

IN THE SUPREME COURT  
OF THE NORTHERN TERRITORY  
OF AUSTRALIA  
AT DARWIN

*The Queen v Murdoch* [2005] NTSC 76

No. 20215807

BETWEEN:

**THE QUEEN**

Plaintiff

AND:

**MURDOCH, Bradley John**

Defendant

CORAM: MARTIN (BR) CJ

REASONS FOR JUDGMENT

(Delivered 15 December 2005)

**Introduction**

[1] The accused is charged that on 14 July 2001 near Barrow Creek he murdered Peter Marco Falconio. He is also charged that on the same occasion he deprived Joanne Rachael Lees of her personal liberty and that he unlawfully assaulted Ms Lees in circumstances of aggravation.

[2] The Crown proposed to lead DNA evidence which it said linked the accused to the scene of the crime. The accused objected to the omission of part of that evidence. I ruled that the evidence could be led and I now set out my reasons for that ruling.

**Facts**

[3] Early in the evening of Thursday 14 July 2001 Ms Lees and Mr Falconio were travelling north in a Kombi van on the Stuart Highway approximately 10 kilometres north of Barrow Creek. Mr Falconio was driving. A vehicle pulled alongside and the driver gestured to Mr Falconio to pull over. It is the Crown case that the driver of the other vehicle was the accused.

[4] After Mr Falconio stopped the vehicle on the side of the highway, he walked to the rear of the Kombi van where he met the driver of the other vehicle. Ms Lees could hear the men talking about sparks coming from the exhaust. Mr Falconio returned to the driver's side door and asked Ms Lees to rev the engine. That was the last time that Ms Lees or anyone else saw Mr Falconio alive.

[5] While Ms Lees was revving the engine, she heard a loud bang. It is the Crown case that the driver of the other vehicle shot Mr Falconio.

[6] Ms Lees ceased revving the engine and turned to look out the window. She observed a male person standing at the driver's side window with a gun pointed at her.

[7] The details of subsequent events relied upon by the Crown for the purposes of the pre-trial objections are set out in my reasons for judgment in *R v Murdoch (No 1)* [2005] NTSC 75. In substance it is the Crown case that the accused forced Ms Lees into his vehicle from where she escaped into the scrub. While Ms Lees was hiding in the scrub the accused shifted the Kombi van and left it in the scrub on the western side of the Stuart Highway.

### **Proposed DNA Evidence**

[8] Blood staining was located on the left shoulder at the back of the T-shirt won by Ms Lees. DNA was obtained from a sample taken from the stain which produced a profile identical to the DNA profile of the accused. The forensic scientist is of the view that "statistical calculations indicate observing this DNA profile is at least 640 billion times more likely if the blood came from [the accused] than from an unrelated person selected at random from the Northern Territory population." No objection was taken to the admissibility of this evidence.

[9] The investigating forensic scientist, Ms Carmen Eckhoff, swabbed a substantial portion of the Kombi steering wheel and the knob of the gear stick.

[10] As to the gear stick knob, Ms Eckhoff reported obtaining "a weak and partial DNA profile" of a male person, the components of which "could all be attributed to" the accused. In evidence at the preliminary examination Ms Eckhoff said the DNA on the knob was "extremely weak, the small amount" and the relative frequency of the identified components "is approximately 1 in 678 individuals in the Northern Territory and includes" the accused.

[11] The preliminary examination concluded on 18 August 2004 and the accused was committed to the Supreme Court for trial. In October 2004 Ms Eckhoff travelled to the United Kingdom where, on 28 October 2004, she handed DNA samples extracted from swabs to Dr Jonathan Whitaker of the Forensic Science Service Laboratory at Wetherby. The Forensic Science Service is an independent agency which has existed for approximately 12 years. It undertakes work for both the prosecution and defence.

[12] Dr Whitaker and others at the Wetherby laboratory have developed a technique for the testing of samples containing very small quantities of DNA. It was the availability of this technique at Wetherby which led to the request of Dr Whitaker to examine the DNA samples in question.

[13] In a report dated 9 December 2004 Dr Whitaker reported a mixed DNA profile in the extract from the steering wheel which, in his opinion, is best explained if there is a contribution of DNA from at least three individuals. On the basis of the DNA bands he observed, Dr Whitaker expressed the opinion that he was unable to exclude the deceased, Ms Lees or the accused as being one of the potential contributors. A qualification was added, however, that even if the DNA for all these three individuals was present, this would not account for all the DNA bands observed and, therefore, another individual or individuals would have to be considered in order to account for all of the DNA bands observed. Dr Whitaker concluded that the DNA mixture of that complexity was not suitable for meaningful comparisons. In Dr Whitaker's opinion, despite being unable to

eliminate the accused as a contributor, the result “lacks any probative value.”

