

## **NOTES ON DETECTOR DOG TRAINING WITH MICROTRACE® MARKERS**

While explosive marker pens were originally developed for use by instrumentation R&D personnel on explosive vapor detection instruments. It was apparent that they might also be suitable for training and testing detector dogs.

The products were designed to contain explosives at a lower limit than concentrations or quantities which would require storage in an explosives magazine. In fact, it was felt that this product line could replace canine training and testing with bulk explosives in many applications.

Early in 1995, we provided very minute concentration formulations, as "scratch and sniff labels", to canine handlers with the Ontario Provincial Police (O.P.P.) and the Royal Canadian Mounted Police (R.C.M.P.). The dogs showed only mild interest. It was obvious that in certain applications and settings, an explosive vapor detector instrument was more sensitive than a dog's nasal apparatus for sensing or differentiating compounds in such low concentrations.

If the labels were secreted in a sealed container, the dogs never detected anything. The active agent quantity on a label was too small and the vapor pressure was insufficient to exit from the seams of the container, where it would be detectable by the dog. If the chemical area of a label was rubbed or smeared across an exposed target surface, occasionally the dog would be momentarily attracted to that spot, then it would move on. The handlers did not feel that this constituted a valid "hit" and suggested that the concentration be increased. We felt that higher concentration marker pens would be better for these tests than the labels. We temporarily discontinued manufacture of the labels, pending further research and development of the concept to enhance the effect we want.

In late 1995, and again in mid-1996, two new and higher concentration level sets of test pen samples were sent to the O.P.P. for testing. They reported that dogs had to work harder than with bulk explosives, to find and alert on the new samples, but they did work.

It is a peculiarity of the marker pens that as they become depleted of solvent through use, or by slow evaporation, the remaining explosive becomes more concentrated in the remaining solvent. This results in the deposition of more explosive on the target surface with each application, as the pens age or after extensive use within their recommended life limit. In practical terms, if you draw a one-inch long comparison line with a new pen and with a 9-month old pen, more explosive will be deposited on the line with the older or more-often-used pen than with the new pen. The more concentrated amount of explosive residue left by the older pen should attract a dog's attention from a greater distance than the residue from the new pen.

The O.P.P. reported that this in fact did happen. With new pens, at the lower concentration in the 1995 series of test samples, the dogs showed mild interest if passing by the deposit area. With the same pens -- after a few months, the now higher concentration --through solvent evaporation-- attracted more interest. It was found that, if the dogs were slowly brought to and through a test area, --within about 2 feet of the target deposit-- there was a better chance that they would score a "hit". Tests were done using a variety of target surfaces, such as couches, beds (including urine stained), wall baseboards, carpets, curtains, concrete surfaces, desktops and desk drawers, among others. They were also done under a variety of environmental conditions including heat, cold, rainy days, high and low humidity, indoors and outdoors. The test protocols called for the handler to lead the dog slowly through a general search area, narrowing the search to specific locations, such as a multi-drawer desk. This can be very painstaking work. If the dog has been trained primarily on larger quantities of explosives, testing with the marker pens is frustrating for the dog, as rewards are slow to come for the amount of work output.

The O.P.P. tests did not call for such procedures as merely entering a warehouse with thousands of containers, to see if the dog could detect the pen trace mark from the entrance door. The volume of air in that warehouse would dilute any microtraces evaporating into the air to a non-detectable level.

Nor were the dogs called upon to do a rapid search of hundreds of pieces of luggage, as in an airport setting where passenger luggage would be processed in bulk in a cargo screening area, or at a customs checkpoint where passengers were lined up with their luggage.

In the last tests from September through November, 1996 by the O.P.P. canine handlers, their detector dogs alerted on the new higher concentration sample markers from as far away as 15 feet. (Previously, the lower concentration level markers, averaging 650 nanograms per microliter, resulted in the dogs alerting a maximum of about 2 feet from the target surface where the deposit was applied).

