Irish Aviation Authority The Times Building 11-12 D'Olier Street Dublin 2, Ireland www.iaa.ie **Safety Regulation Division**	**Údarás Eitlíochta na hÉireann** Foirgneamh na hAmanna 11-12 Sráid D'Olier Baile Átha Cliath 2, Éire **Rannán na Rialachán Sábháilteachta**	**UAS ADVISORY MEMORANDUM (UAM)** NO. UAM 019 ISSUE 1 DATE 27.05.2025	

Guidance on Transport of Dangerous Goods by Unmanned Aircraft Systems

1. Change Record

Date	Issue	Revision Description
27.05.2025	1	Initial publication.

2. References

- Commission Implementing Regulation (EU) 2019/947 on the rules and procedures for the operation of unmanned aircraft (also referred to as Implementing Regulation)[1].
- Commission Delegated Regulation (EU) 2019/945 on unmanned aircraft systems and on third-country operators of unmanned aircraft systems[2].
- Acceptable Means of Compliance to Commission Implementing Regulation (EU) 2019/947 on the rules and procedures for the operation of unmanned aircraft (also referred to as AMC)[3]
- Guidance Material to Commission Implementing Regulation (EU) 2019/947 on the rules and procedures for the operation of unmanned aircraft (also referred to as GM)[4]
- ICAO Doc 9481 on Emergency Response Guidance for Aircraft Incidents Involving Dangerous Goods[5].
- ICAO Doc 9284 on Technical Instructions for the Safe Transport of Dangerous Goods by Air[6] (also referred to as Technical Instructions)
- ICAO Doc 10147 Guidance on a Competency-based Approach to Dangerous Goods Training and Assessment[7]
- ICAO Convention Annex 18[8]
- ADVISORY CIRCULAR (AC) 102-37 of ICAO (also referred to as Advisory Circular)[9]
- Globally Harmonised System of Classification and Labelling of Chemicals (GHS)[10]
- IATA Dangerous Good Regulations (DGR)[11][12]

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02019R0947-20220404#tocId76
[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02019R0945-20200809
[3] https://www.easa.europa.eu/en/document-library/easy-access-rules/easy-access-rules-unmanned-aircraft-systems-regulations-eu
[4] https://www.easa.europa.eu/en/document-library/easy-access-rules/easy-access-rules-unmanned-aircraft-systems-regulations-eu
[5] https://store.icao.int/en/emergency-response-guidance-for-aircraft-incidents-involving-dangerous-goods-doc-9481
[6] https://store.icao.int/en/technical-instructions-for-the-safe-transport-of-dangerous-goods-by-air-doc-9284
[7] https://store.icao.int/en/guidance-on-a-competency-based-approach-to-dangerous-goods-training-and-assessment-doc-10147
[8] https://store.icao.int/en/annex-18-the-safe-transport-of-dangerous-goods-by-air
[9] https://www.icao.int/safety/UA/UAID/Documents/Advisory%20Circular%20102-37.pdf
[10] https://unece.org/fileadmin/DAM/trans/danger/publi/ghs/ghs_rev04/English/ST-SG-AC10-30-Rev4e.pdf
[11] https://www.iata.org/en/publications/dgr/
[12] The IATA (International Air Transport Association) issues Dangerous Goods Regulation (DGR) every year for its airline members. This document is not applicable and legally binding to UAS operators (unless they fall under the scope of Section 1.2.1 of DGR), but as it is based on Technical Instructions and in many cases imposes stricter rules on its members, the DGR may be accepted to be used by the UAS operators, with the proviso that the relevant elements of Technical Instructions should always be referred to in the application and documentation.

3. Contents

4. Purpose

The Technical Instructions *"prescribe the detailed requirements applicable to the international civil transport of dangerous goods by air by any aircraft (including both internal and external carriage)"*[13]. The operator is *"a person, organization or enterprise engaged in or offering to engage in an aircraft operation."*[14] This means that UAS operators may be considered operators under Technical Instructions.

