NATO STANDARD

ATP-96

INTERNATIONAL SYSTEM (SI) UNITS USED BY ARMED FORCES IN THE RADIOLOGICAL/NUCLEAR FIELD

Edition A Version 1
DECEMBER 2015

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED TACTICAL PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

INTENTIONALLY BLANK

NORTH ATLANTIC TREATY ORGANIZATION (NATO)

NATO STANDARDIZATION OFFICE (NSO)

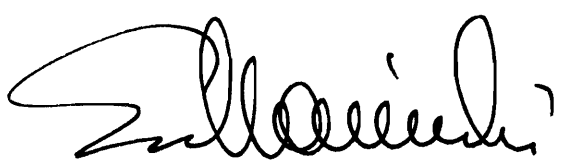
NATO LETTER OF PROMULGATION

11 December 2015

1. The enclosed Allied Tactical Publication ATP-96, Edition A, Version 1, INTERNATIONAL SYSTEM (SI) UNITS USED BY ARMED FORCES IN THE RADIOLOGIC/NUCLEAR FIELD, which has been approved by the nations in the Military Committee Joint Standardization Board, is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 2957.

2. ATP-96, Edition A, Version 1, is effective upon receipt.

4. This publication shall be handled in accordance with C-M(2002)60.



Edvardas MAŽEIKIS
Major General, LTUAF
Director, NATO Standardization Office

INTENTIONALLY BLANK

RESERVED FOR NATIONAL LETTER OF PROMULGATION

INTENTIONALLY BLANK

RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS
Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

INTENTIONALLY BLANK

RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]
NOR	Norway will replace detection equipment not using agreed SI-units, when funding is available

Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.

INTENTIONALLY BLANK

TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION 1-1

1.1. Aim 1-1
1.2. Agreement 1-1
1.3. Modalities of the Agreement 1-1
1.4. Dosimetry Guidance 1-3
1.5. Remarks 1-3

INTENTIONALLY BLANK

CHAPTER 1 INTRODUCTION

1.1. Aim

The aim of this standard is to prescribe which units or derived units from the International System (SI) are to be used by the NATO armed forces in the radiological/nuclear field, namely the field dosimeter, operational procedures for radiological/nuclear defence, military RADIAC equipment and radioactive sources. Those units are to be applied for all types of missions or tasks assigned to NATO. Those units are also to be used during instruction or training of forces and in related documents.

1.2. Agreement

Participating nations agree to use the following units or derived units from the International System (SI).

1.3. Modalities of the Agreement

The following definitions are used in radiological operations:

a. Activity (A): the activity, A, of an amount of a radionuclide in a particular energy state at a given time is the quotient of *dN* by *dt*,

$$A = \frac{dN}{dt}$$

Where

dN is the expectation value of the number of spontaneous nuclear transitions from that energy state in the time interval *dt*:

The unit of activity is the becquerel [Bq], which is defined as one nuclear transition per second.

When measuring radioactive contamination in the field, the activity could also be expressed by:

- Surface activity (A_s). This is the amount of activity per surface unit. The basic unit is the becquerel per square meter (Bq/m^2).
- Specific activity (A_m). This is the radioactivity per mass unit. The basic unit is the becquerel per kilogram (Bq/kg).

- Volume activity (A_v). This is a measure of radioactivity per volume unit. The basic unit is the becquerel per cubic meter (Bq/m^3) for gas, or the becquerel per litre (Bq/L) for liquids.

b. Absorbed dose (D): the energy absorbed per unit mass.

$$D = \frac{d\bar{\varepsilon}}{dm}$$

Where:

$d\bar{\varepsilon}$ is the mean energy imparted by ionizing radiation to the matter in a volume element, and

dm is the mass of the matter in this volume element.

Absorbed dose denotes the dose averaged over a tissue or an organ. The unit for absorbed dose is the gray [Gy]. Fractions of a gray are often used, including the centigray (cGy), and the milligray (mGy).

0.001 Gy = 0.1 cGy = 1 mGy = 1000 µGy

Units of Measurement for Dose Rate. The unit to be used is the gray per hour (Gy/h). The preferred fractions are the centigray per hour (cGy/h) and the milligray per hour (mGy/h).

c. Effective dose (E): the sum of the weighted equivalent doses in all the tissues and organs of the body from internal and external irradiation. It is given by:

$$E = \sum_T w_T H_T = \sum_T w_T \sum_R w_R D_{T,R}$$

Where

$D_{T\,R}$ is the absorbed dose averaged over tissue or organ *T*, due to radiation *R*,

w_R is the radiation weighting factor and

w_T is the tissue weighting factor for tissue or organ *T*.

The unit for effective dose is the sievert [Sv]. The preferred fractions include centisievert (cSv) and the millisievert (mSv).

0.001 Sv = 0.1 cSv = 1 mSv = 1000 µSv

Unit for Effective Dose Rate. The unit to be used is the sievert per hour (Sv/h). The preferred fractions include the centisievert per hour (cSv/h) and the millisievert per hour (mSv/h).

d. Equivalent dose (H_T): the absorbed dose, in tissue or organ *T* weighted for the type and quality of radiation *R*. It is given by:

$$H_{T,R}=w_R D_{T,R}$$

Where

$D_{T,R}$ is the absorbed dose averaged over tissue or organ *T*, due to radiation *R*,

w_R is the radiation weighting factor.

When the radiation field is composed of types and energies with different values of w_R, the total equivalent dose, H_T, is given by:

$$H_T = \sum_R w_R D_{T,R}$$

The unit for equivalent dose is the sievert.

1.4. Dosimetry Guidance

1 . Dosimetry Conventions. The convention is that any very large or very small numbers should be expressed in multiples of 1 X 10^3.

2. The sievert (effective dose) is a measure of the risk of stochastic biological effects in exposed individuals. In complex exposures, the sievert can be used to sum the effect from different types of radiation. Although some agencies can only report measurements in grays; for whole body gamma radiation, if every tissue or organ receives the same equivalent dose, the number of grays (absorbed dose) is numerically equal to the number of Sieverts (effective dose).

1.5. Remarks

1. In the new security environment, the potential for NATO forces to be faced with hazards emanating from LLR (Low Level Radiation) situations has considerably increased, notably in the framework of Non-Article 5 Crisis Response Operations (Non-Article 5 CRO). For reasons linked to the health of personnel and for assisting the commander in the operational and/or legal management of the radiation exposures, it is essential to take the internal dose into account. As a consequence, in all related documentation as for all instrumentation dealing with person net exposure, the effective dose (associated reference unit = sievert) for the dose[1] measurement is to be used.

[1] For high dose levels of external radiation within the context of nuclear weapon detonation (STANAG 2521), the gray remains the appropriate unit for estimating the immediate effects on unit fighting capability. It is agreed that, for this type of exposure, the Sievert and the Gray are easily switchable. For this purpose, 1Gy = 1Sv.

2. The agreed units and preferred multiples of this standard will apply when drafting new NATO CBRN documents. The currently existing documents will be amended accordingly when they will be reviewed.

3. It is not mandatory to change currently fielded equipment.

INTENTIONALLY BLANK

ATP-96(A)(1)