

Università degli Studi di Padova

OPERATING PROCEDURE NO. 2

HANDLING AND DISPOSAL OF EXPLOSIVE

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Curated by:

Environment and Safety Office



HANDLING AND DISPOSAL OF EXPLOSIVES

Introduction

In Italy, activities related to the management of explosives (recognition, possession, production, transport) are regulated by the T.U.L.P.S. (Unified Text of Public Security Laws) of 1931 with the aim of safeguarding public safety. This type of risk includes all activities involving the use of explosive substances, i.e. substances with a high energy content. These substances, when heated, impacted, or rubbed, decompose rapidly and violently, developing volumes of gas considerably greater than the initial ones, generating a pressure wave with the production of high temperatures; during the explosion, a lower energy level is reached, leading to the formation of more stable substances. The term explosive applies to substances that can detonate and/or deflagrate.

According to their sensitivity to ignition sources (shocks, friction, heat), explosives are divided into:

- **Primary or initiating explosives:** Sensitive to shocks, friction, heat; they detonate very easily as a result of heat, percussion, or contact with other chemical species. Many primary explosives are unstable and cannot be handled or stored except under controlled conditions.
- **Secondary (stable) explosives:** Explosives that are less sensitive to mechanical/thermal stresses, however, they present risks in handling. The main problem with secondary explosives is that they are often substances with high explosive potential and devastating effects.

List of common explosives:

- acetyl peroxide(c.a.s.110-22-5), ammonium nitrate(c.a.s.6484-52-2);
- ammonium picrate(c.a.s.131-74-8), barium azide(c.a.s.18810-58-7);
- lead azide(c.a.s.13424-46-9), mercury azide(c.a.s.38232-63-9);
- benzoyl peroxide(c.a.s.94-36-0), diazodinitrophenol(c.a.s.4682-03-5);
- dinitrophenylhydrazine(c.a.s.119-26-6), dipicryl amine(c.a.s.131-73-7);
- dipicryl sulphide(c.a.s.28930-30-5), mercury fulminate(c.a.s.628-86-4);
- MEK peroxide(c.a.s.1338-23-4), nitrocellulose(c.a.s.9004-70-0);
- nitroglicerine(c.a.s.55-63-0), nitroguanidine(c.a.s.556-88-7);
- nitromethane(c.a.s.75-52-5), nitrourea(c.a.s.124-47-0);
- picramide(c.a.s.489-98-5), picric acid(c.a.s.88-89-1);
- picryl chloride(c.a.s.88-88-0), picryl sulphonic acid(c.a.s.2508-19-2);
- sodium dinitrophenate(c.a.s.1011-73-0), tetranitroaniline(c.a.s.3698-54-2);
- trinitroanisole(c.a.s.606-35-9), trinitrobenzene(c.a.s.99-35-4);
- trinitrobenzesulphonic acid(c.a.s.2508-19-2), trinitrobenzoic acid(c.a.s.129-66-8);
- trinitrocresol(c.a.s.602-99-3), trinitroresorcinol(c.a.s.82-71-3), trinitrotoluene(c.a.s.118-96-7).

In research activities, it is possible to use reagent products among the explosive substances listed above.





It should be noted that activities involving explosive materials must be communicated to the Environment and Safety Office and authorized by the Head of the Structure.

Responsibilities

Regarding the indications provided in this operational instruction:

- The Head of the Structure is obliged to adopt the indicated measures and to require their compliance by the workers;
- The RDRL is obliged to supervise and monitor compliance by individual workers;
- The worker is obliged to observe the instructions given, to use the work equipment; substances and any hazardous preparations correctly, as well as the safety devices and personal protective equipment made available.

Potential Risks

The risks are a consequence of possible accidental events (fire, explosion) that these substances can cause and which can escalate to the death of the exposed subject. Other effects that may occur are:

- Amputation, severe damage to body parts;
- Thermal burns, skin injuries;
- Barotrauma;
- Smoke inhalation.

