

INTERNATIONAL STANDARD

**Radiation protection instrumentation – Data format for radiation instruments
used in the detection of illicit trafficking of radioactive materials**





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INTERNATIONAL STANDARD

**Radiation protection instrumentation – Data format for radiation instruments
used in the detection of illicit trafficking of radioactive materials**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RADIATION PROTECTION INSTRUMENTATION –
DATA FORMAT FOR RADIATION INSTRUMENTS USED IN THE DETECTION
OF ILLICIT TRAFFICKING OF RADIOACTIVE MATERIALS**

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International Standard IEC 62755 has been prepared by subcommittee 45B: Radiation protection instrumentation, of IEC technical committee 45: Nuclear instrumentation.

The text of this standard is based on the following documents:

FDIS	Report on voting
45B/739/FDIS	45B/748/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

This standard contains attached files in the form of a zip file. These files are intended to be used as a complement and do not form an integral part of the standard.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

RADIATION PROTECTION INSTRUMENTATION – DATA FORMAT FOR RADIATION INSTRUMENTS USED IN THE DETECTION OF ILLICIT TRAFFICKING OF RADIOACTIVE MATERIALS

1 Scope and object

The purpose of this International Standard is to provide a uniform format for data to be output from radiation measurement instruments for use in detection of illicit trafficking of radioactive materials. This enables interpretation of data without reference to manufacturer's documentation.

This standard specifies the data format used for both required and optional data available at the output of radiation measurement instruments that are used for the detection of illicit trafficking of radioactive materials. The performance requirements for these types of radiation measurement instruments are described in other standards such as IEC 62401, IEC 62533, IEC 62694, IEC 62244, IEC 62327, IEC 62484, and IEC 62618 [26]¹.

The output consists of measurement data and results of any analysis performed by the radiation measurement instrument.

This standard does not address instrument control, data transmission protocols, or the physical media used for communications.

To ensure the largest interoperability of radiation instruments and worldwide operations, the technical content (e.g. data elements and attributes, document structure) of this standard matches the ANSI/IEEE N42.42 standard [28].

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-393:2003, *International Electrotechnical Vocabulary – Part 393: Nuclear instrumentation – Physical phenomena and basic concepts*

IEC 60050-394:2007, *International Electrotechnical Vocabulary – Part 394: Nuclear instrumentation – Instruments, systems, equipment and detectors*

ISO/IEC 10646-1, *Information technology – Universal Multiple-Octet Coded Character Set (UCS) – Part 1: Architecture and Basic Multilingual Plane*²

ISO/IEC 11578, *Information technology – Open Systems Interconnect – Remote Procedure Call (RPC)*³

¹ Numbers in square brackets refer to the Bibliography.

² The Unicode Consortium's Unicode Standard 4.0 is equivalent to the ISO document.

³ The Universally Unique Identifier (UUID) URN Namespace from W3C RFC 4122 is an equivalent standard covering the format of the UUID. Available at <http://www.ietf.org/rfc/rfc4122.txt>

ISO 8601, *Data elements and interchange formats – Information interchange – Representation of dates and times*

3 Terms, definitions, abbreviations, quantities and units

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions, as well as those given in IEC 60050-393 and IEC 60050-394 apply.

3.1.1

air-kerma

kerma in a small volume of air

3.1.2

ambient dose equivalent

$H^*(10)$

dose equivalent at a point in a radiation field, produced by the corresponding aligned and expanded field, in the ICRU sphere at a depth of 10 mm, on the radius opposing the direction of the aligned field

Note 1 to entry: see ICRU Report 39 and 47.

Note 2 to entry: In defining these quantities, it is useful to stipulate certain radiation fields that are derived from the actual radiation field. The terms "expanded" and "aligned" are used to characterise these derived radiation fields. In the expanded field, the fluence and its angular and energy distribution have the same values throughout the volume of interest as in the actual field at the point of reference. In the aligned and expanded field, the fluence and its energy distribution are the same as in the expanded field but the fluence is unidirectional.

Note 3 to entry: The ICRU sphere (see ICRU Report 33) is a 30 cm diameter, tissue-equivalent sphere with a density of $1 \text{ g}\cdot\text{cm}^{-3}$ and a mass composition of tissue equivalent material (see IEC 60050-393:2003, 393-14-78).

Note 4 to entry: The recommended depth d , for environmental monitoring in terms of $H^*(d)$ is 10 mm, and $H^*(d)$ may then be written as $H^*(10)$.

Note 5 to entry: An instrument that has an isotropic response and is calibrated in terms of $H^*(d)$ will measure $H^*(d)$ in radiation fields that are uniform over the dimensions of the instrument.

Note 6 to entry: The definition of $H^*(d)$ requires the design of the instrument to take account of backscatter.

[SOURCE: IEC 60050-393:2003, 393-14-95]

3.1.3

attribute

XML (eXtensible Markup Language) "name-value" construct contained in an XML element start tag

Note 1 to entry: Details are available at [4].

3.1.4

channel

bin of a spectral histogram

Note 1 to entry: Typically, a multichannel analyzer will increment the bin corresponding to the height of each recorded pulse. The contents of each bin are referred to as the "counts" in the channel (also referred to as the channel "value").

Note 2 to entry: Because these histograms can be reprocessed in a variety of ways, the counts in each channel may be a real number (i.e. the counts need not be an integer).

3.1.5

channel position

real number representing the position in a spectral histogram along the channel axis in terms of channels and their fractional parts where the channel number of the left edge of the first

channel in a histogram of N channels is 0,0, and the channel number of the right edge of the last channel is N

Note 1 to entry: One can correlate a particular energy with a channel position; for example, energy 1173,2 keV may correspond to a channel position of 3437,61.

3.1.6

confidence indication

measure provided by the radiation measurement instrument of the reliability assigned to the radiation source identification, with a range from 0,0 to 100,0 %

Note 1 to entry: Higher values indicate a higher likelihood of the presence of the radionuclide.

3.1.7

double escape peak

in a gamma ray spectrum, peaks due to pair production in the detector and escape, from the sensitive part of the detector, of two photons of 511 keV resulting from annihilation

3.1.8

element

XML construct consisting of a start tag contained in angle brackets, optional data, and an optional end tag

Note 1 to entry: Details are available at [4].

3.1.9

energy calibration

describes the relationship between energy and channel number

3.1.10

environmental background

signals of origin other than the radiation to be detected

Note 1 to entry: This may refer to:

- a) signals caused by radiations from sources inside or outside the radiation detector other than those of interest in the measurement;
- b) signals resulting from the short-comings of the electronic circuits of the detecting system and their power supplies.

3.1.11

exposure

quotient of dQ by dm , where dQ is the absolute value of the total charge of the ions of one sign produced in air when all the electrons and positrons, liberated by photons in air of mass dm are completely stopped:

$$X = dQ/dm$$

Note 1 to entry: The special unit of exposure used in this standard is the milliroentgen, abbreviated as mR.

3.1.12

full-energy peak efficiency

ratio of the number of photons detected in the total absorption peak for a given detection assembly and photon energy per unit time to the emission rate of a source in a specified geometry

3.1.13

FWHM

full-width half-maximum

distance between the abscissa of two points on the curve whose ordinates are half of the maximum ordinate of the peak in a distribution curve comprising a single peak

3.1.14

FWHM calibration

describes the relationship of FWHM as a function of energy

3.1.15

gross counts

total number of counts recorded by the radiation measurement instrument

3.1.16

Internet Assigned Numbers Authority

IANA

authority responsible for the registration of globally unique internet domain names and namespaces

Note 1 to entry: For details see <www.iana.org>.

3.1.17

intrinsic full-energy peak efficiency

ratio of the number of photons detected in the total absorption peak for a given photon energy to the number of photons that are incident on the radiation detector in the same time interval

3.1.18

item

object being measured by the radiation measurement instrument. This object may or may not produce a radiation field

3.1.19

kerma

quotient of dE_{tr} by dm , where dE_{tr} is the sum of the initial kinetic energies of all the directly ionizing particles liberated by indirectly ionizing particles in a material of mass dm :

$$K = dE_{tr} / dm$$

Note 1 to entry: The units of kerma are the gray (Gy).

3.1.20

live time

duration during which a detection assembly is sensitive to the input signal

[SOURCE: IEC 60050-394:2007, 394-39-31]

3.1.21

manufacturer

person or company that manufactures hardware or software

3.1.22

MIME

multipurpose internet mail extension

standard which defines the encoding of non-text data such as images and sound, in text format

Note 1 to entry: For details see [36].

3.1.23

MIME type

identifies the format of data

Note 1 to entry: MIME types are maintained by the Internet Assigned Numbers Authority.

Note 2 to entry: For details see [43].

3.1.24**N42 document**

collection of data represented in XML, formatted according to this standard

3.1.25**precision**

number of digits that are used to express a numeric value in text form

3.1.26**radiation detector**

sensor component of a radiation measurement instrument designed to produce a quantifiable response to ionizing radiation

3.1.27**radiation measurement instrument**

complete system comprising one or more radiation detectors and other possible components designed to quantify one or more characteristics of ionizing radiation or of the radioactive material producing the ionizing radiation

3.1.28**real time**

true operational time of measurement

[SOURCE: IEC 60050-394:2007, 394-39-29]

3.1.29**single escape peak**

in a gamma ray spectrum, peaks due to pair production in the detector and escape, from the sensitive part of the detector, of one photon of 511 keV resulting from annihilation

3.1.30**spectrum**

series of monotonically increasing energy bins in which radiation counts are tallied

Note 1 to entry: The energy of each successive bin begins at the energy at which the previous bin ended.

3.1.31**software**

sets of instructions or data that tell a computer what to do

Note 1 to entry: Software is often divided into two categories: system software, which includes the operating system (e.g. Windows 7, MacOS) and all utilities that enable the computer to function, and applications software, which includes programs that perform specific tasks (e.g. word processors, spread sheets, and databases).

3.1.32**state data**

information regarding the state (i.e. orientation, speed, and mode of operation) of an object (e.g. a radiation measurement instrument, detector, or item)

3.1.33**tag**

piece of text that describes a unit of data, or element, in XML

Note 1 to entry: A detailed definition can be found at [4].

3.1.34**uncertainty**

parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand

3.1.35

uniform resource identifier

URI

string of characters used to identify a name or a resource on the Internet

Note 1 to entry: Defined by IETF RFC 2732 [45].

3.1.36

uniform resource locator

URL

specifies where an identified resource is available and the mechanism for retrieving it

Note 1 to entry: Defined by IETF RFC 2396 [44].

3.1.37

UCS transformation format 8

UTF-8

encodes a character in the repertoire of ISO/IEC 10646-1 using between 1 and 6 octets

3.1.38

universally unique identifier

UUID

string of characters used to uniquely identify each N42 document

Note 1 to entry: The format of a UUID is described by ISO/IEC 11578.

3.1.39

world wide web consortium

W3C

main international standards organization that maintains the definitions for XML and associated standards

3.1.40

eXtensible Markup Language

XML

system and hardware independent language for expressing data and their structure within an XML document

Note 1 to entry: An XML document is a text object that contains the data together with markup that defines the structure of the data.

Note 2 to entry: Details are available at [4].

3.1.41

XML schema

provides a means for defining the structure, content and semantics of XML documents through XML itself

Note 1 to entry: Details are available at [5].

3.2 Abbreviations

DU	Depleted Uranium
HEU	Highly Enriched Uranium
LEU	Low Enriched Uranium
MIME	Multipurpose Internet Mail Extension
NIEM	National Information Exchange Model
NIST	National Institute of Standards and Technology
OCR	Optical Character Recognition

RGPU	Reactor Grade Plutonium
RID	Radionuclide Identifier
RPM	Radiation Portal Monitor
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
UTF-8	UCS Transformation Format 8
UUID	Universally Unique Identifier
W3C	World Wide Web Consortium
WGPu	Weapons Grade Plutonium
XML	eXtensible Markup Language

3.3 Quantities and units

Quantities associated to elements and attributes have well defined units. This standard uses the International System of Units (SI). Multiples and submultiples of SI units will be used, when practicable, according to the SI system.

This standard also uses the following units:

- for energy: kilo-electron-volt (symbol: keV), $1 \text{ keV} = 1,602 \times 10^{-16} \text{ J}$.
- for ambient dose equivalent: microsievert (symbol: μSv).
- for exposure: milliroentgen (symbol: mR), $1 \text{ mR/h} = 2,58 \times 10^{-7} \text{ C/kg/h}$.
- for multimedia file size value: kilobytes (symbol: kB).

SI units should be used for those elements whose values require the indication of the associated "unit" attribute; the unit used should be appropriate for the recorded or measured value.

When the present standard refers to the format of input data, it uses the period (".") as decimal sign instead of the comma (","); such data are marked with quotation marks such as "123.456" in 5.1.1.

The conversion of exposure to ambient dose equivalent is discussed in Annex J.

4 General characteristics

4.1 Design principles used in this International Standard

The design principles used in this standard are the following:

- a) Readability: data should be in a format that can be easily accessed and understood by analysts without the need for proprietary software.
- b) Compatibility: data should be in a format that is compatible with accepted international standards for data representation to the broadest extent possible.
- c) Extensibility: the data format should provide for unforeseen future needs and for as-yet unknown requirements particular to the specific needs of individual manufacturers of radiation measurement instrumentation.
- d) Impartiality: the data format should not favour any particular commercial interest by adopting a particular manufacturer's or organization's practices.

4.2 Characteristics of the data format

With the design principles in mind, the data format, henceforth referred to as the “N42 data format”, defined by this standard is based upon the XML specification(see [4]). Specifically, this standard requires that the data from the radiation measurement instrument shall comply with the following data formats:

- a) The data shall be rendered in an XML document in conformance with the W3C XML V1.0 standard, see [4] and [5]. In this standard, an XML document is considered identical to an XML file.
- b) Documents produced according to this standard shall be capable of being validated against the master N42 schema, as well as any other schemas required by that document.
- c) Data authentication, when required, shall be provided via XML-Signature, see [2].
- d) Data encryption, when required, shall be provided via XML Encryption, see [3].

NOTE Document compression is not addressed in this standard.

This standard has the following general characteristics:

- a) Radiation measurement instrumentation information is expressed as a hierarchical structure of data items.
- b) The data format employs XML tagging as defined by XML [4], and follows the guidelines of [29], [35] and [38].
- c) Mixed content is not allowed, i.e., insertion of tags inside of content is not allowed. Non-printing character data are permitted between closing and opening tags.
- d) In order to allow the data to be accessed using simple text editors, only the ISO/IEC 10646-1 UTF-8 (see reference) character encoding shall be used.
- e) The structure of the information is described by an XML Schema document (see [1] and Annex A). This schema defines the standard names for data elements and attributes, and the hierarchical relationships between them. The schema document will be updated in concert with any revision to this standard.
- f) Customized elements and attributes shall not supplant use of standard elements and attributes defined in this standard.
- g) When data in this format are recorded in a file, the data filename extension shall be “N42”, either uppercase or lowercase, to allow for automated recognition.

This standard gives implementers flexibility in deciding what information to include or omit. However, implementers shall provide all data their radiation measurement instruments or accompanying software generates if there is an element in the N42 specification that matches their data. Implementers shall provide the minimum data and analysis results as specified in the standards associated with the specific radiation measurement instrument. Provision for extending the N42 schema to address new data elements has also been provided; see Annex L for details.

4.3 General description of the N42 data format

4.3.1 Basic concepts

This standard considers radiation measurement instruments to have several types of components. Radiation detectors are the primary components. They generate the raw measurement data in response to a radiation field. A radiation measurement instrument may include one or more radiation detectors. A particular radiation detector can only belong to one radiation measurement instrument.

Occupancy sensors, position sensors, and multi-media devices are other possible components of a radiation measurement instrument. Information provided by these components can provide additional context to the measured items producing a radiation field.

Measurements can include data collected by the different radiation measurement instrument components (i.e. the radiation measurement instrument's individual radiation detectors, occupancy sensors, position sensors, and multi-media devices) over a specific period of time. Contributions from a particular component may or may not be present in all radiation measurement instrument measurements.

An N42 document provides data from only one radiation measurement instrument. This implies that systems with more than one radiation measurement instrument must produce separate documents for each instrument (e.g. if the system is composed of an RPM and an RID, each of these radiation measurement instruments shall produce a separate document).

The <RadInstrumentData> element is the parent element for all N42 data in a document that complies with this standard. IEEE N42.42-2006 [28] uses the parent element <N42InstrumentData>; this difference in parent elements can serve as a key to distinguish which standard is applicable to the current document. Also, the namespace in this standard is different from the namespace in the IEEE N42.42-2006 standard [28].

A radiation measurement instrument may produce many N42 documents over its operational life. To distinguish between these documents each should include a unique universal identifier as an attribute in its <RadInstrumentData> parent element.

The primary, high-level, child elements of <RadInstrumentData> are as follows:

- <RadInstrumentInformation>: This element describes the characteristics of the radiation measurement instrument that performed the measurements. Child elements indicate the radiation measurement instrument's manufacturer, identification, model, class, description, and version as well as quality control information. Though there can be only one radiation measurement instrument (with many components) per each N42 document, other elements may need to refer to it; therefore, the <RadInstrumentInformation> element includes an attribute that uniquely identifies the radiation measurement instrument locally within an instance of the N42 document.
- <RadDetectorInformation>: This element describes the characteristics of a radiation detector. Radiation detectors are the components of the radiation measurement instrument that actually generate the raw measurement data in response to a radiation field. The radiation measurement instrument may include one or more radiation detectors; each radiation detector must have its own <RadDetectorInformation> element. A specific radiation detector can only belong to the one radiation measurement instrument. Child elements indicate the radiation detector's name, category, kind, description, and physical dimensions as well as user-defined characteristics. A <RadDetectorInformation> element includes an attribute that uniquely identifies a specific detector locally within an instance of the N42 document.
- <RadItemInformation>: This element describes the characteristics of a specific item the radiation measurement instrument measured; this document often refers to it as "measured item" or just "item". Since a radiation measurement instrument may consist of multiple radiation detectors, the radiation measurement instrument can measure one or more measured items simultaneously. If there is a means to uniquely identify a measured item, this element captures information about the measured item; each measured item then must have its own <RadItemInformation> element. Child elements indicate the measured item's description and measurement geometry as well as user-defined quantities. A <RadItemInformation> element includes an attribute that uniquely identifies a specific measured item locally within an instance of the N42 document.
- <xxxCalibration>: This element contains calibration information. xxx can be Energy, FWHM, FullEnergyPeakEfficiency, IntrinsicFullEnergyPeakEfficiency, or TotalEfficiency. Child elements are xxx-dependent and may detail energies, energy boundaries, coefficients, windows, and uncertainties. A <xxxCalibration> element includes an id attribute that uniquely identifies a specific calibration locally within an instance of the N42 document.

- **<RadMeasurement>**: This element includes the data a radiation measurement instrument collects over a specific period of time from its individual radiation detectors and components such as occupancy and position sensors. The **<MultimediaData>** element includes the data from a radiation measurement instrument's multi-media components, see below. The radiation measurement instrument may acquire data from all or a combination of these components during a specific period of time. The data from distinct time intervals require separate **<RadMeasurement>** elements. Each instance of a **<RadMeasurement>** element shall include an attribute that uniquely identifies it in an N42 document.

When there is a means for the radiation measurement instrument to identify the measured item or items (e.g. shipping container, package, and vehicle), a **<RadMeasurement>** element can also include a list of the measured items as an attribute.

A **<RadMeasurement>** element can belong to one or more radiation measurement groups (see the next bulleted paragraph below that explains the concept of a **<RadMeasurementGroup>** element); an element's **radMeasurementGroupReferences** attribute provides the mechanism to identify each **<RadMeasurementGroup>** element associated with the element.

<StartDateTime> and **<RealTimeDuration>** child elements identify the specific period of time in which the **<RadMeasurement>** applies. The **<RealTimeDuration>** child element also represents the time resolution of associated measurement data.

Child elements, with tag names to reflect the kind of radiation measurement, detail the radiation measurement instrument's detector data. The available child elements are **<Spectrum>**, **<GrossCounts>**, **<DoseRate>**, **<TotalDose>**, **<ExposureRate>**, and **<TotalExposure>**. Each of these child elements includes an attribute that uniquely identifies a specific radiation measurement locally within an instance of the N42 document. Each element also includes an attribute that identifies the radiation detector responsible for the measurement and an attribute that references the appropriate **<xxxCalibration>** elements.

An **<Occupancy>** child element identifies the presence or non-presence of a measured item during the specific period of time the **<RadMeasurement>** covers.

The **<RadInstrumentState>**, **<RadDetectorState>**, and the **<RadItemState>** child elements indicate the state of the radiation measurement instrument, each of the radiation measurement instrument's radiation detectors, and each item the radiation measurement instrument measured, respectively. State data include location, orientation, direction of motion, and speed. For the radiation measurement instrument the state data also include the mode of operation. Radiation measurement instruments equipped with position sensors using a geolocation system is one means of capturing location data.

The radiation measurement instrument acquires the **<RadxxxState>** state data during the time interval denoted by the **<StartDateTime>** and **<RealTimeDuration>** child elements of **<RadMeasurement>**. These states are valid until their next update in a subsequent **<RadMeasurement>** element. For example, if the time resolution of a radiation measurement instrument's position must be higher than other data from the radiation detectors or other components (e.g. gross counts, spectrum, dose rate), the **<RadxxxState>** element can be included in a separate **<RadMeasurement>** element from those that include data from the radiation detectors or other components.

- **<RadMeasurementGroup>**: This element provides a means to identify a set of radiation measurements as a single group; for example: a sequence of radiation measurements indicative of a vehicle's traversal through a portal monitor. The **<RadMeasurementGroupDescription>** child element describes the group. A **<RadMeasurementGroup>** element includes an attribute that uniquely identifies a specific radiation measurement group locally within an instance of the N42 document.

The **<RadMeasurementGroup>** element also includes a unique universal identifier as an attribute. This optional identifier provides a means to distinguish a group of radiation measurements among those the radiation measurement instrument can produce in multiple documents over its operational life.

- **<MultimediaData>**: This element provides a means to identify data from a multi-media device such as camera, OCR, or license plate reader that supplement the radiation

measurement instrument's radiation measurements. If there is more than one device, the document must include a separate <MultimediaData> element for each device. Child elements identify the device, describe the device, indicate its MIME content type, and, detail the device data, or if the device data are not included in the document, reference their location via a URI.

Data from a multi-media device are applicable to a specific slice in time. Data collection time intervals may not directly coincide with those from any particular <RadMeasurement> element or other multi-media devices. Therefore, there are additional child elements of the <MultimediaData> element that indicate data capture start date/time and duration.

A <MultimediaData> element includes an attribute that uniquely identifies multi-media data from a specific device and time locally within an instance of the N42 document. When there is a means to associate a device's data with one or more measured items, the element provides an attribute that identifies the measured items. A device may collect more than one set of data during a specific time; a sequence number attribute provides a means to correctly order the data sets.

- <DerivedData>: This element provides data derived from radiation measurements. Child elements, representing the kind of radiation measurement, detail the derived data. The available child elements are <Spectrum>, <GrossCounts>, <DoseRate>, <TotalDose>, <ExposureRate>, and <TotalExposure>. An attribute in each of these child elements identifies the specific spectra, gross counts, dose rates, total doses, exposure rates, and total exposures from one or more radiation measurements or other derived data that are the sources of the specific derived data (cf. <RadMeasurement> element).

Derived data are applicable to a specific slice in time. Time intervals do not necessarily coincide with those from any particular <RadMeasurement> element or other <DerivedData> elements. Therefore, there are additional child elements of the <DerivedData> element that indicate the applicable start date/time and duration. A <DerivedData> element includes an attribute that uniquely identifies a specific set of derived data locally within an instance of the N42 document.

- <AnalysisResults>: This element provides the information that is the product of analysis of the radiation measurements or derived data. For example: a spectrometer may provide the radionuclides the radiation measurement instrument identified and its associated confidence indication. Child elements identify source indicators, radiation alarms, nuclides, and the details on the analysis algorithms themselves.

Analysis results are applicable to a specific slice in time. Time intervals do not necessarily coincide with those from any particular <RadMeasurement> element or other <DerivedData> elements. Therefore, there are additional child elements of the <AnalysisResults> element that indicate the analysis start date/time and computational duration. An <AnalysisResults> element includes an attribute that uniquely identifies a specific analysis results locally within an instance of the N42 document, and attributes that list the radiation measurements and derived data that are the subject of the analysis. It is possible to have more than one <AnalysisResults> within an instance of the N42 document.

Since an <AnalysisResults> element references the <RadMeasurement>, <RadMeasurementGroup>, or <DerivedData> elements that are the subject of the analysis, the order of these elements as they appear in an N42 document can vary. Annexes D, C, E, and G are examples of sequences of <RadMeasurement> elements followed by one or more <AnalysisResults> elements that reference the applicable preceding <RadMeasurement> elements. Annex I is an example of sequence of <RadMeasurement> elements each immediately followed by their associated <AnalysisResults>.

4.3.2 Example data documents

This standard supports several different types of radiation measurement instruments, each of which customarily have had different data reporting formats. Because this standard supports the requirements of all of these types of instruments, certain aspects of the standard require additional explanation.

Example data documents can be found in Annexes B through I (for the user's convenience certain elements of these annexes are also provided as separate files in zip format):

Annex B	A “spectrometer”, described by IEC 62327 [22] and ANSI/IEEE N42.34 [8]; the document contains only a spectrum and energy calibration and demonstrates the minimum required information. It also provides an alternative energy calibration.
Annex C	A “spectrometer”; more complex than the example in Annex B, the document contains a spectrum, its calibration, and the results of the analysis of that spectrum.
Annex D	A “portal monitor”, described by IEC 62244 [21] and ANSI/IEEE N42.35 [9]; the data are a series of seven count values representing a short occupancy from a monitor with two gamma and two neutron radiation detectors. It also provides an alternative that shows an alarm occupancy fragment.
Annex E	A “spectroscopic portal monitor”, described by IEC 62484 [24] and ANSI/IEEE N42.38 [10].
Annex F	A “personal radiation detector (PRD)”, described by IEC 62401 [23] and ANSI/IEEE N42.32 [6] (note that this example can also apply to survey meters or handheld gamma radiation measurement instruments described by IEC 62533 [25] and ANSI/IEEE N42.33) [7]; the data are a series of four count and dose rate readings.
Annex G	A “mobile” radiation measurement instrument, described by ANSI/IEEE N42.43 [11].
Annex H	A handheld neutron radiation measurement instrument, described by IEC 62534 [20]. It also provides an example on how to add an extension of a quantity measured by the radiation measurement instrument that is not defined by an element in this standard.
Annex I	A “spectroscopic personal radiation detector” (SPRD), described by IEC 62618 [26] and ANSI/IEEE N42.48 [12].

Comments in the example documents (given in the form of XML comments) are not required in real radiation measurement instrument data documents. Also, the examples are indented for readability; this is desirable in real documents but not required.

The schema, these examples, and other non-normative information can be downloaded from the N42 web page [46].

5 Requirements

5.1 Data types

5.1.1 Standard data types

For convenience, the definitions of standard XML Schema data types used in this standard are summarized here. These summaries are not normative; see [5] for authoritative definitions.

- **boolean:** A true or false value (e.g. “0” or “false”, “1” or “true”).
- **dateTime:** A date and time, in ISO 8601 format. The seconds value can be represented to arbitrary precision; the precision used should be appropriate for the value being represented. If the difference between UTC and local time is known, then the offset field (the “-06:00” part of the first example) shall be present. If the time difference is not known, then offset field shall be omitted. For example, November 3, 2004 8:36:04.3 AM CST is represented by “2004-11-03T08:36:04.3-06:00”; February 24, 2010 7:55:48 AM GMT is represented by “2010-02-24T07:55:48-00:00” or “2010-02-24T07:55:48Z”.

- **decimal:** A real number represented by a series of numerals with an optional decimal point; for example, “123” or “123.456”. The precision used should be appropriate for the value being represented. This data type is used when exponent format is not allowed.
- **double:** A floating point number. Format without an exponent (for example, “123.456”) or with an exponent (for example, “1.23456E02”) can be used; the precision used should be appropriate for the value being represented.
- **duration:** A time duration in ISO 8601 format. For example, a one hour, 15 minute, 5,2 second time interval shall be represented by “PT1H15M05.2S”, “PT75M5.2S”, or “PT4505.2S”. The precision of the part of the value for “seconds” can be represented to arbitrary precision; the precision used should be appropriate for the value being represented.
- **ID:** A string containing no whitespace or carriage control characters. An ID is used to uniquely identify elements in the XML document.
- **IDREF:** Identical to the ID data type, an IDREF is a reference to a particular element identified by an ID. For example,
`<Origin originReference="HomePosition">`
- **IDREFS:** A list of IDREF values.
- **list:** A finite-length series of space-separated values of a native data type.
- **nonNegativeInteger:** An integer greater than or equal to zero.
- **positiveInteger:** An integer greater than or equal to one.
- **string:** A character (i.e. text) string.
- **token:** A string that does not contain the carriage return, line feed, or tab characters, that has no leading or trailing spaces, and that has no internal sequences of two or more spaces.

NOTE Values are case-sensitive.

5.1.2 Derived data types

Data types specific to the N42 schema are as follows:

- **DoubleListSimpleType:** A *list* of *double*.
- **NonBlankStringSimpleType:** A *string* that is not empty and does not consist of only white space characters.
- **NonNegativeDoubleListSimpleType:** A *list* of *NonNegativeDoubleSimpleType*.
- **NonNegativeDoubleSimpleType:** A *double* whose value must be greater than or equal to zero.
- **PercentSimpleType:** A *double* with the value range of “0.0” to “100.0”.
- **PositiveDoubleListSimpleType:** A *list* of *PositiveDoubleSimpleType*.
- **PositiveDoubleSimpleType:** A *double* whose value must be greater than zero.
- **ZeroToOneDoubleSimpleType:** A *double* with value range of “0.0” to “1.0”.

5.1.3 Nuclide name format

5.1.3.1 Basic concepts

Radiation measurement instruments with radionuclide identification capabilities shall create the `<NuclideAnalysisResults>`, `<Nuclide>`, and `<NuclideName>` elements. The `<NuclideName>` element is the name of a radionuclide or radioactive source identified by the radiation measurement instrument. The format of the `<NuclideName>` is described in the following subclauses.

5.1.3.2 Standard nuclide name format

For radionuclides listed in the chart of radionuclides, these names shall use the format described in this subclause.

The format of the radionuclide name shall take the form:

Element-Nucleons[Isomer]

where

- *Element* – is the IUPAC chemical element name [33]. Note that the case of the IUPAC names shall be preserved.
- *Nucleons* – is the number of protons and neutrons for this nuclide.
- *Isomer* – is the metastable indicator. If the nuclide has a metastable state, the letter *m* follows *Nucleons*. If there is more than one metastable state, they are designated *m1*, *m2*, *m3*, etc.

Examples of radionuclide names listed in the chart of radionuclides are “Ag-110m”, “Cs-137”, and “I-131” (these names will represent ^{110m}Ag , ^{137}Cs and ^{131}I).

5.1.3.3 Other radiation sources name format

For radiation measurement instruments used in the detection of illicit trafficking of radioactive materials there is a need to identify radioactive sources that have specific characteristics that cannot be described by a specific radionuclide as listed in the chart of radionuclides. For these types of radioactive sources the following name conventions shall be used:

Name	Definition
Annihilation	The 511 keV annihilation peak. Such photopeak can be produced by positron emission tomography (PET) sources; examples of such sources are: ^{11}C , ^{13}N , ^{15}O , ^{18}F .
Bremsstrahlung	The signature of bremsstrahlung radiation has been observed. Bremsstrahlung is produced when fast electrons interact with the Coulombic field of the nucleus or when the fast electrons are decelerated when interacting with a metal target.
DU	Depleted Uranium is uranium with lower than natural abundance of ^{235}U . Approximate abundance: 99,799 % ^{238}U , 0,2 % ^{235}U , 0,001 % ^{234}U .
HEU	Highly Enriched Uranium is uranium with high abundance of ^{235}U . The ^{235}U abundance is higher than 20 %.
LEU	Low Enriched Uranium is uranium with an abundance of ^{235}U of approximately 3 % to 20 %.
N(reaction)	Nuclear reactions are indicated by the chemical element or nuclide name (<i>N</i>) followed by the reaction notation (<i>reaction</i>). Reaction notations include: <ul style="list-style-type: none"> • n,g • n,n'g • a,n • n,2n Examples are: “H(n,g)”, “Fe(n,g)”, and “O-18(a,n)”.
Plutonium	If the radiation measurement instrument cannot discriminate between the different levels of plutonium enrichments (RGPu and WGPu), then they should all be indicated as “Plutonium”.
N-xray	X-rays are indicated by the element name followed by “-xray”. Examples: “U-xray”, “Pb-xray”.
Radium	Naturally occurring radium decay chain in equilibrium.
Refined U	Natural uranium chemically processed to be separated from daughters (^{234}Th and ^{234m}Pa being short lived daughters of ^{238}U are still present).
RGPu	Reactor Grade Plutonium is plutonium with > 7 % ^{240}Pu .

Name	Definition
Shielded Source	The signature of a shielded radioactive source that cannot be fully identified due to the present of shielding material.
Thorium	Naturally occurring thorium decay chain in equilibrium.
Unknown	Sources not identified because radionuclides are not listed in the radiation measurement instrument library or because the energy spectrum is distorted due, for example, to the presence of masking or shielding material.
U-natural	Uranium natural is equivalent to uranium-ore; that is, uranium in natural abundance and in secular equilibrium with an abundance of 99,274 5 % ²³⁸ U, 0,72 % ²³⁵ U, and 0,005 5 % ²³⁴ U.
Uranium	If the radiation measurement instrument cannot discriminate between the different levels of uranium enrichments (DU, LEU, HEU and Refined U), then they should all be indicated as "Uranium".
WGPu	Weapons Grade Plutonium is plutonium with ≤ 7 % ²⁴⁰ Pu.

For other sources or conditions not covered above, the manufacturer shall provide a description of the name used and the meaning of the name.

5.2 Code lists

5.2.1 General

Where the value of a *string* or *token* data type element or attribute has a restricted range of values, a code list data type is defined providing the restricted values as enumerations. All enumeration values are case sensitive. Some code lists do not apply to all types of radiation measurement instruments.

5.2.2 AnalysisResultStatusCode

This list describes the status states of the analysis of a measurement or measurement group.

Value	Description
Success	The analysis was successfully completed.
Failure	The analysis was not successfully completed.

5.2.3 CompressionCode

This list describes the kinds of compression used to compress the spectrum channel data

Value	Description
None	No compression.
CountedZeroes	The data are compressed using the CountedZeroes algorithm.

5.2.4 FaultSeverityCode

This list describes the severity of a problem reported in a Fault.

Value	Description
Fatal	The problem has caused the immediate termination of the operation. Data produced by the operation is not trustworthy.
Error	The problem has caused serious disruption of the operation. Data produced by the operation is not trustworthy.
Warning	The problem has caused no or only minor disruption of the operation; however, a condition exists that should be investigated. Data produced by

	the operation may not be trustworthy.
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5.2.5 ImagePerspectiveCode

This list describes the viewing perspectives for image multimedia data.

Value	Description
Front	The image is a view of the front of the subject.
Left Side	The image is a view of the left side of the subject.
Right Side	The image is a view of the right of the subject.
Rear	The image is a view of the rear of the subject.
Top	The image is a view of the top of the subject.
Bottom	The image is a view of the bottom (underside) of the subject.
Interior	The image is a view of the interior of the subject.
NA	Not applicable.
Unknown	The viewing perspective is unknown.

5.2.6 MeasurementClassCode

This list describes the classes of spectrum measurements that a radiation measurement instrument with spectrometric capabilities can acquire for different kinds of radioactive sources or radiation fields.

Value	Description
Foreground	Measurement of an unknown radiation. The data shall be recorded without subtraction of environmental background or intrinsic activity.
Background	Measurement of environmental background. The data shall be recorded without subtraction of intrinsic activity.
Calibration	Measurement to be used for any type of calibration (e.g. energy, stabilization, efficiency).
IntrinsicActivity	Measurement of the radiation intrinsic to the radiation measurement instrument, without contribution from the environment or other sources.
NotSpecified	The measurement cannot be specified by the user or radiation measurement instrument.

5.2.7 MultimediaDeviceCategoryCode

This list describes the kind of devices that can record multimedia data.

Value	Description
Audio	A device that records audible sounds, such as voice.
Camera	A camera that captures images on film.
Camera-D	A camera that captures images on digital/electronic media.
LPR	License Plate Reader
NII	Non-Intrusive Imaging
OCR	Optical Character Recognition
Other	Other
Reader	A device to create digital data from a physical/visual form of the data.
RFID	Radio Frequency Identifier
Scanner	A device to create a digital image of printed material.
Video	A video recording device that captures images on film.
Video-D	A video recording device that captures images on digital/electronic media.
VIS	Visual Inspection System Image

5.2.8 NuclideSourceGeometryCode

This list describes the configurations that are applicable for the geometry of a radiation source detected by the radiation measurement instrument.

Value	Description
Point	A radiation source whose geometry is determined to a specific point.
Extended	A radiation source whose geometry is determined to be an area, not a specific point.
Undetermined	A radiation source whose geometry has not been determined.

5.2.9 RadAlarmCategoryCode

This list describes the kinds of radiation alarms.

Value	Description
Neutron	An alarm indicating presence of neutron radiation.
Gamma	An alarm indicating presence of gamma radiation.
Alpha	An alarm indicating presence of alpha radiation.
Beta	An alarm indicating presence of beta radiation.
Isotope	An alarm indicating presence of a radionuclide.
Other	An alarm produced by some other means.

5.2.10 RadDetectorCategoryCode

This list describes the category of a radiation detector based on the type of particles and/or photon emission that it can detect from a radiological or nuclear substance.

Value	Description
Gamma	A radiation detector that primarily detects gamma rays.
Neutron	A radiation detector that primarily detects neutrons.
Alpha	A radiation detector that primarily detects alpha particles.
Beta	A radiation detector that primarily detects beta particles.
X-ray	A radiation detector that primarily detects X-rays.
Other	A radiation detector that does not fit any of the defined categories

5.2.11 RadDetectorKindCode

This list describes the kinds of radiation detectors that may compose a radiation measurement instrument.

Value	Description
HPGe	High Purity Germanium
HPXe	High Pressure Xenon
NaI	Sodium Iodide
LaBr3	Lanthanum Bromide
LaCl3	Lanthanum Chloride
BGO	Bismuth Germanate scintillator
CZT	Cadmium Zinc Telluride
CdTe	Cadmium Telluride
CsI	Caesium Iodide
GMT	Geiger Muller Tube
GMTW	Windowed GM Tube
LiFiber	Lithium glass fiber
PVT	Polyvinyl Toluene
PS	Polystyrene
He3	³ He proportional counter
He4	⁴ He proportional counter
LiGlass	Lithium Glass

Value	Description
LiI	Lithium Iodide
SrI2	Strontium Iodide
CLYC	Cs ₂ LiYCl ₆
CdWO4	Cadmium Tungstate
BF3	Boron Trifluoride proportional counter
HgI2	Mercuric Iodide
CeBr4	Cerium Bromide
LiCAF	LiCaAlF ₆
LiZnS	⁶ LiZnS
Other	A radiation detector kind not otherwise defined.

5.2.12 RadInstrumentClassCode

This list describes the classes of radiation detection instruments based on type and use.

Value	Description
Backpack or Personal Radiation Scanner	Radiation measurement instruments best described by IEC 62694 or ANSI/IEEE N42.53.
Dosimeter	Radiation measurement instruments best described by IEC 61526, ISO 4037-3, or ANSI/IEEE N42.20.
Electronic Personal Emergency Radiation Detector	Radiation measurement instruments best described by ANSI/IEEE N42.49A.
Mobile System	Radiation measurement instruments best described by ANSI/IEEE N42.43.
Network Area Monitor	A collection of radiation measurement instruments working together as a single instrument. This type of instrument may be described by any of the radiation measurement instrument standards.
Neutron Handheld	Radiation measurement instruments best described by IEC 62534.
Personal Radiation Detector	Radiation measurement instruments best described by IEC 62401 or ANSI/IEEE N42.32.
Radionuclide Identifier	Radiation measurement instruments best described by IEC 62327 or ANSI/IEEE N42.34.
Portal Monitor	Radiation measurement instruments best described by IEC 62244 or ANSI/IEEE N42.35.
Spectroscopic Portal Monitor	Radiation measurement instruments best described by IEC 62484 or ANSI/IEEE N42.38.
Spectroscopic Personal Radiation Detector	Radiation measurement instruments best described by IEC 62618 or ANSI/IEEE N42.48.
Gamma Handheld	Radiation measurement instruments best described by IEC 62533 or ANSI/IEEE N42.33.
Transportable System	Radiation measurement instruments best described by ANSI/IEEE N42.43.
Other	A class of radiation measurement instrument not otherwise defined.

5.2.13 RadInstrumentModeCode

This list describes the operating modes of a radiation measurement instrument.

Value	Description
Calibrate	Calibration mode
Long Dwell	The radiation measurement instrument makes a single long measurement. For example, when a transportable system is stationary measuring a source for higher accuracy.
Search	The radiation measurement instrument makes a series of short

	measurements. For example, when a transportable system is moving and searching for sources, collecting gross count rates or spectra periodically. Another example: a portal monitor that collects gross count rates periodically while conveyances are in transit. Another example, a PRD displaying exposure rate readings as a function of time.
Test	Test or diagnostics mode
Other	Other

5.3 Schema outline

This subclause provides an outline of the elements and attributes contained in the N42 schema, ordered as they would appear in an instance xml document conforming to the schema. The following describes the format of the schema outline.

- The levels of indentation in the outline represent the element containment (i.e., data blocks).
- The schema outline includes element cardinality rules on the same line with the element, enclosed in brackets. The values and meanings are:
 - [1, 1] The element is required and there shall be only one instance.
 - [1, many] The element is required and there may be many instances.
 - [0, 1] The element is optional and there may be zero or one instance.
 - [0, many] The element is optional and there may be zero, one or many instances.
 - [NA] The element is abstract and therefore does not have occurrences. See Annex L for details.
- In some cases if an optional element is used, then a child element may be required. If a parent element is optional (i.e. cardinality of [0, 1] or [0, many]) and a child element is indicated as mandatory (e.g. [1, 1]) this means that the child element is required only if the optional parent element is included. Any rules more specific than this are described in detail in the clauses for each of the elements.
- A cross-reference to the clause number of the detailed information for an element is provided on the right side of the element name line. In the digital version of this document the element name is hyperlinked to the referenced clause.
- If the element has attributes they appear enclosed by parentheses on the line immediately following the element name.
- Required attributes are indicated by "[R]" following the attribute name, and "[O]" if an attribute is optional.
- The start and end of an XML choice group is flagged by lines that contain "*****Choice" and "*****End of Choice".
- The start and end of an XML substitution group is flagged by lines that contain "*****Substitute" and "*****End of Substitution".

RadInstrumentData [1,1]	5.4.161
(id[O], n42DocDateTime[O], n42DocUUID[O])	
Remark [0,many]	5.4.195
RadInstrumentDataCreatorName [0,1]	5.4.162
RadInstrumentInformation [1,1]	5.4.166
(id[R])	
Remark [0,many]	5.4.195
RadInstrumentManufacturerName [1,1]	5.4.168
RadInstrumentIdentifier [0,1]	5.4.165
RadInstrumentModelName [1,1]	5.4.171
RadInstrumentDescription [0,1]	5.4.164
RadInstrumentClassCode [1,1]	5.4.158
RadInstrumentVersion [1,many]	5.4.175
(id[O])	
Remark [0,many]	5.4.195
RadInstrumentComponentName [1,1]	5.4.159
RadInstrumentComponentVersion [1,1]	5.4.160
RadInstrumentQualityControl [0,1]	5.4.172
(id[O])	
Remark [0,many]	5.4.195
InspectionDateTime [1,1]	5.4.90
InCalibrationIndicator [1,1]	5.4.88
RadInstrumentCharacteristics [0,many]	5.4.157
(id[O])	
Remark [0,many]	5.4.195
*****Choice of 1 or more of the following*****	
Characteristic [0,many]	5.4.37
(id[O], valueDateTime[O], valueOutOfLimits[O])	
Remark [0,many]	5.4.195
CharacteristicName [1,1]	5.4.40
CharacteristicValue [1,1]	5.4.41
CharacteristicValueUnits [1,1]	5.4.43
CharacteristicValueDataClassCode [1,1]	5.4.42
CharacteristicGroup [0,many]	5.4.38
(groupOutOfLimits[O], id[O])	
Remark [0,many]	5.4.195
CharacteristicGroupName [1,1]	5.4.39
Characteristic [1,many]	5.4.37
(id[O], valueDateTime[O], valueOutOfLimits[O])	
Remark [0,many]	5.4.195
CharacteristicName [1,1]	5.4.40
CharacteristicValue [1,1]	5.4.41
CharacteristicValueUnits [1,1]	5.4.43
CharacteristicValueDataClassCode [1,1]	5.4.42
*****End of Choice*****	
RadInstrumentInformationExtension [NA]	5.4.167
RadDetectorInformation [1,many]	5.4.148
(id[R])	
Remark [0,many]	5.4.195
RadDetectorName [0,1]	5.4.152
RadDetectorCategoryCode [1,1]	5.4.143
RadDetectorKindCode [1,1]	5.4.150
RadDetectorDescription [0,1]	5.4.146
RadDetectorLengthValue [0,1]	5.4.151
(units[O])	
RadDetectorWidthValue [0,1]	5.4.156
(units[O])	
RadDetectorDepthValue [0,1]	5.4.145

(units[O])	
RadDetectorDiameterValue [0,1]	5.4.147
(units[O])	
RadDetectorVolumeValue [0,1]	5.4.155
(units[O])	
RadDetectorCharacteristics [0,many]	5.4.144
(id[O])	
Remark [0,many]	5.4.195
*****Choice of 1 or more of the following*****	
Characteristic [0,many]	5.4.37
(id[O], valueDateTime[O], valueOutOfLimits[O])	
Remark [0,many]	5.4.195
CharacteristicName [1,1]	5.4.40
CharacteristicValue [1,1]	5.4.41
CharacteristicValueUnits [1,1]	5.4.43
CharacteristicValueDataClassCode [1,1]	5.4.42
CharacteristicGroup [0,many]	5.4.38
(groupOutOfLimits[O], id[O])	
Remark [0,many]	5.4.195
CharacteristicGroupName [1,1]	5.4.39
Characteristic [1,many]	5.4.37
(id[O], valueDateTime[O], valueOutOfLimits[O])	
Remark [0,many]	5.4.195
CharacteristicName [1,1]	5.4.40
CharacteristicValue [1,1]	5.4.41
CharacteristicValueUnits [1,1]	5.4.43
CharacteristicValueDataClassCode [1,1]	5.4.42
*****End of Choice*****	
RadDetectorInformationExtension [NA]	5.4.149
RadItemInformation [0,many]	5.4.178
(id[R])	
Remark [0,many]	5.4.195
RadItemDescription [0,1]	5.4.177
RadItemQuantity [0,1]	5.4.181
(id[O])	
Remark [0,many]	5.4.195
RadItemQuantityValue [1,1]	5.4.184
RadItemQuantityUncertaintyValue [0,1]	5.4.182
RadItemQuantityUnits [1,1]	5.4.183
RadItemMeasurementGeometryDescription [0,1]	5.4.180
RadItemCharacteristics [0,many]	5.4.176
(id[O])	
Remark [0,many]	5.4.195
*****Choice of 1 or more of the following*****	
Characteristic [0,many]	5.4.37
(id[O], valueDateTime[O], valueOutOfLimits[O])	
Remark [0,many]	5.4.195
CharacteristicName [1,1]	5.4.40
CharacteristicValue [1,1]	5.4.41
CharacteristicValueUnits [1,1]	5.4.43
CharacteristicValueDataClassCode [1,1]	5.4.42
CharacteristicGroup [0,many]	5.4.38
(groupOutOfLimits[O], id[O])	
Remark [0,many]	5.4.195
Remark [0,many]	5.4.195
CharacteristicGroupName [1,1]	5.4.39
Characteristic [1,many]	5.4.37

(id[O], valueDateTime[O], valueOutOfLimits[O])	
Remark [0,many]	5.4.195
CharacteristicName [1,1]	5.4.40
CharacteristicValue [1,1]	5.4.41
CharacteristicValueUnits [1,1]	5.4.43
CharacteristicValueDataClassCode [1,1]	5.4.42
RadItemInformationExtension [NA]	5.4.179
*****Choice of 0 or many of the following*****	
RadMeasurement [0,many]	5.4.187
(id[R], radItemInformationReferences[O], radMeasurementGroupReferences[O])	
Remark [0,many]	5.4.195
MeasurementClassCode [1,1]	5.4.101
StartDateTime [1,1]	5.4.210
RealTimeDuration [1,1]	5.4.191
Spectrum [0,many]	5.4.198
(energyCalibrationReference[R], fullEnergyPeakEfficiencyCalibrationReference[O],	
FWHMCalibrationReference[O], id[R],	
intrinsicDoubleEscapePeakEfficiencyCalibrationReference[O],	
intrinsicFullEnergyPeakEfficiencyCalibrationReference[O],	
intrinsicSingleEscapePeakEfficiencyCalibrationReference[O],	
radDetectorInformationReference[O], radRawSpectrumReferences[O])	
Remark [0,many]	5.4.195
LiveTimeDuration [1,1]	5.4.95
ChannelData [1,1]	5.4.36
(compressionCode[O])	
SpectrumExtension [0,many]	5.4.199
GrossCounts [0,many]	5.4.84
(energyWindowsReference[O], id[R], radDetectorInformationReference[R],	
radRawGrossCountsReferences[O])	
Remark [0,many]	5.4.195
LiveTimeDuration [1,1]	5.4.95
CountData [1,1]	5.4.45
TotalCountData [0,1]	5.4.212
DoseRate [0,many]	5.4.51
(id[R], radDetectorInformationReference[R], radRawDoseRateReferences[O])	
Remark [0,many]	5.4.195
DoseRateValue [0,1]	5.4.53
(units[O])	
DoseRateLevelDescription [0,1]	5.4.52
TotalDose [0,many]	5.4.214
(id[R], radDetectorInformationReference[R], radRawTotalDoseReferences[O], units[O])	
ExposureRate [0,many]	5.4.68
(id[R], radDetectorInformationReference[R], radRawExposureRateReferences[O])	
Remark [0,many]	5.4.195
ExposureRateValue [0,1]	5.4.70
(units[O])	
ExposureRateLevelDescription [0,1]	5.4.69
TotalExposure [0,many]	5.4.217
(id[R], radDetectorInformationReference[R], radRawTotalExposureReferences[O],	
units[O])	
RadInstrumentState [0,1]	5.4.173
(id[O], radInstrumentInformationReference[R])	
Remark [0,many]	5.4.195
RadInstrumentModeCode [0,1]	5.4.169
RadInstrumentModeDescription [0,1]	5.4.170
StateVector [0,1]	5.4.211
*****Choice of zero to one of the following*****	
GeographicPoint [0,1]	5.4.80

(datum[O], units[O])	
LatitudeValue [1,1]	5.4.94
(units[O])	
LongitudeValue [1,1]	5.4.97
(units[O])	
ElevationValue [0,1]	5.4.59
ElevationOffsetValue [0,1]	5.4.58
GeoPointAccuracyValue [0,1]	5.4.81
ElevationAccuracyValue [0,1]	5.4.56
ElevationOffsetAccuracyValue [0,1]	5.4.57
LocationDescription [0,1]	5.4.96
RelativeLocation [0,1]	5.4.192
RelativeLocationAzimuthValue [0,1]	5.4.193
(units[O])	
RelativeLocationInclinationValue [0,1]	5.4.194
(units[O])	
DistanceValue [0,1]	5.4.48
(units[O])	
Origin [1,1]	5.4.134
(originReference[O])	
GeographicPoint [0,1]	5.4.80
(datum[O], units[O])	
LatitudeValue [1,1]	5.4.94
(units[O])	
LongitudeValue [1,1]	5.4.97
(units[O])	
ElevationValue [0,1]	5.4.59
ElevationOffsetValue [0,1]	5.4.58
GeoPointAccuracyValue [0,1]	5.4.81
ElevationAccuracyValue [0,1]	5.4.56
ElevationOffsetAccuracyValue [0,1]	5.4.57
OriginDescription [0,1]	5.4.135
*****End of Choice*****	
Orientation [0,1]	5.4.133
AzimuthValue [1,1]	5.4.25
(units[O])	
InclinationValue [0,1]	5.4.89
(units[O])	
RollValue [0,1]	5.4.196
(units[O])	
SpeedValue [0,1]	5.4.209
(units[O])	
Fault [0,many]	5.4.71
(id[O])	
Remark [0,many]	5.4.195
FaultCodeValue [1,1]	5.4.72
FaultDescription [1,1]	5.4.73
FaultSeverityCode [1,1]	5.4.75
RadInstrumentCharacteristics [0,many]	5.4.157
(id[O])	
Remark [0,many]	5.4.195
*****Choice of 1 or more of the following*****	
Characteristic [0,many]	5.4.37
(id[O], valueDateTime[O], valueOutOfLimits[O])	
Remark [0,many]	5.4.195
CharacteristicName [1,1]	5.4.40
CharacteristicValue [1,1]	5.4.41

CharacteristicValueUnits [1,1]	5.4.43
CharacteristicValueDataClassCode [1,1]	5.4.42
CharacteristicGroup [0,many]	5.4.38
(groupOutOfLimits[O], id[O])	
Remark [0,many]	5.4.195
CharacteristicGroupName [1,1]	5.4.39
Characteristic [1,many]	5.4.37
(id[O], valueDateTime[O], valueOutOfLimits[O])	
Remark [0,many]	5.4.195
CharacteristicName [1,1]	5.4.40
CharacteristicValue [1,1]	5.4.41
CharacteristicValueUnits [1,1]	5.4.43
CharacteristicValueDataClassCode [1,1]	5.4.42
*****End of Choice*****	
RadInstrumentStateExtension [NA]	5.4.174
RadDetectorState [0,many]	5.4.153
(id[O], radDetectorInformationReference[R])	
Remark [0,many]	5.4.195
StateVector [0,1]	5.4.211
*****Choice of zero to one of the following*****	
GeographicPoint [0,1]	5.4.80
(datum[O], units[O])	
LatitudeValue [1,1]	5.4.94
(units[O])	
LongitudeValue [1,1]	5.4.97
(units[O])	
ElevationValue [0,1]	5.4.59
ElevationOffsetValue [0,1]	5.4.58
GeoPointAccuracyValue [0,1]	5.4.81
ElevationAccuracyValue [0,1]	5.4.56
ElevationOffsetAccuracyValue [0,1]	5.4.57
LocationDescription [0,1]	5.4.96
RelativeLocation [0,1]	5.4.192
RelativeLocationAzimuthValue [0,1]	5.4.193
(units[O])	
RelativeLocationInclinationValue [0,1]	5.4.194
(units[O])	
DistanceValue [0,1]	5.4.48
(units[O])	
Origin [1,1]	5.4.134
(originReference[O])	
GeographicPoint [0,1]	5.4.80
(datum[O], units[O])	
LatitudeValue [1,1]	5.4.94
(units[O])	
LongitudeValue [1,1]	5.4.97
(units[O])	
ElevationValue [0,1]	5.4.59
ElevationOffsetValue [0,1]	5.4.58
GeoPointAccuracyValue [0,1]	5.4.81
ElevationAccuracyValue [0,1]	5.4.56
ElevationOffsetAccuracyValue [0,1]	5.4.57
OriginDescription [0,1]	5.4.135
*****End of Choice*****	
Orientation [0,1]	5.4.133
AzimuthValue [1,1]	5.4.25
(units[O])	
InclinationValue [0,1]	5.4.89

(units[O])	
RollValue [0,1]	5.4.196
(units[O])	
SpeedValue [0,1]	5.4.209
(units[O])	
Fault [0,many]	5.4.71
(id[O])	
Remark [0,many]	5.4.195
FaultCodeValue [1,1]	5.4.72
FaultDescription [1,1]	5.4.73
FaultSeverityCode [1,1]	5.4.75
RadDetectorCharacteristics [0,many]	5.4.144
(id[O])	
Remark [0,many]	5.4.195
*****Choice of 1 or more of the following*****	
Characteristic [0,many]	5.4.37
(id[O], valueDateTime[O], valueOutOfLimits[O])	
Remark [0,many]	5.4.195
CharacteristicName [1,1]	5.4.40
CharacteristicValue [1,1]	5.4.41
CharacteristicValueUnits [1,1]	5.4.43
CharacteristicValueDataClassCode [1,1]	5.4.42
CharacteristicGroup [0,many]	5.4.38
(groupOutOfLimits[O], id[O])	
Remark [0,many]	5.4.195
CharacteristicGroupName [1,1]	5.4.39
Characteristic [1,many]	5.4.37
(id[O], valueDateTime[O], valueOutOfLimits[O])	
Remark [0,many]	5.4.195
CharacteristicName [1,1]	5.4.40
CharacteristicValue [1,1]	5.4.41
CharacteristicValueUnits [1,1]	5.4.43
CharacteristicValueDataClassCode [1,1]	5.4.42
*****End of Choice*****	
RadDetectorStateExtension [NA]	5.4.154
RadItemState [0,many]	5.4.185
(id[O], radItemInformationReference[R])	
Remark [0,many]	5.4.195
StateVector [0,1]	5.4.211
*****Choice of zero to one of the following*****	
GeographicPoint [0,1]	5.4.80
(datum[O], units[O])	
LatitudeValue [1,1]	5.4.94
(units[O])	
LongitudeValue [1,1]	5.4.97
(units[O])	
ElevationValue [0,1]	5.4.59
ElevationOffsetValue [0,1]	5.4.58
GeoPointAccuracyValue [0,1]	5.4.81
ElevationAccuracyValue [0,1]	5.4.56
ElevationOffsetAccuracyValue [0,1]	5.4.57
LocationDescription [0,1]	5.4.96
RelativeLocation [0,1]	5.4.192
RelativeLocationAzimuthValue [0,1]	5.4.193
(units[O])	
RelativeLocationInclinationValue [0,1]	5.4.194
(units[O])	

DistanceValue [0,1]	5.4.48
(units[O])	
Origin [1,1]	5.4.134
(originReference[O])	
GeographicPoint [0,1]	5.4.80
(datum[O], units[O])	
LatitudeValue [1,1]	5.4.94
(units[O])	
LongitudeValue [1,1]	5.4.97
(units[O])	
ElevationValue [0,1]	5.4.59
ElevationOffsetValue [0,1]	5.4.58
GeoPointAccuracyValue [0,1]	5.4.81
ElevationAccuracyValue [0,1]	5.4.56
ElevationOffsetAccuracyValue [0,1]	5.4.57
OriginDescription [0,1]	5.4.135
*****End of Choice*****	
Orientation [0,1]	5.4.133
AzimuthValue [1,1]	5.4.25
(units[O])	
InclinationValue [0,1]	5.4.89
(units[O])	
RollValue [0,1]	5.4.196
(units[O])	
SpeedValue [0,1]	5.4.209
(units[O])	
RadItemCharacteristics [0,many]	5.4.176
(id[O])	
Remark [0,many]	5.4.195
*****Choice of 1 or more of the following*****	
Characteristic [0,many]	5.4.37
(id[O], valueDateTime[O], valueOutOfLimits[O])	
Remark [0,many]	5.4.195
CharacteristicName [1,1]	5.4.40
CharacteristicValue [1,1]	5.4.41
CharacteristicValueUnits [1,1]	5.4.43
CharacteristicValueDataClassCode [1,1]	5.4.42
CharacteristicGroup [0,many]	5.4.38
(groupOutOfLimits[O], id[O])	
Remark [0,many]	5.4.195
CharacteristicGroupName [1,1]	5.4.39
Characteristic [1,many]	5.4.37
(id[O], valueDateTime[O], valueOutOfLimits[O])	
Remark [0,many]	5.4.195
CharacteristicName [1,1]	5.4.40
CharacteristicValue [1,1]	5.4.41
CharacteristicValueUnits [1,1]	5.4.43
CharacteristicValueDataClassCode [1,1]	5.4.42
*****End of Choice*****	
RadItemStateExtension [NA]	5.4.186
OccupancyIndicator [0,1]	5.4.132
RadMeasurementExtension [NA]	5.4.188
RadMeasurementGroup [0,many]	5.4.189
(id[R], radMeasurementGroupUUID[O])	
Remark [0,many]	5.4.195
RadMeasurementGroupDescription [0,1]	5.4.190
EnergyCalibration [0,many]	5.4.62
(id[R])	

