered in consultation with the conductor and, usually, the section Principal players. The layout of the pit can change when rehearsals have begun to take account of different and conflicting considerations. The health and safety of orchestra members is of paramount importance when considering the layout. Artistic output is vitally important to a conductor and the orchestra members. The positioning of different orchestra sections can materially affect the overall quality of the sound being produced. Sections who are playing together need to sit near to each other, if they are at opposite ends of the pit they cannot hear each other which makes it difficult to play together. This can have significant consequences for the quality of the music which can have reputational consequences for the ROH.

69. Different repertoires require different sizes and configurations. Wagner's Ring Cycle demands a very large orchestra and many more orchestral players than a smaller work. The pit is not particularly flexible in terms of its size, for a full orchestra careful considerations need to be given in relation to where the different instruments can be located. With a small orchestra the musicians are able to spread out.

70. Mr Downes would usually conduct noise level readings once the rehearsals had begun, in order to monitor noise levels and make health and safety assessments. It can be very difficult to judge how loud a rehearsal or performance will be. In a rehearsal a conductor could spend time discussing the production with orchestra members, thus noise levels will be lower than a session where there is constant playing. If issues arose as a result of noise readings changes to the pit plan could be made. Mr Downes took the noise level readings using dosemeters which were placed as close to an individual's ear as possible, usually on their lapel. Readings were taken from individuals located in different sections of the orchestra to ensure noise readings from all areas.

71. It is very difficult to force the wearing of hearing protection by members of the orchestra. The personalised moulded plugs are clear silicon, they sit flush to the ear, it is often not possible to see them when they are being worn. The foam plugs are bright yellow but the orchestra is crowded, the lighting levels could be low, it is still not possible to see if all the players are wearing earplugs. The only means of enforcing the wearing of protection would be to check players as they enter and exit the pit. During a performance orchestra members take the earplugs in and out as they feel necessary. Some players mark on their musical parts "earplugs" or "gunshots" so to put their earplugs in for these sections. It is common for orchestra members to self regulate in this way, they are the best people to judge whether they can perform with or without earplugs.

72. Mr Downes' evidence as to audiometric testing reflected that of Ms Mitchell (paragraph 56 above).

Screens

73. In 2007 Arup were commissioned to provide a report concerning noise levels in the orchestra pit, a further report was undertaken in December 2008. The recommendations included the continued use of screens and the use of hearing protection. Mr Downes' evidence upon the provision and use of screens reflected that of Ms Mitchell. Mr Downes' predecessor introduced white timber and foam "Baffles", a large screen intended to be placed between the percussion and other sections. They are used today, their size means that their use is not always practical. Hearwig screens which are wrapped tightly around the player's head were trialled. They were large, took up too much space and prevented the player from being able to hear the surrounding music and thus impinged on the ability to play. Mr Downes stated that the most effective way of reducing noise is to create more space in the orchestra pit, however this is not always possible.

The 2012 Ring Cycle

74. In July 2012 Mr Downes met with Sir Antonio Pappano to discuss the pit plan. Pit plans existed for the 2004 and 2007 ROH Ring Cycle performances. A large orchestra is required, the pit area is fully utilised. Seats from both side stalls would be removed from sale so that the pit elevators could be lowered and the pit enlarged. Seating from the stall circle boxes was removed to accommodate the harp section. It was agreed that the woodwind section was to be moved from the middle of the orchestra to the conductor's left. The timpani were moved from the conductor's left to his right, as they play with the brass section for the majority of the time. The brass and horn sections had to be redistributed to accommodate the timpani. The trumpet section was to be located directly behind the viola section. The layout of the pit was made with artistic merit and the players' welfare in mind, space in the pit was maximised as far as was possible.

75. The statement from Mr Downes for the defendant's investigation of the claimant's incident included the following in respect of this meeting:

> "During this meeting we discussed putting the woodwind section 'on the side' (to the left hand side of the conductor) – a change from the previous occasion that we have conducted 'Ring' here in London where the woodwind section was 'in the middle' – directly in front of him. We also had a conversation regarding the brass section. The last time he had performed the Cycle (and as is common practice in many Houses around the world) the trumpets, trombones, French horns and Wagner Tubas were to be positioned together on the same side of the pit. In addition, I had also been requested by my timpani players to find a way in which the timpani could be positioned with the brass players as the majority of the time the two sections play together. Mr Pappano agreed that we should attempt this. As a result I came up with a plan that was set for

> the first three days of rehearsals for the 'Ring' on August 30, 31 and September 01 2012."

Mr Downes accepted that there is no note of any discussion of safety issues at the meeting.

76. Mr Downes said that the distance between the end of the trumpet when it was being played to the head of the viola player sitting in front was approximately three feet. A trumpeter would play his/her instrument slightly angled downwards, which meant that the bell of the trumpet was at a similar level to the viola player's shoulder. There had to be enough room for the trumpet player to lean forward and turn the page of his/her music which was positioned on a music stand approximately 3 feet from the floor. The pit was cramped. In the 2007 pit plan there were six rows of instruments to the right of the conductor, in the original 2012 plan there were three rows of violas and four rows of brass. In the 2007 plan the trumpets and trombones were positioned under the fixed overhang, the timpani was on the opposite side of the pit to the brass. The reason for the change was for acoustic and artistic reasons. When the pit plan was attached to the orchestra notice board in July 2012 no comments were received from any orchestra members.

Risk assessment

77. In 2009 Mr Downes attended a three-day course run by the Institute of Occupational Safety and Health, "Noise in the context of the 2005 Regulations in relation to the music and the entertainment industry", and a five-day course run by the same institute entitled "Managing safely" which focused upon the use of risk assessments as a tool of management, in particular the preparation of the risk assessment form. The risk assessment is fundamental to the safety process. Mr Downes was the "manager responsible" for the purpose of the assessment.

78. Mr Downes undertook an orchestra specific risk assessment in respect of the Das Rheingold and Die Walküre performances prior to rehearsals commencing in 2012. The risk assessment is an electronic document. He omitted to sign or date the document or identify himself as the "manager responsible". It was his evidence that the assessments fully considered the implications of noise and set out recommendations to safeguard orchestra members which were implemented where possible.

79. The risk assessment states:

ROYAL OPERA HOUSE
COVENT GARDEN

Royal Opera House Risk Assessment Form - ORCHESTRA

RA Number:	Address:	Person(s) responsible for Show/ Task:	Sally Mitchell (Orchestra Director); Matthew Downes	
Show/Task: Die Walkure 2012	Location/Area: Orchestra Pit/Stage			
Brief Description Of Show/Task: Hazards identified to those working in/around the orchestra pit for a particular production				

No.	Hazard	Those at Risk	Risk Score Without control measures: Severity	Likelihood	Risk	Control Measures – Must be implemented & communicated to all who may be affected	Risk Score With control measures: Severity	Likelihood	Risk	Additional control measures required	Who will ensure actions are done?	Required By?	Date actions complete
1	Musicians in Orchestra Pit could sustain hearing damage as they could be exposed to noise levels in excess of those prescribed in EU 'Noise at Work Regulations' 2005.	Musicians	4	4	16	The following control measures are in place: The orchestra pit has been laid out to maximise available space between musicians -A variety of hearing protection (ear plugs) is available for the musicians to use -Use of acoustic screens where appropriate -The removal of any synthesized sounds from the orchestra pit if appropriate - The orchestra are aware of all additional noise hazards (such as gunshots on stage, etc) - The side elevators are lowered in order to increase the size of the open area of the pit (especially to protect the French Horns/Wagner Tuben)	4	2	8	-Encourage the musicians to wear their plugs for the duration of each production, as this is the only way to realistically reduce exposure	Orchestra Operations, Orchestra Management		

ROYAL OPERA HOUSE
COVENT GARDEN

2	Items/Persons falling from the Stalls Circle into the pit as Auditorium Left elevator has been lowered	Musicians	4	3	12	Orchestra Operations to ensure that MITIE Cleaning have installed all safety barriers securely and that all unnecessary items around the stalls circle have been removed. Orchestra Operations to ensure that necessary technical management know that the lift has been lowered, and that visual barriers are in place at any times when technical or FOH lighting staff may attempt to enter the stalls circle whilst the lifts are down, or when the side pit net bridges are in use.	4	1	4				
3	Stage banda musicians tripping or falling on obstacles on stage due to low level lighting conditions	Stage Banda Musicians	3	3	9	All areas around where the bandas are to play are sufficiently lit from above so to provide safe working conditions for those in stage bandas, Orchestra Operations also are present to supervise the bandas entry onto stage and to ensure that they do not stray into hazardous areas. Orchestra Operations staff are present to ensure that people do not walk past the bandas whilst they are playing.	1	1	13		Orchestra Operations, Technical Staff, Stage Management		

Addendums

Ref. No.	Company	Service	Documentation
1			
2			

ACCEPTANCE
by Manager Responsible

I will ensure that the controls are implemented and, as a result, the above task/show under my control can proceed.

Signature:	Date:

or

PROHIBITION
by Manager Responsible

I am not satisfied the risk(s) identified are acceptable without the additional control measures being in place. I have therefore taken action to prevent the activity continuing until the requirements detailed in this action plan have been implemented.

Does the Show/Task need to be Risk Assessed again when the above controls are in place?	Yes	No
Signature:	Date:	

80. In compiling the risk assessment for Das Rheingold and Die Walküre Mr Downes assumed that there would be a strong likelihood that in respect of exposure to noise the lower EAV or the upper EAV would be breached during the course of the rehearsals and/or performance. On this basis control measures should be put in place. It was not possible to carry out measurements in advance of the rehearsal as he did not know what the dynamics of the rehearsal would be. The use of dosimetry does not allow for real time visualisation. This could be done using handheld monitors but this was unsatisfactory in that it required individuals to stand within the orchestra area, they would be in the way, a reading at one area may not be replicated in another.

81. Mr Downes was asked how in making decisions as to layout and noise risk he could do so without noise level indications. He said the assumption made in the risk assessment was that there was a likelihood that the noise levels would be such as to present a risk to musicians in the pit. In assessing exposure to noise levels in the orchestra pit they were not looking at a consistent level of noise, they were fluctuating noise levels and very difficult to accurately assess without the use of a dosemeter over an extended period. Mr Downes' evidence was that these are professional musicians, there are a number of ways to judge when the noise is getting too high, one of which is their own experience.

82. It was put to Mr Downes that in carrying out his risk assessment there was no consideration for peak features of a rehearsal. He said that in any rehearsal there are set breaks. Every conductor rehearses differently, the only way to know what the peak features of a rehearsal would be would be through the dosemeters.

83. Mr Downes did not prioritise the order of the control measures of which earplugs were the primary measure. He did not recall if any acoustic screens were placed in the pit but said he would be amazed if screens were not put in certain places.

Incident

84. At the lunchtime break on 31 August one of the viola players, a health and safety representative for the orchestra, told Mr Downes that the rehearsals had been loud but not out of the ordinary. Mr Downes attended the afternoon session on 31 August, Die Walküre was rehearsed for the first time. During the rehearsal the claimant gestured to him that the rehearsal was loud by putting his fingers in his ears. The claimant was wearing earplugs on a string around his neck, they were not in his ears at the time he gestured to Mr Downes. Mr Downes would have expected any orchestra member who had difficulty with the noise levels to get up and leave if necessary. This was encouraged, no-one left that afternoon.

85. Following the rehearsal of Die Walküre on the morning of Saturday 1 September Angela Bonetti, a viola player and health and safety representative, told Mr Downes that she thought the noise levels were too high. Mr Downes decided to take sound level readings for the viola and trumpet players during the afternoon rehearsal of Die Walküre. He placed dosemeters on individual viola players in order to ascertain how the distance from the trumpets affected noise levels.

86. During the afternoon a request was received from an orchestra member for a meeting to be held to discuss the pit plan. It took place on 3 September. Mr Downes' evidence of the meeting reflects that of Ms Mitchell.

87. Mr Downes took three sets of noise measurements for Die Walküre, the afternoon rehearsal on 1 September, the morning rehearsal on 11 September and the performance on 28 October. The equivalent continuous sound level for the three-hour period at the claimant's desk on 1 September was 92 dB, the daily noise exposure over an eight-hour day was 91 dB. In the readings taken on 11 September the reading for the three-hour period was 81 dB and 77 dB for the eight-hour working day. The lower figures for the second rehearsal were said to be due to two factors: the conductor was rehearsing less noisy sections of the opera; it was a stop-start rehearsal.

Hearing protection zone

88. Mr Downes anticipated that in the Die Walküre rehearsal the noise level would be above the upper EAV. He was asked why the orchestra pit was not designated a Hearing Protection Zone in compliance with Regulation 7(3) of the 2005 Regulations. Mr Downes replied "I can't give an answer". It was put to him that if it was anticipated that the upper EAV would be exceeded the wearing of earplugs should have been mandatory. Mr Downes said that he never gave instructions that hearing protection must be worn. He said that "our recommendation" was that hearing protection should be worn for the fullest possible time should a musician be exposed to loud noise. The musicians argued that in order to do the job, namely their ability to hear the full spectrum of sound, the full colour of the music, to blend in with the music and with colleagues, to play in tune and to play at the right time, the wearing of hearing protection severely hindered the dynamics. All their players had hearing protection, custom moulded with 9 or 15 dB attenuation or foam plugs with 28 dB attenuation. By providing different forms of protection and educating the staff how to use them it was for the musicians to judge for themselves the use of the hearing protection. Management had to trust the musicians with the training they had had and the information they had been given to know what was right for them. Every person and their hearing is different. Mr Downes said that technology does not yet allow for musicians to have their hearing protected and do their job as professional musicians. It was suggested to Mr Downes that electronic plugs could be used, a new form of electronic filter being used in studio recording. He said that could apply in studio recording as plugs are attenuated to a certain level, the sound is then mixed by the sound engineer through the plugs. It would not work in an orchestra of many players as this would require different sound mixes.

89. HSE Guidance, Controlling Noise at Work 2005. Paragraph 94 of the Guidance refers to Hearing Protection Zones and states:

> "94 In situations where the boundaries of the zone cannot be marked, eg where the work requires people to move the noise sources about a great deal, you should make adequate alternative arrangements to help make sure that people know where or when protectors should be worn. These could include:
>
> (a) attaching signs to tools warning that people who are using them must wear hearing protectors;
>
> (b) written and verbal instructions on how to recognise where and when protectors should be worn, eg by

> designating particular tasks or operations as ones where protectors must be used."

Mr Downes said he was comfortable with that advice.

90. Mr Downes said there is no such thing as a typical day in a rehearsal. The ROH did as much monitoring as time and resources allowed. They knew the likelihood was that they would be over the noise limit, his interpretation of the available resources was they were better directed at mitigating rather than reducing the risk. He agreed that they could not fulfil their legal duties because technology had not caught up with the problem, in particular in respect of hearing protection. He agreed that the earplugs were not fit for purpose, they do provide protection but they do not successfully deal with for example the problem of occlusion. These are well trained professional musicians who have a nuanced understanding of the problem. In rehearsal there is not an ability to know exactly how loud the music will be, the musician is best placed to make that judgement. The ROH did everything it could to make a judgement as to the appropriate noise level.

91. In identifying the right configuration for a pit a consensus has to be reached by a complicated compromise between the musicians and management. Collaboration is essential. If the musicians did not agree to a configuration it would have been impossible. If there is a problem there is an obligation on the musicians to tell management.

Mr Guy Lunn

92. At the outset of this trial it was the defendant's position that it would adduce evidence from six lay witnesses, one of whom was Ruby Grierson, the Occupational Health Advisor at the relevant time. Ms Grierson was out of the country at the time of the trial and her evidence is the subject of a Civil Evidence Act notice. A witness to be called was Guy Lunn of First Option Safety Group, a principal Health and Safety Advisor who between September 2011 and the end of December 2012 was contracted through his employers to work at the ROH as an interim Health and Safety Advisor. Mr Lunn's statement was in the court bundle. He worked five days a fortnight for the ROH, his role was to support and maintain the ROH safety systems and provide advice where necessary. Mr Lunn was involved in discussions at the ROH regarding the hazard of noise upon orchestra members. He refers to noise reduction methods at the ROH and the problems relating to the orchestra pit. In September 2012 Mr Lunn, in his role as interim Health and Safety Advisor, was asked by Ms Mitchell to investigate the circumstances of the claimant's incident. He spoke with individuals, made notes and received the statements. Exhibited to his statement was his report of the incident which contained the account of the viola player in the same desk as that of the claimant who also complained of the loudness of the noise during the relevant rehearsal (paragraph 59 above).

