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## A Second Survey of High Explosives Traces in Public Places\*

**ABSTRACT:** This survey was carried out as a follow-up to a 1994 survey carried out by this laboratory (1) in order to determine the background levels of explosives traces in public places. The first survey concentrated on transport areas and police stations in and around London. This second study examines levels in four of the United Kingdom's major cities: Birmingham, Cardiff, Glasgow, and Manchester. Samples were taken at various transport sites and from hotels, private houses, private vehicles, and clothing. The survey showed that traces of the high explosives nitroglycerine (NG), trinitrotoluene (TNT), pentaerythritol tetranitrate (PETN), and cyclotrimethylene trinitramine (RDX) are rare within the general public environment. Only one low-level trace of RDX was detected. NG, possibly associated with the use of firearms, was detected at low levels in two samples and 2,4-DNT was detected in a separate sample. No PETN was detected in any of the samples. The results of the survey indicate that it is unlikely that persons visiting public areas could become significantly contaminated with explosives. The analytical procedures employed would also have detected ethylene glycol dinitrate (EGDN) if present at levels greater than 2 ng, nitrobenzene (NB) if present at levels greater than 50 ng, mononitrotoluenes if present at levels greater than 50 ng, and the other common isomers of dinitrotoluene if these had been present at levels in excess of 10 ng. None of these were detected. The relatively high volatility of EGDN, NB, and the mononitrotoluenes would, however, cause traces of these compounds to disperse rapidly. A proportion of the samples (approximately 7%) were analyzed for the presence of HMX. No HMX was detected.

**KEYWORDS:** forensic science, explosives traces, survey, ethylene glycol dinitrate, nitrobenzene, nitroglycerine, trinitrotoluene, pentaerythritol tetranitrate, cyclotrimethylene trinitramine, dinitrotoluene, mononitrotoluene, cyclotetramethylene tetranitramine

Prior to 1995, only limited and unsystematic data were available to assess the likelihood that a suspect might have become innocently contaminated with traces of high explosives through contact with the general public environment. This laboratory carried out a survey at a variety of sites in and around London (1) in 1994/1995 with the aim of increasing the available data so that better assessments of the likelihood of innocent contamination could be made. A second survey has now been completed encompassing four of the United Kingdom's major cities—Birmingham, Cardiff, Glasgow, and Manchester—and a similar variety of sampling sites.

This second survey concentrates mainly on public means of transport, as did the first, but also encompasses samples collected from hotel rooms, private houses, private vehicles, and clothing. The first survey also included police stations, police vehicles, and the hands of civilian police workers. These were not included in the second survey due to limitations in finance and time and as it was considered that data from larger numbers of public sites would be of greater value than data from police stations. Public means of transport come into contact with very large numbers of people, from a wide cross section of society, and were thus considered particularly suitable as sampling sites to measure the extent of trace explosives contamination in the public environment. Samples were collected from taxis, buses, trains, airports, hotels, private houses, privately owned vehicles, and clothing purchased from charity shops. Permission was obtained from the relevant parties prior to collection of the samples.

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Forensic trace explosives samples are normally collected either by wiping a surface with a swab or by vacuum onto a filter. The former technique is best suited to nonporous surfaces such as hands or surfaces such as windowsills or tables, while the latter is often used for rough, porous surfaces such as textiles, including clothing. Both of these techniques were employed, as appropriate, during the survey.

During the time between the first and second surveys laboratory procedures have progressed. The most significant alteration to procedures has been the introduction of a 1:1 mixture of ethanol:water for solvent swabbing as it enables combined collection of organic and inorganic traces. The solvent is now included in the kits that the laboratory supplies to the U.K. mainland police forces for collection of explosives trace evidence. Although this survey aimed to collect data for organic species only, and use of ethanol as a collection solvent is still within the scope of the laboratory, it was considered wise to use the mixed solvent as it is in keeping with the most frequently used current laboratory procedures for trace analysis.

### Materials and Methods

#### Sampling Kits

In order to ensure consistent and easy sampling of a variety of different sites, standardized sampling kits were built for each type of site. The resulting kits contained all materials required to take swab samples, including quality-assured cotton wool swabs, ethanol:water to moisten the swabs, pairs of disposable gloves, and an alcohol-soaked wipe for washing operators' hands prior to collection of the samples. Figure 1 is a photograph of a sampling kit designed for collection of samples from private vehicles.