Further field testing by the O.P.P., and research by the U.S. Federal Aviation Administration provided new information that we are passing along to users. Hexane, alcohol and acetone, which we previously used as carrier solvents for the explosives and drug simulants, vary in their evaporation rates; they may leave behind confusing residues. This becomes a real problem particularly with hexane, if the trace mark is deposited on a piece of paper or cloth, which is then hidden in a confined space. Among confined spaces tested, were cardboard boxes, closed desk drawers, metal containers, or a test target stuffed into a tight "stash" area between a pipe and a wall. Under such confinement, hexane appeared to be the slowest to fully evaporate or disperse into the surrounding air. Acetone is also slow to disperse, but much faster than

hexane, which under some conditions was found to take 5-14 days to fully disperse into the outside air.

Any residual carrier can become confusing to the canine. You should fan the target material with a piece of cardboard for at least one minute, to aid in solvent evaporation and dispersion of residual fumes. This will ensure that only the trace explosive or drug simulant is left on the target material. Only then, should you enclose the target material in a tight-fitting container or jam it into a confined space.

Furthermore, some types of cloth and paper are manufactured with a surface stiffening agent called "sizing". F.A.A. tests have demonstrated a reaction of the sizing substance with hexane residue (cyclo-hexanon) producing methyl urea and polycarboxylic acid. This combination can fool a canine into thinking it is sniffing an explosive. There is no way for the canine trainer to know whether this result will occur with test materials, so we have replaced all of the other carrier solvents with methyl alcohol.

Published studies of detector dogs searching luggage for explosives, show that trained dogs require a certain minimum quantity to be contained in sealed luggage for it to be detectable. Vapor pressure varies among different explosives. EGDN and Nitroglycerin have very high vapor pressures. Many other explosives have medium to negligible vapor pressures, The quantity required to be emplaced in luggage will vary with the type of explosive and the seal tightness of the luggage seams and cover.

By way of example, if you are testing for dynamite concealed in luggage, a minimum of 1/3 of a standard dynamite cartridge is generally required. These 1-1/4 inch X 8 inch cartridges weigh 1/2 pound, and 1/3 of a cartridge equates to 1/6 of a pound of explosive, or between 5 and 6 ounces under ideal conditions. Under less than ideal conditions, more explosive is required for the dog to be able to detect it. The SECURESEARCH marker pen fluid reservoir holds a fraction of that amount of explosive in total. Only a Microtrace of the explosive dissolved in solvent is deposited in any single pen stroke applied to a target surface.

Thus it cannot be expected that a dog trained to detect the vapor produced by a sample thousands of times more concentrated than the pen application mark, will detect the traces of explosive in that external mark, or in a Microtrace paper label concealed inside the container.

Detector canines used by some law enforcement agencies are trained primarily on bulk explosives, and tested on bulk explosives. They are also rewarded for finding bulk explosives. In an airport setting, their daily work involves a fairly rapid search of up to several hundred pieces of luggage at one time. It also requires going over and through aircraft, including passenger and cargo areas, and along the external skin of the aircraft. Because of time constraints involving large numbers of passengers and aircraft, the dogs must work quickly. They may be exposed to

several hundred of pieces of luggage at once, and rapidly work through them to detect hidden contraband. The dog knows that its handler expects it to work quickly.

Under such a training regime, the dog will become frustrated if the handler attempts to slow the dog down, holding it back and making it go over each target piece very carefully, before moving on to the next item. Because the dogs have been trained on relatively large amounts of explosives (or drugs), Microtrace such as are found in our pens and labels will probably produce little or no effect during such a rapid pass through bulk luggage. It is not known whether the dog is missing the Microtrace because it is so insignificant, or is ignoring it because it is not as strong as the sample it was trained on-- and was rewarded for finding--and usually detects while working.

All we know is that dogs trained only on larger quantities of explosives, are missing our Microtrace --and they are not saying why.