93. At the end of the first week of the trial Mr Platt QC informed the Court that he would not be calling the lay witnesses to give evidence whose statements were in the court bundle. I raised the calling of Mr Lunn given his position within the company. Mr Platt QC stated that his evidence would add nothing as Mr Downes and Ms Mitchell had responsibility for relevant health and safety matters. Mr Lunn's evidence was largely constructed from the Incident Report Form and not his memory (paragraph 10

of his witness statement). This issue was revisited on the next court day when the Court and Mr Huckle QC raised the calling of Mr Lunn. Mr Huckle QC raised the question of an adverse inference being drawn. The response of Mr Platt QC was unchanged, the evidence of Mr Lunn would add nothing to the evidence of Mr Downes and Ms Mitchell.

94. The focus of this case is the health and safety of an employee of the ROH. The person who held the advisory role for health and safety at the ROH at the relevant time was Mr Lunn. As Mr Platt QC stated that Mr Lunn's evidence would add nothing I have to accept that such an opinion represents his professional judgment. I do not agree with it. Given Mr Lunn's role, knowledge and professional experience in this area he is a person of whom questions relating to health, safety, the duties of the defendants pursuant to the 2005 Regulations and practice at the ROH could properly have been asked. He is the only witness who has first-hand knowledge of the ROH's investigation into the claimant's incident. In my view he is a witness whose evidence would have been of assistance to the Court.

Mr Alexander Beard

95. Mr Beard is the Chief Executive Officer of the ROH and has held the position since September 2013. He provided a statement dealing with financial and reputational issues. In 2016/17 Arup reported on the ROH's options for increasing the pit size. The most realistic option costs £2.4 million at 2016 prices, which he increased to £5 million to make allowance for management and other fees. It would result in an annual loss of about £2 million from the loss of the two front rows of seats. It would necessitate six months closure of the auditorium to allow for construction which would represent a loss of revenue of about £50 million. The ROH would not have been able to raise the funding for the work. The loss of income coupled with the resultant marginal improvement was such that Mr Beard was not able to recommend proceeding to the Board.

96. The ROH is a registered charity. As a globally renowned institution it operates at the pinnacle of orchestral music worldwide. It attracts approximately 20 per cent of funding from public grants, 20 per cent from fund raising totalling over £50 million in 2016/17. This level of funding would not exist if the ROH did not perform at the standard which it does. If the orchestra was unable to perform at the very highest standard then the quality of the product would suffer. This would be particularly adverse if some form of non-statutory and intermediate health and safety sound level was to be imposed on the ROH. A decline in artistic excellence would significantly affect the ROH's reputation and its ability to attract the best artists, conductors, musicians, staff and the most knowledgeable audiences. It would be at risk of losing its best people and its audience and thereby the fundamental basis of its funding. Its reputation would be significantly affected.

Expert evidence

97. Mr Kevin Worthington, called on behalf of the defendant, is a Consulting Engineer, in practice for over 30 years. Since 1987 he has worked in the field of acoustics, this includes briefing those in the music and entertainment fields in relation to noise. Mr Worthington considered the readings taken by the ten dosemeters on the afternoon of 1 September 2012. The claimant and the female viola player with whom he shared a

desk, each wore one on their right shoulder. In evidence were traces which represented the print outs from the dosemeters, a blue trace represented the LEQ, equivalent continuous average noise levels. The trace began at 14:15 and concluded at 17:30. The trace represents a series of blocks, each is a minute in length, each minute represents the average noise level during that period. Above the trace are red dots which indicate peaks, those are instantaneous recordings of noise occurring at the level above 120 dB.

98. The sound levels of the afternoon's rehearsals recorded by the dosemeters worn by the claimant varied considerably. Between 14:30 and 15:00 fluctuating noise levels between 85 and 103 dB were recorded. The noise level traces for the claimant and his desk partner were very similar, as to the EAV there was generally 1 dB between them. The highest peak level recorded for the claimant was 130.8 dB for his partner it was 137.8 dB. To assess the claimant's exposure to noise during the working day an eight hour time period is taken in order to establish the average exposure. Using the dosemeter readings, and allowing for the fact that the eight hour day would have encompassed a rehearsal in the morning, the figure was 91.8 dB which Mr Worthington assumed to be 92 dB for measurement purposes.

99. If the claimant had used the 28 dB earplugs throughout the rehearsal on 1 September 2012 at an average noise level at his location of 92 dB(A)Leq the actual average noise level at his ear would have been in the region of 68-70 dB(A)Leq. The claimant describes inserting the earplugs during the noisy parts of the music, thus his average exposure could have been at least 10 dB greater at 70-80 dB(A) dependent on the effectiveness of the earplugs. The attenuation of the hearing protection would generally have been of a similar level in relation to his exposure to peak noise levels. The peak exposure being in the region of 104-106 dB(C), no adjustment would be needed if he was wearing the earplugs during worst case levels. It is likely there would still have been some peaks, though below 120 dB, during the periods that the claimant was not wearing the earplugs. The actual average exposure of the claimant during the rehearsal must remain unknown because of his fitting and removing of earplugs.

100. In looking at the trace Mr Worthington took out the noisy parts which he assumed to be between 90 and 100 dB. In removing those parts, and it can be no more than a line of sight assessment, what was left was in the order of 70-80 dB. The peak levels of 120-130 dB correlate with the noisy parts i.e. 90-100 dB. There would be lots of individual insults to the ear at the 90-100 dB level.

101. The traces taken on 11 September at another rehearsal were completely different which demonstrated that it is not possible to compare one rehearsal to another.

102. The foam earplugs worn by the claimant are one of the easiest to insert and can be worn for a longer period of time than pre-moulded earplugs as experience shows people feel discomfort wearing the latter. The pre-moulded earplugs have three ridges and musicians are tempted to only place the earplugs in at the level of the first ridge. Wearing earplugs would reduce a peak figure by approximately 19 dB(C). An example of a peak of 112 dB would be travel on the tube and the sound of squeaking brakes.

103. Mr Worthington accepted that the 2005 Regulations and the requirements imposed on employers are not focused on any particular form of hearing loss. The 2005 Regulations refer to noise-induced hearing loss but acknowledge that this is not the only injury that can be suffered through an excess of noise.

104. The HSE Guidance to the 2005 Noise Regulations states that high level peak sound pressures present a risk to hearing from immediate to permanent hearing loss. The 2005 Regulations require employers to take action to reduce the level of exposure if an employee is likely to be exposed to a C rated peak sound level pressure of 137 dB or above and place an absolute limit of 140 dB (which can take account of hearing protection). Examples of noise sources which can produce high peak noise levels between 115 and 160 dB are given, none relate to musical instruments.

105. High frequency sound is more directional than low frequency sound, the intensity of the noise will reduce over a distance. Noise being funnelled from a brass instrument would be highly directional. The bell of a trumpet being relatively close to the head of another player would produce relatively high frequency and directional noise. If a screen had been in place the noise could have bounced back some of that sound to the brass player, it would have been dissipated in the material of the screen and in bouncing back would be less directional.

106. Mr Worthington was asked about the curve which demonstrated the loss of attenuation referable of the non-wearing of earplugs and how, the longer the earplugs are worn, the better the attenuation. He said that such a curve is meant for those working at a constant noise level. It does not apply to fluctuating noise. It is irrelevant to the fluctuating noise in this case.

107. The only method Mr Worthington would use to measure sound during a rehearsal or performance would be a dosemeter. The hand held meter would be intrusive, it would require ten people walking around to replicate the wearing of ten dosemeters. A noise meter held during 15 minutes of a rehearsal would tell one nothing. However, the use of a hand held noise meter would give a rapid indication of noise levels. One could have been used in the first half hour of the Saturday afternoon rehearsal.

Medical evidence

The claimant – Mr Parker

108. Mr Parker was until 2015 a Consultant Ear Nose and Throat Surgeon at the Royal Hallamshire Hospital in Sheffield, he continues to practise independently within the NHS and privately. He remains a senior lecturer in otolaryngology at the University of Sheffield. He has a medico-legal practice working both for claimants and defendants. On 16 May 2014 he examined the claimant. He told Mr Parker that when he finished the rehearsal on Saturday 1 September he felt that his right ear was not as it should be, he was experiencing pain, dizziness and feeling strange, there was a blocked sensation. The claimant's account of his disability included the following:

    i) The hearing loss in the right ear came on straight away, such that he finds it difficult hearing in noisy environments, he now avoids such places because he is unable to hold conversations;

ii) "Straight away" he started to notice a "sensitivity to sound", in respect of his right ear which has not improved. He is unable to play musically, he finds it difficult to be in a car because of road noise and on trains;

iii) He described a high frequency "pylon noise" which he experiences in both ears, worse on the left. He noticed this a few weeks after the index injury. The claimant is aware of it most of the time and it can disrupt his sleep.

iv) For the first six months the claimant experienced excruciating dizziness and nausea which has improved to some extent, it returns if he bends down and becomes physically tired.

109. Examination showed no hearing loss on a one-to-one basis, no evidence of external or middle-ear disease. There was diffuse unsteadiness on Romberg's test without lateralisation, on Unterberger's test the claimant deviated to the right. Pure-tone audiogram showed some high frequency hearing loss in both ears, significantly worse in the right. Mr Parker concluded that the constellation of symptoms which the claimant developed are consistent with acoustic shock in his right ear.

110. Acoustic shock is the mechanism of injury from which the symptoms flow. The injury involves the inner-ear and comprises cellular and/or biochemical changes. There has to be an acoustic incident, the sudden onset of loud noise for which the person is unprepared. This is followed by an acoustic startle, a vestigial innate response to the threat of potential injury. The nature of acoustic shock injury is a physiological response to noise. The ear is over stimulated, it builds up a stock of toxic metabolites and from a physiological response it can move to the infliction of damage. The threshold varies for each individual. The physical response to damage to the ear can comprise deafness, pain, tinnitus or dizziness or a combination of two or more.

111. The noise would be loud, generally unexpected but something extra was needed to get under the stapedius reflex and the unprepared central nervous system, often in the presence of an individual with anxiety, psychological issues or stress. The unexpected noise was that of the Principal trumpet, who was playing from different music which the claimant would not have seen. The claimant would not be familiar with the music of the trumpet because he would not know the trumpet part. The bell of the trumpet is loud. In rehearsal, how the playing occurs would depend upon the conductor's interpretation. The claimant would not know when the trumpet was about to get loud. In Mr Parker's opinion what had occurred was an index exposure, a cluster of short duration, high intensity sounds which presented to the inner ear. The claimant had not suffered a dramatic shift which would be apparent on audiometric testing, nor a dramatic disruption of function, it was not a hydrops loss.

112. In concluding that the claimant has suffered acoustic shock Mr Parker had not assumed a specific sound level. It was loud or very loud and fell within reported levels as producing acoustic shock.

113. Mr Parker produced published reports in the medical literature of cases of acoustic shock and commentary upon the condition. The publications are identified in the Appendix to this judgment and summaries of their contents are included. The first reported cases of acoustic shock were published by an Australian audiologist,

Milhinch, in 2002. In 2006 an Australian audiologist, Westcott, published a paper entitled "Acoustic Shock Injury" which, like Milhinch, reported the injury as occurring in call centres. There, call centre operators, using a telephone headset or handset, were at increased likelihood of exposure close to their ear or ears of sudden unexpected loud sounds randomly transmitted via the telephone line. In 2007 a peer-reviewed British paper on the subject of acoustic shock was published by McFerran and Baguley. The Abstract records:

> "Acoustic shock is a recently recognised clinical entity: following an abrupt, intense and unanticipated acoustic stimulus, usually delivered by a telephone handset or headset, some individuals report a symptom cluster that includes otalgia, altered hearing, aural fullness, imbalance, tinnitus, dislike or even fear of loud noises, and anxiety and/or depression. Symptoms start shortly after the triggering acoustic incident and can be short-lived or can last for a considerable time. If persistent, the condition can lead to significant disability… A formal treatment program has not yet been proposed, but the potential utility of modern therapeutic techniques for tinnitus and hyperacusis are considered…"

114. In the 2008 current edition of what was described as the foremost ENT textbook in the United Kingdom, Scott-Browns Otorhinolaryngology, Head and Neck Surgery, the problem of acoustic shock is recognised and its symptoms identified. In 2014 Mr Parker, with three authors, published an article in the International Journal of Audiology entitled "'Acoustic shock', a new occupational disease? Observations from clinical and medico-legal practice".

115. Mr Parker referred to the McFerran and Baguley paper as identifying the fact that an individual did not have to be a telephone operator in order to develop acoustic shock. It could occur as a result of a single or a cluster of sounds, a clustering of acoustic incidents. The paper records that there are sufficient differences in the symptom complex to warrant the recognition of acoustic shock as a separate condition in its own right rather than a subsection of an existing condition. It states that it is currently under-recognised and anecdotally patients often complain of having their symptoms ignored.

116. Of his own paper Mr Parker said it was the largest series of patients outside Australia and India. He did not accept that all the patients arose in a medico-legal context, some came from clinical practice. The case notes were reviewed by himself and by an audio-vestibular physician. Mr Parker accepted that within the condition known as acoustic shock there is psychological overlay. However, he distinguished the claimant from such overlay. He is a man who was motivated to get better, he had been enjoying his job, there were no problems with it nor with his playing ability. Within acoustic shock are a cluster of symptoms which, save for hearing loss, are subjective in that there cannot be an objective measurement of tinnitus or hyperacusis (a heightened awareness of sound). Mr Parker generally agreed with the description contained in the McFerran and Baguley paper which stated:

> "Noises that generate acoustic shock do not have an intensity and duration profile that would be regarded as dangerous to the

> auditory system within the framework of existing workplace legislation. In this respect, it is important to distinguish acoustic shock from acute acoustic trauma that is experienced with exposure to extremely loud sounds, over 140 dB. Similarly, acoustic shock is unrelated to noise-induced hearing loss, in which repeated exposure to sounds of an intensity greater than 85 dB causes cochlear damage."

In his oral evidence he relied upon the Milhinch paper as providing a range of 82 dB to 120 dB sufficient to cause acoustic shock.

117. Acoustic trauma is recognised as occurring at between 137 dB to 140 dB, peak action levels. The noise levels are so high as to physically damage the structure of the ear, for example perforation of eardrum, structural distortion of the inner ear.

118. It was suggested that when the claimant presented to his GP, Mr Rubin and Professor Saeed he was giving the impression that he had been subjected to a huge noise dose and the doctors assumed he had suffered acoustic trauma. To that Mr Parker said that senior and experienced practitioners would not diagnose acoustic trauma on the noise levels reported by the claimant.

