TRAIN ACCIDENT AT LADBROKE GROVE JUNCTION, 5 OCTOBER 1999

First HSE interim report, 8 October 1999

1. This is the first interim response to HSC's request for an investigation and report under section 14(2)(a) of the Health and Safety at Work etc Act 1974. It will also be made available to Lord Cullen and Professor Uff for the purposes of the two relevant inquiries and to Sir David Davies who is preparing advice for the Deputy Prime Minister.

The accident

2. At 8.11am on 5 October two trains collided 2 miles outside Paddington station, at Ladbroke Grove Junction. One was a Great Western High Speed Train (HST) running from Cheltenham Spa to Paddington, the other a Thames Train 3-car diesel unit going from Paddington to Bedwyn, in Wiltshire. 30 people are already confirmed as dead and many more are unaccounted for. There are also 160 injured, some critically, because of a rapid outbreak of fire in some of the HST carriages.

The investigation

3. HSE's Railway Inspectorate (RI) is investigating the cause of the accident with the aim of answering three main questions:

- **why did the accident happen?** RI is looking not just at the immediate and technical issues but also at the root causes;
- **what remedial action needs to be taken** to prevent a further accident? RI can insist on immediate or longer-term remedial action as appropriate, using wide-ranging powers under the Health and Safety at Work etc Act 1974 (HSWA);
- **does what was done (or undone) merit further enforcement action (including prosecution)?** A prosecution could be taken under HSWA or, if there was evidence of gross negligence, the Crown Prosecution Service could be asked to consider a charge of manslaughter, which is outside the scope of the charges that HSE is empowered to deal with.

4. The final report will take some time to complete but, as significant findings come to light, RI will make them public and will also take action where this is appropriate. This interim report sets out the initial findings from the first three days' worth of work.

5. **Key points**

- The immediate cause of the accident appears to be that the Thames Train passed a red signal (a "signal at danger") some 700m before the collision point. The reasons why the train passed the red light are likely to be complex. RI will be looking at the underlying causes as well as any more obvious ones. Our belief is that it is a systems failure and that any action or omission on the part of the driver was only one factor.
• Analysis of data tapes suggest that the signalling equipment is unlikely to have been at fault. This cannot be fully confirmed until all the testing of the trackside equipment relevant to signal SN109 has been completed.

• Early evidence suggests that the accident would have been prevented by installation and correct operation of a Train Protection Warning System (TPWS). Moreover the signal in question is one which is required to be fitted with TPWS by 31 December 2003 by virtue of the recent Railway Safety Regulations 1999.

• As part of a pilot scheme, Automatic Train Protection (ATP) equipment was fitted to the Great Western train. However, experience has shown the ATP to suffer from reliability problems and the equipment was switched off because it was not operational. However, on the evidence gained so far, this was unlikely to have had a bearing on the accident. Because of other investigations it has not yet been possible to establish if the ATP in the rear cab was working.

• Despite substantial damage to the leading vehicle of the Great Western train, we know that the driver's Automatic Warning System device was not switched off. However, we cannot tell whether it was operational at this stage, neither is the result likely to have any bearing on the accident

Layout of the accident site

6. A greatly simplified diagram at Appendix 1 (for illustrative purposes only) shows the layout of the lines where the accident happened, which is also described in the following paragraphs.

7. To the west of Ladbroke Grove Junction there are four running lines:

• the Up and Down Main lines and
• the Up and Down Relief lines.

The "Up" direction of travel is towards Paddington.

8. To the east of Ladbroke Grove Junction there are six bi-directional running lines identified as Lines 1 to 6. At the junction there are connections between the various lines.

9. The Up Main line becomes Line 2. There is a high-speed connection from the Up Main Line to Line 3 just to the east of the Up Main line signal SN120 for trains travelling towards Paddington. Further to the east there is a crossover between Line 3 and the Down Relief line. Further east still there is another crossover from Line 3 to the Up Main line and another crossover between the Up and Down Main lines which allows trains travelling towards Reading to cross from Line 3 to the Down Main line. Line 3 does not extend to the west of Ladbroke Grove Junction.

Signal SN109
10. Access from Line 3 to either the Down Main or Down Relief lines, for trains travelling towards Reading, is controlled by signal SN109. The signal is located on a gantry which spans all six of the lines and which also carries signals for each of the other lines. The distance between signal SN120 on the Up Main line and Signal SN109 on Line 3 is some 700m.

