

MOONRAKER CRAWLEY

Evidence

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SUSSEX POLICE  
(when complete)

(CJ Act 1967, s.9; MC Act 1980, ss.5A (3) (a) and 5B; MC Rules 1981, r.70)

URN 

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Statement of: Martin RADMALL

Age if under 18: 018 (if over 18 insert 'over 18') Occupation: landlord

This statement (consisting of 1 page(s) each signed by me) is true to the best of my knowledge and belief and I make it knowing that, if it is tendered in evidence, I shall be liable to prosecution if I have wilfully stated anything which I know to be false or do not believe to be true.

Signature: [Redacted] Date: 28/4/2018

Tick if witness evidence is visually recorded  (supply witness details on rear)

I am the above person and I reside at the address shown overleaf.

I am currently the landlord of THE WOOD-RAKER PUBLIC HOUSE in CRAWLEY on THREE BRIDGES ROAD. I have been the landlord for approximately four and a half years.

On Friday the 27<sup>th</sup> of April 2018 I started work at my above pub at approximately 15:30 hours. The pub had already been opened up at 12:00 hours by one of my staff members.

At approximately 22:30 hours I was out on the main pub floor on the other side of the bar where all the customers drink and play pool. At this time I was sat down at a table by the front entrance of the pub playing pokers. I was playing poker with about nine other people. This is something I do every Friday pretty much. These tables I sit at I have described are on the right hand side as you walk into the pub from the main road front entrance.

While I was sat down as I have described at the time I have stated, all of a sudden I could hear a commotion coming

Signature: [Redacted] Signature witnessed by: PC CURTIS 00193

Continuation of statement of: Martin RADMALL

From the other end of the pub, next to the pool table at the far end, I immediately got up and rushed to go to where I could hear it coming from. As I walked up to the far end pool table I could then see a male lying on his back next to the bar. There were lots of people hanging by the pool table and by the male lying on the floor, but I didn't see how he got there or what had happened. I could see one of my regular drinkers I knew as 'R' near by and my immediate instinct was to hold him back. I don't know why as I don't know if he had been involved or not. I can't remember what he said. I also can't remember what any of the other customers were saying while this was happening. I could see one or two stools lying on the floor near to the male on the floor. I looked down to the male on the floor and I could see he had a bloody nose. I don't know how he got this and nobody told me how it happened.

I continued to stay where I was to try and calm the situation down. Several people got the male up off the floor and started walking him to the front entrance of the pub. I couldn't tell you who these people who helped up the male. I can't remember. It was all a haze in my mind. There was too much going on. I let go of the drinker I knew as 'R' at that point and followed the male who had been on the floor out of the pub. I could see he had a bloody nose. I told the male to just make his way home. He didn't say anything to me at all. As soon as he was

Signature: [Redacted] Signature witnessed by: PC (WTS). CC107

Continuation of statement of: Martin RADMALL


outside I then locked the door. This was to stop the male from coming back in or anyone else using that entrance to cause more trouble from inside.

Once the male had gone outside and the door locked I went back up towards the bar pool table area. I could hear people talking about what had happened and mention of a broken pool cue. However, I can't remember any specific detail. I heard someone say 'B●' had been threatened with a pool cue. I think maybe B● then hit the male who was on the floor. I don't know his for certain though. In my eyes it had all just been a storm in a teacup and the problem had now calmed down. I then went back to playing poker on the table I described. B● also came and played with us.

At about 23:45 I then began shutting the pub and everyone had gone. At this time I noticed a broken pool cue in the bin behind the bar. I left it there. I then closed up the pub and made my way home. I didn't see any blood from the male anywhere in the pub.

I would describe the male with the bloody nose as a white male in his 30s, of a medium build. He had short lightish hair. I can't remember what he was wearing. I don't know his name and I couldn't recognise him again.

The male I know as 'B●' I have known as a regular drinker in the pub since I have worked here. He is also known as '●●●' or '●●●'. All I know is he lives with his

Signature: x  Signature witnessed by: PC CURTIS 00195

Continuation of statement of: Marin RAOMALL

man in the local THREE BRIDGES area. I don't know his surname or his address. I would describe 'B...' as a white male, approximately 6'0" in height and of a stocky build. He is approximately late 20s to early 30s. He has short dark hair. He has tattoos on his arms but I don't know what of. He was wearing a dark top and jeans. I would remember him again as he always drinks in my pub.

