

Report

The Performance of Cellmark Forensic Services

R v. [S]

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6 December 2013

FSR-R-625

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1. PURPOSE

- 1.1.1 This report sets out the results of a review, by the Forensic Science Regulator (the Regulator), of the performance of Cellmark Forensic Services (CFS) ¹ in the case of *R v. [S]*.

2. ASSISTANCE

- 2.1.1 The review and the preparation of the report were undertaken with the assistance of officials from the Forensic Science Regulation Unit of the Home Office.

3. INTRODUCTION

3.1 The Forensic Science Regulator

- 3.1.1 The position of the Forensic Science Regulator was proposed in HM Government's response [1] to the report² "Forensic Science on Trial" [2]. The creation of the position was announced by Meg Hillier MP (Parliamentary Under-Secretary of State at the Home Department) on 12 July 2007.
- 3.1.2 The role of the Regulator was described, in a Written Ministerial Statement [3], as follows:

"... will be to advise Government and the Criminal Justice System on quality standards in the provision of forensic science. This will involve identifying the requirement for new or improved quality standards; leading on the development of new standards where necessary; providing advice and guidance so that providers will be able to demonstrate compliance with common standards, for example, in procurement and in courts; ensuring that satisfactory arrangements exist to provide assurance and monitoring of the standards and reporting on quality standards generally."

- 3.1.3 Clearly the role focuses on quality standards within forensic science. It does not deal with market or economic regulation nor does it deal with what could be considered service delivery standards. In performing this role I am supported by the Forensic Science Advisory Council (FSAC).

¹ Orchid Cellmark is a registered trade mark of Orchid Cellmark Ltd.

² By the House of Commons Select Committee on Science and Technology.

3.1.4 Although my remit does not extend to Scotland or Northern Ireland, their respective authorities have agreed to join my work, and the FSAC, as full partners and, accordingly, to implement the resulting standards in their own jurisdictions. This will beneficially ensure the existence of UK-wide standards in forensic science.

3.1.5 It is a feature of the role that I am expected to investigate complaints or concerns raised as to the quality of forensic science supplied to the Criminal Justice Systems in the UK.

3.2 Cellmark Forensic Services

3.2.1 CFS is a commercial organisation which supplies a range of forensic science services to the Criminal Justice System in England and Wales.

3.2.2 It is accredited, by the United Kingdom Accreditation Service^{®3}, to ISO 17025 [4] for a number of the services provided – including DNA analysis.⁴ It is also approved by the Home Office for provision of data to the National DNA Database[®] (NDNAD).⁵

4. BACKGROUND

4.1 The Investigations

Scene 1

4.1.1 Over the weekend of 17-18 March 2012 the premises of [REDACTED], Stalybridge suffered damage to a window.

4.1.2 On 19 March a scene of crime officer attended the premises and two swabs were taken. These were described in the submission records as follows.

- a. PAC/2 - Moist/Dry app. Blood swabs + control. POE window exterior.
Taken by [REDACTED], 19/3/12. 11.23.

³ United Kingdom Accreditation Service is a registered trademark owned by the body of that name.

⁴ Certificate 2045, issue 36 with issue date 13 August 2013.

⁵ National DNA Database is a registered trademark owned by the Secretary of State for the Home Department.

- b. PAC/3 - Moist/Dry app. Blood swabs. Window frame below POE, external.
Taken by [REDACTED]. 19/3/12. 11.23.

4.1.3 At the time the swabs were taken a presumptive test for blood was performed and gave a positive result.

4.1.4 The swabs were taken to the secure store at the Rochdale crime scene investigation unit. They should have been stored in the main freezer.

Scene 2

4.1.5 Over the weekend of 17-18 March 2012 the premises of [REDACTED], Middleton suffered damage to a sliding door.

4.1.6 On 19 March a scene of crime officer attended the premises and two swabs were taken. These were described in the submission records as follows.

