Introduction

For this assembly or lesson, you will need:

A projector and screen

The PowerPoint presentation downloadable from www.networkrail.co.uk/safetyeducation/welshbacc

Some willing members of the audience to take part in the quiz

Background

The number of railway overhead power lines in Britain is increasing.

Electrifying the railway will bring many benefits: a greener, quieter, faster and more reliable service. But it also has safety implications.

Overhead electric lines powering the railway carry an electric current that is 100 times more powerful than that in the home. Tragically, 69 people have been electrocuted on the railway in the last ten years.

‘Live Wire’ is a railway electrification safety awareness campaign for young people, developed by Network Rail as part of its Rail Life youth initiative. It is designed to support school children, parents and local communities in using electrified railways safely.

Aim of the assembly

We hope that the assembly will help the children in your school understand:

• How to recognise electric railways – overhead power lines and the conductor rail
• The benefits of electrification, but also the dangers
• How to stay safe around electric railways
• The key safety ‘rules’ – the Rail Life ‘Safety Top 3’
Slide 2: What’s this?

You’re looking at the future

• Ask the pupils to put their hands up if they’ve seen one of these types of trains before.
• Explain that it’s an electric train and that you know that many pupils may have used one before – probably as part of a longer journey – on holiday, for example.

Note to teachers:
Illustration is HS2.

Slide 3: And this?

• Explain that electric railways are powered by electricity rather than traditional fossil fuels like diesel or coal.
• Highlight for pupils that electricity reaches the train in one of two ways – either via an overhead power line (left hand picture) or a conductor rail, sometimes called the third rail (right hand picture). In Wales it will be overhead power lines.

Slide 4: Electrification is coming to a line near you

• Explain that by 2020, over half (54%) of Britain’s railway and 27% of Wales’ railway network will be electrified.
• If your school is along the South Wales Mainline, tell pupils that the exciting news is that their local line will be ‘electrified’ next.

Slide 5: What benefits will electrification bring to your area?

Explain that electrification will bring a number of important benefits:

• Faster and quieter journeys
• More seats on trains
• Improved reliability on some of the busiest routes
• Better for the environment
• Boost for the local economy

Note to teachers:
Electrifying key routes on the railway will improve services for thousands of passengers and help support economic growth across many of our cities and towns. It will mean faster and quieter journeys with more seats on trains and improved reliability on some of the busiest routes.
Slide 6: The Power Quiz

- Explain that you want to test the pupils' knowledge of electric trains in THE POWER QUIZ.
- Encourage pupils to put their hands up when they know the right answer. Do offer prizes at the end if you like!

Slide 7: Know your trains? Guess their age...

A. 200 years old
B. Nearly 60 years old (1955)
C. This train is just a baby in comparison to the others – it was launched in Britain in 1994

Note to teachers:
- This is ‘Puffing Billy’, the oldest surviving steam locomotive, which pulled trucks from a coal mine in Northumberland to the River Tyne. The mine’s owner wanted to speed up delivery of coal to the waiting ships and knew machines would be faster than horses. ‘Billy’ was part of a transport revolution that introduced steam railways across the country. The locomotive’s top speed was about six miles per hour.
- This poster shows the Manchester-Sheffield-Wath line which, in 1955, became the first main line over which all passenger and freight train operation was carried out by an electric train.
- This is a Eurostar electric train which can travel at speeds of up to 186 miles per hour.

Slide 8: How much of the UK network is already electrified?

A. None of the network
B. 25% – over 1,913 miles (61,574 Olympic-sized swimming pools)
C. 30% – over 3,000 miles (98,556 Olympic-sized swimming pools)

Answer: C. 30% of the overall railway network in Britain. Or, over 3,000 miles – 3,062 miles, to be precise. That’s the same length as 98,556 Olympic-sized swimming pools. In Wales, none of the track is electrified currently, but 27% will be by 2020.
Slide 9: Electric trains have faster journey times than diesel trains – why?

A. Electric trains can accelerate faster  
B. Electric trains can brake later  
C. Electric trains have twice as many wheels  

**Answer: Both A and B are true.** Journey time savings can be made by electric trains due to the superior performance of electric traction.

Slide 10: What’s the top speed of the fastest electric train in Britain?

A. 186 mph  
B. 169 mph  
C. 125 mph  

**Answer: A.** Eurostar’s maximum speed is 186mph.

Slide 11: How many passengers can be seated on an electric train?

A. 20% fewer passengers than on a diesel train  
B. 20% more passengers than on a diesel train  
C. Both seat the same number  

**Answer: B.** Electric trains have 20% more seats compared to diesel trains.

Slide 12: How much carbon dioxide (CO₂) does an electric train give off compared to a diesel train?

A. 10% more CO₂ per passenger  
B. 20–35% less CO₂ per passenger  
C. About the same  

**Answer: B.** An electric train can give off, on average, between 20% and 35% less CO₂ per passenger than a diesel train.

**Note to teachers:**  
This helps improve air quality in pollution ‘hot spots’ such as city centres and main line stations.
Slide 13: How powerful are railway overhead power lines?

A. 100 times greater than the power supply in the average home
B. 10 times as great as the power supply in the average home
C. The same as the power supply in the average home

**Answer: A.** At 25,000 volts, overhead lines are 100 times greater than the power supply in the average home.

**Note to teachers:**
This strength of current is sufficient to easily kill someone. The third rail has 750 volts passing through it.