According to subparagraph 1;4.1.2 of the Technical Instructions, ***"all operators must establish a dangerous goods training programme*** *regardless of whether or not they are approved to transport dangerous goods as cargo."*

The purpose of this guidance document is to outline the regulatory and training requirements of using drones for the transportation of dangerous goods. Due to the proliferation of unmanned aircraft systems (UAS), the aerial transport of dangerous goods is evolving into one of the important use cases where UAS may be used. The Advisory Circular provides a list of dangerous goods that might be transported by UAS[15]:

"a) compressed gases such as aerosols and gas cartridges,
b) flammable liquids, such as ethanol, ether,
c) sterilization materials such as ethylene oxide,
d) infectious substances such as samples for analysis,
e) toxic substances such as certain medicines,
f) first aid kits,
g) medical or clinical waste such as used needles and blood samples,
h) safety devices,
i) lithium batteries, and
j) dry ice."

[13] Subparagraph 1;1.1.1 of the Technical Instructions
[14] Subparagraph 1;3.1.1 of the Technical Instructions
[15] This list includes the most probable or already working use cases. It is not exclusive.

5. Definitions

For the purposes of this guidance document, the definitions in Regulation (EU) 2019/947, Technical Instructions, Irish Aviation Authority Act, 1993 and S.I. No. 24 of 2023 apply.

Misdeclared dangerous goods: When required by subparagraph 5;4.1.6.1 of the Technical instructions to present a Dangerous Goods Transport Document and the information provided is incorrect.

OSO: Operational Safety Objective. Step #8 of SORA (see below) determines safety objective defining the safety gains (integrity) and proofs of achieving these safety gains (assurance) according to the level of operation`s risk identified in Step#6 of SORA.

SORA: Specific Operations Risk Assessment. This is risk assessment method is the acceptable means of compliance to the Article 11 of the Implementing Regulation.

Undeclared dangerous goods: When required by subparagraph 5;4.1.6.1 of the Technical instructions to present a Dangerous Goods Transport Document and no declaration is provided.

6. Dangerous goods and operational categories

Article 2(11) of the Implementing Regulation provides for that *"dangerous goods mean articles or substances, which are capable of posing a hazard to health, safety, property or the environment in the case of an incident or accident."*

According to the Technical Instructions, dangerous goods may be sorted into classes and further into divisions within Classes. The nine classes (with divisions) are the followings:

1. Explosives (mass explosion hazard, blast projection hazard, minor blast hazard, major fire hazard, blasting agents, extremely insensitive explosives),
2. Gases (flammable gas, non-flammable gas, poisonous gas, oxygen, inhalation hazard),
3. Flammable Liquids (flammable liquids; combustible, fuel oil, gasoline),
4. Flammable Solids (flammable solids, spontaneously combustible solids, dangerous when wet),
5. Oxidising Agents and Organic Peroxides,
6. Toxic and Infectious Substances (poison, biohazard),
7. Radioactive Substances,
8. Corrosive Substances, and
9. Miscellaneous Dangerous Substances and Articles, including Environmentally Hazardous Substances.

6.1. Open category

EASA Guidance Material to Article 2(11) of the Implementing Regulation states that *"blood for transfusion and medical samples that are not subject to the provisions of the Technical Instructions may be transported in the 'open', 'specific', or 'certified' categories."*

Accordingly, the operator may fly in open category, but only if all other conditions are met. Please note that it is the operator's responsibility to check for undeclared and misdeclared dangerous goods and please bear in mind that medical samples usually fall under Category B UN 3373 rules using Packing Instruction 650 These goods may only be transported in specific category (see section 6.2 of the present Advisory Memorandum).

6.2. Specific category

According to AMC1 to Article 5 of the Implementing Regulation:

"a) ***Dangerous goods may be transported in the 'specific' category*** *of UAS operations only if the UAS operator is able to demonstrate that these goods will not cause harm or damage to third parties or to the environment in case of accident. When compatible with the operation, a crash-protected container, which will prevent the leakage/dispersion of dangerous goods in case of accident, would be acceptable. In this case,* ***the UAS operator should demonstrate that the container is capable of maintaining/protecting the dangerous goods without causing damage or harm to third parties or the environment in case of accident****. In demonstrating the conformity of the container, the operational characteristics of the flight (flight speed, altitude, weather conditions, etc.) shall be taken into account, as well as the defining aspects of the geographical area of operation."*

According to GM to Article 2(11) of the Implementing Regulation:

*"****Blood that contains or potentially contains infectious substances should be transported in the 'specific' or 'certified' categories. If such transport results in a high risk for third parties in case of an accident, the UAS operation falls under the 'certified' category*** *(as per Article 6(1)(b)(iii) of the Implementing Regulation). If the blood contains or potentially contains infectious substances and is enclosed in such a container such that the blood will not be spilled in case of an accident, the UAS operation may fall under the 'specific' category if there are no other causes of high risk for third parties."*

"Articles and substances which would otherwise be classified as dangerous goods (e.g. fuel, batteries and other goods used during the flight to supply energy to the drone's system) but which are required to be on board the aircraft for the propulsion of the UAS or for the operation of its specialised equipment during transport, or which are required in accordance with the pertinent operating requirements should not be considered as transported dangerous goods and their safety should verified during the design verification of the UAS."