Remark [0,many]	5.4.195
*****Choice of one of the following*****	
CoefficientValues [0,1]	5.4.44
EnergyBoundaryValues [0,1]	5.4.61
(units[O])	
*****End of Choice*****	
EnergyValues [0,1]	5.4.64
(units[O])	
EnergyDeviationValues [0,1]	5.4.63
(units[O])	
CalibrationDateTime [0,1]	5.4.35
FWHMCalibration [0,many]	5.4.77
(id[R])	
Remark [0,many]	5.4.195
EnergyValues [1,1]	5.4.64
(units[O])	
FWHMValues [1,1]	5.4.79
(units[O])	
FWHMUncertaintyValues [0,1]	5.4.78
(units[O])	
CalibrationDateTime [0,1]	5.4.35
TotalEfficiencyCalibration [0,many]	5.4.216
(id[R])	
Remark [0,many]	5.4.195
EnergyValues [1,1]	5.4.64
(units[O])	
EfficiencyValues [1,1]	5.4.55
EfficiencyUncertaintyValues [0,1]	5.4.54
CalibrationDateTime [0,1]	5.4.35
FullEnergyPeakEfficiencyCalibration [0,many]	5.4.76
(id[R])	
Remark [0,many]	5.4.195
EnergyValues [1,1]	5.4.64
(units[O])	
EfficiencyValues [1,1]	5.4.55
EfficiencyUncertaintyValues [0,1]	5.4.54
CalibrationDateTime [0,1]	5.4.35
IntrinsicFullEnergyPeakEfficiencyCalibration [0,many]	5.4.92
(id[R])	
Remark [0,many]	5.4.195
EnergyValues [1,1]	5.4.64
(units[O])	
EfficiencyValues [1,1]	5.4.55
EfficiencyUncertaintyValues [0,1]	5.4.54
CalibrationDateTime [0,1]	5.4.35
IntrinsicSingleEscapePeakEfficiencyCalibration [0,many]	5.4.93
(id[R])	
Remark [0,many]	5.4.195
EnergyValues [1,1]	5.4.64
(units[O])	
EfficiencyValues [1,1]	5.4.55
EfficiencyUncertaintyValues [0,1]	5.4.54
CalibrationDateTime [0,1]	5.4.35
IntrinsicDoubleEscapePeakEfficiencyCalibration [0,many]	5.4.91
(id[R])	
Remark [0,many]	5.4.195
EnergyValues [1,1]	5.4.64

(units[O])	
EfficiencyValues [1,1]	5.4.55
EfficiencyUncertaintyValues [0,1]	5.4.54
CalibrationDateTime [0,1]	5.4.35
EnergyWindows [0,many]	5.4.65
(id[R])	
Remark [0,many]	5.4.195
WindowStartEnergyValues [1,1]	5.4.220
(units[O])	
WindowEndEnergyValues [1,1]	5.4.219
(units[O])	
DerivedData [0,many]	5.4.46
(id[R])	
Remark [0,many]	5.4.195
MeasurementClassCode [1,1]	5.4.101
StartDateTime [1,1]	5.4.210
RealTimeDuration [1,1]	5.4.191
Spectrum [0,many]	5.4.198
(energyCalibrationReference[R], fullEnergyPeakEfficiencyCalibrationReference[O], FWHMCalibrationReference[O], id[R], intrinsicDoubleEscapePeakEfficiencyCalibrationReference[O], intrinsicFullEnergyPeakEfficiencyCalibrationReference[O], intrinsicSingleEscapePeakEfficiencyCalibrationReference[O], radDetectorInformationReference[O], radRawSpectrumReferences[O])	
Remark [0,many]	5.4.195
LiveTimeDuration [1,1]	5.4.95
ChannelData [1,1]	5.4.36
(compressionCode[O])	
SpectrumExtension [NA]	5.4.199
GrossCounts [0,many]	5.4.84
(energyWindowsReference[O], id[R], radDetectorInformationReference[R], radRawGrossCountsReferences[O])	
Remark [0,many]	5.4.195
LiveTimeDuration [1,1]	5.4.95
CountData [1,1]	5.4.45
TotalCountData [0,1]	5.4.212
DoseRate [0,many]	5.4.51
(id[R], radDetectorInformationReference[R], radRawDoseRateReferences[O])	
Remark [0,many]	5.4.195
DoseRateValue [0,1]	5.4.53
(units[O])	
DoseRateLevelDescription [0,1]	5.4.52
TotalDose [0,many]	5.4.214
(id[R], radDetectorInformationReference[R], radRawTotalDoseReferences[O], units[O])	
ExposureRate [0,many]	5.4.68
(id[R], radDetectorInformationReference[R], radRawExposureRateReferences[O])	
Remark [0,many]	5.4.195
ExposureRateValue [0,1]	5.4.70
(units[O])	
ExposureRateLevelDescription [0,1]	5.4.69
TotalExposure [0,many]	5.4.217
(id[R], radDetectorInformationReference[R], radRawTotalExposureReferences[O], units[O])	
DerivedDataExtension [NA]	5.4.47
AnalysisResults [0,many]	5.4.15
(derivedDataReferences[O], id[O], radMeasurementGroupReferences[O], radMeasurementReferences[O])	
Remark [0,many]	5.4.195

AnalysisStartDateTime [0,1]	5.4.18
AnalysisComputationDuration [0,1]	5.4.12
AnalysisAlgorithmName [0,1]	5.4.6
AnalysisAlgorithmCreatorName [0,1]	5.4.4
AnalysisAlgorithmDescription [0,1]	5.4.5
AnalysisAlgorithmVersion [0,many]	5.4.11
(id[O])	
Remark [0,many]	5.4.195
AnalysisAlgorithmComponentName [1,1]	5.4.2
AnalysisAlgorithmComponentVersion [1,1]	5.4.3
AnalysisAlgorithmSetting [0,many]	5.4.7
(id[O])	
Remark [0,many]	5.4.195
AnalysisAlgorithmSettingName [1,1]	5.4.8
AnalysisAlgorithmSettingValue [1,1]	5.4.10
AnalysisAlgorithmSettingUnits [1,1]	5.4.9
AnalysisResultStatusCode [0,1]	5.4.17
AnalysisConfidenceValue [0,1]	5.4.13
AnalysisResultDescription [0,1]	5.4.14
RadAlarm [0,many]	5.4.136
(id[O], radDetectorInformationReferences[R])	
Remark [0,many]	5.4.195
RadAlarmDateTime [0,1]	5.4.138
RadAlarmCategoryCode [1,1]	5.4.137
RadAlarmDescription [0,1]	5.4.139
AlarmAudibleIndicator [0,1]	5.4.1
RadAlarmLightColor [0,1]	5.4.142
RadAlarmEnergyWindowIndices [0,1]	5.4.140
RadAlarmExtension [NA]	5.4.141
NuclideAnalysisResults [0,1]	5.4.119
(id[O])	
Remark [0,many]	5.4.195
Nuclide [0,many]	5.4.115
(id[O])	
Remark [0,many]	5.4.195
NuclideIdentifiedIndicator [1,1]	5.4.126
NuclideName [1,1]	5.4.128
NuclideActivityValue [0,1]	5.4.117
(units[O])	
NuclideActivityUncertaintyValue [0,1]	5.4.116
(units[O])	
NuclideMinimumDetectableActivityValue [0,1]	5.4.127
(units[O])	
*****Choice of one or more of the following*****	
NuclideIDConfidenceValue [0,1]	5.4.125
NuclideIDConfidenceUncertaintyValue [0,1]	5.4.124
NuclideIDConfidenceDescription [0,1]	5.4.123
*****End of Choice*****	
NuclideCategoryDescription [0,1]	5.4.121
NuclideSourceGeometryCode [0,1]	5.4.131
SourcePosition [0,1]	5.4.197
(id[O])	
Remark [0,many]	5.4.195
*****Choice of one of the following*****	
GeographicPoint [0,1]	5.4.80
(datum[O], units[O])	
LatitudeValue [1,1]	5.4.94

(units[O])	
LongitudeValue [1,1]	5.4.97
(units[O])	
ElevationValue [0,1]	5.4.59
ElevationOffsetValue [0,1]	5.4.58
GeoPointAccuracyValue [0,1]	5.4.81
ElevationAccuracyValue [0,1]	5.4.56
ElevationOffsetAccuracyValue [0,1]	5.4.57
LocationDescription [0,1]	5.4.96
RelativeLocation [0,1]	5.4.192
RelativeLocationAzimuthValue [0,1]	5.4.193
(units[O])	
RelativeLocationInclinationValue [0,1]	5.4.194
(units[O])	
DistanceValue [0,1]	5.4.48
(units[O])	
Origin [1,1]	5.4.134
(originReference[O])	
GeographicPoint [0,1]	5.4.80
(datum[O], units[O])	
LatitudeValue [1,1]	5.4.94
(units[O])	
LongitudeValue [1,1]	5.4.97
(units[O])	
ElevationValue [0,1]	5.4.59
ElevationOffsetValue [0,1]	5.4.58
GeoPointAccuracyValue [0,1]	5.4.81
ElevationAccuracyValue [0,1]	5.4.56
ElevationOffsetAccuracyValue [0,1]	5.4.57
OriginDescription [0,1]	5.4.135
*****End of Choice*****	
NuclideShieldingAtomicNumber [0,1]	5.4.130
NuclideShieldingArealDensityValue [0,1]	5.4.129
(units[O])	
NuclideExtension [0,1]	5.4.122
NuclideAnalysisReducedChiSquareValue [0,1]	5.4.118
NuclideAnalysisResultsExtension [NA]	5.4.120
SpectrumPeakAnalysisResults [0,1]	5.4.201
(id[O])	
Remark [0,many]	5.4.195
SpectrumPeak [0,many]	5.4.200
(id[O])	
Remark [0,many]	5.4.195
SpectrumPeakEnergyValue [1,1]	5.4.203
(units[O])	
SpectrumPeakExpectedEnergyValue [0,1]	5.4.204
(units[O])	
SpectrumPeakFWHMValue [0,1]	5.4.206
(units[O])	
SpectrumPeakNetAreaValue [0,1]	5.4.208
SpectrumPeakNetAreaUncertaintyValue [0,1]	5.4.207
SpectrumPeakExtension [NA]	5.4.205
SpectrumPeakAnalysisResultsExtension [0,many]	5.4.202
GrossCountAnalysisResults [0,1]	5.4.82
(id[O])	
Remark [0,many]	5.4.195
AverageCountRateValue [0,1]	5.4.20
(units[O])	

AverageCountRateUncertaintyValue [0,1]	5.4.19
(units[O])	
MaximumCountRateValue [0,1]	5.4.98
(units[O])	
MinimumCountRateValue [0,1]	5.4.102
(units[O])	
TotalCountsValue [0,1]	5.4.213
BackgroundCountRateValue [0,1]	5.4.27
(units[O])	
BackgroundCountRateUncertaintyValue [0,1]	5.4.26
(units[O])	
SourcePosition [0,1]	5.4.197
(id[O])	
Remark [0,many]	5.4.195
*****Choice of one of the following*****	
GeographicPoint [0,1]	5.4.80
(datum[O], units[O])	
LatitudeValue [1,1]	5.4.94
(units[O])	
LongitudeValue [1,1]	5.4.97
(units[O])	
ElevationValue [0,1]	5.4.59
ElevationOffsetValue [0,1]	5.4.58
GeoPointAccuracyValue [0,1]	5.4.81
ElevationAccuracyValue [0,1]	5.4.56
ElevationOffsetAccuracyValue [0,1]	5.4.57
LocationDescription [0,1]	5.4.96
RelativeLocation [0,1]	5.4.192
RelativeLocationAzimuthValue [0,1]	5.4.193
(units[O])	
RelativeLocationInclinationValue [0,1]	5.4.194
(units[O])	
DistanceValue [0,1]	5.4.48
(units[O])	
Origin [1,1]	5.4.134
(originReference[O])	
GeographicPoint [0,1]	5.4.80
(datum[O], units[O])	
LatitudeValue [1,1]	5.4.94
(units[O])	
LongitudeValue [1,1]	5.4.97
(units[O])	
ElevationValue [0,1]	5.4.59
ElevationOffsetValue [0,1]	5.4.58
GeoPointAccuracyValue [0,1]	5.4.81
ElevationAccuracyValue [0,1]	5.4.56
ElevationOffsetAccuracyValue [0,1]	5.4.57
OriginDescription [0,1]	5.4.135
*****End of Choice*****	
GrossCountAnalysisResultsExtension [NA]	5.4.83
DoseAnalysisResults [0,1]	5.4.49
(id[O])	
Remark [0,many]	5.4.195
AverageDoseRateValue [0,1]	5.4.22
(units[O])	
AverageDoseRateUncertaintyValue [0,1]	5.4.21
(units[O])	

MaximumDoseRateValue [0,1]	5.4.99
(units[O])	
MinimumDoseRateValue [0,1]	5.4.103
(units[O])	
BackgroundDoseRateValue [0,1]	5.4.29
(units[O])	
BackgroundDoseRateUncertaintyValue [0,1]	5.4.28
(units[O])	
TotalDoseValue [0,1]	5.4.215
(id[R], units[O])	
SourcePosition [0,1]	5.4.197
(id[O])	
Remark [0,many]	5.4.195
*****Choice of one of the following*****	
GeographicPoint [0,1]	5.4.80
(datum[O], units[O])	
LatitudeValue [1,1]	5.4.94
(units[O])	
LongitudeValue [1,1]	5.4.97
(units[O])	
ElevationValue [0,1]	5.4.59
ElevationOffsetValue [0,1]	5.4.58
GeoPointAccuracyValue [0,1]	5.4.81
ElevationAccuracyValue [0,1]	5.4.56
ElevationOffsetAccuracyValue [0,1]	5.4.57
LocationDescription [0,1]	5.4.96
RelativeLocation [0,1]	5.4.192
RelativeLocationAzimuthValue [0,1]	5.4.193
(units[O])	
RelativeLocationInclinationValue [0,1]	5.4.194
(units[O])	
DistanceValue [0,1]	5.4.48
(units[O])	
Origin [1,1]	5.4.134
(originReference[O])	
GeographicPoint [0,1]	5.4.80
(datum[O], units[O])	
LatitudeValue [1,1]	5.4.94
(units[O])	
LongitudeValue [1,1]	5.4.97
(units[O])	
ElevationValue [0,1]	5.4.59
ElevationOffsetValue [0,1]	5.4.58
GeoPointAccuracyValue [0,1]	5.4.81
ElevationAccuracyValue [0,1]	5.4.56
ElevationOffsetAccuracyValue [0,1]	5.4.57
OriginDescription [0,1]	5.4.135
*****End of Choice*****	
DoseAnalysisResultsExtension [NA]	5.4.50
ExposureAnalysisResults [0,1]	5.4.66
(id[O])	
Remark [0,many]	5.4.195
AverageExposureRateValue [0,1]	5.4.24
(units[O])	
AverageExposureRateUncertaintyValue [0,1]	5.4.23
(units[O])	
MaximumExposureRateValue [0,1]	5.4.100
(units[O])	

MinimumExposureRateValue [0,1]	5.4.104
(units[O])	
BackgroundExposureRateValue [0,1]	5.4.31
(units[O])	
BackgroundExposureRateUncertaintyValue [0,1]	5.4.30
(units[O])	
TotalExposureValue [0,1]	5.4.218
(id[R], units[O])	
SourcePosition [0,1]	5.4.197
(id[O])	
Remark [0,many]	5.4.195
*****Choice of one of the following*****	
GeographicPoint [0,1]	5.4.80
(datum[O], units[O])	
LatitudeValue [1,1]	5.4.94
(units[O])	
LongitudeValue [1,1]	5.4.97
(units[O])	
ElevationValue [0,1]	5.4.59
ElevationOffsetValue [0,1]	5.4.58
GeoPointAccuracyValue [0,1]	5.4.81
ElevationAccuracyValue [0,1]	5.4.56
ElevationOffsetAccuracyValue [0,1]	5.4.57
LocationDescription [0,1]	5.4.96
RelativeLocation [0,1]	5.4.192
RelativeLocationAzimuthValue [0,1]	5.4.193
(units[O])	
RelativeLocationInclinationValue [0,1]	5.4.194
(units[O])	
DistanceValue [0,1]	5.4.48
(units[O])	
Origin [1,1]	5.4.134
(originReference[O])	
GeographicPoint [0,1]	5.4.80
(datum[O], units[O])	
LatitudeValue [1,1]	5.4.94
(units[O])	
LongitudeValue [1,1]	5.4.97
(units[O])	
ElevationValue [0,1]	5.4.59
ElevationOffsetValue [0,1]	5.4.58
GeoPointAccuracyValue [0,1]	5.4.81
ElevationAccuracyValue [0,1]	5.4.56
ElevationOffsetAccuracyValue [0,1]	5.4.57
OriginDescription [0,1]	5.4.135
*****End of Choice*****	
ExposureAnalysisResultsExtension [NA]	5.4.67
Fault [0,many]	5.4.71
(id[O])	
Remark [0,many]	5.4.195
FaultCodeValue [1,1]	5.4.72
FaultDescription [1,1]	5.4.73
FaultSeverityCode [1,1]	5.4.75
FaultExtension [NA]	5.4.74
AnalysisResultsExtension [NA]	5.4.16
MultimediaData [0,many]	5.4.107
(id[O], radItemInformationReferences[O], sequenceNumber[O])	

Remark [0,many]	5.4.195
MultimediaDataDescription [0,1]	5.4.108
*****Choice of 0 or many of the following*****	
BinaryUTF8Object [0,1]	5.4.34
BinaryHexObject [0,1]	5.4.33
BinaryBase64Object [0,1]	5.4.32
*****End of Choice*****	
MultimediaCaptureStartDateTime [0,1]	5.4.106
MultimediaCaptureDuration [0,1]	5.4.105
MultimediaFileURI [0,1]	5.4.114
MultimediaFileSizeValue [0,1]	5.4.113
MultimediaDataMIMEKind [0,1]	5.4.110
EncodingMIMEKind [0,1]	5.4.60
MultimediaDeviceCategoryCode [0,1]	5.4.111
MultimediaDeviceIdentifier [0,1]	5.4.112
ImagePerspectiveCode [0,1]	5.4.86
ImageWidthValue [0,1]	5.4.87
(units[O])	
ImageHeightValue [0,1]	5.4.85
(units[O])	
MultimediaDataExtension [NA]	5.4.109
*****End of Choice*****	
RadInstrumentDataExtension [NA]	5.4.163

5.4 Element descriptions

The following subclauses describe the elements defined in the N42 schema. The following items are described for each element:

- a) parent element(s);
- b) data type of the element's contents, if any;
- c) element attributes. Attributes are required to be present unless noted as optional;
- d) child elements;
- e) number of times the element can occur in its parent;
- f) units of the element contents, if any;
- g) description of the meaning and use of the element;
- h) the recommended usage of the element. This may include examples.

NOTE In a list of child elements, those elements grouped by ellipses (i.e., { }) are members of a Choice group in the XML schema.

5.4.1 <AlarmAudibleIndicator>

- Parent: <RadAlarm>
- Element data type: boolean
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Indicates if an audible alarm was annunciated; true if an audible alarm was announced, false otherwise.
- Usage: This element shall be used when the radiation measurement instrument has an audible alarm capability.

5.4.2 <AnalysisAlgorithmComponentName>

- Parent: <AnalysisAlgorithmVersion>
- Element data type: NonBlankString
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: Name of an algorithm component.
- Usage: No additional information

5.4.3 <AnalysisAlgorithmComponentVersion>

- Parent: <AnalysisAlgorithmVersion>
- Element data type: NonBlankString
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: Version information for the algorithm component.
- Usage: No additional information

5.4.4 <AnalysisAlgorithmCreatorName>

- Parent: <AnalysisResults>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Creator or implementer of the analysis algorithm.
- Usage: Typically this will be the name of a company or organization that developed the algorithm.

5.4.5 <AnalysisAlgorithmDescription>

- Parent: <AnalysisResults>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Free-form text describing the analysis algorithm.
- Usage: Provides a general description of the algorithm used for the data analysis.

5.4.6 <AnalysisAlgorithmName>

- Parent: <AnalysisResults>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: A unique name of the analysis algorithm.
- Usage: This should be a unique name that can identify the analysis algorithm and associated radiation measurement instrument.

5.4.7 <AnalysisAlgorithmSetting>

- Parent: <AnalysisResults>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
- Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
- Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <AnalysisAlgorithmSettingName>, <AnalysisAlgorithmSettingValue>, <AnalysisAlgorithmSettingUnits>
- Occurrences: 0, many
- Units: Not applicable
- Description: List of name – value pairs describing analysis setting information.
- Usage: This element (by use of *AlgorithmSettingName* and *AlgorithmSettingValue*) should list the algorithm settings relevant for the analysis (e.g. alarm threshold, radionuclide library name, etc.).

5.4.8 <AnalysisAlgorithmSettingName>

- Parent: <AnalysisAlgorithmSetting>
- Element data type: NonBlankString
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: Name of an algorithm setting parameter.
- Usage: No additional information

5.4.9 <AnalysisAlgorithmSettingUnits>

- Parent: <AnalysisAlgorithmSetting>
- Element data type: NonBlankString
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: The units of measure of the algorithm setting value, identified by the *AnalysisAlgorithmSettingName* element, if needed.

- Usage: No additional information

5.4.10 <AnalysisAlgorithmSettingValue>

- Parent: <AnalysisAlgorithmSetting>
- Element data type: NonBlankString
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: Value of the setting parameter identified by the *AnalysisAlgorithmSettingName* element.
- Usage: No additional information

5.4.11 <AnalysisAlgorithmVersion>

- Parent: <AnalysisResults>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
- Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
- Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <AnalysisAlgorithmComponentName>, <AnalysisAlgorithmComponentVersion>
- Occurrences: 0, many
- Units: Not applicable
- Description: Information describing the version of a particular analysis algorithm component.
- Usage: This element provides the means to specify a name/version pair to describe the version of each component of the analysis algorithm.

5.4.12 <AnalysisComputationDuration>

- Parent: <AnalysisResults>
- Element data type: duration
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Time (duration) for convergence of the analysis algorithm; i.e., time from start to finish to produce the analysis results.
- Usage: This element provides the means to capture the time required to perform data analysis; this could be used in the benchmarking of analysis algorithms.

5.4.13 <AnalysisConfidenceValue>

- Parent: <AnalysisResults>
- Element data type: Percent
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Indication of confidence, as a percent ranging from "0.0" to "100.0", in the overall accuracy of the analysis, where increasing values indicate higher confidence.
- Usage: When this element is used the developer shall provide the user with a description of the meaning and use of this confidence indication. This information shall be provided in the radiation measurement instrument documentation.

5.4.14 <AnalysisResultDescription>

- Parent: <AnalysisResults>
- Element data type: string
- Attributes: none

- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Free-form text describing the overall conclusion of the analysis regarding the source of concern.
- Usage: No additional information

5.4.15 <AnalysisResults>

- Parent: <RadInstrumentData>
- Element data type: Not Applicable
- Attributes:
 - Name: derivedDataReferences
 - Data Type: IDREFS
 - Use: optional
 - Description: Identifies the *DerivedData* element(s) within the N42 XML document that applies to this particular analysis. There shall be no duplicate IDREF values in the list.
 - Usage: This attribute identifies the derived data input to the analysis from one or more *DerivedData* elements. Note: One and only one of the *derivedDataReferences*, *radMeasurementGroupReferences*, and *radMeasurementReferences* attributes must be specified.
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
 - Name: radMeasurementGroupReferences
 - Data Type: IDREFS
 - Use: optional
 - Description: Identifies the *RadMeasurementGroup* element(s) within the N42 XML document that applies to this particular analysis. There shall be no duplicate IDREF values in the list.
 - Usage: This attribute identifies the raw data input to the analysis from one or more *RadMeasurementGroup* elements. Note: One and only one of the *derivedDataReferences*, *radMeasurementGroupReferences*, and *radMeasurementReferences* attributes must be specified.
 - Name: radMeasurementReferences
 - Data Type: IDREFS
 - Use: optional
 - Description: Identifies the *RadMeasurement* element(s) within the N42 XML document that applies to a particular analysis. There shall be no duplicate IDREF values in the list.
 - Usage: This attribute identifies the raw data input to the analysis from one or more *RadMeasurement* elements. Note: One and only one of the *derivedDataReferences*, *radMeasurementGroupReferences*, and *radMeasurementReferences* attributes must be specified.
- Child Elements:
 - <Remark>, <AnalysisStartDateTime>, <AnalysisComputationDuration>,
<AnalysisAlgorithmName>, <AnalysisAlgorithmCreatorName>,
<AnalysisAlgorithmDescription>, <AnalysisAlgorithmVersion>, <AnalysisAlgorithmSetting>,
<AnalysisResultStatusCode>, <AnalysisConfidenceValue>, <AnalysisResultDescription>,
<RadAlarm>, <NuclideAnalysisResults>, <SpectrumPeakAnalysisResults>,
<GrossCountAnalysisResults>, <DoseAnalysisResults>, <ExposureAnalysisResults>,
<Fault>, <AnalysisResultsExtension>
- Occurrences: 0, many
- Units: Not applicable
- Description: The collection of information resulting from the analysis of the radiation measurements or derived data.
- Usage: Whereas the *RadMeasurement* or *DerivedData* elements provide the raw

measurement data or the data calculated from the raw measurement data, this element provides a means to report the results derived from analysis of the radiation measurements or derived data. Child elements identify source indicators, radiation alarms, nuclides, and the details on the analysis algorithms themselves. Analysis results are applicable to a specific slice in time that does not necessarily coincide with those from any particular *RadMeasurement* or *DerivedData* elements.

5.4.16 <AnalysisResultsExtension>

- Parent: <AnalysisResults>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable
- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 standard schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.17 <AnalysisResultStatusCode>

- Parent: <AnalysisResults>
- Element data type: AnalysisResultStatusCodeSimpleType
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Describes the success or failure status of the measurement analysis. If this element is omitted, the analysis is considered successful. The *AnalysisResultDescription* element shall be used to describe an analysis failure in detail.
- Usage: The possible enumeration values are listed in 5.2.2.

5.4.18 <AnalysisStartDateTime>

- Parent: <AnalysisResults>
- Element data type: dateTime
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Date and time at which the analysis was started.
- Usage: This information shall be entered using the time format described in 5.1.1.

5.4.19 <AverageCountRateUncertaintyValue>

- Parent: <GrossCountAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be counts per second (cps).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: counts per second (cps)
- Description: The 1-sigma uncertainty in *AverageCountRateValue*, in counts per second (cps).
- Usage: If the uncertainty is provided, it shall include all components of the uncertainty in the value of the average count rate.

5.4.20 <AverageCountRateValue>

- Parent: <GrossCountAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be counts per second (cps).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: counts per second (cps)
- Description: The average count rate observed over all measurements input to *AnalysisResults*, in counts per second (cps).
- Usage: No additional information

5.4.21 <AverageDoseRateUncertaintyValue>

- Parent: <DoseAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be microsieverts per hour ($\mu\text{Sv/h}$).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: microsieverts per hour ($\mu\text{Sv/h}$)
- Description: The combined 1-sigma uncertainty associated with the average ambient dose equivalent rate reported in the analysis results, expressed in microsieverts per hour ($\mu\text{Sv/h}$).
- Usage: This element provides a way to report the uncertainty in the average ambient dose equivalent rate. If an instrument reports this uncertainty, the value needs to include all components of the uncertainty.

5.4.22 <AverageDoseRateValue>

- Parent: <DoseAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be microsieverts per hour ($\mu\text{Sv/h}$).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: microsieverts per hour ($\mu\text{Sv/h}$)
- Description: The average ambient dose equivalent rate reported in the analysis results, expressed in microsieverts per hour ($\mu\text{Sv/h}$).
- Usage: This element provides the average ambient dose equivalent rate calculated by the analysis. The uncertainty in this value can be reported in *AverageDoseRateUncertaintyValue*.

5.4.23 <AverageExposureRateUncertaintyValue>

- Parent: <ExposureAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units

- Data Type: token
- Use: optional
- Description: The value's unit of measure, which must be milliroentgen per hour (mR/h).
- Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: milliroentgen per hour (mR/h)
- Description: The combined 1-sigma uncertainty associated with the average exposure rate reported in the analysis results, expressed in milliroentgen per hour (mR/h).
- Usage: This element provides a way to report the uncertainty in the average exposure rate. If a radiation measurement instrument reports this uncertainty, the value needs to include all components of the uncertainty.

5.4.24 <AverageExposureRateValue>

- Parent: <ExposureAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be milliroentgen per hour (mR/h).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: milliroentgen per hour (mR/h)
- Description: The average exposure rate reported in the analysis results, expressed in milliroentgen per hour (mR/h).
- Usage: This element provides the average exposure rate calculated by the analysis. The uncertainty in this value can be reported in *AverageExposureRateUncertaintyValue*.

5.4.25 <AzimuthValue>

- Parents: <Orientation>
- Element data type: decimal
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be decimal degrees (DECDEG).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 1, 1
- Units: decimal degree (DECDEG)
- Description: The orientation of an object (i.e., instrument, detector, or item) with respect to True North. Its value is the angle subtended by a line from the center point of the object to True North in the horizontal plane and the line formed by the object's front-to-back axis projected onto the horizontal plane. The angle range is from “-180.0” to “+180.0” degrees. A value of zero implies the front of the object's body is pointed to True North; positive values imply the front is pointed to the east of True North; negative values imply the front is pointed to the west of True North.
- Usage: Together with the object's location (via either *GeographicPoint* or *RelativeLocation*), *InclinationValue*, and *RollValue* this element provides a means to fully describe how an object is placed in space when information regarding such placement is pertinent to a set of measurements or analyses.

5.4.26 <BackgroundCountRateUncertaintyValue>

- Parent: <GrossCountAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional

- Description: The value's unit of measure, which must be counts per second (cps).
- Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: counts per second (cps)
- Description: The 1-sigma uncertainty in the background count rate used in the analysis, in counts per second (cps).
- Usage: If an uncertainty is provided, it shall include all components of the uncertainty in the value of the background count rate.

5.4.27 <BackgroundCountRateValue>

- Parent: <GrossCountAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be counts per second (cps).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: counts per second (cps)
- Description: The background rate used in the analysis, in counts per second (cps).
- Usage: No additional information

5.4.28 <BackgroundDoseRateUncertaintyValue>

- Parent: <DoseAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be microsieverts per hour ($\mu\text{Sv/h}$).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: microsieverts per hour ($\mu\text{Sv/h}$)
- Description: The 1-sigma absolute uncertainty in the value of *BackgroundDoseRateValue*, in microsieverts per hour ($\mu\text{Sv/h}$).
- Usage: This element provides a way to report the uncertainty in *BackgroundDoseRateValue*. If this uncertainty is reported, the value needs to include all components of the uncertainty.

5.4.29 <BackgroundDoseRateValue>

- Parent: <DoseAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be microsieverts per hour ($\mu\text{Sv/h}$).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: microsieverts per hour ($\mu\text{Sv/h}$)
- Description: The background ambient dose equivalent rate used in the analysis, in microsieverts per hour ($\mu\text{Sv/h}$).
- Usage: Background ambient dose equivalent rate values are associated with measurements where no radioactive sources are present except for natural background. See

ambient dose equivalent in 3.1 and Annex J.

5.4.30 <BackgroundExposureRateUncertaintyValue>

- Parent: <ExposureAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be milliroentgen per hour (mR/h).
- Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: milliroentgen per hour (mR/h)
- Description: The combined 1-sigma uncertainty associated with the average background exposure rate reported in the analysis results, expressed in milliroentgen per hour (mR/h).
- Usage: This element provides a way to report the uncertainty in the average background exposure rate. If an instrument reports this uncertainty, the value needs to include all components of the uncertainty.

5.4.31 <BackgroundExposureRateValue>

- Parent: <ExposureAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be milliroentgen per hour (mR/h).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: milliroentgen per hour (mR/h)
- Description: The average background exposure rate reported in the analysis results, expressed in milliroentgen per hour (mR/h).
- Usage: This element provides the average background exposure rate calculated by the analysis. The uncertainty in this value can be reported in *BackgroundExposureRateUncertaintyValue*.

5.4.32 <BinaryBase64Object>

- Parent: <MultimediaData>
- Element data type: base64Binary
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Base 64 binary encoding of data.
- Usage: This element applies to multimedia datasets encoded using the Base 64 binary coding format.

5.4.33 <BinaryHexObject>

- Parent: <MultimediaData>
- Element data type: hexBinary
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Hex binary encoding of data.
- Usage: This element applies to multimedia datasets encoded using the hexadecimal binary coding format.

5.4.34 <BinaryUTF8Object>

- Parent: <MultimediaData>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: UTF8 binary encoding of data.
- Usage: This element applies to multimedia datasets encoded using binary coding based on the UTF8 format.

5.4.35 <CalibrationDateTime>

- Parents: <EnergyCalibration>, <FullEnergyPeakEfficiencyCalibration>, <FWHMCalibration>, <IntrinsicDoubleEscapePeakEfficiencyCalibration>, <IntrinsicFullEnergyPeakEfficiencyCalibration>, <IntrinsicSingleEscapePeakEfficiencyCalibration>, <TotalEfficiencyCalibration>
- Element data type: dateTime
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: The date and time at which the calibration was put into service.
- Usage: This element provides the means to assign a date and time to each calibration, to assist in determining the validity or provenance of the calibration. The date and time would typically be when the calibration was created and/or approved for use.

5.4.36 <ChannelData>

- Parents: <Spectrum>
- Element data type: DoubleList
- Attributes:
 - Name: compressionCode
 - Data Type: CompressionCodeSimpleType
 - Use: optional
 - Description: Indicates the algorithm, if any, by which the channel data have been compressed. If this attribute is omitted, the data have not been compressed. The kinds of data compression are as follows:
 - None: the data are not compressed. The number of values in the *ChannelData* element is equal to the number of channels of data represented by the element.
 - CountedZeroes: the data have been compressed by the removal of repeated zero values. When a "0" value appears in the *ChannelData* contents, the next value is the number of consecutive zero-value channels beginning with the first zero-value in the sequence. For example, the following 18 channels of uncompressed data:

22 5 0 2 1 0 0 3 4 0 0 0 0 0 0 0 1

would be represented in compressed form by

22 5 0 *1* 2 1 0 *2* 3 4 0 *8* 1

The italicized values in the list show cases where one, two, and eight zeroes have been compressed.

- Usage: No additional information
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: A list of values, one for each of a spectrum's channels. The values represent the number of counts per channel.
- Usage: The *EnergyCalibration* element, which is indicated by the *energyCalibrationReference* attribute of the parent *Spectrum*, defines the energy of each channel.

5.4.37 <Characteristic>

- Parents: <CharacteristicGroup>, <RadDetectorCharacteristics>, <RadInstrumentCharacteristics>, <RadItemCharacteristics>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
 - Name: valueDateTime
 - Data Type: dateTime
 - Use: optional
 - Description: DateTime stamp when the characteristic value was sampled.
 - Usage: No additional information
 - Name: valueOutOfLimits
 - Data Type: boolean
 - Use: optional
 - Description: True if the *CharacteristicValue* exceeds a control limit high or low value; false otherwise.
 - Usage: No additional information
- Child Elements:
 - <Remark>, <CharacteristicName>, <CharacteristicValue>, <CharacteristicValueUnits>, <CharacteristicValueDataClassCode>
- Occurrences: 1, many
- Units: Not applicable
- Description: Describes an additional characteristic of something, such as a radiation instrument, detector, or item being inspected.
- Usage: This is used to supplement those characteristics specifically defined in this standard. For example: health status data, configuration data and security data.

5.4.38 <CharacteristicGroup>

- Parents: <RadDetectorCharacteristics>, <RadInstrumentCharacteristics>, <RadItemCharacteristics>
- Element data type: Not Applicable
- Attributes:
 - Name: groupOutOfLimits
 - Data Type: boolean
 - Use: optional
 - Description: True if the *CharacteristicValue* of one or more of the *Characteristic* in the group, or combinations of the group's *Characteristic* exceeds a control limit high or low value; false otherwise.
 - Usage: No additional information
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <CharacteristicGroupName>, <Characteristic>
- Occurrences: 0, many
- Units: Not applicable
- Description: A set of *Characteristic* grouped in some manner, such as health characteristics of an instrument subsystem or detector.

- Usage: This is used to organize characteristic data by a set of instrument components.

5.4.39 <CharacteristicGroupName>

- Parents: <CharacteristicGroup>
- Element data type: NonBlankString
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: The free-form name of the *CharacteristicGroup*.
- Usage: No additional information

5.4.40 <CharacteristicName>

- Parents: <Characteristic>
- Element data type: NonBlankString
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: The free-form name of the *Characteristic*.
- Usage: No additional information

5.4.41 <CharacteristicValue>

- Parents: <Characteristic>
- Element data type: NonBlankString
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: The value of the *Characteristic*.
- Usage: Since the value of a *Characteristic* may be other than a number (such as the word "Auto") the data type of this element is generalized to a string.

5.4.42 <CharacteristicValueDataClassCode>

- Parents: <Characteristic>
- Element data type: ValueDataClassCodeSimpleType
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: The data class of the *CharacteristicValue*.
- Usage: No additional information

5.4.43 <CharacteristicValueUnits>

- Parents: <Characteristic>
- Element data type: NonBlankString
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: The unit of measure of the *CharacteristicValue*.
- Usage: SI units should be used when applicable. If the value is unit-less, use "unit-less" as the entry in this element.

5.4.44 <CoefficientValues>

- Parent: <EnergyCalibration>
- Element data type: DoubleList
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Energy is expressed in keV and C is the channel position
- Description: The values of the coefficients of a second-order polynomial describing the

energy calibration in which the energies are expressed in keV. The equation has the form:

$$E = T_0 + T_1 \times C + T_2 \times C^2$$

Where E is the energy in keV, C is the channel position, T_0 is the offset coefficient, T_1 is the gain coefficient, and T_2 is the quadratic coefficient. The first value in the list is term 0, the second term 1, and the third value term 2. If the energy calibration is linear, the third coefficient (T_2) shall be zero.

- Usage: This element provides a means to provide energy calibration for spectra in the form of a second-order polynomial equation to convert channel position into energy. The *CoefficientValues* list provides the coefficients of the energy calibration equation. There shall always be three values listed. This energy calibration method may be used in lieu of *EnergyBoundaryValues*.

5.4.45 <CountData>

- Parents: <GrossCounts>
- Element data type: NonNegativeDoubleList
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: The number of counts accumulated during a measurement period over the entire energy range measured by the radiation detector or within pre-defined energy windows.
- Usage: The gross counts accumulated during a measurement period; i.e., beginning at *StartDateTime* for *RealTimeDuration*. There will be one value for each energy window. Energy windows are defined via an *EnergyWindows* element indicated by the *energyWindowsReference* attribute of the parent *GrossCounts* element. The number and order of values in *CountData* and *EnergyWindows* must match. If there are no energy windows explicitly defined, then implicitly there is a single energy window that covers the entire energy range.

5.4.46 <DerivedData>

- Parent: <RadInstrumentData>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <MeasurementClassCode>, <StartDateTime>, <RealTimeDuration>, <Spectrum>, <GrossCounts>, <DoseRate>, <TotalDose>, <ExposureRate>, <TotalExposure>, <DerivedDataExtension>
- Occurrences: 0, many
- Units: Not applicable
- Description: Data derived from raw measured data for use in analysis.
- Usage: As an example of derived data, multiple spectra could be rebinned and summed and the resulting spectrum recorded as a *Spectrum* in *DerivedData*.

5.4.47 <DerivedDataExtension>

- Parent: <DerivedData>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable

- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 standard schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.48 <DistanceValue>

- Parents: <RelativeLocation>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be metres (m).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: metres (m)
- Description: The scalar distance between the center of an object (i.e., instrument, detector, or item) or nuclide and the center of a reference point (*Origin*).
- Usage: Together with the *RelativeLocationAzimuthValue* and *RelativeLocationInclinationValue* child elements of *RelativeLocation*, this element provides a means to describe an object or nuclide's location relative to a reference point (the *Origin* child element of *RelativeLocation*) when such information is pertinent to a set of measurements or analyses.

5.4.49 <DoseAnalysisResults>

- Parent: <AnalysisResults>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <AverageDoseRateValue>, <AverageDoseRateUncertaintyValue>, <MaximumDoseRateValue>, <MinimumDoseRateValue>, <BackgroundDoseRateValue>, <BackgroundDoseRateUncertaintyValue>, <TotalDoseValue>, <SourcePosition>, <DoseAnalysisResultsExtension>
- Occurrences: 0, 1
- Units: Not applicable
- Description: Results of the analysis of the radiation ambient dose equivalent data for a measured item(s).
- Usage: No additional information

5.4.50 <DoseAnalysisResultsExtension>

- Parent: <DoseAnalysisResults>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable
- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 standard schema includes this abstract element to provide a means for an

instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.51 <DoseRate>

- Parents: <DerivedData>, <RadMeasurement>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Name: radDetectorInformationReference
 - Data Type: IDREF
 - Use: required
 - Description: Reference to the radiation detector that was used to collect these data.
 - Usage: No additional information
- Name: radRawDoseRateReferences
 - Data Type: IDREFS
 - Use: optional
 - Description: Identifies the *DoseRate* measurement data element(s) used to produce derived data. There shall be no duplicate IDREF values in the list. This attribute is required whenever the element is used within a *DerivedData* block, but is prohibited otherwise.
 - Usage: No additional information
- Child Elements:
 - <Remark>, <DoseRateValue>, <DoseRateLevelDescription>
- Occurrences: 0, many
- Units: Not applicable
- Description: The measured ambient dose equivalent rate, provided as a value and/or a qualitative description.
- Usage: Under *DoseRate*, either *DoseRateValue* or *DoseRateLevelDescription* shall be provided; both may be provided but only one of the two is required.

5.4.52 <DoseRateLevelDescription>

- Parents: <DoseRate>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: A qualitative description of the radiation ambient dose equivalent rate level, such as "low"/"medium"/"high" or a numerical scale "0" to "9".
- Usage: This element provides a means of expressing the dose rate qualitatively, via free-form text. The radiation measurement instrument manufacturer should provide a list of ambient dose equivalent rate values or ranges (expressed in $\mu\text{Sv/h}$) that are associated with the dose rate level descriptions.

5.4.53 <DoseRateValue>

- Parents: <DoseRate>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be microsieverts per hour

($\mu\text{Sv/h}$).

- Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: microsieverts per hour ($\mu\text{Sv/h}$)
- Description: The measured ambient radiation dose equivalent rate value, in microsieverts per hour ($\mu\text{Sv/h}$).
- Usage: See ambient dose equivalent in 3.1 and Annex J.

5.4.54 <EfficiencyUncertaintyValues>

- Parents: <FullEnergyPeakEfficiencyCalibration>, <IntrinsicDoubleEscapePeakEfficiencyCalibration>, <IntrinsicFullEnergyPeakEfficiencyCalibration>, <IntrinsicSingleEscapePeakEfficiencyCalibration>, <TotalEfficiencyCalibration>
- Element data type: NonNegativeDoubleList
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: The list of the 1-sigma absolute uncertainties in the *EfficiencyValues*.
- Usage: The uncertainty value is determined based on the propagation of uncertainties to include contribution from each quantity used in the full energy peak efficiency calculation. For example, if a set of standard reference sources are used for this efficiency calibration, uncertainties components may include: count rate, live time, half-life, emission probabilities, source activity, source reference time, correction factors, statistical uncertainties, etc.

The number and order of values in the *EfficiencyValues* and *EfficiencyUncertaintyValues* lists must match.

5.4.55 <EfficiencyValues>

- Parents: <FullEnergyPeakEfficiencyCalibration>, <IntrinsicDoubleEscapePeakEfficiencyCalibration>, <IntrinsicFullEnergyPeakEfficiencyCalibration>, <IntrinsicSingleEscapePeakEfficiencyCalibration>, <TotalEfficiencyCalibration>
- Element data type: NonNegativeDoubleList
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: The list of efficiency values as decimal fractions; i.e. normally between “0.0” and “1.0”.
- Usage: Normally, efficiency values will range from “0.0” to “1.0” (i.e. 0,0 % to 100,0 %). However, in some circumstances, the effective efficiency may be greater than “1.0”. The order and number of values in the *EnergyValues* and *EfficiencyValues* lists must match.

5.4.56 <ElevationAccuracyValue>

- Parents: <GeographicPoint>
- Element data type: decimal
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: metres (m)
- Description: Describes the estimated accuracy of the elevation of a geographic point.
- Usage: Note that the elevation of a geographic point may be on, above, or below the surface of the earth at the specified latitude and longitude. This element provides a means of recording the uncertainty in the corresponding *Elevation* element. The value is non-negative, and needs to include all components of the uncertainty.

5.4.57 <ElevationOffsetAccuracyValue>

- Parents: <GeographicPoint>
- Element data type: decimal

- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: metres (m)
- Description: Describes the estimated accuracy of the elevation offset vertically to the earth's surface from a geographic point.
- Usage: The value is non-negative, and needs to include all components of the uncertainty.

5.4.58 <ElevationOffsetValue>

- Parents: <GeographicPoint>
- Element data type: decimal
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: metres (m)
- Description: The difference between the *Elevation* at the point of coordinate measurement and the earth's surface in metres.
- Usage: Positive values indicate the point of coordinate measurement is above the earth surface, and negative values are below.

5.4.59 <ElevationValue>

- Parents: <GeographicPoint>
- Element data type: decimal
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: metres (m)
- Description: Elevation of a *GeographicPoint* in metres relative to the applicable datum's ellipsoid.
- Usage: Positive values are above the ellipsoid, and negative values are below.

5.4.60 <EncodingMIMEKind>

- Parent: <MultimediaData>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Encoding MIME type of a digital data file.
- Usage: This element provides the means to specify how the multimedia data are encoded. For the defined MIME encoding types, see [42].

5.4.61 <EnergyBoundaryValues>

- Parent: <EnergyCalibration>
- Element data type: NonNegativeDoubleList
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be keV.
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: keV
- Description: The list of energy values that indicate the energy of the start of each channel in a spectrum and the end of the last channel of the spectrum; the energies shall appear in the list in increasing order.
- Usage: This element provides a means to provide energy calibration information for spectra in the form of a list. The *EnergyBoundaryValues* element requires N+1 values in the list, where N is the number of channels. This energy calibration method may be used in lieu of a second-order polynomial.

5.4.62 <EnergyCalibration>

- Parent: <RadInstrumentData>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, Choice of {<CoefficientValues> <EnergyBoundaryValues>}, <EnergyValues>, <EnergyDeviationValues>, <CalibrationDateTime>
- Occurrences: 0, many
- Units: Not applicable
- Description: Energy calibration information that spectrum measurements can reference as applicable to a particular spectrum.
- Usage: There are two methods available for providing energy calibration information: either in the form of a second-order polynomial equation in which the *CoefficientValues* child element must be specified, or in a table in which the *EnergyBoundaryValues* child element must be specified. Only one of the two methods applies to a particular energy calibration. The *EnergyDeviationValues* and *EnergyValues* child elements provide a means to account for the difference in the energy predicted by the second-order polynomial equation and the true energy.

5.4.63 <EnergyDeviationValues>

- Parent: <EnergyCalibration>
- Element data type: DoubleList
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be keV.
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: keV
- Description: The data describing the differences in the energies predicted by an energy calibration coefficients equation and the true energies.

$$\begin{aligned}
 E_{\text{Predicted}} &= T_0 + T_1 \times C + T_2 \times C^2 \\
 E_{\text{Deviation}} &= f(E_{\text{Predicted}}) \\
 E_{\text{Actual}} &= E_{\text{Predicted}} + E_{\text{Deviation}}
 \end{aligned}$$

Where T_n are the coefficients from the *CoefficientValues* element data, C is the channel position (the first channel starts at "0.0"), $E_{\text{Predicted}}$ is the predicted energy (in keV) at channel C , $E_{\text{Deviation}}$ is the energy deviation value (in keV) from interpolation of the *EnergyValues* and *EnergyDeviationValues* data, and E_{Actual} is the final corrected energy at channel C .

- Usage: This element provides a means to account for the difference in the energy predicted by the second-order polynomial equation and the true energy. Note that if *EnergyDeviationValues* are provided, then the corresponding *EnergyValues* shall also be provided. The number and order of values in *EnergyValues* and *EnergyDeviationValues* shall be the same.

5.4.64 <EnergyValues>

- Parents: <EnergyCalibration>, <FullEnergyPeakEfficiencyCalibration>, <FWHMCalibration>, <IntrinsicDoubleEscapePeakEfficiencyCalibration>, <IntrinsicFullEnergyPeakEfficiencyCalibration>,

- <IntrinsicSingleEscapePeakEfficiencyCalibration>, <TotalEfficiencyCalibration>
- Element data type: NonNegativeDoubleList
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be keV.
 - Usage: No additional information
- Child Elements: none
- Occurrences: 1, 1
- Units: keV
- Description: A list of energy values, in units of keV; the energies shall appear in the list in strictly increasing order. This element appears paired with an element that provides a corresponding list of other values, such as the *EnergyDeviationValues*, *FWHMValues*, or *EfficiencyValues* elements. The number and order of corresponding values in the pair of lists must match.
- Usage: Each value in *EnergyValues* designates the energy at which the corresponding value in the paired list applies.

5.4.65 <EnergyWindows>

- Parent: <RadInstrumentData>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <WindowStartEnergyValues>, <WindowEndEnergyValues>
- Occurrences: 0, many
- Units: Not applicable
- Description: The definition of a set of energy windows used in gross counting.
- Usage: Energy windows can be used by radiation measurement instruments with full or limited spectroscopic capabilities. Each energy window is defined by a start energy and an end energy. A radiation detector used for gross counting with a single energy window must have sufficient energy discrimination to accumulate counts that occur only within the window; this is equivalent to a traditional single channel analyzer. Some detectors have the discrimination to support multiple windows, accumulating the counts that occur in each window. A set of energy windows consists of a list of one or more start energies, in increasing order of energy, and a list of matching end energies; each end energy must be greater than the corresponding start energy. These two lists are the elements *StartEnergyWindowValues* and *EndEnergyWindowValues*, respectively. When a radiation detector is used for gross counting, the counts accumulated in each window are reported in a *CountData* element; the number of values in this element must match the number of windows defined.

5.4.66 <ExposureAnalysisResults>

- Parent: <AnalysisResults>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an

element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.

- Child Elements:
 - <Remark>, <AverageExposureRateValue>, <AverageExposureRateUncertaintyValue>, <MaximumExposureRateValue>, <MinimumExposureRateValue>, <BackgroundExposureRateValue>, <BackgroundExposureRateUncertaintyValue>, <TotalExposureValue>, <SourcePosition>, <ExposureAnalysisResultsExtension>
- Occurrences: 0, 1
- Units: Not applicable
- Description: Results of the analysis of the radiation exposure data for a measured item(s).
- Usage: No additional information

5.4.67 <ExposureAnalysisResultsExtension>

- Parent: <ExposureAnalysisResults>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable
- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 standard schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.68 <ExposureRate>

- Parents: <DerivedData>, <RadMeasurement>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
 - Name: radDetectorInformationReference
 - Data Type: IDREF
 - Use: required
 - Description: Reference to the radiation detector that was used to collect these data.
 - Usage: No additional information
 - Name: radRawExposureRateReferences
 - Data Type: IDREFS
 - Use: optional
 - Description: Identifies the *ExposureRate* measurement data element(s) used to produce derived data. There shall be no duplicate IDREF values in the list. This attribute is required whenever the element is used within a *DerivedData* block, and prohibited otherwise.
 - Usage: No additional information
- Child Elements:
 - <Remark>, <ExposureRateValue>, <ExposureRateLevelDescription>
- Occurrences: 0, many
- Units: Not applicable
- Description: The radiation exposure rate, provided as the measured value, and/or a qualitative description of the exposure rate level.
- Usage: See exposure in 3.1 and Annex J. Under *ExposureRate*, either *ExposureRateValue* or *ExposureRateLevelDescription* or both may be provided, but only one of the two is required.

5.4.69 <ExposureRateLevelDescription>

- Parents: <ExposureRate>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: A qualitative description of the radiation exposure rate level, such as "low", "medium", "high", or a numerical scale "0" to "9".
- Usage: This element provides a means of expressing the exposure rate qualitatively, via free-form text. It is recommended that the radiation measurement instrument manufacturer provide a list of exposure rate values or ranges (in mR/h) that are associated with the exposure rate level descriptions.

5.4.70 <ExposureRateValue>

- Parents: <ExposureRate>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be milliroentgen per hour (mR/h).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: milliroentgen per hour (mR/h)
- Description: The measured radiation exposure rate value, in milliroentgen per hour (mR/h).
- Usage: See the definition of exposure in 3.1 and Annex J.

5.4.71 <Fault>

- Parents: <AnalysisResults>, <RadDetectorState>, <RadInstrumentState>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <FaultCodeValue>, <FaultDescription>, <FaultSeverityCode>, <FaultExtension>
- Occurrences: 0, many
- Units: Not applicable
- Description: The collection of information describing an error that occurred in the instrument, a specific detector, or during the analysis of data.
- Usage: The element provides the means of reporting errors that occur during data collection or analysis.

5.4.72 <FaultCodeValue>

- Parents: <Fault>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: An instrument-specific code that identifies the error or problem.
- Usage: This element provides the means to report an error code resulting from a problem. For example, if a Windows "file not found" error occurred, the code reported would be "2".

5.4.73 <FaultDescription>

- Parents: <Fault>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: A description of the problem that occurred.
- Usage: This element provides a detailed description of the problem. For example, a detector bias supply failure might be described by "Detector HV supply failure".

5.4.74 <FaultExtension>

- Parents: <Fault>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable
- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 standard schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.75 <FaultSeverityCode>

- Parents: <Fault>
- Element data type: FaultSeverityCodeSimpleType
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: The seriousness of a fault.
- Usage: The possible enumeration values are listed in 5.2.4.

5.4.76 <FullEnergyPeakEfficiencyCalibration>

- Parent: <RadInstrumentData>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <EnergyValues>, <EfficiencyValues>, <EfficiencyUncertaintyValues>, <CalibrationDateTime>
- Occurrences: 0, many
- Units: Not applicable
- Description: A full-energy peak efficiency calibration. The full-energy peak efficiency at any value of energy is the ratio of the net counts in a peak at that energy to the number of photons emitted by a source at that energy.
- Usage: The full-energy peak efficiency is important in quantitative spectroscopy with specific measurement geometry. If Q photons of energy E have been emitted by a source during a collection, and if the net full-energy peak area recorded in the spectrum as a result of those photons is P, the full-energy peak efficiency at energy E is given by P/Q. Alternatively, the source term Q can be stated in terms of activity: if T is the live time, A is the source activity in Becquerel, and B is the branching ratio of the

emission line at energy E, Q is given by $T \times A \times B$.

5.4.77 <FWHMCalibration>

- Parent: <RadInstrumentData>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <EnergyValues>, <FWHMValues>, <FWHMUncertaintyValues>, <CalibrationDateTime>
- Occurrences: 0, many
- Units: Not applicable
- Description: The FWHM calibration for a gamma radiation detector; i.e., FWHM as a function of energy.
- Usage: If *FWHMCalibration* is present, then child elements *EnergyValues* and *FWHMValues* shall be present and the number of entries and order in both elements shall be the same.

5.4.78 <FWHMUncertaintyValues>

- Parent: <FWHMCalibration>
- Element data type: NonNegativeDoubleList
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be keV.
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: keV
- Description: A list of the 1-sigma absolute uncertainties in units of keV, in the FWHM values contained in the *FWHMValues* element list. The number and order of corresponding values in the *FWHMValues* and *FWHMUncertaintyValues* lists must match.
- Usage: This element provides of means of recording the uncertainty in the corresponding *FWHMValues* element. The uncertainty values shall include all components of the uncertainty.

5.4.79 <FWHMValues>

- Parent: <FWHMCalibration>
- Element data type: PositiveDoubleList
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be keV.
 - Usage: No additional information
- Child Elements: none
- Occurrences: 1, 1
- Units: keV
- Description: A list of FWHM values, in units of keV. The number and order of corresponding values in the *EnergyValues* and *FWHMValues* lists must match.
- Usage: For each peak energy listed in *EnergyValues*, the corresponding entry in *FWHMValues* describes the FWHM peak width in keV.

5.4.80 <GeographicPoint>

- Parents: <Origin>, <SourcePosition>, <StateVector>
- Element data type: Not Applicable
- Attributes:
 - Name: datum
 - Data Type: string
 - Use: optional
 - Description: Identifies the spatial reference system in which geographic coordinates are stated. Default is WGS-84.
 - Usage: No additional information
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be metres (m). This describes the units for *ElevationValue*, *ElevationOffsetValue*, *GeoPointAccuracyValue*, *ElevationAccuracyValue*, and *ElevationOffsetAccuracyValue*.
 - Usage: No additional information
- Child Elements:
 - <LatitudeValue>, <LongitudeValue>, <ElevationValue>, <ElevationOffsetValue>, <GeoPointAccuracyValue>, <ElevationAccuracyValue>, <ElevationOffsetAccuracyValue>
- Occurrences: 0, 1
- Units: Not applicable
- Description: Geographical coordinates providing latitude, longitude, and elevation, and uncertainty of the coordinates.
- Usage: Identifies the georef coordinates of the origin from where the relative measurements to an object are made.

5.4.81 <GeoPointAccuracyValue>

- Parents: <GeographicPoint>
- Element data type: decimal
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: metres (m)
- Description: The estimated 1-sigma positional accuracy in metres (m) of the geographic point described by the latitude and longitude coordinates of the point.
- Usage: This element provides a means of recording the uncertainty in the corresponding *GeographicPoint* element. The value is non-negative, and needs to include all components of the uncertainty.

5.4.82 <GrossCountAnalysisResults>

- Parent: <AnalysisResults>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <AverageCountRateValue>, <AverageCountRateUncertaintyValue>, <MaximumCountRateValue>, <MinimumCountRateValue>, <TotalCountsValue>, <BackgroundCountRateValue>, <BackgroundCountRateUncertaintyValue>, <SourcePosition>, <GrossCountAnalysisResultsExtension>
- Occurrences: 0, 1
- Units: Not applicable
- Description: Results of the analysis of the gross count data for a measured item(s).
- Usage: No additional information

5.4.83 <GrossCountAnalysisResultsExtension>

- Parent: <GrossCountAnalysisResults>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable
- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 standard schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.84 <GrossCounts>

- Parents: <DerivedData>, <RadMeasurement>
- Element data type: Not Applicable
- Attributes:
 - Name: energyWindowsReference
 - Data Type: IDREF
 - Use: optional
 - Description: Identifies the energy window calibration that applies to a particular measurement. If this attribute is omitted, then the *CountsData* element shall contain a single value as if there is a single energy window that covers the entire energy range.
 - Usage: No additional information
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
 - Name: radDetectorInformationReference
 - Data Type: IDREF
 - Use: required
 - Description: Reference to the radiation detector that was used to collect these data.
 - Usage: No additional information
 - Name: radRawGrossCountsReferences
 - Data Type: IDREFS
 - Use: optional
 - Description: Identifies the *GrossCounts* measurement data element(s) used to produce derived data. There shall be no duplicate IDREF values in the list. This attribute is required whenever the element is used within a *DerivedData* block, and prohibited otherwise.
 - Usage: No additional information
- Child Elements:
 - <Remark>, <LiveTimeDuration>, <CountData>, <TotalCountData>
- Occurrences: 0, many
- Units: Not applicable
- Description: Gross counts from a radiation detector.
- Usage: This element can be used by radiation measurement instrument with spectroscopic capabilities, with limited spectroscopic capabilities or without spectroscopic capabilities. Gross counts can be obtained within pre-defined energy windows or over the entire energy range measured by the radiation measurement instrument. Gross counts are accumulated over a time interval or integration time set by the radiation measurement instrument.

5.4.85 <ImageHeightValue>

- Parent: <MultimediaData>

- Element data type: positiveInteger
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be pixel.
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: pixel
- Description: Image height in pixels.
- Usage: If the multimedia item is an image, then this element provides the means to specify the pixel height of the image.

5.4.86 <ImagePerspectiveCode>

- Parent: <MultimediaData>
- Element data type: ImagePerspectiveCodeSimpleType
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Describes the viewing perspective of the subject of image multimedia data.
- Usage: If the multimedia item is an image, then this element provides the means to specify the viewing perspective – e.g. "Front", "Rear". The possible enumeration values are listed in 5.2.5.

5.4.87 <ImageWidthValue>

- Parent: <MultimediaData>
- Element data type: positiveInteger
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be pixel.
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: pixel
- Description: Image width in pixels.
- Usage: If the multimedia item is an image, then this element provides the means to specify the pixel width of the image.

5.4.88 <InCalibrationIndicator>

- Parent: <RadInstrumentQualityControl>
- Element data type: boolean
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: The indication that the radiation measurement instrument is fit for service: true when properly calibrated and considered in service; false otherwise.
- Usage: No additional information

5.4.89 <InclinationValue>

- Parents: <Orientation>
- Element data type: decimal
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be decimal degrees (DECDEG).

- Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: decimal degree (DECDEG)
- Description: The orientation of an object (i.e., radiation measurement instrument, radiation detector, or measured item) with respect to the horizontal plane. Its value is the angle subtended by the line formed by the object's front-to-rear axis and the line formed by the projection of that line onto the horizontal plane. The angle range is from “-90.0” to “+90.0” degrees. A value of zero implies the object's front-to-rear axis is level, i.e., aligned with the horizontal plane; positive values implies the object is pointed up; negative values imply the object is pointed down.
- Usage: Together with the object's location (via either *GeographicPoint* or *RelativeLocation*), *AzimuthValue*, and *RollValue*, this element provides a means to fully describe how an object is placed in space when information regarding such placement is pertinent to a set of measurements or analyses.

5.4.90 <InspectionDateTime>

- Parent: <RadInstrumentQualityControl>
- Element data type: dateTime
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: The date and time at which the radiation measurement instrument's calibration and in-service status were determined.
- Usage: This information can be manually entered by the radiation measurement instrument operator or manufacturer if the system allows for such data input, or it can be automatically checked and recorded by the radiation measurement instrument if such a function is available.

