Addendum Report: Review of BLACKBURN DNA Analysis

Prepared by Dr Kirsty Wright, 18 November 2022

This addendum report is provided to the Commission of Inquiry to provide further information about blood screening results for samples obtained from [redacted]' vehicle, and evidence of concern from the BLACKBURN matter. It is based on additional documents provided by the Commission of Inquiry subsequent to my original report.

Blood Screening of [redacted]' Vehicle

Chemical tests to locate and presumptively test for blood was conducted on [redacted]' vehicle by a Queensland Police Service (QPS) Scientific Officer. The results of the screening have led to some confusion about whether twelve samples labelled 'blood' should have provided a DNA profile. It must be emphasised that a positive presumptive test is not confirmation blood is present.

A Scientific Officer (BROCK) conducted two presumptive tests for blood on each of the twelve samples. The inconsistency of the two different test results from the same location, and the lack of visible staining has created doubt whether human blood was present. It may be assumed that both presumptive tests were conducted on each area *prior* to a DNA swab being taken. However, this does not appear to be true. BROCK conducted one test, if he believed the test was positive, he collected a DNA swab from that area, then conducted the second presumptive test on the same area (Table 1).

Table 1: The sequence of biological screening performed QPS.

Sample	Test 1	DNA Swab	Test 2
V14 – handbrake well	Combur – Neg (very slow)[1]	✓	Luminol - Neg
V15 – clutch pedal	Combur – Neg (very slow)[1]	✓	Luminol - Neg
V16 – brake pedal	Combur – Neg (very slow)[1]	✓	Luminol - Neg
V17 – accelerator pedal	Combur – Neg (very slow)[1]	✓	Luminol - Neg
V31 – rear interior driver's side door handle	Combur pos (very slow)[2]	✓	Luminol - Neg

[1] BROCK's examination notes (22.2.13, p12) shows handwritten entry of 'CBT +ve' is crossed out, and 'CBT -ve' is written above it.

[2] Combur pos entered into AUSLAB. BROCK's examination notes (23.2.13, p3) shows handwritten entry of 'CBT -ve (slow change)'.

V32 - rear interior driver's side window wind	Combur pos (very slow)[2]	✓	Luminol - Neg
V33 - rear interior driver's side handle to door	Combur pos (very slow)[2]	✓	Luminol - Neg
V34 - rear interior driver's side door trim	Combur pos (very slow)[2]	✓	Luminol - Neg
V48 – steering wheel	Luminol - Pos	✓	Combur – Neg[3] Combur – Weak slow pos[4]
V49 – ignition	Luminol - Pos	✓	Combur – Neg[3] Combur – Weak slow pos[4]
V50 – rear of driver's seatback	Luminol - Pos	✓	Combur – Neg[3] Combur – Weak slow pos[4]
V51 – front passenger footwell	Luminol - Pos	✓	Combur – Neg[3] Combur – Weak slow pos[4]

The sequence of examination was explained by BROCK in the pre-trial hearing[5]:

> *" Part of our process is once we've actually identified an area of concern or an area that may particularly be behaving like blood, we would then collect [a] swab from that area. Once we've actually collected the blood swab, we'd then subject – the area to further presumptive testing which is typically a Combur Test Strip and that would then give us a further indication as to whether it's blood or not."*

Given none of the twelve areas had visible staining, <u>if</u> blood was present in very small quantities and reacted with the first presumptive test, the subsequent swabbing of that area would remove most, if not all, biological material. The results of the second presumptive test are therefore unreliable, and would be expected to be negative or weakly positive.

In the pre-trial hearing BROCK stated the luminol reaction for V48 to V51 were 'instantaneous'[6]. This is more indicative of blood presence, however, is not confirmatory.

