Information Sheet

Safe use of Desensitised Explosives

Desensitised explosives are used at the university. This document provides information on the risks associated with desensitised explosives and provides the university requirements for the safe management and use. This document should be read in conjunction with the Chemical risk assessment guidance and the Procedure for identifying desensitised explosives, both can be found on Staff H&S pages or PG H&S Pages . Help and support in the management and use of desensitised explosives is available from the HS&R team.

1. What are desensitised explosives?

Desensitised explosives are liquids or solids that were originally classified as explosives but have had their explosive properties suppressed by adding a desensitising agent, making them safer to handle and transport. Common examples include 2,4-Dinitrophenylhydrazine, 2,4-Dinitrophenol, 1-Hydroxybenzotriazole hydrate and Picric acid (Trinitrophenol, wetted).

Under the Explosive Regulations 2014 a desensitised explosive is:

a) a solid explosive substance which has been wetted with water or alcohol or diluted with one or more other substances; or
b) a liquid explosive substance which has been dissolved or suspended in water or one or more other substances, to form a homogeneous mixture to suppress its explosive properties and which, without that treatment, would be classified as falling within Class 1. (Explosive)

While desensitisation reduces the likelihood of a fire, blast, or projection hazard, it does not eliminate the risk; these chemicals may still be sensitive to heat, friction, impact, and fire. Careful storage, handling, and disposal is required.

If the desensitising agent dries out, the chemical can become a Class 1 explosive.

2. How to identify desensitised explosives

Desensitised explosives do not carry an explosive hazard warning label, **due to the presence of the stabilising solvent.** The safety data sheet (SDS) should be used to identify desensitised explosives, the sections of the SDS are shown below:

Section 2: Hazard identification.

The chemical will have:

- A flammable GHS symbol
- A signal word (either Danger or Warning)
- One of the following hazard statements:
  - **H206** - Fire, blast, or projection hazard; increased risk increased risk of explosion if desensitising agent is reduced.

- **H207** - Fire or projection hazard; increased risk of explosion if desensitising agent is reduced.
- **H208** - Fire hazard; increased risk of explosion if desensitising agent is reduced.

For further information regarding the classification of desensitised explosives, see Appendix A.

Section 14: Transport information.
Desensitised explosives can also be identified in Section 14, see sections:

- **Section 14.1 UN number** - This is a four-digit code used to identify hazardous materials during transport. A list of UN Numbers classified as desensitised explosives is given below, in Appendix B.
- **Section 14.3 Transport hazard class** - Desensitised explosives will be in one of the following transport hazard classes:
  - Class 3 - Flammable liquids. **D** – Liquid desensitised explosive (this letter is not always shown on the SDS but is available on the list below).
  - Class 4.1 - Flammable solids, self-reacting substances, polymerising substances, and solid desensitised explosives. **D** – solid desensitised explosive (this letter is not always shown on the SDS but is available on the list below).

3. Purchasing/ Regulations

If you are required to purchase explosives or desensitised explosives you must contact the HS&R Team prior to purchasing. There may be a need to apply for an explosives certificate and/or a licence. The difference between a certificate and licence is explained below:

- **Certificates** are issued by the Police and are used to confirm that a person is fit to acquire or to acquire and keep explosives.
- **Licences** grant permission to manufacture or store explosives and are issued by a number of different authorities. In most cases, licences to store at the University will be issued by either the Police, Fire and Rescue Service or Health and Safety Executive (HSE); see the HSE licence application guidance page for more information.

An exemption from the need to obtain a certificate does not automatically mean that a licence is not needed, and vice versa. Licencing and certification are used for different purposes and in many cases, both will be required.

Do I need a certificate or a licence?
There are some exemptions in The Explosives Regulations 2014 for requiring certification and/or storage licences, the most relevant to the university are explained below:

- Schedule 2 lists the substances that do not need a **certificate** to acquire or keep. The schedule is in two parts. Part 1 is a list of explosives, and their corresponding UN number, which do not require an explosives certificate. Part 2 of the schedule provides a further list of explosives not requiring an explosives certificate; this list includes:

- Schedule 2 (2)(8)(a) - Any desensitised explosive acquired, in a quantity not exceeding 5 grams, for the purposes of
  - research, analysis or testing at a university.
- Schedule 2(16) - A solution of the explosive substance 2,4,6-Trinitrophenol (picric acid) in a concentration no greater than 2% weight per volume intended for use as an analytical reagent, stain, dye, or fixative.