Each kit was packed into a labeled "Securitainer" (a cylindrical plastic pot with sealable lid) which was then double wrapped in

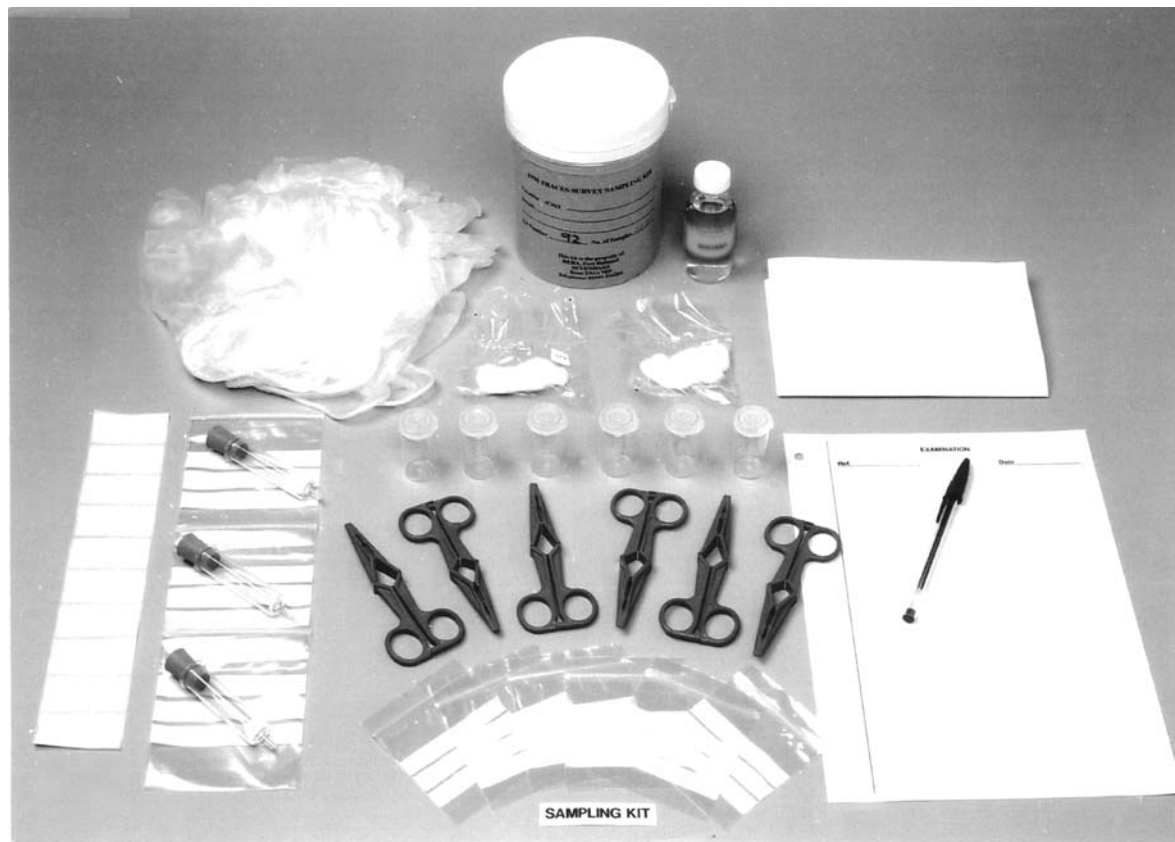


FIG. 1—Photograph showing the contents of a sampling kit.

nylon bags. The kits were prepared in a dedicated explosives trace laboratory, which is regularly sampled to ensure the absence of explosives traces (2). Each kit was given a unique number to identify it. The kits were tailored to individual sampling sites, containing enough materials for the collection of the required number and type of samples; some of the kits included vacuum tubes (1).

#### *Quality Assurance of Sampling Kits*

One in 20 of the kits built were quality assurance tested as follows. Enter the trace laboratory according to the standard operating procedures donning a disposable oversuit, overshoes, gloves, and a hat. Clean the workbench and cover it with glazed paper. Put on a clean pair of disposable gloves and take a control swab sample from the glazed paper, the front of the oversuit, and gloved hands. Open the kit to be tested and don a pair of gloves from the kit. Remove the glazed paper from the kit and open it out on the work surface. Lay out the contents of the kit onto its glazed paper. Use one pair of the kit forceps and the pair of gloves currently being worn for all the swabbing. Use five swabs, each moistened with a 1:1 mixture of ethanol and water as solvent, to sample in turn the kit gloves, forceps, and solvent bottle exterior, the interior of the Securitainer and lid, notepaper and pen, and glazed paper, placing each swab in a separate labeled vial taken from the kit.