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Slide 14: When are overhead power lines & conductor rails switched off?

A. After the train has gone past
B. Overnight
C. Never – the electricity is on all the time

**Answer: C.** The third rail and overhead lines have electricity flowing through them at all times and are never switched off.

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Slide 15: Electricity in overhead power lines can ‘jump’ – but how far?

A. 2 metres
B. 3 metres
C. 5 metres

**Answer: B.** You don’t have to touch the overhead lines to get electrocuted. If you fly or dangle things from bridges near the overhead power lines, the electricity can arc like lightning or jump up to three metres.

**Note to teachers:**
A. The average man in the UK is 175.3cm tall (5ft 9 inches) according to the Office of National Statistics.

B. The World Record for High Jump was established by Cuban athlete Javier Sotomayor at Salamanca, Spain on 27 July 1993 when he jumped 2.45m (8 foot ½ inch).

C. The adult regulation size football goal is 2.44 metres high.
Slide 16: How hot is the power line?

If you came into contact with an overhead line on the railway, the temperature could reach 5,000 degrees centigrade. How hot is that?
A. Hotter than it takes to melt iron
B. Hotter than lava from the world’s hottest volcano
C. Hotter than the surface of the sun

Answer: A, B and C are all correct.

Note to teachers:
A. Iron melts at around 1,535 degrees centigrade.
B. Kilauea on Hawaii is the world’s hottest volcano. The core lava temperature is around 1,050 degrees centigrade (Pinkerton, James, Jones, Lancaster University. Pub. Journal of Volcanology and Geothermal Research, March 2002).
C. 5,000 degrees centigrade is the average temperature on the surface of the sun (the core is 15 million degrees!) (Source: NASA).

Slide 17: In the last ten years, how many people have been electrocuted on the railway in Britain?

A. 10
B. 25
C. Over 60

Answer: C. 69 people have been electrocuted on the railway in the last ten years.

Slide 18: What happens when you get electrocuted?

A. A tingling or painful sensation.
B. A painful shock, muscles contract and grip the electrical source so you’re unable to let go.
C. The heart ‘flutters’ (ventricular fibrillation). Burns at entry and exit points and internal damage.
D. Prolonged exposure or strong muscular contractions stop the heart. Internal organs, tissue and skin burn.

Answer: All of these are the effects of mild, moderate and more severe electric shocks. The effects vary depending on the electric current and frequency, but they affect the whole of the body...
When you get electrocuted

Note to teachers:
This slide and the one that follows go on to explain the effects of electrocution on different parts of the body.

1. Electricity seeks the easiest path to the ground. Human bodies contain 70% water—a great conductor for electricity.

2. Hands, heels, head: points of contact with the electrical source and the ground receive the most severe surface burns.


4. Heart: your heart’s rhythm is disturbed, your heart ‘flutters’ and fails to pump blood properly. With prolonged exposure to the current it will go into cardiac arrest and death.

When you get electrocuted

Continues from previous slide.

5. Skin and tissue: high voltage electricity burns organs beneath the skin, while surface skin and tissue is blackened and melts.

6. Abdomen: internal organs can be injured by strong muscle contractions throwing you clear of an electrical source.

7. Spine/Bones: being thrown by the force of the current or the strength of muscle contractions can lead to broken bones or an injured spine.

FACT: 9 out of 10 people die from the electric shock received from getting too close to railway overhead power lines.

Discover the hidden dangers

Note to teachers:
This slide shows a typical section of electrified railway track. Ask pupils to guess where the electricity is in the picture. With each click, electrical equipment and its voltage will be revealed. The slide ends by revealing that electricity can jump and arc up to 3 metres—so electricity can be found around the whole of the track area.

1. Electric overhead power lines: 25,000 volts.

2. Signalling location case: 650 volts.

3. Conductor or third rail: 750 volts.

4. Buried cable: 25,000 volts.

5. Whole screen: electricity can jump and arc as much as 3 metres.
Slide 22: A final quick recap

Remind pupils of the key facts from this presentation:

– Overhead power lines carry electricity 100 times greater than the power supply in your home.

– 9 out of 10 people die from the electric shock received from getting too close to railway overhead power lines.

Note to teachers:
Click on the play button at the bottom left of the square to play the video.

You can download the infographic animation from: www.networkrail.co.uk/safetyeducation

Slide 23: Plan for the weekend?

– A video based on a real-life story.

Note to teachers:
Click on the play button at the bottom left of the square to play the video.

Slide 24: Stay safe around the railway – stay clear of the tracks

Note to teachers: Slides 25–28 conclude the presentation with a summary of the Rail Life ‘Safety Top 3’.

Stay clear of the tracks. Is it worth putting your life on the line?

Slide 25: Stay safe around the railway – use the level crossing

Use the level crossing. Shortcuts across the railway can kill.

Slide 26: Stay safe around the railway – know the signs

Know the signs. Be alert to railway signs. They could save your life.
Stay safe around the railway – remember the Rail Life ‘Safety Top 3’

Overhead power lines and tracks are always on and can kill. Remember the Rail Life ‘Safety Top 3’.

- Stay clear of the tracks. Is it worth putting your life on the line?
  - Electricity can jump up to three metres.
  - Use the level crossing. Shortcuts across the railway can kill.
- Don’t play with kites or balloons near overhead power lines.
- Know the signs. Be alert to railway signs. They could save your life.