I am willing to assist the police how I can and attend court if required, although as I've stated - I don't remember a great deal about the incident and did not see how it happened. Only what I heard others mention at the time. x M. [REDACTED]

Signature: x M. [REDACTED]

Signature witnessed by: PC CURTIS, 00103

[REDACTED] (when complete)

MG11

### WITNESS STATEMENT

Criminal Procedure Rules, r 16.2; Criminal Justice Act 1967, s.9

URN

[REDACTED]

Occurrence Number: 47180061529

Statement of: TIMOTHY WAINWRIGHT

Age if under 18: Over 18 (if over 18 insert 'over 18') Occupation: Police Officer

This statement (consisting of 2 page(s) each signed by me) is true to the best of my knowledge and belief and I make it knowing that, if it is tendered in evidence, I shall be liable to prosecution if I have wilfully stated in it anything which I know to be false, or do not believe to be true.

Signature: [Signature] #CW162 WAINWRIGHT, T.

Date: 28/04/2018 03:20

Tick if witness evidence is visually recorded

On Friday 28th APRIL 2018 I was on duty in full uniform crewed with PC JANMAN CJ390. At approximately 23:00hrs we were asked to attend [REDACTED] CRAWLEY. Police had received a call from SECAMB stating that a male at this address had been a victim of an assault. When we arrived on scene a male a now know to be [REDACTED] answered the door and let us in. It was dark but I immediately saw that M [REDACTED] had blood round his face and in particular his nose. When we went into the address I could see that a large area of M [REDACTED] nose had split and was hanging down. M [REDACTED] told me that this evening he had been drinking in the MOONRAKER, CRAWLEY and playing pool. A group he was playing pool with began to get rowdy. The next thing he recalls after this was walking home and having a large amount of blood coming from his nose. Ambulance attended and a decision was made to take M [REDACTED] to ST GEORGES HOSPITAL. Whilst at the address I have taken a number of photographs of M [REDACTED]'s injuries which I can exhibit to the court as follows;

23:28hrs TSW/01 ( ) PHOTOGRAPH OF LEFT SIDE OF FACE L [REDACTED] M [REDACTED] S.

23:28hrs TSW/02 ( ) PHOTOGRAPH OF FRONT OF FACE L [REDACTED] M [REDACTED] S.

23:29hrs TSW/03 ( ) PHOTOGRAPH OF RIGHT SIDE OF FACE L [REDACTED] M [REDACTED] S.

23:29hrs TSW/04 ( ) PHOTOGRAPH FULL LENGTH L [REDACTED] M [REDACTED]

Once at hospital I have at 00:58hrs seized clothing items from M [REDACTED] S which I can exhibit to the court as follows;

10/2017

[REDACTED] (when complete) v1.0

[REDACTED] (when complete)

MG11

TSW/05 ( ) BLUE T-SHIRT IN WHITE PLASTIC BAG.

TSW/06 ( ) BLUE PAIR OF JEAN IN WHITE PLASTIC BAG.

During this incident I was recording using my personal issue body worn video camera. Once back at Crawley Police Station at 03:33hrs I have burnt a copy of this footage which I can exhibit to the court as TSW/07 ( ).

10/2017

[REDACTED] (when complete) v1.0

[REDACTED] (when complete)

MG11

### WITNESS STATEMENT

Criminal Procedure Rules, r 16.2; Criminal Justice Act 1967, s.9

URN

47NC1228518

Occurrence Number: 47180061529

Statement of: ELLIOTT WHITEHEAD

Age if under 18: Over 18 (if over 18 insert 'over 18') Occupation: Trainee Detective Constable

This statement (consisting of 2 page(s) each signed by me) is true to the best of my knowledge and belief and I make it knowing that, if it is tendered in evidence, I shall be liable to prosecution if I have wilfully stated in it anything which I know to be false, or do not believe to be true.

Signature:  #CW191 WHITEHEAD, E.