Medical records

119. The GP record of 4 September 2012 stated:

> "Viola player in Royal Orchestra, on Saturday music was too loud and despite earplugs, since Sunday has felt pressure/whooshing in the ears, hearing loss, no tinnitus, no discahrge (sic), pain below ear on right. No headaches, no fevers. Otherwise well … explaied (sic) likely eustachian tube dys and trial stemetil…"

120. Mr Parker said that the pressure or "whooshing" in the ears was tinnitus.

121. On 6 September 2012 the claimant saw Mr Rubin. Mr Rubin's letter to the claimant's GP included the following:

> "He noted discomfort in his ears (particularly the right ear) on Friday; this increased on Saturday and he also began to feel unstable as the week-end progressed. He has a sense of fullness in his right ear and unsteadiness. … On examination both ear-drums appeared intact and air-filled. … an audiogram demonstrated a high frequency hearing loss in the right ear, which is slightly worse than a prior audiogram supplied by Ms Grierson of 2010. He notes that in the intervening time was exposed to loud noise in that right ear, so it is conceivable that he had some acoustic trauma in between the prior audiogram and the recent one. … my impression is cochlear irritation and presumed acoustic trauma. I discussed this with Professor Shak Saeed, the Professor of Otology and we both agree that at this

> point in time … a course of oral steroids is the most appropriate management. …"

122. On 10 September 2012 Mr Rubin saw the claimant who had completed his course of steroids. He was noted as still having a sense of increased sensitisation of his right ear to sounds. An audiogram taken that day again demonstrated a high frequency hearing loss in the right ear. Mr Rubin notes:

> "At this point my sense is that Mr Goldscheider would be best served by staying in a quiet environment and not exerting himself for the next couple of weeks. I have not put him on any particular medications … I am asking if Professor Saeed would be willing to see him…"

123. On 14 September 2012 the claimant collapsed when travelling on the tube. He attended the A&E department at the Royal Free Hospital. He was seen by a specialist ENT Registrar, the doctors queried whether it was a viral episode, the Registrar noted "no tinnitus". Mr Parker said the incident was a vasovagal episode, sensory overload, too much noise. It was put to Mr Parker that this was an episode of Meniere's disease. He disagreed and said that the ENT Registrar had not diagnosed Meniere's disease.

124. On 26 September 2012 the GP notes record "pain much better and hearing improving". It was suggested to Mr Parker that this note represented an improvement in the claimant's condition which demonstrated that it was of fluctuating nature and therefore consistent with Meniere's disease. Mr Parker's understanding of the claimant's evidence was that there was no improvement in his disease.

125. Professor Saeed, Professor of Otology and Neuro-otology at University College London Ear Institute, Consultant ENT and Skull Bone Surgeon at the RNTNEH, saw the claimant on 18 October 2012. In a letter to his GP he recorded that the claimant's problems started on 1 September during a rehearsal during which time he was sitting just in front of the trumpet section of the orchestra, it continued:

> "The rehearsal lasted around six hours and for the remaining part of the day Mr Goldscheider felt generally unwell with some imbalance and discomfort behind his right ear. There was a feeling of fullness in the right ear with possibly diminished hearing. …For the last ten days he has had high pitched whistling tinnitus and finds that when he is playing viola there is marked hyperacusis with some distortion. …His hearing was diminished more so on the right side. The tinnitus is constant and causing sleep disturbance and his hyperacusis remains troublesome. There is no previous history of otologic problems and his general health is good. …general ENT examination was unremarkable. Neuro-otological assessment was interesting in that whilst there was no spontaneous nystagmus he was certainly unsteady on Romberg's testing with an Unterberger's test positive to the left. Repeat audiometry today shows a high frequency hearing impairment on the right side from 4 kHz onwards and a notched high

> frequency change on the left which may be more longstanding. In view of the symptoms and the events around the weekend of 1 September my feeling is that there has been some cochlear-vestibular biochemical changes with possible secondary hydrops. …"

Mr Parker said that Professor Saeed's view was that no structural identifiable defect had been found. Identified were subtle changes in biochemistry in the inner-ear with possibly secondary hydrops. If the hydrops was secondary it could not be idiopathic as there would be a defined primary cause.

126. On 14 February 2013 an entry in the GP notes indicates a history of:

> "…acoustic trauma with permanent hearing loss Right ear, hyperacusis and tinnitus. PT was improving and had returned to work – with lower decibel from string part of orchestra. Over last 1-2 days increasing hyperacusis and tinnitus andacute onset vertigo and pain in r earm [sic], similar to initial episode. …PT very distressed and wnats [sic] to see Prof Saeed again at Harley Street, won't be covered by insurance. PT worried will lose career if takes more time off work. To d/w Dr Russell."

127. It was put to Mr Parker that this was another example of improvement in the claimant's condition. Mr Parker said the claimant was managing his symptoms as told to do on his hospital visits by avoiding the precipitants or those which could exacerbate his symptoms. When he returned to the orchestra his symptoms increased. The note did not indicate improvement of his hearing loss, Mr Parker would expect some improvement in the hyperacusis. An individual who suffers from hyperacusis will find that the condition is exacerbated when in an environment with noise. Hyperacusis is a very difficult therapeutic area, it is not susceptible to surgical or medical intervention, it can be modified or modulated by stress, anxiety or depression. Hyperacusis is not a symptom associated with Meniere's disease, it is not identified in the criteria for the disease.

128. In May 2013 Professor Saeed reviewed the claimant. He recorded that the claimant had returned to work on 12 March and that his hyperacusis deteriorated as did his tinnitus. He also had some imbalance which was treated symptomatically. Over the previous two months the claimant had been struggling with intrusive hyperacusis, nausea and a background feeling of imbalance, all of which was having a significant effect on his life and work. General ENT examination was again unremarkable. Professor Saeed wrote:

> "My feeling is that he may well have a degree of inner-ear hydrops and therefore I have appropriately commenced him on bendrofluazide … I shall also arrange for him to be seen by our Hearing Therapist as a matter of urgency as he clearly is struggling."

Mr Parker said that what was prescribed was a diuretic used in the treatment of hydrops.

129. On 21 January 2014 the claimant attended the clinic of Dr Alles, a Consultant Audiovestibular Physician at University College London. In a detailed letter to his general practitioner Dr Alles stated that the claimant had been seen in her clinic on two occasions and had been working closely with her team. The clinical findings were listed as:

> "1. Hyperacusis;
>
> 2. Hearing difficulties worse in the right ear;
>
> 3. Tinnitus;
>
> 4. Right aural pressure sensation;
>
> 5. Problems with balance.
>
> Above symptoms triggered by exposure to noise."

130. Of the history of the matter Dr Alles recorded that by the end of 1 September 2012 the claimant was feeling very confused, dizzy, sick and disorientated whilst travelling home and these symptoms persisted the following day. By the evening of the first day he noted a difficulty hearing in the right ear. He could not recall having tinnitus at the time. The hyperacusis began the following day (Sunday) by which time he was feeling shell-shocked, unwell, dizzy and confused. He phoned the workplace on the Monday and reported feeling unwell. Dr Alles records that the high frequency tinnitus is mainly in the left ear, the claimant is aware of hearing difficulties in his right ear. The claimant has no ongoing problems with balance but is slightly unsteady on first waking in the morning.

131. Mr Parker described Dr Alles' report as a thorough and inquiring consultation, an evaluation of clinical facts. There was no proposal to investigate the claimant for Meniere's disease or hydrops or to embark on empirical treatment for hydrops or Meniere's disease. Dr Alles, Dr Rubin and Professor Saeed are eminent experts in their field, it is significant that no-one diagnosed Meniere's disease nor embarked on a course of treatment for hydrops.

The defendant – Mr P Jones

132. Mr Jones retired from clinical practice in 2012. He was a Consultant ENT Surgeon for the University Hospital of South Manchester NHS Foundation Trust. He has considerable experience of medico-legal matters. Mr Jones saw the claimant on 6 April 2016. The claimant's main problem was hyperacusis which he would rate at 90 per cent of his overall problems. His tinnitus is a problem at night and in the quiet. His hearing loss is a problem in noise and groups. He is unable to use hearing aids because of hyperacusis. The tinnitus arose a few days after the incident, worsened progressively and has now been the same for several years.

133. In his account to Mr Jones the claimant told him that the bell of the principal trumpeter's instrument was 10 inches away directly behind him. The sound seemed to go into his right ear. The claimant's symptoms have been very severe but were and are virtually unilateral which in Mr Jones' opinion excludes anything other than

completely unilateral exposure as a likely cause of the claimant's symptoms, whatever the mechanism. The claimant told Mr Jones that he could not remember any problems before the Saturday although the sound was loud on Friday. On the Saturday morning the music was very loud, he was fed up with the noise and walked around at lunchtime. He wore a noise monitor in the afternoon when the noise was "incredibly loud". To duck away from the noise he placed his head between his knees. He wore the ear protection during loud passages and would remove them in the quiet passages or to talk to the conductor. He noticed discomfort during the afternoon session, he felt strange on the journey home, slightly disorientated and was worse the next morning. On Monday the claimant was dizzy, pressure and pain were present in his right ear and he was unsteady on his feet. He did not notice tinnitus until two to three weeks later, it became worse over the first year and has been much the same since then. His hyperacusis became rapidly worse over a week or a month, since the rapid worsening it has been steady but always worse if he attempts to play music. His balance was worse, his partner would recognise when episodes of imbalance were coming on as he would go grey. He noticed hearing loss only in his right ear, his hearing has been at a constant level for the last two to three years. Everything sounds muffled.

134. In his report Mr Jones states:

> "Mr Parker states Mr Goldscheider's symptoms are all consistent with acoustic shock. They are not. Genuine hearing loss is not a part of acoustic shock, neither is genuine imbalance. …his symptoms are not entirely typical of Meniere's but with pressure, imbalance, tinnitus and hearing loss that is the closest condition to his symptoms described in otological textbooks and I am happy to adopt any other term which can be demonstrated to match his symptoms better.
>
> Hydrops is not caused by acoustic shock. …if acoustic shock exists he cannot have it because the circumstances in which it arose were completely incompatible with this condition as it is described because there was no shock or startle. …Acoustic shock is basically alleged to occur in unprotected subjects wearing headphones, typically call centre workers, exposed suddenly and unexpectedly to unpleasant and brief loud noise. While it was originally claimed that this syndrome could involve genuine hearing loss and genuine vertigo, this was rapidly dropped when it was realised it was impossible for such noise levels to cause such damage and all that is claimed in modern times is that acoustic shock may involve sensation of imbalance or an impression of muffled or abnormal hearing not accompanied by hearing loss as confirmed on pure tone audiometry.
>
> …
>
> Whereas AT (acoustic trauma) and NIPTS (noise-induced hearing loss) are well-attested and investigated there is no good evidence that acoustic shock exists. So far as it is described, it

> is not possible in this case because the circumstances were not those described as necessary for acoustic shock which Mr Parker refers to at times as acoustic startle which I think is a unique use of the terms although Westmacott has described acoustic startle as the cause of acoustic shock but not as a separate condition. There was nothing unexpected or untoward about his noise exposure. He has clearly had similar noise exposures in the past without developing any such symptoms. He was wearing protection not earphones. The sound was not unpleasant. There is no evidence of NIPTS (aka NIHL), acoustic trauma or acoustic shock.
>
> There is no doubt he has a genuine hearing loss and has had genuine balance problems and these have arisen from an organic disorder in the right inner ear. It appears the left inner ear has not been involved at all or, if it has, to a very much lesser extent and yet the exposure must have been symmetrical again requiring engineering confirmation. There is no evidence on the audiograms of the bilateral symmetrical loss commensurate with NIPTS or AT and genuine hearing loss is not caused by acoustic shock. … There is no doubt that he has had a disorder of his right inner ear involving both the hearing part, the cochlea and the peripheral vestibular system, the balance part and that his symptoms are closest to those described in Meniere's syndrome although not entirely typical of the latter. … Meniere's syndrome or hydrops is characteristically unilateral but may become bilateral as time passes, certainly usually asymmetric at the start. The only logical explanation for what has happened in this case is that he was developing his first episode of hydrops at the time of the rehearsals. The other point which is quite clear from the records is that his symptoms increased some time after the alleged causative traumatic episode, did not come on simultaneously, have developed, fluctuated, recurred and persisted over time all in a way inconsistent with NIHL, acoustic trauma or acoustic shock (although initially too early in onset for delayed hydrops).
>
> Neither acoustic trauma nor NIHL are directly associated with imbalance. If delayed hydrops following acoustic trauma occurred the symptoms could then develop and progress. However, the evidence is that this condition almost certainly does not exist, there was no delay in his symptoms where before the noise in the afternoon. …his symptoms are all genuine but are not due to that afternoon's playing of music."

135. Following a meeting with Mr Parker at which there was little agreement, Mr Jones wrote:

> "My view from the start has been that with the exception of hyperacusis, which is described as a primary symptom of so-

called acoustic shock, Mr Goldscheider's symptoms are all primary symptoms of and explained by only one of the possible diagnoses raised and that is Meniere's syndrome or endolymphatic hydrops.

Meniere's sufferers when symptomatic find loud, or even slightly loud, noise uncomfortable distortion; and over-recruitment i.e. louder sounds appear even louder to a normally hearing subject. Given the devastating effect of this condition on his career and that he, not unreasonably although wrongly, attributes the symptoms to loud noise, it is not surprising that Mr Goldscheider has gone on to develop hyperacusis which commonly accompanies bothersome tinnitus.

In my view there is no causal connection between the rehearsal that day and his symptoms and it is not surprising that they developed during a rehearsal in a professional musician, so could a cold. The real point is that if this were the cause he should have had symptoms long ago.

…

There is no good evidence that this syndrome [AS] exists. If it does then it is not the cause of Mr Goldscheider's problems for several reasons:

- It cannot be the cause of some of his symptoms;
- The rehearsal noise is very far from that claimed to cause AS;
- AS allegedly does not require a very high noise level; hence
- It would have occurred in earlier rehearsals;
- Later noise would have cause the symptoms anyway.

…

Meniere's syndrome

This is usually unilateral or at least asymmetric initially and is characterised by an initially fluctuating low frequency loss with a later permanent loss often involving the high frequencies more, tinnitus, imbalance usually with true rotary vertigo and a feeling of pressure in the ear, the hearing is often distorted and loud sound may be more uncomfortable than before. Meniere's is not due to the noise exposure but arising at that time could cause the sound of the music to be much more uncomfortable than it would otherwise have been. …"

136. In his evidence to the Court Mr Jones said that some people do believe acoustic shock exists but he thought the evidence that it exists is not there. Insofar as there are reported symptoms related to acoustic shock, for example fullness in the ear, nausea, vomiting, distorted hearing, those are supposed to start immediately or within the first few hours. That does not match the claimant's complaint of his symptoms. On the claimant's account his hearing got worse on the Sunday. On 26 September 2012 the GP records that his hearing had improved, that better fitted a diagnosis of Meniere's disease rather than acoustic shock. The medical records indicate that the claimant's tinnitus and vertigo varied, his hearing loss improved and varied. These militated against a diagnosis of acoustic shock.

Hearing loss

137. Mr Parker stated that pre-2012 audiometry demonstrates high frequency hearing loss in the claimant's left ear and a noise notch at 4 kHz, consistent with noise-induced hearing loss. On the right there is high frequency hearing loss. In the left ear the hearing is normal up to 2 kHz but at 3 kHz it represents noise-induced hearing loss. In the right ear the hearing is well preserved across the spectrum. Low frequency would be up to 1 to 2 kHz. For a diagnosis of Meniere's disease one would look for a heavy loss at low frequency or predominantly low frequency. High frequency would be at 4, 6 or 8 kHz and pre the incident was well preserved. In 2012 the hearing in the left ear is unchanged. In the right ear it has become worse but not by a massive amount. The audiograms are nothing like the audiograms for a patient with Meniere's disease. The audiogram taken in 2012 does not demonstrate hydrops.

138. Mr Platt QC put to Mr Parker the proposition that hearing loss is not a part of the diagnosis of acoustic shock. In the McFerran and Baguley paper Mr Parker accepted that hearing loss was relatively uncommon. In his paper a sizeable proportion of the 30 patients had hearing loss. The predominant features in Mr Parker's review were tinnitus, otalgia, deafness and hyperacusis. He agreed with Professor Saeed that a possible cause would be hydrops but he did not think it was probable. It was as Professor Saeed described it "possible".

139. Mr Jones did not dispute Mr Parker's interpretation of the audiograms. The loss in the left ear is virtually identical in the 2010 and 2012 audiograms. It is typical of noise-induced hearing loss but represents very good levels for high frequencies. On the right the loss up to 2 kHz reflects good constitutional hearing. Between 2 and 8 kHz on the right there are reduced levels but not as much as the 2010 loss of hearing levels on the left between 6 and 8 kHz. The loss at 3 and 4 kHz on the left is absent on the right. The 2010 pattern in the right ear is not indicative of noise-induced hearing loss.