[14] As to the gear stick knob, Dr Whitaker obtained a mixed DNA profile which, in his opinion, is best explained if there was a contribution of DNA from two individuals. In Dr Whitaker’s view an assessment of the DNA bands which match the deceased demonstrated that the deceased contributed a minor part of the DNA tested. The remaining foreign DNA bands were all represented in the profile of the accused. Dr Whitaker said the DNA bands observed in the DNA profiling results are what he would expect to find in a mixture of DNA from the deceased and the accused. The particularly significant part of Dr Whitaker’s opinion was reported in the following terms:

“7. I have calculated that the combination of DNA bands, which match the profile of Bradley John Murdoch (and which are not shared with Peter Falconio) would be expected to occur in approximately one in nineteen thousand of the United Kingdom Caucasian population. This result would provide very strong evidence of association between Bradley John Murdoch and the gear stick.

8. Please note that this statistical assessment does not take into account two factors which were taken into account when evaluating this result. ... Taken together in my opinion both of these factors ensure that the statistical evaluation employed is a very conservative estimate of the strength of the DNA evidence against Bradley John Murdoch.

...

In my opinion, the DNA profiling results from the gear stick provide very strong support for the proposition that DNA from Bradley John Murdoch is present on the gear stick. This DNA can be considered to be present in association with DNA from Peter Falconio. This result is one I might expect to find if both individuals had, at some time, driven the van thus transferring their DNA to the gear stick.”

[15] As to the gear stick knob, the proposed evidence from Dr Whitaker is, in all the circumstances of the case, highly probative and of high significance to the Crown case.

[16] Initially, objection was taken to evidence concerning the DNA from the steering wheel and gear stick knob on the basis that all the material had been destroyed in the testing by Dr Whitaker and was not available for testing on behalf of the accused. Dr Whitaker gave evidence prior to the empanelment of the jury. In the course of that evidence it emerged that all the material had not been destroyed. As a consequence this basis of objection was not pursued.

#### **Dr Whitaker**

[17] As I have said, Dr Whitaker and others at the Wetherby laboratory have developed a methodology for testing very small quantities of DNA. This methodology is referred to as the Low Copy Number test (LCN). Dr Whitaker used LCN on the DNA extracts from the swabs taken of the steering wheel and gear stick knob. In substance, senior counsel who appeared for the accused for the purposes of these objections, submitted that Dr Whitaker was “pushing the frontiers of DNA examination” and, in respect of LCN, the Crown had failed to establish that there was an area of expertise which is recognised in Australia. Secondly, counsel contended the evidence could not rise to the level of acceptance beyond reasonable doubt because the Crown cannot exclude the real possibility of contamination which may have given false results.

#### **Evidence**

[18] It is necessary to consider the evidence of Dr Whitaker in some detail. Dr Whitaker is a highly qualified and experienced senior forensic scientist. He has a Bachelor of Science Degree with Honours in Genetics and is a Doctor of Philosophy in molecular genetics. As a result of Royal Commission recommendations, approximately two and a half years ago an Audit Commission was established in the United Kingdom. One of the roles of the Commission is to examine the work of forensic scientists to determine whether such scientists are worthy of membership of a professional body of forensic scientists. The members of the professional body are recognised as experts in particular fields of forensic science. Approximately two years ago Dr Whitaker was accepted and registered as a forensic practitioner in the discipline of DNA profiling.

[19] Dr Whitaker is presently a senior forensic scientist employed by the Forensics Science Service in the United Kingdom. He works at the Wetherby laboratory in Yorkshire. He is highly qualified in the area of forensic science, particularly with respect to DNA profiling. He has given evidence on many occasions in criminal courts of the United Kingdom. Dr Whitaker's general expertise in the area of forensic science and DNA profiling was not challenged. I am satisfied that Dr Whitaker is a highly qualified and experienced expert in this field of expertise.

[20] Dr Whitaker gave evidence that DNA is a chemical found in the cells of human bodies which he described as sometimes viewed as a "chemical sentence". When translated, the chemical sentence will give rise to the appearance of individuals and how bodies behave. Dr Whitaker explained that in a forensic context the scientist is particularly interested in parts of the DNA which are known to differ from one individual to the next. By examination of these particular areas of DNA, known as Short Tandem Repeats ("STR's"), scientists can obtain a very reliable test which enables them to discriminate between individuals.