5.4.91 <IntrinsicDoubleEscapePeakEfficiencyCalibration>

- Parent: <RadInstrumentData>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <EnergyValues>, <EfficiencyValues>, <EfficiencyUncertaintyValues>, <CalibrationDateTime>
- Occurrences: 0, many
- Units: Not applicable
- Description: An intrinsic double-escape peak efficiency calibration. The intrinsic double-escape peak efficiency at any value of energy is the ratio of the counts in the double-escape peak of that energy to the number of photons impinging on the radiation detector surface at that energy.
- Usage: Intrinsic double-escape peak efficiency is important in the deconvolution of double-escape peaks with other peaks near the same energy. If Q photons of energy E have impinged on a radiation detector during a collection, and if the net double-escape peak area recorded in the spectrum as a result of those photons is P , the intrinsic double-escape peak efficiency at energy E is given by P/Q .

5.4.92 <IntrinsicFullEnergyPeakEfficiencyCalibration>

- Parent: <RadInstrumentData>
- Element data type: Not Applicable
- Attributes:

- Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <EnergyValues>, <EfficiencyValues>, <EfficiencyUncertaintyValues>, <CalibrationDateTime>
- Occurrences: 0, many
- Units: Not applicable
- Description: An intrinsic full-energy peak efficiency calibration. The intrinsic full-energy peak efficiency at any value of energy is the ratio of the net counts in a peak at that energy to the number of photons impinging on the radiation detector surface at that energy.
- Usage: Intrinsic full-energy peak efficiency is important in the calculation of the source intensity and of the attenuation by intervening materials. If Q photons of energy E have impinged on a radiation detector during a collection, and if the net full-energy peak area recorded in the spectrum as a result of those photons is P, the intrinsic full-energy peak efficiency at energy E is given by P/Q.

5.4.93 <IntrinsicSingleEscapePeakEfficiencyCalibration>

- Parent: <RadInstrumentData>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <EnergyValues>, <EfficiencyValues>, <EfficiencyUncertaintyValues>, <CalibrationDateTime>
- Occurrences: 0, many
- Units: Not applicable
- Description: An intrinsic single-escape peak efficiency calibration. The intrinsic single-escape peak efficiency at any value of energy is the ratio of the counts in the single-escape peak of that energy to the number of photons impinging on the radiation detector surface at that energy.
- Usage: Intrinsic single-escape peak efficiency is important in the deconvolution of single-escape peaks with other peaks near the same energy. If Q photons of energy E have impinged on a radiation detector during a collection, and if the net single-escape peak area recorded in the spectrum as a result of those photons is P, the intrinsic single-escape peak efficiency at energy E is given by P/Q.

5.4.94 <LatitudeValue>

- Parents: <GeographicPoint>
- Element data type: decimal
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be decimal degrees (DECDEG).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 1, 1
- Units: Decimal degrees (DECDEG)

- Description: The latitude of a point on the surface of the earth expressed as geographic coordinates in decimal degrees. Points in the northern hemisphere range from “0.0” to “+90.0” degrees. Points in the southern hemisphere range from “0.0” to “-90.0”.
- Usage: This element is used with *Longitude* to describe the absolute location of an object (i.e., radiation measurement instrument, radiation detector, measured item), nuclide source, or a reference point.

5.4.95 <LiveTimeDuration>

- Parents: <GrossCounts>, <Spectrum>
- Element data type: duration
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: The duration during which a detection assembly is sensitive to the input signal. The value of *LiveTimeDuration* is always less than or equal to the value of *RealTimeDuration*, because it does not include the time that the radiation detector was unable to respond due to the processing of events.
- Usage: This information shall be entered using the time format described in 5.1.1.

5.4.96 <LocationDescription>

- Parents: <SourcePosition>, <StateVector>
- Element data type: NonBlankString
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: A free-form text description of the location of an object (e.g. radiation measurement instrument, radiation detector, or measured item) or nuclide source.
- Usage: No additional information

5.4.97 <LongitudeValue>

- Parents: <GeographicPoint>
- Element data type: decimal
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be decimal degrees (DECDEG).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 1, 1
- Units: Decimal degrees (DECDEG)
- Description: The longitude of a point on the surface of the earth expressed as geographic coordinates in decimal degrees. Points east of the prime meridian range from “0.0” to “+180.0” degrees. Points west of the prime meridian range from “0.0” to “-180.0”.
- Usage: This element is used with *Latitude* to describe the absolute location of an object (i.e., radiation measurement instrument, radiation detector, measured item), nuclide source position, or a reference point.

5.4.98 <MaximumCountRateValue>

- Parent: <GrossCountAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be counts per second (cps).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1

- Units: counts per second (cps)
- Description: The maximum count rate observed over all measurements input to *AnalysisResults*, in counts per second.
- Usage: No additional information

5.4.99 <MaximumDoseRateValue>

- Parent: <DoseAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be microsieverts per hour ($\mu\text{Sv/h}$).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: microsieverts per hour ($\mu\text{Sv/h}$)
- Description: The maximum ambient dose equivalent rate observed over all measurements input to *AnalysisResults*, in microsieverts per hour ($\mu\text{Sv/h}$).
- Usage: See the definition of ambient dose equivalent in 3.1 and Annex J.

5.4.100 <MaximumExposureRateValue>

- Parent: <ExposureAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be milliroentgen per hour (mR/h).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: milliroentgen per hour (mR/h)
- Description: The maximum exposure rate observed over all measurements input to *AnalysisResults*, in milliroentgen per hour (mR/h).
- Usage: See the definition of exposure in 3.1 and Annex J.

5.4.101 <MeasurementClassCode>

- Parents: <DerivedData>, <RadMeasurement>
- Element data type: MeasurementClassCodeSimpleType
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: Indicates whether the data are a measurement of an item (Foreground), an environmental background (Background), a calibration source (Calibration), the intrinsic activity of the radiation measurement instrument (IntrinsicActivity), or not specified (NotSpecified).
- Usage: The possible enumeration values are listed in 5.2.6.

5.4.102 <MinimumCountRateValue>

- Parent: <GrossCountAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be counts per second (cps).
 - Usage: No additional information
- Child Elements: none

- Occurrences: 0, 1
- Units: counts per second (cps)
- Description: The minimum count rate observed over all measurements input to *AnalysisResults*, in counts per second.
- Usage: No additional information

5.4.103 <MinimumDoseRateValue>

- Parent: <DoseAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be microsieverts per hour ($\mu\text{Sv/h}$).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: microsieverts per hour ($\mu\text{Sv/h}$)
- Description: The minimum ambient dose equivalent rate observed over all measurements input to *AnalysisResults*, in microsieverts per hour ($\mu\text{Sv/h}$).
- Usage: See the definition of ambient dose equivalent in 3.1 and Annex J.

5.4.104 <MinimumExposureRateValue>

- Parent: <ExposureAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be milliroentgen per hour (mR/h).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: milliroentgen per hour (mR/h)
- Description: The minimum exposure rate observed over all measurements input to *AnalysisResults*, in milliroentgen per hour (mR/h).
- Usage: See the definition of exposure in 3.1 and Annex J.

5.4.105 <MultimediaCaptureDuration>

- Parent: <MultimediaData>
- Element data type: duration
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Total duration of time covered by the data recorded by a multimedia device.
- Usage: No additional information

5.4.106 <MultimediaCaptureStartDateTime>

- Parent: <MultimediaData>
- Element data type: dateTime
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Date-time at which capture of the multimedia data was started.
- Usage: No additional information

5.4.107 <MultimediaData>

- Parent: <RadInstrumentData>

- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
 - Name: radItemInformationReferences
 - Data Type: IDREF
 - Use: optional
 - Description: Identifies the *RadItemInformation* elements that are the object of the radiation measurement. There shall be no duplicate IDREF values in the list.
 - Usage: No additional information
 - Name: sequenceNumber
 - Data Type: positiveInteger
 - Use: optional
 - Description: Determines the processing order of multiple *MultimediaData* elements; the elements should be processed in increasing order of this value.
 - Usage: Typically used when there is more than one image file and they need to be ordered in some sequence.
- Child Elements:
 - <Remark>, <MultimediaDataDescription>, Choice of {<BinaryUTF8Object>
<BinaryHexObject> <BinaryBase64Object>}, <MultimediaCaptureStartDateTime>,
<MultimediaCaptureDuration>, <MultimediaFileURI>, <MultimediaFileSizeValue>,
<MultimediaDataMIMEKind>, <EncodingMIMEKind>, <MultimediaDeviceCategoryCode>,
<MultimediaDeviceIdentifier>, <ImagePerspectiveCode>, <ImageWidthValue>,
<ImageHeightValue>, <MultimediaDataExtension>
- Occurrences: 0, many
- Units: Not applicable
- Description: Multimedia data – e.g. images, sound clips, movies, – regarding a measured item or a measurement environment.
- Usage: This element applies to radiation measurement instruments or detectors equipped with a multi-media device, such as a camera, OCR, or license plate reader, that provides data that are an important supplement to the radiation measurement.

5.4.108 <MultimediaDataDescription>

- Parent: <MultimediaData>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Free-form text describing the contents or any other aspects of the multimedia data.
- Usage: No additional information

5.4.109 <MultimediaDataExtension>

- Parent: <MultimediaData>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable
- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 standard schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without

violating the standard.

5.4.110 <MultimediaDataMIMEKind>

- Parent: <MultimediaData>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Media types are listed in [43]. If the media type is not listed, then describe the media type using free-form text.
- Usage: Use media types as listed in [43]. If the media type is not listed, then describe the media type using free-form text.

5.4.111 <MultimediaDeviceCategoryCode>

- Parent: <MultimediaData>
- Element data type: MultimediaDeviceCategoryCodeSimpleType
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: The kind of device that recorded the multimedia data.
- Usage: The possible enumeration values are listed in 5.2.7.

5.4.112 <MultimediaDeviceIdentifier>

- Parent: <MultimediaData>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Identification (e.g. serial number) of the device that recorded the multimedia data.
- Usage: No additional information

5.4.113 <MultimediaFileSizeValue>

- Parent: <MultimediaData>
- Element data type: positiveInteger
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: kilobytes, kB
- Description: Size of a multimedia file in kilobytes (kB).
- Usage: No additional information

5.4.114 <MultimediaFileURI>

- Parent: <MultimediaData>
- Element data type: anyURI
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: The location of the file containing the multimedia data, if the data are not included within the contents of the *MultimediaData* element.
- Usage: The recorded multimedia data, such as an image, may also be included within the *MultimediaData* element using *BinaryBase64Object*, *BinaryHexObject*, or *BinaryUTF8Object* as appropriate.

5.4.115 <Nuclide>

- Parent: <NuclideAnalysisResults>
- Element data type: Not Applicable
- Attributes:

- Name: id
- Data Type: ID
- Use: optional
- Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
- Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <NuclideIdentifiedIndicator>, <NuclideName>, <NuclideActivityValue>, <NuclideActivityUncertaintyValue>, <NuclideIDConfidenceDescription>, <NuclideIDConfidenceUncertaintyValue>, <NuclideIDConfidenceValue>, <NuclideMinimumDetectableActivityValue>, <NuclideCategoryDescription>, <NuclideSourceGeometryCode>, <SourcePosition>, <NuclideShieldingAtomicNumber>, <NuclideShieldingArealDensityValue>, <NuclideExtension>
- Occurrences: 0, many
- Units: Not applicable
- Description: The analysis results for a single radionuclide.
- Usage: If more than one radionuclide is identified for an item measurement, then more than one *Nuclide* element will be present, one for each radionuclide identified.

5.4.116 <NuclideActivityUncertaintyValue>

- Parent: <Nuclide>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be kilobecquerel (kBq) units.
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: kilobecquerel (kBq)
- Description: 1-sigma absolute uncertainty in the value of *NuclideActivityValue*, expressed in kilobecquerel (kBq) units.
- Usage: This element provides for reporting the uncertainty in the corresponding *NuclideActivityValue*. The uncertainty value shall include all components of the uncertainty.

5.4.117 <NuclideActivityValue>

- Parent: <Nuclide>
- Element data type: double
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be kilobecquerel (kBq) units.
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: kilobecquerel (kBq)
- Description: The calculated activity of the nuclide at the measurement time, expressed in kilobecquerel (kBq) units.
- Usage: No additional information

5.4.118 <NuclideAnalysisReducedChiSquareValue>

- Parent: <NuclideAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1

- Units: Not applicable
- Description: The difference between the observed data and predicted values, normalized to an expected value of unity.
- Usage: The reduced chi square is a commonly used measure of the accuracy of many types of data analysis. If the reduced chi square is close to unity then the predicted values are a good match to the data.

5.4.119 <NuclideAnalysisResults>

- Parent: <AnalysisResults>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <Nuclide>, <NuclideAnalysisReducedChiSquareValue>, <NuclideAnalysisResultsExtension>
- Occurrences: 0, 1
- Units: Not applicable
- Description: The results of radionuclide analysis.
- Usage: Within *NuclideAnalysisResults*, each individual nuclide that results from analysis of a *RadMeasurement*, *RadMeasurementGroup*, and/or *DerivedData*, is described by a separate *Nuclide* element.

5.4.120 <NuclideAnalysisResultsExtension>

- Parent: <NuclideAnalysisResults>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable
- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 standard schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.121 <NuclideCategoryDescription>

- Parent: <Nuclide>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Provides documentation regarding the category of the nuclide.
- Usage: Typical category descriptions might include "SNM", "Industrial", "NORM", and "Medical". Because the user's idea of a category is subjective, this standard provides this element as a convenience but does not specify which nuclides belong to specific categories, and does not enumerate the categories themselves.

5.4.122 <NuclideExtension>

- Parent: <Nuclide>
- Element data type: Abstract
- Attributes: none
- Child Elements: none

- Occurrences: Not applicable
- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 standard schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.123 <NuclideIDConfidenceDescription>

- Parent: <Nuclide>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: A free-form text description of the confidence in the identification status of this nuclide; for example, Low, Medium, High.
- Usage: No additional information

5.4.124 <NuclideIDConfidenceUncertaintyValue>

- Parent: <Nuclide>
- Element data type: Percent
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: 1-sigma absolute uncertainty in the value of *NuclideIDConfidenceValue*.
- Usage: No additional information

5.4.125 <NuclideIDConfidenceValue>

- Parent: <Nuclide>
- Element data type: Percent
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Indication of confidence ranging from "0.0" to "100.0" percent, in the identification status of a nuclide, where increasing values indicate more certainty that the nuclide is present. The interpretation of this value is dependent on the characteristics of the nuclide identification algorithm.
- Usage: No additional information

5.4.126 <NuclideIdentifiedIndicator>

- Parent: <Nuclide>
- Element data type: boolean
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: Indicates whether the nuclide was identified by the analysis; it is true if identified, false otherwise.
- Usage: A *Nuclide* element may be present and provide information about the analysis, whether or not the algorithm(s) decide to declare the particular radionuclide as "identified".

5.4.127 <NuclideMinimumDetectableActivityValue>

- Parent: <Nuclide>
- Element data type: PositiveDouble
- Attributes:
 - Name: units
 - Data Type: token

- Use: optional
- Description: The value's unit of measure, which must be kilobecquerel (kBq) units.
- Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: kilobecquerel (kBq)
- Description: Minimum detectable activity (MDA) of the nuclide, expressed in kilobecquerel (kBq) units.
- Usage: This element provides the means to record the minimum detectable activity (MDA) for the nuclide. The MDA shall be given as of the start of the measurement.

5.4.128 <NuclideName>

- Parent: <Nuclide>
- Element data type: NonBlankString
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: Name of the nuclide.
- Usage: The name shall be formed as described in 5.1.3.

5.4.129 <NuclideShieldingArealDensityValue>

- Parent: <Nuclide>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be g/cm².
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: grams per square centimetres (g/cm²)
- Description: The estimated effective areal density of the material shielding this nuclide, in g/cm².
- Usage: This element provides the means to record the estimate of the density of the shielding material present around the nuclide.

5.4.130 <NuclideShieldingAtomicNumber>

- Parent: <Nuclide>
- Element data type: PositiveDouble
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: The estimated effective atomic number of the material shielding this nuclide.
- Usage: No additional information

5.4.131 <NuclideSourceGeometryCode>

- Parent: <Nuclide>
- Element data type: SourceGeometryCodeSimpleType
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: The assessed geometry of a radiation source.
- Usage: This element provides the analysis algorithm's best estimate of the geometry of the radiation source. Possible enumeration values are listed in 5.2.8 and include "Point" and "Extended".

5.4.132 <OccupancyIndicator>

- Parent: <RadMeasurement>
- Element data type: boolean
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Indicates the presence of a measured item in the field of view of the radiation measurement instrument during the period of time defined by the parent *RadMeasurement* element. It will be True if the radiation measurement instrument detects the presence of an item and false otherwise.
- Usage: This element applies to radiation measurement instruments that can provide information about the presence of a measured item during a radiation measurement.

5.4.133 <Orientation>

- Parents: <StateVector>
- Element data type: Not Applicable
- Attributes: none
- Child Elements:
 - <AzimuthValue>, <InclinationValue>, <RollValue>
- Occurrences: 0, 1
- Units: Not applicable
- Description: The orientation of an object (e.g. radiation measurement instrument, radiation detector, or measured item) in space in terms of an internal frame of reference attached to the object's body and an external frame of reference. The object's internal frame of reference consists of three perpendicular axes: front-back, left-right, and top-bottom. The external frame of reference consists of the horizontal plane and True North. The object's orientation is expressed in the terms of three angles: azimuth, inclination, and roll.
- Usage: Together with the object's location (via either *GeographicPoint* or *RelativeLocation*) this element provides a means to fully describe how an object is placed in space when information regarding such placement is pertinent to a set of measurements or analyses. An object's location, *Orientation*, and *SpeedValue* are components of the object's *StateVector*.

5.4.134 <Origin>

- Parents: <RelativeLocation>
- Element data type: Not Applicable
- Attributes:
 - Name: originReference
 - Data Type: IDREF
 - Use: optional
 - Description: Identifies the *RadInstrumentInformation*, *RadDetectorInformation*, or *MeasuredItem* instance to which a particular *Origin* instance applies; i.e., the origin is defined as a radiation measurement instrument, radiation detector, or measured item.
 - Usage: The *originReference* attribute allows the origin for a relative location to be defined as the radiation measurement instrument, a radiation detector, or the measured item. Circular references are not allowed; i.e., an object shall not define its location to be relative to itself. If this attribute is used, then *OriginDescription* shall be included to describe textually the intended origin.
- Child Elements:
 - <GeographicPoint>, <OriginDescription>
- Occurrences: 1, 1
- Units: Not applicable
- Description: Defines the origin of a relative location coordinate system. The coordinates of a point in the relative location system are defined based on this origin.
- Usage: The origin may be defined via a reference to a *RadInstrumentInformation*, *RadDetectorInformation*, *RadItemInformation* element (requires *originReference* attribute), geographical coordinates, or by a textual description, such as "left front bottom corner of a vehicle's front bumper".

5.4.135 <OriginDescription>

- Parents: <Origin>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Free-form text describing the point or object to which the *RelativeLocation* information (distance, inclination angle, azimuth angle) applies.
- Usage: This can be the name of a geographical location (e.g. "Border crossing San Diego") or of a moving object.

5.4.136 <RadAlarm>

- Parent: <AnalysisResults>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Name: radDetectorInformationReferences
 - Data Type: IDREFS
 - Use: required
 - Description: Identifies the *RadDetectorInformation* elements within the N42 XML document for radiation detectors that were used to collect these data. There shall be no duplicate IDREF values in the list.
 - Usage: No additional information
- Child Elements:
 - <Remark>, <RadAlarmDateTime>, <RadAlarmCategoryCode>, <RadAlarmDescription>, <AlarmAudibleIndicator>, <RadAlarmLightColor>, <RadAlarmEnergyWindowIndices>, <RadAlarmExtension>
- Occurrences: 0, many
- Units: Not applicable
- Description: Describes a radiation alarm that was issued based on the measurement(s) collected on the measured item(s).
- Usage: This element provides a means to indicate an alarm condition or state. If an alarm is based on a single measurement, the parent *AnalysisResult* would reference the particular *RadMeasurement* or *DerivedData* element. If an alarm is based on a set of measurements, the parent *AnalysisResult* would reference a list of *RadMeasurement*, *DerivedData*, or *RadMeasurementGroup* elements that identifies the multiple measurement sources. Multiple alarms can be raised as a result of a single analysis or set of data; for example, there could be simultaneous gamma and neutron alarms, each represented by a *RadAlarm* element.

5.4.137 <RadAlarmCategoryCode>

- Parent: <RadAlarm>
- Element data type: RadAlarmCategoryCodeSimpleType
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: The category of radiation alarm (e.g. Neutron).
- Usage: The possible enumeration values are listed in 5.2.9. If "Other" is selected, then the *RadAlarmDescription* element shall provide a description of the alarm.

5.4.138 <RadAlarmDateTime>

- Parent: <RadAlarm>

- Element data type: dateTime
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: The date and time of the alarm.
- Usage: This element describes the onset date/time of the specified alarm; this will generally be the time at which the system annunciated/displayed the alarm or determined that the alarm condition exists.

5.4.139 <RadAlarmDescription>

- Parent: <RadAlarm>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: A free-form description of the radiation alarm.
- Usage: This element describes the specific type of alarm condition conveyed by this *RadAlarm*; e.g. "Gamma gross count", "Spectrum anomaly", "High background counts", "Over range", "SNM", "Medical". This element is required if the *RadAlarmCategoryCode* element is "Other".

5.4.140 <RadAlarmEnergyWindowIndices>

- Parent: <RadAlarm>
- Element data type: PositiveIntegerList
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: If applicable, this is a list of one or more indices that indicate the position(s) of the value(s) in the *WindowStartEnergyValues* and *WindowEndEnergyValues* that triggered alarm(s).
- Usage: The minimum value of any index is 1 and the maximum value is the total number of data values in the start and end energy window elements. Note that only one index value is needed to address a position in the paired lists *WindowStartEnergyValues* and *WindowEndEnergyValues*.

5.4.141 <RadAlarmExtension>

- Parent: <RadAlarm>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable
- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 standard schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.142 <RadAlarmLightColor>

- Parent: <RadAlarm>
- Element data type: token
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Free-form text describing the color of the light (if any) annunciating the alarm.
- Usage: This element should be used only if the radiation measurement instrument has an alarm light capability. When a system has multiple physical lights, multiple alarms

that occur simultaneously may specify different alarm colors as long as it is clear from *RadAlarmDescription* and/or *RadAlarmCategoryCode* which light is described in each *RadAlarm*.

5.4.143 <RadDetectorCategoryCode>

- Parent: <RadDetectorInformation>
- Element data type: RadDetectorCategoryCodeSimpleType
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: The general category of radiation detected; e.g. Gamma, Neutron.
- Usage: The possible enumeration values are listed in 5.2.10. If "Other" is selected, then the *RadDetectorDescription* element shall provide an indication of the radiation detector category.

5.4.144 <RadDetectorCharacteristics>

- Parents: <RadDetectorInformation>, <RadDetectorState>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, Choice of {<Characteristic> <CharacteristicGroup>}
- Occurrences: 0, many
- Units: Not applicable
- Description: Characteristics of the radiation detector that is not otherwise explicitly addressed in this standard. Each non-standard characteristic consists of name, value, units, and value data class. Characteristics may also be organized in characteristic groups.
- Usage: Use with *RadDetectorState* for characteristics whose values are dynamic, i.e., are measured in the time period spanned by the *RadMeasurement*; otherwise use with *RadDetectorInformation*, for example to report health or status. See the sample document in Annex I for an example of the use of this element. Note: characteristics that already have a representation through specialized elements in this standard (e.g. radiation detector dimensions) shall be used instead of this general-purpose element.

5.4.145 <RadDetectorDepthValue>

- Parent: <RadDetectorInformation>
- Element data type: PositiveDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be centimetres (cm).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: centimetres (cm)
- Description: The depth of a rectangular radiation detector, in centimetres (cm).
- Usage: Together with *RadDetectorLengthValue* and *RadDetectorWidthValue*, this element describes the dimensions of rectangular detectors. For cylindrical detectors, use the *RadDetectorLengthValue* and *RadDetectorDiameterValue* elements.

5.4.146 <RadDetectorDescription>

- Parent: <RadDetectorInformation>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Additional information regarding the radiation detector.
- Usage: This element provides a means to describe details of the radiation detector as free-form text; for example: "60 % HPGe wide-energy detector", "Beta Pancake Probe", "5L PVT slab". If either *RadDetectorCategory* or *RadDetectorKind* is "Other", then *RadDetectorDescription* shall to describe the category, kind, or both.

5.4.147 <RadDetectorDiameterValue>

- Parent: <RadDetectorInformation>
- Element data type: PositiveDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be centimetres (cm).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: centimetres (cm)
- Description: The diameter of a cylindrical radiation detector, in centimetres (cm).
- Usage: Together with the *RadDetectorLengthValue*, this element describes the dimensions of cylindrical radiation detectors. For rectangular radiation detectors, use the *RadDetectorLengthValue*, *RadDetectorWidthValue*, and *RadDetectorDepthValue* elements.

5.4.148 <RadDetectorInformation>

- Parent: <RadInstrumentData>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <RadDetectorName>, <RadDetectorCategoryCode>, <RadDetectorKindCode>, <RadDetectorDescription>, <RadDetectorLengthValue>, <RadDetectorWidthValue>, <RadDetectorDepthValue>, <RadDetectorDiameterValue>, <RadDetectorVolumeValue>, <RadDetectorCharacteristics>, <RadDetectorInformationExtension>
- Occurrences: 1, many
- Units: Not applicable
- Description: Contains information describing a radiation detector.
- Usage: One *RadDetectorInformation* element must be present for each radiation detector that provides measurement information to the N42 XML document.

5.4.149 <RadDetectorInformationExtension>

- Parent: <RadDetectorInformation>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable
- Units: Not applicable

- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 standard schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.150 <RadDetectorKindCode>

- Parent: <RadDetectorInformation>
- Element data type: RadDetectorKindCodeSimpleType
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: The specific kind of radiation detector; e.g. "NaI".
- Usage: The possible enumeration values are listed in 5.2.11. If "Other" is selected, then the *RadDetectorDescription* element shall describe the kind of radiation detector.

5.4.151 <RadDetectorLengthValue>

- Parent: <RadDetectorInformation>
- Element data type: PositiveDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be centimetres (cm).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: centimetres (cm)
- Description: The length of a rectangular or cylindrical radiation detector, in centimetres (cm).
- Usage: This element is the length of a radiation detector. When describing a rectangular radiation detector, use this element along with the *RadDetectorWidthValue* and *RadDetectorDepthValue* elements. When describing a cylindrical radiation detector, use the *RadDetectorLengthValue* and *RadDetectorDiameterValue* elements.

5.4.152 <RadDetectorName>

- Parent: <RadDetectorInformation>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: The name of the radiation detector.
- Usage: This element provides a free-form text name for the radiation detector described in this *RadDetectorInformation* element; for example, "Gamma Front/Right", "Neutron #3".

5.4.153 <RadDetectorState>

- Parent: <RadMeasurement>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Name: radDetectorInformationReference

- Data Type: IDREF
- Use: required
- Description: Identifies the *RadDetectorInformation* element to which the state data applies.
- Usage: No additional information
- Child Elements:
 - <Remark>, <StateVector>, <Fault>, <RadDetectorCharacteristics>, <RadDetectorStateExtension>
- Occurrences: 0, many
- Units: Not applicable
- Description: The current state of a radiation detector in terms of its location (absolute or relative), orientation, altitude, speed, and operating parameters.
- Usage: If the detector's location is different that the instrument location, or if the location of the detector is relevant to the interpretation of the radiation data, then this element can be used to store this kind of information. The detector's current operating parameters can be reported using *RadDetectorCharacteristics* (see 5.4.144).

5.4.154 <RadDetectorStateExtension>

- Parent: <RadDetectorState>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable
- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.155 <RadDetectorVolumeValue>

- Parent: <RadDetectorInformation>
- Element data type: PositiveDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be cubic centimetres (cc).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: cubic centimetres (cc)
- Description: The volume of a radiation detector, in cubic centimetres (cc).
- Usage: No additional information

5.4.156 <RadDetectorWidthValue>

- Parent: <RadDetectorInformation>
- Element data type: PositiveDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be centimetres (cm).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: centimetres (cm)
- Description: The width of a rectangular radiation detector, in centimetres (cm).
- Usage: Together with *RadDetectorLengthValue* and *RadDetectorDepthValue*, this element describes the dimensions of rectangular radiation detectors. For cylindrical radiation

detectors, use the *RadDetectorLengthValue* and *RadDetectorDiameterValue* elements.

5.4.157 <RadInstrumentCharacteristics>

- Parents: <RadInstrumentInformation>, <RadInstrumentState>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, Choice of {<Characteristic> <CharacteristicGroup>}
- Occurrences: 0, many
- Units: Not applicable
- Description: A characteristic of the radiation measurement instrument that is not otherwise explicitly addressed in this standard. Each non-standard characteristic consists of name, value, units tuple.
- Usage: Use with *RadInstrumentState* for characteristics whose values are dynamic, i.e., are measured in the time period spanned by the *RadMeasurement*; otherwise use with *RadInstrumentInformation*. Characteristics that already have a representation through specialized elements in this standard (e.g. radiation measurement instrument model) shall be used instead of this general-purpose element. See the sample document in Annex C for an example of the use of this element.

5.4.158 <RadInstrumentClassCode>

- Parent: <RadInstrumentInformation>
- Element data type: RadInstrumentClassCodeSimpleType
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: Class of radiation measurement instrument.
- Usage: Examples of these classes are: "Portal Monitor", "Radionuclide Identifier", "Personal Radiation Detector", etc. The possible enumeration values are listed in 5.2.12.

5.4.159 <RadInstrumentComponentName>

- Parent: <RadInstrumentVersion>
- Element data type: NonBlankString
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: Name of the radiation detection measurement component.
- Usage: This element shall occur at least once with the value "Software". Other components may also be provided, such as hardware and firmware.

5.4.160 <RadInstrumentComponentVersion>

- Parent: <RadInstrumentVersion>
- Element data type: NonBlankString
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: Version information for a particular radiation measurement instrument component.
- Usage: This element shall appear at least once for the Software version.

5.4.161 <RadInstrumentData>

- Parent: <root>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
 - Name: n42DocDateTime
 - Data Type: dateTime
 - Use: optional
 - Description: Provides the date and time of creation of this particular N42 XML document.
 - Usage: No additional information
 - Name: n42DocUUID
 - Data Type: string
 - Use: optional
 - Description: A universally unique identifier for this particular N42 XML document. See ISO/IEC 11578.
 - Usage: The UUID uniquely identifies each N42 XML document, independent of the content of that document. Must be formatted as specified in ISO/IEC 11578.
- Child Elements:
 - <Remark>, <RadInstrumentDataCreatorName>, <RadInstrumentInformation>, <RadDetectorInformation>, <RadItemInformation>, Choice of {<RadMeasurement> <RadMeasurementGroup> <EnergyCalibration> <FWHMCalibration> <TotalEfficiencyCalibration> <FullEnergyPeakEfficiencyCalibration> <IntrinsicFullEnergyPeakEfficiencyCalibration> <IntrinsicSingleEscapePeakEfficiencyCalibration> <IntrinsicDoubleEscapePeakEfficiencyCalibration> <EnergyWindows> <DerivedData> <AnalysisResults> <MultimediaData>}, <RadInstrumentDataExtension>
- Occurrences: 1, 1
- Units: Not applicable
- Description: The top element of an instance of a radiation measurement instrument's N42 XML document. This element contains all the reported measurement and analysis data, and all the information on the instrument, its radiation detector(s), and the item(s) it measured.
- Usage: Parent element of the N42 XML document that contains the output of the radiation measurement instrument.

5.4.162 <RadInstrumentDataCreatorName>

- Parent: <RadInstrumentData>
- Element data type: NonBlankString
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: The name of the organization that created the N42 XML document.
- Usage: If the N42 XML document has been created by translation from an original data file, include the name of the software that was used and the name and format type of the original data file.

5.4.163 <RadInstrumentDataExtension>

- Parent: <RadInstrumentData>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable

- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.164 <RadInstrumentDescription>

- Parent: <RadInstrumentInformation>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Free-form text describing the radiation measurement instrument.
- Usage: This information can be a general description of the radiation measurement instrument or its use.

5.4.165 <RadInstrumentIdentifier>

- Parent: <RadInstrumentInformation>
- Element data type: NonBlankString
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Identification information for the specific radiation measurement instrument; such as serial number or asset tag number.
- Usage: The identification information shall be unique for a given manufacturer and model of radiation measurement instrument. If a radiation measurement instrument cannot produce a unique identifier, then this element shall be omitted.

5.4.166 <RadInstrumentInformation>

- Parent: <RadInstrumentData>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <RadInstrumentManufacturerName>, <RadInstrumentIdentifier>, <RadInstrumentModelName>, <RadInstrumentDescription>, <RadInstrumentClassCode>, <RadInstrumentVersion>, <RadInstrumentQualityControl>, <RadInstrumentCharacteristics>, <RadInstrumentInformationExtension>
- Occurrences: 1, 1
- Units: Not applicable
- Description: Describes the radiation measurement instrument that collected the data contained in the N42 XML document.
- Usage: No additional information

5.4.167 <RadInstrumentInformationExtension>

- Parent: <RadInstrumentInformation>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable

- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 standard schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.168 <RadInstrumentManufacturerName>

- Parent: <RadInstrumentInformation>
- Element data type: NonBlankString
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: Name of the manufacturer of the radiation measurement instrument.
- Usage: No additional information

5.4.169 <RadInstrumentModeCode>

- Parent: <RadInstrumentState>
- Element data type: RadInstrumentModeCodeSimpleType
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: This element indicates the operating modes of a radiation measurement instrument.
- Usage: This element provides the means to describe the operating scenario in which the radiation measurement instrument collected data. For example, a Mobile System or a Portal Monitor would operate in "Search" mode most of the time. A RID taking a long measurement while the measured item is stationary would be in "LongDwell" mode. The possible enumeration values are listed in 5.2.13. If "Other" is selected, then the *RadInstrumentModeDescription* element shall describe the operating mode.

5.4.170 <RadInstrumentModeDescription>

- Parent: <RadInstrumentState>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Free-form description of the operating mode of the radiation measurement instrument. This element shall be used if *RadInstrumentModeCode* is "Other".
- Usage: No additional information

5.4.171 <RadInstrumentModelName>

- Parent: <RadInstrumentInformation>
- Element data type: NonBlankString
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: The radiation measurement instrument manufacturer's model name, number, or other description of the radiation measurement instrument.
- Usage: No additional information

5.4.172 <RadInstrumentQualityControl>

- Parent: <RadInstrumentInformation>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID

- Use: optional
- Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
- Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <InspectionDateTime>, <InCalibrationIndicator>
- Occurrences: 0, 1
- Units: Not applicable
- Description: The quality control status of the radiation measurement instrument, indicating its fitness for service.
- Usage: This element provides a means of indicating the radiation measurement instrument's calibration and in-service status, and when that status was determined.

5.4.173 <RadInstrumentState>

- Parent: <RadMeasurement>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Name: radInstrumentInformationReference
 - Data Type: IDREF
 - Use: required
 - Description: Identifies the *RadInstrumentInformation* element to which the state data applies.
 - Usage: No additional information
- Child Elements:
 - <Remark>, <RadInstrumentModeCode>, <RadInstrumentModeDescription>, <StateVector>, <Fault>, <RadInstrumentCharacteristics>, <RadInstrumentStateExtension>
- Occurrences: 0, 1
- Units: Not applicable
- Description: The current state of a radiation measurement instrument in terms of its mode of operation, location (absolute or relative), orientation, altitude, speed, and operating parameters.
- Usage: This element should be used if any of the: operating mode, location (absolute or relative), orientation, altitude, or speed of the radiation measurement instrument during the measurement is known (see *RadInstrumentModeCode* and *StateVector* child elements). The instrument's current operating parameters can be reported using *RadInstrumentCharacteristics* (see 5.4.157).

5.4.174 <RadInstrumentStateExtension>

- Parent: <RadInstrumentState>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable
- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.175 <RadInstrumentVersion>

- Parent: <RadInstrumentInformation>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <RadInstrumentComponentName>, <RadInstrumentComponentVersion>
- Occurrences: 1, many
- Units: Not applicable
- Description: Information that describes the versions of the various components of the radiation measurement instrument. At a minimum, there shall be an instance of this element with the component name Software that describes the version of the software and/or firmware that produced the current N42 XML document.
- Usage: A radiation measurement instrument may be composed of many different components: hardware, software, firmware, etc. The *RadInstrumentVersion* element allows the user to capture version information at any desired degree of granularity. To determine N42 file compatibility, the user shall always specify the "Software" component.

5.4.176 <RadItemCharacteristics>

- Parents: <RadItemInformation>, <RadItemState>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, Choice of {<Characteristic> <CharacteristicGroup>}
- Occurrences: 0, many
- Units: Not applicable
- Description: A characteristic of the measured item that is not otherwise explicitly addressed in this standard. Each non-standard characteristic consists of name, value, units tuple.
- Usage: Use with *RadItemState* for characteristics whose values are dynamic, i.e., are measured in the time period spanned by the *RadMeasurement*; otherwise use with *RadItemInformation*. Characteristics that already have a representation through specialized elements in this standard (e.g. *RadItemQuantity*) shall be used instead of this general-purpose element. See the sample document in Annex C for an example of the use of this element.

5.4.177 <RadItemDescription>

- Parent: <RadItemInformation>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Free-form text describing the item being measured.
- Usage: This information is typically entered by the radiation measurement instrument

operator.

5.4.178 <RadItemInformation>

- Parent: <RadInstrumentData>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <RadItemDescription>, <RadItemQuantity>,
<RadItemMeasurementGeometryDescription>, <RadItemCharacteristics>,
<RadItemInformationExtension>
- Occurrences: 0, many
- Units: Not applicable
- Description: Information describing the measured item.
- Usage: Typically, the radiation measurement instrument operator enters information on a measured item.

5.4.179 <RadItemInformationExtension>

- Parent: <RadItemInformation>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable
- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 standard schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.180 <RadItemMeasurementGeometryDescription>

- Parent: <RadItemInformation>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: The free-form text description of the position and/or shape of the geometry used in the measurement of this item; e.g. shape of the item, item orientation relative to the radiation detectors, position of any attenuators used.
- Usage: This element should be used if this information is relevant to the interpretation of the radiation data associated with this measurement. Typically this information is manually entered by the radiation measurement instrument operator.

5.4.181 <RadItemQuantity>

- Parent: <RadItemInformation>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.

- Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <RadItemQuantityValue>, <RadItemQuantityUncertaintyValue>, <RadItemQuantityUnits>
- Occurrences: 0, 1
- Units: Not applicable
- Description: Amount or size of the item being measured, and its uncertainty. The units and interpretation of this value will be application-specific, but will normally be the weight or volume of the measured item, used in the calculation of item activity concentration.
- Usage: This information could be automatically determined by the radiation measurement instrument if equipped with sensors to provide such information (e.g. a weigh scale), or it could be manually entered by the radiation measurement instrument operator.

5.4.182 <RadItemQuantityUncertaintyValue>

- Parent: <RadItemQuantity>
- Element data type: PositiveDouble
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: The 1-sigma absolute uncertainty in *RadItemQuantityValue*.
- Usage: This element provides a way to report the uncertainty in the measured item quantity value. If a radiation measurement instrument reports this uncertainty, the value needs to include all components of the uncertainty.

5.4.183 <RadItemQuantityUnits>

- Parent: <RadItemQuantity>
- Element data type: NonBlankString
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: The unit of measure of the measured item quantity value.
- Usage: This element provides the means to document the units of *RadItemQuantityValue*. While the element can be free-form text, standard units should be used; e.g. "kg", "cc". If the value is unit-less, use "unit-less" as the value for this element.

5.4.184 <RadItemQuantityValue>

- Parent: <RadItemQuantity>
- Element data type: PositiveDouble
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: The amount or size of the item being measured.
- Usage: This element provides a means to record the amount or size of a measured item when that information is available and is pertinent to a set of measurements or analyses.

5.4.185 <RadItemState>

- Parent: <RadMeasurement>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other

- elements to associate the elements.
- Name: *radItemInformationReference*
 - Data Type: IDREF
 - Use: required
 - Description: Identifies the *RadItemInformation* element to which the state data applies.
 - Usage: No additional information
- Child Elements:
 - <Remark>, <StateVector>, <RadItemCharacteristics>, <RadItemStateExtension>
- Occurrences: 0, many
- Units: Not applicable
- Description: The current state of a measured item in terms of its location (absolute or relative), orientation, speed, and other known characteristics.
- Usage: If the measured item's location is different that the instrument location, or if the location of the item is relevant to the interpretation of the radiation data, then this element can be used to report this kind of information. Other information regarding the measured item can be reported using *RadItemCharacteristics* (see 5.4.176).

5.4.186 <RadItemStateExtension>

- Parent: <RadItemState>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable
- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.187 <RadMeasurement>

- Parent: <RadInstrumentData>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Name: *radItemInformationReferences*
 - Data Type: IDREFS
 - Use: optional
 - Description: Identifies the *RadItemInformation* elements that are the object of the radiation measurement. There shall be no duplicate IDREF values in the list.
 - Usage: No additional information
- Name: *radMeasurementGroupReferences*
 - Data Type: IDREFS
 - Use: optional
 - Description: Identifies the *RadMeasurementGroup* element(s) within the N42 XML document that applies to this particular analysis. There shall be no duplicate IDREF values in the list.
 - Usage: The *derivedDataReferences*, *radMeasurementGroupReferences*, and *radMeasurementReferences* attributes are mutually exclusive: this attribute identifies the raw data input to the analysis from one or more *RadMeasurementGroup* elements.
- Child Elements:

- <Remark>, <MeasurementClassCode>, <StartDateTime>, <RealTimeDuration>, <Spectrum>, <GrossCounts>, <DoseRate>, <TotalDose>, <ExposureRate>, <TotalExposure>, <RadInstrumentState>, <RadDetectorState>, <RadItemState>, <OccupancyIndicator>, <RadMeasurementExtension>
- Occurrences: 0, many
- Units: Not applicable
- Description: This element records a measurement at a particular *StartDateTime*, for a *RealTimeDuration*, of a particular *MeasurementClassCode* that consists of readings from any number of one or more of the following:
 - a radiation detector
 - an occupancy sensor
 - a positioning sensor that captures the location of a radiation measurement instrument, radiation detector, or measured item
 - the state of a radiation measurement instrument, radiation detector, or measured item
- Usage: Example: a set of Radiation Portal Monitor (RPM) measurements starting at 17 May 2010 14:57:30.50, each measurement with a duration of 100 milliseconds, from four gamma radiation detectors, eight neutron radiation detectors, a presence sensor (returning a count), and a positioning sensor (returning the position of the vehicle traversing the portal) while the vehicle is in view of the radiation detectors (i.e. Foreground).

5.4.188 <RadMeasurementExtension>

- Parent: <RadMeasurement>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable
- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 standard schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.189 <RadMeasurementGroup>

- Parent: <RadInstrumentData>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
 - Name: radMeasurementGroupUUID
 - Data Type: string
 - Use: optional
 - Description: A universally unique identifier within the N42 XML document for a particular measurement group. See ISO/IEC 11578.
 - Usage: This attribute provides a means to reference a particular measurement group outside the N42 XML document. Must be formatted as specified in ISO/IEC 11578.
- Child Elements:
 - <Remark>, <RadMeasurementGroupDescription>
- Occurrences: 0, many
- Units: Not applicable
- Description: Identifies a group of *RadMeasurements*.
- Usage: Provides a means to reference any number of individual *RadMeasurements* within

the XML document as a single entity. A *RadMeasurement* element may be linked to one or more *RadMeasurementGroup* elements by reference via the *radMeasurementGroupReference* attribute.

5.4.190 <RadMeasurementGroupDescription>

- Parent: <RadMeasurementGroup>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Free-form text describing the *RadMeasurementGroup*.
- Usage: This element provides a means to describe a group of *RadMeasurements* identified as belonging to the same *RadMeasurementGroup*.

5.4.191 <RealTimeDuration>

- Parents: <DerivedData>, <RadMeasurement>
- Element data type: duration
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: Total clock time required to collect the measurement data; the duration shall be greater than zero.
- Usage: This information shall be entered using the time format described in 5.1.1.

5.4.192 <RelativeLocation>

- Parents: <SourcePosition>, <StateVector>
- Element data type: Not Applicable
- Attributes: none
- Child Elements:
 - <RelativeLocationAzimuthValue>, <RelativeLocationInclinationValue>, <DistanceValue>, <Origin>
- Occurrences: 0, 1
- Units: Not applicable
- Description: Describes the location of an object (i.e. radiation measurement instrument, radiation detector, or measured item) or a radiation source relative to a reference point (Origin).
- Usage: No additional information

5.4.193 <RelativeLocationAzimuthValue>

- Parents: <RelativeLocation>
- Element data type: decimal
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be decimal degrees (DECDEG).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: decimal degree (DECDEG)
- Description: The horizontal bearing angle with respect to True North from a reference point (*Origin*) to an object (i.e. instrument, detector, or item) or a nuclide. Its value is the angle subtended by the projection onto the horizontal plane of a straight line from the reference point to the center of the object or nuclide, and a line extending in the forward direction from the reference point. The angle range is from “-180.0” to “+180.0” degrees. A value of zero implies the center of the object or nuclide's body is aligned directly in front of the reference point; positive values imply the object or nuclide is to the right of the reference point; negative values imply the object or nuclide is to the left of the reference point.

- Usage: Together with the *RelativeLocationInclinationValue* and *DistanceValue* child elements of *RelativeLocation*, this element provides a means to describe an object or nuclide's location relative to a reference point (the *Origin* child element of *RelativeLocation*) when such information is pertinent to a set of measurements or analyses.

5.4.194 <RelativeLocationInclinationValue>

- Parents: <RelativeLocation>
- Element data type: decimal
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be decimal degrees (DECDEG).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: decimal degree (DECDEG)
- Description: The vertical bearing angle with respect to the horizontal plane from a reference point (*Origin*) to an object (i.e. instrument, detector, or item) or a nuclide. Its value is the angle subtended by a straight line, running from the center of the reference point to the center of the object or nuclide, and a projection of that line onto the horizontal plane. The angle range is from “-90.0” to “+90.0” degrees. A value of zero implies the center of the object or nuclide is at the same altitude or elevation as the reference point; positive values imply the object or nuclide is higher than the reference point; negative values imply the object or nuclide is lower than the reference point.
- Usage: Together with the *RelativeLocationAzimuthValue* and *DistanceValue* child elements of *RelativeLocation*, this element provides a means to describe an object or nuclide's location relative to a reference point (the *Origin* child element of *RelativeLocation*) when such information is pertinent to a set of measurements or analyses.

5.4.195 <Remark>

- Parents: <AnalysisAlgorithmSetting>, <AnalysisAlgorithmVersion>, <AnalysisResults>, <Characteristic>, <CharacteristicGroup>, <DerivedData>, <DoseAnalysisResults>, <DoseRate>, <EnergyCalibration>, <EnergyWindows>, <ExposureAnalysisResults>, <ExposureRate>, <Fault>, <FullEnergyPeakEfficiencyCalibration>, <FWHMCalibration>, <GrossCountAnalysisResults>, <GrossCounts>, <IntrinsicDoubleEscapePeakEfficiencyCalibration>, <IntrinsicFullEnergyPeakEfficiencyCalibration>, <IntrinsicSingleEscapePeakEfficiencyCalibration>, <MultimediaData>, <Nuclide>, <NuclideAnalysisResults>, <RadAlarm>, <RadDetectorCharacteristics>, <RadDetectorInformation>, <RadDetectorState>, <RadInstrumentCharacteristics>, <RadInstrumentData>, <RadInstrumentInformation>, <RadInstrumentQualityControl>, <RadInstrumentState>, <RadInstrumentVersion>, <RadItemCharacteristics>, <RadItemInformation>, <RadItemQuantity>, <RadItemState>, <RadMeasurement>, <RadMeasurementGroup>, <SourcePosition>, <Spectrum>, <SpectrumPeak>, <SpectrumPeakAnalysisResults>, <TotalEfficiencyCalibration>
- Element data type: string
- Attributes: none
- Child Elements: none
- Occurrences: 0, many
- Units: Not applicable
- Description: A placeholder for comments intended to help the consumer of the data to understand better the information encapsulated by the parent element.
- Usage: The comments should be presented as free form text.

5.4.196 <RollValue>

- Parents: <Orientation>
- Element data type: decimal
- Attributes:
 - Name: units
 - Data Type: token

- Use: optional
- Description: The value's unit of measure, which must be decimal degrees (DECDEG).
- Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: decimal degree (DECDEG)
- Description: The orientation of an object (e.g. radiation detection instrument, radiation detector, or measured item) with respect to the axis running from the front to the back of the object. Its value is the angle subtended by a line defined by the object's left-to-right axis and a line defined by the same axis when it is aligned with the horizontal plane. The angle range is from "-180.0" to "+180.0" degrees. A value of zero implies the object's body is not rotated about the front-to-back axis and its left-to-right axis is aligned with the horizontal plane (though the object may be inclined); positive values are clockwise rotations about the front-to-back axis when viewed from behind the object and looking towards the direction to which the object is pointing; negative values are counterclockwise rotations.
- Usage: Together with the object's location (via either *GeographicPoint* or *RelativeLocation*), *AzimuthValue*, and *InclinationValue*, this element provides a means to fully describe how an object is placed in space when information regarding such placement is pertinent to a set of measurements or analyses.

5.4.197 <SourcePosition>

- Parents: <DoseAnalysisResults>, <ExposureAnalysisResults>, <GrossCountAnalysisResults>, <Nuclide>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, Choice of {<GeographicPoint>, <LocationDescription>, <RelativeLocation>}
- Occurrences: 0, 1
- Units: Not applicable
- Description: The estimated location of a nuclide source by actual geographical coordinates or relative to a reference point.
- Usage: This element provides a means to represent the best estimate as to the position of the radioactive source within the container or conveyance.

5.4.198 <Spectrum>

- Parents: <DerivedData>, <RadMeasurement>
- Element data type: Not Applicable
- Attributes:
 - Name: energyCalibrationReference
 - Data Type: IDREF
 - Use: required
 - Description: Identifies the *EnergyCalibration* element within the N42 XML document that applies to a particular spectrum.
 - Usage: No additional information
 - Name: fullEnergyPeakEfficiencyCalibrationReference
 - Data Type: IDREF
 - Use: optional
 - Description: Identifies the *FullEnergyPeakEfficiencyCalibration* element within the N42 XML document that applies to a particular spectrum.
 - Usage: No additional information
 - Name: FWHMCalibrationReference

- Data Type: IDREF
- Use: optional
- Description: Identifies the *FWHMCalibration* element within the N42 XML document that applies to a particular spectrum.
- Usage: No additional information
- Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Name: intrinsicDoubleEscapePeakEfficiencyCalibrationReference
 - Data Type: IDREF
 - Use: optional
 - Description: Identifies the *IntrinsicDoubleEscapePeakEfficiencyCalibration* element within the N42 XML document that applies to a particular spectrum.
 - Usage: No additional information
- Name: intrinsicFullEnergyPeakEfficiencyCalibrationReference
 - Data Type: IDREF
 - Use: optional
 - Description: Identifies the *IntrinsicFullEnergyPeakEfficiencyCalibration* element within the N42 XML document that applies to a particular spectrum.
 - Usage: No additional information
- Name: intrinsicSingleEscapePeakEfficiencyCalibrationReference
 - Data Type: IDREF
 - Use: optional
 - Description: Identifies the *IntrinsicSingleEscapePeakEfficiencyCalibration* element within the N42 XML document that applies to this spectrum.
 - Usage: No additional information
- Name: radDetectorInformationReference
 - Data Type: IDREF
 - Use: optional
 - Description: Reference to the radiation detector that was used to collect these data.
 - Usage: No additional information
- Name: radRawSpectrumReferences
 - Data Type: IDREFS
 - Use: optional
 - Description: Identifies the *Spectrum* data element(s) used to produce derived data. There shall be no duplicate IDREF values in the list. This attribute is required whenever the element is used within a *DerivedData* block, and is prohibited otherwise.
 - Usage: No additional information
- Name: totalEfficiencyCalibrationReference
 - Data Type: IDREF
 - Use: optional
 - Description: Identifies the *totalEfficiencyCalibration* element within the N42 XML document that applies to this spectrum.
 - Usage: No additional information
- Child Elements:
 - <Remark>, <LiveTimeDuration>, <ChannelData>, <SpectrumExtension>
- Occurrences: 0, many
- Units: Not applicable
- Description: Contains a single spectrum measurement with references to other pertinent information about the measurement.
- Usage: No additional information

5.4.199 <SpectrumExtension>

- Parents: <Spectrum>
- Element data type: Abstract

- Attributes: none
- Child Elements: none
- Occurrences: Not applicable
- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 standard schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.200 <SpectrumPeak>

- Parent: <SpectrumPeakAnalysisResults>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <SpectrumPeakEnergyValue>, <SpectrumPeakExpectedEnergyValue>,
<SpectrumPeakFWHMValue>, <SpectrumPeakNetAreaValue>,
<SpectrumPeakNetAreaUncertaintyValue>, <SpectrumPeakExtension>
- Occurrences: 0, many
- Units: Not applicable
- Description: The spectrum peak analysis results information for a single peak.
- Usage: No additional information

5.4.201 <SpectrumPeakAnalysisResults>

- Parent: <AnalysisResults>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: optional
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <SpectrumPeak>, <SpectrumPeakAnalysisResultsExtension>
- Occurrences: 0, 1
- Units: Not applicable
- Description: The results of spectrum peak analysis; each peak found in the spectrum is described by a *SpectrumPeak* child element.
- Usage: No additional information

5.4.202 <SpectrumPeakAnalysisResultsExtension>

- Parent: <SpectrumPeakAnalysisResults>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable
- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).

- Usage: The N42 standard schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.203 <SpectrumPeakEnergyValue>

- Parent: <SpectrumPeak>
- Element data type: PositiveDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be keV.
 - Usage: No additional information
- Child Elements: none
- Occurrences: 1, 1
- Units: keV
- Description: The measured energy of the spectrum peak, in keV.
- Usage: This element provides the means to record the energy (in keV) at which a peak was found in the spectrum.

5.4.204 <SpectrumPeakExpectedEnergyValue>

- Parent: <SpectrumPeak>
- Element data type: PositiveDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be keV.
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: keV
- Description: The expected energy of the spectrum peak, in keV.
- Usage: This element provides the means to record the energy (in keV) at which this peak was expected to be found in the spectrum. This energy may be different from the energy at which the peak was actually found (*SpectrumPeakEnergyValue*) if the energy calibration is inaccurate or this peak was not generated by the expected nuclide.

5.4.205 <SpectrumPeakExtension>

- Parent: <SpectrumPeak>
- Element data type: Abstract
- Attributes: none
- Child Elements: none
- Occurrences: Not applicable
- Units: Not applicable
- Description: An abstract element serving as a substitution group head enabling extension via additional schema(s).
- Usage: The N42 standard schema includes this abstract element to provide a means for an instrument to report additional data elements and remain N42 compliant. Annex L contains the methods and rules for using this extensibility feature of N42 without violating the standard.

5.4.206 <SpectrumPeakFWHMValue>

- Parent: <SpectrumPeak>
- Element data type: PositiveDouble
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional

- Description: The value's unit of measure, which must be keV.
- Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: keV
- Description: The measured FWHM of the spectrum peak, in keV.
- Usage: No additional information

5.4.207 <SpectrumPeakNetAreaUncertaintyValue>

- Parent: <SpectrumPeak>
- Element data type: NonNegativeDouble
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: The 1-sigma absolute uncertainty in the spectrum peak's net area.
- Usage: If an uncertainty is provided, it shall include all components of the uncertainty in the value of the peak's net area.

5.4.208 <SpectrumPeakNetAreaValue>

- Parent: <SpectrumPeak>
- Element data type: double
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: The net number of counts in the peak; i.e. total counts minus continuum counts. No other adjustment (e.g. environmental background subtraction), should be performed.
- Usage: This element provides the means to report the net area in the peak.

5.4.209 <SpeedValue>

- Parents: <StateVector>
- Element data type: double
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be metres per second (m/s).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: metres per second (m/s)
- Description: The speed of an object (e.g. radiation measurement instrument, radiation detector, or measured item). If an orientation bearing is defined by the presence of the *Orientation* element, then the *SpeedValue* is considered to be along this bearing.
- Usage: Typically the speed is reported by specialized sensors connected to the radiation measurement instrument; e.g. geolocation system, Doppler radar.

5.4.210 <StartDateTime>

- Parents: <DerivedData>, <RadMeasurement>
- Element data type: dateTime
- Attributes: none
- Child Elements: none
- Occurrences: 1, 1
- Units: Not applicable
- Description: Time corresponding to the start of the collection of the data contained in a particular measurement.
- Usage: This information shall be entered using the time format described in 5.1.1.

5.4.211 <StateVector>

- Parents: <RadDetectorState>, <RadInstrumentState>, <RadItemState>
- Element data type: Not Applicable
- Attributes: none
- Child Elements:
 - Choice of {<GeographicPoint> <LocationDescription> <RelativeLocation>}, <Orientation>, <SpeedValue>
- Occurrences: 0, 1
- Units: Not applicable
- Description: State values for a radiation measurement instrument, a radiation detector, or a measured item.
- Usage: The state vector for a radiation measurement instrument, radiation detector, and a measured item is given in terms of location (absolute or relative), orientation, altitude, and speed.

5.4.212 <TotalCountData>

- Parents: <GrossCounts>
- Element data type: NonNegativeDoubleList
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: The total number of counts accumulated since the last radiation detection instrument reset over the entire energy range measured by the radiation detect or within pre-defined energy windows.
- Usage: The number of counts accumulated since the last radiation instrument reset; contrast this to *CountData*, which is the number of counts accumulated in this measurement period. There will be one value for each energy window. Energy windows are defined via an *EnergyWindows* element indicated by the *energyWindowsReference* attribute of the parent *GrossCounts* element. The number and order of values in *TotalCountData* and *EnergyWindows* must match. If there are no energy windows explicitly defined, then implicitly there is a single energy window that covers the entire energy range.

5.4.213 <TotalCountsValue>

- Parent: <GrossCountAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes: none
- Child Elements: none
- Occurrences: 0, 1
- Units: Not applicable
- Description: Total counts observed.
- Usage: No additional information

5.4.214 <TotalDose>

- Parents: <DerivedData>, <RadMeasurement>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Name: radDetectorInformationReference
 - Data Type: IDREF
 - Use: required
 - Description: Reference to the radiation detector that was used to collect these data.
 - Usage: No additional information

- Name: radRawTotalDoseReferences
 - Data Type: IDREFS
 - Use: optional
 - Description: Identifies the *TotalDose* measurement data element(s) used to produce derived data. There shall be no duplicate IDREF values in the list. This attribute is required whenever the element is used within a *DerivedData* block and prohibited otherwise.
 - Usage: No additional information
- Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be microsieverts (μSv).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, many
- Units: microsieverts (μSv)
- Description: The accumulated ambient dose equivalent since the last radiation detection instrument reset, with units microsieverts (μSv).
- Usage: Many radiation measurement instruments provide the total ambient dose equivalent accumulated since the last time the radiation measurement instrument was reset; the ambient dose equivalent is equal to the ambient dose equivalent rate integrated over the time of exposure to the radiation field. This element provides the means to capture this value.

5.4.215 <TotalDoseValue>

- Parent: <DoseAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be microsieverts (μSv).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: microsieverts (μSv)
- Description: The accumulated ambient dose equivalent over all measurements input to *AnalysisResults*, in microsieverts (μSv).
- Usage: This element provides the means to report the total ambient dose equivalent calculated by the analysis; the total ambient dose equivalent is equal to the ambient dose equivalent rate integrated over the time of exposure to the radiation field (i.e. the time period covered by the analysis). See the definition of ambient dose equivalent in 3.1.

5.4.216 <TotalEfficiencyCalibration>

- Parent: <RadInstrumentData>
- Element data type: Not Applicable
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object

- type within the N42 XML document.
- Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Child Elements:
 - <Remark>, <EnergyValues>, <EfficiencyValues>, <EfficiencyUncertaintyValues>, <CalibrationDateTime>
- Occurrences: 0, many
- Units: Not applicable
- Description: A total efficiency calibration. The total efficiency at any value of energy is the ratio of the total recorded pulses in a spectrum to the number of photons emitted from a source at that energy.
- Usage: Total efficiency is important in the calculation of coincidence-summing corrections. If Q photons of energy E are emitted from a source during a collection, and if the total number of pulses recorded in the spectrum as a result of those photons is P, the total efficiency at energy E is given by P/Q.

5.4.217 <TotalExposure>

- Parents: <DerivedData>, <RadMeasurement>
- Element data type: NonNegativeDouble
- Attributes:
 - Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
 - Name: radDetectorInformationReference
 - Data Type: IDREF
 - Use: required
 - Description: Reference to the radiation detector that was used to collect these data.
 - Usage: No additional information
 - Name: radRawTotalExposureReferences
 - Data Type: IDREFS
 - Use: optional
 - Description: Identifies the *TotalExposure* measurement data element(s) used to produce derived data. There shall be no duplicate IDREF values in the list. This attribute is required whenever the element is used within a *DerivedData* block, and prohibited otherwise.
 - Usage: No additional information
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be milliroentgen (mR).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, many
- Units: milliroentgen (mR)
- Description: The accumulated exposure since the last instrument reset, in milliroentgen (mR).
- Usage: Many instruments provide the total exposure accumulated since the last time the instrument was reset; the exposure is equal to the exposure rate integrated over the time of exposure to the radiation field. This element provides the means to capture this value.