140. In evidence was a table identifying predicted hearing loss caused as a result of noise levels at 85 dB and 90 dB. 4 kHz is the most sensitive figure at which noise affects the human ear. Over a ten-year period of exposure at 90 dB there is a 50 per cent chance of an 11 dB hearing loss. To the decline in the claimant's right ear shown in the audiograms for 2010 and 2012 which at 4 kHz demonstrates a 14 dB loss, Mr Jones said Meniere's disease was the most likely cause.

141. Asked for the cause of the high frequency loss shown in the 2012 audiogram in the right ear Mr Jones said the most likely explanation is that it is associated with the incident, it is probably the event that day (1 September 2012).

Meniere's disease

142. A paper published in 2015 identifies the diagnostic criteria for Meniere's disease jointly formulated by national committees/societies as follows:

> "Criteria for diagnosis of Meniere's disease
>
> Definite MD:
>
> A two or more spontaneous episodes of vertigo, each lasting 20 minutes to 12 hours.
>
> B audiometrically documented low-to medium-frequency sensorineural hearing loss in one ear, defining the effected ear on at least one occasion before, during or after one of the episodes of vertigo.
>
> C fluctuating aural symptoms (hearing, tinnitus or fullness, in the affected ear).
>
> D not better accounted for by another vestibular diagnosis.
>
> …
>
> Probable MD
>
> A two or more episodes of vertigo or dizziness, each lasting 20 minutes to 24 hours.
>
> B audiometrically documented low-to medium-frequency sensorineural hearing loss in one ear, defining the effected ear on at least one occasion before, during or after one of the episodes of vertigo.
>
> C fluctuating aural symptoms (hearing, tinnitus or fullness, in the affected ear).
>
> D not better accounted for by another vestibular diagnosis."

143. Mr Jones said the claimant fitted the three criteria for probable Meniere's disease, he does not have low frequency hearing loss. As to the criteria for definite Meniere's disease, the fact that low frequency hearing loss is not present does not mean that the claimant does not have Meniere's disease, its presence would be powerful evidence that he does. Mr Jones did not accept that Meniere's disease is a residual diagnosis, it has a cluster of distinct features. He accepted that the definite and probable criteria

include the fact that a diagnosis is not better accounted for by another vestibular diagnosis.

144. Mr Jones accepted that the claimant did not present with a history of fluctuating hearing loss but there was a history of fluctuation in balance. In the description of Meniere's disease in the Scott-Brown textbook the only fluctuating symptom identified is that of hearing loss. The claimant's symptoms are relatively typical but not wholly classical Meniere's disease.

145. Mr Parker said that if it is Meniere's disease it has to be hydrops. Hydrops is an over accumulation of fluid in part of the inner ear which causes pressure and results in the rupture of membranes. Meniere's disease is idiopathic, it is diagnosed when symptoms do not have an identified cause. In identifying Meniere's disease a clinician would look for vertigo lasting 20 minutes to 24 hours, a fluctuating hearing loss in the lower frequency and tinnitus.

146. In Mr Parker's opinion the claimant was not suffering from Meniere's disease. He gave a number of reasons:

    i) Meniere's disease contemplates bilateral symptoms, the claimant's symptoms were unilateral;

    ii) His symptom complex did not fit with those of Meniere's disease. On the claimant's account the symptoms were not fluctuating, the audiograms were not showing low frequency loss;

    iii) The claimant had visited the top ENT hospital in the country, he had been seen by an eminent clinician, Professor Saeed, and by a leading physician, Dr Alles, audiometry had been performed. Neither doctor had diagnosed Meniere's disease or Meniere's syndrome. He had been prescribed a diuretic which can be effective in the treatment of Meniere's disease but he did not improve. No doctor at that hospital had advised more intensive management as would be appropriate for the treatment of Meniere's disease. There was no audiometry confirmation of Meniere's disease. The claimant had attended multiple appointments in the hospital, no-one had diagnosed Meniere's disease;

    iv) Meniere's disease is a residual diagnosis when others have been excluded, specifically no other vestibular cause. In this case there was a vestibular cause, namely acoustic shock.

147. Mr Parker described it as significant that another person in the same desk developed symptoms following an acoustic incident and exposure to noise. This further undermined a suggestion that Meniere's disease was the diagnosis.

148. The claimant told Mr Parker that the sensitivity to sound, dizziness, pain and discomfort and hearing loss occurred straight away, the tinnitus came later, there is a clear account of it in the GP's Record on 4 September. He accepted that the claimant's balance had improved but did not accept it was episodic. There were multiple references in the medical records to the constancy of the symptoms. As to the criteria C the 2015 paper, namely fluctuating aural symptoms, hearing, tinnitus or fullness, there was fluctuation in the fullness criteria but not in hearing or tinnitus. As

to the alteration in the intrusiveness of the claimant's symptoms Mr Parker's interpretation was the claimant was avoiding the precipitants which is what he had been told to do by the healthcare professionals.

149. The only bilateral sign experienced by the claimant is tinnitus. Unilateral symptoms make the diagnosis of acoustic shock more plausible. It was Mr Parker's understanding from what he was told by the claimant that the alleged index exposure was principally to his right ear.

Breach of duty

The claimant's submissions

150. Breaches of the 2005 Regulations are at the heart of this case and provide the simplest answer to the liability issues. The defendant is in breach of virtually every obligation under the 2005 Regulations. The defendant is in breach of its obligations as employer under the Management of Health and Safety at Work Regulations 1999 and/or Workplace (Health, Safety and Welfare) Regulations 1992; the similar obligations under the 1989 Regulations and its common law duties. The 2005 Regulations take precedence in noise matters and govern the noise issues as at 2012. The claimant invites the Court only to consider the remaining allegations of breach of duty under the earlier regulations or at common law if not satisfied as to the claimant's case under the 2005 Regulations with one exception, namely risk assessment under Regulation 3(1) of the Management of Health and Safety at Work Regulations 1999.

151. The claimant's case remains as pleaded in the Particulars of Noise Exposure set out in paragraph 2 of the Particulars of Claim, paragraph 3 above. The pleaded excess of regulatory EAVs has not been challenged. The claimant accepts that the averment of excess regulatory peak levels is not supported by the noise report.

152. The risk to health is that of foreseeable personal injury, it is not confined to any particular type of injury: *Page v Smith* [1996] 1 AC 155. The personal injury is noise damage to hearing of any type.

153. As to the defendant's duty, and what is "reasonably practicable", the focus is on what can be done not what is convenient, whether on financial or other grounds. In *Baker v Quantum* [2011] UKSC 17, a case concerning the question of what is reasonably practicable to make/keep a workplace "safe" within the meaning of the Factories Act 1937 and 1961, the statutory meaning was stated to be very similar to that of the common law test of reasonableness, save that the burden to plead and prove that a given step is not reasonably practicable lies upon the employer/defendant: Lord Mance [76] citing *Nimmo v Alexander Cowan & Sons Ltd* [1968] 1 AC 107 (HL). In the context of this case the issue is what was reasonably practicable to lower the risk of noise damage to hearing. The defendant has not proved that the steps that could have been taken to reduce the risk of injury to the claimant's hearing were not reasonably practicable.

154. The 2005 Regulations make it the primary overriding obligation of the employer to eliminate hazardous noises at source regardless of whether that noise reaches an EAV. The provisions are deliberately protective and aimed at eliminating risk even where

the risks are small. The lower peak EAV is not to be used as a target on the assumption that it is safe.

Regulation 5(1): Risk assessment

155. The risk assessment requirements are detailed. The defendant, in its manager Mr Downes, failed to ensure that the statutory risk assessment was properly carried out. It was undated and uncertified, prepared for productions and not rehearsals. It failed to take proper account of venue, rehearsal, the orchestra pit and the highly directional brass sound. It was done without obtaining any sensible assessment or measurement of likely actual or potential volumes of noise. Mr Downes' assumption that the upper EAV of 85 dB(A)Lepd would be exceeded does not assist the defendant because this leads to reliance upon hearing protection which the Regulations state the employer is not to do. It ignores peak level assessments, it fails to assess the nature and extent of risks so as to inform decisions about reasonably practicable steps to be taken to eliminate/reduce the risk of hazards. No reassessment was undertaken following the change configuration of the brass instruments.

Regulation 6(1)

156. The measurements in the noise report taken at the afternoon rehearsal of 1 September demonstrate that the claimant was exposed to noise levels which gave rise to substantial risk of injury. Risk arose when, after half an hour, the claimant's noise exposure, ignoring the effects of personal hearing protection, reached the lower EAV of 80 dB(A)Lepd. The risk to which section 6(1) refers is that referred to in Regulation 3(1) i.e. "the risk to person's health and safety arising from exposure to noise at work". It is not limited to the more usual risks arising from exposure to loud noise. The employer is bound to take a broad view of potential noise risks. In view of the levels measured at the time the claimant fell ill, there can be no doubt that he was exposed to a risk to his health as a result of the level of noise to which he was exposed, ignoring the effects of personal ear protectors, Regulation 6(1) was engaged.

157. The obligation pursuant to Regulation 6(1) is to eliminate the risk at source. The source of the noise was the orchestra's instruments. Steps which could have been taken included playing quieter, creating more space, managing the rehearsal to prevent sustained loud passages.

158. Following complaints, the afternoon rehearsal could have been postponed or carefully monitored from the outset, more effective hearing protection including ear monitors could have been provided. The afternoon noise measurements demonstrate that the average level across the three hours amounted to 92.2 dB(A), four times as much sound pressure as 85 dB(A). Regulation 6(2) was engaged. It required the claimant's noise exposure to be reduced by measures appropriate to the activity "excluding the provision of personal ear protectors". The only measure introduced by the defendant to reduce the claimant's exposure to noise was the provision of personal ear protectors. The defendant was in breach of its duty pursuant to Regulation 6(2). Following complaints by viola players the orchestra seating plan was rearranged. There is no evidence that it had not been reasonably practicable to have so arranged the seating before. By February 2013 screens were being trialled, there is no evidence that it had not been reasonably practicable to have used such screens in 2012. By March 2014 the orchestra pit had been raised, allowing more of the noise to escape

the pit's confines. There is no evidence that it had not been reasonably practicable to have raised the pit in 2012.

159. The claimant relies upon the defendant's acknowledgement of its failure to comply with the statutory noise threshold as identified in the summary prepared by Sally Mitchell on 23 November 2013 (paragraph 60 above).

Regulation 7: Hearing protection

Regulation 7(3)

160. Given Mr Downes' assessment that the employees were likely to be exposed to noise at or above an upper EAV the orchestra pit should have been designated a Hearing Protection Zone pursuant to Regulation 7(3). A sign indicating that hearing protection must be worn should have been in place, access to the area should have been restricted where practicable. The employer should have ensured, so far as was reasonably practicable, that no employee entered that area unless that he/she was wearing personal hearing protectors. The defendant did not designate, demarcate or identify the orchestra pit or any area within it as a Hearing Protection Zone. No signs indicating that ear protection must be worn were in place, no attempt to restrict access to the area unless hearing protection was worn was made.

161. In so far as it is acceptable, as a last resort, to control noise risks with hearing protection the same must be suitable and adequate. The system of hearing protection adopted by the defendant was wholly inadequate, permitting musicians to insert protection in response to pain is unacceptable and not consistent with modern health and safety methods. The evidence of the claimant was that he had no real understanding of noise risks and how to guard against them, this relates to the inadequate training which he received.

Regulation 9: Health surveillance

162. It is accepted that the claimant and his colleagues were subject to health surveillance and the claimant always complied with it. The claimant contends that the system was inadequate, it failed to bring to the attention of management important matters which demonstrated ongoing problems and future vulnerability. For "confidentiality" reasons the defendant denied itself the opportunity to consider and review the individual and group results of the health surveillance as a means of ongoing assessment of the effectiveness of its noise control methods.

Regulation 10: Training

163. The defendant provided no evidence of the content of any training session or course. It did not call its health and safety manager. The Court cannot be satisfied that the training satisfied the requirements of Regulation 10(1) and (2).

The Compensation Act 2006

164. The provisions of section 1 of the 2006 Act add nothing to the pre-existing law. The factors identified will be taken into account by the Court in the balancing exercise when considering what is reasonable or reasonably practicable: *Uren v Corporate*

Leisure (UK Limited) [2011] EWCA Civ 66. Refurbishment took place in the late-1990s yet steps were not taken to design the area in which the musicians work so as to eliminate noise risks or minimise them so far as is reasonably practicable. The defendant has advanced no evidence that artistic values of productions of its operas, specifically those in the Ring Cycle, would in 2012 or now be reduced by steps taken to eliminate or reduce noise exposure from that created by the configuration of musicians in amongst whom the claimant was rehearsing on Saturday 1 September.

165. The reliance upon "artistic value" implies that statutory health and safety requirements must cede to the needs and wishes of the artistic output of the opera company, its managers and conductors. Such a stance is unacceptable, musicians are entitled to the protection of the law as is any other worker. The employees are subject to instruction, set rehearsal times and performance hours.

The defendant's submissions

166. The central allegation made by the claimant, in the Particulars of Claim and his witness statement, was that the hearing protection he used was inadequate properly to protect him from noise. It is not that he failed to wear the hearing protection or did not wear it properly. It is the claimant's pleaded case that he made full and proper use of the hearing protection provided by the defendant.

167. The key duties owed by the defendant under the 2005 Regulations are qualified by the reasonable practicability test, the leading guidance upon which is that of Lord Mance in *Baker v Quantum* (above) as follows:

> "76. …if the workplace is unsafe, then the burden shifts to the employer to show that it was not reasonably practicable to make and keep it safe…
>
> …
>
> 78. …The standard of reasonableness expressed in the qualification 'so far as is reasonably practicable' (in respect of which the onus of proof is on the employer) makes it more, rather than less, likely in my view that the concept of safety is itself to be judged, as Lord Upjohn thought obvious in *Nimmo*, by reference to what would, according to the knowledge and standards of the relevant time, have been regarded as safe...
>
> …
>
> 80. In summary, safety must, in my view, be judged according to the general knowledge and standards of the times. The onus is on the employee to show that the workplace was unsafe in this basic sense.
>
> *(iv) Reasonably practicable*
>
> 81. Since it took the view that safety is absolute and unchanging, the Court of Appeal had to consider whether the

qualification 'so far as is reasonably practicable' enabled the employers to exonerate themselves by showing that reasonable employers would not have considered that there was cause to reduce

noise exposure in the workplace below 90dB(A). The Court of Appeal held that the qualification gave no scope for such a defence. …

82. … Even the Court of Appeal in its formulation acknowledged the quantum of risk involved as material in the balancing exercise. But this can only mean that some degree of risk may be acceptable, and what degree can only depend on current standards. The criteria relevant to reasonable practicability must on any view very largely reflect the criteria relevant to satisfaction of the common law duty to take care. Both require consideration of the nature, gravity and imminence of the risk and its consequences, as well as of the nature and proportionality of the steps by which it might be addressed, and a balancing of the one against the other. Respectable general practice is no more than a factor, having more or less weight according to the circumstances, which may, on any view at common law, guide the court when performing this balancing exercise...