- a. JAM/2 – Saliva swab & control. Front L/H sliding door. Bottom rail where glass meets frame, O/S. Taken by CSI [REDACTED]. 19/3/12. 09.30.
- b. JAM/3 – Saliva swab & control. Step below front L/H sliding door, O/S. CSI [REDACTED]. 19/03/12. 09.30.

4.1.7 No presumptive tests were performed at the time the swabs were taken.

4.1.8 The swabs were taken to the secure crime scene investigation store at Rochdale on the same day. They should have been stored in the main freezer.

Submission

4.1.9 The swabs taken at both scenes were collected by CFS and taken to its facility at Chorley on 20 March.

4.1.10 On 21 March CFS transferred all of the swabs to its facility at Abingdon.

Examination

PAC/2

4.1.11 On 21 March, at 10:45, the exhibit was examined in a room described as "Exam" at workstation 7 by a scientist with initials [REDACTED].

- 4.1.12 A single chemical test for the presence of blood was performed and provided a positive result. A sample was removed and submitted for DNA analysis with identification F412086.
- 4.1.13 A complete DNA profile was obtained and this was added to the NDNAD on 26 March.
- 4.1.14 On 26 March the NDNAD reported a match between the profile obtained from exhibit PAC/2 and that of [S].
- PAC/3*
- 4.1.15 Exhibit PAC/3 was not examined as a consequence of the result obtained from PAC/2.
- JAM/2*
- 4.1.16 On 21 March, at 10:45, the exhibit was examined in a room described as “Exam” at workstation 4 by a scientist with initials [REDACTED].
- 4.1.17 Two presumptive chemical tests for the presence of blood were performed and both provided a positive result. A sample was removed and submitted for DNA analysis with identification number F412087.
- 4.1.18 A complete DNA profile was obtained and this was added to the NDNAD on 26 March.
- 4.1.19 On 27 March the NDNAD reported a match between the profile obtained from exhibit JAM/2 and that of [S].
- JAM/3*
- 4.1.20 Exhibit JAM/3 was not examined as a consequence of the result obtained from JAM/2.
- 4.2 Arrest and Charge**
- 4.2.1 On 24 April [S] was arrested in relation to the incidents at both scenes discussed above.
- 4.2.2 He was charged, on the same day, with two counts of attempted burglary.

4.2.3 [S] conceded that he was present at scene 1, had caused the damage and was the source of the blood. I understand he stated the damage was the result of an accident [REDACTED].

4.2.4 [S] denied being present at scene 2. As a result a request was made, to CFS, for a full statement. The statement, by [REDACTED], was issued on 1 June.

4.2.5 The conclusions set out in the statement were worded as follows.

“A complete DNA profile, indicative of having originated from a male, was obtained from the DNA tested from the swab (item JAM/2), taken from the bottom rail on the outside of a front sliding door at [REDACTED], Middleton, Manchester. This DNA profile matches the reference DNA profile of [S], such that this DNA could have come from him.

[My opinion as to the strength of the DNA profiling evidence is provided here for the benefit of the prosecution and defence. In the event of a not guilty plea, all the words within these square brackets should be deleted from my statement to avoid contravening the Court of Appeal ruling in R. v. Doheny (1997).

In expressing the evidential significance of my findings I have used the following scale of scientific support: no support, weak, moderate, moderately strong, strong, very strong, extremely strong support.

In my opinion the DNA profiling results provide extremely strong scientific support for the proposition that the DNA tested from the swab (item JAM/2), taken from the bottom rail on the outside of a front sliding door at [REDACTED], Middleton, Manchester, originates from [S], rather than from another person unrelated to him.]”

4.2.6 The conclusions are restricted to commenting on the source of the DNA. No comment is made as to the relationship of the DNA to the activities at the scene.

4.3 Post Charge Developments

4.3.1 Following the charging of [S] a defence examination was performed by [REDACTED] of Keith Borer Consultants (KBC).

4.3.2 On 25 October I was advised by KBC that it had concerns about this case and believed the results obtained could be the consequence of contamination. I explained that it was not part of my role to investigate issues specific to individual cases or to interfere in active investigations/prosecutions. I would,

however, consider any general issues once the risk of interfering with the CJS had ended.

