NOT PROTECTIVELY MARKED

ANALYSIS OF CURRENCY

FOR TARGET CONTROLLED DRUGS

REPORT TO THE FORENSIC SCIENCE REGULATOR

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1 Purpose

1.1.1 This report sets out the results of a preliminary consideration of issues related to the analysis of currency for target[1] controlled drugs[2]. This consideration was initiated in response to concerns raised by the Council for the Registration of Forensic Practitioners (CRFP).

1.1.2 The purpose of this report is to inform the Forensic Science Regulator (Regulator) and to advise as to whether he should instigate a formal review of the use of this type of evidence in the Criminal Justice System (CJS).

2 Introduction

2.1 Referral from CRFP

2.1.1 The CRFP was a company limited by guarantee which stated that its purpose was to "promote public confidence in forensic practice in the UK". It achieved this, at least in part, by[3]:

> "Publishing a register of currently competent forensic practitioners,
>
> Ensuring through periodic revalidation (re-assessment) that registered practitioners keep up-to-date and maintain competence,
>
> Dealing with registered practitioners who fail to meet the necessary standards."

2.1.2 The registration, or re-registration, of forensic practitioners employed by Mass Spec Analytical Ltd. (MSA) generated a debate among the CRFP assessors as to the nature of the work undertaken by MSA. This debate appears to have related to two separate issues. The first was whether the analyses performed by MSA scientists covered sufficient breadth to have warranted accreditation within the CRFP framework. The second related to the techniques employed by MSA.

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1 The term target indicates the sub-set of controlled drugs for which analysis is performed.
2 In this report "controlled drugs" means substances listed in Schedule 2 of the Misuse of Drugs Act 1971 (as amended).
3 Taken from CRFP Internet site www.crfp.org.uk - which is now closed.

2.1.3 The CRFP contacted the Regulator to enquire whether a formal view had been taken as to the suitability of the techniques employed by MSA.

2.2 Mass Spec Analytical Ltd

2.2.1 Mass Spec Analytical Ltd is a company based in the Bristol area. It provides analytical testing services, particularly in relation to controlled drugs. Many of the services offered are based on mass spectrometry analysis.

3 Approach Adopted

3.1 Issues Raised

3.1.1 The initial contact from the CRFP was by e-mail from a representative of the relevant panel within the CRFP. This was in the form of an enquiry as to whether the Regulator would consider issues raised by the CRFP.

3.1.2 Having decided that he would consider issues raised by CRFP with regard to the suitability of the techniques employed by MSA (but not any issues related to who the CRFP should register) the Regulator asked the CEO of the CRFP to make a formal submission.

3.1.3 The CRFP provided a formal reference dated 13 June 2008.

3.1.4 Having considered the reference from the CRFP the Regulator sought clarification of the matters raised. This clarification was obtained in a meeting with a representative of the relevant panel of the CRFP on 20 June 2008.

3.2 Judgment Search

3.2.1 The publicly available judgments[4] of the courts in the UK were searched for cases involving MSA, references to the analysis of banknotes/currency for controlled drugs or the names of scientists known to work for MSA. This highlighted a number of judgments [1-12]. These involved cases in England and Wales, Scotland and Northern Ireland and covered both criminal and civil (asset recovery) cases.

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[4] Available on the British and Irish Legal Information Institute Internet site www.bailii.org.

3.2.2 In many of these cases the evidence provided by MSA amounted to one part of a larger picture of evidence. However, in some cases it was the most significant evidence.

3.3 Mass Spec Analytical

3.3.1 Having clarified the issues raised by the CRFP the Regulator contacted MSA to set out the issues raised and offer the opportunity to respond. The Regulator also suggested a meeting to review the issues.

3.3.2 MSA provided responses to the Regulator on 11 July and 16 July 2008.

3.3.3 A meeting occurred on 6 August 2008 where staff from MSA presented material on the services provided and the issues raised by CRFP. In preparation for that meeting MSA provided a portfolio of supporting material to the Regulator.

3.3.4 MSA also provided a tour of its facilities and a demonstration of the methodology employed.

3.3.5 MSA also provided further information in response to requests from the Regulator's office.

3.4 Mr P Bottomley

3.4.1 The judgments noted above included a number of cases where Mr Peter Bottomley[5] acted as an expert witness and challenged the evidence provided by MSA.

3.4.2 In light of the above, Mr Bottomley was contacted and his views on the analysis of banknotes for controlled drugs were sought.

3.5 HOSDB

3.5.1 In light of the issues under consideration the Regulator sought assistance from the Home Office Scientific Development Branch (HOSDB) and, in particular, the Counter Drugs Technologies Programme.

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[5] Mr Bottomley was a senior scientist with the Laboratory of the Government Chemist (which later became LGC Ltd.) and has, relatively recently, founded his own forensic science consultancy.

3.5.2 A representative of HOSDB assisted the Regulator by advising on technical issues and attending the meeting with MSA.