83. That the qualification 'so far as may be reasonably practicable' may, if necessary, receive a broad interpretation is also indicated by the reasoning of the House in *Marshall v Gotham Co Ltd* [1954] AC 360. Under the Metalliferous Mines General Regulations 1938 (SR & O No 630) the roof and sides of every travelling road in a mine were required to be made secure. An employee was killed by a fall of roof, due to the presence of an unusual geological condition known as 'slickenside', which there was no known means of detecting prior to a fall. It was argued that the mine-owner could have propped all roofs, and that 'reasonably practicable' meant no more than 'practicable' (p 364). The argument was rejected. Lord Oaksey at p 370 agreed with Jenkins LJ's statement, [1953] 1 WB 167, 179, that what 'is "reasonably practicable" in this context is no more nor less than what is capable of being done to make roofs and sides secure within the limits of what it is reasonable to do; and it cannot be reasonable to do for this purpose anything more than that which it appears necessary and sufficient to do according to the best assessment of what is necessary and sufficient that can be made at the relevant time, that is, in the present instance a point of time immediately prior to the accident'. Lord Reid at p 373 said that 'if a precaution is practicable it must be taken unless in the whole circumstances that would be unreasonable' and took into account that the danger was a very rare one, that the trouble and expense

> involved in the use of the precautions, while not prohibitive, would have been considerable, that the precautions would not have afforded anything like complete protection against the danger, and that their adoption would have had the disadvantage of giving a false sense of security. Lord Keith considered at p 378 that there was 'no general rule or test that can safely be relied on for measuring the discharge of such a duty', but that he 'could not, as at present advised, accept … that the measure of an employer's liability can satisfactorily be determined by having regard solely to the proportion which the risk to be apprehended bears to the sacrifice in money, time or trouble involved in meeting the risk'. Lord Tucker (with whom Lord Cohen agreed at p 377) said at pp 374-375 'that the word "secure" does not involve security from the effects of earthquake or an atom bomb', but added that 'it must include security from all the known geological hazards inherent in mining operations'. At p 376 he echoed the list of factors which Lord Reid had identified in support of his conclusion that the precautions were not reasonably practicable.
>
> 84. A further aspect of para 84 in Smith LJ's judgment is the suggestion that 'there must be at least a substantial disproportion' before the desirability of taking precautions can be outweighed by other considerations. This theme was developed in paras 82 to 84 of her judgment, on the basis of dicta in two cases prior to *Marshall v Gotham*. But it represents, in my view, an unjustified gloss on statutory wording which requires the employer simply to show that he did all that was reasonably practicable."

168. The defendant relies upon the words of Sedley LJ in *Bhatt v Fontain Motors* [2010] EWCA Civ 863 observed at [39] to [41]:

> "39. In relation to his comment in paragraph 32 about the burden of proof in relation to what is reasonably practicable, it may be that there is, and needs to be, no fixed allocation of the burden. It will depend on what has happened and the situation in which it has happened.
>
> 40. There will be some cases in which it is open to, and arguably incumbent on, the claimant to say what ought to have been done by the defendant and why. There will be others in which the event itself calls for an explanation by the defendant of why it was not reasonably practicable to have guarded against it. In both kinds of case it will then be for the defendant to show why it was not reasonably practicable to take the step in question. In many cases the burden will shift as the evidence unfolds.
>
> 41. In other words, the reason why there is no formal legal allocation of the burden of proof may well be that judges and

> practitioners recognise that reasonable practicability is a protean concept which has to be addressed case by case."

169. It is the defendant's submission that where it has adduced evidence as to the precautions which were taken as part of the precautions against high level sound, many of which were scarcely challenged the burden then moves to the claimant to challenge this or adduce evidence as to why such steps are not reasonably practicable. The claimant has failed to do this.

170. The claimant's evidence is that he sustained acoustic shock which could be caused by a peak exposure in the range of 82-120 dB. These are not noise levels which the defendant could reasonably have been expected to try to ameliorate. There is nothing in the extensive available guidance to suggest that acoustic shock is a recognised risk for musicians which the defendant should have been aware of. There has never been a case of acoustic shock in the music industry. The defendant's conduct should reasonably have been governed by the risk of established conditions, namely noise-induced hearing loss, associated with long term exposure, or the risk of acoustic trauma, associated with a peak exposure in excess of 135 dB(C). These are the hazards against which the legislation is directed. Exposure at 90 dB(A)Lepd on a daily basis would only be expected to cause a small amount of noise-induced hearing loss after a period of ten years. There was no foreseeable risk of injury posed by such a level of exposure in the context of a single day's rehearsal, particularly when hearing protection was worn. This is relevant to the defendant's collaborative, incremental and reactive approach to planning, a reasonable approach because there was no foreseeable risk of acute or immediate injury at the noise levels in question.

171. The defendant has invested significant time and resources in seeking to ameliorate the sound issue. The most significant step is whether it would be practicable to carry out building works which would increase the size of the orchestra pit. The Arup report indicated that reduction in decibel levels would have been extremely modest, for violas such changes would have been almost zero. Mr Beard's evidence was the financial costs would have exceeded £50 million in lost revenue and construction costs. The defendant operates as a registered charity on a break-even basis and this sort of expense is prohibitive. The provision of screens and Baffles have not proved successful. The defendant's contention is this: "In the end, there has been no option other than the use of hearing protection despite the large amount of time and money spent on alternative solutions."

172. The defendant has engaged with its employees as to noise issues in a collaborative and communicative way. This is the most effective means of reducing the relevant risks it is more productive than a dictatorial approach.

173. Relevant to section 1 of the 2006 Act is the evidence of Mr Beard and the defendant's status as a national institution creating music of the highest quality encapsulated in the defendant's written submissions as follows:

> "The Court should recognise the great cultural value which the defendant's endeavours have to society and consider this value as being of importance when setting the standard which the defendant should reasonably meet. Some of those most invested in the defendant's endeavours are the musicians. They

> are partners and stakeholders with the defendant in the pursuit of the highest possible standards, motivated by such concerns as much as the defendant itself. It would be perverse if the imposition of unrealistic standards jeopardised the very enterprise which gives such meaning and satisfaction to the lives of the employees which the standards seek to protect."

174. The 2005 Regulations and their applicability to the defendant as an employer are not disputed.

Regulation 5(1): Risk assessment

175. It is accepted that the defendant had a duty to make a suitable and sufficient risk assessment relating to noise. The defendant fulfilled this duty when Mr Downes carried out the risk assessment. Mr Downes was trained on the production of risk assessment at a five-day IOSH course in October/November 2009. As to the claimant's criticism that there was no specific measuring of noise levels prior to completion of the risk assessment, Regulation 5(2)(c) requires it only when "necessary". It would have been impossible to attempt to obtain an accurate measurement of the noise levels in the rehearsal process for risk assessment purposes. Every rehearsal is different depending upon which section of the work the conductor may choose to concentrate on, the number and length of the interruptions to the music as the conductor communicates with players, what dynamic the music is played at, which passages require repeating. The data could not be used as a guide to noise levels at other times. Nothing in the published guidance suggests that it is necessary or appropriate to premeasure noise levels at the start of the rehearsal process. Noise readings were not "necessary" for the purpose of the Regulations.

176. The readings would not have assisted with the risk assessment process. Mr Downes' approach being to note that there was a significant likelihood of the upper EAV being exceeded and accordingly, (i) all possible control measures should be taken to reduce noise levels and (ii) the players should be provided with and instructed to wear suitable hearing protection, was sensible. Even if noise monitoring had been carried out at the first Die Walküre rehearsal on the Friday this would not have provoked a different response by the defendant as there were no complaints about the noise level at the first rehearsal. A breach of duty in failing to measure the noise levels at the start of the Die Walküre rehearsal process would not reasonably have made any difference to the claimant's exposure.

Regulation 6

177. Regulation 6 requires the defendant to reduce noise levels in the pit so far as was reasonably practicable by means of organisational and technical measures. The Regulation limits the required limits to those "appropriate to the activity". The evidence of Mr Worthington establishes that the level of sound to which the claimant would have been exposed given his pattern of wearing earplugs would have been 68-70 dB(A), that is both very low and a safe level of exposure. No purpose would be served in making it lower, it was as low as the Regulations demand.

178. Further, on the evidence the defendant took all reasonable steps which it could to reduce the exposure to noise in the pit. There was no single solution and the

defendant worked hard over a number of years to explore and experiment with all potential steps which could reduce noise exposure. Ms Mitchell's evidence that "It is an iterative, evolving process and we are always trying to experiment … we have clearly been working very seriously on this issue for many years – and we have in no way taken our foot off the accelerator" is the evidence which the defendant invites the Court to accept. The defendant relies upon the fact that there is no real criticism by the claimant's witnesses of the efforts made by the defendant to reduce noise levels.

Pit planning

179. Mr Downes' draft pit plan was a reasonable attempt to balance the competing and complex factors which had to be taken into account when organising a pit. The plan produced was not one which Mr Downes should have realised was unsafe, there is no right or wrong answer when producing a draft pit plan for the players to consider. The defendant was not in breach of the duty to take all reasonably practicable steps to reduce noise levels when Mr Downes produced this plan. Relevant is the fact it was provisional, musicians would be provided with a chance to comment on the proposed plan both in the abstract and to raise any difficulties encountered in the course of the rehearsal process. Mr Downes is an expert in and highly experienced in respect of pit planning. Had the plan posed a risk of excessive noise exposure which would have been apparent from the mere printed plan objection could have been taken to it in July when it was available for the orchestra to consider.

180. The claimant's criticism of the layout should be viewed in the context in which it arose. When the claimant brought his claim it was that the pit plan changed between the Das Rheingold and Die Walküre rehearsals. It is now accepted that the pit plan for Das Rheingold and Die Walküre were the same. The change in the claimant's position was simply because he moved one row to the back row of the viola players. It follows that nothing had struck the claimant nor anyone else that there was anything unusual about the pit plan prior to the start of the Die Walküre rehearsal despite him having played two feet away from the relevant area for a day and a half. It would be to set a very high standard upon Mr Downes to find that he should have been aware of a problem when setting the plan as a whole which none of the players themselves considered to be a problem after playing in three, three-hour Das Rheingold rehearsals. The rehearsal in which the complaint arose was the fifth Wagner rehearsal using the unmodified pit plan.

181. As to the comments of the viola player in the same desk as the claimant as recorded in the accident investigation form, she stated that she wore 25 dB earplugs at all times in the course of the rehearsals on 1 September and still found the noise to be too loud. The evidence of Mr Worthington was that if she did indeed wear protection of this attenuation throughout then the dosimetry readings show she would have been exposed to only around 68-70 dB. It is accepted by the defendant that a problem was perceived by the relevant players on Saturday and by lunchtime the viola desk had caused the issue to be raised with Mr Downes.

182. Once the problem was raised at Saturday lunchtime it is the defendant's case that Mr Downes acted reasonably by deciding to measure noise levels in the afternoon before considering the pit plan further. There was no report of injury or illness at lunchtime on the Saturday, there was no foreseeable risk of any injury occurring in the course of a further three hours of rehearsal. Any change needed to be thought through carefully

with input from the conductor and the musicians as mitigating a problem in one area can create a problem somewhere else. When the plan was changed it was done at the expense of space elsewhere in the pit. There was significant artistic compromise as the horns were separated from the remainder of the brass section and the timpani. The defendant contends that the rearrangement was a reasonable step to take in the light of the complaints received from the viola section on 1 September. It was not a step that reasonably could or should have been expected of Mr Downes before the complaints were received and this was reasonable in light of the negligible risk of any injury.

183. The evidence demonstrates that the defendant has made great efforts to experiment with an array of different screens and Baffles but they do not offer a complete or comprehensive solution to the problem of noise exposure. The defendant took all reasonably practicable steps to reduce the noise levels, the standards to which the defendant's efforts should be held is one of reasonableness not perfection. It examined all organisational and technical measures that were reasonable in accordance with Regulation 2, this included the use of screens and Baffles, consideration being given to expanding the pit and pit planning itself. None have been found to be effective to materially reduce the sound levels at reasonable costs. As such Regulation 7(2) is triggered and the defendant was entitled to resort to hearing protection. By doing so the levels of sound were reduced to under 85 dB(A). Given these circumstances the sound levels were therefore reduced to as low a level as was reasonably practicable within the provisions of Regulation 6(1). The evidence of Mr Worthington is that they would have been around 68-70 dB(A). The peak levels were never even crossed without earplug attenuation, at this level of exposure there was no conceivable risk, there is no breach of duty.

Regulation 7

184. The defendant approaches Regulation 7 by stating that:

> "The Regulations do not require that hearing protection be worn whenever an employee is likely to be exposed to noise over the UEAV of 85 dB(A)Lepd. Rather Regulation 7(3) states that in the circumstances the employer 'shall ensure so far as is reasonably practicable that no employee enters that area unless that employee is wearing personal hearing protectors'."

185. The claimant, Mr Wall and Mr Downes agreed that it was not reasonably practicable for all the players to wear hearing protection all of the time. The approach which the defendant adopted with its musicians in the light of these difficulties was collaborative and cooperative. The approach resulted in an increase in the extent to which hearing protection was worn and is consistent with the industry guidance published by the HSE, the BBC and the Association of British Orchestras. The claimant's case, namely that the defendant should enforce the blanket wearing of hearing protection for all players in the pits at all times in the course of the rehearsal or performance whenever a single member of the orchestra was likely to be exposed over the upper EAV is wholly impractical. It is not reasonably practicable for the purpose of Regulation 7(3). It would be impossible to enforce the wearing of hearing protection unless a member of the defendant's staff was standing next to the players in the pit itself. It is not possible to walk around the employees at work and check they

are wearing the hearing protection. The plugs are transparent and cannot easily be seen even when placed in the ear.

Hearing Protection Zone

186. Mr Platt QC described Regulation 7(3) as "difficult". The defendant accepts that the requirement formally to designate an area a Hearing Protection Zone pursuant to Regulation 7(3)(a) and to put up a sign pursuant to 7(3)(b) does not appear to be qualified by reasonably practicability. That is said to be dependent on what is defined as "workplace" and this is likely to be the claimant's station. It would be impossible to put up and take down signs depending on which operas and rehearsals were being undertaken. Such a workplace cannot be demarcated as this would render the pit impossible to operate. The reasonable practicability concept imported into the final sentence of the Regulation should apply to the remainder to give it proper sense. The relevant HSE statutory guidance indicates that such zones can be temporary in nature and sometimes it is not practical to mark the boundaries of a zone:

> "…in situations where the boundaries of the zone cannot be marked, e.g. where the work requires people to move the noise sources round a great deal, you should make adequate alternative arrangements to help make sure that people know where or when protectors should be worn. These could include … written verbal instructions on how to recognise where and when protectors should be worn." (L108-2593/432)

187. The defendant concludes its written submissions on this Regulation thus:

> "In any event any failure to put up a sign is a wholly sterile allegation with no possible bearing on the Claimant's injuries. The Defendant complied with a causatively relevant duty in relation to hearing protection under regulation 7(3), and in any event the Claimant did in fact wear hearing protection at all material times."

Regulation 10: Training

188. The training and information which the claimant received in relation to noise risks was comprehensive. The claimant's pleaded case is that he made full and proper use of the hearing protection provided to him. On 13 March 2012 the claimant was sent advice, namely to wear hearing protection for the whole of sessions if average noise exposure was likely to be over 85 dB (check 1/354). The evidence of Mr Downes and Ms Mitchell was that the defendant consistently advised musicians to wear the hearing protection provided as much as possible whenever they were exposed to high levels of music. Mr Downes':

> "Our recommendation always was that our musicians should wear their hearing protection for the fullest possible time that they could be exposed to loud music."

> "I know that throughout my career, once I had been trained, the advice that I always gave was that you need to wear your

> protection for the full duration of the time you are exposed to potentially harmful noise."

Ms Mitchell:

> "In those 1-2-1 conversations, I would always say that the reason we were trying to encourage 9s was that they fit the ear better and that we want you to try and wear them all the time rather than taking them out."

> "Did you give that message to the claimant? …Yes, I am absolutely sure I would have given that message to him, as I did with the other players in their 1-2-1s."

189. No separate case is made at common law as the duties cannot be higher than under the 2005 Regulations.

Conclusions upon breach of duty

190. The object of the 2005 Regulations is set out in Regulation 3(1):

> "These Regulations shall have effect with a view to protecting persons against a risk to their health and safety arising from exposure to noise at work."