- 4.3.3 On 7 November I informed Greater Manchester Police (GMP) that I had been contacted in this case and that concerns had been raised as to the reliability of the DNA profiling results obtained from exhibit JAM/2.
- 4.3.4 Following discussions with CFS, GMP asked, on 21 November, for JAM/3 to be examined.
- 4.3.5 On 28 November GMP was informed, by the NDNAD, that the DNA profile obtained from the examination of JAM/3 matched that of [W].
- 4.3.6 On 29 November CFS contacted GMP to explain that the DNA profile obtained from JAM/3 was different from that obtained from JAM/2. CFS considered there was a potential problem with the result reported to be from JAM/2 and had initiated an investigation.
- 4.3.7 On 4 December GMP received notification from CFS that the DNA profile which had been reported as arising from JAM/2 was not from JAM/2.
- 4.3.8 On 4 December I was contacted, independently, by GMP and CFS to advise me of this issue. At that point I confirmed that the Crown Prosecution Service (CPS) had been informed.
- 4.3.9 Following these developments the charges against [S] were reduced to a single count of criminal damage.

5. THE REVIEW

5.1 Nature of Review

- 5.1.1 The case raised issues of more general significance and the risk of interfering with the CJS had ended. I therefore decided to review the matter.
- 5.1.2 The aims of the review were as follows.
 - a. To investigate the referral from CFS and GMP to establish the root cause of the incident.
 - b. To assess the corrective actions.

- c. To assess the actions taken to establish whether or not there have been previous incidents of this nature within CFS.
- d. To determine whether there is a risk of similar events having occurred in other forensic science suppliers,
- e. To establish whether the incident raises any other issues or questions regarding the quality standards that applied.
- f. To brief and advise Ministers on issues arising from the referral.

5.1.3 In performing the review I liaised with the Chair of the National DNA Database Strategy Board and the CPS to coordinate activities.

5.1.4 The review followed the following course.

- a. I reviewed the material provided by KBC.
- b. I visited CFS on 7th December 2012 to consider the results, to that date, of the internal investigation into the case and the steps taken in response to that investigation.
- c. I visited CFS on 7th January 2013 to consider the complete internal investigation and steps taken by CFS.
- d. On 15th January 2013 the material in the case was reviewed with GMP.

6. CONSIDERATION

6.1 Greater Manchester Police Procedures

6.1.1 The approach to the case was discussed with GMP. The normal force practices indicate that the following course of action would have been followed in relation to the swabs.

- a. The swabs would have been used to sample the target and returned to the tubes in which they are provided. The tubes would be closed and relevant information written on the tube.
- b. The tubes would have been placed in a tamper evident bag which would have been sealed at the scene. Relevant information would have been written on the bag.
- c. The swabs would have been returned to the unit at Rochdale and placed in the freezer to await collection by CFS.

- d. The swabs would have been removed from the freezer and placed in a container, still in the tamper evident bags, in anticipation of collection by CFS. The container would have been sealed.
- e. The container would have been collected by CFS and transferred to its facility.

6.2 Charges

6.2.1 It appears likely that [S] was charged with attempted burglary because of the DNA evidence link to two separate scenes. Had there only been a link to scene 1 there would probably only have been a single charge of criminal damage.

6.2.2 In relation to scene 1 the presence of blood, and a DNA profile from that blood, in association with a broken window does provide evidence to support [S] involvement in the incident. This is particularly true when combined with an admission.

6.2.3 In relation to scene 2 the presence of the saliva, and a DNA profile from that saliva, does not provide a direct link to the attempt to force entry (assuming that there was such an attempt).

6.3 Keith Borer Consultants

6.3.1 Having reviewed the case KBC, on the basis that [S] was telling the truth, concluded that there must have been a processing error that led to his profile being obtained from JAM/2. A number of options were considered.