3.6 PSSG

3.6.1 The issues raised in relation to interpretation included statistical issues. Advice was therefore sought from the Professional Statistical Support Group (PSSG) of the Home Office.

3.7 CPS

3.7.1 The review of judgments, discussed at 3.2 above, highlighted issues related to the way in which the results of the technique were employed in determining appropriate charges and deployed in evidence.

3.7.2 Representatives of the Crown Prosecution Service (CPS) were therefore asked to provide views on the manner in which the results should be employed.

3.7.3 In light of the issues noted at 4.5 the CPS was also asked to provide views as to the admissibility of this type of evidence.

4 Consideration

4.1 The Technique

Sampling

4.1.1 The technique used to sample the notes has changed since the introduction of the service. At one stage the material for analysis was obtained by collecting “dust” from the banknotes by means of a custom designed attachment to a vacuum cleaner [13]. The current system employs a process of direct thermal desorption from the notes [14-16].

4.1.2 The thermal desorption process involves placing a section of the banknote between two metal plates held at a temperature of 285°C. Airflow is maintained through the plates at 25L/min [16] which draws the material desorbed from the note into the analytical system.

Analysis

4.1.3 The analysis is performed on a triple quadrupole mass spectrometer (also referred to as tandem mass spectrometer or MS-MS) [13, 16-17].

4.1.4 Triple quadrupole systems routinely employ the first quadrupole as a mass filter, the second as a collision cell and the third as a mass filter [18-19]. This allows the investigator to select ions of appropriate mass[6] to pass the first quadrupole. These ions can be subjected to the fragmentation processes in the second quadrupole and the third quadrupole set to monitor for ions (product ions) known to be created by the fragmentation of the molecule of interest.

4.1.5 In the MSA analytical methodology the material vaporised from the banknotes is carried into the atmospheric pressure chemical ionisation (APCI) system. This process tends to produce the protonated molecular ion for the controlled drugs of interest [17].

4.1.6 The first quadrupole is configured to allow ions having the mass of the protonated molecular ion of interest to pass. Thus, for example, when monitoring for cocaine the first quadrupole mass filter would be configured to allow ions of mass 304 (one atomic mass unit greater than the mass of cocaine) to pass [17].

4.1.7 In the second quadrupole a collision induced dissociation (CID) process is employed to cause the protonated molecular ions to fragment into characteristic product ions [17].

4.1.8 The third quadrupole is employed as a mass filter and used to detect a number of the product ions noted above. For each controlled drug of interest two product ions are monitored [17]. The ions monitored are selected to be characteristic of the reactions occurring and have been published [16-17].

4.1.9 Identification on the basis of two ions produced by the fragmentation of the molecular ion is in line with the recommendations of the Valid Analytical Measurement Programme [20].

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[6] The selection of ions is based on the mass to charge ratio rather than mass but, as the process employed by MSA tends to produce the protonated molecular ion, the term mass shall be used in this paper.

Carry Over

4.1.10 The analytical system provides real-time, on-screen results. This allows the operator to monitor the baseline and ensure material from the note under examination has passed through the system before the next note is analysed. This ensures that material originating from one note is not taken as contributing to the result for the next note analysed.

Laboratory Contamination

4.1.11 The MSA site employs separate laboratories for trace drug analysis and work involving larger quantities of controlled drugs.

4.1.12 The real-time presentation of results allows MSA to maintain a number of anti-contamination measures [16].

4.1.13 Staff performing the analysis wear disposable gloves and all surfaces employed for handling the exhibits are covered in new aluminium foil. Both the gloves and foil are swabbed and these swabs tested for the presence of target controlled drugs prior to opening the exhibit bags. If any target controlled drugs are found the work is suspended, corrective steps taken and the items tested again.

4.1.14 The exterior and interior of the exhibit bags are also tested prior to analysis of the exhibits.

4.1.15 The equipment draws air from the laboratory through the analytical system at a rate of approximately 25L/min [16]. Contamination of the laboratory environment with the target controlled drugs for which analysis was being undertaken would therefore be identified.

4.2 Specificity

Technique

4.2.1 The CRFP raised the issue that:

> "… apparently MSA only use this one method of examination and do not confirm their identification of trace material using a second, non-correlated method (that

is, a method the results of which are based on completely different properties of the substances being identified).

This confirmatory approach using two independent methods is recommended internationally and is widely accepted."

4.2.2 It is a widely accepted approach in forensic drugs analysis to employ two techniques for the identification of controlled drugs. This is based on the fact that two different substances may have similar (or even identical) results when subjected to one analytical technique. The probability that the two substances will have similar, or identical, results in a different analytical technique which targets properties of the substance unrelated to the first technique is very low.

4.2.3 The features of the MSA approach noted above reflect the recommendations of the Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG) [21][7]. These set out three categories of analysis in order of decreasing discriminating power from A to C (mass spectrometry is a category A technique). It recommends that, when a validated category A technique is employed it is confirmed by at least one other technique from category A - C. It also states that hyphenated techniques can be employed and would be considered as separate techniques.