The risk to health is that of foreseeable personal injury, it is not confined to any particular type of injury: *Page v Smith* [1996] 1 AC 155. In the context of this case the injury is noise damage to hearing. It is not limited to noise-induced hearing loss in the sense of the sensorineural hearing loss resulting from longer-term exposure to noise. The 2005 Regulations place a duty upon the defendant as employer in respect of its employees. Within the Regulations, for example Regulations 6, 7, the employer's duty can be qualified by what is "reasonably practicable". In *Baker v Quantum* (above) Lord Mance at [76] citing *Nimmo v Alexander Cowan & Sons Ltd* [1968] 1 AC 107 (HL) stated that:

> "…if the workplace is unsafe, then the burden shifts to the employer to show that it was not reasonably practicable to make and keep it safe."

191. Pursuant to Regulations 6(1) and (2) the primary obligation of the employer is to eliminate the risk from the exposure of his employees to noise at source or, where this is not reasonably practicable, to reduce the noise to as low a level as is reasonably practicable. The provisions are protective and are aimed at eliminating risk even where the same is small. In the Health and Safety Executive Guidance "Controlling noise at work" published in respect of the 2005 Regulations ("the HSE Guidance") it is stated:

> "80. You should not consider the exposure limit values to be a target for your noise control programme – remember that regulations 6(1) and 6(2) require you to reduce risks and exposures to as low a level as is reasonably practicable."

Regulation 5

192. Fundamental to the proper approach to health and safety at work to be undertaken by an employer is the requirement in Regulation 5 to carry out an assessment of the risk to the health and safety of employees created by the exposure to noise at the workplace. Regulation 5(3) details the requirements of the assessment. The HSE Guidance indicates what is required for a suitable and sufficient assessment:

> "40. An assessment will be suitable and sufficient if it:
>
> (a) has been drawn up by someone who is competent to carry out the task;
>
> (b) is based on advice and information from competent sources;
>
> (c) identifies where there may be a risk from noise and who is likely to be affected;
>
> (d) contains a reliable estimate of your employees' noise exposures and a comparison of exposure with the exposure action values and limit values;
>
> (e) identifies the measures necessary to eliminate risks and exposures or reduce them to as low a level as is reasonably practicable;
>
> (f) identifies those employees who need to be provided with health surveillance and whether any employees are at particular risk.
>
> …
>
> 42. Your risk assessment must contain an assessment of the noise levels to which your employees are exposed, for comparison with the exposure action values. Where exposure varies from day to day you will need to assess the various daily exposures, taking into account both a typical day and a worst-case day. More detailed advice on assessing noise exposure is given in Part 2.
>
> 43. You are not required to make a highly precise or definitive assessment of individual employees' noise exposure, such as would be obtained by making detailed measurements. Your assessment of exposure must be a reliable estimate with sufficient precision for you to be able to show whether exposure action values are likely to be exceeded. Your assessment of exposure will only be reliable if it uses data which is reasonably representative of individuals' exposure. You would be expected to use data from measurements of noise

> where other sources cannot give you reliable and representative data.
>
> 44. Uncertainties in an assessment of exposure to noise can arise from variability in the level of noise and in the duration of exposure. If you assess exposure as being close to an EAV then you should proceed as if the EAV has been exceeded, or ensure that your assessment is sufficiently precise to demonstrate that exposure is below the EAV.
>
> 47. The Noise Regulations require you to make measurements of noise 'if necessary'. Measurements will be necessary if you cannot make a reliable estimate of your employees' exposure in other ways. You may also wish to use measurements to demonstrate that the noise exposure is below a particular value so that you can assure yourself and others that you are complying with the Noise Regulations, and if you require confirmation that your control actions have reduced exposure.
>
> 48. You should ensure that any measurements are carried out by someone who is competent, ie someone who has the relevant skills, knowledge and experience to undertake measurements in your particular working environment. More detailed advice on measuring noise in the workplace is in Appendix 1."

193. The risk assessment completed by Mr Downes in respect of the performance of Die Walküre identified three hazards, one of which was noise. The hazard is generally identified, namely that "musicians in the orchestra pit could sustain hearing damage as they could be exposed to noise levels in excess of those prescribed in the 2005 Regulations". The severity and likelihood of the risk without a control measure was identified as creating a likelihood of major injury. In completing the risk assessment Mr Downes expected the noise levels to exceed the prescribed EAV and worked upon this basis. That was his evidence, it was a general statement which took little or no account of the specific requirements set out in Regulation 5(3)(a) namely to consider the level, type and duration of exposure including any exposure to peak sound pressure. The readings taken on 1 September 2012 demonstrate that there were peaks above 120 dB. Mr Worthington stated that if the readings had been extended to include peaks in the ranges 100 dB and above then "the whole graph would be covered in them". There is no good evidence upon which to find that Mr Downes, having made the assumption that noise levels would exceed the prescribed upper EAV, specifically considered the level, type and duration of exposure to noise nor the nature and extent of risk which the same created. Such consideration would have better informed his decision as to control measures and any reasonably practicable steps to be taken to eliminate/reduce the risk. This failure is the more acute as the rehearsals were to commence in the absence of any noise measurements.

194. Regulation 5(1) states that the risk assessment "shall identify the measures which need to be taken to meet the requirements of these regulations". Listed in Mr Downes' risk assessment are six control measures, only one of which specifically applied to the claimant, namely the provision of a variety of earplugs. The control

measures are generic in nature, save for the final point in respect of side elevators. Further, given Mr Downes' acceptance that the pit was cramped the first measure, namely maximising space, represents what can only be an expression of hope rather than expectation.

195. The risk assessment was prepared for a production, it did not include rehearsals. There is no reference in the assessment to considerations which would be applicable to rehearsals, for example repetition of loud passages. In the HSE publication Sound Advice it is recommended that employers "carry out a noise risk assessment and take steps to ensure that exposure to sound is reduced as much as possible during warm-ups and rehearsals". Mr Downes completed the risk assessment in the absence of specific measurements. It is said that none would have been of use in the context of a rehearsal given the variability of activities and noises. I accept that no two rehearsals will be the same and that limited assistance will be provided as to noise levels. That said, this was a new orchestral configuration. No noise data existed from previous productions. Given the expectation that the noise levels would exceed the upper EAV in my judgment it would have been reasonable to monitor the noise levels at the first rehearsal and thereafter at the first rehearsal of different parts of the Ring Cycle in order to gauge the level and type of exposure to noise.

196. Absent from this assessment is any recognition of the fact that as employees were likely to be exposed to noise at or above an upper EAV the employer was under a duty to ensure that the area was designated a Hearing Protection Zone (Regulation 7(3)(a)). Asked why this was not done Mr Downes said that he could not give an answer. Given his assessment of noise and the mandatory wording of Regulations 7(3)(a) and (b) the area of the orchestra pit should have been designated a Hearing Protection Zone and should have been demarcated and identified by means of a sign for the purpose of indicating that ear protection must be worn. The wording of these Regulations is clear, these duties are not subject to the concept of reasonable practicability. There is nothing in this risk assessment nor in the defendant's evidence to the Court which provides any basis for a finding that those responsible for assessing risk and control measures during the performance or these rehearsals gave any or any proper consideration to the provisions of Regulations 7(3)(a) and (b). The defendant's submission that such a zone should have been confined to the claimant's workplace ignores the evidence of Mr Downes as to the level of noise identified in his assessment of the orchestra as a whole.

197. Regulation 7 requires, as far as is reasonably practicable, that no employee enters the zone unless he/she is wearing personal hearing protection. In the risk assessment the additional control measures required are to "encourage the musicians to wear their plugs for the duration of each production, as this is the only way to realistically reduce exposure". This wording does not reflect the stringent requirements of Regulation 7(3). I find that the failure to: (a) identify the area as a Hearing Protection Zone together with the absence of appropriate signage; and (b) impose more stringent requirements for the wearing of hearing protection does represent a breach of Regulation 5(1) in that the risk assessment failed to fully identify the measures which needed to be taken to meet requirements of the 2005 Regulations.

198. I find there was a breach of Regulation 5(3)(a) in that the risk assessment did not include specific consideration of the level, type and duration of exposure including peak sound pressure. Regulation 5(4) requires the assessment to be regularly

reviewed and if there is reason to suspect that it is no longer valid changes should be made. No amendment was made to the original risk assessment when changes were made to the orchestral configuration following the claimant's incident. This represents a breach of Regulation 5(4) but one which is not causative of the events of 1 September. However, it is reflective of the care with which this document was completed, as is the fact that Mr Downes did not sign or date the assessment nor identify himself as the "Responsible Manager" as required. Mr Downes' explanation for his failure to date and sign was that this was an electronic document. That will not do. In my view, it is a reflection of the care which he brought to the task of completing this risk assessment.

199. The identified breaches of Regulation 5 are such as to lead me to conclude that the risk assessment prepared by Mr Downes for the production of Die Walküre 2012 was not a suitable or sufficient assessment of risk so as to comply with Regulation 5 of the 2005 Regulations.

Regulation 6(1)

200. The measurements set out in paragraph 11 demonstrate that the average noise level to which the claimant was exposed during the 3 hours, 15 minutes and 24 seconds of the total measurement period was 91.8 dB(A)Leq. The figures identify the times within which the lower and upper EAVs were reached without the wearing of personal hearing protectors. The measured exposure time related to the afternoon rehearsal, there was exposure during the morning rehearsal, a total rehearsal period of six hours. The defendant could not eliminate the risk from the exposure of noise at source at the rehearsal on 1 September 2012 given that it emanated from an instrument or instruments of the defendant's orchestra. HSE Sound Advice recommends playing quieter at rehearsals. The defendant concedes that it would be physically possible to have performed the piece at a lower level of sound but averred that playing quieter would have unreasonably compromised the artistic output of the orchestra. There is no evidence that such a course was contemplated at the rehearsals on 1 September. In the meeting between Sir Antonio Pappano and Mr Downes, which resulted in the revised orchestral configuration, there is no note of any discussion regarding the safety of the musicians in the new configuration. In the 2012 BBC Publication "Musicians' guide to noise and hearing, Toolkit for managers" the rearrangement of sections to reduce noise includes:

> "Single vs. double ranking the brass: ideally the trumpets and trombones should be in a straight line as it is preferable to have more space in front; if there is limited space (and if risers permit it) a curved line can help to increase lateral space. On the other hand if there is too much space the brass ensemble suffers and it increases the number of string players in the firing line."

There is no evidence to suggest this issue was considered.

201. Following the complaints on the Saturday morning and knowing the pit was cramped the afternoon rehearsal could have been postponed to allow for reconfiguration. This was not considered practical. The afternoon rehearsal could have been monitored from the outset using handheld noise meters in the area of the violas to provide live

time readings. This would have been a limited physical presence in a specific area of the orchestra which could have produced an immediate reading of sound levels in the area of the complaint. This was not done. Dosemeters do not provide live time readings, thus no live time readings were taken during the entirety of the rehearsal notwithstanding the viola players' complaints. Had they been done the noise levels which caused particular difficulty to the claimant and his desk partner could have been immediately identified and steps taken to remove or reduce the problem.

202. The primary duty pursuant to Regulation 6(1) is to be judged not only by reference to the EAVs, it is a general obligation to do everything reasonably practicable to remove the risk of any form of noise injury. By reason of the matters set out in paragraph 200 and 201 above, in particular the failure to obtain live time readings, I am not satisfied that the defendant did everything that could reasonably practicably have been done to reduce the risk of noise at the rehearsal on the afternoon of 1 September 2012.

Regulation 6(2)

203. Regulation 6(2) was engaged by reason of the claimant's exposure to the noise levels in excess of 85 dB(A)Lepd. It required the claimant's noise exposure to be reduced by measures appropriate to the activity excluding the provision of personal hearing protectors. The only measure introduced by the defendant to reduce the claimant's exposure to noise was the provision of personal hearing protectors. Prima facie, the defendant is in breach of Regulation 6(2). This was a large orchestra, 96 players plus one conductor. 90 were in the orchestra pit, 6 were adjacent to or raised above the pit. The statement in the risk assessment that "the orchestra pit has been laid out to maximise available space between musicians…" represents wishful thinking rather than practical application. I find that the defendant was in breach of Regulation 6(2).

204. I am grateful to the ROH who facilitated a site visit to the Opera House, in particular to the orchestra pit during the course of the hearing. The pit was set up for a production of Giselle comprising 70 musicians. The overhang is significant and impacts not only on the physical height of the pit but upon a sense of space. Even at 70 players space within the pit was not generous. I have no difficulty accepting that the addition of another 20-plus players would have resulted in a cramped pit.

205. From the time of the meeting between the Musical Director and Mr Downes, the management and Musical Director would have known that a large orchestra was to be employed, they would have known the pit would be cramped, they knew the opera contained loud passages. Save for the provision of earplugs, left to the discretion of musicians as to when they should be worn, no steps were taken to immediately reduce the noise of the Saturday afternoon rehearsal even when the problem had been brought to the attention of management. The primary consideration of the new orchestral configuration was artistic. There is a stated wish to maintain the highest artistic standards in order to maintain the ROH's reputation and attract internationally renowned singers and conductors. Of itself this is laudable. The difficultly arises when such artistic requirements result in a risk to the health and safety of the ROH's employees. This tension was acknowledged. I accept that the ROH took steps to genuinely address its obligations pursuant to the 2005 Regulations. I read and listened to the honest and earnest evidence of Ms Mitchell and Mr Downes. I read the unchallenged statement of Mr Beard. Having done so I am left with a sense that the ROH's wish to maintain the highest artistic standards and uphold its reputation

coupled with the deference accorded to the artistic aims of leading conductors were factors which had the potential to impact upon its obligations pursuant to the 2005 Regulations. However laudable the aim to maintain the highest artistic standards it cannot compromise the standard of care which the ROH as an employer has to protect the health and safety of its employees when at their workplace.

Regulation 7: Hearing protection

206. The wording of Regulation 7(3)(a) and (b) is clear. If an employee is likely to be exposed to noise at or above an upper EAV the employer **shall ensure** that the area is designated a Hearing Protection Zone, is demarcated and identified by means of the sign specified for the purpose of indicating that hearing protection must be worn. I have set out my findings as to the breaches in paragraphs 196 and 197 above. In the detailed evidence given by Ms Mitchell and Mr Downes as to the steps attempted or taken by the ROH over the years to reduce noise there appears to have been no consideration given to the requirements of Regulation 7(3)(a) to (c). In my view this is a matter upon which Mr Lunn, the Health and Safety Advisor of the ROH, could have been questioned had Mr Platt QC called him to give evidence.

207. I do not accept the defendant's contention that the alleged breach of Regulation 7 is a sterile allegation. The mandatory requirements have been breached. The Regulations recognise no distinction as between a factory and an opera house. As at the date of the claimant's accident a breach of the 2005 Regulations provided a basis for a claim in civil liability. Breaches of Regulation 7(3)(a) and (b) are directly relevant to the instruction given to employees for the wearing of personal hearing protectors in the orchestra pit. This Regulation places a more onerous duty on the employer not only in terms of demarcation but in the context of the signage, the instruction it gives to its employees prior to entering the demarcated area, namely that ear protection must be worn. I find that the management of the ROH had not focused properly or at all on these provisions, the instruction given to its employees did not reflect the stringent requirements of Regulation 7(3)(b).

208. The failure to properly consider the provisions of Regulation 7(3) and the need to give instruction consistent with it impacts upon Regulation 10, namely the information, instruction and training provided to employees. There is no evidence from the claimant or the defendant that advice or training consistent with the requirements of Regulation 7(3) and the imperative to wear hearing protection in a Hearing Protection Zone was given to any employee.

209. A consistent theme throughout the evidence of Ms Mitchell and Mr Downes was that musicians will judge for themselves when to wear hearing protection provided by the ROH and that monitoring the use of the same in the orchestra pit is unrealistic. I accept the spirit and honesty of their evidence. It meets the requirements of Regulation 7(1). Insofar as the claimant is concerned, hearing protection was provided, Regulation 7(2) is met. The problems for the defendant are Regulations 7(3)(a) to (c). If management does not fully appreciate or take steps to implement the requirements of the Regulations it cannot fully or properly inform and instruct its musicians as to the imperative nature of the need to wear the protection within what should have been a designated area. This is where the defendant failed.