5.4.218 <TotalExposureValue>

- Parent: <ExposureAnalysisResults>
- Element data type: NonNegativeDouble
- Attributes:

- Name: id
 - Data Type: ID
 - Use: required
 - Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.
 - Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.
- Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be milliroentgen (mR).
 - Usage: No additional information
- Child Elements: none
- Occurrences: 0, 1
- Units: milliroentgen (mR)
- Description: The accumulated exposure over all measurements input to *AnalysisResults*, in milliroentgen (mR).
- Usage: This element provides the means to report the total exposure calculated by the analysis; the total exposure is equal to the exposure rate integrated over the time of exposure to the radiation field (i.e. the time period covered by the analysis). See the definition of exposure in 3.1.

5.4.219 <WindowEndEnergyValues>

- Parent: <EnergyWindows>
- Element data type: NonNegativeDoubleList
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be keV.
 - Usage: No additional information
- Child Elements: none
- Occurrences: 1, 1
- Units: keV
- Description: The end energy for each of a series of energy windows, in keV.
- Usage: Provides a means to define the end energies when defining a set of energy windows. The number of values in the list must match the number and order of the values in the *WindowStartEnergyValues* element and *CountData* elements that reference the parent *EnergyWindows* element. Furthermore, each end-energy value in a *WindowEndEnergyValues* list shall be larger than its corresponding start-energy value in a *WindowStartEnergyValues* list.

5.4.220 <WindowStartEnergyValues>

- Parent: <EnergyWindows>
- Element data type: NonNegativeDoubleList
- Attributes:
 - Name: units
 - Data Type: token
 - Use: optional
 - Description: The value's unit of measure, which must be keV.
 - Usage: No additional information
- Child Elements: none
- Occurrences: 1, 1
- Units: keV
- Description: The start energy for each of a series of energy windows, in keV.
- Usage: Provides a means to define the start energies when defining a set of energy windows. The number of values in the list must match the number and order of the values in the *WindowEndEnergyValues* element and *CountData* elements that reference the parent *EnergyWindows* element. The start energies shall be in

increasing order of energy. Furthermore, each start-energy value in a *WindowStartEnergyValues* list shall be smaller than its corresponding end-energy value in a *WindowEndEnergyValues* list.

5.5 Attribute reference

This subclause provides the attributes contained in the N42 schema and the names of the elements where they are used.

5.5.1 compressionCode

Data Type: CompressionCode

Use: optional

Description: Indicates the algorithm, if any, by which the channel data have been compressed. If this attribute is omitted, the data have not been compressed. The kinds of data compression are as follows:

- None: the data are not compressed. The number of values in the *ChannelData* element is equal to the number of channels of data represented by the element.
- CountedZeroes: the data have been compressed by the removal of repeated zero values. When a "0" value appears in the *ChannelData* contents, the next value is the number of consecutive zero-value channels beginning with the first zero-value in the sequence. For example, the following 18 channels of uncompressed data:

22 5 0 2 1 0 0 3 4 0 0 0 0 0 0 0 1

would be represented in compressed form by

22 5 0 **1** 2 1 0 **2** 3 4 0 **8** 1

The italicized values in the list show cases where one, two, and eight zeroes have been compressed.

Usage: No additional information

Used By: ChannelData

5.5.2 datum

Data Type: string

Use: optional

Description: Identifies the spatial reference system in which geographic coordinates are stated. Default is WGS-84.

Usage: No additional information

Used By: GeographicPoint

5.5.3 derivedDataReferences

Data Type: IDREFS

Use: optional

Description: Identifies the *DerivedData* element(s) within the N42 XML document that applies to this particular analysis. There shall be no duplicate IDREF values in the list.

Usage: The *derivedDataReferences*, *radMeasurementGroupReferences*, and *radMeasurementReferences* attributes are mutually exclusive: this attribute identifies the derived data input to the analysis from one or more *DerivedData* elements.

Used By: AnalysisResults

5.5.4 energyCalibrationReference

Data Type: IDREF

Use: required

Description: Identifies the *EnergyCalibration* element within the N42 XML document that applies to a particular spectrum.

Usage: No additional information

Used By: Spectrum

5.5.5 energyWindowsReference

Data Type: IDREF

Use: optional

Description: Identifies the energy window calibration that applies to a particular measurement. If this attribute is omitted, then the *CountsData* element shall contain a single value as if there is a single energy window that covers the entire energy range.

Usage: No additional information

Used By: GrossCounts

5.5.6 fullEnergyPeakEfficiencyCalibrationReference

Data Type: IDREF

Use: optional

Description: Identifies the *FullEnergyPeakEfficiencyCalibration* element within the N42 XML document that applies to a particular spectrum.

Usage: No additional information

Used By: Spectrum

5.5.7 FWHMCalibrationReference

Data Type: IDREF

Use: optional

Description: Identifies the *FWHMCalibration* element within the N42 XML document that applies to a particular spectrum.

Usage: No additional information

Used By: Spectrum

5.5.8 groupOutOfLimits

Data Type: boolean

Use: optional

Description: True if the *CharacteristicValue* of one or more of the *Characteristic* in the group, or combinations of the group's *Characteristic* exceeds a control limit high or low value; false otherwise.

Usage: No additional information

Used By: CharacteristicGroup

5.5.9 id

Data Type: ID

Use: optional

Description: Uniquely identifies an instance of an element defined by a complex object type within the N42 XML document.

Usage: This attribute provides the means of assigning a unique identifier to an element. This identifier can then be used in the "reference" attributes of other elements to associate the elements.

Used By: RadInstrumentData; RadInstrumentInformation; RadInstrumentVersion; RadInstrumentQualityControl; RadInstrumentCharacteristics; CharacteristicGroup; RadDetectorInformation; RadDetectorCharacteristics; RadItemInformation; RadItemQuantity; RadItemCharacteristics; RadMeasurement; Spectrum; GrossCounts; DoseRate; TotalDose; ExposureRate; TotalExposure; RadInstrumentState; Fault; RadDetectorState; RadItemState; RadMeasurementGroup; EnergyCalibration; FWHMCalibration; TotalEfficiencyCalibration; FullEnergyPeakEfficiencyCalibration; IntrinsicFullEnergyPeakEfficiencyCalibration; IntrinsicSingleEscapePeakEfficiencyCalibration; IntrinsicDoubleEscapePeakEfficiencyCalibration; EnergyWindows; DerivedData; AnalysisResults; AnalysisAlgorithmVersion; AnalysisAlgorithmSetting; RadAlarm; NuclideAnalysisResults; SourcePosition; SpectrumPeakAnalysisResults; GrossCountAnalysisResults; DoseAnalysisResults; TotalDoseValue; ExposureAnalysisResults; TotalExposureValue; MultimediaData

5.5.10 intrinsicDoubleEscapePeakEfficiencyCalibrationReference

Data Type: IDREF

Use: optional

Description: Identifies the *IntrinsicDoubleEscapePeakEfficiencyCalibration* element within the N42 XML document that applies to a particular spectrum.

Usage: No additional information

Used By: Spectrum

5.5.11 **intrinsicFullEnergyPeakEfficiencyCalibrationReference**

Data Type: IDREF

Use: optional

Description: Identifies the *IntrinsicFullEnergyPeakEfficiencyCalibration* element within the N42 XML document that applies to a particular spectrum.

Usage: No additional information

Used By: Spectrum

5.5.12 **intrinsicSingleEscapePeakEfficiencyCalibrationReference**

Data Type: IDREF

Use: optional

Description: Identifies the *IntrinsicSingleEscapePeakEfficiencyCalibration* element within the N42 XML document that applies to this spectrum.

Usage: No additional information

Used By: Spectrum

5.5.13 **n42DocDateTime**

Data Type: dateTime

Use: optional

Description: Provides the date and time of creation of this particular N42 XML document.

Usage: No additional information

Used By: RadInstrumentData

5.5.14 **n42DocUUID**

Data Type: string

Use: optional

Description: A universally unique identifier for this particular N42 XML document. See ISO/IEC 11578.

Usage: The UUID uniquely identifies each N42 XML document, independent of the content of that document. Must be formatted as specified in ISO/IEC 11578.

Used By: RadInstrumentData

5.5.15 **originReference**

Data Type: IDREF

Use: optional

Description: Identifies the *RadInstrumentInformation*, *RadDetectorInformation*, or *MeasuredItem* instance to which a particular *Origin* instance applies; i.e. the origin is defined as a radiation measurement instrument, radiation detector, or measured item.

Usage: The *originReference* attribute allows the origin for a relative location to be defined as the radiation measurement instrument, a radiation detector, or the measured item. Circular references are not allowed; i.e. an object shall not define its location to be relative to itself. If this attribute is used, then *OriginDescription* shall be included to describe textually the intended origin.

Used By: Origin

5.5.16 **radDetectorInformationReference**

Data Type: IDREF

Use: optional

Description: Reference to the radiation detector that was used to collect these data.

Usage: No additional information

Used By: Spectrum; GrossCounts; DoseRate; TotalDose; ExposureRate; TotalExposure; RadDetectorState

5.5.17 **radDetectorInformationReferences**

Data Type: IDREFS

Use: required

Description: Identifies the *RadDetectorInformation* elements within the N42 XML document for radiation detectors that were used to collect these data. There shall be no duplicate IDREF values in the list.

Usage: No additional information

Used By: RadAlarm

5.5.18 radInstrumentInformationReference

Data Type: IDREF

Use: required

Description: Identifies the *RadInstrumentInformation* element to which the state data applies.

Usage: No additional information

Used By: RadInstrumentState

5.5.19 radItemInformationReference

Data Type: IDREF

Use: required

Description: Identifies the *RadItemInformation* element to which the state data applies.

Usage: No additional information

Used By: RadItemState

5.5.20 radItemInformationReferences

Data Type: IDREFS

Use: optional

Description: Identifies the *RadItemInformation* elements that are the object of the radiation measurement. There shall be no duplicate IDREF values in the list.

Usage: No additional information

Used By: RadMeasurement; MultimediaData

5.5.21 radMeasurementGroupReferences

Data Type: IDREFS

Use: optional

Description: Identifies the *RadMeasurementGroup* element(s) within the N42 XML document that applies to this particular analysis. There shall be no duplicate IDREF values in the list.

Usage: The *derivedDataReferences*, *radMeasurementGroupReferences*, and *radMeasurementReferences* attributes are mutually exclusive: this attribute identifies the raw data input to the analysis from one or more *RadMeasurementGroup* elements.

Used By: RadMeasurement; AnalysisResults

5.5.22 radMeasurementGroupUUID

Data Type: string

Use: optional

Description: A universally unique identifier within the N42 XML document for a particular measurement group. See ISO/IEC 11578.

Usage: This attribute provides a means to reference a particular measurement group outside the N42 XML document. Must be formatted as specified in ISO/IEC 11578.

Used By: RadMeasurementGroup

5.5.23 radMeasurementReferences

Data Type: IDREFS

Use: optional

Description: Identifies the *RadMeasurement* element(s) within the N42 XML document that applies to a particular analysis. There shall be no duplicate IDREF values in the list.

Usage: The *derivedDataReferences*, *radMeasurementGroupReferences*, and *radMeasurementReferences* attributes are mutually exclusive: this attribute identifies the raw data input to the analysis from one or more *RadMeasurementGroup* elements.

Used By: AnalysisResults

5.5.24 radRawDoseRateReferences

Data Type: IDREFS

Use: optional

Description: Identifies the *DoseRate* measurement data element(s) used to produce derived data. There shall be no duplicate IDREF values in the list. This attribute is required whenever the element is used within a *DerivedData* block, but is prohibited otherwise.

Usage: No additional information

Used By: DoseRate

5.5.25 radRawExposureRateReferences

Data Type: IDREFS

Use: optional

Description: Identifies the *ExposureRate* measurement data element(s) used to produce derived data. There shall be no duplicate IDREF values in the list. This attribute is required whenever the element is used within a *DerivedData* block, and prohibited otherwise.

Usage: No additional information

Used By: ExposureRate

5.5.26 radRawGrossCountsReferences

Data Type: IDREFS

Use: optional

Description: Identifies the *GrossCounts* measurement data element(s) used to produce derived data. There shall be no duplicate IDREF values in the list. This attribute is required whenever the element is used within a *DerivedData* block, and prohibited otherwise.

Usage: No additional information

Used By: GrossCounts

5.5.27 radRawSpectrumReferences

Data Type: IDREFS

Use: optional

Description: Identifies the *Spectrum* data element(s) used to produce derived data. There shall be no duplicate IDREF values in the list. This attribute is required whenever the element is used within a *DerivedData* block, and is prohibited otherwise.

Usage: No additional information

Used By: Spectrum

5.5.28 radRawTotalDoseReferences

Data Type: IDREFS

Use: optional

Description: Identifies the *TotalDose* measurement data element(s) used to produce derived data. There shall be no duplicate IDREF values in the list. This attribute is required whenever the element is used within a *DerivedData* block and prohibited otherwise.

Usage: No additional information

Used By: TotalDose

5.5.29 radRawTotalExposureReferences

Data Type: IDREFS

Use: optional

Description: Identifies the *TotalExposure* measurement data element(s) used to produce derived data. There shall be no duplicate IDREF values in the list. This attribute is required whenever the element is used within a *DerivedData* block, and prohibited otherwise.

Usage: No additional information

Used By: TotalExposure

5.5.30 sequenceNumber

Data Type: positiveInteger

Use: optional

Description: Determines the processing order of multiple *MultimediaData* elements; the elements should be processed in increasing order of this value.

Usage: Typically used when there is more than one image file and they need to be ordered in some sequence.

Used By: MultimediaData

5.5.31 totalEfficiencyCalibrationReference

Data Type: IDREF

Use: optional

Description: Identifies the *TotalEfficiencyCalibration* element within the N42 XML document that applies to a particular spectrum.

Usage: No additional information

Used By: Spectrum

5.5.32 units

Data Type: token

Use: optional

Description: The value's unit of measure, which must be centimeters (cm).

Usage: No additional information

Used By: RadDetectorLengthValue; RadDetectorWidthValue; RadDetectorDepthValue; RadDetectorDiameterValue; RadDetectorVolumeValue; DoseRateValue; TotalDose; ExposureRateValue; TotalExposure; GeographicPoint; LatitudeValue; LongitudeValue; n42:RelativeLocationAzimuthValue; n42:RelativeLocationInclinationValue; DistanceValue; n42:AzimuthValue; n42:InclinationValue; RollValue; SpeedValue; EnergyBoundaryValues; EnergyValues; EnergyDeviationValues; FWHMValues; FWHMUncertaintyValues; WindowStartEnergyValues; WindowEndEnergyValues; NuclideActivityValue; NuclideActivityUncertaintyValue; NuclideMinimumDetectableActivityValue; NuclideShieldingAreaDensityValue; SpectrumPeakEnergyValue; SpectrumPeakExpectedEnergyValue; SpectrumPeakFWHMValue; AverageCountRateValue; AverageCountRateUncertaintyValue; MaximumCountRateValue; MinimumCountRateValue; BackgroundCountRateValue; BackgroundCountRateUncertaintyValue; AverageDoseRateValue; AverageDoseRateUncertaintyValue; MaximumDoseRateValue; MinimumDoseRateValue; BackgroundDoseRateValue; BackgroundDoseRateUncertaintyValue; TotalDoseValue; AverageExposureRateValue; AverageExposureRateUncertaintyValue; MaximumExposureRateValue; MinimumExposureRateValue; BackgroundExposureRateValue; BackgroundExposureRateUncertaintyValue; TotalExposureValue; ImageWidthValue; ImageHeightValue

5.5.33 valueDateTime

Data Type: dateTime

Use: optional

Description: DateTime stamp when the characteristic value was sampled.

Usage: No additional information

Used By: Characteristic

5.5.34 valueOutOfLimits

Data Type: boolean

Use: optional

Description: True if the *CharacteristicValue* exceeds a control limit high or low value; false otherwise.

Usage: No additional information

Used By: Characteristic

5.6 Possible data elements by class of radiation measurement instrument

The elements that will be typically present for each class of radiation measurement instrument are given in the examples (Annexes B, C, D, F, G, H, I). Standards defining the performance requirements for the different types of radiation measurement instruments (e.g. IEC 62401, IEC 62533, IEC 62694, IEC 62244, IEC 62327, IEC 62484, and IEC 62618) list the minimum set of data that shall be included in the N42 XML document.

Annex A (normative)

N42 XML Schema

The schema is given below, the file can be found at the URL defined in [1].

```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema targetNamespace="http://physics.nist.gov/N42/2011/N42" version="0.0.54"
xmlns:n42="http://physics.nist.gov/N42/2011/N42"
xmlns:xsd="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified">
  <xsd:annotation>
    <xsd:documentation xml:lang="en">Data format standard for radiation instrument
output</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType name="AnalysisAlgorithmSettingType">
    <xsd:annotation>
      <xsd:documentation>A data type to describing the parameter names and values for
setting an analysis algorithm.</xsd:documentation>
      <xsd:appinfo>
      </xsd:appinfo>
    </xsd:annotation>
    <xsd:complexContent>
      <xsd:extension base="n42:OptIdComplexObjectType">
        <xsd:sequence>
          <xsd:element ref="n42:AnalysisAlgorithmSettingName" minOccurs="1"
maxOccurs="1"/>
          <xsd:element ref="n42:AnalysisAlgorithmSettingValue" minOccurs="1"
maxOccurs="1"/>
          <xsd:element ref="n42:AnalysisAlgorithmSettingUnits" minOccurs="1"
maxOccurs="1"/>
        </xsd:sequence>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>
  <xsd:complexType name="AnalysisAlgorithmVersionType">
    <xsd:annotation>
      <xsd:documentation>A data type for information regarding an analysis algorithm
version.</xsd:documentation>
      <xsd:appinfo>
      </xsd:appinfo>
    </xsd:annotation>
    <xsd:complexContent>
      <xsd:extension base="n42:OptIdComplexObjectType">
        <xsd:sequence>
          <xsd:element ref="n42:AnalysisAlgorithmComponentName" minOccurs="1"
maxOccurs="1"/>
          <xsd:element ref="n42:AnalysisAlgorithmComponentVersion" minOccurs="1"
maxOccurs="1"/>
        </xsd:sequence>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>
  <xsd:simpleType name="AnalysisResultStatusCodeSimpleType">
    <xsd:annotation>
      <xsd:documentation>This list describes the status states of the analysis of a
measurement or measurement group.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:token">
      <xsd:enumeration value="Success">
        <xsd:annotation>
          <xsd:documentation>The analysis was successfully completed.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Failure">
        <xsd:annotation>
          <xsd:documentation>The analysis was not successfully
completed.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:complexType name="AnalysisResultsType">
    <xsd:annotation>
```

```

    <xsd:documentation>A data type to provide information on the results of a radiation
data analysis.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
</xsd:annotation>
<xsd:complexContent>
    <xsd:extension base="n42:OptIdComplexObjectType">
        <xsd:sequence>
            <xsd:element ref="n42:AnalysisStartDateTime" minOccurs="0" maxOccurs="1"/>
            <xsd:element ref="n42:AnalysisComputationDuration" minOccurs="0" maxOccurs="1"/>
            <xsd:element ref="n42:AnalysisAlgorithmName" minOccurs="0" maxOccurs="1"/>
            <xsd:element ref="n42:AnalysisAlgorithmCreatorName" minOccurs="0" maxOccurs="1"/>
            <xsd:element ref="n42:AnalysisAlgorithmDescription" minOccurs="0" maxOccurs="1"/>
            <xsd:element ref="n42:AnalysisAlgorithmVersion" minOccurs="0"
maxOccurs="unbounded"/>
            <xsd:element ref="n42:AnalysisAlgorithmSetting" minOccurs="0"
maxOccurs="unbounded"/>
            <xsd:element ref="n42:AnalysisResultStatusCode" minOccurs="0" maxOccurs="1"/>
            <xsd:element ref="n42:AnalysisConfidenceValue" minOccurs="0" maxOccurs="1"/>
            <xsd:element ref="n42:AnalysisResultDescription" minOccurs="0" maxOccurs="1"/>
            <xsd:element ref="n42:RadAlarm" minOccurs="0" maxOccurs="unbounded"/>
            <xsd:element ref="n42:NuclideAnalysisResults" minOccurs="0" maxOccurs="1"/>
            <xsd:element ref="n42:SpectrumPeakAnalysisResults" minOccurs="0" maxOccurs="1"/>
            <xsd:element ref="n42:GrossCountAnalysisResults" minOccurs="0" maxOccurs="1"/>
            <xsd:element ref="n42:DoseAnalysisResults" minOccurs="0" maxOccurs="1"/>
            <xsd:element ref="n42:ExposureAnalysisResults" minOccurs="0" maxOccurs="1"/>
            <xsd:element ref="n42:Fault" minOccurs="0" maxOccurs="unbounded"/>
            <xsd:element ref="n42:AnalysisResultsExtension" minOccurs="0"
maxOccurs="unbounded"/>
        </xsd:sequence>
        <xsd:attribute name="radMeasurementGroupReferences" type="xsd:IDREFS"
use="optional">
            <xsd:annotation>
                <xsd:documentation>Identifies the RadMeasurementGroup element(s) within the N42
XML document that applies to this particular analysis. There shall be no duplicate
IDREF values in the list.</xsd:documentation>
            </xsd:annotation>
        </xsd:attribute>
        <xsd:attribute name="derivedDataReferences" type="xsd:IDREFS" use="optional">
            <xsd:annotation>
                <xsd:documentation>Identifies the DerivedData element(s) within the N42 XML
document that applies to this particular analysis. There shall be no duplicate IDREF
values in the list.</xsd:documentation>
            </xsd:annotation>
        </xsd:attribute>
        <xsd:attribute name="radMeasurementReferences" type="xsd:IDREFS" use="optional">
            <xsd:annotation>
                <xsd:documentation>Identifies the RadMeasurement element(s) within the N42 XML
document that applies to a particular analysis. There shall be no duplicate IDREF
values in the list.</xsd:documentation>
            </xsd:annotation>
        </xsd:attribute>
    </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:simpleType name="Angle180SimpleType">
    <xsd:annotation>
    </xsd:annotation>
</xsd:annotation>
<xsd:restriction base="xsd:decimal">
    <xsd:maxInclusive value="180.0" fixed="true"/>
    <xsd:minInclusive value="-180.0" fixed="true"/>
</xsd:restriction>
</xsd:simpleType>
<xsd:complexType name="Angle180Type">
    <xsd:annotation>
    </xsd:annotation>
    <xsd:documentation>A data type for an angle measure where the units are decimal
degrees and the values range from +180.0 to -180.0.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
</xsd:annotation>
<xsd:simpleContent>
    <xsd:extension base="n42:Angle180SimpleType">
        <xsd:attribute name="units" type="xsd:token" use="optional">
            <xsd:annotation>
                <xsd:documentation>The values unit of measure, which must be decimal degrees
(DECDEG).</xsd:documentation>
            </xsd:annotation>
        </xsd:attribute>

```

```

    </xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
<xsd:simpleType name="Angle90SimpleType">
  <xsd:annotation>
</xsd:annotation>
<xsd:restriction base="xsd:decimal">
  <xsd:maxInclusive value="90.0" fixed="true"/>
  <xsd:minInclusive value="-90.0" fixed="true"/>
</xsd:restriction>
</xsd:simpleType>
<xsd:complexType name="Angle90Type">
  <xsd:annotation>
    <xsd:documentation>A data type for an inclination measure where the units are
    decimal degrees and the values range from +90.0 to -90.0.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
<xsd:simpleContent>
  <xsd:extension base="n42:Angle90SimpleType">
    <xsd:attribute name="units" type="xsd:token" use="optional">
      <xsd:annotation>
        <xsd:documentation>The values unit of measure, which must be decimal degrees
        (DECDEG).</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
  </xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
<xsd:complexType name="ArealDensityType">
  <xsd:annotation>
    <xsd:documentation>A data type for areal density whose value is nonnegative and
    measured in g/cm^2 units.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
<xsd:simpleContent>
  <xsd:extension base="n42:NonNegativeDoubleSimpleType">
    <xsd:attribute name="units" type="xsd:token" use="optional">
      <xsd:annotation>
        <xsd:documentation>The values unit of measure, which must be
        g/cm^2.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
  </xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
<xsd:complexType name="ChannelDataType">
  <xsd:annotation>
    <xsd:documentation>A data type for spectrum channel data.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
<xsd:simpleContent>
  <xsd:extension base="n42:DoubleListSimpleType">
    <xsd:attribute name="compressionCode" type="n42:CompressionCodeSimpleType"
    use="optional">
      <xsd:annotation>
        <xsd:documentation>Indicates the algorithm, if any, by which the channel data
        have been compressed. If this attribute is omitted, the data have not been compressed.
        The kinds of data compression are as follows:
        - None: the data are not
        compressed. The number of values in the ChannelData element is equal to the number of
        channels of data represented by the element.
        - CountedZeroes: the data have been
        compressed by the removal of repeated zero values. When a 0 value appears in the
        ChannelData contents, the next value is the number of consecutive zero-value channels
        beginning with the first zero-value in the sequence. For example, the following 18
        channels of uncompressed data: 22 5 0 2 1 0 0 3 4 0 0 0 0 0 0 0 1 would
        be represented in compressed form by 22 5 0 1 2 1 0 2 3 4 0 8 1 The
        italicized values in the list show cases where one, two, and eight zeroes have been
        compressed.
      </xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
</xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
<xsd:complexType name="CharacteristicGroupType">
  <xsd:annotation>

```



```

    <xsd:documentation>A data type for a named group of
Characteristic.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
</xsd:annotation>
<xsd:complexContent>
    <xsd:extension base="n42:OptIdComplexObjectType">
        <xsd:sequence>
            <xsd:element ref="n42:CharacteristicGroupName" minOccurs="1" maxOccurs="1"/>
            <xsd:element ref="n42:Characteristic" minOccurs="1" maxOccurs="unbounded"/>
        </xsd:sequence>
        <xsd:attribute name="groupOutOfLimits" type="xsd:boolean" use="optional">
            <xsd:annotation>
                <xsd:documentation>True if theCharacteristicValue of one or more of the
Characteristic in the group, or combinations of the group's Characteristic exceeds a
control limit high or low value; false otherwise.</xsd:documentation>
            </xsd:annotation>
        </xsd:attribute>
    </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="CharacteristicsType">
    <xsd:annotation>
        <xsd:documentation>A data type for Characteristics or groupings of
Characteristics.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
</xsd:annotation>
<xsd:complexContent>
    <xsd:extension base="n42:OptIdComplexObjectType">
        <xsd:sequence>
            <xsd:choice minOccurs="1" maxOccurs="unbounded">
                <xsd:element ref="n42:Characteristic" minOccurs="0" maxOccurs="unbounded"/>
                <xsd:element ref="n42:CharacteristicGroup" minOccurs="0"
maxOccurs="unbounded"/>
            </xsd:choice>
        </xsd:sequence>
    </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="CharacteristicType">
    <xsd:annotation>
        <xsd:documentation>A data type for describing additional characteristics of
something, such as a radiation instrument, detector, or item being inspected. This can
be used to supplement those characteristics specifically defined in this
standard.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
</xsd:annotation>
<xsd:complexContent>
    <xsd:extension base="n42:OptIdComplexObjectType">
        <xsd:sequence>
            <xsd:element ref="n42:CharacteristicName" minOccurs="1" maxOccurs="1"/>
            <xsd:element ref="n42:CharacteristicValue" minOccurs="1" maxOccurs="1"/>
            <xsd:element ref="n42:CharacteristicValueUnits" minOccurs="1" maxOccurs="1"/>
            <xsd:element ref="n42:CharacteristicValueDataClassCode" minOccurs="1"
maxOccurs="1"/>
        </xsd:sequence>
        <xsd:attribute name="valueDateTime" type="xsd:dateTime" use="optional">
            <xsd:annotation>
                <xsd:documentation>DateTime stamp when the characteristic value was
sampled.</xsd:documentation>
            </xsd:annotation>
        </xsd:attribute>
        <xsd:attribute name="valueOutOfLimits" type="xsd:boolean" use="optional">
            <xsd:annotation>
                <xsd:documentation>True if the CharacteristicValue exceeds a control limit high
or low value; false otherwise.</xsd:documentation>
            </xsd:annotation>
        </xsd:attribute>
    </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:simpleType name="CompressionCodeSimpleType">
    <xsd:annotation>
        <xsd:documentation>A data type to identify the algorithm with which spectrum
channel data have been compressed.</xsd:documentation>
    </xsd:annotation>

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<xsd:restriction base="xsd:token">
  <xsd:enumeration value="None">
    <xsd:annotation>
      <xsd:documentation>No compression.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="CountedZeroes">
    <xsd:annotation>
      <xsd:documentation>The data are compressed using the CountedZeroes
algorithm.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
</xsd:restriction>
</xsd:simpleType>
<xsd:complexType name="CountRateCPSType">
  <xsd:annotation>
    <xsd:documentation>A data type for a radiation count rate measure whose value is
positive and expressed in counts per second (cps) units.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:simpleContent>
    <xsd:extension base="n42:NonNegativeDoubleSimpleType">
      <xsd:attribute name="units" type="xsd:token" use="optional">
        <xsd:annotation>
          <xsd:documentation>The values unit of measure, which must be counts per second
(cps).</xsd:documentation>
        </xsd:annotation>
      </xsd:attribute>
    </xsd:extension>
  </xsd:simpleContent>
</xsd:complexType>
<xsd:complexType name="DerivedDataType">
  <xsd:annotation>
    <xsd:documentation>A data type for measurement data artificially created by an
analysis algorithm.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:complexContent>
    <xsd:extension base="n42:ReqIdComplexObjectType">
      <xsd:sequence>
        <xsd:element ref="n42:MeasurementClassCode" minOccurs="1" maxOccurs="1"/>
        <xsd:element ref="n42:StartDateTime" minOccurs="1" maxOccurs="1"/>
        <xsd:element ref="n42:RealTimeDuration" minOccurs="1" maxOccurs="1"/>
        <xsd:element ref="n42:Spectrum" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:element ref="n42:GrossCounts" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:element ref="n42:DoseRate" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:element ref="n42:TotalDose" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:element ref="n42:ExposureRate" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:element ref="n42:TotalExposure" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:element ref="n42:DerivedDataExtension" minOccurs="0" maxOccurs="unbounded"/>
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="DistanceType">
  <xsd:annotation>
    <xsd:documentation>A data type for a distance measure where the units are meters
(m) and the values may not be negative.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:simpleContent>
    <xsd:extension base="n42:NonNegativeDoubleSimpleType">
      <xsd:attribute name="units" type="xsd:token" use="optional">
        <xsd:annotation>
          <xsd:documentation>The values unit of measure, which must be meters
(m).</xsd:documentation>
        </xsd:annotation>
      </xsd:attribute>
    </xsd:extension>
  </xsd:simpleContent>
</xsd:complexType>
<xsd:complexType name="DoseAnalysisResultsType">
  <xsd:annotation>
    <xsd:documentation>A data type to provide information on the results of analysis of
radiation dose data.</xsd:documentation>

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    <xsd:appinfo>
  </xsd:appinfo>
</xsd:annotation>
<xsd:complexContent>
  <xsd:extension base="n42:OptIdComplexObjectType">
    <xsd:sequence>
      <xsd:element ref="n42:AverageDoseRateValue" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:AverageDoseRateUncertaintyValue" minOccurs="0"
maxOccurs="1"/>
      <xsd:element ref="n42:MaximumDoseRateValue" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:MinimumDoseRateValue" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:BackgroundDoseRateValue" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:BackgroundDoseRateUncertaintyValue" minOccurs="0"
maxOccurs="1"/>
      <xsd:element ref="n42:TotalDoseValue" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:SourcePosition" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:DoseAnalysisResultsExtension" minOccurs="0"
maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="DoseRateType">
  <xsd:annotation>
    <xsd:documentation>A data type for radiation dose rate data.</xsd:documentation>
  <xsd:appinfo>
  </xsd:appinfo>
</xsd:annotation>
<xsd:complexContent>
  <xsd:extension base="n42:ReqIdComplexObjectType">
    <xsd:sequence>
      <xsd:element ref="n42:DoseRateValue" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:DoseRateLevelDescription" minOccurs="0" maxOccurs="1"/>
    </xsd:sequence>
    <xsd:attribute name="radRawDoseRateReferences" type="xsd:IDREFS" use="optional">
      <xsd:annotation>
        <xsd:documentation>Identifies the DoseRate measurement data element(s) used to
produce derived data. There shall be no duplicate IDREF values in the list. This
attribute is required whenever the element is used within a DerivedData block, but is
prohibited otherwise.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="radDetectorInformationReference" type="xsd:IDREF"
use="required">
      <xsd:annotation>
        <xsd:documentation>Reference to the radiation detector that was used to collect
these data.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="DoseRateuSvhType">
  <xsd:annotation>
    <xsd:documentation>A data type for radiation dose rate whose value is positive and
expressed in microsieverts per hour (uSv/h) units.</xsd:documentation>
  <xsd:appinfo>
  </xsd:appinfo>
</xsd:annotation>
<xsd:simpleContent>
  <xsd:extension base="n42:NonNegativeDoubleSimpleType">
    <xsd:attribute name="units" type="xsd:token" use="optional">
      <xsd:annotation>
        <xsd:documentation>The values unit of measure, which must be microsieverts per
hour (Sv/h).</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
  </xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
<xsd:simpleType name="DoubleListSimpleType">
  <xsd:annotation>
    <xsd:documentation>A data type for a list of doubles.</xsd:documentation>
  </xsd:annotation>
  <xsd:list itemType="xsd:double"/>
</xsd:simpleType>
<xsd:complexType name="EfficiencyCalibrationType">
  <xsd:annotation>

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    <xsd:documentation>A data type for efficiency calibration.</xsd:documentation>
    <xsd:appinfo>
  </xsd:appinfo>
</xsd:annotation>
<xsd:complexContent>
  <xsd:extension base="n42:ReqIdComplexObjectType">
    <xsd:sequence>
      <xsd:element ref="n42:EnergyValues" minOccurs="1" maxOccurs="1"/>
      <xsd:element ref="n42:EfficiencyValues" minOccurs="1" maxOccurs="1"/>
      <xsd:element ref="n42:EfficiencyUncertaintyValues" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:CalibrationDateTime" minOccurs="0" maxOccurs="1"/>
    </xsd:sequence>
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="EnergiesKeVType">
  <xsd:annotation>
    <xsd:documentation>A data type for an Energy measure whose values are positive and
measured in keV.</xsd:documentation>
    <xsd:appinfo>
  </xsd:appinfo>
</xsd:annotation>
<xsd:simpleContent>
  <xsd:extension base="n42:NonNegativeDoubleListSimpleType">
    <xsd:attribute name="units" type="xsd:token" use="optional">
      <xsd:annotation>
        <xsd:documentation>The values unit of measure, which must be
keV.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
  </xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
<xsd:complexType name="EnergyCalibrationType">
  <xsd:annotation>
    <xsd:documentation>A data type for an energy calibration.</xsd:documentation>
    <xsd:appinfo>
  </xsd:appinfo>
</xsd:annotation>
<xsd:complexContent>
  <xsd:extension base="n42:ReqIdComplexObjectType">
    <xsd:sequence>
      <xsd:choice minOccurs="1" maxOccurs="1">
        <xsd:element ref="n42:CoefficientValues" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:EnergyBoundaryValues" minOccurs="0" maxOccurs="1"/>
      </xsd:choice>
      <xsd:element ref="n42:EnergyValues" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:EnergyDeviationValues" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:CalibrationDateTime" minOccurs="0" maxOccurs="1"/>
    </xsd:sequence>
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="EnergyDeviationsKeVType">
  <xsd:annotation>
    <xsd:documentation>A data type for an Energy Deviation measure whose values can be
positive or negative and measured in keV.</xsd:documentation>
    <xsd:appinfo>
  </xsd:appinfo>
</xsd:annotation>
<xsd:simpleContent>
  <xsd:extension base="n42:DoubleListSimpleType">
    <xsd:attribute name="units" type="xsd:token" use="optional">
      <xsd:annotation>
        <xsd:documentation>The values unit of measure, which must be
keV.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
  </xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
<xsd:complexType name="EnergyWindowsType">
  <xsd:annotation>
    <xsd:documentation>A data type for identifying a set of energy window boundaries
for gross counting radiation detector calibration.</xsd:documentation>
    <xsd:appinfo>
  </xsd:appinfo>
</xsd:annotation>

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<xsd:complexContent>
  <xsd:extension base="n42:ReqIdComplexObjectType">
    <xsd:sequence>
      <xsd:element ref="n42:WindowStartEnergyValues" minOccurs="1" maxOccurs="1"/>
      <xsd:element ref="n42:WindowEndEnergyValues" minOccurs="1" maxOccurs="1"/>
    </xsd:sequence>
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="ExposureAnalysisResultsType">
  <xsd:annotation>
    <xsd:documentation>A data type to provide information on the results of analysis of
radiation exposure data.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:complexContent>
    <xsd:extension base="n42:OptIdComplexObjectType">
      <xsd:sequence>
        <xsd:element ref="n42:AverageExposureRateValue" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:AverageExposureRateUncertaintyValue" minOccurs="0"
maxOccurs="1"/>
        <xsd:element ref="n42:MaximumExposureRateValue" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:MinimumExposureRateValue" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:BackgroundExposureRateValue" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:BackgroundExposureRateUncertaintyValue" minOccurs="0"
maxOccurs="1"/>
        <xsd:element ref="n42:TotalExposureValue" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:SourcePosition" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:ExposureAnalysisResultsExtension" minOccurs="0"
maxOccurs="unbounded"/>
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="ExposureRatemRhType">
  <xsd:annotation>
    <xsd:documentation>A data type for a radiation exposure rate whose value is
positive and expressed in milliroentgen per hour (mR/h) units.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:simpleContent>
    <xsd:extension base="n42:NonNegativeDoubleSimpleType">
      <xsd:attribute name="units" type="xsd:token" use="optional">
        <xsd:annotation>
          <xsd:documentation>The values unit of measure, which must be milliroentgen per
hour (mR/h).</xsd:documentation>
        </xsd:annotation>
      </xsd:attribute>
    </xsd:extension>
  </xsd:simpleContent>
</xsd:complexType>
<xsd:complexType name="ExposureRateType">
  <xsd:annotation>
    <xsd:documentation>A data type for radiation exposure rate
data.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:complexContent>
    <xsd:extension base="n42:ReqIdComplexObjectType">
      <xsd:sequence>
        <xsd:element ref="n42:ExposureRateValue" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:ExposureRateLevelDescription" minOccurs="0" maxOccurs="1"/>
      </xsd:sequence>
      <xsd:attribute name="radDetectorInformationReference" type="xsd:IDREF"
use="required">
        <xsd:annotation>
          <xsd:documentation>Reference to the radiation detector that was used to collect
these data.</xsd:documentation>
        </xsd:annotation>
      </xsd:attribute>
      <xsd:attribute name="radRawExposureRateReferences" type="xsd:IDREFS"
use="optional">
        <xsd:annotation>
          <xsd:documentation>Identifies the ExposureRate measurement data element(s) used
to produce derived data. There shall be no duplicate IDREF values in the list. This

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attribute is required whenever the element is used within a DerivedData block, and
prohibited otherwise.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:simpleType name="FaultSeverityCodeSimpleType">
  <xsd:annotation>
    <xsd:documentation>The seriousness of a fault.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:token">
    <xsd:enumeration value="Fatal">
      <xsd:annotation>
        <xsd:documentation>The problem has caused the immediate termination of the
operation. Data produced by the operation is not trustworthy.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Error">
      <xsd:annotation>
        <xsd:documentation>The problem has cause serious disruption of the operation.
Data produced by the operation is not trustworthy.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Warning">
      <xsd:annotation>
        <xsd:documentation>The problem has caused no or only minor disruption of the
operation; however, a condition exists that should be investigated. Data produced by
the operation may not be trustworthy.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
  </xsd:restriction>
</xsd:simpleType>
<xsd:complexType name="FaultType">
  <xsd:annotation>
    <xsd:documentation>A data type for describing an error that occurred in an
instrument, a specific detector, or during the analysis of data.</xsd:documentation>
  </xsd:annotation>
  <xsd:appinfo>
  </xsd:appinfo>
</xsd:complexType>
<xsd:complexContent>
  <xsd:extension base="n42:OptIdComplexObjectType">
    <xsd:sequence>
      <xsd:element ref="n42:FaultCodeValue" minOccurs="1" maxOccurs="1"/>
      <xsd:element ref="n42:FaultDescription" minOccurs="1" maxOccurs="1"/>
      <xsd:element ref="n42:FaultSeverityCode" minOccurs="1" maxOccurs="1"/>
      <xsd:element ref="n42:FaultExtension" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="FWHMCalibrationType">
  <xsd:annotation>
    <xsd:documentation>A data type for a FWHM calibration.</xsd:documentation>
  </xsd:annotation>
  <xsd:appinfo>
  </xsd:appinfo>
</xsd:complexType>
<xsd:complexContent>
  <xsd:extension base="n42:ReqIdComplexObjectType">
    <xsd:sequence>
      <xsd:element ref="n42:EnergyValues" minOccurs="1" maxOccurs="1"/>
      <xsd:element ref="n42:FWHMValues" minOccurs="1" maxOccurs="1"/>
      <xsd:element ref="n42:FWHMUncertaintyValues" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:CalibrationDateTime" minOccurs="0" maxOccurs="1"/>
    </xsd:sequence>
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="FWHMKeVType">
  <xsd:annotation>
    <xsd:documentation>A data type for a FWHM measure whose values are positive and
measured in keV.</xsd:documentation>
  </xsd:annotation>
  <xsd:appinfo>
  </xsd:appinfo>
</xsd:complexType>
<xsd:simpleContent>
  <xsd:extension base="n42:PositiveDoubleListSimpleType">
    <xsd:attribute name="units" type="xsd:token" use="optional">

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        <xsd:annotation>
          <xsd:documentation>The values unit of measure, which must be
keV.</xsd:documentation>
        </xsd:annotation>
      </xsd:attribute>
    </xsd:extension>
  </xsd:simpleContent>
</xsd:complexType>
<xsd:complexType name="FWHMUncertaintiesKeVType">
  <xsd:annotation>
    <xsd:documentation>A data type for FWHM uncertainty measure whose values are
nonnegative and measured in keV.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:simpleContent>
    <xsd:extension base="n42:NonNegativeDoubleListSimpleType">
      <xsd:attribute name="units" type="xsd:token" use="optional">
        <xsd:annotation>
          <xsd:documentation>The values unit of measure, which must be
keV.</xsd:documentation>
        </xsd:annotation>
      </xsd:attribute>
    </xsd:extension>
  </xsd:simpleContent>
</xsd:complexType>
<xsd:complexType name="GeographicPointType">
  <xsd:annotation>
    <xsd:documentation>A data type for geographical coordinates of a point on the
surface of the earth. For latitudes, positive values correspond to Northern latitudes,
and negative values to Southern; for longitudes, positive values are Eastern longitudes
and negative are Western. The units of measure for elevation and positional accuracy
elements is given by the units attribute.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element ref="n42:LatitudeValue" minOccurs="1" maxOccurs="1"/>
    <xsd:element ref="n42:LongitudeValue" minOccurs="1" maxOccurs="1"/>
    <xsd:element ref="n42:ElevationValue" minOccurs="0" maxOccurs="1"/>
    <xsd:element ref="n42:ElevationOffsetValue" minOccurs="0" maxOccurs="1"/>
    <xsd:element ref="n42:GeoPointAccuracyValue" minOccurs="0" maxOccurs="1"/>
    <xsd:element ref="n42:ElevationAccuracyValue" minOccurs="0" maxOccurs="1"/>
    <xsd:element ref="n42:ElevationOffsetAccuracyValue" minOccurs="0" maxOccurs="1"/>
  </xsd:sequence>
  <xsd:attribute name="datum" type="xsd:string" use="optional">
    <xsd:annotation>
      <xsd:documentation>Identifies the spatial reference system in which geographic
coordinates are stated. Default is WGS-84.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="units" type="xsd:token" use="optional">
    <xsd:annotation>
      <xsd:documentation>The values unit of measure, which must be meters (m). This
describes the units for ElevationValue, ElevationOffsetValue, GeoPointAccuracyValue,
ElevationAccuracyValue, and ElevationOffsetAccuracyValue.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
</xsd:complexType>
<xsd:complexType name="GrossCountAnalysisResultsType">
  <xsd:annotation>
    <xsd:documentation>A data type to provide information on the results of analysis of
radiation gross count data.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:complexContent>
    <xsd:extension base="n42:OptIdComplexObjectType">
      <xsd:sequence>
        <xsd:element ref="n42:AverageCountRateValue" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:AverageCountRateUncertaintyValue" minOccurs="0"
maxOccurs="1"/>
        <xsd:element ref="n42:MaximumCountRateValue" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:MinimumCountRateValue" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:TotalCountsValue" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:BackgroundCountRateValue" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:BackgroundCountRateUncertaintyValue" minOccurs="0"
maxOccurs="1"/>

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        <xsd:element ref="n42:SourcePosition" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:GrossCountAnalysisResultsExtension" minOccurs="0"
maxOccurs="unbounded"/>
    </xsd:sequence>
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="GrossCountsType">
    <xsd:annotation>
        <xsd:documentation>A data type providing gross count radiation
data.</xsd:documentation>
        <xsd:appinfo>
        </xsd:appinfo>
    </xsd:annotation>
<xsd:complexContent>
    <xsd:extension base="n42:ReqIdComplexObjectType">
        <xsd:sequence>
            <xsd:element ref="n42:LiveTimeDuration" minOccurs="1" maxOccurs="1"/>
            <xsd:element ref="n42:CountData" minOccurs="1" maxOccurs="1"/>
            <xsd:element ref="n42:TotalCountData" minOccurs="0" maxOccurs="1"/>
        </xsd:sequence>
        <xsd:attribute name="radRawGrossCountsReferences" type="xsd:IDREFS" use="optional">
            <xsd:annotation>
                <xsd:documentation>Identifies the GrossCounts measurement data element(s) used
to produce derived data. There shall be no duplicate IDREF values in the list. This
attribute is required whenever the element is used within a DerivedData block, and
prohibited otherwise.</xsd:documentation>
            </xsd:annotation>
        </xsd:attribute>
        <xsd:attribute name="energyWindowsReference" type="xsd:IDREF" use="optional">
            <xsd:annotation>
                <xsd:documentation>Identifies the energy window calibration that applies to a
particular measurement. If this attribute is omitted, then the CountsData element shall
contain a single value as if there is a single energy window that covers the entire
energy range.</xsd:documentation>
            </xsd:annotation>
        </xsd:attribute>
        <xsd:attribute name="radDetectorInformationReference" type="xsd:IDREF"
use="required">
            <xsd:annotation>
                <xsd:documentation>Reference to the radiation detector that was used to collect
these data.</xsd:documentation>
            </xsd:annotation>
        </xsd:attribute>
    </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:simpleType name="ImagePerspectiveCodeSimpleType">
    <xsd:annotation>
        <xsd:documentation>This list describes the viewing perspectives for image
multimedia data.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:token">
        <xsd:enumeration value="Front">
            <xsd:annotation>
                <xsd:documentation>The image is a view of the front of the
item.</xsd:documentation>
            </xsd:annotation>
        </xsd:enumeration>
        <xsd:enumeration value="Left Side">
            <xsd:annotation>
                <xsd:documentation>The image is a view of the left side of the
item.</xsd:documentation>
            </xsd:annotation>
        </xsd:enumeration>
        <xsd:enumeration value="Right Side">
            <xsd:annotation>
                <xsd:documentation>The image is a view of the right of the
item.</xsd:documentation>
            </xsd:annotation>
        </xsd:enumeration>
        <xsd:enumeration value="Rear">
            <xsd:annotation>
                <xsd:documentation>The image is a view of the rear of the
item.</xsd:documentation>
            </xsd:annotation>
        </xsd:enumeration>
        <xsd:enumeration value="Top">

```



```

        <xsd:annotation>
          <xsd:documentation>The image is a view of the top of the
item.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Bottom">
        <xsd:annotation>
          <xsd:documentation>The image is a view of the bottom (underside) of the
item.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Interior">
        <xsd:annotation>
          <xsd:documentation>The image is a view of the interior of the
item.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="NA">
        <xsd:annotation>
          <xsd:documentation>Not applicable.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Unknown">
        <xsd:annotation>
          <xsd:documentation>The viewing perspective is unknown.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="MeasurementClassCodeSimpleType">
    <xsd:annotation>
      <xsd:documentation>This list describes the classes of spectrum measurements that a
radiation instrument can acquire for different kinds of radioactive sources or
radiation fields.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:token">
      <xsd:enumeration value="Foreground">
        <xsd:annotation>
          <xsd:documentation>Measurement of an unknown radiation field. The data shall be
recorded without subtraction of environmental background or intrinsic
activity.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Background">
        <xsd:annotation>
          <xsd:documentation>Measurement of environmental background. The data shall be
recorded without subtraction of intrinsic activity.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Calibration">
        <xsd:annotation>
          <xsd:documentation>Measurement to be used for any type of calibration (e.g.,
energy, stabilization, efficiency).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="IntrinsicActivity">
        <xsd:annotation>
          <xsd:documentation>Measurement of the radiation intrinsic to the radiation
instrument, without contribution from the environment or other
sources.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="NotSpecified">
        <xsd:annotation>
          <xsd:documentation>The object being measured by the instrument cannot be
specified by the user or radiation instrument.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:complexType name="MultimediaDataType">
    <xsd:annotation>
      <xsd:documentation>A data type to provide data about a multimedia file, and
optionally inclusion of the file content within the instant xml
document.</xsd:documentation>
    </xsd:annotation>
    <xsd:appinfo>
      </xsd:appinfo>
    </xsd:annotation>

```

```

<xsd:complexContent>
  <xsd:extension base="n42:OptIdComplexObjectType">
    <xsd:sequence>
      <xsd:element ref="n42:MultimediaDataDescription" minOccurs="0" maxOccurs="1"/>
      <xsd:choice minOccurs="0" maxOccurs="unbounded">
        <xsd:element ref="n42:BinaryUTF8Object" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:BinaryHexObject" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:BinaryBase64Object" minOccurs="0" maxOccurs="1"/>
      </xsd:choice>
      <xsd:element ref="n42:MultimediaCaptureStartDateTime" minOccurs="0"
maxOccurs="1"/>
      <xsd:element ref="n42:MultimediaCaptureDuration" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:MultimediaFileURI" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:MultimediaFileSizeValue" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:MultimediaDataMIMEKind" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:EncodingMIMEKind" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:MultimediaDeviceCategoryCode" minOccurs="0"
maxOccurs="1"/>
      <xsd:element ref="n42:MultimediaDeviceIdentifier" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:ImagePerspectiveCode" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:ImageWidthValue" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:ImageHeightValue" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:MultimediaDataExtension" minOccurs="0"
maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="radItemInformationReferences" type="xsd:IDREF"
use="optional">
      <xsd:annotation>
        <xsd:documentation>Identifies the RadItemInformation elements that are the
object of the radiation measurement. There shall be no duplicate IDREF values in the
list.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="sequenceNumber" type="xsd:positiveInteger" use="optional">
      <xsd:annotation>
        <xsd:documentation>Determines the processing order of multiple MultimediaData
elements; the elements should be processed in increasing order of this
value.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:simpleType name="MultimediaDeviceCategoryCodeSimpleType">
  <xsd:annotation>
    <xsd:documentation>A data type for the kind of devices that can record multimedia
data.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:token">
    <xsd:enumeration value="Audio">
      <xsd:annotation>
        <xsd:documentation>A device that records audible sounds, such as
voice.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Camera">
      <xsd:annotation>
        <xsd:documentation>A camera that captures images on film.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Camera-D">
      <xsd:annotation>
        <xsd:documentation>A camera that captures images on digital/electronic
media.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="LPR">
      <xsd:annotation>
        <xsd:documentation>License Plate Reader</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="NII">
      <xsd:annotation>
        <xsd:documentation>Non-Intrusive Imaging</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="OCR">
      <xsd:annotation>

```

```

        <xsd:documentation>Optical Character Recognition</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Other">
      <xsd:annotation>
        <xsd:documentation>Other</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Reader">
      <xsd:annotation>
        <xsd:documentation>A device to create digital data from a physical/visual form
of the data. </xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="RFID">
      <xsd:annotation>
        <xsd:documentation>Radio Frequency Identifier</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Scanner">
      <xsd:annotation>
        <xsd:documentation>A device to create a digital image of printed
material.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Video">
      <xsd:annotation>
        <xsd:documentation>A video recording device that captures images on
film.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Video-D">
      <xsd:annotation>
        <xsd:documentation>A video recording device that captures images on
digital/electronic media.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="VIS">
      <xsd:annotation>
        <xsd:documentation>Visual Inspection System Image</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
  </xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="NonBlankStringSimpleType">
  <xsd:annotation>
    <xsd:documentation>A data type for a string that is not empty and does not consist
of only white space characters.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:string">
    <xsd:pattern value="[\w\d ]*[\w\d\S]+[\w\d ]*">
      <xsd:annotation>
        <xsd:documentation>Eliminates empty strings and strings containing only
whitespaces.</xsd:documentation>
      </xsd:annotation>
    </xsd:pattern>
  </xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="NonNegativeDoubleListSimpleType">
  <xsd:annotation>
    <xsd:documentation>A data type for a list of doubles with value of zero or
greater.</xsd:documentation>
  </xsd:annotation>
  <xsd:list itemType="n42:NonNegativeDoubleSimpleType"/>
</xsd:simpleType>
<xsd:simpleType name="NonNegativeDoubleSimpleType">
  <xsd:annotation>
    <xsd:documentation>A data type for a double with value of zero or
greater.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:double">
    <xsd:minInclusive value="0.0" fixed="true"/>
  </xsd:restriction>
</xsd:simpleType>
<xsd:complexType name="NuclideActivityType">
  <xsd:annotation>
    <xsd:documentation>A data type for Nuclide Activity, expressed in kiloBequerel
(kBq) units.</xsd:documentation>

```

```

        <xsd:appinfo>
      </xsd:appinfo>
    </xsd:annotation>
    <xsd:simpleContent>
      <xsd:extension base="xsd:double">
        <xsd:attribute name="units" type="xsd:token" use="optional">
          <xsd:annotation>
            <xsd:documentation>The values unit of measure, which must be kilobecquerel (kBq)
units.</xsd:documentation>
          </xsd:annotation>
        </xsd:attribute>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
  <xsd:complexType name="NuclideActivityUncertaintyType">
    <xsd:annotation>
      <xsd:documentation>A data type for the uncertainty in the value of
NuclideActivityValue, expressed in kiloBecquerel (kBq) units.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:simpleContent>
    <xsd:extension base="n42:NonNegativeDoubleSimpleType">
      <xsd:attribute name="units" type="xsd:token" use="optional">
        <xsd:annotation>
          <xsd:documentation>The values unit of measure, which must be kilobecquerel (kBq)
units.</xsd:documentation>
        </xsd:annotation>
      </xsd:attribute>
    </xsd:extension>
  </xsd:simpleContent>
</xsd:complexType>
<xsd:complexType name="NuclideAnalysisResultsType">
  <xsd:annotation>
    <xsd:documentation>A data type for information regarding the nuclides identified
(if any) by the analysis algorithm.</xsd:documentation>
  <xsd:appinfo>
  </xsd:appinfo>
</xsd:annotation>
<xsd:complexContent>
  <xsd:extension base="n42:OptIdComplexObjectType">
    <xsd:sequence>
      <xsd:element ref="n42:Nuclide" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:element ref="n42:NuclideAnalysisReducedChiSquareValue" minOccurs="0"
maxOccurs="1"/>
      <xsd:element ref="n42:NuclideAnalysisResultsExtension" minOccurs="0"
maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="NuclideMDAType">
  <xsd:annotation>
    <xsd:documentation>A data type for minimum detectable activity (MDA) of a nuclide,
expressed in kiloBecquerel (kBq) units. </xsd:documentation>
  <xsd:appinfo>
  </xsd:appinfo>
</xsd:annotation>
  <xsd:simpleContent>
    <xsd:extension base="n42:PositiveDoubleSimpleType">
      <xsd:attribute name="units" type="xsd:token" use="optional">
        <xsd:annotation>
          <xsd:documentation>The values unit of measure, which must be kilobecquerel (kBq)
units.</xsd:documentation>
        </xsd:annotation>
      </xsd:attribute>
    </xsd:extension>
  </xsd:simpleContent>
</xsd:complexType>
<xsd:complexType name="NuclideType">
  <xsd:annotation>
    <xsd:documentation>A data type for the analysis results for an identified
nuclide.</xsd:documentation>
  <xsd:appinfo>
  </xsd:appinfo>
</xsd:annotation>
<xsd:complexContent>
  <xsd:extension base="n42:OptIdComplexObjectType">

```

```

    <xsd:sequence>
      <xsd:element ref="n42:NuclideIdentifiedIndicator" minOccurs="1" maxOccurs="1"/>
      <xsd:element ref="n42:NuclideName" minOccurs="1" maxOccurs="1"/>
      <xsd:element ref="n42:NuclideActivityValue" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:NuclideActivityUncertaintyValue" minOccurs="0"
maxOccurs="1"/>
      <xsd:element ref="n42:NuclideMinimumDetectableActivityValue" minOccurs="0"
maxOccurs="1"/>
      <xsd:element ref="n42:NuclideIdentificationConfidence" minOccurs="1"
maxOccurs="3"/>
      <xsd:element ref="n42:NuclideCategoryDescription" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:NuclideSourceGeometryCode" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:SourcePosition" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:NuclideShieldingAtomicNumber" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:NuclideShieldingArealDensityValue" minOccurs="0"
maxOccurs="1"/>
      <xsd:element ref="n42:NuclideExtension" minOccurs="0" maxOccurs="1"/>
    </xsd:sequence>
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="OptIdComplexObjectType">
  <xsd:annotation>
    <xsd:documentation>A base type for providing a Remark and an optional id via
inheritance to applicable Types.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element ref="n42:Remark" minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
  <xsd:attribute name="id" type="xsd:ID" use="optional">
    <xsd:annotation>
      <xsd:documentation>Uniquely identifies an instance of an element defined by a
complex object type within the N42 XML document.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
</xsd:complexType>
<xsd:complexType name="OrientationType">
  <xsd:annotation>
    <xsd:documentation>A data type for describing the spatial orientation of an
object.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element ref="n42:AzimuthValue" minOccurs="1" maxOccurs="1"/>
    <xsd:element ref="n42:InclinationValue" minOccurs="0" maxOccurs="1"/>
    <xsd:element ref="n42:RollValue" minOccurs="0" maxOccurs="1"/>
  </xsd:sequence>
</xsd:complexType>
<xsd:complexType name="OriginType">
  <xsd:annotation>
    <xsd:documentation>A data type for the origin of a relative location coordinate
system.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element ref="n42:GeographicPoint" minOccurs="0" maxOccurs="1"/>
    <xsd:element ref="n42:OriginDescription" minOccurs="0" maxOccurs="1"/>
  </xsd:sequence>
  <xsd:attribute name="originReference" type="xsd:IDREF" use="optional">
    <xsd:annotation>
      <xsd:documentation>Identifies the RadInstrumentInformation, RadDetectorInformation,
or MeasuredItem instance to which a particular Origin instance applies; i.e., the
origin is defined as a radiation measurement instrument, radiation detector, or
measured item.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
</xsd:complexType>
<xsd:simpleType name="PercentSimpleType">
  <xsd:annotation>
    <xsd:documentation>A data type for a percent value with range 0.0 to
100.0.</xsd:documentation>
    </xsd:annotation>
  <xsd:restriction base="xsd:double">
    <xsd:maxInclusive value="100.0" fixed="true">

```

```

        <xsd:annotation>
            <xsd:documentation>100 percent</xsd:documentation>
        </xsd:annotation>
    </xsd:maxInclusive>
    <xsd:minInclusive value="0.0" fixed="true">
        <xsd:annotation>
            <xsd:documentation>zero percent</xsd:documentation>
        </xsd:annotation>
    </xsd:minInclusive>
</xsd:restriction>
</xsd:simpleType>
<xsd:complexType name="PixelType">
    <xsd:annotation>
        <xsd:documentation>A data type for an image size measure in pixel
units.</xsd:documentation>
        <xsd:appinfo>
        </xsd:appinfo>
    </xsd:annotation>
    <xsd:simpleContent>
        <xsd:extension base="xsd:positiveInteger">
            <xsd:attribute name="units" type="xsd:token" use="optional">
                <xsd:annotation>
                    <xsd:documentation>The values unit of measure, which must be
pixel.</xsd:documentation>
                </xsd:annotation>
            </xsd:attribute>
        </xsd:extension>
    </xsd:simpleContent>
</xsd:complexType>
<xsd:simpleType name="PositiveDoubleListSimpleType">
    <xsd:annotation>
        <xsd:documentation>A data type for a list of doubles restricted to positive
values.</xsd:documentation>
    </xsd:annotation>
    <xsd:list itemType="n42:PositiveDoubleSimpleType"/>
</xsd:simpleType>
<xsd:simpleType name="PositiveDoubleSimpleType">
    <xsd:annotation>
        <xsd:documentation>A data type for a double with values greater than
zero.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:double">
        <xsd:minExclusive value="0.0" fixed="true"/>
    </xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="PositiveIntegerListSimpleType">
    <xsd:annotation>
        <xsd:documentation>A data type for a list of integers restricted to positive
values.</xsd:documentation>
    </xsd:annotation>
    <xsd:list itemType="xsd:positiveInteger"/>
</xsd:simpleType>
<xsd:complexType name="PositiveLengthCMType">
    <xsd:annotation>
        <xsd:documentation>A data type for a length measure whose value is positive and
expressed in centimeter (cm) units.</xsd:documentation>
        <xsd:appinfo>
        </xsd:appinfo>
    </xsd:annotation>
    <xsd:simpleContent>
        <xsd:extension base="n42:PositiveDoubleSimpleType">
            <xsd:attribute name="units" type="xsd:token" use="optional">
                <xsd:annotation>
                    <xsd:documentation>The values unit of measure, which must be centimeters
(cm).</xsd:documentation>
                </xsd:annotation>
            </xsd:attribute>
        </xsd:extension>
    </xsd:simpleContent>
</xsd:complexType>
<xsd:complexType name="PositiveVolumeCCType">
    <xsd:annotation>
        <xsd:documentation>A data type for a volume measure whose value is positive and
expressed in cubic centimeter (cc) units.</xsd:documentation>
        <xsd:appinfo>
        </xsd:appinfo>
    </xsd:annotation>
    <xsd:simpleContent>