- a. The contamination of JAM/2 from PAC/2 was considered but thought unlikely as the profile obtained from JAM/2 was a single source profile. It would be expected that there would be some DNA on JAM/2 before the contamination leading to a mixed profile.
- b. That the swabs had been switched while in the possession of CFS. This was considered unlikely as different types of swab were used at the different scenes and the practicalities were difficult to envisage.
- c. That the swabs had been switched while in the possession of GMP. It was recognised that this would only be possible if staff had not followed standard GMP processes.

- 6.3.2 KBC did not offer a clear opinion as to the source of the problem.
- 6.3.3 KBC did note a further anomaly. JAM/2 was described as a swab taken from saliva on the glass at the scene. However, it was stained and gave the appearance of having been used to sample blood. CFS tested this swab for blood and got two positive results. It was not tested for the presence of saliva.⁶
- 6.3.4 It must be borne in mind that the views of KBC were expressed at a point where the available information was the DNA profiles from the samples.

6.4 Greater Manchester Police Sample Handling

- 6.4.1 In light of the points raised by KBC the handling of samples was reviewed with GMP. There is no evidence that GMP staff failed to follow the normal procedures set out above.
- 6.4.2 The apparent discrepancy in the description of the material sampled with swab JAM/2 was considered. The photographs from the scene show that the saliva on the glass was contaminated with red material which looked like blood. The matter was raised with the member of staff who took the sample and he was of the view the saliva was contaminated with blood – but this was not part of the recorded description.

6.5 Cellmark Forensic Services Procedures

Overview

- 6.5.1 For crime stain samples CFS employs a semi-automated process. This is a result of (a) the variability of the sample types submitted, (b) the variability of the level of DNA on those samples and (c) the contractual delivery times.
- 6.5.2 The items are examined and material selected for extraction of DNA. The extraction is an automated system which uses two robots. Each robot handles 6 samples. These would, in total, comprise 11 case samples and one control.

⁶ A presumptive test for saliva was not performed as a result of the contractual provisions in place.

- 6.5.3 After extraction the amount of DNA in the extract is estimated using the Quantifiler^{® 7} system.
- 6.5.4 Where samples have a high level of DNA the amount of dilution required to obtain the optimum quantity of DNA for the PCR amplification process is determined. The relevant samples are then subjected to the dilution process – see below.
- 6.5.5 Once the necessary samples have been diluted the samples are transferred to a thermocycler for DNA amplification.
- 6.5.6 The amplified DNA is then analysed using a ABI 3100 DNA Sequencer.
- 6.5.7 The DNA profiling results are checked against all other results obtained in the previous 3 months.⁸ Where a match is found the “embargo” process is triggered. This is discussed below.

Dilution

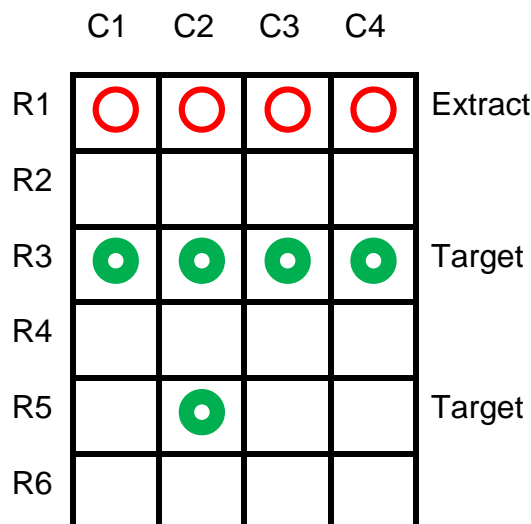
- 6.5.8 The process of dilution follows the steps set out below.
- a. The tubes containing the product of the extraction process (extract tubes) are transferred to a tray containing positions to hold the tubes in a series of rows and columns. The tubes are positioned along a row in sequential order.
 - b. The tubes into which the extract is to be transferred as part of the dilution process (target tubes) are placed in the tray corresponding to the relevant extract tube. If an extract tube is in position Column 1 Row 1 (C1R1) then the related target tube would be placed in the same column – for example at position C1R3.
 - c. In some cases sequential dilution is employed.⁹ In this process the sample would be transferred from the extract tube to the first target tube and subsequently from the first target tube to the second target tube. In

⁷ Quantifiler is a registered trade mark owned by Applied Biosystems.