[21] There are now a number of manufacturers who produce for use by forensic scientists well recognised and accepted DNA profiling tests. For ease of reference these were referred to as "routine" tests. The routine tests examine a number of the forensically important STR sites. Dr Whitaker explained that there are standard procedures followed with each of these tests:

"It really, all of them are based on the same laboratory procedure. Each of them would start with the extraction of DNA from the forensic stain. In some of them that – the amount of DNA which is extracted would be measured or quantified. The next step is a process of DNA copying or DNA amplification by which those STR sites that we're interested in are copied many, many times. This means that DNA profiles can be obtained from very small forensic samples *and the copying doesn't alter the DNA in any way, it just gives you sufficient DNA then to be able to perform a test and produce a profile* (my emphasis).

[22] According to Dr Whitaker the technique of amplification is a well recognised technique which is used in every forensic laboratory in the World. Significantly, in the passage I have cited, Dr Whitaker pointed out that amplification does not alter the DNA in any way.

[23] Dr Whitaker went on to explain the steps in the processes common to all of the routine DNA profiling methods. There is no contention in the scientific community. The routine methodology is accepted.

[24] Dr Whitaker explained that the development of LCN involved intensive research and

development over a period of approximately one and a half years. He and a colleague, Dr Peter Gill, who Dr Whitaker described as one of the very first pioneers of DNA profiling in the UK and who is a very prominent and well published figure in the sphere of forensic DNA profiling, led the LCN research group. Dr Whitaker was involved in designing the experiments and looking at the results of those experiments with a view to determining how the protocol for low copy numbers should eventually be set out for casework use. After the period of research and experimentation, the methodology and findings were published. Publication allowed Dr Whitaker to demonstrate the amount of work which had been put into the validation of the technique. As Dr Whitaker explained, publication meant disclosing the work to peer review by other scientists in the scientific community and it established the credibility of the laboratory to be able to give the evidence in court. [25] The technique was reviewed by an independent organisation referred to as the UK Accreditation Service. The laboratory was examined to ensure that it was fit to carry out the techniques. The methods and working practices were submitted to an audit process. Examination was carried out to ensure that the process was scientifically correct. The technique was assessed by scientists who looked at the papers in which the technique was written up and the data was disclosed. The paper went to an Editorial Board who were scientists in that particular field of molecular biology for comment on the data and experiments. The laboratory and techniques were accredited.

[26] Dr Whitaker accepted that accreditation does not necessarily imply an acceptance within the scientific community generally. However, at the time of the accreditation to which I have referred, the laboratory was already accredited for routine DNA profiling tests. A specific accreditation process was undertaken for the LCN technique. If those examining the technique did not agree with the scientific papers in which the technique was written up and data disclosed, the technique would have been rejected or the paper rejected by a particular journal.

[27] Dr Whitaker agreed that Wetherby is the only laboratory in the world that uses LCN. He expressed the view that the technology is the most sophisticated available in the forensic community and explained the situation in the following terms:

“A. Well, the whole reason why perhaps the Forensic Science Services and Organisations is able to do it is that it requires these huge resources of dedicated laboratories and dedicated staff. I think it’s fair to say that you know, the FSS is actually a huge organisation in terms of forensic testing and has the capacity to do it. Hence why countries such as New Zealand and Sweden are now starting to approach us to do their testing for it, because they don’t have the resource to be able to set the process up in their own right. Now whether labs, there’s another lab in the UK called Forensic Alliance which are applying an increased copy number, cycled number to their tests, that they have developed their own validation for that technique. It’s not the sort of process which you can just buy off the shelf like you can with these other routine tests.

Q. And are you able to help me with whether the technology if you like of your methodology, is it something that is accepted in the forensic science community or the scientific community as a valid process?

A. Well I think the points we’ve been discussing this afternoon, certainly in the British system and the New Zealand system and the Swedish system, it is accepted.

Q. I’m not thinking of the legal side of it, I’m thinking of the scientific community.

A. Yes, the technique has been obviously scientifically published and we’ve not aware of

any rebuttal to that. The technique has been presented at international conferences where the audience is all scientists, forensic scientists, and again if there was any concern about the technique I daresay we wouldn't be using it today. It's been for six years."