```

```

<xsd:extension base="n42:PositiveDoubleSimpleType">
  <xsd:attribute name="units" type="xsd:token" use="optional">
    <xsd:annotation>
      <xsd:documentation>The values unit of measure, which must be cubic centimeters
(cc).</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
</xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
<xsd:simpleType name="RadAlarmCategoryCodeSimpleType">
  <xsd:annotation>
    <xsd:documentation>A data type for the categories of alarms.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:token">
    <xsd:enumeration value="Neutron">
      <xsd:annotation>
        <xsd:documentation>An alarm indicating presence of neutron
radiation.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Gamma">
      <xsd:annotation>
        <xsd:documentation>An alarm indicating presence of gamma
radiation.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Alpha">
      <xsd:annotation>
        <xsd:documentation>An alarm indicating presence of alpha
radiation.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Beta">
      <xsd:annotation>
        <xsd:documentation>An alarm indicating presence of beta
radiation.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Isotope">
      <xsd:annotation>
        <xsd:documentation>An alarm indicating presence of a
radionuclide.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Other">
      <xsd:annotation>
        <xsd:documentation>An alarm produced by some other means.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
  </xsd:restriction>
</xsd:simpleType>
<xsd:complexType name="RadAlarmType">
  <xsd:annotation>
    <xsd:documentation>A data type for radiation alarm information.</xsd:documentation>
  </xsd:annotation>
  <xsd:appinfo>
    <xsd:documentation>
    </xsd:documentation>
  </xsd:appinfo>
</xsd:annotation>
<xsd:complexContent>
  <xsd:extension base="n42:OptIdComplexObjectType">
    <xsd:sequence>
      <xsd:element ref="n42:RadAlarmDateTime" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:RadAlarmCategoryCode" minOccurs="1" maxOccurs="1"/>
      <xsd:element ref="n42:RadAlarmDescription" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:AlarmAudibleIndicator" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:RadAlarmLightColor" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:RadAlarmEnergyWindowIndices" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:RadAlarmExtension" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="radDetectorInformationReferences" type="xsd:IDREFS"
use="required">
      <xsd:annotation>
        <xsd:documentation>Identifies the RadDetectorInformation elements within the
N42 XML document for radiation detectors that were used to collect these data. There
shall be no duplicate IDREF values in the list.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
  </xsd:extension>

```

```

</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="RadDetectorInformationType">
  <xsd:annotation>
    <xsd:documentation>A data type for information regarding a rad
detector.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
</xsd:complexType>
  <xsd:extension base="n42:ReqIdComplexObjectType">
    <xsd:sequence>
      <xsd:element ref="n42:RadDetectorName" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:RadDetectorCategoryCode" minOccurs="1" maxOccurs="1"/>
      <xsd:element ref="n42:RadDetectorKindCode" minOccurs="1" maxOccurs="1"/>
      <xsd:element ref="n42:RadDetectorDescription" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:RadDetectorLengthValue" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:RadDetectorWidthValue" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:RadDetectorDepthValue" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:RadDetectorDiameterValue" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:RadDetectorVolumeValue" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:RadDetectorCharacteristics" minOccurs="0"
maxOccurs="unbounded"/>
      <xsd:element ref="n42:RadDetectorInformationExtension" minOccurs="0"
maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="RadDetectorStateType">
  <xsd:annotation>
    <xsd:documentation>A data type for the state(s) of a radiation detector used in
collecting the measurement data.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
</xsd:complexType>
  <xsd:extension base="n42:OptIdComplexObjectType">
    <xsd:sequence>
      <xsd:element ref="n42:StateVector" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:Fault" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:element ref="n42:RadDetectorCharacteristics" minOccurs="0"
maxOccurs="unbounded"/>
      <xsd:element ref="n42:RadDetectorStateExtension" minOccurs="0"
maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="radDetectorInformationReference" type="xsd:IDREF"
use="required">
      <xsd:annotation>
        <xsd:documentation>Identifies the RadDetectorInformation element to which the
state data applies.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:simpleType name="RadDetectorCategoryCodeSimpleType">
  <xsd:annotation>
    <xsd:documentation>This list describes the category of a radiation detector based
on the type of particles and/or photon emission that it can detect from a radiological
or nuclear substance.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:token">
    <xsd:enumeration value="Gamma">
      <xsd:annotation>
        <xsd:documentation>A detector that primarily detects gamma
rays.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Neutron">
      <xsd:annotation>
        <xsd:documentation>A detector that primarily detects
neutrons.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Alpha">
      <xsd:annotation>

```



```

        <xsd:documentation>A detector that primarily detects alpha
particles.</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="Beta">
    <xsd:annotation>
        <xsd:documentation>A detector that primarily detects beta
particles.</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="X-ray">
    <xsd:annotation>
        <xsd:documentation>A detector that primary detects X-rays.</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="Other">
    <xsd:annotation>
        <xsd:documentation>A detector that does not fit any of the defined
categories.</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
</xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="RadDetectorKindCodeSimpleType">
    <xsd:annotation>
        <xsd:documentation>This list describes the kinds of radiation detectors that may
compose a radiation instrument.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:token">
        <xsd:enumeration value="HPGe">
            <xsd:annotation>
                <xsd:documentation>High Purity Germanium </xsd:documentation>
            </xsd:annotation>
        </xsd:enumeration>
        <xsd:enumeration value="HPXe">
            <xsd:annotation>
                <xsd:documentation>High Pressure Xenon</xsd:documentation>
            </xsd:annotation>
        </xsd:enumeration>
        <xsd:enumeration value="NaI">
            <xsd:annotation>
                <xsd:documentation>Sodium Iodide</xsd:documentation>
            </xsd:annotation>
        </xsd:enumeration>
        <xsd:enumeration value="LaBr3">
            <xsd:annotation>
                <xsd:documentation>Lanthanum Bromide</xsd:documentation>
            </xsd:annotation>
        </xsd:enumeration>
        <xsd:enumeration value="LaCl3">
            <xsd:annotation>
                <xsd:documentation>Lanthanum Chloride</xsd:documentation>
            </xsd:annotation>
        </xsd:enumeration>
        <xsd:enumeration value="BGO">
            <xsd:annotation>
                <xsd:documentation>Bismuth Germanate scintillator</xsd:documentation>
            </xsd:annotation>
        </xsd:enumeration>
        <xsd:enumeration value="CZT">
            <xsd:annotation>
                <xsd:documentation>Cadmium Zinc Telluride</xsd:documentation>
            </xsd:annotation>
        </xsd:enumeration>
        <xsd:enumeration value="CdTe">
            <xsd:annotation>
                <xsd:documentation>Cadmium Telluride</xsd:documentation>
            </xsd:annotation>
        </xsd:enumeration>
        <xsd:enumeration value="CsI">
            <xsd:annotation>
                <xsd:documentation>Cesium Iodide</xsd:documentation>
            </xsd:annotation>
        </xsd:enumeration>
        <xsd:enumeration value="GMT">
            <xsd:annotation>
                <xsd:documentation>Geiger Muller Tube</xsd:documentation>
            </xsd:annotation>
        </xsd:enumeration>
    </xsd:restriction>
</xsd:simpleType>

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</xsd:enumeration>
<xsd:enumeration value="GMTW">
  <xsd:annotation>
    <xsd:documentation>Windowed GM Tube</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="LiFiber">
  <xsd:annotation>
    <xsd:documentation>Lithium glass fiber</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="PVT">
  <xsd:annotation>
    <xsd:documentation>Polyvinyl Toluene</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="PS">
  <xsd:annotation>
    <xsd:documentation>Polystyrene</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="He3">
  <xsd:annotation>
    <xsd:documentation>3He proportional counter</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="He4">
  <xsd:annotation>
    <xsd:documentation>4He proportional counter</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="LiGlass">
  <xsd:annotation>
    <xsd:documentation>Lithium Glass</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="LiI">
  <xsd:annotation>
    <xsd:documentation>Lithium Iodide</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="SrI2">
  <xsd:annotation>
    <xsd:documentation>Strontium Iodide</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="CLYC">
  <xsd:annotation>
    <xsd:documentation>Cs2LiYCl6</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="CdWO4">
  <xsd:annotation>
    <xsd:documentation>Cadmium Tungstate</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="BF3">
  <xsd:annotation>
    <xsd:documentation>Boron Trifluoride proportional counter</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="HgI2">
  <xsd:annotation>
    <xsd:documentation>Mercuric Iodide</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="CeBr4">
  <xsd:annotation>
    <xsd:documentation>Cerium Bromide</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="LiCAF">
  <xsd:annotation>
    <xsd:documentation>LiCaAlF6</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="LiZnS">
  <xsd:annotation>

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        <xsd:documentation>6LiZnS</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Other">
      <xsd:annotation>
        <xsd:documentation>A kind of radiation detector not otherwise
defined.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
  </xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="RadInstrumentClassCodeSimpleType">
  <xsd:annotation>
    <xsd:documentation>This list describes the classes of radiation detection
instruments based on type and use.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:token">
    <xsd:enumeration value="Backpack">
      <xsd:annotation>
        <xsd:documentation>Radiation measurement instruments best described by
IEC 62694 or ANSI/IEEE N42.43.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Dosimeter">
      <xsd:annotation>
        <xsd:documentation>Radiation measurement instruments best described by
IEC 61526, ISO 4037-3, or ANSI/IEEE N42.20.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Electronic Personal Emergency Radiation Detector">
      <xsd:annotation>
        <xsd:documentation>Radiation measurement instruments best described by
ANSI/IEEE N42.49A.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Mobile System">
      <xsd:annotation>
        <xsd:documentation>Radiation measurement instruments best described by
ANSI/IEEE N42.43.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Network Area Monitor">
      <xsd:annotation>
        <xsd:documentation>A collection of radiation instruments working together as a
single instrument. This type of instrument may be described by any of the radiation
measurement instrument standards.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Neutron Handheld">
      <xsd:annotation>
        <xsd:documentation>Radiation measurement instruments best described by
IEC 62534.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Personal Radiation Detector">
      <xsd:annotation>
        <xsd:documentation>Radiation measurement instruments best described by
IEC 62401 or ANSI/IEEE N42.32.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Radionuclide Identifier">
      <xsd:annotation>
        <xsd:documentation>Radiation measurement instruments best described by
IEC 62327 or ANSI/IEEE N42.34.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Portal Monitor">
      <xsd:annotation>
        <xsd:documentation>Radiation measurement instruments best described by
IEC 62244 or ANSI/IEEE N42.35.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Spectroscopic Portal Monitor">
      <xsd:annotation>
        <xsd:documentation>Radiation measurement instruments best described by
IEC 62484 or ANSI/IEEE N42.38.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
  </xsd:restriction>

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<xsd:enumeration value="Spectroscopic Personal Radiation Detector">
  <xsd:annotation>
    <xsd:documentation>Radiation measurement instruments best described by
IEC 62618 or ANSI/IEEE N42.48.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="Gamma Handheld">
  <xsd:annotation>
    <xsd:documentation>Radiation measurement instruments best described by
IEC 62533 or ANSI/IEEE N42.33.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="Transportable System">
  <xsd:annotation>
    <xsd:documentation>Radiation measurement instruments best described by
ANSI/IEEE N42.43.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="Other">
  <xsd:annotation>
    <xsd:documentation>A class of radiation measurement instrument not otherwise
defined.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
</xsd:restriction>
</xsd:simpleType>
<xsd:complexType name="RadInstrumentDataType">
  <xsd:annotation>
    <xsd:documentation>A data type for the output of a radiation detection instrument
from a detection event.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:complexContent>
    <xsd:extension base="n42:OptIdComplexObjectType">
      <xsd:sequence>
        <xsd:element ref="n42:RadInstrumentDataCreatorName" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:RadInstrumentInformation" minOccurs="1" maxOccurs="1"/>
        <xsd:element ref="n42:RadDetectorInformation" minOccurs="1"
maxOccurs="unbounded"/>
        <xsd:element ref="n42:RadItemInformation" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:choice minOccurs="0" maxOccurs="unbounded">
          <xsd:element ref="n42:RadMeasurement" minOccurs="0" maxOccurs="unbounded"/>
          <xsd:element ref="n42:RadMeasurementGroup" minOccurs="0"
maxOccurs="unbounded"/>
          <xsd:element ref="n42:EnergyCalibration" minOccurs="0"
maxOccurs="unbounded"/>
          <xsd:element ref="n42:FWHMCalibration" minOccurs="0" maxOccurs="unbounded"/>
          <xsd:element ref="n42:TotalEfficiencyCalibration" minOccurs="0"
maxOccurs="unbounded"/>
          <xsd:element ref="n42:FullEnergyPeakEfficiencyCalibration" minOccurs="0"
maxOccurs="unbounded"/>
          <xsd:element ref="n42:IntrinsicFullEnergyPeakEfficiencyCalibration"
minOccurs="0" maxOccurs="unbounded"/>
          <xsd:element ref="n42:IntrinsicSingleEscapePeakEfficiencyCalibration"
minOccurs="0" maxOccurs="unbounded"/>
          <xsd:element ref="n42:IntrinsicDoubleEscapePeakEfficiencyCalibration"
minOccurs="0" maxOccurs="unbounded"/>
          <xsd:element ref="n42:EnergyWindows" minOccurs="0" maxOccurs="unbounded"/>
          <xsd:element ref="n42:DerivedData" minOccurs="0" maxOccurs="unbounded"/>
          <xsd:element ref="n42:AnalysisResults" minOccurs="0" maxOccurs="unbounded"/>
          <xsd:element ref="n42:MultimediaData" minOccurs="0" maxOccurs="unbounded"/>
        </xsd:choice>
        <xsd:element ref="n42:RadInstrumentDataExtension" minOccurs="0"
maxOccurs="unbounded"/>
      </xsd:sequence>
      <xsd:attribute name="n42DocUUID" use="optional">
        <xsd:annotation>
          <xsd:documentation>A universally unique identifier for this particular N42
XML document. See ISO/IEC 11578.</xsd:documentation>
        </xsd:annotation>
        <xsd:simpleType>
          <xsd:restriction base="xsd:string">
            <xsd:pattern value="[a-fA-F0-9]{8}-[a-fA-F0-9]{4}-[a-fA-F0-9]{4}-[a-fA-F0-
9]{4}-[a-fA-F0-9]{12}">
              <xsd:annotation>
                <xsd:documentation>Defines a format constraint in the canonical form of
an UUID as specified in ISO/IEC 11578.</xsd:documentation>
              </xsd:annotation>
            </xsd:restriction>
          </xsd:simpleType>
        </xsd:annotation>
      </xsd:attribute>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>

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        </xsd:annotation>
      </xsd:pattern>
    </xsd:restriction>
  </xsd:simpleType>
</xsd:attribute>
<xsd:attribute name="n42DocDateTime" type="xsd:dateTime" use="optional">
  <xsd:annotation>
    <xsd:documentation>Provides the date and time of creation of this particular
N42 XML document.</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="RadInstrumentInformationType">
  <xsd:annotation>
    <xsd:documentation>A data type that provides information regarding a radiation
detection instrument.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:complexContent>
    <xsd:extension base="n42:ReqIdComplexObjectType">
      <xsd:sequence>
        <xsd:element ref="n42:RadInstrumentManufacturerName" minOccurs="1"
maxOccurs="1" />
        <xsd:element ref="n42:RadInstrumentIdentifier" minOccurs="0" maxOccurs="1" />
        <xsd:element ref="n42:RadInstrumentModelName" minOccurs="1" maxOccurs="1" />
        <xsd:element ref="n42:RadInstrumentDescription" minOccurs="0" maxOccurs="1" />
        <xsd:element ref="n42:RadInstrumentClassCode" minOccurs="1" maxOccurs="1" />
        <xsd:element ref="n42:RadInstrumentVersion" minOccurs="1" maxOccurs="unbounded" />
        <xsd:element ref="n42:RadInstrumentQualityControl" minOccurs="0" maxOccurs="1" />
        <xsd:element ref="n42:RadInstrumentCharacteristics" minOccurs="0"
maxOccurs="unbounded" />
        <xsd:element ref="n42:RadInstrumentInformationExtension" minOccurs="0"
maxOccurs="unbounded" />
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:simpleType name="RadInstrumentModeCodeSimpleType">
  <xsd:annotation>
    <xsd:documentation>A data type for the operating modes of a radiation detection
instrument.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:token">
    <xsd:enumeration value="Calibrate">
      <xsd:annotation>
        <xsd:documentation>Calibration mode</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Long Dwell">
      <xsd:annotation>
        <xsd:documentation>The radiation measurement instrument makes a single long
measurement. For example, when a transportable system is stationary, measuring a source
for higher accuracy.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Search">
      <xsd:annotation>
        <xsd:documentation>The radiation measurement instrument makes a series of short
measurements. For example, when a transportable system is moving and searching for
sources, collecting gross count rates or spectra periodically. Another example, a
portal monitor that collects gross count rates periodically while conveyances are in
transit.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Test">
      <xsd:annotation>
        <xsd:documentation>Test or diagnostics mode</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Other">
      <xsd:annotation>
        <xsd:documentation>Other</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
  </xsd:restriction>

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</xsd:simpleType>
<xsd:complexType name="RadInstrumentQualityControlType">
  <xsd:annotation>
    <xsd:documentation>A data type for rad instrument quality control
information.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
<xsd:complexContent>
  <xsd:extension base="n42:OptIdComplexObjectType">
    <xsd:sequence>
      <xsd:element ref="n42:InspectionDateTime" minOccurs="1" maxOccurs="1"/>
      <xsd:element ref="n42:InCalibrationIndicator" minOccurs="1" maxOccurs="1"/>
    </xsd:sequence>
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="RadInstrumentStateType">
  <xsd:annotation>
    <xsd:documentation>A data type for the state of a radiation instrument used in
collecting the measurement data.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
<xsd:complexContent>
  <xsd:extension base="n42:OptIdComplexObjectType">
    <xsd:sequence>
      <xsd:element ref="n42:RadInstrumentModeCode" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:RadInstrumentModeDescription" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:StateVector" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:Fault" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:element ref="n42:RadInstrumentCharacteristics" minOccurs="0"
maxOccurs="unbounded"/>
      <xsd:element ref="n42:RadInstrumentStateExtension" minOccurs="0"
maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attribute name="radInstrumentInformationReference" type="xsd:IDREF"
use="required">
      <xsd:annotation>
        <xsd:documentation>Identifies the RadInstrumentInformation element to which the
state data applies.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="RadInstrumentVersionType">
  <xsd:annotation>
    <xsd:documentation>A data type for version information for the relevant components
of a radiation instrument.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
<xsd:complexContent>
  <xsd:extension base="n42:OptIdComplexObjectType">
    <xsd:sequence>
      <xsd:element ref="n42:RadInstrumentComponentName" minOccurs="1" maxOccurs="1"/>
      <xsd:element ref="n42:RadInstrumentComponentVersion" minOccurs="1"
maxOccurs="1"/>
    </xsd:sequence>
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="RadItemInformationType">
  <xsd:annotation>
    <xsd:documentation>A data type that provides information regarding an item from
which radiation is being measured by the radiation instrument, and measurement data is
reported in this xml document.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
<xsd:complexContent>
  <xsd:extension base="n42:ReqIdComplexObjectType">
    <xsd:sequence>
      <xsd:element ref="n42:RadItemDescription" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:RadItemQuantity" minOccurs="0" maxOccurs="1"/>
      <xsd:element ref="n42:RadItemMeasurementGeometryDescription" minOccurs="0"
maxOccurs="1"/>

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        <xsd:element ref="n42:RadItemCharacteristics" minOccurs="0"
maxOccurs="unbounded" />
        <xsd:element ref="n42:RadItemInformationExtension" minOccurs="0"
maxOccurs="unbounded" />
    </xsd:sequence>
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="RadItemQuantityType">
    <xsd:annotation>
        <xsd:documentation>A data type for expressing a quantity measure of a item that is
the source of the radiation measurement contained in this xml
document.</xsd:documentation>
        <xsd:appinfo>
        </xsd:appinfo>
    </xsd:annotation>
    <xsd:complexContent>
        <xsd:extension base="n42:OptIdComplexObjectType">
            <xsd:sequence>
                <xsd:element ref="n42:RadItemQuantityValue" minOccurs="1" maxOccurs="1" />
                <xsd:element ref="n42:RadItemQuantityUncertaintyValue" minOccurs="0"
maxOccurs="1" />
                <xsd:element ref="n42:RadItemQuantityUnits" minOccurs="1" maxOccurs="1" />
            </xsd:sequence>
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="RadItemStateType">
    <xsd:annotation>
        <xsd:documentation>A data type for the state of an item that is the subject of a
radiation measurement.</xsd:documentation>
        <xsd:appinfo>
        </xsd:appinfo>
    </xsd:annotation>
    <xsd:complexContent>
        <xsd:extension base="n42:OptIdComplexObjectType">
            <xsd:sequence>
                <xsd:element ref="n42:StateVector" minOccurs="0" maxOccurs="1" />
                <xsd:element ref="n42:RadItemCharacteristics" minOccurs="0"
maxOccurs="unbounded" />
                <xsd:element ref="n42:RadItemStateExtension" minOccurs="0"
maxOccurs="unbounded" />
            </xsd:sequence>
            <xsd:attribute name="radItemInformationReference" type="xsd:IDREF" use="required">
                <xsd:annotation>
                    <xsd:documentation>Identifies the RadItemInformation element to which the state
data applies.</xsd:documentation>
                </xsd:annotation>
            </xsd:attribute>
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="RadMeasurementGroupType">
    <xsd:annotation>
        <xsd:documentation>A data type for identifying associated groups of
RadMeasurements.</xsd:documentation>
        <xsd:appinfo>
        </xsd:appinfo>
    </xsd:annotation>
    <xsd:complexContent>
        <xsd:extension base="n42:ReqIdComplexObjectType">
            <xsd:sequence>
                <xsd:element ref="n42:RadMeasurementGroupDescription" minOccurs="0"
maxOccurs="1" />
            </xsd:sequence>
            <xsd:attribute name="radMeasurementGroupUUID" use="optional">
                <xsd:annotation>
                    <xsd:documentation>A universally unique identifier with in the N42 XML document
for a particular measurement group. See ISO/IEC 11578.</xsd:documentation>
                </xsd:annotation>
                <xsd:simpleType>
                    <xsd:restriction base="xsd:string">
                        <xsd:pattern value="[a-fA-F0-9]{8}-[a-fA-F0-9]{4}-[a-fA-F0-9]{4}-[a-fA-F0-
9]{4}-[a-fA-F0-9]{12}" />
                    </xsd:restriction>
                </xsd:simpleType>
                <xsd:annotation>
                    <xsd:documentation>Defines a format constraint in the canonical form of
an UUID as specified in ISO/IEC 11578.</xsd:documentation>
                </xsd:annotation>
            </xsd:attribute>
        </xsd:extension>
    </xsd:complexContent>

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        </xsd:pattern>
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:attribute>
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="RadMeasurementType">
  <xsd:annotation>
    <xsd:documentation>A data type for a set of radiation measurements that were taken
in the same time period.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:complexContent>
    <xsd:extension base="n42:ReqIdComplexObjectType">
      <xsd:sequence>
        <xsd:element ref="n42:MeasurementClassCode" minOccurs="1" maxOccurs="1"/>
        <xsd:element ref="n42:StartDateTime" minOccurs="1" maxOccurs="1"/>
        <xsd:element ref="n42:RealTimeDuration" minOccurs="1" maxOccurs="1"/>
        <xsd:element ref="n42:Spectrum" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:element ref="n42:GrossCounts" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:element ref="n42:DoseRate" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:element ref="n42:TotalDose" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:element ref="n42:ExposureRate" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:element ref="n42:TotalExposure" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:element ref="n42:RadInstrumentState" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:RadDetectorState" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:element ref="n42:RadItemState" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:element ref="n42:OccupancyIndicator" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:RadMeasurementExtension" minOccurs="0"
maxOccurs="unbounded"/>
      </xsd:sequence>
      <xsd:attribute name="radMeasurementGroupReferences" type="xsd:IDREFS"
use="optional">
        <xsd:annotation>
          <xsd:documentation>Identifies the RadMeasurementGroup element(s) within the N42
XML document that applies to this particular analysis. There shall be no duplicate
IDREF values in the list.</xsd:documentation>
        </xsd:annotation>
      </xsd:attribute>
      <xsd:attribute name="radItemInformationReferences" type="xsd:IDREFS"
use="optional">
        <xsd:annotation>
          <xsd:documentation>Identifies the RadItemInformation elements that are the
object of the radiation measurement. There shall be no duplicate IDREF values in the
list.</xsd:documentation>
        </xsd:annotation>
      </xsd:attribute>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="RelativeLocationType">
  <xsd:annotation>
    <xsd:documentation>A data type for describing the relative location of an
object.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element ref="n42:RelativeLocationAzimuthValue" minOccurs="0" maxOccurs="1"/>
    <xsd:element ref="n42:RelativeLocationInclinationValue" minOccurs="0" maxOccurs="1"/>
    <xsd:element ref="n42:DistanceValue" minOccurs="0" maxOccurs="1"/>
    <xsd:element ref="n42:Origin" minOccurs="1" maxOccurs="1"/>
  </xsd:sequence>
</xsd:complexType>
<xsd:complexType name="ReqIdComplexObjectType">
  <xsd:annotation>
    <xsd:documentation>A base type for providing a Remark and a required id via
inheritance to applicable Types.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element ref="n42:Remark" minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
  <xsd:attribute name="id" type="xsd:ID" use="required">
    <xsd:annotation>

```



```

    <xsd:documentation>Uniquely identifies an instance of an element defined by a
complex object type within the N42 XML document.</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
</xsd:complexType>
<xsd:simpleType name="SourceGeometryCodeSimpleType">
  <xsd:annotation>
    <xsd:documentation> This list describes the configurations that are applicable for
the geometry of a radiation source detected by a radiation
instrument.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:token">
    <xsd:enumeration value="Point">
      <xsd:annotation>
        <xsd:documentation>A radiation source whose geometry is determined to a
specific point.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Extended">
      <xsd:annotation>
        <xsd:documentation>A radiation source whose geometry is determined to an area,
and not a specific point.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Undetermined">
      <xsd:annotation>
        <xsd:documentation>A radiation source whose geometry has not been
determined.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
  </xsd:restriction>
</xsd:simpleType>
<xsd:complexType name="SourcePositionType">
  <xsd:annotation>
    <xsd:documentation>A data type for identifying the location of a nuclide source by
actual georef coordinates or by relation to another object.</xsd:documentation>
  <xsd:appinfo>
  </xsd:appinfo>
</xsd:annotation>
<xsd:complexContent>
  <xsd:extension base="n42:OptIdComplexObjectType">
    <xsd:sequence>
      <xsd:choice minOccurs="1" maxOccurs="1">
        <xsd:element ref="n42:GeographicPoint" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:LocationDescription" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:RelativeLocation" minOccurs="0" maxOccurs="1"/>
      </xsd:choice>
    </xsd:sequence>
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="SpectrumPeakAnalysisResultsType">
  <xsd:annotation>
    <xsd:documentation>A data type for the results of a radiation data spectrum peak
analysis.</xsd:documentation>
  <xsd:appinfo>
  </xsd:appinfo>
</xsd:annotation>
<xsd:complexContent>
  <xsd:extension base="n42:OptIdComplexObjectType">
    <xsd:sequence>
      <xsd:element ref="n42:SpectrumPeak" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:element ref="n42:SpectrumPeakAnalysisResultsExtension" minOccurs="0"
maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="SpectrumPeakEnergyKeVType">
  <xsd:annotation>
    <xsd:documentation>A data type for a spectrum peak energy measure whose value is
positive and measured in keV.</xsd:documentation>
  <xsd:appinfo>
  </xsd:appinfo>
</xsd:annotation>
<xsd:simpleContent>
  <xsd:extension base="n42:PositiveDoubleSimpleType">
    <xsd:attribute name="units" type="xsd:token" use="optional">

```

```

        <xsd:annotation>
            <xsd:documentation>The values unit of measure, which must be
            keV.</xsd:documentation>
        </xsd:annotation>
    </xsd:attribute>
</xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
<xsd:complexType name="SpectrumPeakType">
    <xsd:annotation>
        <xsd:documentation>A data type that provides spectrum peak analysis results
        information for a single peak. </xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
</xsd:annotation>
<xsd:complexContent>
    <xsd:extension base="n42:OptIdComplexObjectType">
        <xsd:sequence>
            <xsd:element ref="n42:SpectrumPeakEnergyValue" minOccurs="1" maxOccurs="1"/>
            <xsd:element ref="n42:SpectrumPeakExpectedEnergyValue" minOccurs="0"
maxOccurs="1"/>
            <xsd:element ref="n42:SpectrumPeakFWHMValue" minOccurs="0" maxOccurs="1"/>
            <xsd:element ref="n42:SpectrumPeakNetAreaValue" minOccurs="0" maxOccurs="1"/>
            <xsd:element ref="n42:SpectrumPeakNetAreaUncertaintyValue" minOccurs="0"
maxOccurs="1"/>
            <xsd:element ref="n42:SpectrumPeakExtension" minOccurs="0" maxOccurs="1"/>
        </xsd:sequence>
    </xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="SpectrumType">
    <xsd:annotation>
        <xsd:documentation>A data type that provides spectrum measurement
        data.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
</xsd:annotation>
<xsd:complexContent>
    <xsd:extension base="n42:ReqIdComplexObjectType">
        <xsd:sequence>
            <xsd:element ref="n42:LiveTimeDuration" minOccurs="1" maxOccurs="1"/>
            <xsd:element ref="n42:ChannelData" minOccurs="1" maxOccurs="1"/>
            <xsd:element ref="n42:SpectrumExtension" minOccurs="0" maxOccurs="unbounded"/>
        </xsd:sequence>
        <xsd:attribute name="energyCalibrationReference" type="xsd:IDREF" use="required">
            <xsd:annotation>
                <xsd:documentation>Identifies the EnergyCalibration element within the N42 XML
                document that applies to a particular spectrum.</xsd:documentation>
            <xsd:attribute name="totalEfficiencyCalibrationReference" type="xsd:IDREF"
            use="optional">
                <xsd:annotation>
                    <xsd:documentation>Identifies the TotalEfficiencyCalibrationReference element
                    within the N42 XML document that applies to a particular spectrum.</xsd:documentation>
                </xsd:annotation>
            </xsd:attribute>
            <xsd:annotation>
                <xsd:attribute name="intrinsicSingleEscapePeakEfficiencyCalibrationReference"
                type="xsd:IDREF" use="optional">
                    <xsd:annotation>
                        <xsd:documentation>Identifies the
                        IntrinsicSingleEscapePeakEfficiencyCalibration element within the N42 XML document that
                        applies to this spectrum.</xsd:documentation>
                    </xsd:annotation>
                </xsd:attribute>
                <xsd:attribute name="FWHMCalibrationReference" type="xsd:IDREF" use="optional">
                    <xsd:annotation>
                        <xsd:documentation>Identifies the FWHMCalibration element within the N42 XML
                        document that applies to a particular spectrum.</xsd:documentation>
                    </xsd:annotation>
                </xsd:attribute>
                <xsd:attribute name="intrinsicDoubleEscapePeakEfficiencyCalibrationReference"
                type="xsd:IDREF" use="optional">
                    <xsd:annotation>
                        <xsd:documentation>Identifies the
                        IntrinsicDoubleEscapePeakEfficiencyCalibration element within the N42 XML document that
                        applies to a particular spectrum.</xsd:documentation>
                    </xsd:annotation>
                </xsd:attribute>
            </xsd:sequence>
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>

```

```

        </xsd:attribute>
        <xsd:attribute name="intrinsicFullEnergyPeakEfficiencyCalibrationReference"
type="xsd:IDREF" use="optional">
        <xsd:annotation>
            <xsd:documentation>Identifies the IntrinsicFullEnergyPeakEfficiencyCalibration
element within the N42 XML document that applies to a particular
spectrum.</xsd:documentation>
        </xsd:annotation>
        </xsd:attribute>
        <xsd:attribute name="fullEnergyPeakEfficiencyCalibrationReference" type="xsd:IDREF"
use="optional">
        <xsd:annotation>
            <xsd:documentation>Identifies the FullEnergyPeakEfficiencyCalibration element
within the N42 XML document that applies to a particular spectrum.</xsd:documentation>
        </xsd:annotation>
        </xsd:attribute>
        <xsd:attribute name="radDetectorInformationReference" type="xsd:IDREF"
use="optional">
        <xsd:annotation>
            <xsd:documentation>Reference to the radiation detector that was used to collect
these data.</xsd:documentation>
        </xsd:annotation>
        </xsd:attribute>
        <xsd:attribute name="radRawSpectrumReferences" type="xsd:IDREFS" use="optional">
        <xsd:annotation>
            <xsd:documentation>Identifies the Spectrum data element(s) used to produce
derived data. There shall be no duplicate IDREF values in the list. This attribute is
required whenever the element is used within a DerivedData block, and is prohibited
otherwise.</xsd:documentation>
        </xsd:annotation>
        </xsd:attribute>
    </xsd:extension>
</xsd:complexType>
</xsd:complexType>
<xsd:complexType name="SpeedType">
    <xsd:annotation>
        <xsd:documentation>A speed measure where the units are meters per second
(m/s).</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
</xsd:annotation>
<xsd:simpleContent>
    <xsd:extension base="xsd:double">
        <xsd:attribute name="units" type="xsd:token" use="optional">
            <xsd:annotation>
                <xsd:documentation>The values unit of measure, which must be meters per second
(m/s).</xsd:documentation>
            </xsd:annotation>
        </xsd:attribute>
    </xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
<xsd:complexType name="StateVectorType">
    <xsd:annotation>
        <xsd:documentation>A data type that provides location, orientation, and speed state
data for an object, such as a radiation detection instrument/detector or an item being
measured by an instrument/detector.</xsd:documentation>
    <xsd:appinfo>
    </xsd:appinfo>
</xsd:annotation>
<xsd:sequence>
    <xsd:choice minOccurs="0" maxOccurs="1">
        <xsd:element ref="n42:GeographicPoint" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:LocationDescription" minOccurs="0" maxOccurs="1"/>
        <xsd:element ref="n42:RelativeLocation" minOccurs="0" maxOccurs="1"/>
    </xsd:choice>
    <xsd:element ref="n42:Orientation" minOccurs="0" maxOccurs="1"/>
    <xsd:element ref="n42:SpeedValue" minOccurs="0" maxOccurs="1"/>
</xsd:sequence>
</xsd:complexType>
<xsd:simpleType name="StringListSimpleType">
    <xsd:annotation>
        <xsd:documentation>A data type for a list of strings.</xsd:documentation>
    </xsd:annotation>
    <xsd:list itemType="xsd:string"/>
</xsd:simpleType>
<xsd:complexType name="TotalDoseType">
    <xsd:annotation>

```

```

    <xsd:documentation>A data type for TotalDose data.</xsd:documentation>
    <xsd:appinfo>
  </xsd:appinfo>
</xsd:annotation>
<xsd:simpleContent>
  <xsd:extension base="n42:TotalDoseuSvType">
    <xsd:attribute name="radRawTotalDoseReferences" type="xsd:IDREFS" use="optional">
      <xsd:annotation>
        <xsd:documentation>Identifies the TotalDose measurement data element(s) used to
produce derived data. There shall be no duplicate IDREF values in the list. This
attribute is required whenever the element is used within a DerivedData block and
prohibited otherwise.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="radDetectorInformationReference" type="xsd:IDREF"
use="required">
      <xsd:annotation>
        <xsd:documentation>Reference to the radiation detector that was used to collect
these data.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
  </xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
<xsd:complexType name="TotalDoseuSvType">
  <xsd:annotation>
    <xsd:documentation>A data type for a radiation total dose measure whose value is
nonnegative and expressed in microsieverts (uSv) units.</xsd:documentation>
  <xsd:appinfo>
</xsd:appinfo>
</xsd:annotation>
<xsd:simpleContent>
  <xsd:extension base="n42:NonNegativeDoubleSimpleType">
    <xsd:attribute name="units" type="xsd:token" use="optional">
      <xsd:annotation>
        <xsd:documentation>The values unit of measure, which must be microsieverts
(Sv).</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="id" type="xsd:ID" use="required">
      <xsd:annotation>
        <xsd:documentation>Uniquely identifies an instance of an element defined by a
complex object type within the N42 XML document.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
  </xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
<xsd:complexType name="TotalExposuremRType">
  <xsd:annotation>
    <xsd:documentation>A data type for a radiation total exposure measure whose value
is nonnegative and expressed in milliroentgen (mR) units.</xsd:documentation>
  <xsd:appinfo>
</xsd:appinfo>
</xsd:annotation>
<xsd:simpleContent>
  <xsd:extension base="n42:NonNegativeDoubleSimpleType">
    <xsd:attribute name="units" type="xsd:token" use="optional">
      <xsd:annotation>
        <xsd:documentation>The values unit of measure, which must be milliroentgen
(mR).</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="id" type="xsd:ID" use="required">
      <xsd:annotation>
        <xsd:documentation>Uniquely identifies an instance of an element defined by a
complex object type within the N42 XML document.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
  </xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
<xsd:complexType name="TotalExposureType">
  <xsd:annotation>
    <xsd:documentation>A data type for TotalExposure data.</xsd:documentation>
  <xsd:appinfo>
</xsd:appinfo>
</xsd:annotation>

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```

<xsd:simpleContent>
  <xsd:extension base="n42:TotalExposureMRTType">
    <xsd:attribute name="radDetectorInformationReference" type="xsd:IDREF"
use="required">
      <xsd:annotation>
        <xsd:documentation>Reference to the radiation detector that was used to collect
these data.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="radRawTotalExposureReferences" type="xsd:IDREFS"
use="optional">
      <xsd:annotation>
        <xsd:documentation>Identifies the TotalExposure measurement data element(s)
used to produce derived data. There shall be no duplicate IDREF values in the list.
This attribute is required whenever the element is used within a DerivedData block, and
prohibited otherwise.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
  </xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
<xsd:simpleType name="ValueDataClassCodeSimpleType">
  <xsd:annotation>
    <xsd:documentation>This list describes the atomic data classes available for
defining the underlying data class for data elements represented by string values. The
data classes are a subset of the W3c data types and the derived atomic data types
defined in this standard.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:token">
    <xsd:enumeration value="anyURI">
      <xsd:annotation>
        <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-20041028/datatypes.html#anyURI</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="base64Binary">
      <xsd:annotation>
        <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-20041028/datatypes.html#base64Binary</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="boolean">
      <xsd:annotation>
        <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-20041028/datatypes.html#boolean</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="byte">
      <xsd:annotation>
        <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-20041028/datatypes.html#byte</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="date">
      <xsd:annotation>
        <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-20041028/datatypes.html#date</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="dateTime">
      <xsd:annotation>
        <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-20041028/datatypes.html#dateTime</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="decimal">
      <xsd:annotation>
        <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-20041028/datatypes.html#decimal</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="double">
      <xsd:annotation>
        <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-20041028/datatypes.html#double</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="DoubleList">

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        <xsd:annotation>
            <xsd:documentation>A list of doubles.</xsd:documentation>
        </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="duration">
        <xsd:annotation>
            <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-
20041028/datatypes.html#duration</xsd:documentation>
        </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="float">
        <xsd:annotation>
            <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-
20041028/datatypes.html#float</xsd:documentation>
        </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="hexBinary">
        <xsd:annotation>
            <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-
20041028/datatypes.html#hexBinary</xsd:documentation>
        </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="ID">
        <xsd:annotation>
            <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-
20041028/datatypes.html#ID</xsd:documentation>
        </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="IDREF">
        <xsd:annotation>
            <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-
20041028/datatypes.html#IDREF</xsd:documentation>
        </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="IDREFS">
        <xsd:annotation>
            <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-
20041028/datatypes.html#IDREFS</xsd:documentation>
        </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="int">
        <xsd:annotation>
            <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-
20041028/datatypes.html#int</xsd:documentation>
        </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="integer">
        <xsd:annotation>
            <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-
20041028/datatypes.html#integer</xsd:documentation>
        </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="long">
        <xsd:annotation>
            <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-
20041028/datatypes.html#long</xsd:documentation>
        </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="Name">
        <xsd:annotation>
            <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-
20041028/datatypes.html#Name</xsd:documentation>
        </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="NCName">
        <xsd:annotation>
            <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-
20041028/datatypes.html#NCName</xsd:documentation>
        </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="negativeInteger">
        <xsd:annotation>
            <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-
20041028/datatypes.html#negativeInteger</xsd:documentation>
        </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="NonBlankString">
        <xsd:annotation>

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        <xsd:documentation>A string that is not empty and does not consist of only
white space characters.</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="NonNegativeDoubleList">
    <xsd:annotation>
        <xsd:documentation>A list of doubles with value of zero or
greater.</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="NonNegativeDouble">
    <xsd:annotation>
        <xsd:documentation>A double with value of zero or greater.</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="nonNegativeInteger">
    <xsd:annotation>
        <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-20041028/datatypes.html#nonNegativeInteger</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="nonPositiveInteger">
    <xsd:annotation>
        <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-20041028/datatypes.html#nonPositiveInteger</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="normalizedString">
    <xsd:annotation>
        <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-20041028/datatypes.html#normalizedString</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="Percent">
    <xsd:annotation>
        <xsd:documentation>A percent value with range 0.0 to 100.0.</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="PositiveDoubleList">
    <xsd:annotation>
        <xsd:documentation>A list of doubles restricted to positive
values.</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="PositiveDouble">
    <xsd:annotation>
        <xsd:documentation>A double with values greater than zero.</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="positiveInteger">
    <xsd:annotation>
        <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-20041028/datatypes.html#positiveInteger</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="PositiveIntegerList">
    <xsd:annotation>
        <xsd:documentation>A list of integers restricted to positive
values.</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="short">
    <xsd:annotation>
        <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-20041028/datatypes.html#short</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="string">
    <xsd:annotation>
        <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-20041028/datatypes.html#string</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="StringList">
    <xsd:annotation>
        <xsd:documentation>A list of space separated strings.</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>

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<xsd:enumeration value="time">
  <xsd:annotation>
    <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-
20041028/datatypes.html#time</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="token">
  <xsd:annotation>
    <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-
20041028/datatypes.html#Token</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="unsignedByte">
  <xsd:annotation>
    <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-
20041028/datatypes.html#unsignedByte</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="unsignedInt">
  <xsd:annotation>
    <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-
20041028/datatypes.html#unsignedInt</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="unsignedLong">
  <xsd:annotation>
    <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-
20041028/datatypes.html#unsignedLong</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="unsignedShort">
  <xsd:annotation>
    <xsd:documentation>As defined in http://www.w3.org/TR/2004/REC-xmlschema-2-
20041028/datatypes.html#unsignedShort</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="ZeroToOneDouble">
  <xsd:annotation>
    <xsd:documentation>A double with positive value between 0.0 and
1.0.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
</xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="ZeroToOneDoubleSimpleType">
  <xsd:annotation>
    <xsd:documentation>A data type for a double with positive value between 0.0 and
1.0.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:double">
    <xsd:maxInclusive value="1.0" fixed="true"/>
    <xsd:minInclusive value="0.0" fixed="true"/>
  </xsd:restriction>
</xsd:simpleType>
<xsd:element name="AlarmAudibleIndicator" type="xsd:boolean" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Indicates if an audible alarm was annunciated; true if an
audible alarm was announced, false otherwise.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="AnalysisAlgorithmComponentName"
type="n42:NonBlankStringSimpleType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Name of an algorithm component.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="AnalysisAlgorithmComponentVersion"
type="n42:NonBlankStringSimpleType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Version information for the algorithm
component.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="AnalysisAlgorithmCreatorName" type="xsd:string" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Creator or implementer of the analysis
algorithm.</xsd:documentation>
  </xsd:annotation>

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</xsd:element>
<xsd:element name="AnalysisAlgorithmDescription" type="xsd:string" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Free-form text describing the analysis
algorithm.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="AnalysisAlgorithmSetting" type="n42:AnalysisAlgorithmSettingType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>List of name - value pairs describing analysis setting
information.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="AnalysisAlgorithmSettingName" type="n42:NonBlankStringSimpleType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>Name of an algorithm setting parameter.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="AnalysisAlgorithmSettingUnits" type="n42:NonBlankStringSimpleType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The units of measure of the algorithm setting value,
identified by the AnalysisAlgorithmSettingName element, if needed.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="AnalysisAlgorithmSettingValue" type="n42:NonBlankStringSimpleType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>Value of the setting parameter identified by the
AnalysisAlgorithmSettingName element.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="AnalysisAlgorithmName" type="xsd:string" nillable="false">
  <xsd:annotation>
    <xsd:documentation>A unique name of the analysis algorithm.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="AnalysisAlgorithmVersion" type="n42:AnalysisAlgorithmVersionType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>Information describing the version of a particular analysis
algorithm component.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="AnalysisComputationDuration" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Time (duration) for convergence of the analysis algorithm;
i.e., time from start to finish to produce the analysis results.</xsd:documentation>
  </xsd:annotation>
  <xsd:simpleType>
    <xsd:restriction base="xsd:duration">
      <xsd:minInclusive value="P0Y0M0DT0H0M0S" fixed="true">
        <xsd:annotation>
          <xsd:documentation>Duration may not be negative.</xsd:documentation>
        </xsd:annotation>
      </xsd:minInclusive>
    </xsd:restriction>
  </xsd:simpleType>
</xsd:element>
<xsd:element name="AnalysisConfidenceValue" type="n42:PercentSimpleType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>Indication of confidence, as a percent ranging from 0.0 to
100.0, in the overall accuracy of the analysis, where increasing values indicate higher
confidence.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="AnalysisResultDescription" type="xsd:string" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Free-form text describing the overall conclusion of the
analysis regarding the source of concern. </xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="AnalysisResults" type="n42:AnalysisResultsType" nillable="false">
  <xsd:annotation>

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    <xsd:documentation>The collection of information resulting from the analysis of
the radiation measurements or derived data.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
  <xsd:element name="AnalysisResultsExtension" abstract="true" nillable="false">
    <xsd:annotation>
      <xsd:documentation>An abstract element serving as a substitution group head
enabling extension via additional schema(s).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="AnalysisResultStatusCode"
type="n42:AnalysisResultStatusCodeSimpleType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>Describes the success or failure status of the measurement
analysis. If this element is omitted, the analysis is considered successful. The
AnalysisResultDescription element shall be used to describe an analysis failure in
detail.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="AnalysisStartDateTime" type="xsd:dateTime" nillable="false">
    <xsd:annotation>
      <xsd:documentation>Date and time at which the analysis was started.
</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="AverageCountRateUncertaintyValue" type="n42:CountRateCPSType"
nillable="false">
    <xsd:annotation>
      <xsd:documentation>The 1-sigma uncertainty in AverageCountRateValue, in counts
per second (cps).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="AverageCountRateValue" type="n42:CountRateCPSType"
nillable="false">
    <xsd:annotation>
      <xsd:documentation>The average count rate observed over all measurements input to
AnalysisResults, in counts per second (cps).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="AverageDoseRateUncertaintyValue" type="n42:DoseRateuSvhType"
nillable="false">
    <xsd:annotation>
      <xsd:documentation>The combined 1-sigma uncertainty associated with the average
ambient dose equivalent rate reported in the analysis results, expressed in
microsieverts per hour (Sv/h).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="AverageDoseRateValue" type="n42:DoseRateuSvhType"
nillable="false">
    <xsd:annotation>
      <xsd:documentation>The average ambient dose equivalent rate reported in the
analysis results, expressed in microsieverts per hour (Sv/h).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="AverageExposureRateUncertaintyValue"
type="n42:ExposureRatemRhType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>The combined 1-sigma uncertainty associated with the average
exposure rate reported in the analysis results, expressed in milliroentgen per hour
(mR/h).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="AverageExposureRateValue" type="n42:ExposureRatemRhType"
nillable="false">
    <xsd:annotation>
      <xsd:documentation>The average exposure rate reported in the analysis results,
expressed in milliroentgen per hour (mR/h).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="BackgroundCountRateUncertaintyValue" type="n42:CountRateCPSType"
nillable="false">
    <xsd:annotation>
      <xsd:documentation>The 1-sigma uncertainty in the background count rate used in
the analysis, in counts per second (cps).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="BackgroundCountRateValue" type="n42:CountRateCPSType"
nillable="false">

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    <xsd:annotation>
      <xsd:documentation>The background rate used in the analysis, in counts per second
(cps).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="BackgroundDoseRateUncertaintyValue" type="n42:DoseRateuSvhType"
nillable="false">
    <xsd:annotation>
      <xsd:documentation>The 1-sigma absolute uncertainty in the value of
BackgroundDoseRateValue, in microsieverts per hour (Sv/h).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="BackgroundDoseRateValue" type="n42:DoseRateuSvhType"
nillable="false">
    <xsd:annotation>
      <xsd:documentation>The background ambient dose equivalent rate used in the
analysis, in microsieverts per hour (Sv/h).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="BackgroundExposureRateUncertaintyValue"
type="n42:ExposureRatemRhType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>The combined 1-sigma uncertainty associated with the average
background exposure rate reported in the analysis results, expressed in milliroentgen
per hour (mR/h).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="BackgroundExposureRateValue" type="n42:ExposureRatemRhType"
nillable="false">
    <xsd:annotation>
      <xsd:documentation>The average background exposure rate reported in the analysis
results, expressed in milliroentgen per hour (mR/h).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="BinaryBase64Object" type="xsd:base64Binary" nillable="false">
    <xsd:annotation>
      <xsd:documentation>Base 64 binary encoding of data.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="BinaryHexObject" type="xsd:hexBinary" nillable="false">
    <xsd:annotation>
      <xsd:documentation>Hex binary encoding of data.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="BinaryUTF8Object" type="xsd:string" nillable="false">
    <xsd:annotation>
      <xsd:documentation>UTF8 binary encoding of data.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="CalibrationDateTime" type="xsd:dateTime" nillable="false">
    <xsd:annotation>
      <xsd:documentation>The date and time at which the calibration was put into
service.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="ChannelData" type="n42:ChannelDataType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>A list of values, one for each of a spectrum's channels. The
values represent the number of counts per channel.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="Characteristic" type="n42:CharacteristicType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>Describes an additional characteristic of something, such as a
radiation instrument, detector, or item being inspected.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="CharacteristicGroup" type="n42:CharacteristicGroupType"
nillable="false">
    <xsd:annotation>
      <xsd:documentation>A set of Characteristic grouped in some manner, such as health
characteristics of an instrument subsystem or detector.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="CharacteristicGroupName" type="n42:NonBlankStringSimpleType"
nillable="false">
    <xsd:annotation>

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        <xsd:documentation>The free-form name of the
CharacteristicGroup.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="CharacteristicName" type="n42:NonBlankStringSimpleType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>The free-form name of the Characteristic.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="CharacteristicValue" type="n42:NonBlankStringSimpleType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>The value of the Characteristic.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="CharacteristicValueDataClassCode"
type="n42:ValueDataClassCodeSimpleType" nillable="false">
    <xsd:annotation>
        <xsd:documentation>The data class of the CharacteristicValue.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="CharacteristicValueUnits" type="n42:NonBlankStringSimpleType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>The unit of measure of the
CharacteristicValue.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="CoefficientValues" nillable="false">
    <xsd:annotation>
        <xsd:documentation>The values of the coefficients of a second-order polynomial
describing the energy calibration in which the energies are expressed in keV. The
equation has the form:  $E = T_0 + T_1 \cdot C + T_2 \cdot C^2$  Where E is the energy in keV, C
is the channel position, T0 is the offset coefficient, T1 is the gain coefficient, and
T2 is the quadratic coefficient. The first value in the list is term 0, the second term
1, and the third value term 2. If the energy calibration is linear, the third
coefficient (T2) shall be zero.</xsd:documentation>
    </xsd:annotation>
    <xsd:simpleType>
        <xsd:restriction base="n42:DoubleListSimpleType">
            <xsd:length value="3" fixed="true">
                <xsd:annotation>
                    <xsd:documentation>Three and only three coefficient values are
allowed.</xsd:documentation>
                </xsd:annotation>
            </xsd:length>
        </xsd:restriction>
    </xsd:simpleType>
</xsd:element>
<xsd:element name="CountData" type="n42:NonNegativeDoubleListSimpleType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>The number of counts accumulated during a measurement period
over the entire energy range measured by the radiation detector or within pre-defined
energy windows.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="DerivedData" type="n42:DerivedDataType" nillable="false">
    <xsd:annotation>
        <xsd:documentation>Data derived from raw measured data for use in
analysis.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="DerivedDataExtension" abstract="true" nillable="false">
    <xsd:annotation>
        <xsd:documentation>An abstract element serving as a substitution group head
enabling extension via additional schema(s).</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="DistanceValue" type="n42:DistanceType" nillable="false">
    <xsd:annotation>
        <xsd:documentation>The scalar distance between the center of an object (i.e.,
instrument, detector, or item) or nuclide and the center of a reference point
(Origin).</xsd:documentation>
    </xsd:annotation>
</xsd:element>

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<xsd:element name="DoseAnalysisResults" type="n42:DoseAnalysisResultsType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>Results of the analysis of the radiation ambient dose
equivalent data for a measured item(s).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="DoseAnalysisResultsExtension" abstract="true" nillable="false">
  <xsd:annotation>
    <xsd:documentation>An abstract element serving as a substitution group head
enabling extension via additional schema(s).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="DoseRate" type="n42:DoseRateType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The measured ambient dose equivalent rate, provided as a value
and/or a qualitative description.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="DoseRateLevelDescription" type="xsd:string" nillable="false">
  <xsd:annotation>
    <xsd:documentation>A qualitative description of the radiation ambient dose
equivalent rate level, such as low/medium/high or a numerical scale 0 to 9.
</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="DoseRateValue" type="n42:DoseRateuSvhType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The measured ambient radiation dose equivalent rate value, in
microsieverts per hour (Sv/h).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="EfficiencyUncertaintyValues"
type="n42:NonNegativeDoubleListSimpleType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The list of the 1-sigma absolute uncertainties in the
EfficiencyValues. </xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="EfficiencyValues" type="n42:NonNegativeDoubleListSimpleType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The list of efficiency values as decimal fractions; i.e.,
normally between 0.0 and 1.0.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="ElevationAccuracyValue" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Describes the estimated accuracy of the elevation of a
geographic point.</xsd:documentation>
  </xsd:annotation>
  <xsd:simpleType>
    <xsd:restriction base="xsd:decimal">
      <xsd:minInclusive value="0" fixed="true">
        <xsd:annotation>
          <xsd:documentation>Accuracy value is non-negative.</xsd:documentation>
        </xsd:annotation>
      </xsd:minInclusive>
    </xsd:restriction>
  </xsd:simpleType>
</xsd:element>
<xsd:element name="ElevationOffsetAccuracyValue" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Describes the estimated accuracy of the elevation offset
vertically to the earth's surface from a geographic point.</xsd:documentation>
  </xsd:annotation>
  <xsd:simpleType>
    <xsd:restriction base="xsd:decimal">
      <xsd:minExclusive value="0" fixed="true">
        <xsd:annotation>
          <xsd:documentation>Accuracy value is non-negative.</xsd:documentation>
        </xsd:annotation>
      </xsd:minExclusive>
    </xsd:restriction>
  </xsd:simpleType>
</xsd:element>
<xsd:element name="ElevationOffsetValue" type="xsd:decimal" nillable="false">
  <xsd:annotation>

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        <xsd:documentation> The difference between the Elevation at the point of
coordinate measurement and the earth's surface in meters.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="ElevationValue" type="xsd:decimal" nillable="false">
    <xsd:annotation>
        <xsd:documentation> Elevation of a GeographicPoint in meters relative to the
applicable datums ellipsoid.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="EncodingMIMEKind" type="xsd:string" nillable="false">
    <xsd:annotation>
        <xsd:documentation>Encoding MIME type of a digital data file.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="EnergyBoundaryValues" type="n42:EnergiesKeVType" nillable="false">
    <xsd:annotation>
        <xsd:documentation>The list of energy values that indicate the energy of the
start of each channel in a spectrum and the end of the last channel of the spectrum;
the energies shall appear in the list in increasing order.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="EnergyCalibration" type="n42:EnergyCalibrationType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>Energy calibration information that spectrum measurements can
reference as applicable to a particular spectrum.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="EnergyDeviationValues" type="n42:EnergyDeviationsKeVType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>The data describing the differences in the energies predicted
by an energy calibration coefficients equation and the true energies.  $EPredicted = T0 + T1 \cdot C + T2 \cdot C^2$   $EDeviation = f(EPredicted)$   $EActual = EPredicted + EDeviation$  Where  $Tn$  are the coefficients from the CoefficientValues element data,  $C$  is the channel position (the first channel starts at 0.0),  $EPredicted$  is the predicted energy (in keV) at channel  $C$ ,  $EDeviation$  is the energy deviation value (in keV) from interpolation of the EnergyValues and EnergyDeviationValues data, and  $EActual$  is the final corrected energy at channel  $C$ .</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="EnergyValues" type="n42:EnergiesKeVType" nillable="false">
    <xsd:annotation>
        <xsd:documentation>A list of energy values, in units of keV; the energies shall
appear in the list in strictly increasing order. This element appears paired with an
element that provides a corresponding list of other values, such as the
EnergyDeviationValues, FWHMValues, or EfficiencyValues elements. The number and order
of corresponding values in the pair of lists must match.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="EnergyWindows" type="n42:EnergyWindowsType" nillable="false">
    <xsd:annotation>
        <xsd:documentation>The definition of a set of energy windows used in gross
counting.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="ExposureAnalysisResults" type="n42:ExposureAnalysisResultsType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>Results of the analysis of the radiation exposure data for a
measured item(s).</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="ExposureAnalysisResultsExtension" abstract="true"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>An abstract element serving as a substitution group head
enabling extension via additional schema(s).</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="ExposureRate" type="n42:ExposureRateType" nillable="false">
    <xsd:annotation>
        <xsd:documentation>The radiation exposure rate, provided as the measured value,
and/or a qualitative description of the exposure rate level.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="ExposureRateLevelDescription" type="xsd:string" nillable="false">

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    <xsd:annotation>
      <xsd:documentation>A qualitative description of the radiation exposure rate
      level, such as low, medium, high, or a numerical scale 0 to 9. </xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="ExposureRateValue" type="n42:ExposureRateRhType"
  nillable="false">
    <xsd:annotation>
      <xsd:documentation>The measured radiation exposure rate value, in milliroentgen
      per hour (mR/h).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="Fault" type="n42:FaultType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>The collection of information describing an error that
      occurred in the instrument, a specific detector, or during the analysis of
      data.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="FaultCodeValue" type="xsd:string" nillable="false">
    <xsd:annotation>
      <xsd:documentation>An instrument-specific code that identifies the error or
      problem.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="FaultDescription" type="xsd:string" nillable="false">
    <xsd:annotation>
      <xsd:documentation>A description of the problem that
      occurred.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="FaultExtension" abstract="true" nillable="false">
    <xsd:annotation>
      <xsd:documentation>An abstract element serving as a substitution group head
      enabling extension via additional schema(s).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="FaultSeverityCode" type="n42:FaultSeverityCodeSimpleType"
  nillable="false">
    <xsd:annotation>
      <xsd:documentation>The seriousness of a fault.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="FullEnergyPeakEfficiencyCalibration"
  type="n42:EfficiencyCalibrationType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>A full-energy peak efficiency calibration. The full-energy
      peak efficiency at any value of energy is the ratio of the net counts in a peak at that
      energy to the number of photons emitted by a source at that energy.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="FWHMCalibration" type="n42:FWHMCalibrationType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>The FWHM calibration for a gamma radiation detector; i.e.,
      FWHM as a function of energy.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="FWHMUncertaintyValues" type="n42:FWHMUncertaintiesKeVType"
  nillable="false">
    <xsd:annotation>
      <xsd:documentation>A list of the 1-sigma absolute uncertainties in units of keV,
      in the FWHM values contained in the FWHMValues element list. The number and order of
      corresponding values in the FWHMValues and FWHMUncertaintyValues lists must
      match.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="FWHMValues" type="n42:FWHMKeVType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>A list of FWHM values, in units of keV. The number and order
      of corresponding values in the EnergyValues and FWHMValues lists must
      match.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="GeographicPoint" type="n42:GeographicPointType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>Geographical coordinates providing latitude, longitude, and
      elevation (at the point of measurement and at the point on the earths surface), and
      uncertainty of the coordinates.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>

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    </xsd:annotation>
  </xsd:element>
  <xsd:element name="GeoPointAccuracyValue" nillable="false">
    <xsd:annotation>
      <xsd:documentation>The estimated 1-sigma positional accuracy in meters (m) of the
geographic point described by the latitude and longitude coordinates of the
point.</xsd:documentation>
    </xsd:annotation>
    <xsd:simpleType>
      <xsd:restriction base="xsd:decimal">
        <xsd:minInclusive value="0" fixed="true">
          <xsd:annotation>
            <xsd:documentation>Accuracy value is non-negative.</xsd:documentation>
          </xsd:annotation>
        </xsd:minInclusive>
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:element>
  <xsd:element name="GrossCountAnalysisResults"
type="n42:GrossCountAnalysisResultsType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>Results of the analysis of the gross count data for a measured
item(s).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="GrossCountAnalysisResultsExtension" abstract="true"
nillable="false">
    <xsd:annotation>
      <xsd:documentation>An abstract element serving as a substitution group head
enabling extension via additional schema(s).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="GrossCounts" type="n42:GrossCountsType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>The gross counts from a radiation
detector.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="ImageHeightValue" type="n42:PixelType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>Image height in pixels.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="ImagePerspectiveCode" type="n42:ImagePerspectiveCodeSimpleType"
nillable="false">
    <xsd:annotation>
      <xsd:documentation>Describes the viewing perspective of the subject of image
multimedia data.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="ImageWidthValue" type="n42:PixelType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>Image width in pixels.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="InCalibrationIndicator" type="xsd:boolean" nillable="false">
    <xsd:annotation>
      <xsd:documentation>The indication that the radiation measurement instrument is
fit for service: true when properly calibrated and considered in service; false
otherwise.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="InspectionDateTime" type="xsd:dateTime" nillable="false">
    <xsd:annotation>
      <xsd:documentation>The date and time at which the radiation measurement
instrument's calibration and in-service status were determined.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="IntrinsicDoubleEscapePeakEfficiencyCalibration"
type="n42:EfficiencyCalibrationType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>An intrinsic double-escape peak efficiency calibration. The
intrinsic double-escape peak efficiency at any value of energy is the ratio of the
counts in the double-escape peak of that energy to the number of photons impinging on
the radiation detector surface at that energy.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>

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<xsd:element name="IntrinsicFullEnergyPeakEfficiencyCalibration"
type="n42:EfficiencyCalibrationType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>An intrinsic full-energy peak efficiency calibration. The
intrinsic full-energy peak efficiency at any value of energy is the ratio of the net
counts in a peak at that energy to the number of photons impinging on the radiation
detector surface at that energy.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="IntrinsicSingleEscapePeakEfficiencyCalibration"
type="n42:EfficiencyCalibrationType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>An intrinsic single-escape peak efficiency calibration. The
intrinsic single-escape peak efficiency at any value of energy is the ratio of the
counts in the single-escape peak of that energy to the number of photons impinging on
the radiation detector surface at that energy.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="LatitudeValue" type="n42:Angle90Type" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The latitude of a point on the surface of the earth expressed
as geographic coordinates in decimal degrees. Points in the northern hemisphere range
from 0.0 to +90.0 degrees. Points in the southern hemisphere range from 0.0 to -
90.0.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="LiveTimeDuration" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The duration during which a detection assembly is sensitive to
the input signal. The value of LiveTimeDuration is always less than or equal to the
value of RealTimeDuration, because it does not include the time that the radiation
detector was unable to respond due to the processing of events.</xsd:documentation>
  </xsd:annotation>
  <xsd:simpleType>
    <xsd:restriction base="xsd:duration">
      <xsd:minInclusive value="P0Y0M0DT0H0M0S" fixed="true">
        <xsd:annotation>
          <xsd:documentation>Duration may not be negative.</xsd:documentation>
        </xsd:annotation>
      </xsd:minInclusive>
    </xsd:restriction>
  </xsd:simpleType>
</xsd:element>
<xsd:element name="LocationDescription" type="n42:NonBlankStringSimpleType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>A free-form text description of the location of an object
(e.g., radiation measurement instrument, radiation detector, or measured item) or
nuclide source.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="LongitudeValue" type="n42:Angle180Type" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The longitude of a point on the surface of the earth expressed
as geographic coordinates in decimal degrees. Points east of the prime meridian range
from 0.0 to +180.0 degrees. Points west of the prime meridian range from 0.0 to -
180.0.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="MaximumCountRateValue" type="n42:CountRateCPSType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The maximum count rate observed over all measurements input to
AnalysisResults, in counts per second.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="MaximumDoseRateValue" type="n42:DoseRateuSvhType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The maximum ambient dose equivalent rate observed over all
measurements input to AnalysisResults, in microsieverts per hour
(Sv/h).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="MaximumExposureRateValue" type="n42:ExposureRatemRhType"
nillable="false">
  <xsd:annotation>

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        <xsd:documentation>The maximum exposure rate observed over all measurements input
to AnalysisResults, in milliroentgen per hour (mR/h).</xsd:documentation>
    </xsd:annotation>
</xsd:element>
    <xsd:element name="MeasurementClassCode" type="n42:MeasurementClassCodeSimpleType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>Indicates whether the data are a measurement of an item
(Foreground), an environmental background (Background), a calibration source
(Calibration), the intrinsic activity of the radiation measurement instrument
(IntrinsicActivity), or not specified (NotSpecified).</xsd:documentation>
    </xsd:annotation>
    </xsd:element>
    <xsd:element name="MinimumCountRateValue" type="n42:CountRateCPSType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>The minimum count rate observed over all measurements input to
AnalysisResults, in counts per second.</xsd:documentation>
    </xsd:annotation>
    </xsd:element>
    <xsd:element name="MinimumDoseRateValue" type="n42:DoseRateuSvhType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>The minimum ambient dose equivalent rate observed over all
measurements input to AnalysisResults, in microsieverts per hour
(Sv/h).</xsd:documentation>
    </xsd:annotation>
    </xsd:element>
    <xsd:element name="MinimumExposureRateValue" type="n42:ExposureRatemRhType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>The minimum exposure rate observed over all measurements input
to AnalysisResults, in milliroentgen per hour (mR/h).</xsd:documentation>
    </xsd:annotation>
    </xsd:element>
    <xsd:element name="MultimediaCaptureDuration" nillable="false">
    <xsd:annotation>
        <xsd:documentation>Total duration of time covered by the data recorded by a
multimedia device.</xsd:documentation>
    </xsd:annotation>
    <xsd:simpleType>
        <xsd:restriction base="xsd:duration">
            <xsd:minInclusive value="P0Y0M0DT0H0M0S" fixed="true">
                <xsd:annotation>
                    <xsd:documentation>Duration may not be negative.</xsd:documentation>
                </xsd:annotation>
            </xsd:minInclusive>
        </xsd:restriction>
    </xsd:simpleType>
    </xsd:element>
    <xsd:element name="MultimediaCaptureStartDateTime" type="xsd:dateTime"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>Date-time at which capture of the multimedia data was started.
</xsd:documentation>
    </xsd:annotation>
    </xsd:element>
    <xsd:element name="MultimediaData" type="n42:MultimediaDataType" nillable="false">
    <xsd:annotation>
        <xsd:documentation>Multimedia data - e.g., images, sound clips, movies, -
regarding a measured item or a measurement environment.</xsd:documentation>
    </xsd:annotation>
    </xsd:element>
    <xsd:element name="MultimediaDataDescription" type="xsd:string" nillable="false">
    <xsd:annotation>
        <xsd:documentation>Free-form text describing the contents or any other aspects of
the multimedia data.</xsd:documentation>
    </xsd:annotation>
    </xsd:element>
    <xsd:element name="MultimediaDataExtension" abstract="true" nillable="false">
    <xsd:annotation>
        <xsd:documentation>An abstract element serving as a substitution group head
enabling extension via additional schema(s).</xsd:documentation>
    </xsd:annotation>
    </xsd:element>
    <xsd:element name="MultimediaDataMIMEKind" type="xsd:string" nillable="false">
    <xsd:annotation>

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    <xsd:documentation>Media types are listed in
    http://www.iana.org/assignments/media-types/index.html. If the media type is not
    listed, then describe the media type using free-form text.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
  <xsd:element name="MultimediaDeviceCategoryCode"
    type="n42:MultimediaDeviceCategoryCodeSimpleType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>The kind of device that recorded the multimedia
    data.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="MultimediaDeviceIdentifier" type="xsd:string" nillable="false">
    <xsd:annotation>
      <xsd:documentation>Identification (e.g., serial number) of the device that
    recorded the multimedia data.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="MultimediaFileSizeValue" type="xsd:positiveInteger"
    nillable="false">
    <xsd:annotation>
      <xsd:documentation>Size of a multimedia file in kilobytes
    (kB).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="MultimediaFileURI" type="xsd:anyURI" nillable="false">
    <xsd:annotation>
      <xsd:documentation>The location of the file containing the multimedia data, if
    the data are not included within the contents of the MultimediaData
    element.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="AzimuthValue" type="n42:Angle180Type" nillable="false">
    <xsd:annotation>
      <xsd:documentation>The orientation of an object (i.e., instrument, detector, or
    item) with respect to True North. Its value is the angle subtended by a line from the
    center point of the object to True North in the horizontal plane and the line formed by
    the object's front-to-back axis projected onto the horizontal plane. The angle range is
    from -180.0 to +180.0 degrees. A value of zero implies the front of the object's body
    is pointed to True North; positive values imply the front is pointed to the east of
    True North; negative values imply the front is pointed to the west of True
    North.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="InclinationValue" type="n42:Angle90Type" nillable="false">
    <xsd:annotation>
      <xsd:documentation>The orientation of an object (i.e., radiation measurement
    instrument, radiation detector, or measured item) with respect to the horizontal plane.
    Its value is the angle subtended by the line formed by the objects front-to-rear axis
    and the line formed by the projection of that line onto the horizontal plane. The angle
    range is from -90.0 to +90.0 degrees. A value of zero implies the object's front-to-
    rear axis is level, i.e., aligned with the horizontal plane; positive values implies
    the object is pointed up; negative values imply the object is pointed
    down.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="RelativeLocationAzimuthValue" type="n42:Angle180Type"
    nillable="false">
    <xsd:annotation>
      <xsd:documentation>The horizontal bearing angle with respect to True North from a
    reference point (Origin) to an object (i.e., instrument, detector, or item) or a
    nuclide. Its value is the angle subtended by the projection onto the horizontal plane
    of a straight line from the reference point to the center of the object or nuclide, and
    a line extending in the forward direction from the reference point. The angle range is
    from -180.0 to +180.0 degrees. A value of zero implies the center of the object or
    nuclide's body is aligned directly in front of the reference point; positive values
    imply the object or nuclide is to the right of the reference point; negative values
    imply the object or nuclide is to the left of the reference point.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="RelativeLocationInclinationValue" type="n42:Angle90Type"
    nillable="false">
    <xsd:annotation>
      <xsd:documentation>The vertical bearing angle with respect to the horizontal
    plane from a reference point (Origin) to an object (i.e., instrument, detector, or
    item) or a nuclide. Its value is the angle subtended by a straight line, running from
    the center of the reference point to the center of the object or nuclide, and a
    projection of that line onto the horizontal plane. The angle range is from -90.0 to

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+90.0 degrees. A value of zero implies the center of the object or nuclide is at the same altitude or elevation as the reference point; positive values imply the object or nuclide is higher than the reference point; negative values imply the object or nuclide is lower than the reference point.

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    </xsd:annotation>
  </xsd:element>
  <xsd:element name="Nuclide" type="n42:NuclideType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>The analysis results for a single
radionuclide.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="NuclideExtension" abstract="true" nillable="false">
    <xsd:annotation>
      <xsd:documentation>An abstract element serving as a substitution group head
enabling extension via additional schema(s).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="NuclideActivityUncertaintyValue"
type="n42:NuclideActivityUncertaintyType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>1-sigma absolute uncertainty in the value of
NuclideActivityValue, expressed in kilobecquerel (kBq) units.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="NuclideActivityValue" type="n42:NuclideActivityType"
nillable="false">
    <xsd:annotation>
      <xsd:documentation>The calculated activity of the nuclide at the measurement
time, expressed in kilobecquerel (kBq) units. </xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="NuclideAnalysisReducedChiSquareValue"
type="n42:NonNegativeDoubleSimpleType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>The difference between the observed data and predicted values,
normalized to an expected value of unity.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="NuclideAnalysisResults" type="n42:NuclideAnalysisResultsType"
nillable="false">
    <xsd:annotation>
      <xsd:documentation>The results of radionuclide analysis.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="NuclideAnalysisResultsExtension" abstract="true" nillable="false">
    <xsd:annotation>
      <xsd:documentation>An abstract element serving as a substitution group head
enabling extension via additional schema(s).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="NuclideCategoryDescription" type="xsd:string" nillable="false">
    <xsd:annotation>
      <xsd:documentation>Provides documentation regarding the category of the
nuclide.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="NuclideIDConfidenceDescription" type="xsd:string"
substitutionGroup="n42:NuclideIdentificationConfidence" nillable="false">
    <xsd:annotation>
      <xsd:documentation>A free-form text description of the confidence in the
identification status of this nuclide; for example, Low, Medium,
High.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="NuclideIDConfidenceUncertaintyValue" type="n42:PercentSimpleType"
substitutionGroup="n42:NuclideIdentificationConfidence" nillable="false">
    <xsd:annotation>
      <xsd:documentation>1-sigma absolute uncertainty in the value of
NuclideIDConfidenceValue.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="NuclideIDConfidenceValue" type="n42:PercentSimpleType"
substitutionGroup="n42:NuclideIdentificationConfidence" nillable="false">
    <xsd:annotation>
      <xsd:documentation>Indication of confidence ranging from 0.0 to 100.0 percent, in
the identification status of a nuclide, where increasing values indicate more certainty

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that the nuclide is present. The interpretation of this value is dependent on the characteristics of the nuclide identification algorithm. </xsd:documentation>

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    </xsd:annotation>
  </xsd:element>
  <xsd:element name="NuclideIdentificationConfidence" abstract="true" nillable="false">
    <xsd:annotation>
      <xsd:documentation>A data concept for the confidence of identification of a
nuclide. </xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="NuclideIdentifiedIndicator" type="xsd:boolean" nillable="false">
    <xsd:annotation>
      <xsd:documentation>Indicates whether the nuclide was identified by the analysis;
it is true if identified, false otherwise.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="NuclideMinimumDetectableActivityValue" type="n42:NuclideMDAType"
nillable="false">
    <xsd:annotation>
      <xsd:documentation>Minimum detectable activity (MDA) of the nuclide, expressed in
kilobecquerel (kBq) units. </xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="NuclideName" type="n42:NonBlankStringSimpleType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>Name of the nuclide. </xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="NuclideShieldingArealDensityValue" type="n42:ArealDensityType"
nillable="false">
    <xsd:annotation>
      <xsd:documentation>The estimated effective areal density of the material
shielding this nuclide, in g/cm^2.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="NuclideShieldingAtomicNumber" type="n42:PositiveDoubleSimpleType"
nillable="false">
    <xsd:annotation>
      <xsd:documentation>The estimated effective atomic number of the material
shielding this nuclide.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="NuclideSourceGeometryCode" type="n42:SourceGeometryCodeSimpleType"
nillable="false">
    <xsd:annotation>
      <xsd:documentation>The assessed geometry of a radiation
source.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="OccupancyIndicator" type="xsd:boolean" nillable="false">
    <xsd:annotation>
      <xsd:documentation>Indicates the presence of a measured item in the field of view
of the radiation measurement instrument during the period of time defined by the parent
RadMeasurement element. It will be True if the radiation measurement instrument detects
the presence of an item and false otherwise.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="Orientation" type="n42:OrientationType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>The orientation of an object (e.g., radiation measurement
instrument, radiation detector, or measured item) in space in terms of an internal
frame of reference attached to the object's body and an external frame of reference.
The object's internal frame of reference consists of three perpendicular axes: front-
back, left-right, and top-bottom. The external frame of reference consists of the
horizontal plane and True North. The object's orientation is expressed in the terms of
three angles: azimuth, inclination, and roll. </xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="Origin" type="n42:OriginType" nillable="false">
    <xsd:annotation>
      <xsd:documentation>Defines the origin of a relative location coordinate system. The
coordinates of a point in the relative location system are defined based on this
origin.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="OriginDescription" type="xsd:string" nillable="false">
    <xsd:annotation>

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    <xsd:documentation>Free-form text describing the point or object to which the
    RelativeLocation information (distance, inclination angle, azimuth angle)
    applies.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadAlarm" type="n42:RadAlarmType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Describes a radiation alarm that was issued based on the
    measurement(s) collected on the measured item(s).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadAlarmExtension" abstract="true" nillable="false">
  <xsd:annotation>
    <xsd:documentation>An abstract element serving as a substitution group head
    enabling extension via additional schema(s).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadAlarmCategoryCode" type="n42:RadAlarmCategoryCodeSimpleType"
    nillable="false">
  <xsd:annotation>
    <xsd:documentation>The category of radiation alarm (e.g.,
    Neutron).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadAlarmDateTime" type="xsd:dateTime" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The date and time of the alarm.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadAlarmDescription" type="xsd:string" nillable="false">
  <xsd:annotation>
    <xsd:documentation>A free-form description of the radiation
    alarm.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadAlarmEnergyWindowIndices"
    type="n42:PositiveIntegerListSimpleType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>If applicable, this is a list of one or more indices that
    indicate the position(s) of the value(s) in the WindowStartEnergyValues and
    WindowEndEnergyValues that triggered alarm(s). </xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadAlarmLightColor" type="xsd:token" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Free-form text describing the color of the light (if any)
    annunciating the alarm.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadDetectorCharacteristics" type="n42:CharacteristicsType"
    nillable="false">
  <xsd:annotation>
    <xsd:documentation>Characteristics of the radiation detector that is not otherwise
    explicitly addressed in this standard. Each non-standard characteristic consists of
    name, value, units, and value data class. Characteristics may also be organized in
    characteristic groups.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadDetectorCategoryCode"
    type="n42:RadDetectorCategoryCodeSimpleType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The general category of radiation detected; e.g., Gamma,
    Neutron.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadDetectorDepthValue" type="n42:PositiveLengthCMType"
    nillable="false">
  <xsd:annotation>
    <xsd:documentation>The depth of a rectangular radiation detector, in centimeters
    (cm).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadDetectorDescription" type="xsd:string" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Additional information regarding the radiation
    detector.</xsd:documentation>
  </xsd:annotation>
</xsd:element>

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<xsd:element name="RadDetectorDiameterValue" type="n42:PositiveLengthCMType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The diameter of a cylindrical radiation detector, in centimeters
(cm).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadDetectorInformation" type="n42:RadDetectorInformationType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>Contains information describing a radiation
detector.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadDetectorInformationExtension" abstract="true" nillable="false">
  <xsd:annotation>
    <xsd:documentation>An abstract element serving as a substitution group head
enabling extension via additional schema(s).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadDetectorKindCode" type="n42:RadDetectorKindCodeSimpleType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The specific kind of radiation detector; e.g.,
NaI.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadDetectorLengthValue" type="n42:PositiveLengthCMType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The length of a rectangular or cylindrical radiation detector,
in centimeters (cm).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadDetectorName" type="xsd:string" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The name of the radiation detector.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadDetectorState" type="n42:RadDetectorStateType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The ccurrent state of a radiation detector in terms of its
location (absolute or relative), orientation, altitude, and speed.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadDetectorStateExtension" abstract="true" nillable="false">
  <xsd:annotation>
    <xsd:documentation>An abstract element serving as a substitution group head
enabling extension via additional schema(s).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadDetectorVolumeValue" type="n42:PositiveVolumeCCType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The volume of a radiation detector, in cubic centimeters
(cc).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadDetectorWidthValue" type="n42:PositiveLengthCMType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The width of a rectangular radiation detector, in centimeters
(cm).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadInstrumentCharacteristics" type="n42:CharacteristicsType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>Characteristics of the radiation measurement instrument that is
not otherwise explicitly addressed in this standard. Each non-standard characteristic
consists of name, value, units, and value data class. Characteristics may also be
organized in characteristic groups.groups.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadInstrumentClassCode" type="n42:RadInstrumentClassCodeSimpleType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>Class of radiation measurement instrument.</xsd:documentation>
  </xsd:annotation>

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    </xsd:annotation>
</xsd:element>
<xsd:element name="RadInstrumentComponentName" type="n42:NonBlankStringSimpleType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>Name of the radiation detection measurement
component.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="RadInstrumentComponentVersion" type="n42:NonBlankStringSimpleType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>Version information for a particular radiation measurement
instrument component.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="RadInstrumentData" type="n42:RadInstrumentDataType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>The top element of an instance of a radiation measurement
instrument's N42 XML document. This element contains all the reported measurement and
analysis data, and all the information on the instrument, its radiation detector(s),
and the item(s) it measured.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="RadInstrumentDataExtension" abstract="true" nillable="false">
    <xsd:annotation>
        <xsd:documentation>An abstract element serving as a substitution group head
enabling extension via additional schema(s).</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="RadInstrumentDataCreatorName" type="n42:NonBlankStringSimpleType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>The name of the organization that created the N42 XML
document.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="RadInstrumentDescription" type="xsd:string" nillable="false">
    <xsd:annotation>
        <xsd:documentation>Free-form text describing the radiation measurement
instrument.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="RadInstrumentIdentifier" type="n42:NonBlankStringSimpleType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>Identification information for the specific radiation
measurement instrument; such as serial number or asset tag number. </xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="RadInstrumentInformation" type="n42:RadInstrumentInformationType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>Describes the radiation measurement instrument that collected
the data contained in the N42 XML document.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="RadInstrumentInformationExtension" abstract="true" nillable="false">
    <xsd:annotation>
        <xsd:documentation>An abstract element serving as a substitution group head
enabling extension via additional schema(s).</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="RadInstrumentManufacturerName" type="n42:NonBlankStringSimpleType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>Name of the manufacturer of the radiation measurement
instrument.</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="RadInstrumentModeCode" type="n42:RadInstrumentModeCodeSimpleType"
nillable="false">
    <xsd:annotation>
        <xsd:documentation>This element indicates the operating modes of a radiation
measurement instrument.</xsd:documentation>
    </xsd:annotation>
</xsd:element>