Date: 28/04/2018 16:30

Tick if witness evidence is visually recorded

On Saturday the 28<sup>th</sup> April 2018 at 11:15 hours I spoke to a Martin RADMILL who is the landlord of the Moonraker Public House. I made enquiries about CCTV cameras within the pub itself. RADMILL stated that I was allowed to attend the pub and gather any footage that I needed in relation to an assault which took place the night before. 11:30 hours I attended the Moonraker Public House on Three Bridges Road. I spoke to the bar staff who showed me to the CCTV system. The system had 8 cameras attached

Camera 1 showed the pool area to the rear of the pub

Camera 2 was off line

Camera 3 was of the entrance area and pool table to the front of the pub

Camera 4 was of the outside to the front of the pub

Camera 5 was of the outside to the front of the pub

Camera 6 was of the rear garden

Camera 7 covered the bar area to the rear of the pub

Camera 8 covered the side alleyway

I looked at the time on the CCTV system which read 09:30 hours. The whole system was 2 hours show.

10/2017

[REDACTED] (when complete) v1.0



I was aware that at around 22:30 the previous night an assault had taken place. I had viewed footage on exhibit RSS/01 prior to attending the pub and knew that the assault took place at 20:36 (22:36).

I therefore backed up footage from camera 1, 3, 4, 5, 6, 7 from 20:00 – 22:00 (22:00 – 00:00) on the 27<sup>th</sup> April 2018. This backed up onto a USB stick as AVI video files. I took the USB stick and copied the files from it onto a DVD. I can exhibit this as ETW/280418/1317.

I watched the footage. In the footage on camera 1 you can see L [REDACTED] M [REDACTED] playing pool with a group of young males. I estimate these males are between 19 – 21 years old. There appears to be an argument between M [REDACTED] and the male who he is playing and his friend. M [REDACTED] gets pushed by the male who is watching the pool game. M [REDACTED] reacts by raising the snooker cue above his head. At this point the male who is playing pool puts down his cue and walks towards M [REDACTED]. At this point you see a male appear from the front of the pub. This male is wearing a pink shirt. He approaches the males and appears to try to calm the situation down. He is followed by another male who is wearing a two tone top. He stands near to M [REDACTED] but slightly out of sight of the camera. The last male comes marching over to the pool table is wearing a purple top and has tattoos on his arms. As he stands in front of M [REDACTED], M [REDACTED] hits the snooker cue on the pool table breaking it in half. Upon the cue being broken the purple shirt, two tone shirt and pink shirt males push M [REDACTED] down the pub to in front of the bar. At this stage they are in the back ground of the CCTV camera. You can see an object swing through the air however it is not clear what it is or what it hits.


Switching to camera 3 you can see two other customers eject M [REDACTED] from the pub. The male in the purple shirt eventually comes back to sit at the table next to the front door. It would appear that the people on this table are playing a game. I note that in the statement of RADMILL he states he was sat by the front door playing poker.

On Camera 7 you can see a young male hand a broken snooker cue to the bar staff. The member of bar staff puts the snooker cue behind the bar area.

I created some still images which I can exhibit as ETW/280418/1540.

[REDACTED] (when complete)

MG11

<b>WITNESS STATEMENT</b>	
Criminal Procedure Rules, r 16.2; Criminal Justice Act 1967, s.9	
URN	
Occurrence Number: 47180061529	
Statement of: ROSS SANDIFORD	
Age if under 18: Over 18	<i>(if over 18 insert 'over 18')</i> Occupation: Police Officer
This statement (consisting of 1 page(s) each signed by me) is true to the best of my knowledge and belief and I make it knowing that, if it is tendered in evidence, I shall be liable to prosecution if I have wilfully stated in it anything which I know to be false, or do not believe to be true.	
Signature:  #CS623 SANDIFORD, R.	Date: 28/04/2018 04:17
Tick if witness evidence is visually recorded <input type="checkbox"/>	

On Saturday 28th April 2018 I was on duty in full uniform crewed in a marked Police car (call sign WR104). At approximately 03:00hrs I was tasked to attend a Crime scene at The Moonraker Public House, Crawley in order to download the CCTV at the location which covered a serious assault. (CAD [REDACTED] 27APR18 refers). I attended the location and downloaded the footage of the incident. The CCTV system had a -2 hour time difference. I downloaded the footage onto a USB stick which I placed into an evidence bag and exhibited as RSS/01.

10/2017

[REDACTED] (when complete) v1.0



MG 11(T)

**ONLY**  
(when complete)

URN:

Statement of: Warren Matthew JONES

Age if under 18: Over 18 (if over 18 insert 'over 18') Occupation: Police Constable CJ903

This statement (consisting of 3 page(s) each signed by me) is true to the best of my knowledge and belief and I make it knowing that, if it is tendered in evidence, I shall be liable to prosecution if I have wilfully stated anything in it, which I know to be false or do not believe to be true.