Extract the samples by adding 5 mL of ethanol:water (1:1) to the first vial and pounding the swab with a Pasteur pipette. Use the pipette to transfer the solvent and repeat the procedure for each vial, finally transferring the solvent solution to a fresh non-kit-labeled vial. Repeat this procedure with one further aliquot of solvent to produce a final extract of about 10 mL. Clean up the extract (using the method outlined below) and analyze.

In addition to the samples produced from the quality assurance of the kits, control samples taken during the preparation of kit components, the building of the kits and the quality assurance of the kits were also processed and analyzed. All of the kit quality assurance samples and the associated control samples were found to be free of explosives.

#### *Sampling of the Chosen Areas*

On arrival at the chosen site the alcohol-moistened wipe attached to the kit was used to clean the operators' hands. Personnel carrying out the sampling donned disposable gloves, a disposable suit, hat, and boots. The purpose-built sampling kits were then used as follows. Open the kit, keeping it in the nylon bag. Don a pair of gloves and lay out the contents of the kit on the glazed paper. Take a swab and solvent control sample. Take a control swab sample from the glazed paper and the front of the oversuit. Use the pen and notepaper to draw a plan of the site and note each area to be sampled. Don a fresh pair of gloves and swab the first area. Label the swab vial. Repeat for the remaining areas using fresh gloves, forceps, vials, and swabs for each area. (The kits contained some spare swabs that could be used if an area required more than one swab.) Seal the samples and notes into the Securitainer, then seal the Securitainer into a clean nylon bag.

Vacuum sampling was carried out as described in Ref 1 using a fresh clean length of tubing for each set of samples and a portable Laboport vacuum pump.

Each site required different samples to be taken. Even within each class of site there were significant differences; however, in every case the areas chosen for sampling were those that were most likely to have been in contact with people and their clothing. Typical areas for each class of site are given in Table 1.

TABLE 1—*Areas sampled.*

Site	Number Sampled	Areas Sampled
Taxis	10	Rear seats, floor, rear doors, door handles, backs of front seats
Buses	8	Seats, handles, luggage area, ticket issue area, handrails
Trains	8	Tables, handles (on seat tops), seats, luggage racks
Airports	3	Baggage search benches, baggage X-ray machine, rollers at end of baggage X-ray machine, tables, chairs, information desks, telephones
Hotels	4 (five rooms in each)	Desktops, bedside tables, carpet, clothes tidy, inside of drawers of desk, handles—desk and door, switches, telephone, kettle, hairdryer, chairs, windowsill, area around bathroom sink, TV remote control
Private houses	20	Desk, shelves, inside of wardrobe, kitchen surfaces, kitchen table, inside of kitchen cupboards, kitchen floor, windowsills, living room carpet, stair banister, radiators, top of television, settee
Private vehicles	25	Driver's controls—steering wheel, gear stick, indicators, door handles inside, seats (front/back), footwells, trunk, parcel shelf, rear passenger doors, rear cargo area (small vans only)
Clothing	100 items	Jeans, coats, blouses, shirts, children's dresses, ladies' nightdress, ladies' boots, girls' skirts, ladies' skirts, underwear, baby-gro, mens' trousers, mens' suit jackets, children's sweatshirts, children's coats, baby's cardigan, men's shoes, men's jumpers, T-shirts, adult sweatshirts, ladies' suit trousers

### Control Samples

At least two controls were collected with every set of samples as described above and were processed alongside the appropriate samples. The true control—the swab and solvent control—sampled only the materials to be used and in effect controls the process of extracting, cleaning up, and analysis of the samples as it is carried through the procedure alongside its related samples. The monitor controls comprised a work surface/operator control (a swab of the glazed paper and the operator's suit and gloved hands) and, in kits where vacuum samples were collected, also a vacuum control collected of the surrounding air.

All of the areas were sampled either during or after their normal usage and before any cleaning procedures were carried out. The items of clothing were purchased directly from charity shops in the four cities, wrapped in three thick plastics bags by the staff in each shop, transported back to the trace laboratory, and were sampled by vacuuming as described in Ref 1.

