

Canine Odour Discrimination Test

What is this note about?

This note outlines the procedure used to conduct an odour discrimination test to confirm acceptable odour recognition by detection dogs. The test aims to identify whether a dog is able to reliably identify trained (target) odours and discriminate against untrained odours.

Who is this note relevant for?

Personnel responsible for training and testing detection dog capability.

Test Introduction

- This test has been designed to balance speed and ease of use with operational viability and is underpinned by peer reviewed statistical analysis and experimental work [1].
- The test, set-up and necessary components have been designed to be low cost, accessible and easy to use, transport and store.
- The test takes approximately six minutes per target odour type and gives a documented history of individual dog performance.
- The test forms part of UK police explosives detection dog licensing requirements and is suitable for use with detection dogs working in government or the private sector.
- The test is based on a linear or curved-line set-up involving eight stands. However, the test can also be applied to other stand-based systems with eight stands, such as the carousel.
- The odour discrimination test does NOT confirm that a dog is able to locate emplaced hides or conduct a safe search; a search based test must be conducted in an operationally relevant scenario to confirm these capabilities. Equally, a dog's ability to perform in particular circumstances is always subject to variation, and passing the test is not a guarantee of performance.

Each test comprises six "runs". On each run, the dog must search eight identical sample pots and discriminate the target odour from the non-target "interferent" odours.

Figure 1: A trained dog works on-lead down a line of plastic stands with stainless steel sample pots.



Test Outline

Each test must be carried out by two people: the person running the test (assessor) and the dog handler. The test is conducted “blind” i.e. the dog handler does not know the location of the target and the person running the test does not watch while the dog works.

Tests can be conducted indoors or outdoors.

If the assessor watches the search they may affect the test result by providing inadvertent cues to the dog or handler; this is known as the “Clever Hans Effect”.

- Eight identical sample pots are placed in stands. Each “run” of eight stands is set up according to a Trial Plan generated from the Canine Odour Discrimination Test Setup Tool [2] (available on the CPNI website – along with user instructions [3]). The Tool is a Microsoft Excel spreadsheet which quasi-randomises the order and location of targets:
 - On positive runs, one sample pot contains a target odour sample; for testing this specific sample must be one that the dog has not previously been trained on.
 - All other sample pots contain “interferent” odours, which are non-target odours that the dog should ignore.
- The dog should search the stands in order, preferably on-lead. To pass the test, the dog is required to ignore the interferents and indicate on the trained target odour samples.
- The dog searches six runs per target type (five containing a target and one “blank” run with no target); if more than one target type is being tested, targets are randomised across blocks so the dog encounters several target types in each block of six runs.
- The Tool standardises target location and number of interferents searched such that all dogs search an average of 22.5 interferents per target type (range 20-25).
- The Tool allows dogs to end each run following a correct indication rather than searching the remaining samples, whilst maintaining standardisation. This speeds up testing, while still ensuring that there is less than 1% chance of a dog passing the test by chance (i.e. by guessing).
- Once one dog has finished six runs, the next dog conducts the test using different target locations.

Test Equipment

The following equipment is required:

- Eight stands (stand types are detailed under “Equipment Maintenance”).
- 30-40 identical sample pots that fit into the stands (pot types are detailed under “Equipment Maintenance”).
- Test table, to place the sample pots on.
- Disposable gloves.
- Training samples (which for testing, should be different to those used for training). Best practice is to use the smallest samples available; note that training samples should not be cut up.
- For test sessions, include one sample of a target that the dog is not being tested on that day from the dog’s training kit to allow for training runs.

Training samples may absorb local contaminants during storage and use which could alter their odour. Therefore, different training samples to those used for training should be used wherever possible. Different samples must also be used during any formal assessment / accreditation activity.

- A range of interferent odours including “low odour” substances (e.g. soil, grass, cotton wool, paper, wood) and “high odour” substances (e.g. scented products, food flavouring on cotton wool).
- Interferent odours related to training samples (e.g. clean bags, pots and gloves).

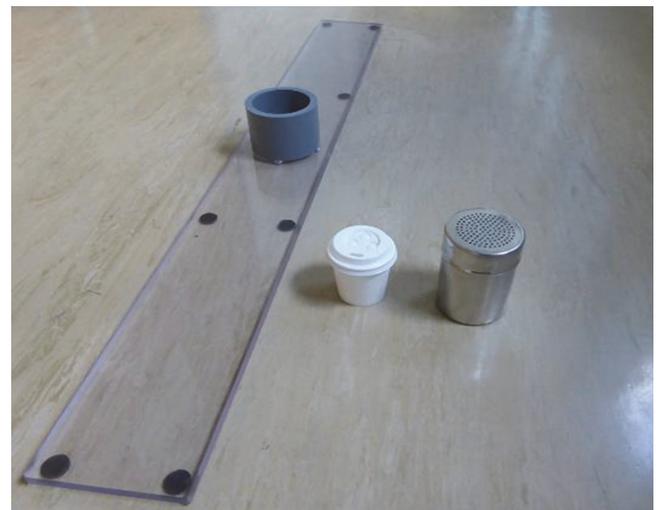


Figure 2: A plastic stand with two examples of sample pots: a disposable sample pot (a paper cup) and a re-usable sample pot (a stainless steel container with a perforated lid).