Signature:  Date: 28<sup>th</sup> August 2018


Tick if witness evidence is visually recorded  (supply witness details on rear)


At about 1115 hours on Wednesday 30<sup>th</sup> May 2018, I was on duty in plain clothes, when I attended the Moonraker public house, at 199 Three Bridges Road, Crawley, West Sussex, RH10 1LE.


This premises has been issued Premises Licence 05/00073/LAPRE by Crawley Borough Council, permitting it to conduct certain licensable activities under the Licensing Act 2003.

At the time of my visit, the premises was permitted to conduct licensable activities, but had not yet been opened up to the public.

I was aware of a member of staff being on site, and after raising their attention, I identified myself to them, and they subsequently allowed me to enter the premises.

I recognised the member of staff from previous visits to the premises, and they too acknowledged recognising me. The member of staff produced her personal licence or inspection, and I now know her to be K B  - personal licence 16/01877/LAPER.

The Designated Premises Supervisor, and Premises Licence Holder, Mr Marlin Randmall, was not on site, but B  agreed to assist me on his behalf, in checking for compliance with the conditions attached to the above premises licence.

Condition 3 of Annex 2 of the premises licence states, "Active drug policy shall be in place, all persons caught dealing or using drugs will be reported to the local authorities and banned from the premises"  was unaware of such a policy document, and was therefore unable to produce it for inspection.

Condition 4 of Annex 3 of the premises licence states, "Fire drill records shall be on the premises at all times."



 mg11(t) 9/2007



MG 11(T)

[REDACTED] ONLY  
(when complete)

B [REDACTED] was able to produce for me, a Fire Risk Assessment document, dated 13<sup>th</sup> February 2018, and a Fire Safety Log Book. The latter had no entries in it, and B [REDACTED] was unable to locate any separate records of any Fire Drills. I took photographs of these documents, which I produce as my exhibits marked WMJ/01, WMJ/02, and WMJ/03.

Condition 7 of Annex 2 of the premises licence relates to the provision of CCTV at the premises. B [REDACTED] was unable to access the system to demonstrate it was retaining images for 28 days as required, but was able to show me the monitor screen. I noted that Camera 2 was not displaying a visible image. B [REDACTED] immediately recognised that this was the camera directly behind the entrance lobby, and was angled to view the main bar area through to the rear of the premises. She went over to that location, and moved a number of patio umbrellas that had been placed there for storage. The image on the CCTV monitor was immediately restored, and from this image could see that it would have captured footage of an assault that took place on 17<sup>th</sup> April 2018, had an obstruction not been present on that date.

Condition 8 of Annex 2 of the premises licence states, "All new members of staff (including any member of staff who is re-employed having previously worked at the premises) will receive induction training regarding the responsible sale of alcohol before being permitted to sell alcohol. All staff involved in the sale of alcohol shall be reminded of their obligations under the Licensing Act (and in particular not to sell alcohol to persons under 18 or to persons who are drunk) at least once every twelve weeks. All staff training shall be fully documented and copies of the training records made available to the local authority and Sussex Police on reasonable request." B [REDACTED] was unable to locate and produce any such training records, and confirmed to me that other than the training she had received on her Personal Licence course, she had never received any such training at the premises.

Condition 11 of Annex 2 of the premises licence states, "A written log shall be kept of all refusals to serve alcohol, refusals of entry to the premises and ejections from the premises. The premises licence holder shall have responsibility for making sure that this log is properly maintained and available for inspection upon request to Sussex Police and the Local Authority." B [REDACTED] was able to produce a clipboard with a single sheet of A4 paper on it, which was titled "ASK: Alcohol Refusals Police & Log". There were 13 entries on the log in regards to refusals of service. The most recent was dated 19/8/16, with the one prior having been entered on



[REDACTED] *PLS*

mg11(t) 9/2007



MG 11(T)

**CONFIDENTIAL ONLY**  
(when complete)

to the sheet in 2014. There was no record of any incidents of refusal of entry, or of ejection from the premises, and no entries dated 17<sup>th</sup> April 2018. I took two photographs of this sheet, which I produce as my exhibits WMJ/04 and WMJ/05.