- A Health and Safety Executive (HSE) Certificate of Exemption is available (from the HS&R team) for 2,4-Dinitrophenylhydrazine (commonly known as 2,4-DNP or 2,4-DNPH, which has the chemical formulation $C_6H_3(NO_2)_2NHNH_2$). There is an exemption at the university, from the requirements and prohibitions in Regulation 5 of The Explosive Regs 2014 (including the requirement to have a certificate), if the following conditions are met:
  a) the explosive (2,4-Dinitrophenylhydrazine) is –
     i) wetted with not less than 30% water, by mass and allocated in accordance with the United Nations Recommendations the U.N. No 3380; or
     ii) dissolved in ethanol and sulphuric acid and allocated in accordance with the United Nations Recommendations the U.N. No 3379; or
     iii) dissolved in ethanol and phosphoric acid and allocated in accordance with the United Nations Recommendations the U.N. No 3379; and
  b) the total quantity of the explosive (2,4-Dinitrophenylhydrazine) must not exceed 25 grams when –
     i) wetted with not less than 30% water; or
     ii) dissolved in ethanol and the permitted acid for preparation of an analytical reagent; and
  c) the explosive (2,4-Dinitrophenylhydrazine) may only be acquired and kept by, and at, relevant educational institutions to be used only for chemical testing purposes as part of an educational activity.
  d) Exceptions to the need for a manufacturing licence can be found in Regulation 6 of the 2014 Regulations, and exceptions for storage licences are in Regulation 7. Storage exemptions are typically short-term and depend on the hazard type of the explosive.
  e) The maximum amount that can be kept without a licence refers to an individual's possession and NOT the cumulative possession by a building or by a School/ Department.

Remember, if you are purchasing any explosives or desensitised explosives, you must contact the HS&R Team prior to purchasing.

4. Safe use

4.1 Pre-purchase

Prior to purchasing any chemicals, the university procedure requires a chemical pre-purchase form to be completed. The forms and guidance can be found on the Staff H&S pages or PG H&S Pages.

The pre-purchase form assists with identifying the hazards associated with the chemical, the appropriate storage required, any additional emergency equipment/ protocols and how to dispose of it safely including "empty containers." All this information can be found on the SDS for the chemical.

When purchasing desensitised explosives, only purchase the minimum quantity required for use and minimise the time they are stored at the university. The manufacturer/ supplier must give information in the SDS about the shelf-life. New bottles and stock solutions should be clearly labelled to indicate the date of opening and expiry date.

Ensure that desensitised explosives are stored in a fire-resistant cabinet; they must not be stored in a cabinet with flammable liquids. See the chemical storage document on the Staff H&S pages or PG H&S Pages.

4.2 Risk Assessment

The HSE has a guidance section on managing explosives and desensitised explosives, see Explosives Regulations 2014.

Prior to using the chemical there must be a chemical risk assessment in place for the proposed activity.

Chemical risk assessment training is recommended for all staff and postgraduate students using chemicals. Details found here on the training section of the Staff H&S training pages or PG H&S training pages.

4.3 Monitoring of desensitised explosives

It is critical that any desensitised explosives stored are kept wetted with the solvent that is appropriate for the chemical. This is to ensure that the chemical does not dry out and become explosive. Details of the appropriate solvent and safe storage information can be found in section 2 and section 7 of the SDS (e.g. Section 2, Precautionary statement P230- keep wetted with……*water*). The manufacturer/ supplier must give instructions on the SDS about verifying desensitisation.

Users should also conduct a visual inspection of the container prior to use, before opening the container.

To conduct a visual inspection of the desensitised explosive, see Appendix C - Guidance for Checking Desensitised Explosives (visual inspection and wetting). This must be conducted monthly.