[28] Dr Whitaker said the first case they did "live" was January 1999. The laboratory now processes about 80 cases per week using LCN. Dr Whitaker and Dr Gill were the first two people to give evidence of LCN in court. Today there are approximately 60 scientists trained in the interpretation of LCN and they all go to court and give evidence. Since 1999 evidence based on this technique would have been given in the criminal courts of the United Kingdom on approximately 200 occasions. Reference was made to a number of specific cases in which the evidence was apparently accepted. In addition the evidence has been accepted on one occasion in each of New Zealand and Sweden. It is unnecessary to refer to the details of those cases.

[29] As to the use of LCN in connection with mixed DNA, Dr Whitaker agreed that the validation did not extend to use of this method in connection with mixed DNA. He expressed the opinion, however, that the use in connection with mixed DNA did not need to be validated. Asked if it was validated for other things, Dr Whitaker responded: "It's validated to understand how the profiles are behaving in a system using LCN. That understanding can be applied to mixtures."

[30] Dr Whitaker pointed out that the fundamental steps used in LCN are, generally speaking, the same as the steps in the routine methods, but there are differences at certain steps of the process and there is one additional step which can be included. The first difference to which Dr Whitaker referred was a step after the DNA has been extracted from the forensic stain. For LCN purposes an additional step occurs which is called "microconing". This is a process which removes chemicals which might have been co-extracted in the forensic stain such as dirt, clothing dyes and nicotine. Forensic scientists know from experience and research that these substances have an inhibitory effect on the DNA profiling process. Dr Whitaker likened these inhibitors to putting water in a petrol tank. The process of microconing is used to remove these inhibitory substances.

[31] The second function of microconing is to concentrate the DNA down. If the DNA is more concentrated it is easier to identify than when it is diluted.

[32] According to Dr Whitaker the most significant difference between LCN and other conventional methods is at the amplification stage. In the conventional process an amplification is run 28 times. This is the figure which is recommended by the manufacturers of the routine kit tests. The LCN methodology amplifies 34 times. The figure of 34 was established during the research of the technique. Dr Whitaker explained that a whole set of experiments were conducted which examined different increments of the copy number. The DNA profile results from known samples of DNA were examined at the different increments. In particular the degree of artefacts and ease of interpretation were considered. Dr Whitaker said that 34 was chosen "because it gave the most unambiguous set of results but it gave us successful results at the same time." The success was known because the experiment started with a known sample. The research took about a year and a half to complete at a research laboratory in Birmingham.

[33] As to other differences between LCN and routine methodology, Dr Whitaker explained that with LCN everything is done at least twice. In substance, this is a cross check to ensure that the results are not distorted, particularly by contaminants and artefacts. It is unnecessary to canvass in any further detail Dr Whitaker's evidence in

respect of those matters.

[34] Dr Whitaker impressed me as a careful and reliable witness. There is no evidence to contradict the evidence of Dr Whitaker. Although reference was made to published articles for specific purposes, no article was put to Dr Whitaker challenging the reliability of LCN or Dr Whitaker's evidence generally and on specific issues.

[35] I accept the evidence of Dr Whitaker generally. In particular I accept his evidence concerning the research, validation of LCN and reliability of LCN. I also accept his evidence as to accreditation, publication and the absence of challenge to LCN from within the scientific community. Further, I accept his evidence concerning the fundamental technique and the differences between the routine methodologies and LCN.

### **Principles**

[36] The fundamental principles governing the admissibility of expert evidence are not in doubt. In *R v Bonython* (1984) 38 SASR 45 at 46, King CJ identified the issues in the following terms:

“Before admitting the opinion of a witness into evidence as expert testimony, a Judge must consider and decide two questions. The first is whether the subject matter of the opinion falls within the class of subjects upon which expert testimony is permissible. This first question may be divided into two parts: (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. The second question is whether the witness has acquired by study or experience sufficient knowledge of the subject matter to render his opinion of value in resolving the issues before the court.” (my emphasis).

[37] Speaking generally, there is no doubt that the subject matter of Dr Whitaker's opinion, namely, DNA 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. Dr Whitaker possesses special knowledge, experience and expertise in this field.