4.2.4 The analytical method employed by MSA utilises mass spectrometry only. However, the technique is used (in an approach regarded as a hyphenated analytical technique) for two different purposes. In the first quadrupole the system selects ions of mass corresponding to that of the protonated molecular ion of the controlled drugs of interest. The third quadrupole is used to determine whether chemical reactions, characteristic of the particular controlled drug, have occurred. It does not appear likely that the mass of the protonated molecular ion is related to the probability of certain product ions being formed in fragmentation reactions.

Specificity

4.2.5 The true issue appears not to be the number of analytical techniques employed but, rather, the specificity of those techniques in combination. The question appears to be

[7] The recommendations relate to the identification of unknown substances believed to be controlled drugs rather than monitoring for the presence of specific substances.

- given a positive indication from the technique can the operator have confidence, to the level required, that the identified controlled drug is present.

4.2.6 The methodology employed by MSA is such that, for a substance other than the controlled drug of interest to give a positive result it would have to have the following properties.

- It must vaporise under the conditions employed.
- The APCI process must generate an ion of mass equal to (or within the first quadrupole selectivity range) that of the protonated molecular ion of the controlled drug of interest.
- The CID process must cause the ion created at the APCI stage (which passed the first quadrupole) to fragment into at least two product ions with two of them having mass equal to (or within the third quadrupole selectivity range of) the product ions of the controlled drug being monitored.
- The relative intensities of the peaks generated by the fragments must match (within set tolerances) those obtained from the controlled drug of interest.

4.2.7 The possibility of such a false positive result being obtained cannot be entirely excluded. This possibility was considered by Prof. JJ Monaghan[8] [22]. His view was that the probability of such a false positive result occurring was very low.

4.2.8 He noted that for a false positive for cocaine the interfering substance would have to have the same molecular mass, 303 atomic mass units, as cocaine (as APCI tends to produce protonated molecular ions rather than fragments of the molecule). This ion would then have to undergo a fragmentation process to generate product ions of mass 182 and 105. Having examined the Eight Peak Index of Mass Spectra [23] he was unable to identify any compound that would have similar behaviour to cocaine. This does not establish that such a molecule does not exist but suggests it is unlikely that such a material will be seen on banknotes.

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[8] Of the School of Chemistry at the University of Edinburgh.

4.2.9 MSA note that in its use of the technique no candidate molecule for false positives for the controlled drugs investigated has been identified [24].

4.2.10 The Counter Drug Technologies Team at HOSDB investigated possible sources of false positive results. No molecule capable of giving such a result was found. Again this does not prove that such a molecule does not exist but indicates that the probability of notes in general circulation being contaminated with such a molecule is low.

Interfering Substances

4.2.11 If there were a commonly occurring material which could produce false positive results then it would be expected that contamination with this material would appear in the "database" samples (see 4.4 below) obtained by MSA.

4.2.12 The database results do not indicate the existence of commonly occurring interfering substances.

Court Challenges

4.2.13 The techniques employed by MSA have been challenged in court. Such challenges have focussed on both the underlying science and the value of the results. Considering, at this stage, challenges to the science, the cases of relevance are *R v Benn & Ors.* [3], *R v Compton & Ors*. [2] and *Director of the Assets Recovery Agency v Jackson & Ors.* [4]. *Benn* and *Compton* were both decided at the Court of Appeal (Criminal Division).

4.2.14 In *Compton* the MSA evidence was challenged in evidence given by Mr Peter Bottomley. However, it is clear[9] that Mr Bottomley made no serious criticism of the scientific techniques employed by MSA[10]. It was also clear that a different scientist (Mr Manners) had been instructed by the defence at the initial trial and made no criticism of the MSA techniques[11].

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9 Paragraph 16 of the judgment of Buxton LJ.
10 This has been confirmed in discussions with Mr Bottomley.
11 Paragraph 12 of the judgment of Buxton LJ.

4.2.15 In *Benn* the MSA evidence was challenged at trial in evidence given by Dr Young[12] and, on appeal, Mr Bottomley.

4.2.16 Dr Young made no criticism of the reliability and accuracy of the results obtained by MSA[13] and, on appeal, the challenge on the basis of the techniques employed by MSA was abandoned by the appellant[14].

4.2.17 The acceptance of the reliability of the techniques was also seen in *Jackson*[15].

4.2.18 The challenges in *McGinty* [11] and *Smith* [12] related to the interpretation or value of the results rather than the accuracy of the results and they shall be discussed below (see 4.5).

4.3 Repeatability

4.3.1 The CRFP raised the issue:

> "… because MSA are effectively removing all the trace amounts substance(s) from the banknote in the area of it that they subject to their analysis. In this sense, the examination cannot be repeated …"

4.3.2 The issue being that the results obtained cannot be confirmed by others.

Requirement

4.3.3 The ability to confirm results (particularly when the confirmation is undertaken by the defence) is desirable, but not essential, in forensic science. There are many circumstances in which destructive analyses/examinations are performed.