According to Subparagraph 1;1.1.5.1. c) of the Technical Instructions, ICAO Doc 9284 does not apply to dangerous goods carried by an aircraft where the dangerous goods are for dropping in connection with agricultural, horticultural, forestry activities. In case of using spraying drones please refer to UAM 016[16].

In cases where the operation exceeds the boundaries of the 'OPEN' category, the operation may be conducted according to the rules of the 'SPECIFIC' category.
Dangerous goods may only be transported by an operator who holds operational authorisation or a Light UAS operator`s certificate under SORA. For details, please check the UAM 012[16] and UAM 015[16].

Regarding UAS.STS-01.010(4) and UAS.STS-02.010(4) of the Appendix 1 to the Implementing Regulation, dangerous goods may not be transported in operations falling under standard scenarios.

[16] https://www.iaa.ie/general-aviation/drones/uas-advisory-memoranda

6.3. Certified category

Article 40(1)(c) Delegated Regulation (EU) 2019/945:

"1. The design, production and maintenance of UAS shall be certified if (...) it is designed for the purpose of transporting dangerous goods and requiring a high level of robustness to mitigate the risks for third parties in case of accident;"

The Guidance Material (GM)[17] to Article 6 of the Implementing Regulation states, that *"the transport of dangerous goods is in the 'certified' category if the payload is not in a crash-protected container, such that there is a high risk for third parties in the case of an accident."*

It is important to note that the GM is part of the so-called "soft law" and has no binding force. Therefore, the competent authority shall investigate the applicability of certified category on a case-by-case basis. Aspects to be investigated may be the followings:

- The nature of transported dangerous goods (i.e. explosives – where only Division 1.3: Compatibility Groups C, G and Division 1.4: Compatibility Groups B, C, D, E, G, S may be transported via air[18] – pose a higher risk than corrosives for instance),
- The quantity of transported dangerous goods (Technical Instructions provide different provisions for excepted quantity, for limited quantity and fully regulated quantities of dangerous goods),
- The packaging of the transported dangerous goods (the different packing groups refer to hazard meant by the dangerous goods),
- The long-term effects of crash of container (e.g. radioactive materials have long term effects on the environment and human health), and
- Overflown area (number of third parties exposed to the risks of UAS operation, flight over sensitive areas /e.g. natural reserves or fresh water/ or flight over assemblies of people with small drones carrying dangerous goods).

[17] Guidance Material can be found in Easy Access Rules for Unmanned Aircraft Systems.
[18] Subparagraph 7;2.2.2.1 of the Technical Instructions

7. UAS Operators` obligations

The UAS Operators` obligations have two main sources when carrying dangerous goods:

- Implementing Regulation and its AMC (Section 7.1 of the present Advisory Memorandum), and
- Technical Instructions (Section 7.2 of the present Advisory Memorandum).

These regulations may overlap (see below in different sections of the present Advisory Memorandum). It is the operator`s obligation to comply with both regulations. Sections 7. to 9. are also important elements of the UAS operator`s daily operation that follow from Section 7. For the sake of better understanding however, they are described separately.

7.1. Concept of operation (CONOPS)

According to AMC1 to UAS.SPEC.030(3)(e), the operator shall describe the concept of the operation (CONOPS). The CONOPS should consist of the following elements:

1. Nature of the operation and associated risks
2. Operational environment and geographical area for the intended operations
3. Technical means used
4. Competency, duties and responsibilities of personnel involved in the operations
5. Risk analysis and methods for reduction of identified risks
6. Maintenance

7.1.1. Nature of the operation and associated risks

The operator should provide a description of activities performed by their personnel.

First, the UAS operator shall determine, that they act as operator under the Technical Instructions (Part 7. of the Technical Instructions) and they will determine the scope of responsibilities that should be indicated in the CONOPS and Operations Manual.