This is not a criticism of that type of detector dog training, and it should not be taken that way. It is an observation we make which should be taken into account if you intend to train your detector dogs with our pens. The training technique, and the field application to which you will put your dogs once trained, should be considered when you are deciding whether or not to use our products in your program. We would strongly suggest that if your dogs are trained from the beginning to detect microtrace explosives or drugs applied to a target surface, then they will be that much better when they approach a concealed amount of bulk explosives or drugs. In fact, they should be trained to detect both trace levels and bulk quantities of explosives or drugs.

We discussed this situation with Bill Grimmer, in December, 1996. He owns a Canadian detector dog training company (Grimmer's Canine Training College) in Shediac, New Brunswick. He is also a Trainer for the Texas Narcotics Control Program Detector Dog Task Force and works with the Criminal Justice Training Center, in Fort Worth, Texas. He noticed that canines trained on-- and rewarded--to alert only on trace quantities, may have difficulties recognizing the overwhelming odor of a bulk quantity of the same materials, perhaps partly through sensory overload. Likewise, dogs trained exclusively on bulk quantities may ignore or fail to recognize trace quantities, such as would be found in a tiny surface smear on luggage--either through sensory "underload"-- or because they have never been rewarded on trace amounts. Perhaps the canines do not recognize the wide disparity from the very faint trace scent to the overwhelming bulk scent, as being the same scents. Thus, says Bill Grimmer, dogs should be trained on both, because at some point in their working lives, they will probably be called upon to detect both.

Bill Grimmer had tested our earlier, low-concentration TNT marker pens. In one test project, he used a dog trained the conventional way with real explosives, then exposed him to "swipes" of

the supplied markers. The dog "indicated" on all swipes within a 1-hour time frame. Once the swipes had aged for 6 hours, there was little if any indication by the dog. He also trained a 10-week old puppy using the TNT pen. Within 2 days, the dog was reliably indicating the swiped areas. We have video footage available from him testing several different breeds of dogs in various test scenarios.

He trains young dogs with the marker pens, and introduces pens containing additional explosives at scheduled intervals. Contact him at: [grimmer@rogers.com](mailto:grimmer@rogers.com)

New York/New Jersey Port Authority Police bomb squad personnel also tested several of our markers at JFK Airport in New York, in November, 1996, with favorable results. Their one concern in using the markers on luggage which will pass on to another airport after testing, was whether a detector dog or vapor detector instrument at the next airport would also pick up the remaining traces. In some cases, traces may be picked up, and in others, there may be no residue left to provide a "hit". It will depend on the explosive used, the size of the trace deposit "swiped" across the surface, ambient temperature, porosity of the surface, whether there was an attempt made by test personnel to clean the surface after testing using an alcohol swab, and time between deposit and the next test.

If there is a delay of only one or two hours between tests in the two airports, and no cleaning has been attempted, chances are high that the traces will be detected at the next airport stop. If the delay is 6-12 hours, chances of detection drop considerably-- as dog tests have shown with some explosive markers. However, some explosives vaporize very slowly, and there could be a long-term residual effect on surfaces where no cleaning was attempted. This has been proven in U.S. aircraft where test bulk explosives were used some months before, and detectable residues still remained even after that time. Such a test was said to have been done on TWA flight 800, giving false evidence leads when forensic testing was done on crash residue in November, 1996.

The Microtrace explosive test marks applied to a surface from our pens will not detonate. The bulk quantities that detector dogs are normally trained on, are sufficient to detonate, and could seriously damage an aircraft.

A dog trained to detect Microtrace, should be much more efficient at detecting bulk explosives, after being exposed to training with both. It is noteworthy that luggage may not contain explosives or drugs but may have been handled externally by a person who had contact with explosives or drugs. Fingerprints or smears on the lock, cover and handle surfaces could contain Microtrace explosives or drugs. It is important to detect these people at the screening checkpoint for further investigation, even though their luggage may not actually contain the contraband items.