### Processing of the Samples

All sample processing was carried out in the trace laboratory. Each kit and each sample were processed separately, taking care to avoid cross-contamination. Swabs in vials and vacuum tubes were removed from the Securitainer and a fresh set of laboratory vials was labeled to correspond with the sample vials. Each swab was extracted with two 5 mL aliquots of 50:50 ethanol:water, pounding the swab thoroughly with the Pasteur pipette after adding each aliquot. The aliquots were transferred to the appropriately labeled vial. The resulting sample was cleaned up using the method outlined below. Each vacuum tube was extracted by adding 6 mL of the 1:1 ethanol:water mixture in two 3 mL aliquots. The eluate was collected in an appropriately labeled vial and cleaned up in the same way as the swab extracts.

### Summary of Cleanup Process

Cleanup tubes consisted of a 230 mm glass Pasteur pipette containing a 6 mm depth of Chromosorb 104 (100–200 mesh) acrylonitrile/styrene copolymer adsorbent confined between disks of Whatman GF/D glass fiber filter paper. Each cleanup tube was washed thoroughly prior to use, first with 1 mL of ethyl acetate, then with 2 mL of a 1:1 ethanol:water mixture. The sample was passed through

TABLE 2—*Composition of explosives standard solution.*

Explosive	Concentration (ng/ $\mu$ L)
ethylene glycol dinitrate (EGDN)	0.1
nitrobenzene (NB)	0.5
2-nitrotoluene (2-NT)	0.6
3-nitrotoluene (3-NT)	0.6
4-nitrotoluene (4-NT)	0.6
nitroglycerine (NG)	0.2
2,4-dinitrotoluene (2,4-DNT)	0.4
2,6-dinitrotoluene (2,6-DNT)	0.3
3,4-dinitrotoluene (3,4-DNT)	0.2
2,4,6-trinitrotoluene (TNT)	0.4
pentaerythritol tetranitrate (PETN)	0.75
cyclotrimethylene trinitramine (RDX)	0.5

the cleanup tube under gravity flow and the eluate retained. A 1 mL aliquot of 15:85 MTBE:n-pentane was then passed through the tube and the Chromosorb-104 was blown free of solvent using the teat of a Pasteur pipette. Explosives were retained on the Chromosorb-104 and were recovered by eluting with 0.8 mL of ethyl acetate. The resulting final extract was collected in an appropriately labeled septum vial with a microvolume insert. It was concentrated down to approximately 100  $\mu$ L under a stream of dry nitrogen at room temperature ready for analysis.

### Analysis of Samples

Gas chromatography with chemiluminescence detection (GC/TEA) (1) and, where necessary, combined gas chromatography/mass spectrometry (GC/MS) were employed to detect, identify, and confirm the presence of explosives traces. Although the most common high explosives—ethylene glycol dinitrate (EGDN), nitrobenzene (NB), nitroglycerine (NG), trinitrotoluene (TNT), pentaerythritol tetranitrate (PETN), cyclotrimethylene trinitramine (RDX), and the mononitrotoluenes and dinitrotoluenes—may all be detected by these techniques, the explosive cyclotetramethylene tetranitramine (HMX) and the propellant ingredient nitrocellulose are not sufficiently volatile to be detected.

A standard solution (known as the “TEA standard”) containing 12 common explosives was used for retention time comparisons. The composition of the solution is given in Table 2.

TABLE 3—Details of gas chromatography columns.

Column	Oven Program	Carrier Pressure
SGE type 12QC2/BP1 0.25, 12-m polyimide clad silica, 0.22 mm i.d., 0.33 mm o.d., coated with bonded dimethylsiloxane 0.25 $\mu\text{m}$ film thickness	75°C/1 min +20°C/min to 200°C/2 min	250 kPa
SGE type 12QC2/BP5 0.25, 12-m polyimide clad silica, 0.22 mm i.d., 0.33 mm o.d., coated with bonded 5% diphenyl-dimethylsiloxane 0.25 $\mu\text{m}$ film thickness	75°C/1 min +20°C/min to 200°C/2 min	250 kPa
Chrompack CP-Sil-19CB, 4 m cut from 25-m polyimide clad silica, 0.25 mm i.d., 0.39 mm o.d., coated with bonded 7% cyanopropyl-7% phenyl-1% vinyl-dimethylsiloxane 0.21 $\mu\text{m}$ film thickness	65°C/1 min +20°C/min to 250°C/2 min	70 kPa