Equipment Maintenance

Stands

Stands can be made from hard materials such as plastic, stainless steel or wood. Materials which can be more readily cleaned, such as plastic, can reduce the likelihood of contamination. Stands should be wiped clean regularly using clean paper towel, warm water and washing up liquid. Stands should measure 1 m in length; this ensures each sample is presented at a suitable distance from the other samples. Example stand manufacture drawings are available on the CPNI website [4].

Pots

Either stainless steel or disposable pots (e.g. paper cups) can be used. Whilst stainless steel pots can be more expensive to purchase than disposable pots, stainless steel pots are re-usable and can be readily cleaned, therefore reducing the likelihood of contamination. Stainless steel pots may be used if the following washing protocols are adhered to:

- Re-usable pots should be washed at the end of each day of testing/training.
 - All pots should be washed on an intensive wash programme of a domestic dishwasher (used only for washing test equipment and not items which will come into contact with food).
 - Interferents and targets may be washed together but it is good practice to place the target pots on the bottom shelf.
- If a dishwasher is not available pots may be washed by hand as follows:
 - Fill a washing up bowl with warm water and washing up liquid.
 - Place all blank and interferent pots in the solution.
- For each pot/lid:
 - Rub the outside for 5 seconds with a cloth.
 - Rub the inside for 5 seconds with a cloth.
 - Hold the item under running water and rub inside and out for 5 seconds with a clean paper towel (one per pot).
- Repeat the washing procedures with the target pots:
 - Washing cloths will retain some contamination; do not use them for domestic purposes.
 - Washing cloths should be regularly replaced or washed in a washing machine.

Re-useable pots should be replaced every 6 months to prevent dogs learning individual target pots, or sooner if they become identifiable (e.g. dented or marked).

Disposable pots (target and interferent pots) and lids must be disposed of at the end of each day of testing/training. A new complete set of disposable sample pots must then be used during the next testing/training session. Consideration should be given to the impact on the environment when using disposable pots.

Sample Set-up

Sample preparation should occur away from the search area to prevent contamination of the working area.

- Sample pots should be prepared for each target type to be tested.
- Clean gloves should be worn to prepare each target type, where possible avoid touching the outside of pots with “dirty” gloves.
- Twenty interferent sample pots should be made up to present operationally relevant strong and weak odours as well as interferents associated with training samples (e.g. clean packaging). Gloves do not need to be changed between interferents.
- Additionally, five empty pots should be marked as “blank”; these should be treated as interferents.
- To be able to quickly identify the content of each pot during the test, without the need to open it, all pots should be marked (e.g. with “target A” or “interferent” stickers) on their base, where the mark is not visible during testing. It is important that the marking method is consistent across all pots; in order to prevent dogs and handlers from differentiating between interferent and target pots.
- Once set up, the same substances will remain in the pots for the duration of the day’s tests.
- One training pot should be set up using a known training sample of a non-test target.
- A clean pair of gloves should be put on at the end of set up.

Area Set-up

All setting up should be completed by the assessor prior to dog teams entering the area.

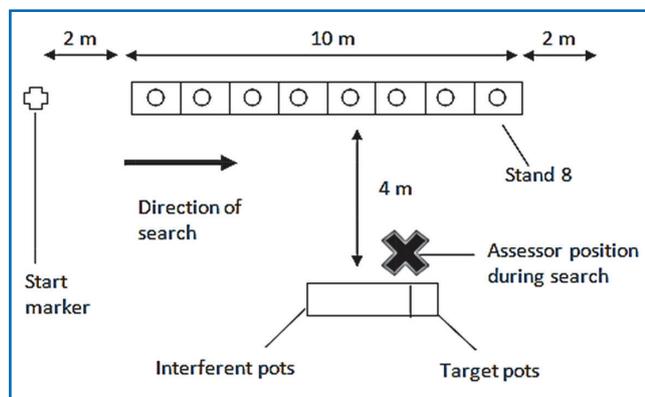


Figure 3: Area set up showing sample table with interferent and target sample pots, stands, start marker and location of the assessor during testing.

