

Studies into the environmental pollution by munitions

Munitions in the environment

Munitions contain substances that are harmful to people as well as the environment. TNO has therefore developed reliable and very accurate research methods to detect and measure these munitions-related substances in the environment.



TNO studies the environmental impact of the munitions dumped at sea.

Contamination of soil, water and air by residual munitions and substances that are released when munitions are used may cause skin irritation and inflammation of the eyes. The environment also suffers from the contamination; the harmful substances kill off some species, which reduces the bio diversity.

Taking samples

As a result of detonating munitions, contaminating substances disperse over a large area causing non-homogeneous pollution of the affected area. The concentration of the substances in the environment is usually low, making it

difficult to obtain a representative sample of the contaminated area. Therefore, TNO uses a method of composite sampling.

The terrain to be sampled is divided into a grid of squares and from each square TNO takes a sample. The samples that are collected over a large surface area are then put together to form a single representative composite sample. TNO then analyses the composite sample in its laboratory, using highly specialised, sensitive equipment. In this way the contaminants can be measured at ppt level (10^{-12}).



The extent to which a terrain is contaminated by the use of munitions is very accurately investigated using a grid.

Sample treatment

Munitions-related substances are extracted from the soil samples and isolated for further investigation. TNO has developed an internationally accepted protocol for the sampling, extraction and chemical analysis.

For instance, a hollow fibre is placed in a water sample, which is covered with a plastic layer, to which specific substances will absorb. TNO uses a similar method for air samples. These are directed over an absorbent medium to which harmful substances absorb. For soil samples the contaminating substances are rinsed out with a liquid in which they can easily dissolve.

Analysis

To be able to determine which substances are contained in a sample, TNO uses various analytical techniques. To determine the extent to which the substances may be harmful to the many organisms that are

present in the environment, bioassays are used. Natural organisms like bacteria, algae, plants, crustaceans, worms and fish are exposed to the sample for a period of time under controlled conditions, and then studied to check whether any negative effects have occurred. While the bioassay may reveal the extent of the harm to the environment, it does not indicate which substance is the actual perpetrator. That is done by performing a toxicity identification evaluation (TIE) combined with chemical analyses.

Studies

Studies have revealed that the current use of munitions produces only marginal harm to the environment. The environmental norms may well be exceeded locally at military firing ranges. It has also been shown that the destruction of munitions by open detonation deteriorates the air quality. TNO is studying the existing methods of disposal and their potential alternatives.

Substances that are released as the result of the use of munitions can be divided into heavy metals, residues of energetic materials and their reaction products. Many of the substances are cancer-inducing and harmful to the environment. It is therefore important to be able to predict the impact these substances will have on people and the environment in both the short and long term. TNO has been commissioned to carry out an extensive study into the effects of munitions-related substances, to identify the bottlenecks and allow customers to respond in good time to policy amendments and changes in environmental law and legislation.



The firing of guns deteriorates the air quality.



A bioassay is used to determine whether a contaminated sample is harmful to the environment.

TNO Defence, Security and Safety

'TNO Defence, Security and Safety' is the title under which TNO operates as a strategic partner for the Dutch Ministry of Defence and makes innovative contributions to enhancing the security of the Netherlands both at home and abroad. We also use our accumulated knowledge for foreign governments and for defence-related industries.

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