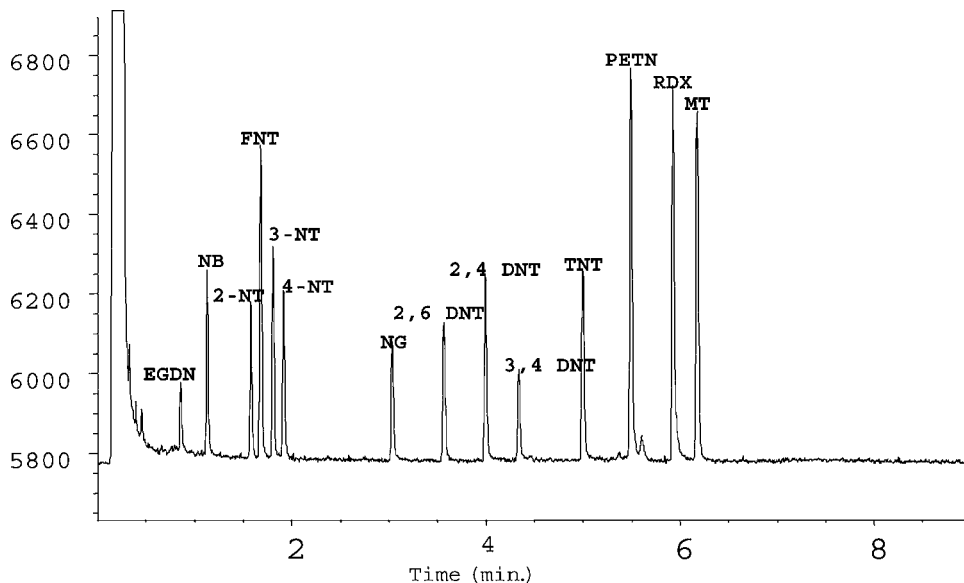


FIG. 2—Example chromatogram of TEA Standard—BP5 column. FNT is 2-fluoro-5-nitrotoluene reference marker. MT is 'Musk Tibetine' (2,6-dinitro-3,4,5-trimethyl-tert-butylbenzene) reference marker.

The samples were analyzed as described in Ref 1 with the exception of a modification to the temperature program of the gas chromatographs to allow screening for NB. The details of the gas chromatography columns are given in Table 3 and a chromatogram of the TEA standard analyzed on the BP5 column is shown in Fig. 2.

#### Interpretation of Chromatograms

Interpretations of the chromatograms were carried out as described in Ref 1. It is important to stress that detection using a single column type was not regarded as sufficient for confirmed identification of an explosive. Samples in which one or more explosives had been possibly detected on one column type were subsequently analyzed using two further column types. A positive explosive detection was recorded only if analyses using all three column types gave consistent results. This procedure is the same as that applied to forensic samples analyzed at the Forensic Explosives Laboratory. Results presented in the tables are the average of the three analyses.

Samples found to contain explosives traces were analyzed by GC/MS for further confirmation of this identification. The analytical system consisted of a Fisons/Carlo-Erba 8000 series GC operated as for the GC/TEA method, connected to a Fisons/VG MD800 Quadrupole mass spectrometer operated in electron impact mode at unit mass resolution. The gas chromatograph contained a BP-5 column. Mass spectra were directly compared with those obtained

when the TEA standard solution was analyzed under identical conditions.

#### Analysis of Samples for the Presence of HMX

Thirty-seven of the kit samples were analyzed using liquid chromatography/mass spectrometry (LC/MS) for the presence of the high explosive species cyclotetramethylene tetranitramine (HMX). The apparatus used was an HP1100 quaternary pump system with membrane degasser, autosampler, thermostatically controlled column oven, and UV/Vis photodiode array detector. A Thermo-Finnigan "Navigator" (benchtop quadrupole mass spectrometer) was coupled to the liquid chromatography system electrospray ionization interface. The ethyl acetate was removed from the samples by evaporation and the samples were taken up into methanol (HPLC grade) and water. Operating conditions for the LC/MS system are given in Table 4. HMX was not detected in any of the 37 kit samples analyzed.

## Results and Discussion

#### Background Information

When interpreting the results presented below it is necessary to bear in mind that some members of the general public have legitimate access to explosives and firearms and thus could act as

TABLE 4—Details of LC/MS operating conditions.