4.3.4 The inability to confirm the results obtained does not automatically render the results inadmissible as evidence.

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12 Paragraph 9 of the judgment of Latham LJ.
13 Paragraph 9 of the judgment of Latham LJ.
14 Paragraph 39 of the judgment of Latham LJ.
15 Paragraph 183 of the judgment of King J.

Consideration

4.3.5 The process adopted by MSA involves exposing the same portion (approximately one third of the area) of each banknote to the thermal desorption equipment by insertion of the standard part of the note between the desorption plates.

4.3.6 It follows that a repeat analysis could be performed on a different portion of the note. However, for such an approach to be worthwhile it would have to be shown that analysis at different points on the note provided similar results.

4.3.7 MSA has undertaken a study on this issue which shows that the location chosen does not lead to a significant change in the results [16, 24].

4.3.8 MSA has also undertaken work which establishes that the thermal desorption process does not remove all the material of interest from the note [24]. The analysis provides an indication of the quantity of target compounds present rather than a fully quantitative result. It may therefore, depending on the level of the target controlled drugs present and the contamination of the note surface, be able to repeat analysis on the same portion of the note and still obtain the same result.

4.4 The Database

4.4.1 CRFP raised the issue:

> "This issue of the occurrence of drugs on banknotes in general circulation is central to the MSA approach in two respects. First, they have effectively produced a database against which they compare their case findings. The comparison between case work findings and the records in the database clearly requires that the database itself is a fair representation of banknotes in general circulation.
>
> Issue: There is concern that the MSA database is not as representative as they say it is."

4.4.2 The database referred to is the collection of information generated by MSA as to the prevalence of controlled drugs on banknotes obtained from locations around the UK.

4.4.3 The following discussion relates to the database employed to estimate the presence of target controlled drugs on banknotes in general circulation.

The Database

4.4.4 The database is, largely, formed from withdrawals from banks (either across the counter or through cash machines) from locations across the UK. The locations are often chosen because MSA staff happen to be travelling to that place [24].

4.4.5 The data thus collected has been supplemented by data on notes collected from public houses, post-offices, shops, a casino and the takings from a pop festival [24].

4.4.6 A series of withdrawals (comprising 27 separate withdrawals from different banks) was also made from different regions around Bristol to investigate the issue of micro-economies [24].

4.4.7 As of the 6th August 2008 the database was comprised of information from 67,385 banknotes obtained from 366 separate withdrawals. The total value of the notes being £891,945 [24]. The Bank of England estimates the total value of notes in circulation in 2008 as £44,979 Million [25].

Issues

4.4.8 The issue raised by the CRFP is whether the database is sufficiently representative to allow its use in evaluation of the results obtained.

4.4.9 The validity of the database was challenged in *R v Compton & Ors.* [2] and *R v Benn & Ors.* [3].

4.4.10 In *Compton* the defence challenge was based largely on the views of Mr Bottomley. The criticisms of the database were as follows[16].

- Whether the sampling is sufficiently representative of the general population of banknotes in circulation.
- The absence of any known history of the banknotes involved.
- The fact many samples were obtained from branches of one bank.

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[16] Paragraph 26 of the judgment of Buxton LJ.

- Uncertainty as to the level of variation between different geographical locations.

4.4.11 In *Benn* the defence challenge was based on the views of Mr Bottomley and Prof. Laycock[17]. The issues raised included, but are not limited to, the following.

- The limited number of background notes examined.
- The apparent differences in contamination of notes of different denomination.
- Uncertainty as to the level of variation between different geographical locations.
- The lack of understanding of the meaning of "general circulation".
- The statistical validity of the database.

4.4.12 In *Benn* the use of the MSA database was supported by Prof. Monaghan[18] and Dr Brereton[19] [26].

4.4.13 In *Compton* the Court of Appeal (Criminal Division) took the view[20] that the difference in levels of positive results between the currency in the possession of the accused and that in "general circulation" was so large that "even if some attack could be made on the margins of MSA's data base the discrepancy would still cry out for an explanation".

4.4.14 In *Benn* the Court of Appeal (Criminal Division) accepted[21] the criticisms of the database made by Prof. Laycock but adopted[22] the views expressed by the Court in *Compton*.

4.4.15 A similar approach was taken by King J in *The Director of the Assets Recovery Agency v Jackson & Ors.* [4]. In this case Prof. Laycock, in a joint statement with Dr Sleeman (of MSA) opined[23]:

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17 Of the University of Manchester Institute of Science and Technology (UMIST).
18 Of the University of Edinburgh.
19 Of the University of Bristol.
20 Paragraph 28 of the judgment of Buxton LJ.
21 Paragraph 44 of the judgment of Latham LJ.
22 Paragraphs 44-45 of the judgment of Latham LJ.
23 Paragraph 185 of the judgment of King J.