5. Emergency Procedures

If a desensitised explosive is found that has not been stored, maintained and used correctly, (i.e. all or part of the solvent has evaporated, the container has degraded or there is no record of checking and maintaining the substance) then there may be a risk of fire or explosion, and you must not handle or move it. Inform the HS&R team and Faculty technical team immediately; refer to the procedure for identifying desensitised explosives.

6. Safe disposal of remaining managed liquid/ empty containers

Follow the advice on the SDS and contact Estates-Waste@swansea.ac.uk

7. Contact Details

H&S contact can be found on Staff H&S pages or PG H&S pages

Appendix A – Classification of Desensitised Explosives

Desensitised explosives are categorised for supply and use into 4 categories. Category 1 is the highest category. This information is found in Section 2 of the safety data sheet.

	Category 1	Category 2	Category 3	Category 4
GHS Pictogram				
Signal word	**Danger**	**Danger**	**Warning**	**Warning**
Hazard statement	**H206**: Fire, blast, or projection hazard; increased risk of explosion if desensitising agent is reduced.	**H207**: Fire or projection hazard; increased risk of explosion if desensitising agent is reduced.	**H207**: Fire or projection hazard; increased risk of explosion if desensitising agent is reduced.	**H208**: Fire hazard; increased risk of explosion if desensitising agent is reduced.
All categories will have the following precautionary statements				
Precautionary statements: **Prevention**	**P210** – Keep away from heat, hot surfaces, sparks, open flames, and other ignition sources. No smoking. **P212** – Avoid heating under confinement or reduction of the desensitising agent. **P230** – Keep wetted with… P233 – Keep container tightly closed. P280 – Wear protective gloves/protective clothing/eye protection/face protection/hearing protection/…			
Precautionary statements: **Response**	**P370 + P380 + P375** – In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion.			
Precautionary statement: **Storage**	**P401** – Store in accordance with…			
Precautionary statement**:** **Disposal**	**P501** – Dispose of contents/container to…			

Appendix B – Desensitised Explosives

To identify desensitised explosives, go to section 14 of the safety data sheet. Find the UN number. UN Numbers classified as desensitised explosives are listed below.

- **Class 3** Flammable liquids, D – Liquid desensitised explosives
- **Class 4.1** Flammable solids, self-reacting substances, polymerising substances, and solid desensitised explosives. D – solid desensitised explosive, T – Toxic.

Note

- A single CAS Number can have several UN Numbers associated with it. When an explosive is wetted or desensitised, it may be considered a distinct substance with different physical and handling properties — leading to different UN Numbers.
- Several CAS numbers can have the same UN Number (e.g. isomers of Dinitrophenol, that are desensitised explosives, are classified as UN1320).

UN No.	Class, classification code	Name and description	CAS number	Description
1310	4.1, D (1.1 dry)	**Ammonium Picrate wetted** with not less than 10% water, by mass	131-74-8	This comes in a form of a wet slurry and can dry out if not maintained correctly. Can explode under prolonged exposure to fire or heat.
1320	4.1, DT (1.1 dry)	**Dinitrophenol, wetted** with not less than 15% water, by mass. Covers all isomers of DNP - 2,3-DNP, 2,4-DNP, 2,5-DNP, 2,6-DNP, 3,4-DNP, and 3,5 DNP.	Generic 25550-58-7 2,3-dinitrophenol 66-56-8 2,4-dinitrophenol 51-28-5 2,5-dinitrophenol 329-71-5 2,6-dinitrophenol 573-56-8 3,4-dinitrophenol 577-71-9	Keep away from open flames, hot surfaces, and sources of ignition. Take precautionary measures against static discharge.