⁸ Historically the check was against all results on the LIMS but, following a direction from the NDNAD, this has been limited to 3 months.

⁹ Sequential dilution is employed where the level of DNA requires a high level of dilution. Pipetting very small quantities is not very accurate so a larger quantity is pipetted into the first target tube and again from the first to the second target tube.

such cases the target tubes may be placed at positions C2R3 and C2R5 – assuming the extract tube is at C2R1. The result is illustrated below.



- d. The appropriate quantity of buffer is placed in the target tubes.
- e. The correct location of all extract tubes and target tubes is checked by a second scientist.
- f. The operator then checks, with a second scientist, the amount of extract to be transferred from the extract tube to the target.
- g. Once all transfers have been completed the second scientist checks that all of the extract tubes and target tubes are in the expected positions.

6.5.9 Many scientists at CFS adopt a process of moving the tubes during the transfer. For example if the extract tube is at C1R1 and the target tube at C1R3, the scientist would pick up the extract tube to take the sample and place it back at C1R2 and pick up the target tube to pipette the material in and put it down at C1R4. It is therefore clear what samples have already been handled.¹⁰ This was not part of the written CFS procedures.

6.5.10 The result of one version of this process, after the transfer of material in columns 1 and 2 is illustrated below.

¹⁰ This approach was standard practice in the Forensic Science Service following a recommendation made by Jack Fish (then a FSS laboratory director) apparently following an investigation into a liquid handling problem in the early 1980s.

	C1	C2	C3	C4	
R1			○	○	Extract
R2	○	○			
R3			●	●	Target
R4	●	●			
R5					Target
R6		●			

6.5.11 This approach has the advantage that the tubes which have been used are clear,

Embargo Process

6.5.12 Where the DNA analysis produces a profile which has 6 or more allele designations in common with a profile loaded to the LIMS in the previous 3 months the embargo process is triggered.

6.5.13 Once the process is triggered (which involves recording the matter as a non-conformance in the quality management system) the scientist has to consider whether there is a risk that one of the results is not reliable. This includes consideration of issues such as the following.

- a. Whether the profiles matched.
- b. Whether the results were generated from the same batch or on the same day?
- c. The nature of the profiles. Were they high quality single source profiles or mixtures?
- d. What were the levels of DNA in the samples?
- e. What were the offence types?
- f. Where were the offences committed?

6.5.14 It must be noted that the forensic scientist may have to make the decision with limited information.

6.5.15 Where the scientist considered there might be an issue they would commission further work. Depending on the circumstances this may have been re-analysis starting from the extract or going back to the exhibit to start again.

6.6 Analysis of JAM/2

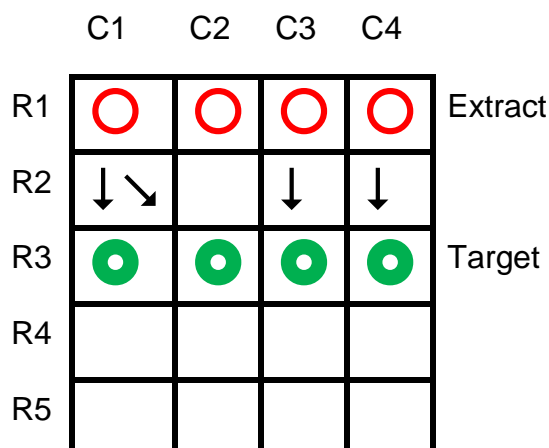
6.6.1 It has been determined that the profile reported to have been generated from JAM/2 was, in fact, not from that sample. This is clear because:

- a. JAM/3 was analysed and a good quality single source DNA profile obtained which matched the profile of [W]; and
- b. JAM/2 has been re-analysed and the result obtained was a good quality single source profile which matched the profile of [W].

6.6.2 This matter has been investigated by CFS and it believes the reason for the wrong profile being obtained for JAM/2 was the following sequence of events in the dilution process.