The operator`s tasks may vary however, therefore the UAS operator should determine what tasks would be performed by crewmembers. This description should include the list of dangerous tasks as provided for in ICAO Doc 10147. The UAS operator that wishes to carry dangerous goods with a UAS should establish standard operating procedures (DG-SOP). The DG-SOP should include a safety risk assessment (for details see Section 7.1.5).

7.1.2. Operational environment and geographical area for the intended operations

When the UAS operator wishes to carry dangerous goods, it should consider that each state might have introduced State Variations that might impose more onerous regulations on UAS operators. According to Chapter 1 of the Attachment 3 to the Technical Instructions, State Variations shall apply to *“all transport of dangerous goods by air:*

1) *to, from or through all territory subject to the sovereignty of the notifying State by all operators; and*
2) *outside the territory of the notifying State to all operators for whom the notifying State is the State of the Operator".*

7.1.3. Technical means used

Beside the technical specifications of the UAS, the CONOPS should include the detailed description of the cargo hold, the packaging (material, size, volume, layers of packaging, reference to packing instruction – if applicable, etc.).

7.1.4. Competency, duties and responsibilities of personnel involved in the operations

According to the Advisory Circular the content and complexity of the DG-SOP should *"depend on the size of the organization, the nature of the operation and on the level of safety risk. At a minimum, the DG-SOP should include:*

> *b) a training program and the level of competency achieved once training is completed; providing adequate instruction ensures that individuals handling dangerous goods are competent to perform the function commensurate with their responsibilities taking into account the level of safety risk;*

According to paragraph c) of AMC1 to Article 5 of the Implementing Regulation the UAS operator should provide a training program for their personnel. *"The training programmes should be subject to review and approval by the competent authority, and should cover at least the following aspects:*

> *(1) dangerous goods terminology;*
> *(2) classification of dangerous goods;*
> *(3) labelling of dangerous goods;*
> *(4) identification of dangerous goods that use 'SDSs' and the Globally Harmonised System of Classification and Labelling of Chemicals (GHS) consumer labelling;*
> *(5) use of the dangerous goods list provided in the Technical Instructions;*
> *(6) storage and handling of dangerous goods, including but not limited to the segregation of incompatible dangerous goods, dangerous goods loading, and dangerous goods securing;*
> *(7) instructions and safety precautions to be provided to employees and third parties; and*
> *(8) emergency/reporting procedures included in the ERP in case of an accident/incident with dangerous goods."*

According to the Technical Instructions Subparagraph 1;4.2.1 *"Such training must be competency based and shall include:*

- *a) general awareness/familiarization training*
- *b) function-specific training* (dangerous goods related tasks)
- *c) safety training, "* and
- d) a safety awareness training (Subparagraph 1;5.2.2 of the Technical Instructions).

The ICAO Doc 10147 introduced the CBTA - Competency Based Training and Assessment concept to dangerous goods. The first element is that the training shall be function-based, meaning *"that **personnel must be trained commensurate with the functions for which they are responsible. These responsibilities are determined by the specific functions the personnel perform and not by their job titles.**"*[19]

"The goal of competency-based training and assessment is to produce a competent workforce by providing focused training. It does so by identifying key competencies that need to be achieved, determining the most effective way of achieving them and establishing valid and reliable assessment tools to evaluate their achievement."[20]

Therefore, the operator should put determine the training and the assessment.

In case if the UAS operator is LUC holder (see UAM 015) and has a Safety Management System (SMS), "competency-based training and assessment programme should be integrated with the continuous improvement cycle of their SMS."

7.1.4.1. Training

The operator should use the ADDIE model, when developing its training program in line with the CBTA concept. The ADDIE model consists of five elements:

1. **A**nalyse (determination training requirements)
2. **D**esign (design local competency-based training)
3. **D**evelop (development of training materials)
4. **I**mplement (conduct the course)
5. **E**valuate (evaluate the course and assessment to decide whether any changes or improvements are required)

This means that the UAS operator is responsible for analysing the initial qualifications and the training needs of their staff (inputs) and for properly defining the training objectives (outputs). The latter includes the definition required knowledge, skills and attitudes (KSA) that will be necessary to enable the crewmembers to safely perform their dangerous goods related tasks during future operations.

According to ICAO Doc 10147, the dangerous goods related tasks may be the following:

1. Classifying dangerous goods
2. Preparing dangerous goods for shipment
3. Processing/accepting cargo
4. Managing cargo pre-loading

[19] Foreword of ICAO Doc 10147
[20] Section 1.2.1 of ICAO Doc 10147

5. Accepting passenger and crew baggage
6. Transporting cargo/baggage
7. Collecting safety data

The Technical Instructions require the UAS operator to determine what dangerous goods related tasks they will perform during the operations and ensure that these tasks will be covered by their training program and assessment.