Regulation 9: Health surveillance

210. The claimant and his colleagues were subject to health surveillance, the claimant underwent audiometric testing and accepted the provision of earplugs. There is nothing in Regulation 9 which requires the results of that surveillance to be disclosed to persons other than those in occupational health. The highest the claimant can put his case is that in respect of Regulation 10 the information, instruction and training provided shall include the collective results of any health surveillance undertaken in accordance with Regulation 9 in a form calculated to prevent those results from being identified in relation to a particular person. The defendant's evidence is that the confidentiality of the results was observed for reasons which are referable to the sensitivity of its employees and their future employment. It was only if there was a particular concern or a grouping of musicians where hearing loss was being found that such information would be passed to management. I regard the approach of the defendant as sensitive to patient confidentiality and proportionate. I do not find that in respecting the confidentiality of employees, save in limited circumstances, they breached Regulation 10. There was no duty in respect of Regulation 9 to disclose the results of health surveillance.

Regulation 10: Information, instruction and training

211. The claimant contends the defendant provided no evidence of the content of any training session or course. It did not call its Health and Safety Manager, thus the Court cannot be satisfied that the training satisfied the requirements of Regulations 10(1) and (2). The defendant has provided detail of courses/meetings attended by the claimant and the provision of written guidance relating to noise exposure. I accept that the defendant took steps to inform its employees of the risks of noise exposure and the need to wear hearing protection. Where the information and instruction failed was in respect of the defendant's obligations arising from Regulations 7(3)(a) to (c). I note the terms of the letter sent with the provisional schedule by the Orchestra Manager in March 2012 (paragraph 47 above) namely:

> "For shows where the average noise exposure is over 85 dB you should wear hearing protection for the whole of the session…"

Firstly this uses the word "should" rather than "must" and secondly its effect is diluted by the evidence of Ms Mitchell and Mr Downes to the effect that the wearing of earplugs was left to the judgment of the individual musician.

212. I find that the ROH did not inform the claimant, nor it would appear other orchestra players, of the mandatory requirement to wear hearing protection when the noise was likely to be above the upper EAV. It is not enough to leave the issue to the musicians to judge for themselves, they should have been informed of the strict requirement and the need for it, an instruction which should have been replicated in signage in and around the orchestra pit at the time of the rehearsal on 1 September 2012. For these reasons I find that there is a breach of Regulation 10(1).

213. I have found that the defendant was in breach of Regulations 5, 6, 7 and 10 of the 2005 Regulations. The defendant's reliance upon section 1 of the Compensation Act 2006 provides no assistance in respect of a failure to carry out a sufficient risk

assessment, its failure to immediately live time monitor noise levels in the area of the violas at the afternoon rehearsal, its failure to observe and implement the requirements of Regulation 7(3)(a) to (c) which impacted upon the information/instruction given to its employees (Regulation 10). It was these breaches which led directly or contributed to the breaches of Regulation 6.

Causation

The claimant's case

214. The claimant is unable to ascribe a single trigger as being causative of the injury to his hearing. He cannot identify a particular peak but identifies the readings between 120 and 130 dB as representing exposure to noise at a high level, in particular noise from brass instruments and within them the Principal trumpet. The levels between 120 and 130 dB created the greatest risk, between 100 and 120 dB there were risks. The claimant contends that the higher the level of risk the greater the preparedness in order to cope with such a risk. Based upon the medical literature it was the evidence of Mr Parker that peak levels between 90 and 130 dB, in particular exposure between 120 and 130 dB, are sufficient to cause acoustic shock injury. The literature reports that noise levels between 82 dB and 120 dB are capable of causing acoustic shock.

The defendant's case

215. The defendant accepts that there are "obvious issues" with "technical breaches" over risk assessment and signage. The evidence is that the defendant would in any event have operated the same system of work including earplugs which would have reduced the exposure levels to around 78 to 80 dB(A) even if one assumes use only during the louder sections. This is sufficient to defeat any allegation of breach of duty, it is not at a level which it is possible to cause any hearing loss. The issues on causation are:

    i) How the claimant proves that any reduction in the sound level as a result of moving the brass backwards would have prevented the injury. There is no evidence on the actual diminution of sound level, nor medical evidence on whether that would have made any difference.

    ii) Because the evidence on causation of acoustic shock is so opaque how can the claimant prove when the relevant index trigger event occurred and at what level the sound was. If such damage occurred when the noise was as low as 82 dB it means that acoustic shock would have been caused without negligence. Mr Parker describes the unexpected, sudden or threatening nature of the noise as the key characteristic of acoustic shock rather than its noise level. In his oral evidence Mr Parker relied on the Milhinch paper which stated that acoustic shock could be caused by short durations of sound in the range 82 to 120 dB. The evidence was that these are very low and routinely encountered peak sound levels, heard according to Mr Worthington on an underground train, the slamming of a door or a car horn. The mechanism of injury relied upon by the claimant is a unitary acoustic shock incident, the claimant did not give evidence of the specific incident which caused him injury. He was unable to describe any specific moment when he was shocked or startled by a particular sound, which he could identify as the start of his problems. As best he could recall his symptoms came on gradually without

any precipitating incident. Given the huge variability of noise incidents which can cause acoustic shock and the huge variability in noise levels during orchestral music it is very difficult for the Court to draw any conclusions about the circumstances of the relevant noise incident. It may have been a relatively low peak exposure but one which happened to take the claimant by surprise and startle him. The acoustic shock suffered by the claimant could have been the result simply of taking part in a musical performance. It cannot be attributed to any breach of duty which is said to have caused a small increase in the actual level of any particular peak because on the claimant's evidence the fact of the startle reflex is not dependent on that extra increase in that noise level it is dependent on being taken by surprise and this appears to occur even at extremely low noise levels.

Conclusion

216. The unchallenged evidence of the claimant is that prior to the rehearsal on 1 September 2012 he had no problems in his right ear nor had he suffered any of the symptoms which developed following the rehearsal on that day. Audiometry in 2010 demonstrated noise-induced hearing loss in the left ear, some unremarkable high frequency loss in the right ear. The audiometry following the 2012 incident demonstrated a high frequency hearing loss in the right ear and a change in the claimant's hearing which even Mr Jones, the defendant's medical expert, attributed to the rehearsal on Saturday. The claimant's evidence was unequivocal, it was the rehearsal on the Saturday afternoon which caused his symptoms to develop and led to his inability to work. It has not been suggested that his symptoms, as described by himself and found by treating clinicians and independent experts, are anything other than genuine.

217. The claimant's desk partner wore personalised 25 dB earplugs throughout the entire rehearsal and performance period of the Ring Cycle. She described the noise on 1 September as "unbearably loud" even with her "very heavy duty plugs in". Following the two rehearsals on 1 September she felt physically sick, her hearing was affected. She stated that she was much more sensitive to noise for a number of weeks after these rehearsals. She told Mr Lunn that the subsequent creation of the 1 metre gap between the brass and back desk of the violas had led to a definite decrease in the noise level. This viola player, who remains in the employment of the ROH, was called by neither party. It was not suggested that her account to Mr Lunn is anything other than truthful.

218. The evidence is that the level of noise at the rehearsal on 1 September 2012 was such as to cause hearing difficulties and other symptoms to the two musicians seated in the last desk of the violas immediately in front of the trumpets and the banked brass section. I regard it as beyond coincidence that the two viola players should each complain of the level of noise and, resulting from it, problems with hearing. The symptoms suffered by the second viola player reflect two of those experienced by the claimant, nausea and the sensitivity to noise which continued for a number of weeks. This player was continuously wearing 25 dB earplugs. The fact that even these did not prevent injury/damage is a reflection of the high noise level at the viola desk which the defendant's submissions about likely noise levels fail to undermine. Critically each player identifies the loud noise as the only factor at the rehearsal. The

female viola player reported upon the reduction in noise level following the reconfiguration.

219. In my view there is a clear factual and causal link between the identified breaches of the Regulations and the high level of noise which ensued at the rehearsal. It commenced with an inadequate risk assessment, continued with a failure to undertake any monitoring of noise levels in the cramped orchestra pit with a new orchestral configuration which had been chosen for artistic reasons. Even when complaints were raised the three-hour afternoon rehearsal was commenced and completed in the absence of any live time noise monitoring. All of this was done against a background of a failure by the management at the ROH to properly appreciate or act upon the mandatory requirements of Regulation 7(3) of the 2005 Regulations when it knew the noise would exceed the upper EAV.

220. The claimant wore his earplugs when he felt pain/discomfort or in anticipation of a loud passage. In so doing he was not acting contrary to the advice of the defendant's managers who left it to the individual musicians to judge for themselves when to use the protection. The defendant's reliance on the claimant's pleaded case that he made "full and proper use" of the hearing protection is dependent upon the claimant's understanding of the advice/instruction given to him by the defendant which I have found to be in breach of Regulation 10. Had the instruction as to the mandatory need to wear hearing protection as required by Regulation 7(3) been given to the claimant he would have been required to wear earplugs continuously throughout the rehearsal which would have reduced his risk of exposure to high noise levels. He did not. That is not a failure for which the claimant can be held liable in the absence of appropriate instruction.

221. The breaches have been established, the risk identified in the 2005 Regulations has materialised. There was only one agent of harm, namely high level noise. Had the defendant complied with its statutory duty the claimant would not have been exposed to the level of noise which he was. Three issues remain:

    i) What is the nature of the injury sustained by the claimant?

    ii) Was it caused by the high level of noise at the rehearsal?

    iii) Did the claimant contribute to any injury he sustained?

Causation of injury

222. Mr Parker contends that the claimant developed acoustic shock as a result of exposure to a cluster of short duration, high intensity sounds in his right ear emanating from the Principal trumpet during the rehearsal. It is the defendant's contention that the claimant experienced a coincidental onset of an idiopathic condition, namely Meniere's disease, during the course of the rehearsal. In its closing submissions the defendant postulated a third option, namely that the claimant has failed to prove that his aural condition has been caused by noise.

223. The concept of acoustic shock is relatively new and thus far primarily associated with reports emanating from call centres. Mr Jones, the defendant's expert who retired from clinical practice some five and a half years ago, was dismissive of the concept. I

do not regard the absence of reported cases of acoustic shock amongst professional musicians as being determinative on this issue of causation. Medical learning and knowledge is an evolving concept. It is the mechanism of acoustic shock and the nature and symptomatology of the claimant's injury which is relevant to the determination of this issue.

224. The description of acoustic shock, namely an index exposure to any sound or cluster of sounds of short duration but at a high intensity reflects and is consistent with the evidence of the claimant as to the playing of the Principal trumpet at or close to his right ear. The sound or sounds would have been unexpected because the claimant had only his own musical part in front of him, the trumpet player had his own part. Audiometry following the incident demonstrates changes in the right ear, not reflected in the left ear. I regard the defendant's contention that Meniere's disease developed at the rehearsal as stretching the concept of coincidence too far by reason of: (i) the nature of the index exposure and (ii) the fact that the person sitting next to the claimant described the loud noise of the trumpets and the similar physical effect upon her. The level of noise recorded during the afternoon, in particular the peak levels, would be consistent with those reported in the medical literature as causing acoustic shock.

225. The claimant's evidence is that his symptoms commenced on Saturday and worsened over the weekend. He saw his GP on Monday. In his first complaint to a doctor he attributes his symptoms to the fact that the music on Saturday was too loud.

226. The symptoms of which the claimant complains are genuine. One is capable of independent assessment, that is the high frequency hearing loss in his right ear. This is significant. High frequency hearing loss is not one of the identified criteria for Meniere's disease. It is low/medium frequency hearing loss which is identified for "definite" or "probable" Meniere's disease. The symptom which has caused and continues to cause the claimant the greatest difficulty is that of hyperacusis. Hyperacusis is not identified as one of the criteria for Meniere's disease.

227. The account given by the claimant and the evidence of his attempts to return to work given on behalf of the defendant demonstrate that in 2013 the claimant was making real efforts to return to work and take part in rehearsals and performances. In all of this he was assisted by the defendant. His symptoms are such that he can no longer work as a professional musician in an orchestra and that is accepted by all. The claimant has been the subject of detailed investigation by treating clinicians skilled and experienced in otology none of whom have diagnosed Meniere's disease. It is right to record that, save for Mr Rubin at the outset identifying acoustic trauma as the source of the claimant's symptoms, no treating clinician has diagnosed acoustic shock.

228. I accept that some of the symptoms experienced by the claimant have fluctuated. However, I take account of the claimant's evidence that following medical advice and recognising the triggers for his symptoms he has changed his lifestyle and daily activities so as to avoid the activities which result in symptomatology. That is demonstrated by the events in 2013 when he attempted to return to work which triggered a deterioration in his condition, well documented in the medical records. I do not conclude that any such fluctuations are sufficient to undermine the finding of acoustic shock given the nature of the index exposure, the absence of low frequency

hearing loss, the presence of hyperacusis and the absence in the extensive medical records of a diagnosis of Meniere's disease, a well established clinical diagnosis.

229. I am satisfied that the noise levels at the afternoon rehearsal on 1 September 2012 were within the range identified as causing acoustic shock. The index exposure was the playing of the Principal trumpet in the right ear of the claimant whether it was one sound or a cluster of sounds of short duration. It was that exposure which resulted in the claimant sustaining acoustic shock which led to the injury which he sustained and the symptoms which have developed, from which he continues to suffer.

Contributory negligence

230. The defendant contends that any condition which the claimant has developed was caused or contributed to by his own negligence in that he failed to heed the instruction, training and information provided by the defendant in relation to noise exposure, he failed to wear the hearing protection at all times, he failed to inform the defendant of any difficulty which he had wearing the hearing protection. To the extent that noise levels at the rehearsals on 1 September 2012 were excessive the claimant failed to immediately alert the defendant to this or to the fact that he felt unwell. He continued to take part in the rehearsals when he knew or should have known that they were or might be causing him harm.

231. The claimant contends that he wore the hearing protection when he believed the noise level was too loud for comfort or safety, if he failed to wear it at any relevant time that was a consequence of the defendant's failure to inform the claimant to wear the hearing protection at that time. It is pleaded that the claimant was unaware of any difficulty in wearing the hearing protection provided to him. The pleadings admit that the claimant considered the noise levels during the rehearsals to be excessive and that he failed to alert the defendant immediately that he felt unwell. The claimant admits that he continued to take part in the rehearsals but denies that he did so knowing what he was doing might be causing him harm. He denies that he was reasonably required to leave the rehearsal and reasonably required to refuse to participate further until such time as the defendant reduced the noise levels (to his liking).

232. Notwithstanding the evidence of Ms Mitchell as to the conversation she recalled having with the claimant some months after his accident it was no part of the claimant's case that he had a particular difficulty wearing the hearing protection provided. The allegation of contributory negligence which relates to the failure of the claimant to wear hearing protection throughout the rehearsal is dealt with at paragraph 220 above. The manner in which the claimant used the hearing protection was consistent with the advice that was given, namely that hearing protection should be worn but it was left to the individual musician to use such protection as and when thought necessary. The manner in which the claimant used the hearing protection was consistent with that of other musicians and this was known and accepted by management.

233. The rehearsal at which the claimant alleges injury was sustained was the Saturday afternoon rehearsal. Prior to its commencement the defendant was on notice of a complaint on behalf of a viola player or players that the music was too loud. The defendant was alerted to the problem.

234. In my judgment the real issue in respect of contributory negligence is that the claimant took part in the entirety of the afternoon rehearsal when he was aware that the music was loud and that it was causing him discomfort. I accept the evidence of the defendant that a musician could leave a rehearsal if he or she was feeling unwell and that this would be dealt with sympathetically. I accept that it would be the ethos amongst the professional musicians employed to play in the orchestra to be precisely that, professionals. As such a musician would not easily leave a rehearsal and would attempt to deal with any difficulties that arose.