UN No.	Class, classification code	Name and description	CAS number	Description
			3,5-Dinitrophenol 586-11-8	
1321	4.1, DT (1.3 dry)	**Dinitrophenolates, wetted** with not less than 15% water, by mass	74893-76-8 Sodium 2,4-dinitrophenolate 1011-73-0	
1322	4.1, D (1.1 dry)	**Dinitroresorcinol, wetted** with not less than 15% water, by mass	35860-51-6 4,6-Dinitroresorcinol 616-74-0 2,4-Dinitroresorcinol 519-44-8	
1336	4.1, D (1.1 dry)	**Nitroguanidine (picrite), wetted** with not less than 20% water, by mass	556-88-7	This comes in a form of a wet slurry and can dry out if not maintained correctly. May explode under exposure to intense heat or fire.
1337	4.1, D (1.1 dry)	**Nitrostarch, wetted** with not less than 20% water, by mass	9056-38-6	Clearly wet on inspection and can dry out if not maintained correctly. Need to protect from static discharge due to ignition risk. When dry is a fluffy, nearly white, cotton-like material.
1344	4.1, D	**Trinitrophenol (picric acid), wetted** with not less than 30% water, by mass	88-89-1	Comes in form of wet slurry. The dry compound is a sensitive explosive, dangerous if shocked or exposed to heat.
1347	4.1, D	**Silver picrate, wetted** with not less than 30% water, by mass	146-84-9	When wetted with at least 30% water, silver picrate appears as a white to light-coloured solid paste.

UN No.	Class, classification code	Name and description	CAS number	Description
1348	4.1, DT	**Sodium dinitro-o-cresolate, wetted** with not less than 15% water, by mass	25641-53-6	Yellow crystalline solid when wetted or dry. Dried out - material may explode if exposed to heat, flame, friction, or shock.
1349	4.1, D (1.3. dry)	**Sodium picramate, wetted** with not less than 20% water, by mass	831-52-7	Dark red crystals in a slurry form when wetted. Highly explosive, especially in large quantities or if dry.
1354	4.1, D (1.1 dry)	**Trinitrobenzene, wetted** with not less than 30% water, by mass	99-35-4	Moist mass of crystals or a slurry. Highly explosive, especially when dry.
1355	4.1, D (1.1 dry)	**Trinitrobenzoic acid, wetted** with not less than 30% water, by mass	129-66-8	Sludge of yellow crystals. When dry is easily ignited, burns vigorously, and is highly explosive.
1356	4.1, D (1.1 dry)	**Trinitrotoluene (TNT), wetted** with not less than 30% water, by mass	118-96-7	Sludge of yellow crystals. When dry is easily ignited, burns vigorously, and is highly explosive.
1357	4.1, D (1.1 dry)	**Urea nitrate, wetted** with not less than 20% water, by mass	124-47-0	Slurry of colourless crystals. The dry form is a high explosive and easily ignites.
1517	4.1, D (1.3 dry)	**Zirconium picramate, wetted**	63868-82-6	Looks like a slurry or sludge of yellow crystals.

UN No.	Class, classification code	Name and description	CAS number	Description
		with not less than 20% water, by mass		Dried out material may explode if exposed to heat, flame, friction, or shock.
1571	4.1, D (1.1 dry)	**Barium azide, wetted** with not less than 50% water, by mass	18810-58-7	Suspension or slurry of an unstable solid (barium azide) in water. When dry, it is a high explosive that can ignite easily and decompose explosively under shock or heat. Wetting reduces its sensitivity but does not eliminate the risk
2555	4.1, D (1.1 dry)	**Nitrocellulose with water** (not less than 25% water, by mass)	9004-70-0	Clearly wet on inspection and can dry out if not maintained correctly. Need to protect from static discharge due to ignition risk. When dry is a fluffy, nearly white, cotton-like material.
2556	4.1, D (1.1 dry)	**Nitrocellulose with alcohol** (not less than 25% alcohol, by mass, and not more than 12.6% nitrogen, by dry mass)	9004-70-0	Clearly wet on inspection and can dry out if not maintained correctly. Need to protect from static discharge due to ignition risk. When dry is a fluffy, nearly white, cotton-like material.
2557	4.1, D (1.1 dry)	**Nitrocellulose**, with not more than 12.6% nitrogen, by dry mass, mixture with or without plasticiser, with or without pigment	9004-70-0	Clearly wet on inspection and can dry out if not maintained correctly. Need to protect from static discharge due to ignition risk. When dry