> "the measurements made on the banknotes in the MSA database as used for in comparison in court can be regarded as reasonably representative of all such measurements which might be made on banknotes taken from banks located in the United Kingdom."

4.4.16 The debate in this case centred on whether the data derived from cash taken from banks was representative of the currency in general circulation.

4.4.17 It has been suggested that banks act as a filter on the notes in circulation. Whilst a large proportion of banknotes are fed back into banks the notes issued by banks do not reflect that range of notes. The banks filter out the older and more damaged notes and, as a consequence, the notes issued by the banks may not reflect the notes in general circulation.

4.4.18 A further issue is whether the level of drugs on banknotes has changed with time so that the information held in the database decreases in relevance with time since its inclusion.

Consideration

4.4.19 The database is not built from a statistically valid random sample of currency in circulation. This fact is accepted by MSA [24]. It follows that the information contained in the database cannot be assumed to exactly represent the level of controlled drugs on currency in general circulation.

4.4.20 The use of databases built from samples of convenience rather than a statistically valid random sample is relatively common in forensic science (and elsewhere [27]). The issue which must be addressed is whether, in each case, the results obtained from the database differ from those which would have been obtained from a random sample and, if they do, whether the difference would have a significant impact on the use of the data.

4.4.21 Whilst this issue arises in a number of areas of forensic science it is not easy to address because a comparison with the database built from a random sample cannot be made – such a database not existing.

4.4.22 MSA, in conjunction with the University of Bristol, has undertaken a study to consider the effect of a number of factors on the level of controlled drugs present on banknotes [28].

4.4.23 This study found none of the factors studied had a significant influence of the level of controlled drugs found.

4.4.24 The notes were all drawn from banks so the question of whether the notes issued by banks are representative of the currency in general circulation was not addressed.

4.4.25 The issue has been considered in publications [16] and in witness statements (in particular the statement of Dr Sleeman in *Benn* [29]) on the basis of information about banking practices. These considerations have concluded that there should be no significant difference between banknotes issued by banks and those in general circulation.

4.4.26 There is a divergence in the community as to whether the database is sufficiently representative. The existence of different views on a technique does not prevent information arising from that technique being used as evidence [30]. However, the inability of experts to agree as to the meaning of the results may render a prosecution based on that evidence a high risk proposition [31]. This risk can be reduced or eliminated by the presence of other forms of evidence [32].

4.4.27 Part 33 of the Criminal Procedures Rules[24] [33] places a number of obligations on expert witnesses[25]. In particular it requires the expert to (a) set out the range of professional opinion on the matter on which evidence is given and to explain why the expert gives his opinion[26] and (b) state any reservation or qualification about the evidence being given[27]. As long as these provisions are complied with the issues can be identified and considered in detail, if relevant, before the court. If this approach is adopted any risks to the CJS should be controlled.

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[24] For ease of reference the text of Part 33.3 of the Criminal Procedure Rules is provided at Annex 1.

[25] These would apply only if the evidence is expert evidence. Whilst this is not clear those providing evidence in relation to all forms of forensic science would be well advised to comply with the rules. Indeed, it could be argued that many parts of the Rules merely reflect good practice in forensic science.

[26] Part 33.3(1)(f).

[27] Part 33.3(1)(g).

4.4.28 The approach adopted by the Court of Appeal may well indicate a sensible solution. The difference between the database and what would be obtained from a truly representative sample is likely to be relatively small. The extent of that difference is not known. However, the strength of the inference which may be drawn from the evidence increases as the difference between the casework results and the database increases.

4.4.29 There may, of course, be differences between experts as to the level of inference which can be drawn at a given level of difference. This is a common feature of many types of trace evidence.

4.4.30 In relation to changes of the level of contamination over time MSA is undertaking work with the University of the Bristol [29]. This work is still underway but results to date indicate no significant changes since 2000.

4.5 Reporting

4.5.1 CRFP raised the issue:

> "The second issue is the way that MSA scientists report their findings using a quasi-statistical approach, using phrases such as 'higher than contamination found on banknotes taken from general circulation'.
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> Such wording implies a statistical approach but invites interpretation by others; arguably, that is not expert evidence. Expert evidence requires the interpreting to be done by the expert.
>
> In this context, reports from MSA scientists state that they don't know how contaminants got on to the banknotes or when such contamination occurred. By its very nature, trace evidence at very low concentrations has to be treated very carefully. If MSA scientists cannot offer such an explanation, how can any one else (the defendant, for example)?
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> Issue: Is MSA providing expert evidence (that is, opinion evidence considering various alternative explanations) or are they providing factual findings which are then left to others - the court – to interpret? If that is the case, is it appropriate?"

Issues

4.5.2 The generally accepted test for admissibility of expert evidence is that set out in the South African case of *Bonython* [34][28] where the court stated that the question of admissibility was to be addressed by asking the questions:

> "(a) whether the subject matter of the opinion is such that a person without instruction or experience in the area of knowledge or human experience would be able to form a sound judgment on the matter without the assistance of witnesses possessing special knowledge or experience in the area; and
>
> (b) whether the subject matter of the opinion forms part of a body of knowledge or experience which is sufficiently organised or recognised to be accepted as a reliable body of knowledge or experience, a special acquaintance with which by the witness would render his opinion of assistance to the court."

