

Fireworks in a Safe and Healthy Environment

The know-how on pyrotechnics in combination with the most modern test facilities make TNO a dedicated partner for applied research, development, testing, risk assessments and classification of fireworks, focussing on the performance, the safety and the environmental impact of fireworks. TNO is competent authority for classification of fireworks. The continuous research activities on pyrotechnics and the strong interaction with defence related activities put TNO at the highest level of know-how and technology.



Pyropack container

Services on Fireworks:

- Research and Development of fireworks products and pyrotechnic components
- Classification tests of fireworks products
- Risk assessment on transport and storage of fireworks
- Product development of storage containers
- Desk study classification for transport
- Advice on Safety regulations and Development of Standards

Projects examples:

• Assessment of the Enschede fireworks disaster.

In the afternoon of 13th of May 2000 a fireworks explosion took place in Enschede, the Netherlands. This event caused 23 deaths, injured 950 people and destroyed houses and buildings in the surrounding of the firework storage. TNO investigated the damage and possible cause of the explosion as well as the proper classification of the fireworks involved in the explosion.

• Development of the Pyropack fireworks container.

In order to prevent that fireworks is expelled from their packages in a fire situation, TNO has developed a transport container that passes all relevant tests and can also be used for storage and resale purposes.

• Several fireworks classification studies and tests.

TNO performs classification tests on fireworks articles. Classification can be done using a desk study or by doing tests like the orange book classification tests, chemical and physical analysis or performance testing.

• European CHAF research program (cooperation with BAM, Germany and HSL, UK).

The EC Framework 5 programme project 'Quantification and control of the hazards associated with the transport and bulk storage of fireworks (CHAF) is aimed at better understanding the critical conditions that give rise to explosions from professional fireworks (specifically the potential mass explosive behaviour of 1.3 classified fireworks items) and to obtain improved methods of predicting performance on large-scale.

- **Development of environmentally friendly pyrotechnic compositions.**

Increasing environmental awareness has led to a demand for "green" military pyrotechnics products (for example, virtually all hexachlorethane based smoke is phased out) and for the same is slowly but noticeably happening for fireworks.

The big challenge is to develop novel pyrotechnic compositions which maintain excellent performance whilst using better ingredients, and ensure that after functioning there is nothing harmful left. TNO has excellent capabilities to do this sort of work.



Safety testing

TNO Defence, Security and Safety

TNO Defence, Security and Safety provides innovative contributions to the advance of comprehensive security and is a strategic partner of the Dutch Ministry of Defence to build up the defence knowledge-base. We employ our acquired knowledge for and together with contractors.

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