- a. The extracts from PAC/2 and JAM/2 were identified as requiring dilution.
- b. The extract tubes from these samples were placed in adjacent positions in the tray.
- c. The scientist picked up the extract tube related to PAC/2 and transferred material to the target tube for PAC/2.
- d. The scientist then picked up the extract tube related to PAC/2 again and transferred material to the target tube for JAM/2.
- e. The extract tube related to JAM/2 was not used as a source of material for any target tube.

6.6.3 This process is illustrated below.



6.6.4 It is possible that, if sequential dilution were employed, the pattern described above would have occurred in relation to the transfer from the first target tube to the second target tube as opposed to the transfer from the extract tube.

6.6.5 The evidence to support this conclusion is as follows.

- a. The re-analysis shows that the extract tubes related to PAC/2 and JAM/2 contained the correct extracts so the problem could not have occurred before the dilution stage.
- b. When the analysis of JAM/3 was performed the profile of [W] was obtained. It had not been seen on CFS systems previously. This means the error was not the result of a sample swap – as both the profiles of [S] and [W] would still have been obtained. Instead it indicates the extract from JAM/2 did not progress through the analytical process. This suggests two points where the error could have occurred. The first is at the dilution stage. The second is the transfer of the sample from the PCR tube to the capillary electrophoresis plate. The latter is not believed to be the relevant point for the following reasons.
 - i. The transfer from the PCR tube was a witnessed process where the actual dilution (as opposed to the numbers on the tubes) was not.
 - ii. Had the error occurred at the transfer from the PCR tube the capillary electrophoresis results obtained from both samples should have been very similar (as the same sample would have been run through

the capillary electrophoresis system twice). The results were, in fact, different.¹¹

iii. If the error occurred at the dilution stage the capillary electrophoresis results could have been different because the dilution process involves different levels of dilution for each sample.¹²

c. The profiles obtained from PAC/2 and, apparently, from JAM/2 in the original analysis were good quality, single source, profiles which indicates that contamination was not the cause.

6.6.6 The volumes in the extract tubes could not be analysed to assist the investigations as the volumes were very small and the differences after samples had been removed in the dilution process small. The contents of the target tubes could not be analysed as these were no longer retained.

6.6.7 The “embargo” process was triggered by the generation of the same profile apparently from PAC/2 and JAM/2. However, the scientist concluded that there was no problem. Factors which were relevant include the following.

- a. The scientist was not aware of the fact the two samples were adjacent in the dilution process.
- b. Both profiles were good quality single source profiles.
- c. The offences were of a similar type.
- d. The offences were in the same area.

6.6.8 As a result both results were provided to the NDNAD.

6.7 Statement

6.7.1 The statement issued on 1st June provided a conclusion in relation to the match between the DNA profile obtained from JAM/2. No conclusions were provided in relation to the activities which may have occurred at the scenes.

6.7.2 This appears appropriate.

¹¹ While the DNA profiles determined from the results were the same the actual electropherograms output by the system were different. The peak heights in the EPG identified as being from F412086 (from PAC/2) were in the approximate range 1500-2200 RFU. Those from the EPG identified as being from F412087 were in the approximate range 400-500 RFU.

¹² The dilution planned for PAC/2 was 1:10 where the dilution for JAM/2 was to be 1:100.

6.8 Cellmark Forensic Services Response - Prevention

6.8.1 Having identified the cause of the problem CFS introduced modifications to its process to prevent a re-occurrence.

Dilution Process

6.8.2 The dilution process has been modified.

- a. The target tubes are now being labelled with printed labels (rather than hand written) to avoid the risk of transcription errors – even though this was not thought to be an issue in this case.
- b. The use of sequential dilution has been abandoned. As each liquid transfer created a risk of error the aim was to minimise the number. While the accuracy of the dilution process is reduced the impact on the resultant profile is not sufficient to cause a problem.
- c. The scientist performing the dilution will now have to read the number on the extraction and target tubes to a second scientist to ensure they match.
- d. The extraction and target tubes will be moved as part of the process so it is clear what samples have been dealt with.
- e. The dilution process will be witnessed.