[38] As to whether LCN “forms part of the body of knowledge or experience which is sufficiently organised or recognised *to be accepted as a reliable body of knowledge or experience*” in *Bonython*, after the passage to which I have referred, King CJ went on to say (47):

“An investigation of the methods used by the witness in arriving at his opinion may be pertinent, in certain circumstances, to the answers to both the above questions. *If the witness has made use of new or unfamiliar techniques or technology, the court may require to be satisfied that such techniques or technology have a sufficient scientific basis to render results arrived at by that means part of a field of knowledge which is a proper subject of expert evidence.* Examples of cases in which that question arose are *The Queen v Gilmore* [1977] 2 NSWLR 935, *The Queen v McHardie and Danielson* [1983] 2 NSWLR 733 and *United States v Williams* (1978) 583 F(2d) 1194. An investigation of the methods adopted by a witness may be relevant to an assessment of his qualifications as a witness if such an investigation might reveal that the witness has “posing as an

expert made assertions that are contrary to proved scientific facts or the known phenomena of nature, thus exposing his ignorance of the learned he professed” (*Commissioner for Government Transport v Adamcik* [1961] HCA 43; (1961) 106 CLR 292, per Windeyer J at p 306), or that the witness has adopted methods which are so unscientific as to expose that ignorance.” (my emphasis).

[39] In *R v Runjanjic; R v Kontinnen* [1991] SAS 2951; (1992) 56 SASR 114 the Court of Criminal Appeal was concerned with the rejection at trial of proposed evidence by a clinical forensic psychologist concerning a condition known by psychologists as the “battered woman syndrome”. The appellant had been found guilty of false imprisonment and causing grievous bodily harm with intent and the proposed evidence was relevant to the defence of duress.

[40] In allowing the appeal and holding the evidence admissible, in remarks touching upon the issue of general acceptance, King CJ said (119):

“An essential prerequisite to the admission of expert evidence as to the battered woman syndrome is that *it be accepted by experts competent in the field of psychology or psychiatry as a scientifically established facet of psychology*. This must be established by appropriate evidence.” (my emphasis).

[41] Counsel for the appellant submitted that the general acceptance test identified by King CJ required general acceptance within the Australian scientific community. He was unable to support that proposition with any authority. In my opinion the proposition does not represent a correct statement of the law. The body of knowledge and general acceptance with which the fundamental principle is concerned are not limited to a body of knowledge or general acceptance within the confines of the Australian boundaries. For present purposes it is unnecessary to explore this issue.

[42] As to the degree of acceptance required, in *R v Gilmore* [1977] 2 NSWLR 935 (at 939) Street CJ quoted at length with approval passages from the judgment of the United States Court of Appeal in *United States v Baller* (1975) 519 Fed 2d 463 which included the following observation (466–467):

“Absolute certainty of result or unanimity of scientific opinion is not required for admissibility. ‘Every useful new development must have its first day in court. And court records are full of the conflicting opinions of doctors, engineers and accountants to name just a few of the legions of expert witnesses’.”

[43] *Gilmore* was cited with approval by King CJ in *Bonython* who also referred to *United States v Williams* (1978) 583 F(2d) 1194. In that decision, the United States Court of Appeals, Second Circuit, considered the admissibility of spectrographic voice identification evidence. The Court noted that the weight of authority supported the admissibility of the evidence, but said “we rest our decision on an independent evaluation”. After noting that there was no universal test for the general admissibility of all scientific evidence and that an oft cited test laid down in a previous authority requiring “general acceptance in the particular field to which it belongs” had created difficulties in application, the Court focused its enquiry upon reliability and tendency of the evidence to mislead. As to reliability, the Court observed (1198):

“A determination of reliability cannot rest solely on a process of “counting (scientific) noses”. ... Lastly, unanimity of opinion in the scientific community, on virtually any scientific question, is extremely rare. Only slightly less rare is a strong majority. Doubtless, a technique unable to garner any support, or only minuscule support, within

the scientific community would be found unreliable by a court. In testing for admissibility of a particular type of scientific evidence, whatever the scientific “voting” pattern may be, the courts cannot in any event surrender to scientists the responsibility for determining the reliability of that evidence.

Nor need it be found that spectrographic evidence is infallible. The sole question is whether spectrographic analysis has reached a level of reliability sufficient to warrant its use in the courtroom.

One indicator of evidential reliability is the potential rate of error. ...

Another reliability indicia is the existence and maintenance of standards. ...

A third reliability factor can be the care and concern with which a scientific technique has been employed, and whether it appears to lend itself to abuse. ...

A further indication of the reliability of spectrographic analysis is its analogous relationship with other types of scientific techniques, and their results, routinely admitted into evidence. Like handwriting exemplars and gun barrel striations, spectrograms are variable, but contain sufficient points of similarity or dissimilarity to enable a trained expert to reach a conclusion.

Lastly, a convincing element in determining reliability is the presence of “failsafe” characteristics.”