If latent blood was present, the slow weak Combur test results (test 1) could be explained by the lower sensitivity of Combur. Research conducted by Butler *et al.* (2019)[7] using QPS methods found luminol was significantly more sensitive than Combur (90% vs 10% success) meaning it is more suitable for detecting blood traces. This may be due to the Combur strips used by QPS being developed to detect trace amounts of blood in urine (the test strip is

[3] Result reported in AUSLAB.
[4] Result reported in BROCK's statement of witness (03/12/2014).
[5] R v [redacted], Pre-trial hearing (16 March 2017), page 20, paragraph 25.
[6] R v [redacted], Pre-trial hearing (16 March 2017), page 19, paragraph 40.
[7] J. Butler, J. Chaseling, and K. Wright. A comparison of four presumptive tests for the detection of blood on dark materials. *Journal of Forensic Sciences*, 2019, Vol. 64, No. 6.

dipped into urine), rather than the test strip being wiped over dry surfaces. The suitability of this test method for trace blood requires further investigation.

Overall, the process of screening for blood used in this instance, the inconsistent reporting of screening results, and labelling of swabs as blood has created confusion. The lower sensitivity of the Combur test for the vehicle examination should be considered when interpreting detection of latent blood (for test 1). Given the positive presumptive tests, perhaps the Scientific Officer used the 'blood' labelling as a flag for QHFSS, or was required to nominate a biological type for appropriate DNA extraction processing (that is, blood vs cell extraction). Only the results of the first presumptive test should be considered, however, it is still unknown whether human blood was present in these samples.

When QHFSS did not detect any DNA in the twelve samples labelled blood (and a majority of other trace samples from the vehicle, S14, and the ML series), there is no evidence they undertook further investigation to understand the reliability of the results. Analysis of the positive controls related to the samples, investigation into OQIs that may have impacted the results, checking instrument performance including maintenance and calibration schedules, and liaison with the QPS Scientific Officer could have been informative. The lack of documented investigation, however, may have been due to the fragmented workflows within the laboratory, and separation of sample collection by QPS and sample processing by QHFSS.

Performance of Positive Controls in BLACKBURN Evidence of Concern

After reviewing all electropherograms in the BLACKBURN DNA case file, key crime scene evidence that provided unexpected and unexplained DNA profiling results were noted. Samples labelled as 'blood' from [redacted]' vehicle were also considered. The evidence of concern was grouped together to reveal they belonged to four common 'blood' lysis batches (Tables 1 to 4). The concentrations of the lysis positive controls are included in each table.

All other BLACKBURN evidence was searched against these batch numbers and included in the tables below to examine their profiling outcome. These samples were also poor quality or required Microcon concentration to obtain a profile, suggesting there may have been an issue with the extraction batches. Only two samples out of 36 provided good quality profiles that did not require concentration.

Table 1: Evidence processed on 1 March 2013 (batch 2)

Sample	Comment
Lysis Batch # CWIQLYS20130301_02, (1 March 2013) Extraction Batch # CWEXT20130305_02, (5 March 2013)	
Item V32: Swab of Blood from rear interior driver's side window wind	No DNA detected
Item V17: Swab of Blood from accelerator pedal	No DNA detected
Item V51: Swab of Blood from front passenger's side footwell	No DNA detected
Item V15: Swab of Blood from clutch pedal	No DNA detected
Item V50: Swab of Blood from rear of driver's seatback	No DNA detected
Item V48: Swab of Blood from steering wheel	No DNA detected
Item ML5: Cutting of Blood Soaked Fabric from rear of T-Shirt	No DNA detected
Item ML2: Cutting of Blood Soaked Fabric from rear of T-Shirt	No DNA detected
Item V34: Swab of Blood from rear interior driver's side door trim	No DNA detected
Item V31: Swab of Blood from rear interior driver's side door handle	No DNA detected
Item V14: Swab of Blood from handbrake well	No DNA detected
Item V16: Swab of Blood from brake pedal	No DNA detected
Item V33: Swab of Blood from rear interior driver's side handle to door	No DNA detected
Lysis positive control concentration: 0.592 ng/ul	

Table 2: Evidence processed on 1 March 2013 (batch 3)

Sample	Comment
Lysis Batch # CWIQLYS20130301_03, (1 March 2013) Extraction Batch # CWEXT20130305_01 (5 March 2013)	
Item ML4: Cutting of Blood Soaked Fabric from front of T-Shirt	No DNA detected
Item V49: Swab of Blood from ignition	No DNA detected
Other BLACKBURN samples	
Item F5 - a trace DNA swab collected from bottom front of the mobile phone	Microcon. Poor profile