Embargo Process

6.8.3 The embargo process has been modified.

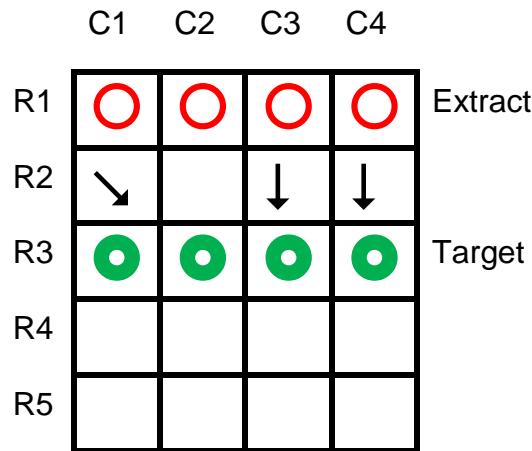
- a. The fact samples have been involved in the dilution process will be flagged as part of the process.
- b. Scientists have been advised to commission additional work in any case where the embargoed results were produced on the same day.

Swap and Omission

6.8.4 Consideration was given to a case where the following sequence occurred.

- a. Material from the extract tube at C1R1 was transferred to the target tube at C2R3.
- b. The extract at C2R1 was not used.
- c. Material from all extract tubes from C3 onwards is transferred correctly.

6.8.5 This process is illustrated below.



6.8.6 This would result in the profile which should have been linked to the extract in the first column being linked to the extract in the second column. This profile would only appear once and, as a result, the embargo process would not be triggered.

6.8.7 In this scenario it would appear that no DNA profile was obtained from the extract at column 1. As the dilution process is only employed with samples that have a high level of DNA this would be considered unusual and lead to a re-analysis of the sample. At that point the duplicate profile would be obtained and the embargo process be triggered. The problem would be identified.

6.8.8 There are variants in this scenario, For example all extracts could be pipetted to the target tube one column to the right. These lead to one extract not being transferred to the next stage with the consequence that there would be an investigation.

6.8.9 It follows that the preventative steps taken cover these scenarios.

6.9 Cellmark Forensic Services Response – Investigation

6.9.1 Having identified the cause of the problem CFS initiated an investigation to identify any cases where this problem could have occurred in the past.

6.9.2 It identified those cases at risk as follows.

- a. The risk only exists in relation to crime stain samples.
- b. The risk only applies to crime stains which were subjected to the dilution process.
- c. The risk will only exist where the embargo process has been triggered.
- d. The risk will only exist where the samples were handled in the same batch.
- e. The risk is highest when the samples were adjacent in the dilution process but cannot be eliminated as long as they were in the same batch.

6.9.3 Clearly as the embargo process will have been triggered in any applicable case there may already have been re-analysis in a number of the cases.

6.9.4 CFS reviewed approximately 550,000 crime stain DNA profiles generated since 1999. It identified 268 samples where there was a risk of the same problem having occurred.

6.9.5 A process was implemented for each of those cases to be re-investigated. By 5 January 2013 all of the samples where an error may have occurred were re-profiled. In every case the profile originally reported was confirmed as correct.

7. CONCLUSIONS

7.1 The Cause of the Error

Greater Manchester Police

7.1.1 The first potential source of the error is the swapping or cross-contamination of samples while in the control of GMP.

7.1.2 I do not believe this is the source of the error.

- a. It could not have occurred unless GMP procedures were not complied with and there is no evidence to suggest this is the case.
- b. The investigation by CFS demonstrates that:
 - i. The samples were associated with the correct identifications up to the point of the dilution process; and
 - ii. The samples were not cross-contaminated.

Cellmark Forensic Services

7.1.3 The second potential source of the error is the swapping or cross-contamination of the samples while in the control of CFS.