Critical Situations

A critical situation arises whenever conditions are generated with the presence of an explosive substance and an ignition source (heat, flame, spark, excessive shocks, friction, etc.). This situation may occur in particular in the following cases:

- Handling substances near ignition sources or heat sources;
- Use of deteriorated explosive material;
- Preparation of the explosive charge;
- Transferring substances in confined spaces;
- Transport of the substance;
- Storage.

Potential Accidental Events

Primary events:

- Detonation;
- Deflagration;
- Explosion;
- Fire.

Induced events:

- Projection of objects;
- Release of toxic substances;
- Vibrations.



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Prevention and Protection Measures

Before starting the activity:

- Work in an area free of possible ignition sources;
- Take appropriate precautions against the accumulation of static electricity;
- Read the instructions on the product label and the related safety data sheet;
- Ensure the immediate availability of adequate firefighting equipment;
- Wear the necessary personal protective equipment, checking its integrity and/or efficiency beforehand;
- Avoid wearing clothing made of easily electrified fibers (pile or similar);
- Activate and/or prepare the necessary collective protection devices;
- Ensure the presence or prepare the necessary emergency devices by referring to the safety data sheet;
- Clean the work and handling area of explosive materials thoroughly before and after.

During the activity:

- Do not use open flames;
- Handle explosives carefully, avoiding drops, impacts, friction, and throwing;
- For heating substances, where provided, use warm water baths;
- Use only the quantity of explosives necessary for the activity;
- Be careful of the possible formation of static electricity during the handling of flammables.

At the end of the activities:

- Store the material, hermetically sealed, in the original container;
- Store the containers in suitable, cool, and well-ventilated places, away from heat sources and agents that may promote dangerous reactions;
- Avoid storing the material in metal containers if this is not specified in the technical data sheet (for example, carbide must be kept in metal containers);
- Clean and decontaminate equipment that may have been contaminated with explosives.

General measures:

- Adequately train and inform personnel about the risks of fire and explosion;
- Use safety containers;
- Use the minimum amount of explosive necessary for the operations;
- Operate in areas dedicated to the handling of explosives;
- Limit the number of people working in the explosives use area as much as possible.

Disposal

Waste from research activities using explosives and powders must be disposed of through specific procedures managed by the Environment and Safety Office, which will ensure the securing of the material and its disposal by authorized companies in accordance with the current regulations on explosives. All material (paper, gloves, plastic, etc.) that has come into contact with explosive powders must be collected separately, avoiding mixing with ordinary laboratory waste. The disposal of obsolete reagents containing explosives is only possible after a written request to the Environment and Safety Office.



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Personal Protective Equipment (PPE) to be adopted

Collective protective equipment

If deemed necessary based on the risk assessment related to the actual operational situation:

Chemical fume hood.

Individual protective equipment

An indicative, non-exhaustive list of the main PPE is reported as an example; these must be chosen based on the type of risk and in any case according to the indications reported in the risk assessment:

- Disposable gloves made of non-allergenic material, compatible with the substances handled;
- Safety glasses with side shields for protection against splashes;
- Face shields or protective masks;
- Laboratory coat (fire-resistant and acid-resistant).

Safety devices:

- Interception devices.

Regulatory References:

- T.U.L.P.S. (Royal Decree 1931) and Annex Regulation R.D. May 6, 1940 no. 635;
- DPR April 27, 1955 no. 547;
- DPR March 19, 1956 no. 302;
- Legislative Decree no. 152 of 3rd April 2006, and subsequent amendments;
- Legislative Decree no. 81 of 9th April 2008, and subsequent amendments.

Recommendations, prohibitions and incompatibilities

Recommendations:

- Work in well-ventilated areas;
- Keep explosives away from flammable products.

Prohibitions:

- The use of open flames is prohibited;
- It is forbidden to wear clothing that can accumulate static electricity in the presence of a flammable atmosphere;
- The use of metal materials is prohibited, unless they are spark-proof.

Incompatibilities

The mixed storage of explosives with different risk categories is prohibited, for example: flammables, oxidizers, metal powders.

Information and training

Information:

- Safety data sheets of the materials in use;
- Work procedures in research activities.





Training:

- Explosion risk;
- Handling and storage of explosives;
- Main physicochemical characteristics of explosives.

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