The area lay out should be as follows:

- Numbered stands should be set up with a start marker at least 2 m in front of the first stand. The start marker aligns dogs and allows them time to search the first stand.
 - Fig. 3 shows a linear set up however a curved line can be used as long as dogs are trained in a curved configuration.
 - A circular set up such as a carousel can be used, in this instance there is no start marker.
- The table should be set up approximately 4 m from the stands to ensure that dogs are not drawn to the odour emanating from the targets on the table. It is good practice to set up the targets out of the direct line of sight of handlers where possible.
- The sample pots for each target type should be placed on clearly labelled pieces of paper on one side of the table.
- Twenty interferent sample pots and five blank pots should be pooled together on the other side of the table. An additional area on the table should be defined where used interferent pots can be placed.
- A mark should be placed on the floor by the table. The assessor should return to this mark throughout each search run and should face the table (so that they are facing away from the stands). This ensures that the assessor does not unintentionally affect the outcome of the test.

Handler Briefing

Prior to starting a test, all handlers should be informed about the correct actions following an indication (as outlined in the test procedure section on the next page) and they should be briefed as follows:

1. Dogs will be given a training run at the start of their first search each day and at the start of their first search after a long break (e.g. after lunch).
2. Dog to begin at the start marker on each run.
3. Dogs should interrogate each sample pot in turn and not return to previously cleared pots; dogs should be worked on-lead.
4. The assessor will not watch the dog searching, therefore handlers must declare all indications AND any interest that their dog shows by stating the stand number without prompting (e.g. by stating “indication stand five” or “interest stand three”).
5. The assessor will not respond to declarations of interest. The assessor will confirm or deny declarations of indication, after which a reward can be given for correct indications.
6. Some runs will be blank (i.e. will not contain a target sample pot).
7. Stands one and eight will not contain target sample pots during testing. False alarms on these stands will not count against the dog as they may be procedural training issues rather than odour discrimination issues:
 - Stand one acts as an “overlap” stand and ensures that dogs have settled into the search prior to encountering the first potential target.
 - Stand eight addresses indications given by dogs that have failed to find a target and take the chance of getting rewarded at the last stand. The absence of targets allows handlers to address false alarms as a procedural training issue.

Trial Plan

Prior to conducting a test, the assessor should generate and print a copy of the Trial Plan using the Tool [2] (available on the CPNI website – along with user instructions [3]). The Tool is a Microsoft Excel spreadsheet which can also be used for an eight stand carousel.

The Trial Plan generated by the spreadsheet will dictate the order and location of targets. It should also be used to record results as the test is conducted.

Trial Plans should be generated separately for all dogs being tested; up to three dogs can be included on one print-out. If more than three dogs are being tested, multiple tests should be generated rather than using duplicate copies of the same Trial Plan.

Test Procedure

See flow chart for test procedure (page 8).

1. One clean pair of gloves is worn by the assessor.
2. A training run is set up and the handler is told where the hide is.
3. The dog may complete the training run multiple times until it has indicated on the training target once without assistance.
4. The handler and dog leave the room or turn away from the search area.
5. The first run is set up as dictated by the Trial Plan.
6. The dog team enters the room and searches the run on-lead:

If the dog indicates, the handler declares the stand number and waits for a response from the assessor:

- **Correct indication:** The assessor will inform the handler that the dog is correct and the dog will be rewarded; this will complete the run. The team will leave the search area until recalled to commence the next run.
- **Incorrect indication (false alarm):** The assessor will inform the handler that the dog is incorrect. The team will leave the search area and the line is reset as follows:
 - All of the sample pots up to and including the pot where the false alarm was declared are temporarily removed.
- The handler and dog team are recalled and asked to re-search the entire run including the empty stands.
- False alarms on stand eight finish the run and the dog moves on to the next run.

The pot on which a false alarm was given should be removed from use and disposed of (if disposable) or given a thorough clean at the end of the day of testing (if non-disposable).

If the dog does not indicate but the handler believes that they showed significant interest in one or more samples, the handler must state “interest” and identify the stand in question.

- **Interest declared:** Interest will be scored according to the assessment criteria; handlers will not be informed whether they were correct or not. The run will continue as if no indication has been declared.
- **No declaration:** If no declaration is made during a run the team will leave the room until recalled to commence the next search.

7. Next run set up as follows:
 - Refer to paperwork and select next target.
 - Select one interferent sample pot at random.
 - Remove previous target from line and replace with the selected interferent.
 - Place next selected target substance in correct position in the line.
 - Return previous target substance to labelled paper and return used interferent to the designated “used interferent” area.
 - Select two new interferents from table and swap them into the line in any non-target position; place the old interferents in the “used interferent” area.
8. Repeat steps 6-7 until dog has completed six consecutive runs.
9. Change gloves for a new pair at the end of the 6-run block.
10. Rest the dog for a minimum of 5 minutes or whilst other dogs complete their first 6-run blocks.
11. Once all interferents have been moved to the “used interferent” area, they can be moved back to the general interferent pool and cycled through again.
 - It is not necessary for all dogs to see all interferents; however it is good practice to ensure that all interferents have similar usage.