B [redacted] allowed me to take a number of swabs from within the premises, which I later tested for the presence of illegal narcotics. The results of these swabs are detailed in a separate statement [redacted] (S03)

[redacted] (S03)




URN 

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Statement of: Warren Matthew JONES


Age If under 18: Over 18 (If over 18 insert 'over 18') Occupation: Police Officer

This statement (consisting of 3 page(s) each signed by me) is true to the best of my knowledge and belief and I make it knowing that, if it is tendered in evidence, I shall be liable to prosecution if I have wilfully stated anything in it, which I know to be false or do not believe to be true.

Signature:  *W. Jones*

Date 28<sup>th</sup> August 2018

Tick if witness evidence is visually recorded  (supply witness details on rear)

At approximately 1115 hours on Wednesday 30<sup>th</sup> May 2018 I was on duty in plain clothes at the Moonraker, 199 Three Bridges Road, Crawley, RH10 1LE. A member of staff, Mrs K-B  was present, and with her permission, 22 swab samples were taken by myself, from various surfaces around the premises. These swabs are Teflon coated fibreglass strips which pick up microscopic amounts of whatever substance is on a surface, such as controlled substances. The samples obtained were all placed individually into separate, fresh, and unused envelopes. The sample traps were subsequently tested by myself, in the Ion Track Itemiser machine which is situated in the licensing office at Horsham Police Station. I have received training from the manufacturers of the Ion Track machine which enables me to use the machine to test swabs taken and to interpret the results obtained. I ensured that the machine was working correctly prior to the testing of the swabs. The Itemiser is programmed to detect and identify microscopic amounts of many different types of narcotics and will correctly identify contamination down to nanogram (billionth of a gram) levels. Cocaine is one of the most reactive and easy to detect substances in the Itemiser's library. Responses are reported to the user by a simple and clear computer interface. An 'alarm' strength number gives the intensity of the response. This strength is an indication of the amount of narcotic contamination that was collected on the swab taken. The results of those 22 swabs are listed below, indicating where the sample was obtained, followed by the strength of any Narcotic substance detected:

MALE TOILET SEAT AND CISTERN: COCAINE – 5.76

MALE TOILET WINDOW: COCAINE – 6.69

MALE TOILET DOOR: COCAINE – 4.67; MDMA – 1.62

MALE TOILET PUBLIC AREA: COCAINE – 4.46; MDMA – 1.00

FEMALE TOILET 1 PAPER DISPENSER AND CISTERN: COCAINE – 5.17

FEMALE TOILET 1 WINDOW: COCAINE – 5.85

 *W. Jones*

FEMALE TOILET 1 DOOR: COCAINE – 2.60  
FEMALE TOILET 2 CISTERN: COCAINE – 4.17  
FEMALE TOILET 2 WINDOW: COCAINE – 2.97  
FEMALE TOILET 2 DOOR: COCAINE – 4.59  
FEMALE TOILET PUBLIC AREA: COCAINE – 3.52  
BAR RIGHT HAND END: COCAINE – 2.82  
BAR LEFT HAND END: COCAINE – 4.15  
FRUIT MACHINE: COCAINE – 4.30  
POOL TABLE (FRONT): COCAINE – 4.24  
POOL TABLE (REAR): COCAINE – 4.13  
GAMING MACHINE: COCAINE – 4.85  
JUKEBOX: COCAINE – 4.54  
TABLE UNDER REAR TV: COCAINE – 2.57  
TWO TALL TABLES BY SIDE TV: COCAINE – 2.65  
TABLE BY FRONT DOOR: COCAINE – 2.93  
TABLE UNDER FRONT WINDOW: COCAINE – 1.62; MDA – 1.62

Alarms of between 1 and 2 times the alarm threshold can be classed as a 'low' response. It could be attributed to cross contamination of the surface tested, background contamination, or greatly degraded historic contamination. It is not indicative of recent direct contact.


Alarms of between 2 and 3 times the alarm threshold can be classed as a 'medium' response. It could be attributed to cross contamination of the surface tested or recent historic contamination that may have been left a number of days prior to the sample being taken.

Alarms of between 3 and 4 times the alarm threshold would be classed as a 'high' response. This level of response would not be attributed to cross contamination and is indicative of recent and direct contact with measurable quantities of the narcotic identified by the machine.