Chromatograph	HP1100 series
Column	Phenomenex spherex 5 C18 250 × 2.0 mm with C18 guard column
Mobile phase	60:40 MeOH:H <sub>2</sub> O with 20 mM NH <sub>4</sub> Ac
Oven temperature	30°C
Spectrometer interface	Electrospray probe assembly
Source temperature	150°C
Gas flow rate	300 L/h
Source needle setting	3.5 kV
Source skimmer setting	1.5 V
Source skimmer offset	5 V
Rf lens setting	0.2 V
Low mass resolution	12
High mass resolution	12
Ion energy	1 V
Ion energy ramp	0
Multiplier	650 V
Cone voltage	15 V
Masses monitored	226 257 281 286 318 346 355 375

TABLE 5—Taxi results.

Taxi	No. of Areas Sampled	Area of Detection	Explosive Detected	Approx. Amount (ng)
1	2	none	NED	...
2	2	none	NED	...
3	2	none	NED	...
4	2	none	NED	...
5	2	none	NED	...
6	2	none	NED	...
7	2	none	NED	...
8	2	floor	NG	3.6
9	2	none	NED	...
10	2	none	NED	...

NED = no explosives detected.

a source of contamination. Such people include military personnel and quarry workers. In addition, some explosives are used in other applications, for instance, PETN and NG have some medical uses. In the past NG was very widely used in the manufacture of commercial blasting explosives, but this usage has almost ceased. NG is still commonly used in gun propellant formulations. DNTs are used in the manufacture of dyes and polyurethane foams. PETN, TNT, and RDX are used in military explosives. RDX and PETN can be found in Semtex-H which is a plastic explosive similar to those used for military demolition purposes. In recent years the Provisional IRA has made use of Semtex-H and PETN detonating cord during their terrorist activities in the United Kingdom.

It should be noted that in most cases the samples were taken from a relatively large surface area compared to that of a human hand. A person coming into contact with the chosen surface would normally be exposed to a much smaller area than that sampled. It is unlikely that transfer would be 100% efficient; thus contact transfer of explosives traces from the surfaces sampled would probably not result in contamination of the person to the same level as that upon the whole surface.

#### Taxis

Twenty samples were collected from a total of ten taxis divided among the four cities. Visual inspection and information gained from the taxi drivers suggested that the taxis had not been thoroughly cleaned inside recently. The analysis results are presented in Table 5. Only one sample from one of the taxis contained any explosives traces. Taxi 8 yielded a low-level trace of NG. Such lev-

els are consistent with the taxi having transported items or people contaminated with NG. One possible source of contamination was from firearms ammunition.

#### Buses

Two buses from each city were sampled. The buses varied in age and cleanliness. The results are summarized in Table 6. No explosives were detected in any of the samples collected from the buses.

#### Trains

Two trains from each city were sampled. Approximately 7.5 ng of RDX was detected in a collective swab sample taken from nine seats in one train carriage sampled in Cardiff. No explosives were detected in any of the other samples collected from the trains. The results are summarized in Table 7.

#### Airports

Samples were taken at Birmingham International, Manchester, and Glasgow airports. Only one explosive trace was detected, approximately 15.2 ng of 2,4 DNT on the back of the X-ray machine in a search area at Glasgow airport. The results for the airports are summarized in Table 8.

TABLE 6—Bus results.

Bus	City	No. of Areas Sampled	Area of Detection	Explosive Detected	Approx. Amount (ng)
1	Birmingham	4	none	NED	...
2	Manchester	4	none	NED	...
3	Cardiff	4	none	NED	...
4	Glasgow	3	none	NED	...
5	Birmingham	4	none	NED	...
6	Manchester	4	none	NED	...
7	Glasgow	3	none	NED	...
8	Cardiff	4	none	NED	...

NED = no explosives detected.

TABLE 7—Train results.

Train	City	No. of Areas Sampled	Area of Detection	Explosives Detected	Approx. Amount (ng)
1	Birmingham	4	none	NED	...
2	Manchester	4	none	NED	...
3	Glasgow	3	none	NED	...
4	Manchester	4	none	NED	...
5	Glasgow	3	none	NED	...
6	Cardiff	4	none	NED	...
7	Cardiff	4	seats	RDX	7.5 ng
8	Birmingham	4	none	NED	...

NED = no explosives detected.

TABLE 8—Airport results.

