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BC/GTA

15th January 1983

Christopher Price Esq, MP
House of Commons
London SW1 OAA

Dear Christopher

Please find enclosed my report on the work carried out for the prosecution in the Conlon case. Once you have read it perhaps you will let me know if you wish me to meet with you in London. I don't think now that there is any need to visit Woolwich but you may be of a different opinion.

Kindest regards.

Yours sincerely

Dr Brian Caddy
Senior Lecturer in Forensic Science

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11th January 1983

Case Against Patrick Joseph Conlon:
Evidence Presented at Trial by the Prosecution

Opinion by:

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Further to my earlier report on the work of Mr Yallop (5th February 1982), produced on instructions from Mr Christopher Price, MP, I have now read copies of additional papers relating to the trial of Patrick Joseph Conlon. These are the scientific evidence for the prosecution presented by Mr Elliott (E1, E1A, E2), Mr Wyndham and Dr Hayes (E2) and Mr Higgs (E3), together with experimental data labelled Ex43, Ex44, Ex45, and Ex46. I have also read a copy of the transcript of the decision of the Court of Appeal before Lords Justices Roskill and Waller and Mr Justice Ackner dated 30th July 1977.

Clearly the prosecution evidence rests upon the positive identification of nitroglycerine removed by dry and wet swabbing and finger nail scrapings from the hands of Patrick Joseph Conlon. It is important that this collection procedure was correctly carried out in order to avoid cross contamination. Apart from a minor discrepancy (E3-79/80) this appears to have been satisfactory. Subsequent identification was based upon one thin layer chromatographic test employing silica gel as the layer material and toluene as eluant. While

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this would appear to be a single test it is multifacetted in that not only has the distance of migration of the suspect material applied to the chromatographic plate, expressed as the Rf value, to be the same as a standard of nitroglycerine, but the response of the compound after chromatography and following various chemical and physical treatments should also be identical with the response for nitroglycerine. For purposes of clarity the thin layer chromatographic migration of the suspect material will be discussed separately from the chemical and physical responses.

Chromatographic Migration

The Rf value of a substance, defined as the distance of migration of that material relative to the distance of travel of the eluting solvent, is dependent upon the nature or "activity" of the silica gel material, the purity of the eluting solvent, temperature, slope of the plate in the developing chamber and the position of the applied material relative to the surface of the eluant, etc. When all these parameters are not controlled variations in Rf value for a particular substance may occur from one

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chromatographic run to another. This is clearly demonstrated by reference to page 1 of the document referred to as Ex43 which gives values of Rf for nitroglycerine ranging from 0.58 to 0.74. For identification of an unknown material with a particular compound such as nitroglycerine it is therefore necessary always to run a standard of nitroglycerine on the same chromatoplate. To correct for variations across such a plate it is good practice to apply more than one standard of nitroglycerine usually one in the centre and one at either edge. There is no evidence in the documents I have examined to indicate that this latter practice was followed.

Efforts were made to show that some 351 available compounds containing the nitro chemical grouping could not have interferred with the thin layer test for nitroglycerine. One criterion for eliminating most of these compounds was their Rf value in comparison with that of nitroglycerine. In the experimental data provided in the document Ex44 only one Rf value of 0.58 was recorded for nitroglycerine and since it would be impossible to analyse the whole 351 compounds on a single plate, one is left wondering if a nitroglycerine standard was applied to each of the many chromatoplates which would

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have been required for such a study. This would be especially important in view of the variation in Rf value demonstrated for nitroglycerine and probably the compounds themselves. This problem of referring the Rf value of an unknown compound to a collection of Rf values of a series of known compounds for the purposes of identification of the former has been known for many years and for this reason it has been common practice to report Rs values i.e. the Rf value relative to the Rf value for some standard materials applied to the same chromatoplate and chromatographed under identical conditions. Alternative methods employ a series of standards applied as a single spot, each compound having a different Rf value usually of the order of 0.2-0.3, 0.4-0.6, 0.7-0.9. These values can then be used to produce corrected Rf values. Neither Rs values nor corrected Rf values have been used in the work under examination. As a consequence, while the list of 351 Rf values is a rough comparative guide, it cannot be used with any confidence. It should be pointed out that although the numbering in document Ex44 reaches a value of 351 there are considerable gaps in the number of compounds actually listed. Of particular note are the non-listing* of the compounds pentaerythritol tetranitrate (PETN) and ethylene glycol dinitrate (EGDN) the former being referred to in the Appeal Judgement (17-C/D) in Exhibit 60