The signalling system

11. The signalling at Paddington is controlled by a Solid State Interlocking (SSI) system located at the Slough Control Centre. The system also includes a computer-driven Automatic Route Setting (ARS) facility. ARS requests the SSI to set routes for trains in accordance with a pre-loaded timetable, instead of the signaller doing it manually. On the morning of the collision the ARS was in use and the signaller at the Control Centre was visually monitoring the progress of trains, using VDU displays on the control desk.

The routes set for the two trains

12. The 6.03 Cheltenham to Paddington train (train 1A09) was following an earlier train along the Up Main line towards Paddington. After the signals had turned back to red behind the previous train, they progressively turned back through yellow to double yellow and then green as the train proceeded - which is normal. Therefore, 1A09 was travelling on green signals a safe distance behind the previous train.

13. The ARS had set a route for the 08.06 Paddington to Bedwyn train (train 1K20) up to Signal SN109 on Line 3. The train on leaving Paddington Station had travelled on Line 4 and crossed on to Line 3 on the approach to SN109.

Signalling systems: RI's findings so far

14. On the morning of Tuesday 5 October Mr Alan Cooksey, Deputy Chief Inspector of Railways, went directly to the control centre at Slough where he confirmed with the signallers what they had observed from the signalling displays. He also oversaw the removal of the data recording tape from the SSI and the initial analysis of the information it contained.

Analysis of the SSI data

15 There are data tape records of

- each instruction given to the SSI from the ARS or signaller
- the instructions given by the SSI to the signals and points
- the response from the signals and points
- the progress of the trains detected by the track circuits.

16. While a high level of confidence can be gained from the analysis of the SSI data tapes, we cannot absolutely confirm that all of the signal equipment at the site did function in accordance with the instructions issued by the SSI until each piece of equipment from the site has been tested. That work is in progress at the moment. In particular, we must be absolutely certain to ensure that although signal SN109 was
required to be showing a stop (red) aspect and reported back to the SSI as doing so, that there is no possibility, however unlikely, that it was showing any other aspect. What follows is the most likely sequence of events, based on present knowledge. RI's interpretation has now been confirmed by an additional independent report from W S Atkins.

17. The signaller who had been observing the progress of the trains on the VDU realised that train 1K20 had passed Signal SN109 and was heading towards the Up Main Line on which train 1A09 was approaching. He immediately changed signal SN120 on the Up Main Line to Danger. However, by that time train 1A09 must have been very close to the signal and travelling at speed (which needs to be confirmed when analysis of the data recorder from the rear cab is to hand) and the collision occurred almost simultaneously.

18. Examination of the SSI data tape confirms that the route for train 1A09 had been requested by the ARS, the instructions were processed by the SSI, and the commands issued to the computer modules which control the signals and points for a route from the Up Main Line to Line 2 and Paddington Station. The signal aspects displayed for 1A09 and its progress through the occupation and then clearing of the relevant track circuits were also confirmed from the data tapes.

19. The data tapes also confirm the ARS requesting the route up to Signal SN109, which was showing a red aspect, for train 1K20. Subject to the further tests outlined above, the likelihood is that train 1K20 therefore passed a red light. The data tapes show the progressive occupation of track circuits as train 1K20 passed signal SN109 and travelled some 700m into the path of train 1A09.

20. At the time train 1K20 approached Signal SN109 it appears that no other routes had been set which would have resulted in the other signals on the gantry showing any aspects other than red.

The other signals on the SN109 gantry

21. HSE has deployed two fire experts from the Health and Safety Laboratory to investigate the nature of the fire. They have made a survey of the fire damage where access has been possible to do this:

- A major fire appears to have occurred in Coach H of the HST but it has not yet been possible to investigate the nature and extent of this fire.

- Diesel fuel has been spilled over a wide area of the track and trackside. The sources of this fuel have been identified as the three fuel tanks from the Thames train and from the forward tanks of the HST. As a result of this spill, fires occurred in the central Thames train carriage and on the south side of Coaches C to H of the HST.

22. On this basis of what we know so far about the speed of train 1K20, the accident was preventable by the Train Protection Warning System (TPWS).
23. We have also made a videotaped reconstruction of 1K20's approach to signal SN109, which shows that there are issues relating to **signal siting** which need further investigation.

24. **Further lines of enquiry for RI's investigation** will include:

- checks on equipment, including the final checks of the signalling equipment
- further forensic work on the site, before it is cleared
- scrutiny and analysis of driver training and asset maintenance records.