235. The claimant had experienced some difficulty with the noise levels prior to the afternoon. He was on notice of the problem, he knew the complaint had been made. In my opinion it would be reasonable for the claimant to commence the rehearsal. However, there would have come a time when he would have appreciated that the noise levels had not been reduced. It was at this point that it would have been reasonable for the claimant to leave the rehearsal so as not to cause further discomfort with his hearing. On the evidence I find that the noise was the directional sound which emanated from the Principal trumpet. By reason of that, I think it more likely than not that by the time the claimant should have appreciated that he should leave the rehearsal the acoustic shock damage had occurred. In those circumstances, although I find the claimant should have left the rehearsal earlier, I am unable to find that had he done so this would have prevented the injury which he sustained. Accordingly I do not find that the claimant's failure to leave the rehearsal before it concluded contributed to his injury.

236. By reason of the above findings there be judgment for the claimant on the preliminary issue. Damages to be assessed.

Appendix

Medical literature

1. The first reported cases of acoustic shock were published by an Australian audiologist, Janice Milhinch, in 2002. The abstract reads:

> "Isolated reports of injury following exposure to loud sounds from headsets have met with scepticism. This study involved examination of the case records of 103 call centre operators who experienced acoustic incidents, sometimes described as 'shrieks' or 'howls', from headsets. Acoustic incidents are loud, unexpected, randomly occurring, high-pitched and startling stimuli, typically tones of 2.3 - 3.4 kHz, at intensities varying from 82 to 120 dB S.P.L. at the tympanic membrane, with rise times of 0 - 20 milliseconds and varying durations. Operators described being shocked by the incidents and experienced a range of physiological symptoms including pain (81%), tinnitus (50%), vestibular disturbance (48%) and hyperacusis (38%). Headaches and sensations of numbness, burning, tingling, blocking, pressure or fullness, echo or hollow feelings in the ear were also frequently reported."

2. In 2006 an Australian audiologist, Westcott, published a paper entitled "Acoustic Shock Injury". The abstract reads:

> "CONCLUSION: The potential severity and persistence of ASI [acoustic shock injury] symptoms has significant clinical and medico-legal implications. With the rapid growth of call centres around the world, professionals providing tinnitus and hyperacusis therapy are increasingly likely to encounter some or all of the cluster of ASI symptoms in their clients.
>
> BACKGROUND: Acoustic shock injury (ASI), occurring as a result of exposure to a sudden unexpected loud sound, has been observed to cause a specific and consistent pattern of neurophysiological and psychological symptoms. These include aural pain, tinnitus, hyperacusis/phonophobia, vertigo and other unusual symptoms such as numbness or burning sensations around the ear. A range of emotional reactions including trauma, anxiety and depression can develop. Call centre staff using a telephone headset or handset are vulnerable to ASI because of the increased likelihood of exposure, close to their ear(s), of sudden unexpected loud sounds randomly transmitted via the telephone line."

3. In 2007 a paper published in the Journal of Laryngology and Otology DJ McFerran and DM Baguley stated in its Abstract that:

> "Acoustic shock is a recently recognised clinical entity: following an abrupt, intense and unanticipated acoustic

> stimulus, usually delivered by a telephone handset or headset, some individuals report a symptom cluster that includes otalgia, altered hearing, aural fullness, imbalance, tinnitus, dislike or even fear of loud noises, and anxiety and/or depression. Symptoms start shortly after the triggering acoustic incident and can be short-lived or can last for a considerable time. If persistent, the condition can lead to significant disability…"

The paper identified the fact that persons who work in call centres wearing headsets at work may be subjected to spurious auditory signals. Reports of workers developing a pattern of both physical and psychological symptoms arising immediately after or soon after exposure to sudden, unexpected noise over their headset or handset had risen. It identified the symptom cluster occurring after such noise exposure as now known as acoustic shock syndrome, acoustic shock injury or simply acoustic shock. It states that:

> "Noises that generate acoustic shock do not have an intensity and duration profile that would be regarded as dangerous to the auditory system within the framework of existing workplace legislation. In this respect, it is important to distinguish acoustic shock from acute acoustic trauma that is experienced with exposure to extremely loud sounds, over 140 dB. Similarly, acoustic shock is unrelated to noise-induced hearing loss, in which repeated exposure to sounds of an intensity greater than 85 dB causes cochlear damage.
>
> The majority of reports of acoustic shock have come from Denmark and Australia with a significant but smaller number arising from the United Kingdom. However, there is a dearth of reports from other countries with large numbers of call centre workers. This has led some researchers to question whether the syndrome is a genuine entity. One of the possible explanations for this seeming paradox is that, as an emerging syndrome, the condition often passes unrecognised and is almost certainly under-reported at present.
>
> Although acoustic shock has become firmly associated with the use of telecommunications equipment, it is likely that exposure to other forms of sudden, unexpected sound can generate similar symptoms. There are anecdotal reports of people developing symptoms resembling acoustic shock after exposure to noise from engineering equipment or from their personal stereo headphones. Although many different sound sources seem capable of generating acoustic shock, there are some common features in the characteristics of the sounds. …A Danish study identified acoustic instance featuring sounds of intensities varying from 56 to 108 dB, in the frequency range of 100 Hz to 3.8 kHz. Work in Australia by Milkhinch suggested that the causative sound is often in the frequency range 2.3 to 3.4 kHz, with an intensity of 82 to 120 dB. The rise time of the sound is usually very short, varying between 0 and 20

> milliseconds. The duration of exposure is very difficult to estimate because the natural response of the affected person is to remove the headset or handset from the affected ear(s).
>
> Symptom profile
>
> …Although most people develop their symptoms immediately after exposure to the acoustic incident, there are a small number of people who develop their symptoms several hours after the event. …of the symptoms seen immediately or soon after exposure to an acoustic incident, ear pain was the most common complaint, occurring in 81 per cent of cases. There were reports of pain in the neck or jaw in 11 per cent and of pain in the face in 7 per cent. Tinnitus was described in 50% of cases and balance problems were present in 48%. Other symptoms included a sensation blockage or aural fullness, numbness or even collapse. Hearing loss was relatively uncommon, occurring in only 18.4 per cent of cases, and there was no statistically significant audiological difference between exposed and non-exposed ears except at a frequency of 1.5 kHz. Other symptoms took longer to emerge and included anxiety, depression, head-ache, sensitivity to previously tolerated sounds, hyper vigilance and anger…
>
> Pathophysiology
>
> The pathophysiological mechanisms underpinning acoustic shock remain obscure, and it is reasonable to assume that these will be complex and multi factorial. The symptom profile includes experiences that can variously been described to middle-ear, cochlear and central auditory pathway involvement. Additionally, the marked emotional impact of the acoustic shock experience leads one to consider a role for psychological mechanisms."

The paper concludes that:

> "The symptom complex arising from exposure to sudden, unexpected sound has been recognised. This condition shares some features with other conditions such as hyperacusis. However, there are sufficient differences to warrant its recognition as a separate condition in its own right, rather than as a subsection of an existing condition. …otology and audiology departments need to increase their awareness of this condition, as it is currently under-recognised and, anecdotally, patients often complain of having their symptoms ignored."

4. Recognition of the concept of acoustic shock is contained in what was described as the foremost ENT textbook in the United Kingdom: Scott-Brown's Otorhinolaryngology, Head and Neck Surgery. In the 2008 current edition, part 19, "The ear, hearing and balance", it is stated:

> "The problem of acoustic shock is very different and is thought to be more of an acute stress reaction. Objective hearing loss is rarely a feature but high levels of psychological stress are common."

It summarises the symptoms found in acoustic shock. The common symptoms are identified as otalgia, tinnitus, hyperacusis, dizziness, headaches, sleep disturbance and poor concentration. Less frequent are neck pain, shoulder pain and panic attacks.

5. In 2014 Mr Parker, with three co-authors, published an article in the International Journal of Audiology entitled "'Acoustic Shock': A new occupational disease? Observations from clinical and medico-legal practice". The abstract reads:

> "OBJECTIVE: 'Acoustic Shock' injury has arisen with the proliferation of telephone-based employment but is not yet fully understood. This study aimed to further characterize this phenomenon by reviewing the current literature and analysing a case series.
>
> DESIGN: Cases were identified from medicolegal and clinical practice. Case notes, including General Practitioner and occupational health records where available, were scrutinised and information on demographics and medical history obtained. Patients underwent interview, examination, and pure-tone audiometry.
>
> STUDY SAMPLE: Thirty cases were included. Eighteen (60%) were female. Mean age was 41.6 years.
>
> RESULTS: There was a range of otological symptoms (mean 3.2 per patient), most commonly tinnitus which was present in 27 (90%), accompanied by diverse non-otological symptoms. Twenty-one (70%) had previous oto-pathology, 19 (63%) psychopathology, and five (17%) head injury. Examination was normal in 28 (93%), as was audiometry in 13 (43%). Eleven (50%) smoked. Hearing loss was not necessarily a feature.
>
> CONCLUSIONS: The condition known as 'acoustic shock' injury is a complex disorder producing a range of symptoms with psychological overlay. However, there is often little clinical evidence of pathology and it has not been adequately defined as yet. By further characterization, epidemiology and aetiology can be better understood."
>
> "Patel and Broughton (2002) assessed the noise exposure of call centre operators. They found that noise levels from voice communication via a headset were unlikely to breach health and safety legislation, hence making NIHL in this setting unlikely. However, as well as routine voice calls, other noises have been noted to be transmitted through call centre headsets.

These include electrical interference or transmission of loud sounds at the other end of the line, for example fire alarms and deliberately loud malicious calls. Noises such as these may not be immediately filtered out by internal noise limiting software. Episodes of this kind have been termed 'acoustic incidents' (Acoustic safety programme: National Physical Laboratory, 2006) and are typically of short duration (seconds), lasting until the headset is removed by the operator. This level of intensity is normally taken as above 118 dBA (Australian Communications Industry Forum, 2006). Some authors, e.g. Milhinch (2002) and Westcott (2006) define an acoustic incident as a loud unexpected randomly occurring high pitched and startling stimulus typically tones of 2 – 3 or 3 – 4 kHz at intensities varying from as loud as 82 to 120 dB SPL at the tympanic membrane with rise times of 0 – 20 milliseconds. The noise dose in an acoustic incident is distinguished from that associated with disruptive pressure changes, such as blast injury. The clinical phenomena that we describe arise from high intensity, short duration exposure.

Acoustic startle is a temporary response of an individual to an acoustic incident which can be associated with temporary hearing loss and produces a 'startle response' leading to vestigial reflexes such as those seen with any sudden onset short duration potentially injurious stimulus, for example, a blast of wind into the eyes. This 'startle' response is innate and represents a normal physiological response. A typical startle reaction can involve involuntary movements of the head, neck or even arms and in extreme cases falling to the floor, pain in the ear, neck, arm, tinnitus, sensation of burning, numbness, and fullness in the ear. Vertigo may occur as a result of pressure changes transmitted into the inner ear (Tullio's phenomenon). A temporary threshold shift, i.e. temporary loss of hearing shortly after exposure to an acoustic incident is well described and also constitutes a physiological response, i.e. not a manifestation of disease. A detailed review of this is given by Westcott (2006).

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So called, 'acoustic shock' has been defined by several official bodies including by the International Telecommunications Union European Transmission Standards Institute as 'Any temporary or permanent disturbance of the functioning of the ear, or of the nervous system, which may be caused to the user of a telephone earphone by a sudden sharp rise in the acoustic pressure produced by it', and by the Acoustic Safety Programme (2006) as '… an adverse response to an acoustic incident resulting in alteration of auditory function'. (Acoustic Safety Programme, National Physical Laboratory National

definitions of Acoustic Shock in Telephone and Headset Users, 2006). This implies a semi-permanent/irreversible change, i.e. essentially the symptoms associated with noise exposure which persist beyond the normal duration of the physiological response. Westcott (2006) makes the point that pre-existing stress/anxiety as well as fear of repeated incident exposure appears to increase the vulnerability of those to acoustic shock.

Symptoms of acoustic startle/shock come on at the time of or very shortly after the acoustic incident and do not develop later on. They must be specific to the ear, e.g. tinnitus and hearing loss occur in the exposed ear (and not in the contralateral non-exposed ear).

Despite the large number of call centre workers and apparent frequency of acoustic incidents there are few published case series of 'acoustic shock' and surprisingly these individuals tend to be seen in medico-legal practice rather than a clinical setting. The explanation for this has been difficult to ascertain. The concept of discrete clinical entities presenting to medico-legal, rather than general clinical practice has been seen before in relation to diagnoses of industrial rhinitis and in some cases of cervical whiplash injury. Individuals with 'acoustic shock' generally present to the legal sector with an intention to claim for damages. The relatively small number of patients who present clinically indicates either under-reporting or a low incidence/low level of disability caused by acoustic incidents. Furthermore, it is perplexing why these cases have only been seen recently when people have been exposed to short duration high levels of noise for years.

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Symptoms

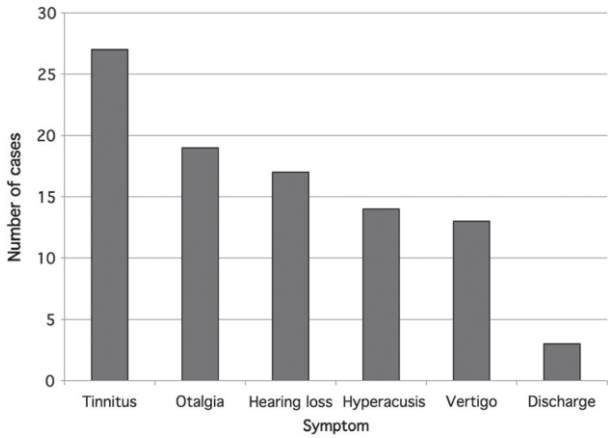

Figure 1. Otological symptoms reported in 30 patients presenting with 'acoustic shock'.

There were a range of otological symptoms reported (Figure 1). Twenty-seven out of 30 (90%) patients reported tinnitus. Where recorded, the nature of this was high pitched ringing or squealing in 14 cases (52%), hissing in four (15%), humming in four (15%), clicking in one (4%), clanging/twanging in two (7%) and pulsatile in one (4%). Tinnitus was bilateral in three cases, all of which had received bilateral acoustic incidents. In some cases this came on at time of injury, some up to months post-incident. Tinnitus was reported as constant in most cases, whilst one case reported cyclical symptoms every seven days.

Otalgia was present in 19 out of 30 cases (63%). The nature of the pain reported was burning in three cases, pounding/throbbing in two, stabbing in two, and unrecorded in the remainder. There was radiation of the pain to the ipsilateral neck in four cases. In one case the pain was only in the contralateral ear.

Subjective hearing difficulties were reported in 17 cases (57%). In four cases, reported hearing symptoms were bilateral, three of these had been exposed to a bilateral incident but in one case exposure had been unilateral. Unilateral hearing difficulties in the ear in which the alleged exposure had occurred were reported in the remainder. Subjective hyperacusis was present in 14 cases (47%). Two patients had bilateral hyperacusis where the incident was unilateral.

Vertigo was reported in 13 cases (43%). This was of sudden onset in two and reported as intermittent in two. Two felt unsteady and two had reported falling over. Nausea was reported in 12 cases (40%).

Three patients (10%) reported a sensation of fluid coming from the exposed ear. Examination was unremarkable in all three at time of assessment. Three patients (10%) perceived swelling of the affected ear and reported a pressure sensation within the head.

There was a diverse range of additional non-otological symptoms reported by patients with acoustic shock which they associated in precipitation with the acoustic incident(s). These included flailing of arms (which the GP diagnosed as an ‘animal reaction’); lethargy; confusion; disorientation; insomnia; headaches; palpitations; facial pain; lactorrhoea; onset of rhinitis; stress; panic attacks; phobia of earphones, mobile phones etc; anhedonia; fear of shopping; associability (‘prisoner in own home’); needing the television set on all night; giving up hobbies e.g. dancing, dressmaking, bowling, singing, swimming; having to sit down/wear ear defenders whilst vacuum cleaning; difficulty driving; lack of

concentration; effects on libido; and difficulty reading and writing.

The mean number of otological symptoms reported per patient was 3.2 (95% CI 2.8 – 3.6).”