American National Standard Data Format Standard for Radiation Detectors Used for Homeland Security

Accredited by the American National Standards Institute

Sponsored by the
National Committee on Radiation Instrumentation, N42

N42.42

IEEE
3 Park Avenue
New York, NY 10016-5997, USA

23 March 2007

ANSI N42.42-2006

American National Standard Data Format Standard for Radiation Detectors Used for Homeland Security

Sponsor
National Committee on Radiation Instrumentation, N42

Accredited by the
American National Standards Institute

Secretariat
Institute of Electrical and Electronics Engineers, Inc.

Approved 3 November 2006
American National Standards Institute

Abstract: This standard specifies the data format that shall be used for both required and optional data to be made available by radiation instruments for U.S. Homeland Security applications. The performance for these types of instruments is described in other standards, such as ANSI N42.32, ANSI N42.33, ANSI N42.34, ANSI N42.35, and ANSI N42.38.
Keywords: data format, DHS standards, homeland security, radiation detectors

---

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

Print: ISBN 0-7381-5560-8 SH95638
PDF: ISBN 0-7381-5561-6 SS95638

American National Standard

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic reviews and users are cautioned to obtain the latest editions.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken to affirm, revise, or withdraw this standard no later than five years from the date of publication. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

Introduction

This introduction is not part of ANSI N42.42-2006, American National Standard Data Format Standard for Radiation Detectors Used for Homeland Security.

This standard is the responsibility of the Accredited American Standards Committee on Radiation Instrumentation, N42. The standard was approved on N42 letter ballot of August–September 2006.

Notice to users

Errata

Errata, if any, for this and all other standards can be accessed at the following URL: http://standards.ieee.org/reading/ieee/updates/errata/index.html. Users are encouraged to check this URL for errata periodically.

Interpretations

Current interpretations can be accessed at the following URL: http://standards.ieee.org/reading/ieee/interp/index.html.

Patents

Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken with respect to the existence or validity of any patent rights in connection therewith. The IEEE shall not be responsible for identifying patents or patent applications for which a license may be required to implement an IEEE standard or for conducting inquiries into the legal validity or scope of those patents that are brought to its attention.

Participants

At the time it approved this standard, the Accredited Standards Committee on Radiation Instrumentation, N42, had the following membership:

George Lasche, *Chair*

Louis Costrell, *Deputy Chair*

William Ash, *Administrative Secretary*

Organization Represented.....*Name of Representative*

Bartlett Services ……Morgan Cox
Canberra ……Markku Koskelo
Chew, M.H ……..Jack M. Selby
Commerce Dept, U.S. NIST ……..Michael P. Unterweger
.....Louis Costrell (*Alt.*)
Consultant .....Frank X. Masse
Department of Homeland Security ……..Peter Shebell
Entergy-ANO ……...Ron Schwartz
Health Physics Society ……Sandy Perle
IEEE .....Louis Costrell
.....Julian Forster (*Alt.*)
.....Anthony Spurgin (*Alt.*)
.....Michael P. Unterweger (*Alt.*)
International Medcom ……Don Sythe
Lawrence Berkeley National Lab ……Edward J. Lampo
Lawrence Livermore National Lab ……...Gary Johnson
NASA, GSFC ……Sachidananda R. Babu
Nuclear Regulatory Commission ……..Cynthia Jones
Nuclear Stds Unlimited ……Al N. Tschaeche
ORNL ……Peter J. Chiaro, Jr.
……...Charles Britton (*Alt.*)
ORTEC ……..Ronald M. Keyser
Pacific NW Labs ……...Richard Kouzes
Swinth Associates ……Kenneth L. Swinth
U.S. Army ……Edward Groeber
Members-At-Large ……....Ernesto Corte
……Joseph C. McDonald
……..Paul L. Phelps
……Joseph Stencel
…….. Lee J. Wagner

At the time this standard was completed, Subcommittee N42.HSI had the following membership:

Morgan Cox, *Co-chair*

Michael P. Unterweger, *Co-chair*

Paul Bailey
Peter J. Chiaro, Jr.
David Gilliam
Mark D. Hoover
Cynthia G. Jones
Ronald Keyser
Richard Kouzes
Joseph C. McDonald
Leticia Pibida
Brian Rees
Peter Shebell
David Trombino

At the time this standard was completed, the ANSI N42.42 Working Group had the following membership:

George Lasche, *Chair*

Leticia Pibida, *Project leader*

Robert Bass
Peter J. Chiaro, Jr.
Carl Czajkowski
Charles Finfrock
Larry Fluty
Bob Huckins
Ronald Keyser
Johnny Long
Lew Meixler
Keith Olson
Scott Rogers
Richard Smola
Adrian Stoian
Dave Weirup

Contents

American National Standard Data Format Standard for Radiation Detectors Used for Homeland Security

1. Overview

1.1 Scope

This standard specifies the data format that shall be used for both required and optional data available at the output of radiation instruments for U.S. Homeland Security applications. The performance requirements for these types of instruments are described in other standards, such as ANSI N42.32[1], ANSI N42.33, ANSI N42.34, ANSI N42.35, and ANSI N42.38.