### **Conclusion**

[44] The body of knowledge and experience concerning DNA, and the fundamental techniques or methodology applied by forensic scientists in examining DNA, are not new or unfamiliar. They are accepted as having “a sufficient scientific basis” to justify the admissibility in evidence of results achieved by those techniques and methodologies. LCN is an extension or refinement of those techniques and methodologies. I am satisfied that LCN has a “sufficient scientific basis” and general acceptance within the relevant scientific community to render results achieved by LCN “part of a field of knowledge which is a proper subject of expert evidence”. I am satisfied that the criteria of reliability identified in *United States v Williams* are well satisfied.

[45] The ruling that the evidence of Dr Whitaker was admissible was made on the basis of the material then before the court. As I have said, the evidence of Dr Whitaker was not contradicted by other oral evidence or written material. Dr Whitaker gave evidence before the jury and the accused called Dr Both, a scientist of extensive experience in the area of forensic DNA. Dr Both does not accept the scientific validity of LCN and identified a number of areas which are of concern to her.

[46] It is unnecessary to canvass the evidence of Dr Both in detail except to observe that her evidence did not shake my confidence in the evidence of Dr Whitaker. Dr Both has had very little practical experience with the LCN methodology and her knowledge of LCN is derived primarily from reading publications. In certain respects Dr Both displayed an unfortunate intransigence.

[47] The evidence at trial did not cause me to alter my opinion that the evidence of Dr Whitaker was admissible and that it should not be excluded in the exercise of my discretion.

### **Contamination**

[48] The Kombi van was removed by police from the scrub and transported to Alice Springs. In essence, counsel submitted that a jury could not conclude beyond reasonable doubt that there was no contamination at some stage in the process between removing the

van from the scrub on 17 July 2001 and the handing of samples to Dr Whitaker on 24 October 2003. In addition to the risks of contamination through handling by police officers, counsel contrasted the conditions that existed at that time in the laboratory in Darwin with the stringent conditions under which LCN is conducted at the Wetherby Laboratory. Counsel contended that in these circumstances the evidence cannot exclude the real possibility of contamination before the samples reached the Wetherby Laboratory.

[49] Ms Carmen Eckhoff is a forensic scientist employed by the Northern Territory Police at the Forensic Science Centre. She possesses a Degree in Science with Honours from Flinders University and has been practicing as a forensic biologist for at least 14 years. There was no challenge to her qualifications or expertise in the area of DNA.

[50] Ms Eckhoff gave evidence for the purposes of the objections to the DNA evidence. She understood that crime scene examiners had examined the Kombi van before it was moved from the scrub. In particular the outside of the vehicle had been dusted for fingerprints and examined for signs of blood.

[51] Ms Eckhoff also understood that on 15 July 2001 the van was towed from the scene to Alice Springs. She made enquiries about how the vehicle was towed because she had been asked to take swabs of both the steering wheel and the gear stick. She was told that nothing had been touched. It was Ms Eckhoff's understanding that the van was placed in the crime scene vehicle examination bay in Alice Springs to which police officers generally do not have access.

[52] Ms Eckhoff commenced her examination on 16 July and completed it on 17 July 2001. She swabbed the knob of the gear stick. She tested the rest of the gear stick for blood, but did not swab it for DNA purposes. Using a small portion of the swab from the gear stick knob, Ms Eckhoff carried out a presumptive test for the presence of blood. The swab from the gear stick knob was the source of material which was subsequently examined by Ms Eckhoff for the presence of DNA.

[53] As to the steering wheel, Ms Eckhoff said that while she was waiting for the fingerprint examination to be completed, she saw a police officer touch the steering wheel. She could not say why he did so, but he did not appear to do it for the purposes of adjusting the steering wheel or driving the vehicle. The officer did not touch the gear stick. Ms Eckhoff advised the officer that the forensic examination had not been completed and he and his team were to have nothing further to do with the vehicle.

[54] Ms Eckhoff described what the officer did in the following terms:

“A. He basically just lent on the steering wheel at about one to three o'clock on the steering wheel as the clock handles go and he was ungloved and I reminded him that a forensic examination was still taking place.

Q. And you demonstrated then by putting out your open hand.

A. Well, I can't remember right now as to how he actually touched the steering wheel, I know that when I was doing the subsequent tape – swabbing of the steering wheel, I avoided the area that I saw him touch.”

[55] Following the presumptive tests for blood, the swabs were put into separate containers and allowed to dry. They were then conveyed to the laboratory.