Readings of 4.00 and above are estimated to relate to microgram amounts of contamination being transferred to the swab. This level of contamination is not generally experienced in any other environment than somewhere that has been in direct contact with a bulk amount of the source narcotic, in this case cocaine. This level is not generally experienced as background contamination or through incidental cross contamination by being in close contact with other contaminated areas or persons.



This statement and the enclosed results cannot be used in any Criminal investigations, and are provided on the understanding that they will only be used in civil proceedings.



3/2/03



Date and Time 30/05/2018 20:30

OFFICERS ATTENDED MOONRAKER PUB THREE BRIDGES ROAD AT APPROXIMATELY 20:30 ON WEDNESDAY 30/05/2018.

WE WERE TO SEE IF ANY SIA DOOR SUPERVISORS WERE EMPLOYED BY THE PUB.  
ALSO TO SEE IF A POOL LEAGUE WAS TAKING PLACE AT THE PUB WHICH POLICE HADN'T BEEN MADE AWARE OF.

NO SIA SUPERVISORS ARE EMPLOYED BY THE PUB, AND THE LICENSEE STATED THAT IN HIS 5 YEARS OF BEING MANAGER, THEY HAVE NEVER HAD SIA STAFF.

THE LICENCE HOLDER IS MARTIN RADMALL DOB: \*\*/\*\*/\*\*\*\*

OFFICERS CAN CONFIRM THAT THERE WAS A POOL LEAGUE EVENT TAKING PLACE AT THE PUB ON TWO SEPARATE TABLES. THESE ARE APPARENTLY LOCAL TEAMS AND NAME'S HAVE BEEN TAKEN FROM THOSE INVOLVED. THE NAME FOR THE LEAGUE IS CRAWLEY SUMMER POOL LEAGUE.

EMAIL ADDRESS IS: \*\*\*\*\*

THE HOME TEAM DETAILS ARE -

NAME: 8 BALL BANDITS

PLAYERS: J, P, M., S, G

THE AWAY TEAM DETAILS ARE -

NAME: INTER LEAGUE REJECTS

PLAYERS: A., S., W., S., N..

THE SECOND GAME UNDER WAY AT THE OPPOSITE END OF THE PUB HAD TWO MORE TEAMS.

HOME TEAM DETAILS ARE -

NAME: CUNNING STUNTZ

PLAYERS: S., A., C. J, R. P, A..

THE AWAY TEAM DETAILS ARE -

NAME: GRASSHOPPER

PLAYERS: T. P, G. H, N. A, P. S, L. B.

THE LICENSEE WAS WORKING ALONE, AND STATED THAT HE RARELY HAS OTHER STAFF WORKING AT THE PUB.

Innkeeper entry,  
copied & redacted.

*B. J. O'Leary*  
16/10/18

## GE Security Technology Statement

The Itemiser is programmed to detect and identify microscopic amounts of many different types of narcotics. Cocaine is one of the most reactive and easy to detect substances in the Itemiser's library. Responses are reported to the user by a simple and clear computer interface. An "alarm Strength" number gives intensity of the response. This strength is an indication of the amount of narcotic contamination that was collected on the sampling media used, in the case of Itemiser Mk 2, a cotton – paper disk and with the Itemiser 3 a Teflon coated fibreglass strip. These traps are cleaned and packed by GEIT in Boston, USA to ensure they are not contaminated before use. They should also be checked before use on site in a customs or police application.

Samples are taken from areas likely to contain fingerprints from the target subject but not necessarily directly from the person themselves. The machine will correctly identify contamination down to nanogram (billionth of a gram) levels.

Alarms of between 1 and 2 times the alarm threshold can be classed as a "low" response. It could be attributed to cross contamination of the surface tested, background contamination, or greatly degraded historic contamination. It is not indicative of recent direct contact.

Alarms of between 2 and 3 times the alarm threshold can be classed as a "medium" response. It could be attributed to cross contamination of the surface tested or recent historic contamination that may have been left a number of days prior to the sample being taken.

Alarms of between 3 and 4 times the alarm threshold can be classed as a "high" response. This level of response would not be attributed to cross contamination and is indicative of recent and direct contact with measurable quantities of the narcotic identified by the machine.