7.1.4 I do not believe this is the source of the error.

- a. The samples could not have been swapped.
 - i. One profile was not obtained as opposed to two profiles being related to the wrong samples.
 - ii. The investigation has shown the right profiles could be obtained from the extracts.
- b. The samples do not appear to be cross-contaminated.
 - i. The profiles obtained were not mixed source profiles.
 - ii. The correct single source profiles could be obtained from the extracts.

7.1.5 The third potential source of the error is a handling error during the analytical process.

7.1.6 This appears to be the cause of the error.

- a. The evidence is clear that the error occurred after the extraction process.
- b. The error caused a sample to not progress through the analytical process.
- c. The only apparent source would be one of the liquid transfer processes.
- d. The evidence strongly suggests it was the dilution process which was the source of the problem.

7.2 Cellmark Forensic Services Investigation

7.2.1 CFS has reviewed all cases, since 1999, where this error may have occurred. No further occurrences have been found.

7.3 Preventative Measures

Cellmark Forensic Services

7.3.1 CFS has taken steps to reduce the risk of the problem re-occurring and has improved the process for detecting an occurrence.

Other Suppliers

7.3.2 Depending on the sample handling and analytical processes employed by other forensic science laboratories the risk of a similar liquid handling error may exist.

7.3.3 I will therefore write to all forensic science laboratories undertaking DNA analysis in the UK to:

- a. Explain the error, and the cause of the error, in the case of [S];
- b. Ask them to review the processes employed in their laboratories to determine whether the risk of such an event exists; and
- c. If such a risk does exist ask them to take steps to manage the risk and review whether errors may have occurred in previous cases.

General

7.3.4 I will review the standards for DNA profiling to ensure that appropriate standards are in place to minimise the risk of sample handling errors affecting the results.

7.4 Criminal Prosecutions

7.4.1 Over the last year I have published reports in relation to two cases where individuals were charged with an offence on the basis of a DNA profile which was subsequently found to be unreliable. These are the cases of [S] and Mr Scott [5].

7.4.2 The courts have made clear that prosecuting on DNA evidence alone is a dangerous approach.¹³ It therefore appears unlikely that a successful prosecution could be mounted on such a basis. I believe the CPS would be unlikely to attempt a prosecution in such circumstances.

7.4.3 There is, however, a question as to the level of reliance some police and/or CPS staff place on unsupported DNA evidence when making decisions about charging.

7.4.4 I shall raise this matter with the policy lead at CPS headquarters.

¹³ See *R v. Lashley* [2000] EWCA Crim 88 and *R v. Ogden* [2013] EWCA Crim 1294.

8. ACKNOWLEDGEMENTS

8.1.1 I would like to thank:

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- d. Ms J Guinness OBE and Dr J Adams of the Home Office for their assistance with the review and preparation of the report.

9. REFERENCES

- 1 Forensic Science on Trial: Government Response to the Committee's Seventh Report of Session 2004–05, 2005.
- 2 Forensic Science on Trial, Report of the House of Commons Select Committee on Science and Technology, 2005.
- 3 House of Commons Hansard, 12 July 2007, Column 67WS.
- 4 BS ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories.
- 5 Forensic Science Regulator, Report into the circumstances of a complaint received from the Greater Manchester Police on 7 March 2012 regarding DNA evidence provided by LGC Forensics, FSR-R-618, 2012.

10. ABBREVIATIONS

Abbreviation	Meaning
BS	British Standard
CFS	Cellmark Forensic Services
Crim	In conjunction with EWCA means Criminal Division
CPS	Crown Prosecution Service

CSI	Crime Scene Investigator
DNA	Deoxyribonucleic acid
EPG	Electropherogram
EWCA	England and Wales Court of Appeal
FSAC	Forensic Science Advisory Council
FSS	Forensic Science Service
GMP	Greater Manchester Police
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
KBC	Keith Borer Consultants
L/H	Left Hand
LIMS	Laboratory Information Management System
Ltd	Limited
MP	Member of Parliament
MSc	Master of Science
NDNAD	National DNA Database
OBE	Order of the British Empire
O/S	Outside
PCR	Polymerase Chain Reaction
POE	Point of Entry
RFU	Relative Fluorescence Units
UK	United Kingdom