The Technical Instructions further require the operator to provide recurrent dangerous goods *"training and assessment within 24 months of previous training and assessment to ensure that competency has been maintained"*.

The training must be performed by properly trained and certified personnel. The training personnel may be provided by the UAS operator (in-house) or by third party. The training program should be accepted by the competent authority and records of dangerous goods training and assessment should be kept for at least 36 months.

7.1.4.2. Assessment

The operator should also define the form of assessment for which ICAO Doc 10147 also provides guidance: the UAS operator should be responsible for "establishing valid and reliable assessment tools to evaluate their achievement."[21]

According to Section 1.2.5 point i) of ICAO Doc 10147, the *"assessment of competencies is based on multiple observations across multiple contexts"*. As UAS operations may be versatile, the required competencies may also be different, and this is what the UAS operator should consider according to Section 6.1.4.1 of ICAO Doc 10147. Therefore, the assessment`s form might be different for each UAS operator and for each UAS operation.

"**Employers should ensure that training is designed and developed to establish clear links among the competencies to be achieved**, the learning objectives, **assessment methods**, and course materials."[22]

[21] Section 1.2.1 of ICAO Doc 10147
[22] Section 1.4.1.1 of ICAO Doc 10147

Section 2.3.3.3.3 of the ICAO Doc 10147 includes description of designing an assessment plan. Accordingly, the assessment plan details:

*a) the **final competency standard** associated with the final milestone;*
*b) the **interim competency standard** associated with each milestone (if required);*[23]
c) the list of assessments (formative and summative assessments, examinations, oral assessments, etc.)
required for each of the milestone(s) that has been defined,
d) when assessments should take place,
e) the tools to be used to collect evidence during practical assessment,
f) the pass marks for projects, examinations or oral assessments,
g) if required, the minimum number of formative assessments to be undertaken prior to starting summative assessments, and
h) the number of observations required to assess performance for the interim and final competency standards."

[23] E.g. repetitive questions at the end of each module.

7.1.5. Risk analysis and methods for reduction of identified risks

According to the Advisory Circular the content and complexity of the DG-SOP should *"depend on the size of the organization, the nature of the operation and on the level of safety risk. At a minimum, the DG-SOP should include:*

a) how to conduct a safety risk assessment; procedures to identify hazards, determine their potential consequences and ensure the risk can be managed to an acceptable level;"

According to paragraph b) of AMC1 to Article 5 of the Implementing Regulation *"the assessment of the operational risk of transporting dangerous goods should take into account the following:*

(1) the risk that such goods pose to persons that are directly involved in their handling, to the environment, and to third parties and their properties;
(2) the hazard posed by the quantity and class of the dangerous goods;
(3) the characteristics of the container for the dangerous goods;
(4) the level of competence of those handling the dangerous goods; and
(5) the geographical area in which the flight will be operated."

Below you can find further details and additional aspects to the above elements of the risk assessment.

Ad. (1) and (2)

- Infectious substances that are capable of causing permanent disability, life-threatening or fatal disease for which no vaccine or cure is available have the highest consequences. They could potentially affect multiple persons or animals.
- Infectious pathogens that are spread by ingestion, for which prophylactic treatment or a cure is available will have moderate consequences.
- Non-communicable pathogens for which prophylactic treatment or a cure is available will have a low consequence.
- Chemicals with high toxicity to human, animal and aquatic life will have the highest consequences, and may affect multiple persons or animals.
- Chemicals that are highly corrosive will have a high consequence to package handlers or receivers.
- The operator should check for compatibility if different types of dangerous goods are being transported.

Ad (3)

- Design related OSOs might be considered. Detailed description of the packaging, evidence of drop test and other tests required by the Technical Instructions. In case of multi-layer packaging (e.g. Packing instruction 650 for UN 3373) the operator should provide evidence of using all packaging layers, absorbent and/or cushioning materials if applicable.
- Provisions of the Technical Instructions (ICAO Doc 9284) should be followed.
- Type of packaging should take into account the containment characteristics of the UA and damage that could be caused by exposure to airflow and weather such as rain or snow.