Airport	No. of Areas Sampled	Area of Detection	Explosive Detected	Approx. Amount (ng)
Birmingham International	8	none	NED	...
Glasgow	6	back of X-ray machine Gate 1/Gate 2	2,4 DNT	15.2
Manchester	8	none	NED	...

NED = no explosives detected.

TABLE 9—Hotel results.

Hotel Room	City	No. of Areas Sampled	Area of Detection	Explosive Detected	Approx. Amount (ng)
A	Birmingham	5	none	NED	...
B	Birmingham	5	none	NED	...
C	Birmingham	5	none	NED	...
D	Birmingham	5	none	NED	...
E	Birmingham	5	none	NED	...
F	Cardiff	5	none	NED	...
G	Cardiff	5	none	NED	...
H	Cardiff	5	none	NED	...
I	Cardiff	5	wardrobe	NG	11.7 ng
J	Cardiff	5	none	NED	...
K	Glasgow	5	none	NED	...
L	Glasgow	5	none	NED	...
M	Glasgow	5	none	NED	...
N	Glasgow	5	none	NED	...
O	Glasgow	5	none	NED	...
P	Manchester	5	none	NED	...
Q	Manchester	5	none	NED	...
R	Manchester	5	none	NED	...
S	Manchester	5	none	NED	...
T	Manchester	5	none	NED	...

### Hotels

Twenty-five samples were collected from five rooms in one hotel in each city, making a total of 100 samples. The results are summarized in Table 9. Only one explosive trace was detected, in a sample collected from a wardrobe in a hotel in Cardiff. Approximately 11.7 ng of NG was detected in this sample. The chromatogram of this sample analyzed on the BP5 is shown in Fig. 3. The hotel had been used for an international conference a few months prior to the sample collection. Armed police officers had occupied rooms at the hotel while enforcing conference security. It is possible that the NG trace was present as a result of the presence of the officers.

### Private Houses

Five samples were collected from five houses or student halls of residence in each of the four cities, making a total of 100 samples. No explosive traces were detected in samples from any of the houses, some of which had apparently not been cleaned for a considerable length of time. The results are summarized in Table 10.

### Private Vehicles

Samples were collected from 25 privately owned vehicles, mostly family cars. The number of samples totaled 101 and no explosives were detected in any of these samples. The results are summarized in Table 11.

### Clothing

Vacuum samples were collected from 100 items of various clothing, 25 from each city. The clothing was purchased at two or three different charity shops in each city. In most cases the clothing on sale at charity shops had not been washed by the shop prior to its sale. It may or may not have been washed by the donor prior to donating it to the charity. No explosives were detected in any of the samples collected from the clothing.

### GC/MS Confirmations

The presence of explosives traces was further confirmed by selected ion recording GC/MS in the following samples:

Taxi 8 (Glasgow)—floor (NG)

TABLE 10—Private houses results.

House	City	No. of Areas Sampled	Area of Detection	Explosive Detected	Approx. Amount (ng)
a	Birmingham	5	none	NED	...
b	Birmingham	5	none	NED	...
c	Birmingham	5	none	NED	...
d	Birmingham	5	none	NED	...
e	Birmingham	5	none	NED	...
f	Cardiff	5	none	NED	...
g	Cardiff	5	none	NED	...
h	Cardiff	5	none	NED	...
i	Cardiff	5	none	NED	...
j	Cardiff	5	none	NED	...
k	Glasgow	5	none	NED	...
l	Glasgow	5	none	NED	...
m	Glasgow	5	none	NED	...
n	Glasgow	5	none	NED	...
o	Glasgow	5	none	NED	...
p	Manchester	5	none	NED	...
q	Manchester	5	none	NED	...
r	Manchester	5	none	NED	...
s	Manchester	5	none	NED	...
t	Manchester	5	none	NED	...

TABLE 11—Private vehicles results.

Vehicle	City	No. of Areas Sampled	Area of Detection	Explosive Detected	Approx. Amount (ng)
1	Birmingham	5	none	NED	...
2	Birmingham	5	none	NED	...
3	Birmingham	5	none	NED	...
4	Birmingham	5	none	NED	...
5	Birmingham	5	none	NED	...
6	Birmingham	5	none	NED	...
7	Cardiff	5	none	NED	...
8	Cardiff	5	none	NED	...
9	Cardiff	4	none	NED	...
10	Cardiff	5	none	NED	...
11	Cardiff	5	none	NED	...
12	Cardiff	4	none	NED	...
13	Cardiff	6	none	NED	...
14	Glasgow	5	none	NED	...
15	Glasgow	4	none	NED	...
16	Glasgow	4	none	NED	...
17	Glasgow	4	none	NED	...
18	Glasgow	5	none	NED	...
19	Glasgow	5	none	NED	...
20	Manchester	4	none	NED	...
21	Manchester	5	none	NED	...
22	Manchester	5	none	NED	...
23	Manchester	5	none	NED	...
24	Manchester	5	none	NED	...
25	Manchester	5	none	NED	...