UN No.	Class, classification code	Name and description	CAS number	Description
				is a fluffy, nearly white, cotton-like material.
2852	4.1, D (1.1 dry)	**Dipicryl sulphide, wetted** with not less than 10% water, by mass	2217-06-3	White/ light coloured solid when wetted. Insoluble in water, so water should be visible. Flammable/combustible material. May be ignited by heat, sparks, or flames. Dried out - material may explode if exposed to heat, flame, friction, or shock.
2907	4.1, D.	**Isosorbide dinitrate mixture** with not less than 60% lactose, mannose, starch, or calcium hydrogen phosphate.	87-33-2	White crystalline solid. Will likely appear as a powder or granular material. The specific colour and texture will depend on the chosen diluent and any other excipients included in the formulation. If mixed with reducing agents, including hydrides, sulphides, and nitrides, they may begin a vigorous reaction that culminates in a detonation
3317	4.1, D	**2-amino-4,6-dinitrophenol, wetted** with not less than 20% water, by mass	96-91-3	Picramic acid. Dark red crystals/solid. Insoluble in water so level of water should be visible. Explodes if dried and exposed to heat, flame, friction, or shock.

UN No.	Class, classification code	Name and description	CAS number	Description
3319	4.1, D. (1.1 Desensitised)	**Nitroglycerin mixture, desensitised, solid**, N.O.S. with more than 2% but not more than 10% nitroglycerin, by mass	55-63-0	The mixture is in a solid state. It is a Colourless to pale-yellow, viscous liquid when not desensitised.
3344	4.1, D *(*1.1 dry)	**Pentaerythrite tetranitrate (pentaerythritol tetranitrate; petn) mixture, desensitised, solid**, N.O.S. with more than 10% but not more than 20% PETN, by mass	78-11-5	A thick to waxy slurry of white crystals. Dry Colourless to white solid. Sensitive to heat, shock, and friction.
3364	4.1, D (1.1 dry)	**Trinitrophenol (picric acid), wetted** with not less than 10% water, by mass.	88-89-1	A yellow mass of moist crystals or a slurry. Dangerously explosive if allowed to dry out (less than 10%). Highly sensitive to heat, shock, and friction.
3365	4.1, D (1.1 dry)	**Trinitrochlorobenzene (picryl chloride), wetted** with not less than 10% water, by mass	88-88-0	Light yellow, fine crystals/needles in slurry. Explosive when dry. Risk of explosion in contact with impact, friction, ignition sources.
3366	4.1, D (1.1 dry)	**Trinitrotoluene (TNT), wetted** with not less than 10% water, by mass	118-96-7	Yellowish mass of crystals or a slurry. Highly explosive when dry.
3367	4.1, D (1.1 dry)	**Trinitrobenzene, wetted** with not less than 10% water, by mass	99-35-4	Light yellow, crystalline sludge, or slurry. Dangerously explosive if allowed to dry out (heat, flame, friction, or shock).
3368	4.1, D	**Trinitrobenzoic acid, wetted** with	129-66-8	White to yellow moist mass of crystals or a

UN No.	Class, classification code	Name and description	CAS number	Description
	(1.1dry).	not less than 10% water, by mass		slurry. Dangerously explosive if allowed to dry out.
3369	4.1, DT (1.3 dry)	**Sodium dinitro-o-cresolate, wetted** with not less than 10% water, by mas	534-52-1	Yellow crystalline solid when wetted or dry. Dried out - material may explode if exposed to heat, flame, friction, or shock.
3370	4.1, D (1.1 dry)	**Urea nitrate, wetted** with not less than 10% water, by mass	*124-47-0*	Milky cloudy appearance when wet. Dry White / pale yellow crystal. Sensitive to prolonged heat, friction, and shock,
3376	4.1, D	**4-Nitrophenyl-hydrazine,** with not less than 30% water, by mass	100-16-3	Orange/red leaflet or needles wetted with water. It may be explosive and sensitive to friction in the dry state.
3880	4.1, D	**Desensitised explosive, solid, n.o.s.**	N/A	
3474	4.1, D (1.3C Anhydrous)	**1-Hydroxybenzotriazole monohydrate**	123333-53-9	Solid. White / almost white crystal powder. Fire or projection hazard; increased risk of explosion if desensitising agent is reduced.
3343	3, D (1.3 dry)	**Nitroglycerin mixture, desensitised, liquid, flammable, n.o.s**. with not more than 30% nitroglycerin, by mass	55-63-0	Colourless liquid. Avoid operations that could increase the concentration of the nitroglycerin or separate it from the diluent. Conc. Nitroglycerin is explosive. Contacting the product with water