[56] Ms Eckhoff was cross-examined at some length about the conditions that existed in the laboratory in which the examinations were carried out. The forensic science group moved to a new purpose built building on 15 October 2001. The new laboratory has been

accredited as a laboratory suitable for DNA examination and reporting. At the time of the examinations with which I am concerned, the previous laboratory was not accredited for those purposes.

[57] Ms Eckhoff said that the biology staff had access to the whole laboratory. The extractions of DNA from the samples were carried out in a fume cupboard which was about three feet across. The cupboard was located in a corner of the laboratory which prevented it being used as a thoroughfare.

[58] Ms Eckhoff explained that the area used within the fume cupboard was sterilised. It had an UV light to reduce contamination and the bench was wiped down before each use. Large sheets of blotting paper were put on the bench and the items for examination were placed on the blotting paper. It was the policy of the laboratory to have only one item on the bench at a time. The examiner was gowned and wearing gloves. Items yet to be examined were kept in boxes in an exhibit room.

[59] The swab from the gear stick knob was examined by Ms Eckhoff on 17 July 2001 in Alice Springs. On the same day in Darwin the extraction of DNA from a sample of Ms Lees' T-shirt was carried out by another member of the laboratory. Ms Eckhoff explained that all items were sent from Alice Springs to Darwin in individual containers.

[60] As to the potential for cross-contamination, Ms Eckhoff gave the following evidence:

“Q. There was considerable potential for cross examination in your laboratory, was there not?

A. No.

Q. Was there potential at all for cross-contamination?

A. There is always potential, but if you adhere to procedures and protocol you minimise that potential and we haven't had a contamination issue in the laboratory.

Q. The laboratory then wasn't even accredited, was it, as being suitable for what you were doing?

A. The building we were in was not suitable for accreditation. The laboratory was working to accreditation standards and has been for a long time.”

[61] When it was suggested to Ms Eckhoff that the laboratory did not meet appropriate standards, Ms Eckhoff responded:

“Well, I disagree. The whole of the forensic area that we took up in the Police Headquarter would not meet OCC. Health and safety standards but certainly the procedures used in the biology laboratory and the chemistry, which are the two science disciplines, we did the best we could with the accommodation we had to meet the requirements.”

[62] Counsel put to Ms Eckhoff that while she and others may have done the best they could, their precautions were not good enough to prevent contamination. Ms Eckhoff objected to the suggestion and responded by referring to the fact that negative controls were taken with the samples to the Wetherby laboratory and the work at that laboratory did not give any indication of contaminants.

[63] Dr Whitaker explained the detailed and sophisticated precautions taken within the laboratory at Wetherby to avoid contamination. In terms of the conclusion to be drawn from results, however, Dr Whitaker agreed that the validity of the conclusions would depend upon the possibility of contamination occurring before the samples reached the laboratory.

[64] In discussing contamination, Dr Whitaker drew a distinction between “contamination” and “cross-contamination”. Dr Whitaker related contamination to an after crime event occurring before the samples reach the laboratory. In that period there is a potential to contaminate the source material by the introduction of foreign DNA to that material by those who attend the scene and deal with the object and samples. Adopting that approach, one of the critical questions is whether the evidence is capable of satisfying a jury beyond reasonable doubt that contamination of the steering wheel or gear stick knob and swabs from those objects did not occur by the introduction of the accused’s DNA to those objects at some time after the van had been left in the scrub by the offender and before the swabs were examined by Ms Eckhoff. This is an issue upon which Dr Whitaker was unable to comment.

[65] Dr Whitaker spoke of cross-contamination as being the contamination of a sample in the laboratory by another sample which is being processed in that laboratory environment. Another critical question is, therefore, whether the evidence is capable of satisfying a jury beyond reasonable doubt that such cross-contamination did not occur in the laboratory where Ms Eckhoff carried out her examinations. Subject to obvious limitations, Dr Whitaker gave evidence relevant to this issue.

[66] Dr Whitaker explained two methods by which the scientists at the Wetherby laboratory addressed the issue of both aspects of contamination. As mentioned, duplication of the process is used as a cross-check to ensure results are not distorted by contaminants. As to cross-contamination, blank or negative samples, which are treated in the same way as the forensic samples, are used as a means of testing for such contamination.