Readings of 4.00 and above are estimated to relate to microgram amounts of contamination being transferred to the sample media. This level of contamination is not generally experienced in any other environment than somewhere that has been in direct contact with a bulk amount of the source narcotic, i.e. this level is not generally experienced as background contamination or through incidental cross contamination by being in close contact with other contaminated areas or persons.

It should be noted that the presence of any response to drugs using the Itemiser could be used as grounds for furthering an investigation depending on the SOP of the enforcement agency using the device.

A full technical introduction to the Itemiser detection principals follows.

### Technology Notes - Trace Detection Technologies

The three most prevalent technologies available for trace detection of narcotics and explosives include Ion Mobility Spectrometry (IMS), Combination Gas Chromatography-Chemiluminescence (GC-CLD), and enhanced IMS, or Ion Trap Mobility Spectrometry (*ITIMS*). A fourth combination gas chromatography and mass spectrometry (GC-MS) is also available, but it is used mostly in lab-related equipment.

*IMS* separates ionized molecular compounds on the basis of their transit times (sometimes called "time of flight" or "drift time") when subjected to an electric field in a tube. This time is then compared to stored transit times of known compounds making it possible to distinguish the target material (explosives or narcotics) from other molecules. This technique is fast and makes a compact device possible.

Gaseous samples enter an ionization chamber where an ionization source emits low-energy beta particles resulting in ion formation in the gaseous phase. A gating mechanism allows the ions of the correct polarity to pass through the shutter grid and enter the ion drift region where an applied electric field mobilizes the ions. Less than 1% of the ions created

in the ionization chamber actually reach the drift tube as more than 99% of the ions are discharged on the shutter grid. The rate at which these ions traverse the ion drift region is inversely proportional to the size of the ion. This correlation allows for the identification of the analyte of interest[3]

**GC-Chemiluminescence** uses quantitative measurements of the optical emission from excited molecules to determine analyte concentration. Although GC-CLD technology has good sensitivity and selectivity, its range of detection is fairly limited. The GC-CLD technology employed in explosive detectors can only detect nitro compounds. Today, with the ever-increasing threat of non-nitro substances such as HMTD and TATP that are outside the detection range of this technology, the practical application of GC-CLD as an option for security outside the structured controls of a laboratory is limited. In addition, there are practical concerns about the expense of maintenance, instrument complexity, high consumable gas costs, and containment of potentially harmful materials, such as ozone, from the operator.

**ITMS**, like IMS, separates ionized vapours and then measures the mobility of the ions in an electric field. In the typical implementation of ITMS, the gaseous sample passes through a semi-permeable membrane prior to ionization. Also like IMS, the gaseous samples then enter an ionization chamber where an ionization source emits low-energy beta particles resulting in ion formation in the gaseous phase.

Unlike IMS, however, the ionization in ITMS is allowed to reach equilibrium in a field free region and then pulsed into the drift tube where an electric field accelerates the ions to the collector. Note that in the ITMS detector, the shutter grid does not exist, resulting in a much greater portion of the ions entering the drift tube.

#### **Performance Requirements of Trace Detection**

When comparing these technologies, there are important performance requirements that we can use to evaluate their application for checkpoint, facility, or event security. The requirements include sensitivity, selectivity, and range of compounds detected, logistics, and reliability/maintenance.

**Sensitivity (detection effectiveness)** is the degree of response of an instrument to an introduced concentration. In other words, how much of an explosive or narcotic material is required to detect it. In real world application of these devices, we must realize that there is a time limit to complete the analysis in order to process sample targets through the unit, typically in the 3- to 10-second range.

Assuming this is a realistic range; GC-CLD technology will have a loss in selectivity, as the GC column will not provide enough separation of the nitro compounds over this analysis time.

Traditional IMS loses sensitivity with the loss of ions to the shutter grid with its non-equilibrium ionization. ITMS enhances the sensitivity through many methods.

**Selectivity** is the ability to distinguish between compounds. Typically when sampling for explosives or narcotics, other materials are present and the threat signals need to be selected by the technology. All three technologies are able to accurately select the threat compound if it is present above the sensitivity level of that detector, although there are significant operational differences.

**Range of compounds detected** is quite simply the spectrum of material that the device can detect simultaneously. GC-CLD concentrates on distinguishing between nitro compounds, but detects *only* nitro substances. IMS detects *either* negative or positive

ions, but not both at the same time. ITMS simultaneously detects negative and positive ions, including both nitro and non-nitro target substances.