```



```

<xsd:element name="RadInstrumentModeDescription" type="xsd:string" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Free-form description of the operating mode of the radiation
    measurement instrument. This element shall be used if RadInstrumentModeCode is
    Other.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadInstrumentModelName" type="n42:NonBlankStringSimpleType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The radiation measurement instrument manufacturer's model name,
    number, or other description of the radiation measurement
    instrument.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadInstrumentQualityControl"
type="n42:RadInstrumentQualityControlType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The quality control status of the radiation measurement
    instrument, indicating its fitness for service.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadInstrumentState" type="n42:RadInstrumentStateType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The current state of a radiation measurement instrument in terms
    of its mode of operation, location (absolute or relative), orientation, altitude, and
    speed.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadInstrumentStateExtension" abstract="true" nillable="false">
  <xsd:annotation>
    <xsd:documentation>An abstract element serving as a substitution group head
    enabling extension via additional schema(s).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadInstrumentVersion" type="n42:RadInstrumentVersionType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>Information that describes the versions of the various
    components of the radiation measurement instrument. At a minimum, there shall be an
    instance of this element with the component name Software that describes the version of
    the software and/or firmware that produced the current N42 XML
    document.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadItemCharacteristics" type="n42:CharacteristicsType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>Characteristics of the measured item that is not otherwise
    explicitly addressed in this standard. Each non-standard characteristic consists of
    name, value, units, and value data class. Characteristics may also be organized in
    characteristic groups.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadItemDescription" type="xsd:string" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Free-form text describing the item being
    measured.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadItemInformation" type="n42:RadItemInformationType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>Information describing the measured item.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadItemInformationExtension" abstract="true" nillable="false">
  <xsd:annotation>
    <xsd:documentation>An abstract element serving as a substitution group head
    enabling extension via additional schema(s).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadItemMeasurementGeometryDescription" type="xsd:string"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The free-form text description of the position and/or shape of
    the geometry used in the measurement of this item; e.g., shape of the item, item

```

```

orientation relative to the radiation detectors, position of any attenuators
used.</xsd:documentation>
</xsd:annotation>
</xsd:element>
<xsd:element name="RadItemQuantity" type="n42:RadItemQuantityType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Amount or size of the item being measured, and its uncertainty.
    The units and interpretation of this value will be application-specific, but will
    normally be the weight or volume of the measured item, used in the calculation of item
    activity concentration.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadItemQuantityUncertaintyValue" type="n42:PositiveDoubleSimpleType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The 1-sigma absolute uncertainty in
RadItemQuantityValue.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadItemQuantityUnits" type="n42:NonBlankStringSimpleType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The unit of measure of the measured item quantity
value.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadItemQuantityValue" type="n42:PositiveDoubleSimpleType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The amount or size of the item being
measured.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadItemState" type="n42:RadItemStateType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The current state of a measured item in terms of its location
(absolute or relative), orientation, and speed.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadItemStateExtension" abstract="true" nillable="false">
  <xsd:annotation>
    <xsd:documentation>An abstract element serving as a substitution group head
enabling extension via additional schema(s).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadMeasurement" type="n42:RadMeasurementType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>This element to records a measurement at a particular
StartDateTime, for a RealTimeDuration, of a particular MeasurementClassCode that
consists of readings from any number of one or more of the following:
- a radiation detector
- an occupancy sensor
- a positioning sensor that captures
the location of a radiation measurement instrument, radiation detector, or measured
item
- the state of a radiation measurement instrument, radiation detector, or
measured item </xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadMeasurementExtension" abstract="true" nillable="false">
  <xsd:annotation>
    <xsd:documentation>An abstract element serving as a substitution group head
enabling extension via additional schema(s).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadMeasurementGroupDescription" type="xsd:string" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Free-form text describing the
RadMeasurementGroup.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RadMeasurementGroup" type="n42:RadMeasurementGroupType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>Identifies a group of RadMeasurements.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RealTimeDuration" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Total clock time required to collect the measurement data; the
duration shall be greater than zero.</xsd:documentation>
  </xsd:annotation>

```

```

</xsd:annotation>
<xsd:simpleType>
  <xsd:restriction base="xsd:duration">
    <xsd:minExclusive value="P0Y0M0DT0H0M0S" fixed="true">
      <xsd:annotation>
        <xsd:documentation>RealTimeDuration must be greater than
zero.</xsd:documentation>
      </xsd:annotation>
    </xsd:minExclusive>
  </xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="RelativeLocation" type="n42:RelativeLocationType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Describes the location of an object (i.e., radiation measurement
instrument, radiation detector, or measured item) or a radiation source relative to a
reference point (Origin).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="Remark" type="xsd:string" nillable="false">
  <xsd:annotation>
    <xsd:documentation>A placeholder for comments intended to help the consumer of the
data to better understand the information encapsulated by the parent
element.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="RollValue" type="n42:Angle180Type" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The orientation of an object (e.g., radiation detection
instrument, radiation detector, or measured item) with respect to the axis running from
the front to the back of the object. Its value is the angle subtended by a line defined
by the objects left-to-right axis and a line defined by the same axis when it is
aligned with the horizontal plane. The angle range is from -180.0 to +180.0 degrees. A
value of zero implies the object's body is not rotated about the front-to-back axis and
its left-to-right axis is aligned with the horizontal plane (though the object may be
inclined); positive values are clockwise rotations about the front-to-back axis when
viewed from behind the object and looking towards the direction to which the object is
pointing; negative values are counterclockwise rotations.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="SourcePosition" type="n42:SourcePositionType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The estimated location of a nuclide source by actual
geographical coordinates or relative to a reference point.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="Spectrum" type="n42:SpectrumType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Contains a single spectrum measurement with references to other
pertinent information about the measurement.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="SpectrumExtension" abstract="true" nillable="false">
  <xsd:annotation>
    <xsd:documentation>An abstract element serving as a substitution group head
enabling extension via additional schema(s).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="SpectrumPeak" type="n42:SpectrumPeakType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The spectrum peak analysis results information for a single
peak.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="SpectrumPeakAnalysisResults"
type="n42:SpectrumPeakAnalysisResultsType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The results of spectrum peak analysis; each peak found in the
spectrum is described by a SpectrumPeak child element.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="SpectrumPeakExtension" abstract="true" nillable="false">
  <xsd:annotation>
    <xsd:documentation>An abstract element serving as a substitution group head
enabling extension via additional schema(s).</xsd:documentation>
  </xsd:annotation>
</xsd:element>

```

```

<xsd:element name="SpectrumPeakNetAreaUncertaintyValue"
type="n42:NonNegativeDoubleSimpleType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The 1-sigma absolute uncertainty in the spectrum peak's net
area.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="SpectrumPeakNetAreaValue" type="xsd:double" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The net number of counts in the peak; i.e., total counts minus
continuum counts. No other adjustment (e.g., environmental background subtraction),
should be performed.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="SpectrumPeakAnalysisResultsExtension" abstract="true"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>An abstract element serving as a substitution group head
enabling extension via additional schema(s).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="SpectrumPeakEnergyValue" type="n42:SpectrumPeakEnergyKeVType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The measured energy of the spectrum peak, in
keV.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="SpectrumPeakExpectedEnergyValue"
type="n42:SpectrumPeakEnergyKeVType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The expected energy of the spectrum peak, in
keV.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="SpectrumPeakFWHMValue" type="n42:SpectrumPeakEnergyKeVType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The measured FWHM of the spectrum peak, in
keV.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="SpeedValue" type="n42:SpeedType" nillable="false">
  <xsd:annotation>
    <xsd:documentation> The speed of an object (e.g., radiation measurement instrument,
radiation detector, or measured item). If an orientation bearing is defined by the
presence of the Orientation element, then the SpeedValue is considered to be along this
bearing.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="StartDateTime" type="xsd:dateTime" nillable="false">
  <xsd:annotation>
    <xsd:documentation>Time corresponding to the start of the collection of the data
contained in a particular measurement.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="StateVector" type="n42:StateVectorType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>State values for a radiation measurement instrument, a radiation
detector, or a measured item.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="TotalCountData" type="n42:NonNegativeDoubleListSimpleType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The total number of counts accumulated since the last radiation
detection instrument reset over the entire energy range measured by the radiation
detect or within pre-defined energy windows.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="TotalCountsValue" type="n42:NonNegativeDoubleSimpleType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>Total counts observed.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="TotalDose" type="n42:TotalDoseType" nillable="false">
  <xsd:annotation>

```

```

    <xsd:documentation>The accumulated ambient dose equivalent since the last radiation
detection instrument reset, with units microsieverts (Sv).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="TotalDoseValue" type="n42:TotalDoseuSvType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The accumulated ambient dose equivalent over all measurements
input to AnalysisResults, in microsieverts (Sv).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="TotalEfficiencyCalibration" type="n42:EfficiencyCalibrationType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>A total efficiency calibration. The total efficiency at any
value of energy is the ratio of the total recorded pulses in a spectrum to the number
of photons emitted from a source at that energy.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="TotalExposure" type="n42:TotalExposureType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The accumulated exposure since the last instrument reset, in
milliroentgen (mR).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="TotalExposureValue" type="n42:TotalExposuremRType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The accumulated exposure over all measurements input to
AnalysisResults, in milliroentgen (mR).</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="WindowEndEnergyValues" type="n42:EnergiesKeVType" nillable="false">
  <xsd:annotation>
    <xsd:documentation>The end energy for each of a series of energy windows, in
keV.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="WindowStartEnergyValues" type="n42:EnergiesKeVType"
nillable="false">
  <xsd:annotation>
    <xsd:documentation>The start energy for each of a series of energy windows, in
keV.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
</xsd:schema>

```

Annex B (informative)

Example: A simple spectrometer

B.1 General

This is a simple document from a 256-channel spectroscopic analyzer (MCA). The document contains:

- The definition of the radiation measurement instrument, a “radionuclide identifier”, via <RadInstrumentInformation>.
- The definition of the radiation detector, a NaI scintillator, via <RadDetectorInformation>.
- The energy calibration used by the radiation detector, given as a quadratic equation.
- A spectrum measurement, via <RadMeasurement>. The data were acquired beginning November 10, 2003, at 11:45:19 P.M, Mountain Standard Time. The real time is 60 s, and the live time is 59,61 s.

NOTE 1 Two examples are given. In the first example, the energy calibration is quadratic, represented via <CoefficientValues>; the same calibration using <EnergyBoundaryValues> is given in the second example.

NOTE 2 The indented formatting is purely for readability and is not required. Line breaks are not required, and there is no limit to line length - the entire document could be represented on a single line.

NOTE 3 All numeric values, including channel data, can be in either integer or floating point representation.

B.2 Energy calibration – Quadratic equation

```
<?xml version="1.0"?>
<?xml-model href="http://physics.nist.gov/N42/2011/schematron/n42.sch"
type="application/xml" schematypens="http://purl.oclc.org/dsdl/schematron"?>
<RadInstrumentData xmlns="http://physics.nist.gov/N42/2011/N42"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://physics.nist.gov/N42/2011/N42
http://physics.nist.gov/N42/2011/n42.xsd"
  n42DocUUID="d72b7fa7-4a20-43d4-b1b2-7e3b8c6620c1">

  <RadInstrumentInformation id="RadInstrumentInformation-1">
    <RadInstrumentManufacturerName>RIIDS R Us</RadInstrumentManufacturerName>
    <RadInstrumentModelName>iRIID</RadInstrumentModelName>
    <RadInstrumentClassCode>Radionuclide Identifier</RadInstrumentClassCode>
    <RadInstrumentVersion>
      <RadInstrumentComponentName>Software</RadInstrumentComponentName>
      <RadInstrumentComponentVersion>1.1</RadInstrumentComponentVersion>
    </RadInstrumentVersion>
  </RadInstrumentInformation>

  <RadDetectorInformation id="RadDetectorInformation-1">
    <RadDetectorCategoryCode>Gamma</RadDetectorCategoryCode>
    <RadDetectorKindCode>NaI</RadDetectorKindCode>
  </RadDetectorInformation>

  <EnergyCalibration id="EnergyCalibration-1">
    <CoefficientValues>-21.8 12.1 6.55e-03</CoefficientValues>
  </EnergyCalibration>

  <RadMeasurement id="RadMeasurement-1">
    <MeasurementClassCode>Foreground</MeasurementClassCode>
    <StartDateTime>2003-11-22T23:45:19-07:00</StartDateTime>
    <RealTimeDuration>PT60S</RealTimeDuration>
    <Spectrum id="RadMeasurement-1Spectrum-1"
radDetectorInformationReference="RadDetectorInformation-1"
energyCalibrationReference="EnergyCalibration-1">
      <LiveTimeDuration>PT59.61S</LiveTimeDuration>
      <ChannelData compressionCode="None">
        0 0 0 22 421 847 1295 1982 2127 2222 2302 2276
```

```

2234 1921 1939 1715 1586 1469 1296 1178 1127 1047 928 760
679 641 542 529 443 423 397 393 322 272 294 227
216 224 208 191 189 163 167 173 150 137 136 129
150 142 160 159 140 103 90 82 83 85 67 76
73 84 63 74 70 69 76 61 49 61 63 65
58 62 48 75 56 61 46 56 43 37 55 47
50 40 38 54 43 41 45 51 32 35 29 33
40 44 33 35 20 26 27 17 19 20 16 19
18 19 18 20 17 45 55 70 62 59 32 30
21 23 10 9 5 13 11 11 6 7 7 9
11 4 8 8 14 14 11 9 13 5 5 6
10 9 3 4 3 7 5 5 4 5 3 6
5 0 5 6 3 1 4 4 3 10 11 4
1 4 2 11 9 6 3 5 5 1 4 2
6 6 2 3 0 2 2 2 2 0 1 3
1 1 2 3 2 4 5 2 6 4 1 0
3 1 2 1 1 0 1 0 0 2 0 1
0 0 0 1 0 0 0 0 0 0 0 2
0 0 0 1 0 1 0 0 2 1 0 0
0 0 1 3 0 0 0 1 0 1 0 0
0 0 0 0
</ChannelData>
</Spectrum>
</RadMeasurement>
</RadInstrumentData>

```

B.3 Energy calibration – Energy boundaries

An alternate form of energy calibration, using <EnergyBoundaryValues>, is shown in the following fragment. These values express a calibration equivalent to the one represented by <CoefficientValues> in the example.

```

<EnergyCalibration id="EnergyCalibration-1">
  <EnergyBoundaryValues>
    0.800 1.693 2.426 14.559 26.705 38.864 51.036 63.221
    75.419 87.631 99.855 112.093 124.343 136.607 148.884 161.174
    173.477 185.793 198.122 210.465 222.820 235.189 247.570 259.965
    272.373 284.794 297.228 309.675 322.135 334.609 347.095 359.595
    372.107 384.633 397.172 409.724 422.289 434.867 447.458 460.063
    472.680 485.311 497.954 510.611 523.281 535.964 548.660 561.369
    574.091 586.827 599.575 612.337 625.111 637.899 650.700 663.514
    676.341 689.181 702.034 714.901 727.780 740.673 753.578 766.497
    779.429 792.374 805.332 818.303 831.287 844.285 857.295 870.319
    883.355 896.405 909.468 922.544 935.633 948.735 961.850 974.979
    988.120 1001.275 1014.442 1027.623 1040.817 1054.024 1067.244 1080.477
    1093.723 1106.983 1120.255 1133.541 1146.839 1160.151 1173.476 1186.814
    1200.165 1213.529 1226.906 1240.297 1253.700 1267.117 1280.546 1293.989
    1307.445 1320.914 1334.396 1347.891 1361.399 1374.921 1388.455 1402.003
    1415.563 1429.137 1442.724 1456.324 1469.937 1483.563 1497.202 1510.855
    1524.520 1538.199 1551.890 1565.595 1579.313 1593.044 1606.788 1620.545
    1634.315 1648.099 1661.895 1675.705 1689.527 1703.363 1717.212 1731.074
    1744.949 1758.837 1772.738 1786.653 1800.580 1814.521 1828.474 1842.441
    1856.421 1870.414 1884.420 1898.439 1912.471 1926.517 1940.575 1954.647
    1968.731 1982.829 1996.940 2011.064 2025.201 2039.351 2053.514 2067.691
    2081.880 2096.083 2110.298 2124.527 2138.769 2153.024 2167.292 2181.573
    2195.867 2210.175 2224.495 2238.829 2253.175 2267.535 2281.908 2296.294
    2310.693 2325.105 2339.530 2353.969 2368.420 2382.885 2397.362 2411.853
    2426.357 2440.874 2455.404 2469.947 2484.503 2499.073 2513.655 2528.251
    2542.859 2557.481 2572.116 2586.764 2601.425 2616.099 2630.786 2645.487
    2660.200 2674.927 2689.666 2704.419 2719.185 2733.964 2748.756 2763.561
    2778.379 2793.211 2808.055 2822.913 2837.783 2852.667 2867.564 2882.474
    2897.397 2912.333 2927.282 2942.245 2957.220 2972.209 2987.210 3002.225
    3017.253 3032.294 3047.348 3062.415 3077.495 3092.589 3107.695 3122.815
    3137.947 3153.093 3168.252 3183.424 3198.609 3213.807 3229.018 3244.243
    3259.480 3274.731 3289.994 3305.271 3320.561 3335.864 3351.180 3366.509
    3381.851 3397.207 3412.575 3427.957 3443.351 3458.759 3474.180 3489.614
    3505.061
  </EnergyBoundaryValues>
</EnergyCalibration>

```

Annex C (informative)

Example: A radionuclide identifier

This example is a more complex version of Annex B. In addition to the basic data in Annex B, this document contains:

- Additional information regarding the radiation measurement instrument: the version of the hardware, the instrument's QC status, and several special characteristics.
- Additional information regarding the NaI radiation detector: its dimensions and several special characteristics.
- The definition of a second radiation detector, a GM tube.
- FWHM and efficiency calibrations.
- The measurement of a background spectrum prior to the foreground measurement.
- The measurement data includes the gross counts from the GM tube, and the dose rate as determined by the NaI detector. Note that at a higher dose rate, the source of the dose rate would be the GM tube; this would be indicated by the radDetectorInformationReference attribute value.
- Definition of a measurement group that links the foreground and background measurements.
- Analysis results (both nuclide identification and spectrum peak analysis)

```
<?xml version="1.0"?>
<?xml-model href="http://physics.nist.gov/N42/2011/schematron/n42.sch"
type="application/xml" schematypens="http://purl.oclc.org/dsdl/schematron"?>
<RadInstrumentData xmlns="http://physics.nist.gov/N42/2011/N42"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://physics.nist.gov/N42/2011/N42
http://physics.nist.gov/N42/2011/n42.xsd"
  n42DocUUID="64a170f5-4c39-4bd8-af16-f9e927b31ce6">

  <RadInstrumentDataCreatorName>iRID</RadInstrumentDataCreatorName>

  <RadInstrumentInformation id="RadInstrumentInformation-1">
    <RadInstrumentManufacturerName>RIDs R Us</RadInstrumentManufacturerName>
    <RadInstrumentIdentifier>SN 7890A</RadInstrumentIdentifier>
    <RadInstrumentModelName>iRID</RadInstrumentModelName>
    <RadInstrumentClassCode>Radionuclide Identifier</RadInstrumentClassCode>
    <RadInstrumentVersion>
      <RadInstrumentComponentName>Hardware</RadInstrumentComponentName>
      <RadInstrumentComponentVersion>31Z</RadInstrumentComponentVersion>
    </RadInstrumentVersion>
    <RadInstrumentVersion>
      <RadInstrumentComponentName>Software</RadInstrumentComponentName>
      <RadInstrumentComponentVersion>1.1</RadInstrumentComponentVersion>
    </RadInstrumentVersion>
    <RadInstrumentQualityControl>
      <InspectionDateTime>2003-01-01T12:00:00-07:00</InspectionDateTime>
      <InCalibrationIndicator>true</InCalibrationIndicator>
    </RadInstrumentQualityControl>
    <RadInstrumentCharacteristics>
      <Characteristic>
        <CharacteristicName>IP</CharacteristicName>
        <CharacteristicValue>192.168.100.32</CharacteristicValue>
        <CharacteristicValueUnits>unit-less</CharacteristicValueUnits>
        <CharacteristicValueDataClassCode>string</CharacteristicValueDataClassCode>
      </Characteristic>
      <Characteristic>
        <CharacteristicName>RF BAND</CharacteristicName>
        <CharacteristicValue>2.1</CharacteristicValue>
        <CharacteristicValueUnits>GHz</CharacteristicValueUnits>
      </Characteristic>
    </RadInstrumentCharacteristics>
  </RadInstrumentInformation>
</RadInstrumentData>

<CharacteristicValueDataClassCode>PositiveDouble</CharacteristicValueDataClassCode>
</Characteristic>
```



```

    </RadInstrumentCharacteristics>
  </RadInstrumentInformation>

  <RadDetectorInformation id="RadDetectorInformation-1">
    <RadDetectorCategoryCode>Gamma</RadDetectorCategoryCode>
    <RadDetectorKindCode>NaI</RadDetectorKindCode>
    <RadDetectorDescription>1x1 NaI Detachable probe</RadDetectorDescription>
    <RadDetectorLengthValue>2.54</RadDetectorLengthValue>
    <RadDetectorDiameterValue>2.54</RadDetectorDiameterValue>
    <RadDetectorVolumeValue>12.9</RadDetectorVolumeValue>
    <RadDetectorCharacteristics>
      <Characteristic>
        <CharacteristicName>Bias</CharacteristicName>
        <CharacteristicValue>1000</CharacteristicValue>
        <CharacteristicValueUnits>V</CharacteristicValueUnits>
        <CharacteristicValueDataClassCode>double</CharacteristicValueDataClassCode>
      </Characteristic>
      <Characteristic>
        <CharacteristicName>Vendor</CharacteristicName>
        <CharacteristicValue>Krystals 'R Us</CharacteristicValue>
        <CharacteristicValueUnits>unit-less</CharacteristicValueUnits>
        <CharacteristicValueDataClassCode>string</CharacteristicValueDataClassCode>
      </Characteristic>
    </RadDetectorCharacteristics>
  </RadDetectorInformation>

  <RadDetectorInformation id="RadDetectorInformation-2">
    <RadDetectorCategoryCode>Gamma</RadDetectorCategoryCode>
    <RadDetectorKindCode>GMT</RadDetectorKindCode>
    <RadDetectorDescription>Built-in GM tube</RadDetectorDescription>
    <RadDetectorLengthValue>4.1</RadDetectorLengthValue>
    <RadDetectorDiameterValue>1.5</RadDetectorDiameterValue>
  </RadDetectorInformation>

  <EnergyCalibration id="EnergyCalibration-1">
    <CoefficientValues>-21.8 12.1 6.55e-03</CoefficientValues>
  </EnergyCalibration>

  <FWHMCalibration id="FWHMCalibration-1">
    <EnergyValues>88.0 661.65 1173.21 1838.01</EnergyValues>
    <FWHMValues>2.9 11.1 14.2 19.8</FWHMValues>
  </FWHMCalibration>

  <FullEnergyPeakEfficiencyCalibration
id="TotalAbsorptionDetectorEfficiencyCalibration-1">
    <EnergyValues>88.0 661.65 1173.21 1838.01</EnergyValues>
    <EfficiencyValues>2.8e-01 1.2e-01 5.2e-02 3.4e-02</EfficiencyValues>
    <EfficiencyUncertaintyValues>1.1e-02 2.8e-3 5.3e-04 9.6e-
04</EfficiencyUncertaintyValues>
  </FullEnergyPeakEfficiencyCalibration>

  <RadMeasurement id="RadMeasurement-1"
radMeasurementGroupReferences="RadMeasurementGroup-1">
    <MeasurementClassCode>Background</MeasurementClassCode>
    <StartDateTime>2003-11-22T23:35:30-07:00</StartDateTime>
    <RealTimeDuration>PT60S</RealTimeDuration>

    <Spectrum id="RadMeasurement-1-Spectrum-1"
radDetectorInformationReference="RadDetectorInformation-1"
energyCalibrationReference="EnergyCalibration-1"
FWHMCalibrationReference="FWHMCalibration-1"
fullEnergyPeakEfficiencyCalibrationReference="TotalAbsorptionDetectorEfficiencyCalibrat
ion-1">
      <LiveTimeDuration>PT59.7S</LiveTimeDuration>
      <ChannelData compressionCode="None">
        0 0 0 22 421 847 1295 1982 2127 2222 2302 2276
        2234 1921 1939 1715 1586 1469 1296 1178 1127 1047 928 760
        679 641 542 529 443 423 397 393 322 272 294 227
        216 224 208 191 189 163 167 173 150 137 136 129
        150 142 160 159 140 103 90 82 83 85 67 76
        73 84 63 74 70 69 76 61 49 61 63 65
        58 62 48 75 56 61 46 56 43 37 55 47
        50 40 38 54 43 41 45 51 32 35 29 33
        40 44 33 35 20 26 27 17 19 20 16 19
        18 19 18 20 17 45 55 70 62 59 32 30
        21 23 10 9 5 13 11 11 6 7 7 9
        11 4 8 8 14 14 11 9 13 5 5 6
        10 9 3 4 3 7 5 5 4 5 3 6
      </ChannelData>
    </Spectrum>
  </RadMeasurement>

```

```

5 0 5 6 3 1 4 4 3 10 11 4
1 4 2 11 9 6 3 5 5 1 4 2
6 6 2 3 0 2 2 2 2 0 1 3
1 1 2 3 2 4 5 2 6 4 1 0
3 1 2 1 1 0 1 0 0 2 0 1
0 0 0 1 0 0 0 0 0 0 0 2
0 0 0 1 0 1 0 0 2 1 0 0
0 0 1 3 0 0 0 1 0 1 0 0
0 0 0 0
</ChannelData>
</Spectrum>

<GrossCounts id="RadMeasurement-1-GrossCounts-1"
radDetectorInformationReference="RadDetectorInformation-2">
  <LiveTimeDuration>PT60S</LiveTimeDuration>
  <CountData>549</CountData>
</GrossCounts>

<DoseRate id="RadMeasurement-1-DoseRate-1"
radDetectorInformationReference="RadDetectorInformation-1">
  <DoseRateValue>0.3</DoseRateValue>
</DoseRate>
</RadMeasurement>

<RadMeasurement id="RadMeasurement-2"
radMeasurementGroupReferences="RadMeasurementGroup-1">
  <MeasurementClassCode>Foreground</MeasurementClassCode>
  <StartDateTime>2003-11-22T23:45:19-07:00</StartDateTime>
  <RealTimeDuration>PT60S</RealTimeDuration>

  <Spectrum id="RadMeasurement-2-Spectrum-2"
radDetectorInformationReference="RadDetectorInformation-1"
energyCalibrationReference="EnergyCalibration-1"
FWHMCalibrationReference="FWHMCalibration-1"
fullEnergyPeakEfficiencyCalibrationReference="TotalAbsorptionDetectorEfficiencyCalibration-1">
    <LiveTimeDuration>PT59.61S</LiveTimeDuration>
    <ChannelData compressionCode="CountedZeroes">
      0 3 22 421 847 1295 1982 2127 2222 2302 2276 2234 1921 1939 1715 1586
      1469 1296 1178 1127 1047 928 760 679 641 542 529 443 423 397 393 322
      272 294 227 216 224 208 191 189 163 167 173 150 137 136 129 150
      142 160 159 140 103 90 82 83 85 67 76 73 84 63 74 70
      69 76 61 49 61 63 65 58 62 48 75 56 61 46 56 43
      37 55 47 50 40 38 54 43 41 45 51 32 35 29 33 40
      44 33 35 20 26 27 17 19 20 16 19 18 19 18 20 17
      45 55 70 62 59 32 30 21 23 10 9 5 13 11 11 6
      7 7 9 11 4 8 8 14 14 11 9 13 5 5 6 10
      9 3 4 3 7 5 5 4 5 3 6 5 0 1 5 6
      3 1 4 4 3 10 11 4 1 4 2 11 9 6 3 5
      5 1 4 2 6 6 2 3 0 1 2 2 2 2 0 1
      1 3 1 1 2 3 2 4 5 2 6 4 1 0 1 3
      1 2 1 1 0 1 1 0 2 2 0 1 1 0 3 1
      0 7 2 0 3 1 0 1 1 0 2 2 1 0 4 1
      3 0 3 1 0 1 1 0 6
    </ChannelData>
  </Spectrum>

  <GrossCounts id="RadMeasurement-2-GrossCounts-2"
radDetectorInformationReference="RadDetectorInformation-2">
    <LiveTimeDuration>PT60S</LiveTimeDuration>
    <CountData>549</CountData>
  </GrossCounts>

  <DoseRate id="RadMeasurement-2-DoseRate-2"
radDetectorInformationReference="RadDetectorInformation-1">
    <DoseRateValue>0.5</DoseRateValue>
  </DoseRate>
</RadMeasurement>

<RadMeasurementGroup id="RadMeasurementGroup-1"/>

<AnalysisResults id="AnalysisResults-1"
radMeasurementGroupReferences="RadMeasurementGroup-1">
  <AnalysisStartDateTime>2003-11-22T23:46:20-07:00</AnalysisStartDateTime>
  <AnalysisAlgorithmName>SuperNID</AnalysisAlgorithmName>
  <AnalysisAlgorithmCreatorName>Spectrometers R Us</AnalysisAlgorithmCreatorName>
  <AnalysisAlgorithmVersion>
  <AnalysisAlgorithmComponentName>Main</AnalysisAlgorithmComponentName>

```

```
<AnalysisAlgorithmComponentVersion>1.0</AnalysisAlgorithmComponentVersion>
</AnalysisAlgorithmVersion>
<AnalysisAlgorithmVersion>
  <AnalysisAlgorithmComponentName>FitEngine</AnalysisAlgorithmComponentName>
  <AnalysisAlgorithmComponentVersion>2.1a</AnalysisAlgorithmComponentVersion>
</AnalysisAlgorithmVersion>

<NuclideAnalysisResults>
  <Nuclide>
    <NuclideIdentifiedIndicator>true</NuclideIdentifiedIndicator>
    <NuclideName>Cs-137</NuclideName>
    <NuclideIDConfidenceValue>0.99</NuclideIDConfidenceValue>
    <NuclideCategoryDescription>Industrial</NuclideCategoryDescription>
  </Nuclide>
  <Nuclide>
    <NuclideIdentifiedIndicator>true</NuclideIdentifiedIndicator>
    <NuclideName>K-40</NuclideName>
    <NuclideIDConfidenceValue>0.99</NuclideIDConfidenceValue>
    <NuclideCategoryDescription>NORM</NuclideCategoryDescription>
  </Nuclide>
</NuclideAnalysisResults>

<SpectrumPeakAnalysisResults>
  <SpectrumPeak>
    <SpectrumPeakEnergyValue>661.7</SpectrumPeakEnergyValue>
    <SpectrumPeakNetAreaValue>1234.5</SpectrumPeakNetAreaValue>
<SpectrumPeakNetAreaUncertaintyValue>123.4</SpectrumPeakNetAreaUncertaintyValue>
  </SpectrumPeak>
  <SpectrumPeak>
    <SpectrumPeakEnergyValue>1460.9</SpectrumPeakEnergyValue>
    <SpectrumPeakNetAreaValue>234.5</SpectrumPeakNetAreaValue>
    <SpectrumPeakNetAreaUncertaintyValue>23.4</SpectrumPeakNetAreaUncertaintyValue>
  </SpectrumPeak>
</SpectrumPeakAnalysisResults>
</AnalysisResults>
</RadInstrumentData>
```

Annex D (informative)

Example: A gross counting portal monitor

D.1 General

This document is an example of output from a gross counting radiation portal monitor (RPM).

- The RPM has four gamma and two neutron radiation detectors, named according to DNDO conventions (e.g. Aa1, Ba1).
- Each of the gamma radiation detectors has three energy windows.
- The detectors are sampled every 100 ms.
- The document represents one non-alarmed occupancy, consisting of seven time slices: the RPM is occupied in the third, fourth, and fifth slices; the first and second, and sixth and seventh slices are pre- and post-occupancy data.
- Following the document, a fragment shows the <AnalysisResults> element resulting from an alarmed occupancy, with both a gamma alarm (from three detectors), and a neutron alarm (from one detector only). An additional fragment, D.4, shows the usage of the <NuclideIdentifiedIndicator> element resulting from an RPM with limited spectroscopic radionuclide categorization capability. D.5 provides an example of the usage of the <RadInstrumentCharacteristics> indicating the state of two occupancy sensors (OccupancySensor1 and OccupancySensor2) where OccupancySensor1 is on and OccupancySensor2 is off. The data would have been sampled as of the <StartTime> indicated for the measurement. If more precision is required, then either the *valueDateTime* attribute could be used to indicate the toggle time with more precision, or the contents of <CharacteristicValue> could be a time counter value. Note that if the same sensor changed state during the measurement, this could be indicated with more <Characteristic> elements.