Train 158821 Car 52 (Cardiff)—collective sample of nine seats (RDX)

Hotel Room I (Cardiff)—floor and shelves in the wardrobe (NG)  
Airport (Glasgow)—back of X-ray machine (2,4-DNT)

### Limits of Detection

The limits of detection are discussed in Ref 1.

### Conclusions

#### Summary

A summary of all the results is given in Table 12.

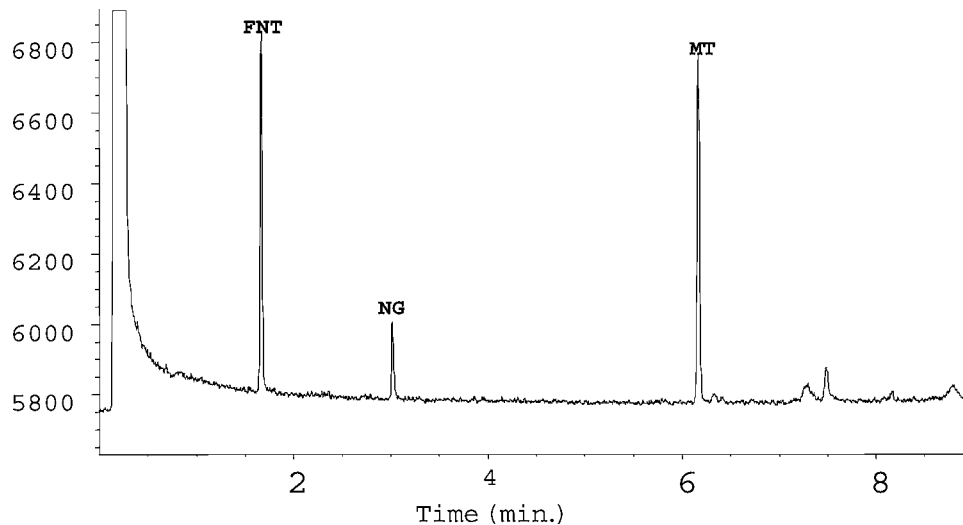


FIG. 3—Example of chromatogram of positive sample—BP5 column.

TABLE 12—Results summary.

Site	No. of Samples Analyzed (Exc. Controls)	No. of Controls (Not Including Controls Taken at Laboratory)	No. of Controls Taken at Laboratory During Processing	No. of Samples Requiring More Than One GC/TEA Analysis (Exc. Controls)	No. of Positive Samples
Taxis	20	20	*	2	1
Buses	30	16	*	5	0
Trains	30	16	*	5	1
Airports	20	12	*	1	1
Hotels	100	40	*	11	1
Private houses	100	40	*	16	0
Private vehicles	101	69	*	11	0
Clothing	100	0	20	1	0
Total	501	213	70	52	4 (0.80% of real samples)

\* Fifty controls taken during processing of the kit samples which were not segregated into sample type.

### Public Areas

Traces of the high explosives NG, TNT, PETN, and RDX are rare within the general public environment. In fact, no traces of TNT or PETN were detected at any of the sites sampled during this project. No traces of explosives were detected on any of the 100 items of clothing sampled. No traces of explosives were detected in buses, private houses or private vehicles. The number of positive samples amounted to 0.8% of the number of real samples collected (i.e., not including controls). No explosives were detected in any of the control samples. The levels of explosives that were detected in areas frequented by the public were very low, amounting in total to 7.5 ng of RDX, 15.3 ng of NG, and 15.2 ng of 2,4 DNT. The techniques employed would also have detected EGDN, NB, and other nitro-toluenes had they been present at the levels detailed earlier, but none were detected. No traces of HMX were detected in the limited number of samples screened for the presence of that species.

### Recommendations

While this survey has provided much useful data in an area which has undergone only limited previous research (1), the number of sites sampled is relatively small. Further work at more sites, and

different types of sites, would obviously increase the value of the data.

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