[67] Dr Whitaker was cross-examined about the conditions that existed in the laboratory at Darwin in July 2001. He agreed that keeping the extraction area distinct from other parts of the laboratory is obviously desirable. He added, however, that there are many laboratories who are not set up that way and those laboratories have appropriate controls within the system which allow them to see if anything untoward is occurring. He said the degree of increased risk of cross-contamination depends upon the people working in the environment.

[68] A sketch of the suggested layout of the Darwin laboratory and observations about the absence of protection such as disposal masks and gowns was put to Dr Whitaker. He was asked to comment on the adequacy or otherwise of the facilities. Dr Whitaker responded as follows:

“A. I think in order to give a proper and accurate answer, you need to look at the quality of the results coming out of that system. That set-up is nothing different to what our own lab was like many years before we revamped. People have to start with what’s available to them. And if there are inbuilt safeguards within the system, these controls which give an indication as to the quality of the results coming out of it. They – in terms of my own laboratory, this is sort of where we were at many years ago, but it doesn’t mean to say that it’s inadequate to provide DNA profiling results.”

[69] In re-examination Dr Whitaker said accreditation is not an essential requirement for a laboratory to function according to proper scientific practices and methods.

Accreditation is a relatively new thing and there was a time when Dr Whitaker’s laboratory was not accredited, but followed proper scientific practices and methods.

[70] Dr Whitaker agreed with the general proposition that even in a laboratory that is as

well conducted as Wetherby, it is not possible to completely avoid contamination. In response to the proposition that when he received the samples from Dr Eckhoff he had no way of knowing whether they were contaminated, Dr Whitaker responded:

“I’ll answer no to that, Mr Barker, but I think I would like to add that had there been DNA in there from another source and it was actually there to be tested, it would have come through in the results and I would have reported it.”

[71] In response to further cross-examination on this issue, Dr Whitaker explained that from the beginning of the process of extraction in Darwin, a negative control was in place. When the samples were delivered to the Wetherby laboratory, the negative control was also delivered. That negative control was processed by those working on the samples at Wetherby and showed no indication of any DNA in it.

[72] As to what the negative control is intended to do, Dr Whitaker explained as follows: “The negative control, when you receive a sample in the lab as we talked about, every batch of crime stain samples, a tube which is treated in exactly the same way as the crime stains with the same reagents and the same handling procedures is produced at the same time. That is processed right through to the DNA profiling stage and the results of that sample would indicate whether any of the solutions had DNA in them, whether somebody had introduced foreign DNA by perhaps coughing all over all the samples, it’s there to give an indicator health check to the system.”

[73] Dr Whitaker agreed that within the context of LCN the negative control does not act as an indicator of minor contamination. He added that the limit in that regard is the reason why in the LCN process a duplication is carried out to detect the other sorts of contamination. Notwithstanding the limited value to be attached to the negative control, Dr Whitaker regarded that control as of “some great value because it shows a health check of the Darwin system, which shows it to be fine”. He said it demonstrated, as far as he could tell from the control, that in the process of extraction there had been no gross contamination of the sample. Dr Whitaker regarded the state of the negative control as a good health check of what was happening in the Darwin laboratory because if that laboratory had sloppy working practice and contamination was happening all over the place, he would have expected to see representation of that contamination event in the negative control.

[74] Ms Eckhoff is an experienced forensic scientist. She, like Dr Whitaker, impressed me as a person who is proud of her work and who, in 2001, would have approached her tasks in a careful and professional manner. While the conditions in which Ms Eckhoff and other scientists in the laboratory worked in 2001 may not have been ideal and did not meet the very high standards required of the Wetherby laboratory, I accept the evidence of Ms Eckhoff that she and others in the laboratory worked to a high standard with particular emphasis on avoiding contamination. There is no evidence that the laboratory had previously experienced difficulties in this regard and no evidence to suggest that the practices adopted by the scientists within the laboratory were inadequate to prevent contamination. Within the limits identified by Dr Whitaker, subsequent results tend to negate the existence of relevant contamination.

[75] On the basis of the material and evidence before me, in my opinion it would be open to the jury to exclude beyond reasonable doubt the possibility of relevant contamination or cross-contamination. To put it another way, it would be open to a jury to conclude beyond reasonable doubt that the results obtained by Ms Eckhoff and Dr Whitaker

accurately represent the DNA present on the steering wheel and gear stick knob at the time the swabs were taken by Ms Eckhoff. In arriving at that conclusion I have also taken into account the possibility of cross-contamination in the conveyance of samples from Darwin to the Wetherby laboratory, a possibility which it would be open to the jury to reject.

[76] Having heard the evidence given before the jury I remain of the same opinion.