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which is not in my possession. Reference to both PETN and EGDN is important because it is known, and was known at the time of the trial, that these two compounds, both of which are explosives, could not be distinguished from nitroglycerine on the basis of their Rf values in the thin layer test which employs toluene as the eluting solvent. This highlights the dangers of trying to identify a chemical by using a single thin layer chromatographic system. A quotation from a recent publication in the learned Journal "The Analyst" by Stead, A.H., Gill, R., Wright, T., Gibbs, J.P. and Moffat, A.C. (October 1982, 107, 1106-1168) of the Home Office Central Research Establishment is apposite. They state that "A single system, no matter how good, is of limited use for the identification of unknown compounds". While their paper refers to drug analysis it is this principle that has been accepted by most analysts since the introduction of the thin layer chromatographic technique. However in the present context there may have been insufficient material available from the swabs to permit further analysis (see Higgs evidence E3-37D) although I cannot find any reference to this problem.

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Chemical Verification

The other aspect of this thin layer chromatographic analysis for nitroglycerine relates to the response to certain chemical and physical tests of the chromatographed material. The principle involved is concerned with the reductive hydrolysis (not simply a reduction as stated by Mr Elliott (Document E1-36A) of nitroglycerine with sodium hydroxide solution to produce a nitrite which then participates in a diazonium coupling reaction involving the Griess reagent to yield a pink colouration. Heating for a short period accelerates this reaction. Observation of the chromatogram at each stage of this reaction sequence under both visible and ultra violet light will act as a discriminator for nitroglycerine when compared with other nitro compounds. Of the compounds listed in document Ex44 (nominally 351) all can be discriminated from nitroglycerine on the basis of observations of Rf and chemical effects as described above even for those compounds which have an apparently similar Rf value. This is not surprising since all but 4** of the compounds listed are aromatic nitro compounds unlike nitroglycerine which is an aliphatic nitrate ester, not as described by Mr Elliott (E1A-154D) an aromatic nitrate. As I have stated above, noteable

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omissions in document Ex44 are the compounds PETN and EGDN whose response to the chemical and physical tests would be important in trying to distinguish them from nitroglycerine since they demonstrate the same Rf value as the latter. However, reference to the Appeal Court Document - (page 17-C/D) would indicate that nitroglycerine may be distinguished from PETN by the rate of colour development with the Griess reagent. I am not aware of any reported study on this topic and since the rate of appearance of colour is usually concentration dependent I am sceptical as to the validity of this observation especially since the concentration of materials removed from swabs is unknown. No comments can be made about the response of EGDN to the chemical reagents since these are not recorded in any of the documents in my possession.

Conclusions

From the above certain conclusions can be drawn. If one accepts the validity of the listed Rf values (document Ex44) for comparison with that of nitroglycerine, and doubt must be expressed of such an assumption, then very few known compounds have the same chromatographic mobility as nitroglycerine in the eluant toluene and still fewer known compounds will also give the same

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response as nitroglycerine to all aspects of the Griess test applied to the chromatographed material. The prosecution witnesses contend that no other known compounds conform in all aspects of the analysis to nitroglycerine (Mr Elliott El 81 C/D) but I am of the opinion that both pentaerythritol tetranitrate and ethylene glycol dinitrate could not have been distinguished from nitroglycerine by these tests. For this reason and because there is always doubt arising from a single thin layer chromatographic examination using only one solvent system (Mr Elliott El 81F), I would expect at least one further confirmatory test to have been carried out. This could have been thin layer chromatography using an eluent which is known to resolve the three compounds or another technique such as gas chromatography. Appropriate analytical systems were reported in the scientific literature prior to the date of the trial and have recently been summarised by Yinon and Zitrin in a book published by Pergamon entitled "The Analysis of Explosives". To find that they have not been used in such an important case where the key evidence rests upon the unequivocal identification of nitroglycerine I find surprising.

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My opinion of the work of Mr Yallop is confirmed by the chromatographic analysis carried out by Dr Hayes on certain proprietary products (Ex45) in that there is no evidence of any material present in these products which could be misidentified as nitroglycerine.

Signed: Ian Caddy

Brian Caddy

Date: 11th January 1983

* These compounds may of course be listed in the complete document.

**This number is not exact owing to the imprecise nomenclature used for some compounds.

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