UN No.	Class, classification code	Name and description	CAS number	Description
				will dissolve the diluent and concentrate the nitroglycerin. When desensitising agent has reduced the Nitroglycerin will become more dense, oily liquid that is typically colourless or pale yellow
3357	3, D (1.3 dry)	**Nitroglycerin mixture, desensitised, liquid, n.o.s.** with not more than 30% nitroglycerin, by mass	55-63-0	Avoid operations that could increase the concentration of the nitroglycerin or separate it from the diluent. Concentrated Nitroglycerin is explosive. Contacting the product with water will dissolve the diluent and concentrate the nitroglycerin. When desensitising agent has reduced the Nitroglycerin will become more dense, oily liquid that is typically colourless or pale yellow
3379	3, D	**Desensitised explosive, liquid, n.o.s.**		
2059	3, D	**Nitrocellulose solution, flammable** with not more than 12.6% nitrogen, by dry mass, and not more than 55% nitrocellulose	9004-70-0	Desensitised is a light yellowish, clear, or slightly opalescent, syrupy liquid. Dried out - is a fluffy, nearly white, cotton-like material. Nitrocellulose solutions can be ignited by heat, sparks, or friction

Appendix C – Guidance for Checking Desensitised Explosives (Visual, Inspection and Wetting).

The owner is responsible for ensuring that this activity is risk assessed for the chemical that they are inspecting. They must always read the safety data sheet (SDS) carefully.

The chemical owner is responsible for ensuring visual inspections and wetting are conducted and recorded; a monthly check is required.

A visual inspection must be conducted every time the chemical is used before the bottle is opened.

The appearance of the desensitised explosives can vary (see SDS, section 9).

Container and desensitised explosive inspection (monthly, and prior to use)

1. Look at the inspection record, check that the chemical has been regularly inspected and wetted (as required). If you cannot verify the chemical has been inspected and wetted contact the Faculty Operation Teams and HS&R Team immediately. The HS&R team will advise on the next steps.
2. Look at the container, check that it is intact and not showing signs of degradation or swelling.
3. Look at the label on the bottle, check that it has not exceeded the expiry date recorded. Do not open if it has passed it's expiry date.
4. Without opening the bottle, conduct a visual check:
    - Check that there are no dried crystals on the outside of the bottle near the cap.
    - Check that the material inside has not dried out (look for dryness, crystals, or cracking), and check that it looks wetted (usually moist, pasty, or glossy).
    - Check if it appears to have altered from its original form (it may be solid or liquid in its desensitised state).

    Warning: Do not open the bottle if there are signs of crystals outside of the bottle near the cap or if the chemical is not adequately wetted as this would be a sign that there may be dried crystals on the thread of the bottle that may detonate when opening. Contact the Faculty Operation Teams and HS&R Team immediately. The HS&R team will advise on the next steps.
5. If safe to proceed:
    - Move the container into a fume cupboard.
    - Ensure there are no sources of ignition nearby; the most common sources of ignition are:
        - naked lights and flames,
        - heat and temperature,
        - electricity (including static electricity and electromagnetic energy),
        - sparks from mechanical or frictional contact between metal surfaces,
        - impact and friction,
        - pressure, and
        - chemical incompatibility between certain substances (e.g. picric acid is incompatible with some metals, in contact it can form explosive salts)

- Gently open the container.
- Gently and slowly add the appropriate solvent. Refer to SDS, section 2 for the appropriate solvent (e.g., P230 - keep wetted with…… **water**). This is to keep the solid materials desensitised.
- Gently turn samples to rehydrate all the solid material.
- Any residue on the neck of the bottle must be washed back into the bottle using a pipette and the threads of the container should be wiped with a wet cloth to remove any remaining residue before resealing.

6. Waste
   - Ensure that cloth remains wetted and dispose of in line with the risk assessment.
   - Empty containers should be disposed of as recommended on the SDS to prevent dehydration and degradation. Contact Estates-Waste@swansea.ac.uk
7. Record Keeping

   A record of the inspection must be kept and available to view by all lab users and the technical support team. Inspection records must be available to the HS&R team on request.