Detection Scoring Criteria

Target detection scoring:

- Each correct indication is scored as 1.0.
- Each correct “interest” is scored as 0.5.

Dogs are scored **separately** for each target type.

The pass rate of dogs should always be determined in consultation with the end user (e.g. the individual requesting canine detection services). The test was validated using dogs proven to have good general search ability. For these dogs, the validation showed that:

- The majority of dogs (between 71-100%) that score 1 to 2.5 on a target in the test will find less than 80% of the same target type on an equivalent building search.
- The majority (between 62-98%) of dogs that score 4 to 5 on the test will find at least 80% of the same target type on an equivalent building search.
- A score of 3 to 3.5 on the test is inconclusive; as such it is advisable to repeat.

False Alarm Scoring Criteria

False alarm scoring:

- Each incorrect indication is scored as 1.0 FA.
- Each incorrect “interest” is scored as 0.5 FA.
- False alarms on stands one and eight do not count towards the FA score and are ignored for scoring.

A single false alarm score (FAS) is calculated as an average across the number of targets tested as follows:

Average false alarm score (FAS) = total FA score / number of targets tested.

When run using the odour ID software, each dog will encounter a minimum of 20 interferences per target type.

The average FAS therefore correspond to the following false alarm rates:

- FAS 0.5 = 2.5%
- FAS 1 = 5%
- FAS 1.5 = 7.5%
- FAS 2 = 10%
- FAS 2.5 = 12.5%

The acceptable false alarm rate should be determined in consultation with the end user.

Preparing Dogs for the Test

The following procedure has been shown to be effective in preparing dogs for the odour discrimination test:

1. A pot containing a target is placed at position one, no other pots are placed in the line.
2. The dog is tasked to the pot and immediately rewarded on any indication behaviour.
3. The pot is moved half way down the line; the dog is worked to the pot along the empty holes and again rewarded on source indication.

False indications are addressed by waiting for the dog to move on to the next pot voluntarily.

Dogs are never corrected, punished or pulled off pots that they false indicate on, this ensures that the dog learns the task required of it rather than learning to rely on handler intervention to find the correct sample.

4. Empty pots are placed in the first holes, with the target at approximately position three; the dog is worked down the line and given a prompt reward at target.
5. Several runs are completed including empty pots and a target at different locations until the dog has successfully not indicated on the empty pots and indicated on the target on two consecutive runs.

6. A line of empty pots is placed out for the dog to search; this is repeated until the dog searches the line once without false indicating.
7. An interferent odour is placed at position one and a target at position two; the number of interferent pots is gradually increased until the dog has successfully searched one complete run.
8. Handlers work blind for all future training runs.
9. The target position is varied; once the dog has completed three successful consecutive runs a new target odour is introduced.
10. Training continues using all targets and introducing new interferent odours. During training, targets are often present in stands one and eight, although these stands do not contain a target during testing.

Trouble Shooting

- Dog missing the target in pots :
 - If this occurs early in training ensure that the dog is able to identify the target by placing the target out in a “normal” search hide and rewarding indication.
 - Give early reinforcement on the target in the odour line up using empty pots for all non-target holes.
- Dogs not searching the first stands – ensure that handlers are starting from the start marker and conduct several runs with the target at position one.
- Dogs giving multiple false indications stands 1-7–
 - Ensure that training has not progressed too rapidly, return to an earlier step if required.
 - Set up a line of 4-8 interferences and work the dog along the line repeatedly until it completes it once without false indicating. Reward the dog at the end of that run. Place a target early in the next run and then maintain a high proportion of blank runs in training, praising or rewarding the dog at the end of blank runs.
- Dogs false indicating on stand eight
 - Conduct several blank runs, rewarding the dog for not indicating on stand eight.

These training methods have been shown to be effective previously and are offered as advice only. It is accepted that there are multiple training approaches that may be as effective or more effective depending on the dog and trainer’s previous experience.

Associated Guides and Information

- [1] Scientific validation of the odour discrimination procedure for use with detection dogs:
Porritt et al. (2015) Validation of a short odour discrimination test for working dogs, Applied Animal Behaviour Science, vol. 165, pp. 133-142
<http://www.sciencedirect.com/science/article/pii/S0168159114003086>
- [2] Canine Odour Discrimination Test Setup Tool
DSTL/PUB89157
- [3] Canine Odour Discrimination Test Setup Tool –
Software User Instructions DSTL/PUB89154
- [4] Canine Odour Discrimination Test - Stand
Manufacture Drawings DSTL/PUB103695

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Assessor Procedure

