

INTERNATIONAL STANDARD

**Mobile remotely controlled systems (MRCSS) for nuclear and radiological applications -
Part 2: Particular requirements for aerial surveillance**

get full document from standards.iteh.ai



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2026 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search -

webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references	6
3 Terms, definitions and abbreviated terms	6
3.1 Terms and definitions	6
3.2 Abbreviated terms	7
4 General description	7
4.1 Aerial surveillance missions for nuclear and radiological applications	7
4.1.1 General	7
4.1.2 Aerial radiation mapping for nuclear facility.....	7
4.1.3 Radiation emergency responding and supporting evacuation plan:	8
4.1.4 Monitoring the structural integrity of nuclear facility:.....	8
4.1.5 Security and intrusion detection of nuclear facility:.....	8
4.2 Operation conditions for aerial surveillance mission	8
4.2.1 General	8
4.2.2 Radiation conditions for aerial surveillance mission.....	8
4.2.3 Mobility conditions for aerial surveillance mission	9
4.2.4 Temperature conditions for aerial surveillance mission.....	9
4.2.5 Weather conditions for aerial surveillance mission	10
4.2.6 Communication conditions for aerial surveillance mission	10
4.2.7 Other conditions for aerial surveillance mission	11
4.3 Structure of aerial MRCS for aerial surveillance mission.....	11
4.3.1 Slave subsystem	11
4.3.2 Master subsystem	11
4.4 Risk analysis and safety measures of aerial MRCS	11
4.4.1 General	11
4.4.2 Risk analysis of fault tolerance	11
4.4.3 Risk minimization	12
4.4.4 Probabilistic risk assessment	12
4.4.5 Safety design.....	12
5 Particular requirements.....	12
5.1 General.....	12
5.2 Reliability requirements	13
5.2.1 General	13
5.2.2 Radiation tolerance	13
5.2.3 Mobile controllability and stability tolerance	14
5.2.4 Temperature tolerance	14
5.2.5 Weather tolerance	15
5.2.6 Waterproof function.....	15
5.2.7 Fail-safe functionality	15
5.3 Functional requirements	16
5.3.1 General	16
5.3.2 Functional requirements for aerial MRCS.....	16
5.3.3 Functional requirements for mobility	18
5.3.4 Functional requirements for communication	18

5.4	Safety requirements	19
5.5	Operational requirements	19
5.6	Test requirements	20
6	Verification and validation	21
6.1	General.....	21
6.2	Required verification and validation of the aerial MRCS	21
Annex A (informative)	Adopted classifications of dangerous zones.....	23
A.1	Radiation control zone.....	23
A.2	Radiation hardness assurance.....	24
Bibliography		25
Table 1 – Verification and validation methods of aerial MRCS requirements and countermeasures		22

Sample Document

get full document from standards.iteh.ai

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**Mobile remotely controlled systems (MRCSS)
for nuclear and radiological applications -
Part 2: Particular requirements for aerial surveillance**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 63048-2 has been prepared by IEC technical committee 45: Nuclear instrumentation. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
45/1056/FDIS	45/1066/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts of the IEC 63048 series of standards, published under the general title *Mobile remotely controlled systems (MRCSS) for nuclear and radiological applications*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

Sample Document

get full document from standards.iteh.ai

INTRODUCTION

IEC 63048 provides the general requirements for mobile remotely controlled systems (MRCS) intended for various missions at nuclear facilities. Depending on the given missions, different types of MRCSs can be used, and the requirements of the MRCSs are applied in different level.

Nuclear facilities are strictly regulated to prevent leakage of radioactive materials, and surveillance is an important mission for all nuclear facilities. A nuclear power plant, which is a representative nuclear facility, is operated in different situations, such as normal operation, transient, accident conditions and decommission. Whereas various missions of MRCSs are required in different situations, the surveillance mission of MRCSs is essential for all operation situations.

All types of MRCSs (i.e. unmanned ground vehicles, remotely operated mobile manipulators, aerial drones, underwater drones, etc.) are useful for surveillance of nuclear facilities. However, aerial MRCSs are faster than other types of MRCS and are effective for surveillance of large areas.

This document establishes the particular requirements for MRCSs used for aerial surveillance.

Sample Document

get full document from standards.iteh.ai

1 Scope

This part of IEC 63048 establishes the particular requirements of aerial MRCSs used for aerial surveillance mission for nuclear and radiological applications, such as rapid radiation mapping, structural damage monitoring, monitoring of radioactive plume transport, or finding a radioactive material. It provides the functional and operational requirements of aerial MRCS.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 63048:2020, *Mobile remotely controlled systems for nuclear and radiological applications - General requirements*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1.1

mission

objective description of the fundamental task performed by a system

[SOURCE: IEC 63048:2020, 3.3]

3.1.2

mobile remotely controlled system

MRCS

robotics in nuclear instrumentation that are mobile, remotely controlled by an operator, and consisting of sub-systems, modules or assemblies

EXAMPLE Subsystems, modules or assemblies are, for example, mechanical and electrical/electronic controls, communications (between the operator and the robotic, and some robotic subsystems, modules or assemblies), lighting and possibly audio subsystems, modules or assemblies, sampling and monitoring subsystems, modules or assemblies, used for photographing the environment with video or still photos, sampling or monitoring the contacted air or surfaces for radioactive materials, noxious gases and particulates such as asbestos, and performing other designed activities, all controlled by the operator.

[SOURCE: IEC 63048:2020, 3.4]

3.1.3**surveillance**

continual checking, critically observing or determining the status in order to identify change from the risk (3.1.4) level required or expected

[SOURCE: ISO Guide 73:2009 [5], 3.8.2.1, modified – "Monitoring" has been changed to "surveillance"; "Supervising" has been deleted, and "performance level" has been changed to "risk". In addition, Note 1 to entry has been deleted.]

3.1.4**risk**

potential that a given threat will exploit vulnerabilities of an asset or group of assets and thereby cause harm to the organization

Note 1 to entry: Risk is measured in terms of combination of the severity of impact from the environment, probability of the exposure time to the radiation and the controllability for MRCS.

[SOURCE: IAEA Nuclear Security Series No. 17:2011 [7], modified. The second sentence in the definition has been removed, and Note 1 to entry has been added.]

3.2 Abbreviated terms

CBRN	Chemical, biological, radiological or nuclear
GPS	Global positioning system
HMI	Human-machine interface
HVAC	Heat, ventilation, and air conditioning
IMU	Inertial measurement unit
LTE	Long-term evolution
MRCS	Mobile remotely controlled system
MTBF	Mean time between failures
SLAM	Mimultaneous localization and mapping

4 General description**4.1 Aerial surveillance missions for nuclear and radiological applications****4.1.1 General**

Aerial surveillance missions are conducted to enhance safety and security by providing real-time, accurate, and comprehensive data for decision-making, risk mitigation, and response coordination in the context of nuclear facility management or public safety.

Aerial surveillance is conducted to monitor radiation distributions in large areas, such as, regular monitoring of a nuclear facility, regulatory monitoring or inspection of a nuclear facility, the expected location of a lost radiation source, the area suspected of radioactive contamination, the area of a chemical, biological, radiological or nuclear (CBRN) emergency, and the area supposed to be affected by a nuclear security event (e.g. sabotage of a nuclear facility or detonation of a radiological dispersal device).

4.1.2 Aerial radiation mapping for nuclear facility

The aerial surveillance is conducted to monitor the nuclear facility. The nuclear facility is operated under strict regulation. Each zone of the nuclear facility has a limited level of radiation. The aerial MRCS is commonly utilized for regular monitoring and legal regulatory investigation of nuclear facility.