- Generally, dangerous goods should be packed in the lowest volume container necessary for the intended purpose.
- Measures to prevent leakage of liquid dangerous goods need to be taken into consideration.
- The contents of the packages should be documented and easily accessible in case of an incident or accident requiring emergency response. (UN Number, Container Type, volume and number of items).
- When dangerous goods are prepared for open external carriage (e.g. suspended from a helicopter or in open external carrying devices), consideration should be given to the type of packaging used and protection of those packagings where necessary from the effects of airflow and weather (e.g. by damage from rain or snow).[24]
- Forces and shock should also be considered if the DG is dropped.

Ad. (5).

- Consideration of the overflown area (operational scenarios of SORA) with respect to environmental issues (water, natural reserve, etc.)

7.1.6. Maintenance

The maintenance provisions shall be in line with SORA and OSOs related to maintenance. This element of the CONOPS should however cover the following aspects, for instance:

- Maintenance of the cargo bay or equipment used for carrying dangerous goods
- Sanitation of the UAS
- If applicable, what personal protective equipment (PPE) is required for conducting maintenance tasks.

[24] Note 11 to Part 4 (Packing Instructions) of the Technical Instructions

7.2. Operators` obligations under Technical Instructions

Part 7 of the Technical Instructions includes obligations of the operators:

- Acceptance (Chapter 1)
- Storage and Loading (Chapter 2)
- Inspection and decontamination (Chapter 3)
- Provisions of Information (Chapter 4)
- Provisions concerning passengers and crew (Chapter 5)
- Provisions to aid recognition of undeclared dangerous goods (Chapter 6)
- Helicopter operations (Chapter 7)

7.2.1. Acceptance

*"Operators' **acceptance staff must be adequately trained** to assist them in **identifying and detecting dangerous goods**."*[25] For the details of training please see Section 7.1.4 of the present Advisory Memorandum.

"Cargo acceptance staff should seek confirmation from shippers about the contents of any item of cargo where there are suspicions that it may contain dangerous goods, with the aim of preventing undeclared dangerous goods from being loaded on an aircraft as general cargo. Many innocuous-looking items may contain dangerous goods, and a list of general descriptions which, experience has shown, are often applied to such items is shown in Chapter 6."[26]

"An operator must not accept for transport aboard an aircraft a package or overpack containing dangerous goods or a freight container containing radioactive material or a unit load device containing the dangerous goods as described in 1. 4.1 b) and c) unless:

a) it is accompanied by two copies of the dangerous goods transport document; or
b) the information applicable to the consignment is provided in electronic form; or
c) it is accompanied, where permitted, by alternative documentation."[27]

According to Paragraph 7;1.3 of the technical Instructions, the UAS operator should use an acceptance checklist that verifies the followings elements:

- Completeness of Documentation (e.g. DGD, NOTOC airway bill)
- *"**the quantity of dangerous goods** stated on the dangerous goods transport document is within the limits per package on a passenger or cargo aircraft as appropriate;*
- *the **package, overpack or freight container marks** accord with the details stated on the accompanying dangerous goods transport document and are clearly visible;*
- *where required, the **letter in the packaging specification mark** designating the packing group for which the design type has been successfully tested is appropriate for the dangerous goods contained within. This does not apply to overpacks where the specification mark is not visible;*

[25] Subparagraph 7;1.1.1 of the Technical Instructions
[26] Subparagraph 7;1.1.2 of the Technical Instructions
[27] Subparagraph 7;1.2.1 of the Technical Instructions

- ***proper shipping names, UN numbers, labels, and special handling instructions*** *appearing on the interior package(s) are clearly visible or reproduced on the outside of an overpack;*
- *the* ***labelling of the package, overpack or freight container*** *is as required by 5;3;*
- *the* ***outer packaging of a combination packaging or the single packaging*** *is permitted by the applicable packing instruction, and, when visible, is of the type stated on the accompanying dangerous goods transport document;*
- *the* ***package or overpack does not contain different dangerous goods*** *which require* ***segregation*** *from each other according to Table 7-1; and*
- *the package, overpack, freight container or unit load device is not* ***leaking*** *and there is no indication that its* ***integrity*** *has been compromised."*

7.2.2. Storage and Loading

In case of storage and loading the UAS operator should comply with Paragraph 7;2. of the Technical Instructions. This chapter of the Technical Instruction describes how to load, secure dangerous goods.
In cases where several different dangerous goods are loaded into the aircraft the UAS operator should consider the provisions applicable to segregate (Table 7-1. of the Technical Instructions) and if several different explosives are loaded into the unmanned aircraft, the rules of separation must be kept (Table 7-2 of the Technical Instructions).