4.5.3 The role of the expert witness was set out in *Davie v Edinburgh City Magistrates* [35][29]. It was stated:

> "[Expert witnesses'] duty is to furnish the Judge or jury with the necessary scientific criteria for testing the accuracy of their conclusions, so as to enable the Judge or jury to form their own independent judgment by the application of these criteria to the facts proved in evidence."

4.5.4 The requirement for the opinion of an expert to be founded on a proper factual basis has been considered in a number of cases (see, for example *R v Shillibier* [36] and *R v Nugent* [37]).

Consideration

4.5.5 Whether evidence of contamination of currency with controlled drugs is expert evidence is not a simple question to answer. The evidence provided does contain

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[28] Although a South African case the approach has been adopted in England and Wales -see, for example, *Luttrell & Ors. R v* [2004] EWCA Crim 1344.

[29] Although a Scottish case the approach has been adopted in England and Wales -see, for example *Luttrell & Ors. R v* [2004] EWCA Crim 1344.

what may be considered an opinion[30] (the proportion of notes giving positive indications for controlled drugs as compared to notes in general circulation) but this opinion is, in effect, a statement of fact (albeit based on scientific analysis and study).

4.5.6 Having discussed the matter with the CPS the view was taken that it is not necessary, in relation to the question of admissibility, to reach a conclusion on this issue.

4.5.7 This type of evidence would, subject to the point at 4.5.8 below, be admissible as "normal" evidence if not as expert evidence.

4.5.8 The nature of the evidence (see 4.8 below) is such that an application could be made to exclude the evidence on the grounds that the probative value is outweighed by the prejudicial effect.

4.5.9 This type of evidence has been considered by the Court of Appeal (Criminal Division) on at least two occasions[31] and by the High Court of Justiciary (as a court of appeal) in at least two cases[32].

4.5.10 The Court of Appeal did not suggest the evidence was inadmissible.

4.5.11 The High Court of Justiciary ruled, in *McGinty*[33], that the evidence should not have been heard by the court but this appeared to relate to the validity of the conclusions drawn rather than the nature of the evidence. In the later case of *Smith* the court did not question the admissibility of the evidence but ruled that the circumstantial evidence was not sufficient to support a conviction.

4.5.12 The issue of whether the evidence is of fact or opinion does not appear to significantly alter its admissibility.

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30 The key attribute of expert evidence is provision of an opinion – as implicit in the second limb of the *Bonython* test.

31 In *Benn* and *Compton*.

32 In *McGinty* and *Smith*.

33 In *McGinty* the relevant evidence was not obtained from MSA. Scientists from, or now at, MSA did appear in the case but did so to discuss issues related to the interpretation of the evidence and conclusions drawn by the initial supplier.

4.5.13 The wording used in the reports does, as the CRFP indicate, employ language that could suggest a statistical approach. For example “not significantly greater” [38].

4.5.14 Whilst the wording can, to a scientist or statistician, suggest the use of statistical significance testing the statements do not state such testing was employed. It is not obvious that the court will assume that such statements are based on such an analysis[34].

4.6 Reporting – Additional Point

4.6.1 In the example statement provided by MSA [38] there is a discussion of the Court of Appeal judgments in *Benn* and *Compton*.

4.6.2 The quotation of favourable or complimentary judgments is acceptable but the picture presented must be balanced and accurate. The issue has recently been considered by the Asylum and Immigration Tribunal in *SD (expert evidence) Lebanon [2008] UKAIT 00078* were it was noted:

> “… where an expert refers the Tribunal to cases in which his expertise has been accepted or acknowledged or in which he has received praise, he must, at the same time, refer to the Tribunal to any cases which he is aware of and which may detract from what is said about him in the cases he has referred to. In other words, failure to place before the Tribunal such material in an even-handed way may reflect on the weight to be given to the evidence which the subject matter of the expert's report(s).”

4.6.3 The Tribunal is not a court of criminal jurisdiction but the principle set out appears to be good practice for any expert.

4.6.4 I am not in a position to determine whether the material provided does provide a balanced picture (and in no way suggest it does not) but MSA may wish to review the material and ensure processes are in place to assess new court judgments with regard to its evidence so that the text is current.

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[34] The issue of whether statistical testing could have been performed has not been considered.

4.7 Interpretation

4.7.1 Examination of cases where evidence of controlled drugs on currency has been used has raised a number of issues related to the interpretation of such results.

Contamination

4.7.2 There is a risk that the banknotes could have been contaminated with target controlled drugs after the notes are out of the control of the suspect but prior to analysis at the laboratory. Such contamination could arise in the following circumstances [2-3].

- By law enforcement officials at the scene of crime.
- By law enforcement officials during packaging.
- Re-distribution of controlled drugs between the banknotes in the evidence container.