Item F9 - a trace DNA swab collected from the rear right side of the mobile phone	No DNA detected
Item F6 - a trace DNA swab collected from front upper and sides of the mobile phone	Microcon. Good profile
Item F10 - a trace DNA swab collected from the rear left side of the mobile phone	Microcon. Poor profile
Lysis positive control concentration: 0.416 ng/ul	

Table 3: Evidence processed on 8 March 2013

Sample	Comment
Lysis Batch # CWIQLYS20130308_03, (8 March 2013) Extraction Batch # CWIQEXT20130312_01, (12 March 2013)	
Item S14: Swab of Blood from gutter on Boddington Street	No DNA detected
Item S15: Swab of Blood from gutter on Boddington Street just west of Item S14	Unexplained weak profile
Item S16: Swab of Blood from upper gutter verge on Boddington Street	Unexplained weak profile
Other BLACKBURN samples	
Item L52: Swab of Blood from medial arch area on lower sole of LHS shoe	Good profile
Item L51: Swab of Blood from front upper label of LHS shoe	Average profile
Item L48: Swab of Blood from front upper sole of RHS shoe	Microcon. Avg profile
Item L24: Cutting of Blood Soaked Fabric from LHS rear of knee of pants	Good profile
Lysis positive control concentration: 0.677 ng/ul	

Table 4: Evidence processed on 23 April 2013

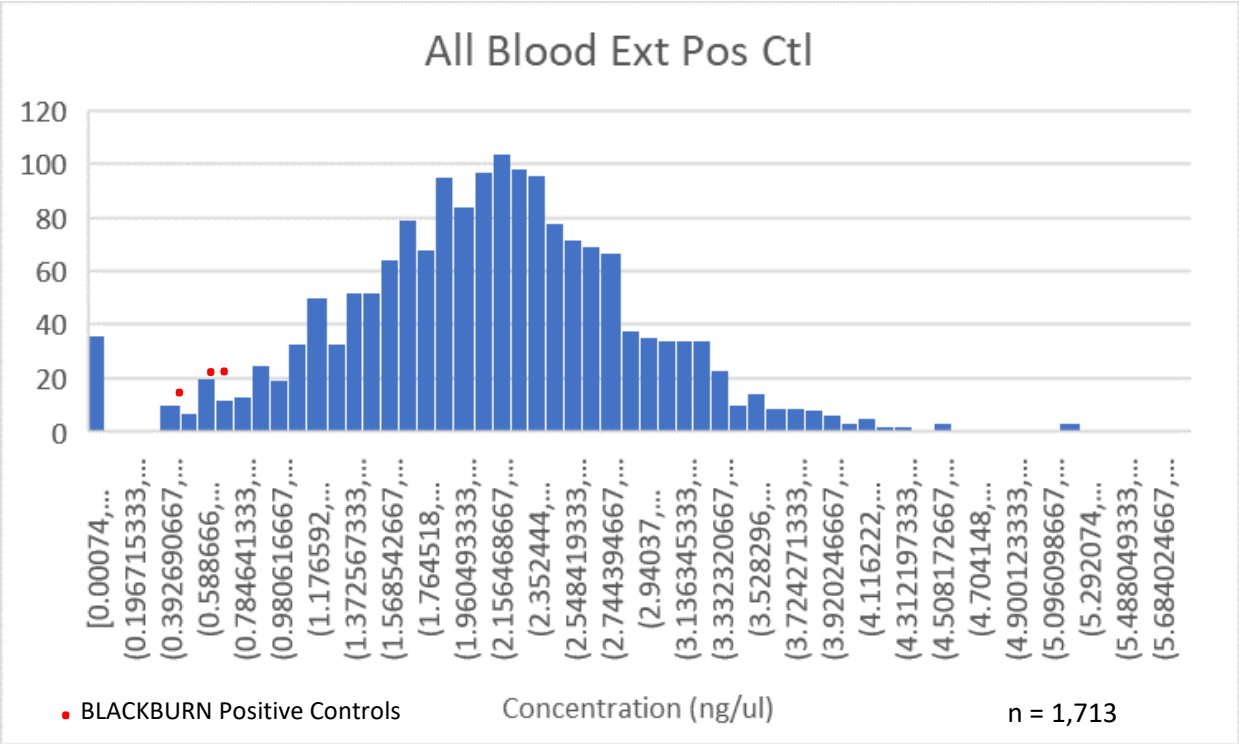
Sample	Comment
Lysis Batch # CWIQLYS20130423_01 (23 April 2013) Extraction Batch # CWIQEXT20130429_01 (29 April 2013)	
Item L14a - bloodstained fabric ~5mmx5mm excised from back right armpit	Unexplained degradation
Item L1a - bloodstained fabric ~5mmx5mm excised from front right upper chest area	Unexplained degradation
Item L6a - bloodstained fabric ~5mmx5mm excised from front LHS chest area	Unexplained degradation