The UAS operator shall check the hazard labels and handling label also and conduct loading and unloading accordingly.

"During the course of air transport, including storage, markings and labels required by these Instructions must not be covered or obscured by any part of or attachment to the packaging or any other label or marking."[28]

"When an operator discovers that any of the marks required by 5;2.4.9, 5;2.4.11, 5;2.4.12 or 5;2.4.16 or labels for packages of dangerous goods have become lost, detached or illegible the operator must replace them with appropriate marks or labels in accordance with the information provided on the dangerous goods transport document or other transport document, such as an air waybill, when applicable."[29]

[28] Paragraph 7;2.6 of the Technical Instructions
[29] Paragraph 7;2.7 of the Technical Instructions

7.2.3. Inspection and decontamination

Subparagraph 7;3.1.1 of the Technical Instructions requires the **operator "*to ensure that a package or overpack containing dangerous goods is not loaded onto an aircraft or into a unit load device unless it has been inspected*** *immediately* ***prior to loading*** *and* ***found free from evidence of leakage or damage***."

*"**Packages or overpacks** containing dangerous goods **must be inspected for signs of damage or leakage upon unloading** from the aircraft or unit load device. If evidence of damage or leakage is found, the position where the dangerous goods or unit load device was stowed on the aircraft must be inspected for damage or contamination and any hazardous contamination removed."*

The UAS operator should incorporate inspection into its normal procedures (or if transport of dangerous goods is not the main part of the business, as procedure peculiar to a single operation).

According to Subparagraph 7;3.1.4 of the technical Instructions:
"If any person responsible for the carriage of packages containing infectious substances becomes aware of damage to or leakage from such a package, that person must:

a) avoid handling the package or keep handling to a minimum;
b) inspect adjacent packages for contamination and put aside any that may have been contaminated;
c) inform the appropriate public health authority or veterinary authority and provide information on any other countries of transit where persons may have been exposed to danger;
d) notify the shipper and/or the consignee."

Decontamination may be part of the contingency/emergency procedures or even the emergency response plan, depending on the circumstances. In some cases, the sanitation of the UAS may be part of the maintenance procedures (see Section 7.1.6 of the present Advisory Memorandum).

7.2.4. Provisions of information

Chapter 7;4. of the Technical Instruction refers to the obligations related to providing information to the pilot-in-command and employees of the UAS operator about the carried dangerous goods.

7.2.5. Provisions concerning passenger and crew

According to Subparagraph 7;5.1.2 of the Technical Instructions this obligation relates to operators of passenger aircrafts, but these rules may be -mutatis mutandis - applicable to UAS operator. See Section 7.1.4 of the present Advisory Memorandum.

7.2.6. Provisions to aid recognition of undeclared dangerous goods

As it is referred to in Section 6.1 of the present Advisory Memorandum, the UAS operator - irrespective of the operational category - is responsible for avoiding carrying misdeclared or undeclared dangerous goods. The UAS operator shall provide information – mainly in the form of training and procedures – to its personnel about:

> *"a) general descriptions that are often used for items in cargo or in passengers' baggage which may contain dangerous goods;*
> *b) other indications that dangerous goods may be present (e.g. labels, markings);"*[30]

The UAS operator shall provide the competent authority with these documents upon submitting their application for operational authorisation or LUC.

Hint: Subparagraph 7;6.1 of the Technical Instructions provide a list of goods that might contain dangerous goods but that may not be obvious.

[30] Paragraph 7;6.1 of the Technical Instructions

8. Instructions for communicating information

According to the Advisory Circular the content and complexity of the DG-SOP should *"depend on the size of the organization, the nature of the operation and on the level of safety risk. At a minimum, the DG-SOP should include:*

> *c) instructions for communicating information to relevant persons related to the dangerous goods being transported in case of an accident or incident;*

Furthermore:
"The Technical Instructions include provisions for communicating hazards of dangerous goods through marking and labelling of the package and documentation, which are well-known to those involved in their transport. Individuals who are exposed to UAs involved in an incident or accident may not be aware of these hazard communication methods.
Procedures should be established by the operator that explains the instructions for effectively communicating hazards to those not familiar with dangerous goods marking and labelling and how the instructions should be attached to the shipment. Contact information and instructions for informing appropriate authorities, including public health authorities, should also be included in the procedures."