4.7.3 There is also a risk of contamination of the banknotes with controlled drugs during the handling and analysis processes at the laboratory [3].

Origin

4.7.4 It is not possible, at the current state of knowledge, to determine the source of the controlled drug traces found on the banknotes nor is it currently possible to compare the results obtained with the results of chemical analysis of any drug seizure [3].

4.7.5 It is also impossible, at the current state of knowledge, to determine when the controlled drugs attached to the banknotes [3].

Knowledge

4.7.6 The quantities of controlled drugs present on the banknotes are very small and, as a consequence, could be present without the knowledge of the person in possession of the notes [3].

Consideration

4.7.7 The risk of contamination within the laboratory appears low as a consequence of the measures discussed at 4.1 above. If such contamination were to occur, the processes in place will minimise the risk that contamination will not be recognised.

4.7.8 The risk of contamination of the notes prior to arrival at the laboratory is more difficult to assess.

4.7.9 MSA has established procedures for swabbing the exterior and interior of the exhibit container and testing these swabs for target controlled drugs [24]. This allows an assessment of the risk of contamination at scene and transfer within the container.

4.7.10 MSA, in conjunction with the University of the West of England, has undertaken research into routes of contamination by, and transfer of, controlled drugs on banknotes and between banknotes and other surfaces [39].

4.7.11 In relation to contamination at scenes this work demonstrates that handling of notes in an environment containing controlled drugs can lead to contamination with controlled substances. This is to be expected. However, it does show that inappropriate handling by law enforcement officials could lead to positive results[35].

4.7.12 With regard to transfer of controlled drugs between notes in an exhibits container it proves that this can occur but that the level of such cross-contamination is relatively small.

4.7.13 These issues are not specific to trace drugs analysis and are a feature of the interpretation of other forms of trace evidence. Forensic scientists routinely assess such issues as part of the evaluation of the evidence.

4.7.14 The level of contamination with controlled drugs is such that it would be possible for the person in possession of the banknotes to have no knowledge of the contamination or the risk of such contamination having occurred.

4.8 Deployment

4.8.1 The manner in which the results of this form of analysis are deployed in evidence is clearly an important issue. In some of the cases noted above (for example *Smith*) the

[35] This could place the accused in the forensic dilemma of arguing that the notes were contaminated by controlled drugs due to handling in a heavily contaminated environment when that environment is likely to be under his control.

evidence of the contamination of the banknotes was held to be insufficient to support the allegations being made, apparently, on the basis of those results[36].

4.8.2 It is important to recognise that the results of the analysis cannot establish any of the following.

- How the banknotes became contaminated with controlled drugs.
- When the banknotes became contaminated with controlled drugs.
- Whether the person in possession of the notes was in possession of the notes at the time of contamination.
- Whether the person in possession of the notes had knowledge of the contamination.

4.8.3 MSA does not claim that these matters can be dealt with conclusively in its statements [38].

4.8.4 It therefore appears that prosecuting authorities must have a clear policy on the use of this form of evidence.

4.9 Validation

4.9.1 The methods employed by MSA have been the subject of a validation study [40] – perhaps as part of the ISO accreditation process (see 4.10 below).

4.10 Accreditation

4.10.1 MSA is accredited[37] by the United Kingdom Accreditation Service Ltd (UKAS) to ISO 17025:2005 for the examination of banknotes involving semi-quantitative detection of controlled drugs as follows.

- Amphetamine.
- Methylenedioxymethylamphetamine.
- Methylamphetamine.
- Diamorphine.

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[36] No criticism is made of the prosecution in this case as the full circumstances of the case and evidence (including evidence which may not have been before the court) is not known.

[37] Certificate number 2672.

- Cocaine.
- Delta-9-tetrahydrocannabinol.

4.10.2 It is recognised that MSA may hold different quantities of background information for these different target controlled drugs.

5 Conclusions

5.1 Issues

Specificity

5.1.1 The results from the analytical techniques employed by MSA appear to be sufficiently specific to identify the presence of the target controlled drugs under examination. There is no evidence to suggest a significant risk to the CJS.

Repeatability

5.1.2 The use of results obtained from techniques which cannot be tested by a re-analysis of the sample is acceptable within the CJS. Were the techniques employed by MSA non-repeatable this would not act as a bar to their use within the CJS.

5.1.3 The techniques employed by MSA can be tested, if perhaps not confirmed by exact repetition, by further analysis of the banknotes. As such the risk (albeit acceptable) created by use of non-repeatable results does not arise.

The Database

5.1.4 Whether the database is entirely representative of the banknotes in general circulation is a matter of disagreement in the community. It is not possible, in this report, to resolve this matter.

5.1.5 This is a problem that arises in relation to many forms of trace evidence and can be addressed by the evidence of experts.

5.1.6 If experts comply with the provisions of Part 33 of the Criminal Procedure Rules the issues related to the database should be made clear.