D.2 Unalarmed occupancy

```
<?xml version="1.0"?>
<?xml-model href="http://physics.nist.gov/N42/2011/schematron/n42.sch"
type="application/xml" schematypens="http://purl.oclc.org/dsdl/schematron"?>
<RadInstrumentData xmlns="http://physics.nist.gov/N42/2011/N42"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://physics.nist.gov/N42/2011/N42
http://physics.nist.gov/N42/2011/n42.xsd"
  n42DocUUID="f7f99b76-d6dd-41b7-9452-9202931316af">

  <RadInstrumentInformation id="A1234b">
    <RadInstrumentManufacturerName>RPMs R Us</RadInstrumentManufacturerName>
    <RadInstrumentIdentifier>A1234b</RadInstrumentIdentifier>
    <RadInstrumentModelName>RPM 3000</RadInstrumentModelName>
    <RadInstrumentDescription>Lane 1 RPM at Holland Tunnel</RadInstrumentDescription>
    <RadInstrumentClassCode>Portal Monitor</RadInstrumentClassCode>
    <RadInstrumentVersion>
      <RadInstrumentComponentName>Hardware</RadInstrumentComponentName>
      <RadInstrumentComponentVersion>22</RadInstrumentComponentVersion>
    </RadInstrumentVersion>
    <RadInstrumentVersion>
      <RadInstrumentComponentName>Software</RadInstrumentComponentName>
      <RadInstrumentComponentVersion>55Q</RadInstrumentComponentVersion>
    </RadInstrumentVersion>
    <RadInstrumentCharacteristics>
      <Characteristic>
        <CharacteristicName>Lane Width</CharacteristicName>
        <CharacteristicValue>4</CharacteristicValue>
        <CharacteristicValueUnits>meters</CharacteristicValueUnits>
        <CharacteristicValueDataClassCode>double</CharacteristicValueDataClassCode>
      </Characteristic>
    </Characteristic>
  </RadInstrumentInformation>
</RadInstrumentData>
```

```

        <CharacteristicName>IP</CharacteristicName>
        <CharacteristicValue>192.168.100.12</CharacteristicValue>
        <CharacteristicValueUnits>unit-less</CharacteristicValueUnits>
        <CharacteristicValueDataClassCode>string</CharacteristicValueDataClassCode>
    </Characteristic>
</RadInstrumentCharacteristics>
</RadInstrumentInformation>

<RadDetectorInformation id="Aa1">
    <RadDetectorName>Aa1</RadDetectorName>
    <RadDetectorCategoryCode>Gamma</RadDetectorCategoryCode>
    <RadDetectorKindCode>PVT</RadDetectorKindCode>
    <RadDetectorDescription>Driver's side panel left slab</RadDetectorDescription>
    <RadDetectorLengthValue units="cm">76</RadDetectorLengthValue>
    <RadDetectorWidthValue units="cm">15</RadDetectorWidthValue>
    <RadDetectorDepthValue units="cm">4</RadDetectorDepthValue>
    <RadDetectorVolumeValue units="cc">1.77E07</RadDetectorVolumeValue>
</RadDetectorInformation>

<RadDetectorInformation id="Aa2">
    <RadDetectorName>Aa2</RadDetectorName>
    <RadDetectorCategoryCode>Gamma</RadDetectorCategoryCode>
    <RadDetectorKindCode>PVT</RadDetectorKindCode>
    <RadDetectorDescription>Driver's side panel right slab</RadDetectorDescription>
    <RadDetectorLengthValue units="cm">76</RadDetectorLengthValue>
    <RadDetectorWidthValue units="cm">15</RadDetectorWidthValue>
    <RadDetectorDepthValue units="cm">4</RadDetectorDepthValue>
    <RadDetectorVolumeValue units="cc">1.77E07</RadDetectorVolumeValue>
</RadDetectorInformation>

<RadDetectorInformation id="Ba1">
    <RadDetectorName>Ba1</RadDetectorName>
    <RadDetectorCategoryCode>Gamma</RadDetectorCategoryCode>
    <RadDetectorKindCode>PVT</RadDetectorKindCode>
    <RadDetectorDescription>Passenger's side panel left slab</RadDetectorDescription>
    <RadDetectorLengthValue units="cm">76</RadDetectorLengthValue>
    <RadDetectorWidthValue units="cm">15</RadDetectorWidthValue>
    <RadDetectorDepthValue units="cm">4</RadDetectorDepthValue>
    <RadDetectorVolumeValue units="cc">1.77E07</RadDetectorVolumeValue>
</RadDetectorInformation>

<RadDetectorInformation id="Ba2">
    <RadDetectorName>Ba2</RadDetectorName>
    <RadDetectorCategoryCode>Gamma</RadDetectorCategoryCode>
    <RadDetectorKindCode>PVT</RadDetectorKindCode>
    <RadDetectorDescription>Passenger's side panel right slab</RadDetectorDescription>
    <RadDetectorLengthValue units="cm">76</RadDetectorLengthValue>
    <RadDetectorWidthValue units="cm">15</RadDetectorWidthValue>
    <RadDetectorDepthValue units="cm">4</RadDetectorDepthValue>
    <RadDetectorVolumeValue units="cc">1.77E07</RadDetectorVolumeValue>
</RadDetectorInformation>

<RadDetectorInformation id="Aa1N">
    <RadDetectorName>Aa1N</RadDetectorName>
    <RadDetectorCategoryCode>Neutron</RadDetectorCategoryCode>
    <RadDetectorKindCode>He3</RadDetectorKindCode>
    <RadDetectorDescription>Driver's side panel He3 tube</RadDetectorDescription>
    <RadDetectorLengthValue units="cm">91</RadDetectorLengthValue>
    <RadDetectorDiameterValue units="cm">5</RadDetectorDiameterValue>
</RadDetectorInformation>

<RadDetectorInformation id="Ba1N">
    <RadDetectorName>Ba1N</RadDetectorName>
    <RadDetectorCategoryCode>Neutron</RadDetectorCategoryCode>
    <RadDetectorKindCode>He3</RadDetectorKindCode>
    <RadDetectorDescription>Passenger's side panel He3 tube</RadDetectorDescription>
    <RadDetectorLengthValue units="cm">91</RadDetectorLengthValue>
    <RadDetectorDiameterValue units="cm">5</RadDetectorDiameterValue>
</RadDetectorInformation>

<RadItemInformation id="ITEM"/>

<EnergyWindows id="GammaWindowSettings">
    <WindowStartEnergyValues>0 0 100</WindowStartEnergyValues>
    <WindowEndEnergyValues>100 3000 400</WindowEndEnergyValues>
</EnergyWindows>

<RadMeasurementGroup id="MG-1"/>

```

```

<RadMeasurement id="M-1" radMeasurementGroupReferences="MG-1">
  <MeasurementClassCode>Background</MeasurementClassCode>
  <StartDateTime>2003-11-22T23:45:00.0-07:00</StartDateTime>
  <RealTimeDuration>PT0.1S</RealTimeDuration>
  <GrossCounts id="GC-1-1" radDetectorInformationReference="Aa1"
energyWindowsReference="GammaWindowSettings">
    <LiveTimeDuration>PT0.1S</LiveTimeDuration>
    <CountData>5 22 200</CountData>
  </GrossCounts>
  <GrossCounts id="GC-1-2" radDetectorInformationReference="Aa1N">
    <LiveTimeDuration>PT0.1S</LiveTimeDuration>
    <CountData>0</CountData>
  </GrossCounts>
  <GrossCounts id="GC-1-3" radDetectorInformationReference="Aa2"
energyWindowsReference="GammaWindowSettings">
    <LiveTimeDuration>PT0.1S</LiveTimeDuration>
    <CountData>6 11 300</CountData>
  </GrossCounts>
  <GrossCounts id="GC-1-4" radDetectorInformationReference="Ba1"
energyWindowsReference="GammaWindowSettings">
    <LiveTimeDuration>PT0.1S</LiveTimeDuration>
    <CountData>22 7 555</CountData>
  </GrossCounts>
  <GrossCounts id="GC-1-5" radDetectorInformationReference="Ba1N">
    <LiveTimeDuration>PT0.1S</LiveTimeDuration>
    <CountData>1</CountData>
  </GrossCounts>
  <GrossCounts id="GC-1-6" radDetectorInformationReference="Ba2"
energyWindowsReference="GammaWindowSettings">
    <LiveTimeDuration>PT0.1S</LiveTimeDuration>
    <CountData>3 7 345</CountData>
  </GrossCounts>
  <OccupancyIndicator>0</OccupancyIndicator>
</RadMeasurement>

<RadMeasurement id="M-2" radMeasurementGroupReferences="MG-1">
  <MeasurementClassCode>Background</MeasurementClassCode>
  <StartDateTime>2003-11-22T23:45:00.1-07:00</StartDateTime>
  <RealTimeDuration>PT0.1S</RealTimeDuration>
  <GrossCounts id="GC-2-1" radDetectorInformationReference="Aa1"
energyWindowsReference="GammaWindowSettings">
    <LiveTimeDuration>PT0.1S</LiveTimeDuration>
    <CountData>5 22 200</CountData>
  </GrossCounts>
  <GrossCounts id="GC-2-2" radDetectorInformationReference="Aa1N">
    <LiveTimeDuration>PT0.1S</LiveTimeDuration>
    <CountData>0</CountData>
  </GrossCounts>
  <GrossCounts id="GC-2-3" radDetectorInformationReference="Aa2"
energyWindowsReference="GammaWindowSettings">
    <LiveTimeDuration>PT0.1S</LiveTimeDuration>
    <CountData>6 11 300</CountData>
  </GrossCounts>
  <GrossCounts id="GC-2-4" radDetectorInformationReference="Ba1"
energyWindowsReference="GammaWindowSettings">
    <LiveTimeDuration>PT0.1S</LiveTimeDuration>
    <CountData>22 7 555</CountData>
  </GrossCounts>
  <GrossCounts id="GC-2-5" radDetectorInformationReference="Ba1N">
    <LiveTimeDuration>PT0.1S</LiveTimeDuration>
    <CountData>1</CountData>
  </GrossCounts>
  <GrossCounts id="GC-2-6" radDetectorInformationReference="Ba2"
energyWindowsReference="GammaWindowSettings">
    <LiveTimeDuration>PT0.1S</LiveTimeDuration>
    <CountData>3 7 345</CountData>
  </GrossCounts>
  <OccupancyIndicator>0</OccupancyIndicator>
</RadMeasurement>

<RadMeasurement id="M-3" radMeasurementGroupReferences="MG-1">
  <MeasurementClassCode>Background</MeasurementClassCode>
  <StartDateTime>2003-11-22T23:45:00.2-07:00</StartDateTime>
  <RealTimeDuration>PT0.1S</RealTimeDuration>
  <GrossCounts id="GC-3-1" radDetectorInformationReference="Aa1"
energyWindowsReference="GammaWindowSettings">
    <LiveTimeDuration>PT0.1S</LiveTimeDuration>

```

```

        <CountData>5 22 200</CountData>
    </GrossCounts>
    <GrossCounts id="GC-3-2" radDetectorInformationReference="Aa1N">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>0</CountData>
    </GrossCounts>
    <GrossCounts id="GC-3-3" radDetectorInformationReference="Aa2"
energyWindowsReference="GammaWindowSettings">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>6 11 300</CountData>
    </GrossCounts>
    <GrossCounts id="GC-3-4" radDetectorInformationReference="Ba1"
energyWindowsReference="GammaWindowSettings">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>22 7 555</CountData>
    </GrossCounts>
    <GrossCounts id="GC-3-5" radDetectorInformationReference="Ba1N">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>1</CountData>
    </GrossCounts>
    <GrossCounts id="GC-3-6" radDetectorInformationReference="Ba2"
energyWindowsReference="GammaWindowSettings">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>3 7 345</CountData>
    </GrossCounts>
    <OccupancyIndicator>1</OccupancyIndicator>
</RadMeasurement>

<RadMeasurement id="M-4" radMeasurementGroupReferences="MG-1">
    <MeasurementClassCode>Background</MeasurementClassCode>
    <StartDateTime>2003-11-22T23:45:00.3-07:00</StartDateTime>
    <RealTimeDuration>PT0.1S</RealTimeDuration>
    <GrossCounts id="GC-4-1" radDetectorInformationReference="Aa1"
energyWindowsReference="GammaWindowSettings">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>5 22 200</CountData>
    </GrossCounts>
    <GrossCounts id="GC-4-2" radDetectorInformationReference="Aa1N">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>0</CountData>
    </GrossCounts>
    <GrossCounts id="GC-4-3" radDetectorInformationReference="Aa2"
energyWindowsReference="GammaWindowSettings">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>6 11 300</CountData>
    </GrossCounts>
    <GrossCounts id="GC-4-4" radDetectorInformationReference="Ba1"
energyWindowsReference="GammaWindowSettings">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>22 7 555</CountData>
    </GrossCounts>
    <GrossCounts id="GC-4-5" radDetectorInformationReference="Ba1N">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>1</CountData>
    </GrossCounts>
    <GrossCounts id="GC-4-6" radDetectorInformationReference="Ba2"
energyWindowsReference="GammaWindowSettings">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>3 7 345</CountData>
    </GrossCounts>
    <OccupancyIndicator>1</OccupancyIndicator>
</RadMeasurement>

<RadMeasurement id="M-5" radMeasurementGroupReferences="MG-1">
    <MeasurementClassCode>Background</MeasurementClassCode>
    <StartDateTime>2003-11-22T23:45:00.4-07:00</StartDateTime>
    <RealTimeDuration>PT0.1S</RealTimeDuration>
    <GrossCounts id="GC-5-1" radDetectorInformationReference="Aa1"
energyWindowsReference="GammaWindowSettings">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>5 22 200</CountData>
    </GrossCounts>
    <GrossCounts id="GC-5-2" radDetectorInformationReference="Aa1N">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>0</CountData>
    </GrossCounts>
    <GrossCounts id="GC-5-3" radDetectorInformationReference="Aa2"
energyWindowsReference="GammaWindowSettings">

```

```

        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>6 11 300</CountData>
    </GrossCounts>
    <GrossCounts id="GC-5-4" radDetectorInformationReference="Ba1"
energyWindowsReference="GammaWindowSettings">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>22 7 555</CountData>
    </GrossCounts>
    <GrossCounts id="GC-5-5" radDetectorInformationReference="Ba1N">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>1</CountData>
    </GrossCounts>
    <GrossCounts id="GC-5-6" radDetectorInformationReference="Ba2"
energyWindowsReference="GammaWindowSettings">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>3 7 345</CountData>
    </GrossCounts>
    <OccupancyIndicator>1</OccupancyIndicator>
</RadMeasurement>

<RadMeasurement id="M-6" radMeasurementGroupReferences="MG-1">
    <MeasurementClassCode>Background</MeasurementClassCode>
    <StartDateTime>2003-11-22T23:45:00.5-07:00</StartDateTime>
    <RealTimeDuration>PT0.1S</RealTimeDuration>
    <GrossCounts id="GC-6-1" radDetectorInformationReference="Aa1"
energyWindowsReference="GammaWindowSettings">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>5 22 200</CountData>
    </GrossCounts>
    <GrossCounts id="GC-6-2" radDetectorInformationReference="Aa1N">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>0</CountData>
    </GrossCounts>
    <GrossCounts id="GC-6-3" radDetectorInformationReference="Aa2"
energyWindowsReference="GammaWindowSettings">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>6 11 300</CountData>
    </GrossCounts>
    <GrossCounts id="GC-6-4" radDetectorInformationReference="Ba1"
energyWindowsReference="GammaWindowSettings">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>22 7 555</CountData>
    </GrossCounts>
    <GrossCounts id="GC-6-5" radDetectorInformationReference="Ba1N">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>1</CountData>
    </GrossCounts>
    <GrossCounts id="GC-6-6" radDetectorInformationReference="Ba2"
energyWindowsReference="GammaWindowSettings">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>3 7 345</CountData>
    </GrossCounts>
    <OccupancyIndicator>0</OccupancyIndicator>
</RadMeasurement>

<RadMeasurement id="M-7" radMeasurementGroupReferences="MG-1">
    <MeasurementClassCode>Background</MeasurementClassCode>
    <StartDateTime>2003-11-22T23:45:00.6-07:00</StartDateTime>
    <RealTimeDuration>PT0.1S</RealTimeDuration>
    <GrossCounts id="GC-7-1" radDetectorInformationReference="Aa1"
energyWindowsReference="GammaWindowSettings">
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        <CountData>5 22 200</CountData>
    </GrossCounts>
    <GrossCounts id="GC-7-2" radDetectorInformationReference="Aa1N">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>0</CountData>
    </GrossCounts>
    <GrossCounts id="GC-7-3" radDetectorInformationReference="Aa2"
energyWindowsReference="GammaWindowSettings">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>6 11 300</CountData>
    </GrossCounts>
    <GrossCounts id="GC-7-4" radDetectorInformationReference="Ba1"
energyWindowsReference="GammaWindowSettings">
        <LiveTimeDuration>PT0.1S</LiveTimeDuration>
        <CountData>22 7 555</CountData>
    </GrossCounts>

```



```

    <GrossCounts id="GC-7-5" radDetectorInformationReference="Ba1N">
      <LiveTimeDuration>PT0.1S</LiveTimeDuration>
      <CountData>1</CountData>
    </GrossCounts>
    <GrossCounts id="GC-7-6" radDetectorInformationReference="Ba2"
energyWindowsReference="GammaWindowSettings">
      <LiveTimeDuration>PT0.1S</LiveTimeDuration>
      <CountData>3 7 345</CountData>
    </GrossCounts>
    <OccupancyIndicator>0</OccupancyIndicator>
  </RadMeasurement>

  <AnalysisResults radMeasurementGroupReferences="MG-1">
    <AnalysisStartDateTime>2003-11-22T23:45:00.7-07:00</AnalysisStartDateTime>
    <AnalysisAlgorithmName>SPRT</AnalysisAlgorithmName>
  </AnalysisResults>
</RadInstrumentData>

```

D.3 Alarmed occupancy fragment

```

<AnalysisResults radMeasurementGroupReferences="MG-1">
  <RadAlarm id="A-1-1" radDetectorInformationReferences="Aa1 Aa2 Ba1 Ba2">
    <RadAlarmCategoryCode>Gamma</RadAlarmCategoryCode>
    <RadAlarmDescription>SPRT alarm</RadAlarmDescription>
    <RadAlarmLightColor>Red</RadAlarmLightColor>
  </RadAlarm>
  <RadAlarm radDetectorInformationReferences="Aa1N">
    <RadAlarmCategoryCode>Neutron</RadAlarmCategoryCode>
    <RadAlarmDescription>SPRT alarm</RadAlarmDescription>
    <RadAlarmLightColor>Red</RadAlarmLightColor>
  </RadAlarm>
</AnalysisResults>

```

D.4 Alarmed occupancy fragment with categorization

```

<AnalysisResults radMeasurementGroupReferences="MG-1">
  <RadAlarm id="A-1-1" radDetectorInformationReferences="Aa1 Aa2 Ba1 Ba2">
    <RadAlarmCategoryCode>Gamma</RadAlarmCategoryCode>
    <RadAlarmDescription>SPRT alarm</RadAlarmDescription>
    <RadAlarmLightColor>Red</RadAlarmLightColor>
  </RadAlarm>
  <RadAlarm radDetectorInformationReferences="Aa1N">
    <RadAlarmCategoryCode>Neutron</RadAlarmCategoryCode>
    <RadAlarmDescription>SPRT alarm</RadAlarmDescription>
    <RadAlarmLightColor>Red</RadAlarmLightColor>
  </RadAlarm>
  <NuclideAnalysisResults>
    <Nuclide>
      <NuclideIdentifiedIndicator>true</NuclideIdentifiedIndicator>
      <NuclideName>Unknown</NuclideName>
      <NuclideIDConfidenceDescription>Low</NuclideIDConfidenceDescription>
      <NuclideCategoryDescription>SNM</NuclideCategoryDescription>
    </Nuclide>
  </NuclideAnalysisResults>
</AnalysisResults>

```

D.5 Multiple occupansy sensor state indications

```

<RadInstrumentCharacteristics>
  <Characteristic>
    <CharacteristicName>OccupancySensor1</CharacteristicName>
    <CharacteristicValue>1</CharacteristicValue>
    <CharacteristicValueUnits>unit-less</CharacteristicValueUnits>
    <CharacteristicValueDataClassCode>boolean</CharacteristicValueDataClassCode>
  </Characteristic>
  <Characteristic>
    <CharacteristicName>OccupancySensor2</CharacteristicName>
    <CharacteristicValue>0</CharacteristicValue>
    <CharacteristicValueUnits>unit-less</CharacteristicValueUnits>
    <CharacteristicValueDataClassCode>boolean</CharacteristicValueDataClassCode>
  </Characteristic>
</RadInstrumentCharacteristics>

```

```
</Characteristic>  
</RadInstrumentCharacteristics>
```

Annex E (informative)

Example: A spectroscopic radiation portal monitor

This is an example of a spectroscopic radiation portal monitor (SRPM) document.

- The SRPM's detectors are named according to Domestic Nuclear Detection Office (DNDO) conventions. There are two pillars A and B, each containing one HPGe gamma radiation detector (Aa1 and Ba1) and one a neutron radiation detector (Aa1N and Ba1N). The SRPM can determine occupant (i.e. the measured item) presence and speed, and allows the entry of occupant metadata; in this case, the container identification and manifest.
- The example document records a single occupancy:
 - First, the applicable background data are recorded
 - Six one second measurements (i.e. time slices) are recorded: the first two unoccupied, the third and fourth occupied, and the fifth and sixth unoccupied.
 - For the two occupied measurements, the occupant's position (relative to the SRPM) and speed are recorded via <RadItemState>.
 - The sum of the two occupied measurements is recorded via <DerivedData>
 - The analysis of the summed data is recorded. The analysis resulted in an alarm due to the identification of ⁵⁷Co and ¹³⁷Cs.

NOTE If spectra from different radiation detectors, in the same radiation measurement instrument, are acquired at different start times or different durations then they will have their own <RadMeasurement> element instance, see 4.3.1.

```
<?xml version="1.0"?>
<?xml-model href="http://physics.nist.gov/N42/2011/schematron/n42.sch"
type="application/xml" schematypens="http://purl.oclc.org/dsdl/schematron"?>
<RadInstrumentData xmlns="http://physics.nist.gov/N42/2011/N42"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://physics.nist.gov/N42/2011/N42
http://physics.nist.gov/N42/2011/n42.xsd"
  n42DocUUID="3efc2d27-ce4a-41e3-8745-deb5417841de">

  <RadInstrumentInformation id="NTSTT_CS01S">
    <RadInstrumentManufacturerName>SRPMs R Us</RadInstrumentManufacturerName>
    <RadInstrumentIdentifier>SRPM123</RadInstrumentIdentifier>
    <RadInstrumentModelName>iSRPM</RadInstrumentModelName>
    <RadInstrumentDescription>SRPM at test facility lane 1</RadInstrumentDescription>
    <RadInstrumentClassCode>Spectroscopic Portal Monitor</RadInstrumentClassCode>
    <RadInstrumentVersion>
      <RadInstrumentComponentName>Hardware</RadInstrumentComponentName>
      <RadInstrumentComponentVersion>5</RadInstrumentComponentVersion>
    </RadInstrumentVersion>
    <RadInstrumentVersion>
      <RadInstrumentComponentName>Software</RadInstrumentComponentName>
      <RadInstrumentComponentVersion>4.2</RadInstrumentComponentVersion>
    </RadInstrumentVersion>
  </RadInstrumentInformation>

  <RadDetectorInformation id="Aa1">
    <RadDetectorCategoryCode>Gamma</RadDetectorCategoryCode>
    <RadDetectorKindCode>HPGe</RadDetectorKindCode>
    <RadDetectorLengthValue>3</RadDetectorLengthValue>
    <RadDetectorDiameterValue>9</RadDetectorDiameterValue>
    <RadDetectorCharacteristics>
      <Characteristic>
        <CharacteristicName>RelativeEfficiency</CharacteristicName>
        <CharacteristicValue>65</CharacteristicValue>
        <CharacteristicValueUnits>%</CharacteristicValueUnits>
      </Characteristic>
    </RadDetectorCharacteristics>
  </RadDetectorInformation>

  <CharacteristicValueDataClassCode>PositiveDouble</CharacteristicValueDataClassCode>
</Characteristic>
```

```

    </RadDetectorCharacteristics>
</RadDetectorInformation>

<RadDetectorInformation id="Aa1N">
  <RadDetectorCategoryCode>Neutron</RadDetectorCategoryCode>
  <RadDetectorKindCode>He3</RadDetectorKindCode>
  <RadDetectorVolumeValue>1000</RadDetectorVolumeValue>
  <RadDetectorCharacteristics>
    <Characteristic>
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      <CharacteristicValue>2</CharacteristicValue>
      <CharacteristicValueUnits>ATM</CharacteristicValueUnits>
    </Characteristic>
  </RadDetectorCharacteristics>
<CharacteristicValueDataClassCode>PositiveDouble</CharacteristicValueDataClassCode>
</Characteristic>
</RadDetectorCharacteristics>
</RadDetectorInformation>

<RadDetectorInformation id="Ba1">
  <RadDetectorCategoryCode>Gamma</RadDetectorCategoryCode>
  <RadDetectorKindCode>HPGe</RadDetectorKindCode>
  <RadDetectorLengthValue>3</RadDetectorLengthValue>
  <RadDetectorDiameterValue>9</RadDetectorDiameterValue>
  <RadDetectorCharacteristics>
    <Characteristic>
      <CharacteristicName>RelativeEfficiency</CharacteristicName>
      <CharacteristicValue>65</CharacteristicValue>
      <CharacteristicValueUnits>%</CharacteristicValueUnits>
    </Characteristic>
  </RadDetectorCharacteristics>
<CharacteristicValueDataClassCode>PositiveDouble</CharacteristicValueDataClassCode>
</Characteristic>
</RadDetectorCharacteristics>
</RadDetectorInformation>

<RadDetectorInformation id="Ba1N">
  <RadDetectorCategoryCode>Neutron</RadDetectorCategoryCode>
  <RadDetectorKindCode>He3</RadDetectorKindCode>
  <RadDetectorVolumeValue>1000</RadDetectorVolumeValue>
  <RadDetectorCharacteristics>
    <Characteristic>
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      <CharacteristicValue>2</CharacteristicValue>
      <CharacteristicValueUnits>ATM</CharacteristicValueUnits>
    </Characteristic>
  </RadDetectorCharacteristics>
<CharacteristicValueDataClassCode>PositiveDouble</CharacteristicValueDataClassCode>
</Characteristic>
</RadDetectorCharacteristics>
</RadDetectorInformation>

<RadItemInformation id="Vehicle">
  <RadItemCharacteristics>
    <Characteristic>
      <CharacteristicName>ContainerID</CharacteristicName>
      <CharacteristicValue>YMLU3030933</CharacteristicValue>
      <CharacteristicValueUnits>unit-less</CharacteristicValueUnits>
      <CharacteristicValueDataClassCode>string</CharacteristicValueDataClassCode>
    </Characteristic>
    <Characteristic>
      <CharacteristicName>Manifest</CharacteristicName>
      <CharacteristicValue>Scrap Metal</CharacteristicValue>
      <CharacteristicValueUnits>unit-less</CharacteristicValueUnits>
      <CharacteristicValueDataClassCode>string</CharacteristicValueDataClassCode>
    </Characteristic>
  </RadItemCharacteristics>
</RadItemInformation>

<EnergyCalibration id="ENCAL">
  <CoefficientValues>0 .3662 0</CoefficientValues>
</EnergyCalibration>

<FWHMCalibration id="FWHMCAL">
  <EnergyValues>59 661.65 1460.8</EnergyValues>
  <FWHMValues>2.0 2.2 2.4</FWHMValues>
</FWHMCalibration>

<IntrinsicFullEnergyPeakEfficiencyCalibration id="EFFCAL">
  <EnergyValues>59.5 661.65 1460.8 2614.5</EnergyValues>
  <EfficiencyValues>0.1 0.05 0.01 0.005</EfficiencyValues>

```

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<EfficiencyUncertaintyValues>1.0e-2 5e-3 1e-3 5.0e-4</EfficiencyUncertaintyValues>
</IntrinsicFullEnergyPeakEfficiencyCalibration>

<RadMeasurement id="Background-20100127150000">
  <MeasurementClassCode>Background</MeasurementClassCode>
  <StartDateTime>2010-01-27T12:50:00.0Z</StartDateTime>
  <RealTimeDuration>PT300.0S</RealTimeDuration>

  <Spectrum id="Background-20100127150000-Aa1" radDetectorInformationReference="Aa1"
energyCalibrationReference="ENCAL" FWHMCalibrationReference="FWHMCAL"
intrinsicFullEnergyPeakEfficiencyCalibrationReference="EFFCAL">
    <LiveTimeDuration>PT298.212262S</LiveTimeDuration>
    <ChannelData compressionCode="CountedZeroes">
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16 28 22 16 24 25 24 36 25 18 27 31 21 19 23 37 16 23 34 32 35 42 23 18 36 36 22 30 39
25 33 19 43 27 37 44 31 46 40 33 28 46 34 37 32 40 36 38 24 38 38 49 43 45 52 43 49 42
32 49 43 55 39 56 38 52 40 55 63 35 40 47 55 38 47 53 48 33 47 52 46 48 55 46 54 52 61
47 55 48 56 63 63 66 62 54 48 51 51 59 55 59 55 49 50 45 53 57 56 46 57 53 58 46 57 51
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3 3 2 4 2 3 1 2 5 2 1 2 2 2 1 2 4 3 3 3 8 4 5 5 1 2 3 0 1 3 3 0 1 2 3 3 4 3 0 1 4 0 1 3
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0 1 2 0 1 3 3 5 3 3 0 1 3 1 1 1 2 5 1 5 1 3 2 3 1 1 1 1 1 1 4 3 0 2 1 1 0 1 2 1 2 2 4 2
4 1 1 1 1 3 1 0 1 2 2 2 1 2 0 1 3 5 1 2 1 3 2 3 2 5 5 3 3 2 2 4 0 1 2 2 1 2 3 2 1 1 1
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0 2 2 1 0 1 1 1 4 1 2 0 1 1 0 1 4 4 3 1 3 3 1 3 1 3 0 1 3 2 0 1 5 2 2 1 1 0 1 2 1 1 3 3
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6 10 11 7 13 18 19 12 9 1 4 5 2 3 2 1 2 0 1 4 0 1 2 2 2 0 1 1 1 1 3 4 1 1 4 0 1 1 3 2 2
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1 3 0 1 1 2 3 0 1 2 2 1 0 1 1 2 0 1 2 3 3 2 2 0 1 3 1 1 0 1 2 2 2 1 2 0 1 3 2 1 1 2 0 2
3 3 1 5 3 1 1 1 1 2 4 2 3 2 3 2 2 0 1 1 2 5 2 3 2 1 2 2 1 0 1 1 3 2 1 3 4 3 1 5 3 1 2 0
1 2 3 3 5 3 9 12 12 11 5 4 1 2 1 5 1 2 2 1 2 0 1 1 1 1 1 2 2 1 4 2 3 2 2 4 1 2 3 0 1 3 2
1 1 3 2 4 0 1 1 0 2 3 3 1 1 3 0 1 1 2 1 1 1 0 1 2 1 1 3 0 1 2 3 3 4 4 1 1 4 4 1 1 2 0 1
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1 3 1 1 0 1 1 2 5 2 2 1 1 0 1 1 2 1 6 1 3 2 0 1 1 1 0 2 1 2 4 2 1 1 1 0 1 1 2 0 1 2 4 1
0 2 2 0 3 1 1 2 0 2 1 3 2 1 3 0 1 1 4 2 1 1 0 2 2 0 1 5 1 2 0 1 2 1 3 0 2 2 1 0 1 1 2 0
1 4 1 5 0 1 2 1 1 1 4 3 1 3 2 1 1 0 1 4 0 1 1 0 1 1 0 1 4 0 2 1 0 2 2 2 0 1 3 3 0 1 2 2
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96 1 0 5 1 0 60 1 0 107 1 0 48 1 0 114 1 0 86 1 0 207 1 0 141 1 0 7 1 0 93 1 0 16 1 0
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Annex F (informative)

Example: A personal radiation detector

This is an example of a personal radiation detector (PRD) document, which periodically (once every 2 s) records the ambient dose equivalent rate and the PRD's geographic location.

NOTE Instead of, or in addition to, the dose rate, the exposure rate and/or the gross counts could be recorded.

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  <Remark>Dose rate values are the average over the integration time</Remark>

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    </DoseRate>
    <RadInstrumentState radInstrumentInformationReference="RadInstrumentInformation-1">
        <StateVector>
            <GeographicPoint>
                <LatitudeValue>42.123</LatitudeValue>

```

```
<LongitudeValue>-22.456</LongitudeValue>
<ElevationValue>5.2</ElevationValue>
</GeographicPoint>
</StateVector>
<RadInstrumentCharacteristics>
  <CharacteristicGroup groupOutOfLimits="false">
    <CharacteristicGroupName>StateOfHealth</CharacteristicGroupName>
    <Characteristic valueOutOfLimits="false">
      <CharacteristicName>BatteryCharge</CharacteristicName>
      <CharacteristicValue>83</CharacteristicValue>
      <CharacteristicValueUnits>% charge</CharacteristicValueUnits>
      <CharacteristicValueDataClassCode>double</CharacteristicValueDataClassCode>
    </Characteristic>
    <Characteristic valueOutOfLimits="false">
      <CharacteristicName>RadioSignalStrength</CharacteristicName>
      <CharacteristicValue>-49</CharacteristicValue>
      <CharacteristicValueUnits>dBm</CharacteristicValueUnits>
      <CharacteristicValueDataClassCode>double</CharacteristicValueDataClassCode>
    </Characteristic>
  </CharacteristicGroup>
</RadInstrumentCharacteristics>
</RadInstrumentState>
</RadMeasurement>
</RadInstrumentData>
```

Annex G (informative)

Example: A mobile spectroscopic instrument

This is an example of a mobile spectroscopic radiation measurement instrument document; this particular instrument made measurements while in motion.

- a) The mobile instrument is described via the <RadInstrumentInformation> element.
- b) The radiation detectors are described via <RadDetectorInformation> elements; the gamma radiation detector is a 1,6 l NaI(Tl); the neutron radiation detector is a 1 l ³He proportional counter.
- c) The energy and FWHM calibrations of the gamma radiation detector are given.
- d) Two spectrum measurements and the analyses thereof are given, via two pairs of <RadMeasurement> and <AnalysisResults> elements.
- e) Each <RadMeasurement> has a unique identifier ("M-1222" and "M-1223"). The mean position, direction, and speed of the radiation measurement instrument are described via <RadInstrumentState>: the direction is -90° due West; the speed is 2,2 m/s.
- f) The <AnalysisResults> elements resulting from the spectral analysis each report the identification of ¹³⁷Cs, and the quantification of two spectral peaks at 661,7 keV and 1460,8 keV.

```
<?xml version="1.0"?>
<?xml-model href="http://physics.nist.gov/N42/2011/schematron/n42.sch"
type="application/xml" schematypens="http://purl.oclc.org/dsdl/schematron"?>
<RadInstrumentData xmlns="http://physics.nist.gov/N42/2011/N42"
xsi:schemaLocation="http://www.w3.org/2001/XMLSchema-instance
http://physics.nist.gov/N42/2011/n42.xsd"
n42DocUID="54d0f17f-0ed5-46ea-9390-e8f22d880396">

  <RadInstrumentInformation id="RadInstrumentInformation-1">
    <RadInstrumentManufacturerName>Mobiles R Us</RadInstrumentManufacturerName>
    <RadInstrumentModelName>iCarTop</RadInstrumentModelName>
    <RadInstrumentClassCode>Mobile System</RadInstrumentClassCode>
    <RadInstrumentVersion>
      <RadInstrumentComponentName>Software</RadInstrumentComponentName>
      <RadInstrumentComponentVersion>4.2</RadInstrumentComponentVersion>
    </RadInstrumentVersion>
    <RadInstrumentVersion>
      <RadInstrumentComponentName>Hardware</RadInstrumentComponentName>
      <RadInstrumentComponentVersion>66</RadInstrumentComponentVersion>
    </RadInstrumentVersion>
    <RadInstrumentVersion>
      <RadInstrumentComponentName>Firmware</RadInstrumentComponentName>
      <RadInstrumentComponentVersion>117-1</RadInstrumentComponentVersion>
    </RadInstrumentVersion>
  </RadInstrumentInformation>

  <RadDetectorInformation id="GammaDetector">
    <RadDetectorCategoryCode>Gamma</RadDetectorCategoryCode>
    <RadDetectorKindCode>NaI</RadDetectorKindCode>
    <RadDetectorLengthValue>30</RadDetectorLengthValue>
    <RadDetectorWidthValue>10</RadDetectorWidthValue>
    <RadDetectorDepthValue>10</RadDetectorDepthValue>
    <RadDetectorCharacteristics>
      <Characteristic>
        <CharacteristicName>HV</CharacteristicName>
        <CharacteristicValue>1500</CharacteristicValue>
        <CharacteristicValueUnits>V</CharacteristicValueUnits>
        <CharacteristicValueDataClassCode>double</CharacteristicValueDataClassCode>
      </Characteristic>
    </RadDetectorCharacteristics>
  </RadDetectorInformation>

  <RadDetectorInformation id="NeutronDetector">
    <RadDetectorCategoryCode>Neutron</RadDetectorCategoryCode>
```

```

    <RadDetectorKindCode>He3</RadDetectorKindCode>
    <RadDetectorVolumeValue>25</RadDetectorVolumeValue>
    <RadDetectorCharacteristics>
      <Characteristic>
        <CharacteristicName>GasPressure</CharacteristicName>
        <CharacteristicValue>15</CharacteristicValue>
        <CharacteristicValueUnits>ATM</CharacteristicValueUnits>
      </Characteristic>
    </RadDetectorCharacteristics>
    <CharacteristicValueDataClassCode>PositiveDouble</CharacteristicValueDataClassCode>
  </RadDetectorInformation>

  <EnergyCalibration id="ENCAL">
    <CoefficientValues>0.5 3.15 .0013</CoefficientValues>
  </EnergyCalibration>

  <FWHMCalibration id="FWHMCAL">
    <EnergyValues>59 661.65 1460.8</EnergyValues>
    <FWHMValues>10.5 126.5 256.5</FWHMValues>
  </FWHMCalibration>

  <RadMeasurement id="M-1222">
    <MeasurementClassCode>Foreground</MeasurementClassCode>
    <StartDateTime>2003-11-22T23:45:19-07:00</StartDateTime>
    <RealTimeDuration>PT3.0S</RealTimeDuration>
    <Spectrum id="GammaDetector-1222" radDetectorInformationReference="GammaDetector"
energyCalibrationReference="ENCAL" FWHMCalibrationReference="FWHMCAL">
      <LiveTimeDuration>PT2.9S</LiveTimeDuration>
      <ChannelData>
        0 0 0 22 421 847 1295 1982 2127 2222 2302 2276
        2234 1921 1939 1715 1586 1469 1296 1178 1127 1047 928 760
        679 641 542 529 443 423 397 393 322 272 294 227
        216 224 208 191 189 163 167 173 150 137 136 129
        150 142 160 159 140 103 90 82 83 85 67 76
        73 84 63 74 70 69 76 61 49 61 63 65
        58 62 48 75 56 61 46 56 43 37 55 47
        50 40 38 54 43 41 45 51 32 35 29 33
        40 44 33 35 20 26 27 17 19 20 16 19
        18 19 18 20 17 45 55 70 62 59 32 30
        21 23 10 9 5 13 11 11 6 7 7 9
        11 4 8 8 14 14 11 9 13 5 5 6
        10 9 3 4 3 7 5 5 4 5 3 6
        5 0 5 6 3 1 4 4 3 10 11 4
        1 4 2 11 9 6 3 5 5 1 4 2
        6 6 2 3 0 2 2 2 2 0 1 3
        1 1 2 3 2 4 5 2 6 4 1 0
        3 1 2 1 1 0 1 0 0 2 0 1
        0 0 0 1 0 0 0 0 0 0 0 2
        0 0 0 1 0 1 0 0 2 1 0 0
        0 0 1 3 0 0 0 1 0 1 0 0
        0 0 0 0
      </ChannelData>
    </Spectrum>

    <GrossCounts id="NeutronDetector-1222"
radDetectorInformationReference="NeutronDetector">
      <LiveTimeDuration>PT3.0S</LiveTimeDuration>
      <CountData>2</CountData>
    </GrossCounts>

    <RadInstrumentState radInstrumentInformationReference="RadInstrumentInformation-1">
      <RadInstrumentModeCode>Search</RadInstrumentModeCode>
      <StateVector>
        <GeographicPoint>
          <LatitudeValue>41.608476</LatitudeValue>
          <LongitudeValue>-72.88579</LongitudeValue>
          <ElevationValue>84</ElevationValue>
        </GeographicPoint>
        <Orientation>
          <AzimuthValue>-90.0</AzimuthValue>
        </Orientation>
        <SpeedValue>2.2</SpeedValue>
      </StateVector>
    </RadInstrumentState>
  </RadMeasurement>

  <RadMeasurement id="M-1223">

```

```

<MeasurementClassCode>Foreground</MeasurementClassCode>
<StartDateTime>2003-11-22T23:48:22-07:00</StartDateTime>
<RealTimeDuration>PT3.0S</RealTimeDuration>
<Spectrum id="GammaDetector-1223" radDetectorInformationReference="GammaDetector"
energyCalibrationReference="ENCAL" FWHMCalibrationReference="FWHMCAL">
  <LiveTimeDuration>PT2.9S</LiveTimeDuration>
  <ChannelData>
    0 0 0 22 421 847 1295 1982 2127 2222 2302 2276
    2234 1921 1939 1715 1586 1469 1296 1178 1127 1047 928 760
    679 641 542 529 443 423 397 393 322 272 294 227
    216 224 208 191 189 163 167 173 150 137 136 129
    150 142 160 159 140 103 90 82 83 85 67 76
    73 84 63 74 70 69 76 61 49 61 63 65
    58 62 48 75 56 61 46 56 43 37 55 47
    50 40 38 54 43 41 45 51 32 35 29 33
    40 44 33 35 20 26 27 17 19 20 16 19
    18 19 18 20 17 45 55 70 62 59 32 30
    21 23 10 9 5 13 11 11 6 7 7 9
    11 4 8 8 14 14 11 9 13 5 5 6
    10 9 3 4 3 7 5 5 4 5 3 6
    5 0 5 6 3 1 4 4 3 10 11 4
    1 4 2 11 9 6 3 5 5 1 4 2
    6 6 2 3 0 2 2 2 2 0 1 3
    1 1 2 3 2 4 5 2 6 4 1 0
    3 1 2 1 1 0 1 0 0 2 0 1
    0 0 0 1 0 0 0 0 0 0 0 2
    0 0 0 1 0 1 0 0 2 1 0 0
    0 0 1 3 0 0 0 1 0 1 0 0
    0 0 0 0
  </ChannelData>
</Spectrum>

<GrossCounts id="NeutronDetector-1223"
radDetectorInformationReference="NeutronDetector">
  <LiveTimeDuration>PT3.0S</LiveTimeDuration>
  <CountData>3</CountData>
</GrossCounts>

<RadInstrumentState radInstrumentInformationReference="RadInstrumentInformation-1">
  <RadInstrumentModeCode>Search</RadInstrumentModeCode>
  <StateVector>
    <GeographicPoint>
      <LatitudeValue>41.608494</LatitudeValue>
      <LongitudeValue>-72.885999</LongitudeValue>
      <ElevationValue>84</ElevationValue>
    </GeographicPoint>
    <Orientation>
      <AzimuthValue>-90.0</AzimuthValue>
    </Orientation>
    <SpeedValue>2.2</SpeedValue>
  </StateVector>
</RadInstrumentState>
</RadMeasurement>

<AnalysisResults radMeasurementReferences="M-1222">
  <AnalysisAlgorithmName>SuperNID</AnalysisAlgorithmName>
  <AnalysisAlgorithmCreatorName>Spectrometers R Us</AnalysisAlgorithmCreatorName>
  <AnalysisAlgorithmVersion>
    <AnalysisAlgorithmComponentName>Main</AnalysisAlgorithmComponentName>
    <AnalysisAlgorithmComponentVersion>1.0</AnalysisAlgorithmComponentVersion>
  </AnalysisAlgorithmVersion>

  <NuclideAnalysisResults>
    <Nuclide>
      <NuclideIdentifiedIndicator>true</NuclideIdentifiedIndicator>
      <NuclideName>Cs-137</NuclideName>
      <NuclideIDConfidenceValue>0.99</NuclideIDConfidenceValue>
    </Nuclide>
  </NuclideAnalysisResults>

  <SpectrumPeakAnalysisResults>
    <SpectrumPeak>
      <SpectrumPeakEnergyValue>661.7</SpectrumPeakEnergyValue>
      <SpectrumPeakNetAreaValue>123.5</SpectrumPeakNetAreaValue>
      <SpectrumPeakNetAreaUncertaintyValue>12.4</SpectrumPeakNetAreaUncertaintyValue>
    </SpectrumPeak>
    <SpectrumPeak>
      <SpectrumPeakEnergyValue>1460.9</SpectrumPeakEnergyValue>

```

```
<SpectrumPeakNetAreaValue>23.4</SpectrumPeakNetAreaValue>
<SpectrumPeakNetAreaUncertaintyValue>2.3</SpectrumPeakNetAreaUncertaintyValue>
</SpectrumPeak>
</SpectrumPeakAnalysisResults>
</AnalysisResults>

<AnalysisResults radMeasurementReferences="M-1223">
  <AnalysisAlgorithmName>SuperNID</AnalysisAlgorithmName>
  <AnalysisAlgorithmCreatorName>Spectrometers R Us</AnalysisAlgorithmCreatorName>
  <AnalysisAlgorithmVersion>
    <AnalysisAlgorithmComponentName>Main</AnalysisAlgorithmComponentName>
    <AnalysisAlgorithmComponentVersion>1.0</AnalysisAlgorithmComponentVersion>
  </AnalysisAlgorithmVersion>

  <NuclideAnalysisResults>
    <Nuclide>
      <NuclideIdentifiedIndicator>true</NuclideIdentifiedIndicator>
      <NuclideName>Cs-137</NuclideName>
      <NuclideIDConfidenceValue>0.99</NuclideIDConfidenceValue>
    </Nuclide>
  </NuclideAnalysisResults>

  <SpectrumPeakAnalysisResults>
    <SpectrumPeak>
      <SpectrumPeakEnergyValue>661.7</SpectrumPeakEnergyValue>
      <SpectrumPeakNetAreaValue>123.4</SpectrumPeakNetAreaValue>
      <SpectrumPeakNetAreaUncertaintyValue>12.3</SpectrumPeakNetAreaUncertaintyValue>
    </SpectrumPeak>
    <SpectrumPeak>
      <SpectrumPeakEnergyValue>1460.9</SpectrumPeakEnergyValue>
      <SpectrumPeakNetAreaValue>23.4</SpectrumPeakNetAreaValue>
      <SpectrumPeakNetAreaUncertaintyValue>2.3</SpectrumPeakNetAreaUncertaintyValue>
    </SpectrumPeak>
  </SpectrumPeakAnalysisResults>
</AnalysisResults>
</RadInstrumentData>
```

Annex H (informative)

Example: A neutron handheld

This is an example of a Neutron Handheld radiation measurement instrument document; these instruments simply record the neutron counts per measurement interval. This example:

- Describes the radiation measurement instrument and its neutron radiation detector via <RadInstrumentInformation> and <RadDetectorInformation> elements.
- Records two successive neutron count readings (taken using a 10 s integration time, as indicated by the <RealTime> element value) and each reading of the geolocation system.
- The instrument's location and battery status is reported for each reading.

```
<?xml version="1.0"?>
<?xml-model href="http://physics.nist.gov/N42/2011/schematron/n42.sch"
type="application/xml" schematypens="http://purl.oclc.org/dsdl/schematron"?>
<RadInstrumentData xmlns="http://physics.nist.gov/N42/2011/N42"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://physics.nist.gov/N42/2011/N42
http://physics.nist.gov/N42/2011/n42.xsd"
  n42DocUUID="e757f277-a2f7-419b-8ffa-cf8c87290d62">

  <RadInstrumentInformation id="RadInstrumentInformation-1">
    <RadInstrumentManufacturerName>Handhelds R Us</RadInstrumentManufacturerName>
    <RadInstrumentIdentifier>Serial Number 101</RadInstrumentIdentifier>
    <RadInstrumentModelName>N1234</RadInstrumentModelName>
    <RadInstrumentClassCode>Neutron Handheld</RadInstrumentClassCode>
    <RadInstrumentVersion>
      <RadInstrumentComponentName>Software</RadInstrumentComponentName>
      <RadInstrumentComponentVersion>1</RadInstrumentComponentVersion>
    </RadInstrumentVersion>
    <RadInstrumentVersion>
      <RadInstrumentComponentName>CPU</RadInstrumentComponentName>
      <RadInstrumentComponentVersion>27X</RadInstrumentComponentVersion>
    </RadInstrumentVersion>
  </RadInstrumentInformation>

  <RadDetectorInformation id="RadDetectorInformation-1">
    <RadDetectorCategoryCode>Neutron</RadDetectorCategoryCode>
    <RadDetectorKindCode>He3</RadDetectorKindCode>
    <RadDetectorVolumeValue>1.0</RadDetectorVolumeValue>
    <RadDetectorCharacteristics>
      <Characteristic>
        <CharacteristicName>Gas Pressure</CharacteristicName>
        <CharacteristicValue>10</CharacteristicValue>
        <CharacteristicValueUnits>ATM</CharacteristicValueUnits>
      </Characteristic>
      <CharacteristicValueDataClassCode>PositiveDouble</CharacteristicValueDataClassCode>
    </Characteristic>
    <Characteristic>
      <CharacteristicName>Quench Gas</CharacteristicName>
      <CharacteristicValue>CO2</CharacteristicValue>
      <CharacteristicValueUnits>unit-less</CharacteristicValueUnits>
      <CharacteristicValueDataClassCode>string</CharacteristicValueDataClassCode>
    </Characteristic>
  </RadDetectorCharacteristics>
</RadDetectorInformation>

  <RadMeasurement id="RadMeasurement-1">
    <MeasurementClassCode>Foreground</MeasurementClassCode>
    <StartDateTime>2003-11-22T23:46:30-07:00</StartDateTime>
    <RealTimeDuration>PT10.0S</RealTimeDuration>
    <GrossCounts id="RadMeasurement-1-GrossCounts-1"
radDetectorInformationReference="RadDetectorInformation-1">
      <LiveTimeDuration>PT10.0S</LiveTimeDuration>
      <CountData>4</CountData>
    </GrossCounts>
  </RadMeasurement>
</RadInstrumentData>
```



```

    <RadInstrumentState id="RadMeasurement-1-RadInstrumentState-1"
radInstrumentInformationReference="RadInstrumentInformation-1">
    <StateVector>
        <GeographicPoint>
            <LatitudeValue>35.840603</LatitudeValue>
            <LongitudeValue>-106.267576</LongitudeValue>
            <ElevationValue>2052</ElevationValue>
            <GeoPointAccuracyValue>10</GeoPointAccuracyValue>
            <ElevationAccuracyValue>15</ElevationAccuracyValue>
        </GeographicPoint>
    </StateVector>
    <RadInstrumentCharacteristics>
        <Characteristic valueOutOfLimits="false">
            <CharacteristicName>BatteryCharge</CharacteristicName>
            <CharacteristicValue>10</CharacteristicValue>
            <CharacteristicValueUnits>%</CharacteristicValueUnits>
        </Characteristic>
    </RadInstrumentCharacteristics>
</RadInstrumentState>
</RadMeasurement>

    <RadMeasurement id="RadMeasurement-2">
        <MeasurementClassCode>Foreground</MeasurementClassCode>
        <StartDateTime>2003-11-22T23:46:40-07:00</StartDateTime>
        <RealTimeDuration>PT10.0S</RealTimeDuration>
        <GrossCounts id="RadMeasurement-2-GrossCounts-1"
radDetectorInformationReference="RadDetectorInformation-1">
            <LiveTimeDuration>PT10.0S</LiveTimeDuration>
            <CountData>2</CountData>
        </GrossCounts>
        <RadInstrumentState id="RadMeasurement-2-RadInstrumentState-1"
radInstrumentInformationReference="RadInstrumentInformation-1">
            <StateVector>
                <GeographicPoint>
                    <LatitudeValue>35.840603</LatitudeValue>
                    <LongitudeValue>-106.267576</LongitudeValue>
                    <ElevationValue>2052</ElevationValue>
                    <GeoPointAccuracyValue>10</GeoPointAccuracyValue>
                    <ElevationAccuracyValue>15</ElevationAccuracyValue>
                </GeographicPoint>
            </StateVector>
            <RadInstrumentCharacteristics>
                <Characteristic valueOutOfLimits="false">
                    <CharacteristicName>BatteryCharge</CharacteristicName>
                    <CharacteristicValue>10</CharacteristicValue>
                    <CharacteristicValueUnits>%</CharacteristicValueUnits>
                </Characteristic>
            </RadInstrumentCharacteristics>
        </RadInstrumentState>
    </RadMeasurement>

</RadInstrumentData>

```

Annex I (informative)

Example: A spectroscopic personal radiation detector

This is an example of a document produced by a spectroscopic personal radiation detector (SPRD). In this document:

- The instrument is described via a <RadInstrumentInformation> element.
- The gamma radiation detector (a CsI) and the neutron radiation detector (a LiI) are described by a <RadDetectorInformation> element.
- The energy declaration of the gamma radiation detector is defined via a linear model with no zero offset and 4,0 keV/channel.
- Two measurements, and their corresponding nuclide identification results, are recorded:
 - Each measurement consists a <RadMeasurement> element containing a spectrum from the gamma radiation detector, counts from the a neutron radiation detector, and the ambient dose equivalent rate (in $\mu\text{Sv/h}$) as collected over a one second integration time; the instrument's location and operating mode are captured as well, via <RadInstrumentState>. The id attribute value assigned to each <RadMeasurement> uses a simple sequential scheme (i.e. "M112", "M113"); each child element id attribute adds a unique suffix depending on the type of element (e.g. "M112G" for the <Spectrum> from the gamma radiation detector for measurement M112).
 - Immediately following each <RadMeasurement> element, the analysis results for that measurement are given by an <AnalysisResults> element.
- There is a fault flag for a value out of limit.

```
<?xml version="1.0"?>
<?xml-model href="http://physics.nist.gov/N42/2011/schematron/n42.sch"
type="application/xml" schematypens="http://purl.oclc.org/dsdl/schematron"?>
<RadInstrumentData xmlns="http://physics.nist.gov/N42/2011/N42"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://physics.nist.gov/N42/2011/N42
http://physics.nist.gov/N42/2011/n42.xsd"
  n42DocUUID="563f866d-1322-4510-a8e4-9dcc4cb302da">

  <RadInstrumentInformation id="RadInstrument-1">
    <RadInstrumentManufacturerName>SPRDs R Us</RadInstrumentManufacturerName>
    <RadInstrumentModelName>iSPRD</RadInstrumentModelName>
    <RadInstrumentClassCode>Spectroscopic Personal Radiation
Detector</RadInstrumentClassCode>
    <RadInstrumentVersion>
      <RadInstrumentComponentName>Firmware</RadInstrumentComponentName>
      <RadInstrumentComponentVersion>C</RadInstrumentComponentVersion>
    </RadInstrumentVersion>
    <RadInstrumentVersion>
      <RadInstrumentComponentName>Hardware</RadInstrumentComponentName>
      <RadInstrumentComponentVersion>B</RadInstrumentComponentVersion>
    </RadInstrumentVersion>
    <RadInstrumentVersion>
      <RadInstrumentComponentName>Software</RadInstrumentComponentName>
      <RadInstrumentComponentVersion>11</RadInstrumentComponentVersion>
    </RadInstrumentVersion>
  </RadInstrumentInformation>

  <RadDetectorInformation id="Gamma">
    <RadDetectorCategoryCode>Gamma</RadDetectorCategoryCode>
    <RadDetectorKindCode>CsI</RadDetectorKindCode>
    <RadDetectorLengthValue>1.3</RadDetectorLengthValue>
    <RadDetectorDiameterValue>5.1</RadDetectorDiameterValue>
    <RadDetectorCharacteristics>
      <Characteristic>
        <CharacteristicName>Readout</CharacteristicName>
        <CharacteristicValue>PIN diode</CharacteristicValue>
        <CharacteristicValueUnits>unit-less</CharacteristicValueUnits>
      </Characteristic>
    </RadDetectorCharacteristics>
  </RadDetectorInformation>
</RadInstrumentData>
```

```

        <CharacteristicValueDataClassCode>string</CharacteristicValueDataClassCode>
    </Characteristic>
</RadDetectorCharacteristics>
</RadDetectorInformation>

<RadDetectorInformation id="Neutron">
    <RadDetectorCategoryCode>Neutron</RadDetectorCategoryCode>
    <RadDetectorKindCode>LiI</RadDetectorKindCode>
    <RadDetectorVolumeValue>2.5</RadDetectorVolumeValue>
</RadDetectorInformation>

<EnergyCalibration id="Energy">
    <CoefficientValues>0.0 4.0 0.0</CoefficientValues>
</EnergyCalibration>

<RadMeasurement id="M112">
    <MeasurementClassCode>Foreground</MeasurementClassCode>
    <StartDateTime>2010-03-15T22:30:12</StartDateTime>
    <RealTimeDuration>PT1.0S</RealTimeDuration>
    <Spectrum id="M112G" radDetectorInformationReference="Gamma"
energyCalibrationReference="Energy">
        <LiveTimeDuration>PT0.98S</LiveTimeDuration>
        <ChannelData>
            0 0 0 22 421 847 1295 1982 2127 2222 2302 2276
            2234 1921 1939 1715 1586 1469 1296 1178 1127 1047 928 760
            679 641 542 529 443 423 397 393 322 272 294 227
            216 224 208 191 189 163 167 173 150 137 136 129
            150 142 160 159 140 103 90 82 83 85 67 76
            73 84 63 74 70 69 76 61 49 61 63 65
            58 62 48 75 56 61 46 56 43 37 55 47
            50 40 38 54 43 41 45 51 32 35 29 33
            40 44 33 35 20 26 27 17 19 20 16 19
            18 19 18 20 17 45 55 70 62 59 32 30
            21 23 10 9 5 13 11 11 6 7 7 9
            11 4 8 8 14 14 11 9 13 5 5 6
            10 9 3 4 3 7 5 5 4 5 3 6
            5 0 5 6 3 1 4 4 3 10 11 4
            1 4 2 11 9 6 3 5 5 1 4 2
            6 6 2 3 0 2 2 2 2 0 1 3
            1 1 2 3 2 4 5 2 6 4 1 0
            3 1 2 1 1 0 1 0 0 2 0 1
            0 0 0 1 0 0 0 0 0 0 0 2
            0 0 0 1 0 1 0 0 2 1 0 0
            0 0 1 3 0 0 0 1 0 1 0 0
            0 0 0 0
        </ChannelData>
    </Spectrum>

    <GrossCounts id="M112N" radDetectorInformationReference="Neutron">
        <LiveTimeDuration>PT3.0S</LiveTimeDuration>
        <CountData>2</CountData>
    </GrossCounts>

    <DoseRate id="M112D" radDetectorInformationReference="Gamma">
        <DoseRateValue units="uSv/h">0.11</DoseRateValue>
        <DoseRateLevelDescription>Low</DoseRateLevelDescription>
    </DoseRate>

    <RadInstrumentState radInstrumentInformationReference="RadInstrument-1">
        <RadInstrumentModeCode>Search</RadInstrumentModeCode>
        <StateVector>
            <GeographicPoint>
                <LatitudeValue>48.234239</LatitudeValue>
                <LongitudeValue>16.416986</LongitudeValue>
                <ElevationValue>7</ElevationValue>
            </GeographicPoint>
        </StateVector>
        <RadInstrumentCharacteristics>
            <CharacteristicGroup groupOutOfLimits="false">
                <CharacteristicGroupName>StateOfHealth</CharacteristicGroupName>
                <Characteristic valueOutOfLimits="false">
                    <CharacteristicName>BatteryCharge</CharacteristicName>
                    <CharacteristicValue>83</CharacteristicValue>
                    <CharacteristicValueUnits>% charge</CharacteristicValueUnits>
                    <CharacteristicValueDataClassCode>double</CharacteristicValueDataClassCode>
                </Characteristic>
                <Characteristic valueOutOfLimits="false">
                    <CharacteristicName>RadioSignalStrength</CharacteristicName>

```

```

        <CharacteristicValue>-49</CharacteristicValue>
        <CharacteristicValueUnits>dBm</CharacteristicValueUnits>
        <CharacteristicValueDataClassCode>double</CharacteristicValueDataClassCode>
    </Characteristic>
</CharacteristicGroup>
</RadInstrumentCharacteristics>
</RadInstrumentState>

<RadDetectorState radDetectorInformationReference="Gamma">
    <RadDetectorCharacteristics>
        <CharacteristicGroup groupOutOfLimits="false">
            <CharacteristicGroupName>StateOfHealth</CharacteristicGroupName>
            <Characteristic valueOutOfLimits="false">
                <CharacteristicName>StabilizationCorrectionFactor</CharacteristicName>
                <CharacteristicValue>0.01</CharacteristicValue>
                <CharacteristicValueUnits>% full scale</CharacteristicValueUnits>
                <CharacteristicValueDataClassCode>double</CharacteristicValueDataClassCode>
            </Characteristic>
        </CharacteristicGroup>
    </RadDetectorCharacteristics>
</RadDetectorState>

</RadMeasurement>

<AnalysisResults radMeasurementReferences="M112">
    <NuclideAnalysisResults>
        <Nuclide>
            <NuclideIdentifiedIndicator>true</NuclideIdentifiedIndicator>
            <NuclideName>K-40</NuclideName>
            <NuclideIDConfidenceValue>0.99</NuclideIDConfidenceValue>
        </Nuclide>
    </NuclideAnalysisResults>
</AnalysisResults>

<RadMeasurement id="M113">
    <MeasurementClassCode>Foreground</MeasurementClassCode>
    <StartDateTime>2010-03-15T22:30:13</StartDateTime>
    <RealTimeDuration>PT1.0S</RealTimeDuration>
    <Spectrum id="M113G" radDetectorInformationReference="Gamma"
energyCalibrationReference="Energy">
        <LiveTimeDuration>PT0.98S</LiveTimeDuration>
        <ChannelData>
            0 0 0 22 421 847 1295 1982 2127 2222 2302 2276
            2234 1921 1939 1715 1586 1469 1296 1178 1127 1047 928 760
            679 641 542 529 443 423 397 393 322 272 294 227
            216 224 208 191 189 163 167 173 150 137 136 129
            150 142 160 159 140 103 90 82 83 85 67 76
            73 84 63 74 70 69 76 61 49 61 63 65
            58 62 48 75 56 61 46 56 43 37 55 47
            50 40 38 54 43 41 45 51 32 35 29 33
            40 44 33 35 20 26 27 17 19 20 16 19
            18 19 18 20 17 45 55 70 62 59 32 30
            21 23 10 9 5 13 11 11 6 7 7 9
            11 4 8 8 14 14 11 9 13 5 5 6
            10 9 3 4 3 7 5 5 4 5 3 6
            5 0 5 6 3 1 4 4 3 10 11 4
            1 4 2 11 9 6 3 5 5 1 4 2
            6 6 2 3 0 2 2 2 2 0 1 3
            1 1 2 3 2 4 5 2 6 4 1 0
            3 1 2 1 1 0 1 0 0 2 0 1
            0 0 0 1 0 0 0 0 0 0 0 2
            0 0 0 1 0 1 0 0 2 1 0 0
            0 0 1 3 0 0 0 1 0 1 0 0
            0 0 0 0
        </ChannelData>
    </Spectrum>

    <GrossCounts id="M113N" radDetectorInformationReference="Neutron">
        <LiveTimeDuration>PT3.0S</LiveTimeDuration>
        <CountData>2</CountData>
    </GrossCounts>

    <DoseRate id="M113D" radDetectorInformationReference="Gamma">
        <DoseRateValue units="uSv/h">0.11</DoseRateValue>
        <DoseRateLevelDescription>Low</DoseRateLevelDescription>
    </DoseRate>

<RadInstrumentState radInstrumentInformationReference="RadInstrument-1">

```

```

<RadInstrumentModeCode>Search</RadInstrumentModeCode>
<StateVector>
  <GeographicPoint>
    <LatitudeValue>48.234239</LatitudeValue>
    <LongitudeValue>16.416986</LongitudeValue>
    <ElevationValue>7</ElevationValue>
  </GeographicPoint>
</StateVector>
<RadInstrumentCharacteristics>
  <CharacteristicGroup groupOutOfLimits="false">
    <CharacteristicGroupName>StateOfHealth</CharacteristicGroupName>
    <Characteristic valueOutOfLimits="false">
      <CharacteristicName>BatteryCharge</CharacteristicName>
      <CharacteristicValue>83</CharacteristicValue>
      <CharacteristicValueUnits>% charge</CharacteristicValueUnits>
      <CharacteristicValueDataClassCode>double</CharacteristicValueDataClassCode>
    </Characteristic>
    <Characteristic valueOutOfLimits="false">
      <CharacteristicName>RadioSignalStrength</CharacteristicName>
      <CharacteristicValue>-49</CharacteristicValue>
      <CharacteristicValueUnits>dBm</CharacteristicValueUnits>
      <CharacteristicValueDataClassCode>double</CharacteristicValueDataClassCode>
    </Characteristic>
  </CharacteristicGroup>
</RadInstrumentCharacteristics>
</RadInstrumentState>
<RadDetectorState radDetectorInformationReference="Gamma">
  <Fault>
    <FaultCodeValue>123</FaultCodeValue>
    <FaultDescription>Stabilizer out of range fault</FaultDescription>
    <FaultSeverityCode>Error</FaultSeverityCode>
  </Fault>
  <RadDetectorCharacteristics>
    <CharacteristicGroup groupOutOfLimits="true">
      <CharacteristicGroupName>StateOfHealth</CharacteristicGroupName>
      <Characteristic valueOutOfLimits="true">
        <CharacteristicName>StabilizationCorrectionFactor</CharacteristicName>
        <CharacteristicValue>25</CharacteristicValue>
        <CharacteristicValueUnits>% full scale</CharacteristicValueUnits>
        <CharacteristicValueDataClassCode>double</CharacteristicValueDataClassCode>
      </Characteristic>
    </CharacteristicGroup>
  </RadDetectorCharacteristics>
</RadDetectorState>
</RadMeasurement>