The operator should use the proper labelling on packages. The operator should check the necessity of shipper` s declaration (DGD) and NOTOC (Notification to Captain) and in case if it is necessary, for filling it out properly.

9. Actions to be taken in emergency situations

According to the Advisory Circular the content and complexity of the DG-SOP should *"depend on the size of the organization, the nature of the operation and on the level of safety risk. At a minimum, the DG-SOP should include:*

d) action to be taken in the event of emergencies involving dangerous goods;

The operator should draw up and implement an Emergency Response Plan, that should cover emergency situations related to dangerous goods. The operator should prepare procedure to handle release of dangerous goods. *"A current list of contacts indicating whom should be notified if either event occurs, should be maintained."*

According to the Technical Instructions "packages or overpacks containing dangerous goods must be inspected for signs of damage or leakage upon unloading from the aircraft or unit load device. If evidence of damage or leakage is found, the position where the dangerous goods or unit load device was stowed on the aircraft must be inspected for damage or contamination and any hazardous contamination removed."

The UAS operator, beside complying with AMC2 to UAS.SPEC.030(3)(e) should consider the ERG Code—Emergency Response Drill Code as found in the International Civil Aviation Organization (ICAO) document "The Emergency Response Guidance for Aircraft Incidents Involving Dangerous Goods" (ICAO Doc. 9481). The code consists of a combination of letters and numbers, which represents suggested responses to incidents involving the specific dangerous good entry to which the drill code is assigned.
The ERG code can be found in Column N of Dangerous Goods list in Section 4.2 of IATA Dangerous Goods Regulations (DGR)[31].

[31] https://www.iata.org/en/publications/dgr/

10. Collection of safety data

According to the Advisory Circular the content and complexity of the DG-SOP should *"depend on the size of the organization, the nature of the operation and on the level of safety risk. At a minimum, the DG-SOP should include:*

e) instructions for the collection of safety data related to dangerous goods accidents and dangerous goods incidents."

According to ICAO Doc 10147, the operator should train the personnel on collecting safety data. This should comprise the following:

- Report dangerous goods accidents
- Report dangerous goods incidents
- Report undeclared/misdeclared dangerous goods
- Report dangerous goods occurrences

According to the Technical Instructions:

*"An **operator must report dangerous goods accidents and incidents** to the appropriate authorities of the State of the Operator and the State in which the accident or incident occurred in accordance with the reporting requirements of those appropriate authorities."*[32]

*"**In the event of:***

a) an aircraft accident; or

***b) a serious incident where dangerous goods carried as cargo may be involved**, the **operator** of the aircraft carrying dangerous goods as cargo **must, without delay, provide to emergency services responding to the accident or serious incident, information about the dangerous goods on board, as shown on the copy of the information provided to the pilot-in-command**. As soon as possible, the operator must also provide this information to the appropriate authorities of the State of the Operator and the State in which the accident or serious incident occurred."*[33]

"In the event of an aircraft incident, if requested to do so, the operator of an aircraft carrying dangerous goods as cargo must, without delay, provide to emergency services responding to the incident and to the appropriate authority of the State in which the incident occurred, information about the dangerous goods on board, as shown on the copy of the information provided to the pilot-in-command."[34]

"An operator must report any occasion when undeclared or misdeclared dangerous goods are discovered in cargo or mail. Such a report must be made to the appropriate authorities of the

[32] Paragraph 7;4.4 of Technical Instructions
[33] Subparagraph 7;4.7.1 of Technical Instructions
[34] Subparagraph 7;4.7.2 of Technical Instructions

State of the Operator and the State in which this occurred. An operator must also report any occasion when dangerous goods not permitted under 8;1.1.1 are discovered by the operator, or the operator is advised by the entity that discovers the dangerous goods, either in the baggage or on the person, of passengers or crew members. Such a report must be made to the appropriate authority of the State in which this occurred."[35]

"An operator must report to the appropriate authority of the State of the Operator any occasion when:

a) dangerous goods are discovered to have been carried when not loaded, segregated, separated or secured accordingly; or

b) dangerous goods are discovered to have been carried without information having been provided to the pilot-in-command accordingly."[36]

Further information on Occurrence Reporting may be found in UAM 011[37].

[35] Paragraph 7;4.6 of Technical Instructions
[36] Paragraph 7;4.6 of Technical Instructions
[37] https://www.iaa.ie/general-aviation/drones/uas-advisory-memoranda