5.1.7 In particular the provisions of Part 33.3(1)(f) should be complied with to set out the range of opinions on the validity of the database and explain why the expert takes the position that he does.

Reporting

5.1.8 The evidence produced by MSA appears to be admissible (subject to the opportunity to challenge) either as expert evidence or evidence of fact. It has therefore not been necessary to reach a conclusion on that point.

5.1.9 The statements from MSA do include phrases that suggest, to those who understand statistics, that a statistical approach has been adopted. However, there is no suggestion that such an approach has been adopted and it appears unlikely that the court will assume such an approach.

Interpretation

5.1.10 The interpretation of this form of evidence is complex as a result of the issues discussed in 4.7 above. Many of these issues appear in other forms of trace evidence.

5.1.11 These issues can be addressed in evidence.

5.1.12 If the experts comply with the requirements of Part 33 Criminal Procedure Rules the issues should be made clear.

5.1.13 In particular the provisions of Part 33.3(1)(f) should be complied with to set out the range of opinions that exist in relation to the evidence and explain why the expert takes the position that he does.

Deployment

5.1.14 This is perhaps the most significant issue dealt with.

5.1.15 The results obtained can only establish that the banknotes in possession of the accused have a determined level of contamination with one, or more, controlled drugs. The inference which can be drawn from this evidence depends on the level of contamination found and other circumstances of the case.

5.1.16 It is not possible to establish when or how the banknotes became contaminated. Nor is it possible to determine whether the person in possession of the banknotes was in possession at the time when contamination occurred or knew of that contamination (or had reason to consider such contamination may have occurred).

5.1.17 This form of evidence should be used by the prosecution in criminal cases very carefully and in circumstances where the information it can provide is of direct relevance and value. Using this form of evidence, without more, to found a prosecution appears a high risk strategy (cf *Smith*).

5.2 Recommendations

5.2.1 As discussed through the report and summarised in paragraph 5.1 the use of this form of analysis is complex and raises issues for the CJS. Having reviewed this subject in relation to one supplier it appears reasonable to make some general recommendations.

5.2.2 The recommendations noted in paragraph 5.2.1 are that any organisation providing this form of analysis should ensure the following issues are addressed.

- The issues surrounding the use of reference databases and the range of views on the use of such databases are discussed in the report in line with r33.3(1)(f) and r33.3(1)(g) Criminal Procedure Rules [see paragraphs 4.4.27, 5.1.6 and 5.1.7].
- The report makes clear what has been established by the examination and the limitations on what has been established [see paragraph 4.7].
- The report sets out the authors opinion as to the value of the evidence, the range of views which exists amongst experts and the reasons for the position he takes – as required by r33.3(1)(f) Criminal Procedure Rules. Further, reservations about the evidence should be discussed – as required by r33.3(1)(g) [see paragraphs 5.1.12 and 5.1.13].
- This type of analysis should only be used in cases where the evidence generated is of direct relevance and value [see paragraphs 4.8 and 5.1.17].

5.3 Overall

5.3.1 On the basis that issues discussed in this report, and summarised in sections 5.1 and 5.2, are addressed the evidence currently available does not suggest there is a risk to the CJS which requires action by the Forensic Science Regulator.

6 Acknowledgments

6.1.1 Whilst this had been a preliminary consideration it has covered a wide range of issues and it has only been possible to prepare this report with the assistance from a number of individuals and organisations. In particular the assistance of the following must be recognised.

- The CRFP its CEO and staff from the relevant committees – particularly Dr Mike Allen.
- Dr Richard Sleeman and the staff of MSA
- The Counter Drugs Technologies Team at HOSDB.
- David Matz of PSSG.
- The Crown Prosecution Service.
- Mr Peter Bottomley.

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ANNEX 1

Criminal Procedure Rules

Content of expert's report

33.3.— (1) An expert's report must —

(a) give details of the expert's qualifications, relevant experience and accreditation;

(b) give details of any literature or other information which the expert has relied on in making the report;

(c) contain a statement setting out the substance of all facts given to the expert which are material to the opinions expressed in the report or upon which those opinions are based;

(d) make clear which of the facts stated in the report are within the expert's own knowledge;

(e) say who carried out any examination, measurement, test or experiment which the expert has used for the report and—

(i) give the qualifications, relevant experience and accreditation of that person,

(ii) say whether or not the examination, measurement, test or experiment was carried out under the expert's supervision, and

(iii) summarise the findings on which the expert relies;

(f) where there is a range of opinion on the matters dealt with in the report—

(i) summarise the range of opinion, and

(ii) give reasons for his own opinion;

(g) if the expert is not able to give his opinion without qualification, state the qualification;

(h) contain a summary of the conclusions reached;

(i) contain a statement that the expert understands his duty to the court, and has complied and will continue to comply with that duty; and

(j) contain the same declaration of truth as a witness statement.

(2) Only sub-paragraphs (i) and (j) of rule 33.3(1) apply to a summary by an expert of his conclusions served in advance of that expert's report.