Item L3a - bloodstained fabric ~5mmx5mm excised from front RHS below collar	Unexplained degradation
Item L9a - bloodstained fabric ~5mmx5mm excised from front left sleeve of shirt	Unexplained degradation
Other BLACKBURN samples	
Item L13a - bloodstained fabric ~5mmx5mm excised from proximal back left sleeve	Unexplained degradation
Item L5a - bloodstained fabric ~5mmx5mm excised from front LHS lower chest area	Slight degradation
Item L2a - bloodstained fabric ~5mmx5mm excised from front right button hole	Slight degradation
Item L12a - bloodstained fabric ~5mmx5mm excised from distal back left sleeve of shirt	Microcon. Good profile.
Item L4a - bloodstained fabric ~5mmx5mm excised from front LHS adjacent to buttons	Microcon. Slight degradation.
Lysis positive control concentration: 1.83 ng/ul	

It was noted that three of the four positive controls provided a low concentration value (three were below 0.7 ng/ul). OQI#34043 states "…*typically the positive extraction control yields values in the range of 1 – 3 ng/ul*". Analysis was conducted on all 'blood' positive controls from mid-2012 to mid-2013 using both extraction methods to further examine the expected concentration range. A total of 1,713 positive controls were included[8], providing a mean concentration of 2.145 ng/ul. The concentration range was between 0.00074 ng/ul to 5.88 ng/ul. This is a 7,945 fold difference between the lowest and highest concentration which is highly unexpected, indicating the QHFSS DNA extraction methods are providing inconsistent DNA yields which may be affecting profiling success. Figure 1 illustrates the distribution of positive control concentration values. The concentration of the positive controls from the three BLACKBURN batches (0.416 ng/ul, 0.592 ng/ul, and 0.677 ng/ul) are in the lower range of the distribution.

[8] Positive controls from both manual and automated extraction methods were included in the data set.

Figure 1: Distribution of 'blood' extraction positive controls concentration values from mid-2012 to mid-2013.



The performance of the BLACKBURN positive controls demonstrates they are below the QHFSS expected range (1 ng/ul to 3 ng/ul) and indicates poor success of these DNA extraction batches. It appears that QHFSS did not check the concentration values of positive controls, rather they checked the electropherograms to determine if positive controls 'passed'. The practice was to use the concentration value to automatically calculate how much DNA from each sample was required for amplification to provide a good profile (including positive controls). Therefore, if a positive control provided a very low concentration, more DNA would be added to the amplification reaction inadvertently 'masking' the poor batch result. Poorly performing crime scene samples would therefore be missed and released. Given the very high quantitation threshold in 2013 (0.01 ng/ul) this would have prevented many crime scene evidence from being tested.

Of the 1,713 positive controls examined over 2012 and 2013, 129 fell below the lower QHFSS expected range of 1 ng/ul. This represents 7.53% of all blood extraction batches that may have provided poor crime scene profiles, or failed to provide evidence when expected to. It is unknown what impact this may have had on each matter. Further investigation is needed into the QHFSS DNA extraction procedures to determine why they are providing significantly different results between batches. It is likely not due to a single

major cause (which would be easily identifiable), but rather a number of minor issues having a collective impact on profiling results that have evaded attention.