**Logistics** incorporate practical application issues present with each technology. This could include regulatory issues for ozone, radioactive sources, bottled gases, etc. IMS and ITMS contain radioactive sources. GCCLD requires handling of sensitive gases such as hydrogen, ozone, or helium.

### ***Reliability/Maintenance.***

Looking at the real world application of this technology in areas outside the controlled laboratory environment, reliability of operation and the ability to maintain peak performance in dusty, high-traffic, or humid conditions become a concern. Downtimes due to maintenance or excessive maintenance costs become other factors of concern. Both GC-CLD and IMS are unprotected from dust, dirt, and water vapour entering the system. This is a serious problem for traditional IMS, as the dryer or desiccant requires frequent changing and leads to downtime. In addition, the contamination material can lead to a loss of sensitivity over time if it is not installed in a very clean environment. The latest ITMS systems have regenerating dryers that do not require changing and a semi-permeable membrane to protect them from dirt, dust, and humidity. GC-CLD systems require replacement of the chemical modules approximately every 3-6 months if usage is high, which can be almost as expensive as a new bench-top ITMS or IMS detector. While all three require similar sampling consumables, the GC-CLD requires gas bottle replacement on top of the consumables. The ITMS and IMS devices require dopant depending on the application.

### **ITMS vs. IMS Technology**

Enhancements to IMS analysis through ITMS technology allow for vast improvements to ionization efficiency, and therefore sensitivity of the detector. ITMS enables extremely low concentrations of electrophillic vapours, such as explosive vapours, to be detected—impossible with traditional IMS.

The ionization chamber in the ITMS detector is a field-free region where the ion population, both negative and positive ions, is allowed to build up by the action of the beta particles on the dopant gas. With IMS and ITMS, the high density of electrons produce a high probability of ionization of the dopant gas molecules, which in turn collide with the target molecules. Electric charge is then transferred to the target molecules because of their extremely high charge affinity, and the overall result is high ionization efficiency.

Since the ITMS detector does not incorporate a shutter grid as in traditional IMS, there is no loss of ions by discharge onto the shutter grid, which could account for a loss of up to 99% of the ions. With ITMS, ions are accumulated over a 20mS interval and then compressed into a pulse of 0.2mS, increasing the density and collected current by a factor of 100 [4,5,6]. Further enhancement is made with the addition of a semi-permeable membrane that excludes dust and dirt.

This enhancement makes the system more sensitive to the materials of concern and allows continued operation and sensitivity in environments outside the lab that are high-traffic, humid, or dusty. In addition to providing a charge medium, the chemical dopant that is added into the analysis in the detector region to reduce the chances of ionizing unwanted analyte. Ammonia is the primary dopant for positive ions used in the ITMS detector, while methylene chloride is used as the dopant for negative ions. The dopants accept charge from the low-energy beta particles thereby reducing the chance of analytes with charge affinities lower than

that of the dopant to accept charge. The target contraband molecules will accept the charge more readily than the dopants due to their higher affinity for the charge. This process reduces the amount of possible interferences due to the other analytes because the detector recognizes only charged species [4,5,6]. Finally, recent advancements in ITMS technology incorporate engineered high speed switching systems that allow for millisecond alternating from positive to negative ion mode, thereby allowing for simultaneous detection and analysis of target positive and negative ions. Most narcotics have a positive ion affinity, while most explosives have a negative ion affinity; however, there are some important exceptions. TATP, for example, is an explosive that is seen as a positive affinity molecule, which would not be detected in a traditional IMS in single-mode operation for explosives. Detection limits for real world samples in ITMS in vapour sampling mode is in the picogram range.

#### Summary

As we look to implement a total solution for security, trace detection technologies become an integral component of that solution. Complementing x-ray scanners and metal detection, trace detection closes security loopholes by detecting microscopic particles that remain on clothing, luggage, ID cards, and more after explosives or narcotics are handled. Because it can sniff out vapours that build up in confined spaces, trace detection is especially effective for finding contraband hidden in compartments, suitcases, and lockers. ITMS technology offers the advantage of detecting a wider range of targeted substances in a more flexible detector design. Therefore it is ideal for practical applications such as checkpoint security, and screening vehicles, personnel, shipside, sea craft, packages, luggage, and cargo.

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