<AnalysisResults radMeasurementReferences="M113">
  <NuclideAnalysisResults>
    <Nuclide>
      <NuclideIdentifiedIndicator>true</NuclideIdentifiedIndicator>
      <NuclideName>K-40</NuclideName>
      <NuclideIDConfidenceValue>0.99</NuclideIDConfidenceValue>
    </Nuclide>
  </NuclideAnalysisResults>
</AnalysisResults>
</RadInstrumentData>

```

Annex J (informative)

Conversion factors for exposure and dose equivalent

Exposure rate is a measure of the charge liberated by ionization radiation (x- or gamma-rays) per unit mass of air per unit time. Exposure rate is expressed in this standard in units of milliroentgens per hour (mR/h), or in coulombs per kilogram per hour (C/ kg/h), where $1 \text{ mR/h} = 2,58 \times 10^{-7} \text{ C/ kg/h}$. Exposure rate can be converted to air-kerma rate by using the conversion equations for air listed in Table J.1.

Table J.1 – Roentgen to Gy conversion equations for air

Radionuclide	Conversion equation
Photons (<300 keV)	1 R/h = 8,764 mGy/h
¹³⁷ Cs	1 R/h = 8,778 mGy/h
⁶⁰ Co	1 R/h = 8,792 mGy/h

For x-rays and gamma-rays the factor to convert from absorbed-dose (Gy) to dose equivalent (Sv) is equal to 1. Therefore in SI units $1 \text{ Gy} = 1 \text{ Sv}$.

Conversion coefficients can be used to convert from air-kerma to dose equivalent quantities such as the deep and shallow ambient dose equivalent ($H^*(10)$ and $H^*(0,07)$), and the deep and shallow personal dose equivalent ($Hp(10)$ and $Hp(0,07)$). The conversion coefficients are tabulated as a function of photon energy for ISO beam qualities in ISO 4037:3 [32].

A subset of conversion coefficients from air-kerma to deep ambient dose equivalent, $H^*(10)$, (International Commission on Radiation Units and Measurement (ICRU) Tissue Sphere Phantom at a depth of 10 mm) are given in Table J.2.

Table J.2 – Conversion coefficients from air-kerma to $H^*(10)$

Photon Source	$C_k (\text{Sv/Gy})^a$	$C_x (\text{rem/R})$
²⁴¹ Am	1,74	1,66
N80 (65 keV)	1,73	1,65
¹³⁷ Cs	1,20	1,06
⁶⁰ Co	1,16	1,03
^a ISO 4037-3 [32]		

Annex K (normative)

Description of location and orientation

K.1 General

This standard provides the means to describe the location of an object on the Earth, via the specification of its latitude, longitude, and elevation. The object's location may also be given as a distance and bearing relative to something else; e.g. the radiation measurement instrument itself. In addition to the location, the orientation of the object – i.e. the direction it is pointing – can also be described.

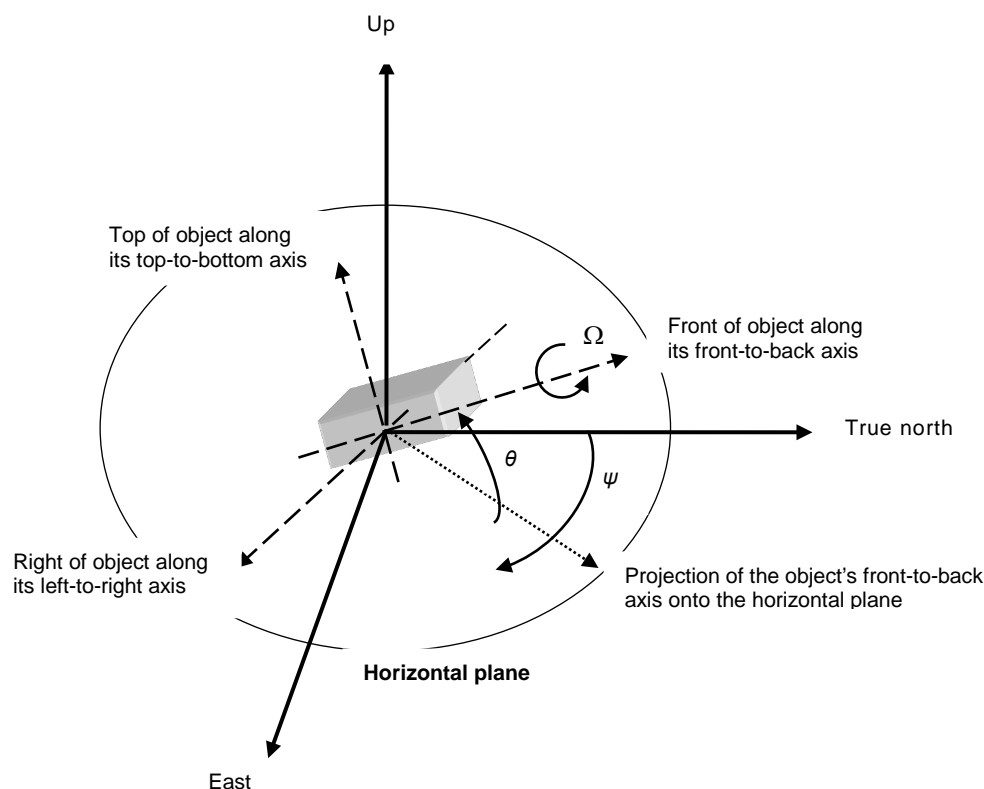
Location and orientation information is given via the following elements:

- `<GeographicPoint>` describes an absolute location on the Earth, in terms of latitude, longitude, and elevation.
- `<Orientation>` describes an attitude via bearing (azimuth and inclination) and roll angle.
- `<RelativeLocation>` describes a position relative to a reference point, using the bearing and distance. The reference point can be a simple description (e.g. "Front Gate Barrier"), an absolute location (i.e. a `<GeographicPoint>`), or a radiation measurement instrument, radiation detector, or measured item described in the current XML document.

K.2 and K.3 describe the specification of orientation and relative location in detail. Sample uses of these concepts can be found in the example documents in the Annexes.

K.2 Orientation of an object

The `<Orientation>` element describes the attitude of an object (i.e. instrument, detector, or item) in space in terms of an internal frame of reference attached to the object's body and an external frame of reference. The object's internal frame of reference consists of three perpendicular axes: front - back, left-right, and top-bottom. The external frame of reference is the horizontal plane and True North. The object's orientation is expressed in terms of three angles: azimuth (Ψ), inclination (θ), and roll (Ω), as shown in Figure K.1:



IEC 1985/12

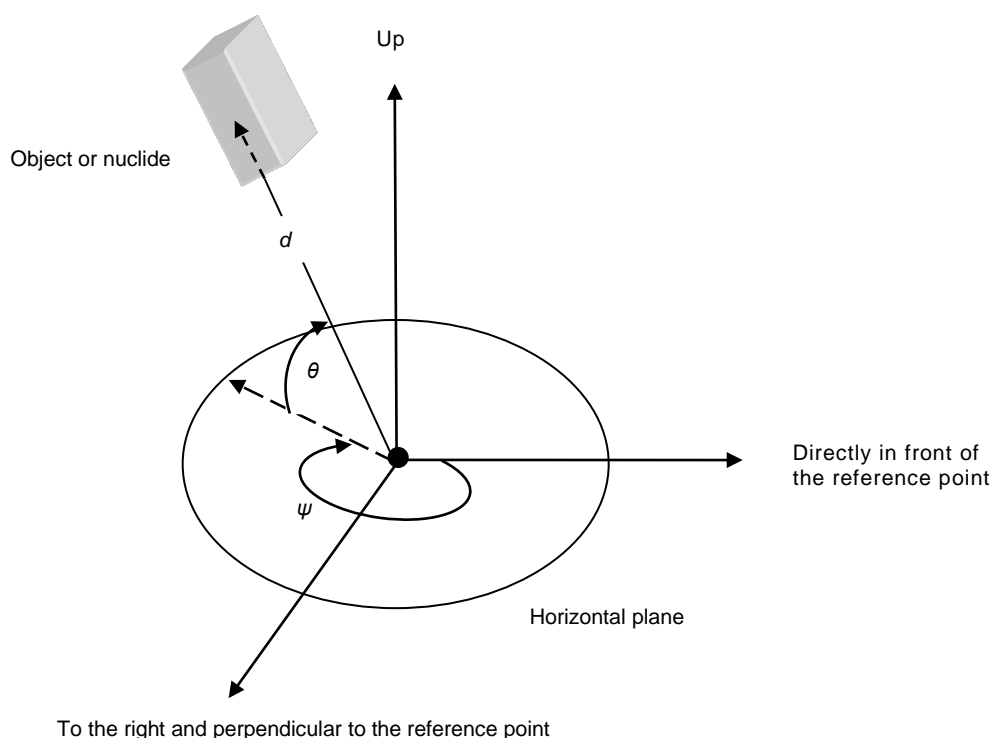
Figure K.1 – Orientation of an object

The following child elements of <Orientation> correspond to the values Ψ , θ , and Ω :

- Ψ <AzimuthValue>: The orientation of an object (i.e. instrument, detector, or item) with respect to True North. Its value is the angle subtended by a line from the centre point of the object to True North in the horizontal plane and the line formed by the object's front-to-back axis projected onto the horizontal plane. The angle range is from $-180,0^\circ$ to $+180,0^\circ$. A value of zero implies the front of the object's body is pointed to True North; positive values imply the front is pointed to the east of True North; negative values imply the front is pointed to the west of True North.
- θ <InclinationValue>: The orientation of an object (i.e. instrument, detector, or item) with respect to the horizontal plane. Its value is the angle subtended by the line formed by the object's front-to-rear axis and the line formed by the projection of that line onto the horizontal plane. The angle range is from $-90,0^\circ$ to $+90,0^\circ$. A value of zero implies the object's front-to-rear axis is level, i.e., aligned with the horizontal plane; positive values imply the object is pointed up; negative values imply the object is pointed down.
- Ω <RollValue>: The orientation of an object (i.e. instrument, detector, or item) with respect to the axis running from the front to the back of the object. Its value is the angle subtended by a line defined by the object's left-to-right axis and a line defined by the same axis when it is aligned with the horizontal plane. The angle range is from $-180,0^\circ$ to $+180,0^\circ$. A value of zero implies the object's body is not rotated about the front-to-back axis and its left-to-right axis is aligned with the horizontal plane (though the object may be inclined); positive values are clockwise rotations about the front-to-back axis when viewed from behind the object and looking towards the direction to which the object is pointing; negative values are counter clockwise rotations.

K.3 Location of an object with respect to a reference point

The <RelativeLocation> element describes the location of an object (i.e. instrument, detector, or item) or radionuclide relative to a reference point in terms of polar coordinates from the reference point, as shown in Figure K.2:



IEC 1986/12

Figure K.2 – Location of an object with respect to a reference point

The reference point (Origin) and the coordinates of the object are described by child elements of <RelativeLocation>.

The reference point (Origin) can be one of the following:

- an absolute point – described by a <GeographicPoint> element, in which case the forward direction of the reference point is True North;
- another radiation measurement instrument, radiation detector, or measured item – identified by an originReference attribute;
- some other object – described by an <OriginDescription> element.

The location of the object relative to the reference point, corresponding to Ψ , θ , and d in the figure, are given by the elements <RelativeLocationAzimuthValue>, <RelativeLocationInclinationValue>, and <DistanceValue>:

Ψ <RelativeLocationAzimuthValue>: The horizontal bearing angle with respect to True North from a reference point (Origin) to an object (i.e., instrument, detector, or item) or a radionuclide. Its value is the angle subtended by the projection onto the horizontal plane of a straight line from the reference point to the centre of the object or radionuclide, and a line extending in the forward direction from the reference point. The angle range is from $-180,0^\circ$ to $+180,0^\circ$. A value of zero implies the centre of the object or radionuclide's body is aligned directly in front of the reference point; positive values imply the object or radionuclide is to the right of the reference point; negative values imply the object or radionuclide is to the left of the reference point.

- θ** <RelativeLocationInclinationValue>: The vertical bearing angle with respect to horizontal plane from a reference point (Origin) to an object (i.e. instrument, detector, or item) or a radionuclide. Its value is the angle subtended by a straight line, running from the centre of the reference point to the centre of the object or radionuclide, and a projection of that line onto the horizontal plane. The angle range is from $-90,0^\circ$ to $+90,0^\circ$. A value of zero implies the centre of the object or radionuclide is at the same altitude or elevation as the reference point; positive values imply the object or radionuclide is higher than the reference point; negative values imply the object or radionuclide is lower than the reference point.
- d** <DistanceValue>: The scalar distance between the centre of an object (i.e. instrument, detector, or item) or radionuclide and the centre of a reference point (Origin).

Annex L (informative)

Creating extensions to the standard

The standard provides a means to extend the N42 schema by added custom elements to selected standard N42 elements. Before adding custom elements, however, it shall be determined that there is no possibility of representing the desired data using existing N42 elements.

The method employed to provide extensibility is an XML concept called “substitution groups” that is described in 4.6 of [38]. The rules that govern the use of this substitution group feature of N42 are set forth in [35]. Only elements specifically designated in this annex as extendible have included substitution group heads in the N42 schema. These are:

- AnalysisResults
- DerivedData
- DoseAnalysisResults
- ExposureAnalysisResults
- GrossCountAnalysisResults
- MultimediaData
- Nuclide
- NuclideAnalysisResults
- RadAlarm
- RadDetectorInformation
- RadDetectorState
- RadInstrumentData
- RadInstrumentInformation
- RadInstrumentState
- RadItemInformation
- RadItemState
- RadMeasurement
- Spectrum
- SpectrumPeak
- SpectrumPeakAnalysisResults

The definition of each of these elements includes an abstract element that serves as a substitution group head. Each of these abstract elements is the last child element in the list of child elements for the parent, and has the same name as the parent with an “Extension” suffix; e.g. for <NuclideAnalysisResults>, the substitution group head element is <NuclideAnalysisResultsExtension>.

The method for implementing extensibility is the use of one or more additional schemas, referred to as “add-in” schemas, in which new elements are declared and defined as substituting for the N42 abstract substitution group head elements. The basic procedure is as follows:

- a) Determine the suitable N42 parent element for the custom element(s). For example, a unique type of measurement data would most logically be added to <RadMeasurement>, as is done in the example below.
- b) Determine the name and type of the custom element; in the example add-in schema below the two custom elements are <HumidityValue> and <TemperatureValue>.
- c) Devise a unique namespace identifier (URI) for this add-in schema and create a new XML Schema “xsd” file. In this file:
 - 1) Define the namespaces to be used; the XML Schema and N42 namespaces shall be referenced, and the targetNamespace should be the add-in schema URI.
 - 2) Use XML Schema <import> to identify the N42 namespace as containing the relevant substitution group head, i.e. *n42:RadMeasurementExtension*.
 - 3) Use XML Schema <element> to define the custom elements, using the substitutionGroup attribute with the value of the extension element for the parent element; in the example below, since the custom elements are to be children of <RadMeasurement>, the substitutionGroup is “n42:RadMeasurementExtension”.
- d) Save the final add-in schema file:

```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema targetNamespace="http://www.handheldsrus.com/downloads/N42SchemaAddin"
  xmlns:n42="http://physics.nist.gov/N42/2011/N42"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  elementFormDefault="qualified">

  <xsd:import namespace="http://physics.nist.gov/N42/2011/N42"
    schemaLocation="http://physics.nist.gov/N42/2011/n42.xsd"/>

  <xsd:element name="HumidityValue"
    substitutionGroup="n42:RadMeasurementExtension"
    type="n42:NonNegativeDoubleSimpleType">
    <xsd:annotation>
      <xsd:documentation>The relative humidity at the time and location of the
radiation measurement.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="TemperatureValue"
    substitutionGroup="n42:RadMeasurementExtension"
    type="xsd:double">
    <xsd:annotation>
      <xsd:documentation>The ambient temperature at the time and location of the
radiation measurement in degrees centigrade (C).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
</xsd:schema>
```

- e) To create an instance document that includes these custom elements:

- 1) Include the add-in schema namespace in the <RadInstrumentData> element; for example:

```
<RadInstrumentData xmlns="http://physics.nist.gov/N42/2011/N42"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:HHRUs="http://www.handheldsrus.com/downloads/N42SchemaAddin"
  xsi:schemaLocation="http://physics.nist.gov/N42/2011/N42
http://physics.nist.gov/N42/2011/n42.xsd
http://www.handheldsrus.com/downloads/N42SchemaAddin
http://www.handheldsrus.com/downloads/N42SchemaAddin.xsd"
  n42DocUUID="15fccb52-539f-40e8-82ca-1a2fdc0bbe30">
```

- 2) Add the custom elements at the end of the N42 parent element instances; for this example, <TemperatureValue> and <HumidityValue> elements are added to each <RadMeasurement> instance:

```
</StateVector>
</RadInstrumentState>
<HHRUs:HumidityValue>40</HHRUs:HumidityValue>
<HHRUs:TemperatureValue>21</HHRUs:TemperatureValue>
</RadMeasurement>
```

A single add-in schema can add custom elements to many regular N42 parent elements. The custom elements can have child elements themselves, if desired.

The general rules that apply to these “extension” XML namespaces are:

- 1) The add-in namespace shall provide new elements and subordinate declarations that apply only to the substitution group head elements provided in the N42 schema.
- 2) The add-in namespace shall not contain elements, attributes, or types that replace or supersede those defined in this N42 standard other than those abstract elements designated as substitution group heads.
- 3) The add-in namespace should conform to the rules set forth in [35].
- 4) Documentation for an add-in schema shall be sufficient to allow unambiguous understanding and processing of instance documents that utilize elements from the add-in schema.

The complete example is given below:

```
<?xml version="1.0"?>
<?xml-model href="http://physics.nist.gov/N42/2011/schematron/n42.sch"
type="application/xml" schematypens="http://purl.oclc.org/dsdl/schematron"?>
<RadInstrumentData xmlns="http://physics.nist.gov/N42/2011/N42"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:HHRUs="http://www.handheldsrus.com/downloads/N42SchemaAddin"
  xsi:schemaLocation="http://physics.nist.gov/N42/2011/N42
http://physics.nist.gov/N42/2011/n42.xsd
http://www.handheldsrus.com/downloads/N42SchemaAddin
n42SchemaAddin.xsd"
  n42DocUUID="15fccb52-539f-40e8-82ca-1a2fdc0bbe30">

  <RadInstrumentInformation id="RadInstrument-1">
    <RadInstrumentManufacturerName>Handhelds R Us</RadInstrumentManufacturerName>
    <RadInstrumentIdentifier>Serial Number 101</RadInstrumentIdentifier>
    <RadInstrumentModelName>N1234</RadInstrumentModelName>
    <RadInstrumentClassCode>Neutron Handheld</RadInstrumentClassCode>
    <RadInstrumentVersion>
      <RadInstrumentComponentName>Software</RadInstrumentComponentName>
      <RadInstrumentComponentVersion>1</RadInstrumentComponentVersion>
    </RadInstrumentVersion>
    <RadInstrumentVersion>
      <RadInstrumentComponentName>CPU</RadInstrumentComponentName>
      <RadInstrumentComponentVersion>27X</RadInstrumentComponentVersion>
    </RadInstrumentVersion>
  </RadInstrumentInformation>

  <RadDetectorInformation id="RadDetectorInformation-1">
    <RadDetectorCategoryCode>Neutron</RadDetectorCategoryCode>
    <RadDetectorKindCode>He3</RadDetectorKindCode>
    <RadDetectorVolumeValue>1.0</RadDetectorVolumeValue>
    <RadDetectorCharacteristics>
      <Characteristic>
        <CharacteristicName>GasPressure</CharacteristicName>
        <CharacteristicValue>10</CharacteristicValue>
        <CharacteristicValueUnits>ATM</CharacteristicValueUnits>
      </Characteristic>
    </RadDetectorCharacteristics>
  </RadDetectorInformation>

  <RadMeasurement id="RadMeasurement-1">
    <MeasurementClassCode>Foreground</MeasurementClassCode>
    <StartDateTime>2003-11-22T23:46:30-07:00</StartDateTime>
    <RealTimeDuration>PT10.0S</RealTimeDuration>
    <GrossCounts id="RadMeasurement-1-GrossCounts-1"
radDetectorInformationReference="RadDetectorInformation-1">
      <LiveTimeDuration>PT10.0S</LiveTimeDuration>
      <CountData>4</CountData>
    </GrossCounts>
  </RadMeasurement>
</RadInstrumentData>
```

```

    <RadInstrumentState id="RadMeasurement-1-RadInstrumentState-1"
radInstrumentInformationReference="RadInstrument-1">
    <StateVector>
        <GeographicPoint>
            <LatitudeValue>35.840603</LatitudeValue>
            <LongitudeValue>-106.267576</LongitudeValue>
            <ElevationValue>2052</ElevationValue>
            <GeoPointAccuracyValue>10</GeoPointAccuracyValue>
            <ElevationAccuracyValue>15</ElevationAccuracyValue>
        </GeographicPoint>
    </StateVector>
    <RadInstrumentCharacteristics>
        <Characteristic valueOutOfLimits="false">
            <CharacteristicName>BatteryCharge</CharacteristicName>
            <CharacteristicValue>10</CharacteristicValue>
            <CharacteristicValueUnits>%</CharacteristicValueUnits>
        </Characteristic>
    </RadInstrumentCharacteristics>
</RadInstrumentState>
<HHRUs:HumidityValue>40</HHRUs:HumidityValue>
<HHRUs:TemperatureValue>21</HHRUs:TemperatureValue>
</RadMeasurement>

<RadMeasurement id="RadMeasurement-2">
    <MeasurementClassCode>Foreground</MeasurementClassCode>
    <StartDateTime>2003-11-22T23:46:40-07:00</StartDateTime>
    <RealTimeDuration>PT10.0S</RealTimeDuration>
    <GrossCounts id="RadMeasurement-2-GrossCounts-1"
radDetectorInformationReference="RadDetectorInformation-1">
        <LiveTimeDuration>PT10.0S</LiveTimeDuration>
        <CountData>2</CountData>
    </GrossCounts>
    <RadInstrumentState id="RadMeasurement-2-RadInstrumentState-1"
radInstrumentInformationReference="RadInstrument-1">
        <StateVector>
            <GeographicPoint>
                <LatitudeValue>35.840603</LatitudeValue>
                <LongitudeValue>-106.267576</LongitudeValue>
                <ElevationValue>2052</ElevationValue>
                <GeoPointAccuracyValue>10</GeoPointAccuracyValue>
                <ElevationAccuracyValue>15</ElevationAccuracyValue>
            </GeographicPoint>
        </StateVector>
        <RadInstrumentCharacteristics>
            <Characteristic valueOutOfLimits="false">
                <CharacteristicName>BatteryCharge</CharacteristicName>
                <CharacteristicValue>10</CharacteristicValue>
                <CharacteristicValueUnits>%</CharacteristicValueUnits>
            </Characteristic>
        </RadInstrumentCharacteristics>
    </RadInstrumentState>
<HHRUs:HumidityValue>40</HHRUs:HumidityValue>
<HHRUs:TemperatureValue>21</HHRUs:TemperatureValue>
</RadMeasurement>

</RadInstrumentData>

```

Annex M (informative)

Supplemental data validation rules

M.1 Introduction

The N42 schema can be used to apply basic XML Schema data validation to any N42 format document. However, the W3C standard for XML Schema provides only a limited capability to express/encode business rules relevant to validating the data quality of XML documents. Additional N42 validation rules that cannot be expressed in the N42 XML Schema are described in Table M.1. These rules can be applied as part of the testing of a radiation instrument that creates N42 documents, and as a preliminary data quality check prior to routine N42 document processing.

Note that additional validation rules may also be specified on a per-instrument make/model/version basis.

The rules described in Table M.1 have been implemented as an ISO Schematron schema, which can be found in Annex N and at [41]. The ISO Schematron is described in ISO/IEC 19757-3 [40]. A number of commercial tools are available to apply ISO Schematron schemas.

M.2 Rule description format

Each rule is listed is characterized by:

- a) Rule Name: a unique name for this rule. Rule names are italicized.
- b) Rule Description: a brief description of the rule.
- c) Reference: a reference to the section in the N42 standard to which the rules applies.

Table M.1 – Universal data validation rules

Rule Name	Rule Description	Reference
<i>AnalysisDataReferencesExclusivityCheck</i>	In <AnalysisResults>, the <i>derivedDataReferences</i> , <i>radMeasurementGroupReferences</i> , and <i>radMeasurementReferences</i> attributes are mutually exclusive.	5.4.15
<i>AnalysisStartDateCheck</i>	The value of <AnalysisStartDateTime> cannot be in the future.	5.4.18
<i>CalibrationDateCheck</i>	The value of <CalibrationDateTime> cannot be in the future.	5.4.35
<i>CharacteristicGroupOOLConsistencyCheck</i>	The <CharacteristicGroup> <i>groupOutOfLimits</i> attribute shall be true if any of descendant <Characteristic> <i>valueOutOfLimits</i> attributes are true; otherwise, <i>groupOutOfLimits</i> may be true, false, or absent.	5.5.8
<i>CompressionCheck</i>	<p>If the <i>compressionCode</i> attribute of <ChannelData> is "CountedZeroes", the content of the <ChannelData> shall be coherent:</p> <ul style="list-style-type: none"> • All zero values in the list shall be followed by a value that is greater than zero and an integer. • The last value in the list cannot be a zero. 	<p>5.4.36</p> <p>5.5.1</p>

Rule Name	Rule Description	Reference
<i>CountDataValuesCheck</i>	If the <GrossCounts> <i>energyWindowsReference</i> attribute is omitted, the child <CountData> shall have exactly one value. Otherwise, the number of values in <CountData> and the referenced <WindowStartEnergyValues> shall be identical.	5.4.45
<i>DerivedDataReferencesTypeMatch</i>	Each value of the <i>derivedDataReferences</i> attribute shall be the id of a <DerivedData>.	5.5.3
<i>EBoundariesChannelsCheck</i>	If the energy calibration of <Spectrum> is defined using <EnergyBoundaryValues>, then the number of values in <EnergyBoundaryValues> shall be one greater than the number of channels contained in the <Spectrum>.	5.4.61
<i>EfficiencyUncertaintyMatch</i>	Within their parent element, <EfficiencyValues> and <EfficiencyUncertaintyValues> shall have the same number of values.	5.4.54
<i>EnergyBoundaryIncreasingValuesCheck</i>	The values of an <EnergyBoundaryValues> shall be continuously increasing.	5.4.61
<i>EnergyCalibrationReferenceTypeMatch</i>	The value of an <i>energyCalibrationReference</i> attribute shall be the id of an <EnergyCalibration> element.	5.5.4
<i>EnergyEfficiencyMatch</i>	In a parent element, <EnergyValues> and <EfficiencyValues> shall have the same number of values.	5.4.64
<i>EnergyFWHMMatch</i>	In <FWHMCalibration>, <EnergyValues> and <FWHMValues> shall have the same number of values.	5.4.64
<i>EnergyIncreasingValuesCheck</i>	The values of an <EnergyValues> shall be continuously increasing.	5.4.64
<i>FullEnergyPECalibrationReferenceTypeMatch</i>	The value of a <i>fullEnergyPeakEfficiencyCalibrationReference</i> attribute shall be the id of a <FullEnergyPeakEfficiencyCalibration>.	5.5.6
<i>FWHMCalibrationReferenceTypeMatch</i>	The value of a <i>FWHMCalibrationReference</i> attribute shall be the id of an <FWHMCalibration>.	5.5.7
<i>IDoubleEscapePECalibrationReferenceTypeMatch</i>	The value of an <i>intrinsicDoubleEscapePeakEfficiencyCalibrationReference</i> attribute shall be the id of an <IntrinsicDoubleEscapePeakEfficiencyCalibration>.	5.5.10
<i>IFullEnergyPECalibrationReferenceTypeMatch</i>	The value of an <i>intrinsicFullEnergyPeakEfficiencyCalibrationReference</i> attribute shall be the id of an <IntrinsicFullEnergyPeakEfficiencyCalibration>.	5.5.11
<i>InspectionDateCheck</i>	The value of <InspectionDateTime> cannot be in the future.	5.4.90
<i>ISingleEscapePECalibrationReferenceTypeMatch</i>	The value of all <i>intrinsicSingleEscapePeakEfficiencyCalibrationReference</i> attributes shall be the id of an <IntrinsicSingleEscapePeakEfficiencyCalibration>.	5.5.12
<i>N42DocDateCheck</i>	The value of the <i>n42DocDateTime</i> attribute cannot be in the future.	5.5.13
<i>OriginReferenceCircularReferenceCheck</i>	The use of the <i>originReference</i> attribute shall not result in a circular reference; i.e., an object referenced by an <i>originReference</i> attribute may not have its location defined by a <RelativeLocation> whose <i>originReference</i> is itself.	5.5.15
<i>OriginReferenceDescriptionCheck</i>	An <Origin> element using the <i>originReference</i> attribute shall also contain an <OriginDescription>.	5.5.15
<i>OriginReferenceTypeMatch</i>	The value of an <i>originReference</i> attribute shall be the id of a <RadInstrumentInformation>, <RadDetectorInformation>, or <RadItemInformation>.	5.5.15

Rule Name	Rule Description	Reference
<i>RadAlarmCategoryCheck</i>	A <RadAlarm> containing a <RadAlarmCategory> with the value of “Other” shall also contain a <RadAlarmDescription>.	5.4.137
<i>RadAlarmDateCheck</i>	The value of <RadAlarmDateTime> cannot be in the future.	5.4.138
<i>RadDetectorCategoryCheck</i>	A <RadDetector> containing a <RadDetectorCategoryCode> with the value of “Other” shall also contain <RadDetectorDescription>.	5.4.143
<i>RadDetectorInformationReferencesTypeMatch</i>	Each value of a <i>radDetectorInformationReferences</i> attribute (data type IDREFS) shall be the id of a <RadDetectorInformation>.	5.5.17
<i>RadDetectorInformationReferenceTypeMatch</i>	The value of a <i>radDetectorInformationReference</i> attribute shall be the id of a <RadDetectorInformation>.	5.5.16
<i>RadDetectorKindCheck</i>	A <RadDetector> containing a <RadDetectorKindCode> with a value of “Other” shall also contain <RadDetectorDescription>.	5.4.150
<i>RadItemInformationReferenceTypeMatch</i>	The value of a <i>radItemInformationReference</i> attribute shall be the id of a <RadItemInformation>.	5.5.19
<i>RadItemInformationReferencesTypeMatch</i>	Each value of a <i>radItemInformationReferences</i> attribute (data type IDREFS) shall be the id of a <RadItemInformation>.	5.5.20
<i>RadMeasurementGroupReferencesTypeMatch</i>	Each value of a <i>radMeasurementGroupReferences</i> attribute (data type IDREFS) shall be the id of a <RadMeasurementGroup>.	5.5.21
<i>RadMeasurementReferencesTypeMatch</i>	Each value of a <i>radMeasurementReferences</i> attribute (data type IDREFS) shall be the id of a <RadMeasurement>.	5.5.23
<i>RadMeasurementUniqueDetectorCheck</i>	A <RadMeasurement> shall contain only one of each of the following elements with the same detector id: <Spectrum>, <GrossCounts>, <DoseRate>, <ExposureRate>, <TotalDose>, <TotalExposure>.	4.3.1
<i>RadRawDoseRateReferencesCheck</i>	The parent element of an element using the <i>radRawDoseRateReferences</i> attribute shall be <DerivedData>.	5.5.24
<i>RadRawDoseRateReferencesTypeMatch</i>	Each values of a <i>radRawDoseRateReferences</i> attribute shall be the id of a <DoseRate> element.	5.5.24
<i>RadRawExposureRateReferencesCheck</i>	The parent element of an element using the <i>radRawExposureRateReferences</i> attribute shall be <DerivedData>.	5.5.25
<i>RadRawExposureRateReferencesTypeMatch</i>	Each value of a <i>radRawExposureRateReferences</i> attribute shall be the id of a <ExposureRate>.	5.5.25
<i>RadRawGrossCountsDataReferencesCheck</i>	The parent element of an element using the <i>radRawGrossCountsReferences</i> attribute shall be <DerivedData>.	5.5.26
<i>RadRawGrossCountsDataReferencesTypeMatch</i>	Each value of a <i>radRawGrossCountsReferences</i> attribute shall be the id of a <GrossCounts>.	5.5.26
<i>RadRawSpectrumDataReferencesCheck</i>	The parent element of an element using the <i>radRawSpectrumReferences</i> attribute shall be <DerivedData>.	5.5.27
<i>RadRawSpectrumDataReferencesTypeMatch</i>	Each value of a <i>radRawSpectrumReferences</i> attribute shall be the id of a <Spectrum>.	5.5.27
<i>RadRawTotalDoseReferencesCheck</i>	The parent element of an element using the <i>radRawTotalDoseReferences</i> attribute shall be <DerivedData>.	5.5.28
<i>RadRawTotalDoseReferencesTypeMatch</i>	Each value of a <i>radRawTotalDoseDataReferences</i> attribute shall be the id of a <Spectrum>.	5.5.28

Rule Name	Rule Description	Reference
<i>RadRawTotalExposureReferencesCheck</i>	The parent element of an element using the <i>radRawTotalExposureReferences</i> attribute shall be <DerivedData>.	5.5.29
<i>RadRawTotalExposureReferencesTypeMatch</i>	Each value of a <i>radRawTotalExposureDataReferences</i> attribute shall be the <i>id</i> of a <TotalExposure>.	5.5.29
<i>StartDateCheck</i>	The value of <StartDateTime> cannot be in the future.	5.4.210
<i>TotalEfficiencyCalibrationReferenceTypeMatch</i>	The value of a <i>totalEfficiencyCalibrationReference</i> attribute shall be the <i>id</i> of a <TotalEfficiencyCalibration>.	5.5.31
<i>ValueDateCheck</i>	The value of the <i>valueDateTime</i> attribute cannot be in the future.	5.5.33
<i>WindowStartEndCheck</i>	In <EnergyWindows>, each value in <WindowEndEnergyValues> shall be greater than or equal to the corresponding value in <WindowStartEnergyValues>.	5.4.219
<i>WindowStartEndMatch</i>	In <EnergyWindows>, <WindowStartEnergyValues> and <WindowEndEnergyValues> shall have the same number of values.	5.4.220
<i>WindowStartIncreasingListValuesCheck</i>	The values of <WindowStartEnergyValues> shall appear in non-decreasing order.	5.4.220

Annex N (informative)

N42 ISO Schematron schema

```
<?xml version="1.0" encoding="UTF-8"?>
<schema xmlns="http://purl.oclc.org/dsdl/schematron" queryBinding="xslt2"
        fpi="ISO//ANSI N42 Committee//ANSI N42.42/IEC 62755 Base Data Validation
Rules//EN">

  <title>ANSI N42.42-2011/IEC 62755 Data Format Base Data Validation Rules</title>

  <!--
  Description:
    This schema contains Schematron rules for validation of ANSI N42.42-2011 and
    IEC 62755 compliant documents.
    These rules are designed to be used in concert with XML Schema validation; they do
    not duplicate or replace
    the XML Schema rules. The rules contained in this schema are considered "universal"
    because they apply to
    any compliant "N42" format document. Additional Schematron rules for validation of
    N42 documents in
    specific circumstances are contained in separate schemas.

    The Schematron rules in this document are derived from Annex M of the ANSI/IEEE
    N42.42-2011 and IEC 67455
    standards.

  Design notes:
    - Each rule in Annex M is represented by one Schematron pattern (with one
    exception; see below).
    - Where rule reuse is given or likely, an abstract pattern is defined; specific
    Annex M rules instantiate the abstract pattern with
    appropriate arguments.
    - The abstract patterns are defined at the beginning of the schema, in alphabetical
    order.
    - Instantiated and directly defined patterns are appearing after the abstract
    patterns, also in alphabetical order. The id of each
    pattern matches the name of the Annex M rule.
    - The exception to the "one pattern per Annex M rule" is
    RadMeasurementUniqueDetectorCheck; there is one pattern per child
    element mentioned in the Annex M rule.
    - In general, the assert text is taken straight from Annex M and should adequately
    describe the purpose of the test.
    Abstract patterns are briefly described in an XML comment at the head of the
    pattern.

  Revision history:
    January 2012: Original
    -->

  <ns uri="http://physics.nist.gov/N42/2011/N42" prefix="n42"/>

  <!-- ***** Abstract pattern definitions ***** -
  ->

  <pattern id="AbstractAttributeFutureDateCheck" abstract="true">
    <!-- Verifies that the date of the specified attribute is not in the future.
    Parameter is attribute-name. -->
    <rule context="@${attribute-name}">
      <assert test="". &lt; current-dateTime()>The value of the <value-of
      select="'${attribute-name}'"/> attribute (<value-of select="."/>) cannot be in the
      future.</assert>
    </rule>
  </pattern>

  <pattern id="AbstractAttributeElementCheck" abstract="true">
    <!-- Verifies that if the specified attribute is specified, the element using that
    attribute has a specified child element. Parameters are element-name and attribute-
    name. -->
    <rule context="@${attribute-name}">
```

```

    <assert test="../n42:$element-name">An element using the <value-of
select="'$attribute-name'"/> attribute shall contain an <value-of select="'$element-
name'"/> element.</assert>
  </rule>
</pattern>

<pattern id="AbstractAttributeParentCheck" abstract="true">
  <!-- Verifies that any element using the specified attribute is a child of the
specified element. Parameters are element-name and attribute-name. -->
  <rule context="*[*/@$attribute-name]">
    <assert test="local-name(.) = '$element-name'">An element using the <value-of
select="'$attribute-name'"/> attribute shall be the descendant of a <value-of
select="'$element-name'"/> element.</assert>
  </rule>
</pattern>

<pattern id="AbstractElementReferenceCardinalityCheck" abstract="true">
  <!-- Verifies that within a parent element, only one instance of the specified
child element has the specified attribute with the same value. Parameters are
parentelement-name, childelement-name, attribute-name, and reference-type (used only in
the assert message). -->
  <rule context="n42:$parentelement-name/n42:$childelement-name">
    <let name="attribute-value" value="string(@$attribute-name)"/>
    <assert test="count(../n42:$childelement-name[@$attribute-name=$attribute-value])
= 1">In a <value-of select="'$parentelement-name'"/> element, there shall be only one
<value-of select="'$childelement-name'"/> element which references the same <value-of
select="'$reference-type'"/> (<value-of select="..@$attribute-name"/>).</assert>
  </rule>
</pattern>

<pattern id="AbstractFutureDateCheck" abstract="true">
  <!-- Verifies that the date of the specified element is not in the future.
Parameter is element-name. -->
  <rule context="n42:$element-name">
    <assert test=". &lt; current-dateTime()>The value of the <value-of
select="'$element-name'"/> element (<value-of select=".."/>) cannot be in the
future.</assert>
  </rule>
</pattern>

<pattern id="AbstractOrderedElementCheck" abstract="true">
  <!-- Verifies that the values in a list element appear in strictly increasing
order. Parameter is element-name. -->
  <rule context="n42:$element-name">
    <let name="list-as-seq" value="tokenize(normalize-space(string(.)), '\s+')"/>
    <let name="list-positions" value="2 to count(tokenize(normalize-
space(string(.)), '\s+')"/>
    <!-- The test uses a for expression to check that each value is less than it's
predecessor; if there are any falses in the returned sequence, index-of() will find
them and produce a non-empty sequence, which will cause empty() to return false -->
    <assert test="empty(index-of(for $x in $list-positions return number($list-as-
seq[$x - 1]) &lt; number($list-as-seq[$x]), false()))">The values of a <value-of
select="'$element-name'"/> element shall appear in ascending order (<value-of
select=".."/>).</assert>
  </rule>
</pattern>

<pattern id="AbstractNonDecreasingElementCheck" abstract="true">
  <!-- Verifies that the values in a list element appear in order (greater than or
equal to). Parameter is element-name. -->
  <rule context="n42:$element-name">
    <let name="list-as-seq" value="tokenize(normalize-space(string(.)), '\s+')"/>
    <let name="list-positions" value="2 to count(tokenize(normalize-
space(string(.)), '\s+')"/>
    <!-- The test uses a for expression to check that each value is less than it's
predecessor; if there are any falses in the returned sequence, index-of() will find
them and produce a non-empty sequence, which will cause empty() to return false -->
    <assert test="empty(index-of(for $x in $list-positions return not(number($list-
as-seq[$x - 1]) &gt; number($list-as-seq[$x]), false()))">The values of a <value-of
select="'$element-name'"/> element shall appear in ascending order (<value-of
select=".."/>).</assert>
  </rule>
</pattern>

<pattern id="AbstractOtherDescriptionCheck" abstract="true">
  <!-- Verifies that if the value of the specified element is 'Other', there is
another specified element as a child of the same parent. Parameters are parentelement-
name, childelement-name, and descriptionelement-name. -->

```

```

    <rule context="n42:$parentelement-name[n42:$schildelement-name='Other']">
      <assert test="n42:$descriptionelement-name">A <value-of select="'$parentelement-
name'"/> element containing a <value-of select="'$schildelement-name'"/> element with a
value of 'Other' shall also contain the <value-of select="'$descriptionelement-name'"/>
element.</assert>
    </rule>
  </pattern>

  <pattern id="AbstractPairedElementOrderCheck" abstract="true">
    <!-- Verifies that the values in a list element are less than the corresponding
values in a specified sibling element. Parameters are parent-name, element1-name, and
element2-name. -->
    <rule context="n42:$parent-name">
      <let name="list1-as-seq" value="tokenize(normalize-space(string(n42:$element1-
name)), '\s+')"/>
      <let name="list2-as-seq" value="tokenize(normalize-space(string(n42:$element2-
name)), '\s+')"/>
      <let name="list-positions" value="1 to count($list1-as-seq)"/>
      <!-- The test uses a for expression to check that each value in element1 is less
than it's partner in element2; if there are any falses in the returned sequence, index-
of() will find them and produce a non-empty sequence, which will cause empty() to
return false-->
      <assert test="empty(index-of(for $x in $list-positions return number($list1-as-
seq[$x]) &lt; number($list2-as-seq[$x]), false()))">Each value of a <value-of
select="'$element1-name'"/> element shall less than the corresponding value in the
sibling <value-of select="'$element2-name'"/> element.</assert>
    </rule>
  </pattern>

  <pattern id="AbstractReferencesTypeMatch" abstract="true">
    <!-- Verifies that all values of the specified attribute are the id of an instance
of the specified element. Parameters are element-name and attribute-name. -->
    <rule context="@${attribute-name}">
      <!-- The test uses a for expression to check that each value points to an element
of the right type; if there are any falses in the returned sequence, index-of() will
find them and produce a non-empty sequence, which will cause empty() to return false-->
      <assert test="empty(index-of(for $x in tokenize(normalize-space(string(.)), '\s+')
return local-name(id($x)) = '$element-name', false()))">Each value of the <value-of
select="'${attribute-name}'"/> attribute (data type IDREFS) shall be the id of a <value-
of select="'$element-name'"/> element.</assert>
    </rule>
  </pattern>

  <pattern id="AbstractReferenceTypeMatch" abstract="true">
    <!-- Verifies that the value of the specified attribute are the id of an instance
of the specified element. Parameters are element-name and attribute-name. -->
    <!-- This pattern really could be subsumed into the "references" pattern, but I'm
too tired to consolidate them -->
    <rule context="@${attribute-name}">
      <assert test="local-name(id(.)) = '$element-name'">The value of an <value-of
select="'${attribute-name}'"/> attribute shall be the id of an <value-of
select="'$element-name'"/> element.</assert>
    </rule>
  </pattern>

  <pattern id="AbstractSiblingListMatchCheck" abstract="true">
    <!-- Verifies that the number of values in sibling elements are the same.
Parameters are listelement-name and list2element-name. -->
    <rule context="n42:$listelement-name">
      <assert test="(count(tokenize(normalize-space(string(.)), '\s+')) =
count(tokenize(normalize-space(string(..n42:$list2element-name)), '\s+'))">Sibling
<value-of select="'$listelement-name'"/> and <value-of select="'$list2element-name'"/>
elements shall have the same number of values.</assert>
    </rule>
  </pattern>

  <!-- ***** Instantiated abstract and directly defined patterns
***** -->

  <pattern id="AnalysisDataReferencesExclusivityCheck">
    <rule context="n42:AnalysisResults">
      <assert test="not((@derivedDataReferences and @radMeasurementGroupReferences) or
(derivedDataReferences and @radMeasurementReferences) or
(@radMeasurementGroupReferences and @radMeasurementReferences)) and
(@derivedDataReferences or @radMeasurementGroupReferences or
@radMeasurementReferences)">One and only one of the AnalysisResults
derivedDataReferences, radMeasurementGroupReferences, and radMeasurementReferences
attributes shall be specified.</assert>

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```

    </rule>
</pattern>

<pattern id="AnalysisStartDateCheck" is-a="AbstractFutureDateCheck">
  <param name="element-name" value="AnalysisStartDateTime"/>
</pattern>

<pattern id="CalibrationDateCheck" is-a="AbstractFutureDateCheck">
  <param name="element-name" value="CalibrationDateTime"/>
</pattern>

<pattern id="CharacteristicGroupOOLConsistencyCheck">
  <rule context="n42:CharacteristicGroup[@groupOutOfLimits=false()]">
    <assert test="count(n42:Characteristic[@valueOutOfLimits=true()]) = 0">The
CharacteristicGroup groupOutOfLimits attribute shall be true if any of descendant
Characteristic valueOutOfLimits attributes are true.</assert>
  </rule>
</pattern>

<pattern id="CompressionCheck">
  <rule context="n42:ChannelData[@compressionCode='CountedZeroes']">
    <let name="list-as-seq" value="tokenize(normalize-space(string(.)), '\s+')"/>
    <let name="list-length" value="count($list-as-seq)"/>
    <assert test="number($list-as-seq[$list-length]) != 0">The compressed content of
ChannelData shall be coherent: the last value in the list shall not be zero.</assert>
    <!-- See previous comments on use of empty() and index-of() to process the output
of a for expression -->
    <assert test="empty(index-of(for $x in 1 to $list-length - 1 return
(number($list-as-seq[$x]) != 0) or (number($list-as-seq[$x]) = 0 and number($list-as-
seq[$x + 1]) != 0 and (floor(number($list-as-seq[$x + 1])) = number($list-as-seq[$x +
1])),false()))">The compressed content of ChannelData shall be coherent: all zero
values in the list shall be followed by a value that is greater than zero and an
integer.</assert>
  </rule>
</pattern>

<pattern id="CountDataValuesCheck">
  <rule context="n42:GrossCounts">
    <assert test="@energyWindowsReference or (not(@energyWindowsReference) and
count(tokenize(normalize-space(string(n42:CountData)), '\s+') = 1)"> If the GrossCounts
element's energyWindowsReference attribute is omitted, the child CountData element
shall have exactly one value.</assert>
    <assert test="not(@energyWindowsReference) or (count(tokenize(normalize-
space(string(id(@energyWindowsReference)/n42:WindowStartEnergyValues)), '\s+') =
count(tokenize(normalize-space(string(n42:CountData)), '\s+')))"> If the GrossCounts
element's energyWindowsReference attribute is present, the child CountData element and
the referenced EnergyWindows shall have the same number of values.</assert>
  </rule>
</pattern>

<pattern id="DerivedDataReferencesTypeMatch" is-a="AbstractReferencesTypeMatch">
  <param name="attribute-name" value="DerivedDataReferences"/>
  <param name="element-name" value="DerivedData"/>
</pattern>

<pattern id="EBoundariesChannelsCheck">
  <!-- This is the most complicated rule. The steps are:
    1. Convert the list in ChannelData to a sequence
    2. Get the number of items in that sequence
    3. Determine if the ChannelData data is compressed
    4. Get the number of values in the referenced EnergyBoundaryValues (if any). HACK
ALERT: this logic depends on access to a non-existent element not doing anything
disastrous.
    5. In case the data was compressed, count the number of zero channels in the
sequence. Then get the number of non-zero channels, which is the number of values minus
2 * the number of zero values.
    6. Finally get the real number of channels in the spectrum: if the data is not
compressed, it's just the number of values in the sequence; otherwise it is the sum of
the number of zero and non-zero channels calculated in the last step.
    7. After all this, the actual test is easy: if EnergyBoundaryValues is used for
the calibration, the number of items in that element must be one greater than the
number of channels.
  -->
  <rule context="n42:Spectrum">
    <let name="cd-list-as-seq" value="tokenize(normalize-
space(string(n42:ChannelData)), '\s+')"/>
    <let name="cd-list-length" value="count($cd-list-as-seq)"/>

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```

        <let name="cd-is-compressed" value="boolean(n42:ChannelData/@compressionCode =
'CountedZeroes')"/>
        <let name="eb-channels" value="count(tokenize(normalize-
space(string(id(@energyCalibrationReference)/n42:EnergyBoundaryValues)),'\s+'))"/>
        <let name="cd-decompressed-zeroes" value="sum(for $x in 1 to $cd-list-length - 1
return (number(number($cd-list-as-seq[$x]) = 0) * number($cd-list-as-seq[$x + 1])) +
(number(number($cd-list-as-seq[$x]) != 0) * 0))"/>
        <let name="cd-decompressed-nonzeroes" value="$cd-list-length - 2 * sum(for $x in
1 to $cd-list-length - 1 return number(number($cd-list-as-seq[$x]) = 0))"/>
        <let name="cd-channels" value="(number($cd-is-compressed) * ($cd-decompressed-
zeroes + $cd-decompressed-nonzeroes)) + (number(not($cd-is-compressed)) * $cd-list-
length)"/>
        <assert test="($eb-channels = 0) or ($eb-channels = $cd-channels + 1)">If the
energy calibration of Spectrum is defined using EnergyBoundaryValues, then the number
of values in EnergyBoundaryValues (<value-of select="number($eb-channels)"/>) shall be
one greater than the number of channels contained in the Spectrum (<value-of
select="number($cd-channels)"/>).</assert>
    </rule>
</pattern>

<pattern id="EfficiencyUncertaintyMatch" is-a="AbstractSiblingListMatchCheck">
    <param name="list1element-name" value="EfficiencyUncertaintyValues"/>
    <param name="list2element-name" value="EfficiencyValues"/>
</pattern>

<pattern id="EnergyBoundaryIncreasingValuesCheck" is-a="AbstractOrderedElementCheck">
    <param name="element-name" value="EnergyBoundaryValues"/>
</pattern>

<pattern id="EnergyCalibrationReferenceTypeMatch" is-a="AbstractReferenceTypeMatch">
    <param name="attribute-name" value="energyCalibrationReference"/>
    <param name="element-name" value="EnergyCalibration"/>
</pattern>

<pattern id="EnergyFWHMMatch" is-a="AbstractSiblingListMatchCheck">
    <param name="list1element-name" value="FWHMValues"/>
    <param name="list2element-name" value="EnergyValues"/>
</pattern>

<pattern id="EnergyEfficiencyMatch" is-a="AbstractSiblingListMatchCheck">
    <param name="list1element-name" value="EfficiencyValues"/>
    <param name="list2element-name" value="EnergyValues"/>
</pattern>

<pattern id="EnergyIncreasingListValuesCheck" is-a="AbstractOrderedElementCheck">
    <param name="element-name" value="EnergyValues"/>
</pattern>

<pattern id="FullEnergyPECalibrationReferenceTypeMatch" is-
a="AbstractReferenceTypeMatch">
    <param name="attribute-name" value="fullEnergyPeakEfficiencyCalibrationReference"/>
    <param name="element-name" value="FullEnergyPeakEfficiencyCalibration"/>
</pattern>

<pattern id="FWHMCalibrationReferenceTypeMatch" is-a="AbstractReferenceTypeMatch">
    <param name="attribute-name" value="FWHMCalibrationReference"/>
    <param name="element-name" value="FWHMCalibration"/>
</pattern>

<pattern id="IDoubleEscapePECalibrationReferenceTypeMatch" is-
a="AbstractReferenceTypeMatch">
    <param name="attribute-name"
value="intrinsicDoubleEscapePeakEfficiencyCalibrationReference"/>
    <param name="element-name" value="IntrinsicDoubleEscapePeakEfficiencyCalibration"/>
</pattern>

<pattern id="IFullEnergyPECalibrationReferenceTypeMatch" is-
a="AbstractReferenceTypeMatch">
    <param name="attribute-name"
value="intrinsicFullEnergyPeakEfficiencyCalibrationReference"/>
    <param name="element-name" value="IntrinsicFullEnergyPeakEfficiencyCalibration"/>
</pattern>

<pattern id="InspectionDateCheck" is-a="AbstractFutureDateCheck">
    <param name="element-name" value="InspectionDateTime"/>
</pattern>

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```

    <pattern id="ISingleEscapePECalibrationReferenceTypeMatch" is-
a="AbstractReferenceTypeMatch">
    <param name="attribute-name"
value="intrinsicSingleEscapePeakEfficiencyCalibrationReference"/>
    <param name="element-name" value="IntrinsicSingleEscapePeakEfficiencyCalibration"/>
    </pattern>

    <pattern id="N42DocDateCheck" is-a="AbstractAttributeFutureDateCheck">
    <param name="attribute-name" value="n42DocDateTime"/>
    </pattern>

    <pattern id="OriginReferenceCircularReferenceCheck">
    <!-- This test just checks for 'immediate' circularity (e.g., originReference
points to the same object to which its ancestor RadxxxState radxxxInformationReference
points). Someday do better... -->
    <rule
context="n42:RadInstrumentState/n42:StateVector/n42:RelativeLocation/n42:Origin/@origin
Reference">
    <assert test="local-name(id()) != 'RadInstrumentInformation'">The use of the
originReference attribute shall not result in a circular reference.</assert>
    </rule>
    <rule
context="n42:RadDetectorState/n42:StateVector/n42:RelativeLocation/n42:Origin/@originRe
ference">
    <assert test=". != ../../../../@radDetectorInformationReference">The use of the
originReference attribute shall not result in a circular reference.</assert>
    </rule>
    <rule
context="n42:RadItemState/n42:StateVector/n42:RelativeLocation/n42:Origin/@originRefere
nce">
    <assert test=". != ../../../../@radItemInformationReference">The use of the
originReference attribute shall not result in a circular reference.</assert>
    </rule>
    </pattern>

    <pattern id="OriginReferenceDescriptionCheck" is-a="AbstractAttributeElementCheck">
    <param name="attribute-name" value="originReference"/>
    <param name="element-name" value="OriginDescription"/>
    </pattern>

    <pattern id="OriginReferenceTypeMatch">
    <rule context="@originReference">
    <assert
test="local-name(id()) = 'RadInstrumentInformation' or
local-name(id()) = 'RadDetectorInformation' or
local-name(id()) = 'RadItemInformation'"> The value of a originReference
attribute shall be the id of a RadInstrumentInformation, RadDetectorInformation, or
RadItemInformation element.</assert>
    </rule>
    </pattern>

    <pattern id="RadAlarmCategoryCheck" is-a="AbstractOtherDescriptionCheck">
    <param name="parentelement-name" value="RadAlarm"/>
    <param name="childelement-name" value="RadAlarmCategoryCode"/>
    <param name="descriptionelement-name" value="RadAlarmDescription"/>
    </pattern>

    <pattern id="RadAlarmDateCheck" is-a="AbstractFutureDateCheck">
    <param name="element-name" value="RadAlarmDateTime"/>
    </pattern>

    <pattern id="RadDetectorCategoryCheck" is-a="AbstractOtherDescriptionCheck">
    <param name="parentelement-name" value="RadDetectorInformation"/>
    <param name="childelement-name" value="RadDetectorCategoryCode"/>
    <param name="descriptionelement-name" value="RadDetectorDescription"/>
    </pattern>

    <pattern id="RadDetectorInformationReferencesTypeMatch" is-
a="AbstractReferencesTypeMatch">
    <param name="attribute-name" value="radDetectorInformationReferences"/>
    <param name="element-name" value="RadDetectorInformation"/>
    </pattern>

    <pattern id="RadDetectorInformationReferenceTypeMatch" is-
a="AbstractReferenceTypeMatch">
    <param name="attribute-name" value="radDetectorInformationReference"/>
    <param name="element-name" value="RadDetectorInformation"/>
    </pattern>

```



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<pattern id="RadDetectorKindCheck" is-a="AbstractOtherDescriptionCheck">
  <param name="parentelement-name" value="RadDetectorInformation"/>
  <param name="childelement-name" value="RadDetectorKindCode"/>
  <param name="descriptionelement-name" value="RadDetectorDescription"/>
</pattern>

<pattern id="RadItemInformationReferencesTypeMatch" is-
a="AbstractReferencesTypeMatch">
  <param name="attribute-name" value="radItemInformationReferences"/>
  <param name="element-name" value="RadItemInformation"/>
</pattern>

<pattern id="RadMeasurementGroupReferencesTypeMatch" is-
a="AbstractReferencesTypeMatch">
  <param name="attribute-name" value="radMeasurementGroupReferences"/>
  <param name="element-name" value="RadMeasurementGroup"/>
</pattern>

<pattern id="RadMeasurementReferencesTypeMatch" is-a="AbstractReferencesTypeMatch">
  <param name="attribute-name" value="radMeasurementReferences"/>
  <param name="element-name" value="RadMeasurement"/>
</pattern>

<pattern id="RadMeasurementUniqueDetectorCheck-DoseRate"
is-a="AbstractElementReferenceCardinalityCheck">
  <param name="parentelement-name" value="RadMeasurement"/>
  <param name="childelement-name" value="DoseRate"/>
  <param name="attribute-name" value="radDetectorInformationReference"/>
  <param name="reference-type" value="detector"/>
</pattern>

<pattern id="RadMeasurementUniqueDetectorCheck-ExposureRate"
is-a="AbstractElementReferenceCardinalityCheck">
  <param name="parentelement-name" value="RadMeasurement"/>
  <param name="childelement-name" value="ExposureRate"/>
  <param name="attribute-name" value="radDetectorInformationReference"/>
  <param name="reference-type" value="detector"/>
</pattern>

<pattern id="RadMeasurementUniqueDetectorCheck-GrossCounts"
is-a="AbstractElementReferenceCardinalityCheck">
  <param name="parentelement-name" value="RadMeasurement"/>
  <param name="childelement-name" value="GrossCounts"/>
  <param name="attribute-name" value="radDetectorInformationReference"/>
  <param name="reference-type" value="detector"/>
</pattern>

<pattern id="RadMeasurementUniqueDetectorCheck-Spectrum"
is-a="AbstractElementReferenceCardinalityCheck">
  <param name="parentelement-name" value="RadMeasurement"/>
  <param name="childelement-name" value="Spectrum"/>
  <param name="attribute-name" value="radDetectorInformationReference"/>
  <param name="reference-type" value="detector"/>
</pattern>

<pattern id="RadMeasurementUniqueDetectorCheck-TotalDose"
is-a="AbstractElementReferenceCardinalityCheck">
  <param name="parentelement-name" value="RadMeasurement"/>
  <param name="childelement-name" value="TotalDose"/>
  <param name="attribute-name" value="radDetectorInformationReference"/>
  <param name="reference-type" value="detector"/>
</pattern>

<pattern id="RadMeasurementUniqueDetectorCheck-TotalExposure"
is-a="AbstractElementReferenceCardinalityCheck">
  <param name="parentelement-name" value="RadMeasurement"/>
  <param name="childelement-name" value="TotalExposure"/>
  <param name="attribute-name" value="radDetectorInformationReference"/>
  <param name="reference-type" value="detector"/>
</pattern>

<pattern id="RadRawDoseRateReferencesCheck" is-a="AbstractAttributeParentCheck">
  <param name="attribute-name" value="radRawDoseRateReferences"/>
  <param name="element-name" value="DerivedData"/>
</pattern>

<pattern id="RadRawDoseRateReferencesTypeMatch" is-a="AbstractReferencesTypeMatch">

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    <param name="attribute-name" value="radRawDoseRateReferences"/>
    <param name="element-name" value="DoseRate"/>
</pattern>

<pattern id="RadRawExposureRateReferencesCheck" is-a="AbstractAttributeParentCheck">
    <param name="attribute-name" value="radRawExposureRateReferences"/>
    <param name="element-name" value="DerivedData"/>
</pattern>

<pattern id="RadRawExposureRateReferencesTypeMatch" is-
a="AbstractReferencesTypeMatch">
    <param name="attribute-name" value="radRawExposureRateReferences"/>
    <param name="element-name" value="ExposureRate"/>
</pattern>

<pattern id="RadRawGrossCountsReferencesCheck" is-a="AbstractAttributeParentCheck">
    <param name="attribute-name" value="radRawGrossCountsReferences"/>
    <param name="element-name" value="DerivedData"/>
</pattern>

<pattern id="RadRawGrossCountsReferencesTypeMatch" is-
a="AbstractReferencesTypeMatch">
    <param name="attribute-name" value="radRawGrossCountsReferences"/>
    <param name="element-name" value="GrossCounts"/>
</pattern>

<pattern id="RadRawSpectrumReferencesCheck" is-a="AbstractAttributeParentCheck">
    <param name="attribute-name" value="radRawSpectrumReferences"/>
    <param name="element-name" value="DerivedData"/>
</pattern>

<pattern id="RadRawSpectrumReferencesTypeMatch" is-a="AbstractReferencesTypeMatch">
    <param name="attribute-name" value="radRawSpectrumReferences"/>
    <param name="element-name" value="Spectrum"/>
</pattern>

<pattern id="RadRawTotalDoseReferencesCheck" is-a="AbstractAttributeParentCheck">
    <param name="attribute-name" value="radRawTotalDoseReferences"/>
    <param name="element-name" value="DerivedData"/>
</pattern>

<pattern id="RadRawTotalDoseReferencesTypeMatch" is-a="AbstractReferencesTypeMatch">
    <param name="attribute-name" value="radRawTotalDoseReferences"/>
    <param name="element-name" value="TotalDose"/>
</pattern>

<pattern id="RadRawTotalExposureReferencesCheck" is-a="AbstractAttributeParentCheck">
    <param name="attribute-name" value="radRawTotalExposureReferences"/>
    <param name="element-name" value="DerivedData"/>
</pattern>

<pattern id="RadRawTotalExposureReferencesTypeMatch" is-
a="AbstractReferencesTypeMatch">
    <param name="attribute-name" value="radRawTotalExposureReferences"/>
    <param name="element-name" value="TotalExposure"/>
</pattern>

<pattern id="StartDateCheck" is-a="AbstractFutureDateCheck">
    <param name="element-name" value="StartDateTime"/>
</pattern>

<pattern id="TotalEfficiencyCalibrationReferenceTypeMatch" is-
a="AbstractReferenceTypeMatch">
    <param name="attribute-name" value="totalEfficiencyCalibrationReference"/>
    <param name="element-name" value="TotalEfficiencyCalibration"/>
</pattern>

<pattern id="ValueDateCheck" is-a="AbstractAttributeFutureDateCheck">
    <param name="attribute-name" value="valueDateTime"/>
</pattern>

<pattern id="WindowStartEndCheck" is-a="AbstractPairedElementOrderCheck">
    <param name="parent-name" value="EnergyWindows"/>
    <param name="element1-name" value="WindowStartEnergyValues"/>
    <param name="element2-name" value="WindowEndEnergyValues"/>
</pattern>

<pattern id="WindowStartEndMatch" is-a="AbstractSiblingListMatchCheck">

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<param name="list1element-name" value="WindowStartEnergyValues"/>
<param name="list2element-name" value="WindowEndEnergyValues"/>
</pattern>

<pattern id="WindowStartIncreasingListValuesCheck" is-
a="AbstractNonDecreasingElementCheck">
  <param name="element-name" value="WindowStartEnergyValues"/>
</pattern>

</schema>
```

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