1.2 Purpose

The purpose of this standard is to facilitate manufacturer-independent transfer of information from radiation measurement instruments to a standard file format for use in U.S. Homeland Security applications. The goal is to enable interpretation of data without reference to manufacturers' documentation. It specifies the format of data provided by radiation instruments used for homeland security. The purpose of this data is for analysis and storage of the radiation measurements. The data may consist of raw or unprocessed data, analysis results, device parameters or settings, or other measurements needed or applicable to the further analysis or to verify the quality of the results produced by the instrument.

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

[1] The ANSI N42 publications included in this clause are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, Piscataway, NJ 08855-1331, USA (http://standards.ieee.org/).

2. Normative references

NOTE—Internet URLs are provided for convenience only; while accurate at the time of printing, these addresses may be changed by the information provider.[2]

This standard shall be used in conjunction with the following publications. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

ANSI N42.32, American National Standard Performance Criteria for Alarming Personal Radiation Detectors for Homeland Security.[3]

ANSI N42.33, American National Standard for Portable Radiation Detection Instrumentation for Homeland Security.

ANSI N42.34, American National Standard Performance Requirements for Hand-held Instruments for the Detection and Identification of Radionuclides.

ANSI N42.35, American National Standard for Evaluation and Performance of Radiation Detection Portal Monitors for Use in Homeland Security.

ANSI N42.38, American National Standard Performance Criteria for Spectroscopy-Based Portal Monitors Used for Homeland Security.

EPSG Map Datum Codes.[4]

IETF RFC 1590, Media Type Registration Procedure, March 1994.[5]

IETF RFC 2045, Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies.

IETF RFC 3275, (Extensible Markup Language) XML-Signature Syntax and Processing.

ISO 8601, Data elements and interchange formats—Information Interchange—Representation of dates and times.[6]

ISO/IEC 10646-1, Information Technology—Universal Multiple-Octet Coded Character Set (UCS)—Part 1: Architecture and Basic Multilingual Plane.

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

ISO/IEC 11578, Information Technology—Open Systems Interconnect—Remote Procedure Call (RPC).

NOTE—W3C RFC 4122, A Universally Unique Identifier (UUID) URN Namespace, is an equivalent standard covering the format of the UUID.

---

[2] Notes in text, tables, and figures are given for information only and do not contain requirements needed to implement this standard.

[3] The ANSI N42 publications included in this clause are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, Piscataway, NJ 08855-1331, USA (http://standards.ieee.org/).

[4] The Map Datum codes are contained in a database that may be downloaded from http://www.epsg.org.

[5] Internet Engineering Task Force. http://www.ietf.org/rfc.html.

[6] ISO publications are available from the ISO Central Secretariat, Case Postale 56, 1 rue de Varembé, CH-1211, Genève 20, Switzerland/ Suisse (http://www.iso.ch/). ISO publications are also available in the United States from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA (http://www.ansi.org/).

National Institute of Science and Technology (NIST) ANSI N42.42 XML Schema.[7]

Nomenclature of Inorganic Chemistry, Recommendations 1990, Blackwell Scientific Publications, 1990.

W3C Recommendation, Extensible Markup Language (XML) 1.0, Third Edition, 4 Feb 2004.[8]

W3C Recommendation, XML Schema Part 2: Datatypes, Second Edition, 28 Oct 2004.[9]

3. Definitions and acronyms

3.1 Definitions

The following definitions apply to this standard, which has been developed at the request of the U.S. Department of Homeland Security (DHS) for instruments to be used by DHS and emergency responders.

3.1.1 absolute efficiency: The ratio of the total count rate of pulses recorded by the detector to the number emitted by the source.

3.1.2 absolute full-energy efficiency: The ratio of the net count rate of pulses recorded by the detector in the full-energy peak to the number emitted by the source.

NOTE—Net count rate is the total count rate minus the continuum count rate.

3.1.3 absorbed dose: The energy imparted by ionizing radiation per unit mass of irradiated material.

NOTE—The units of absorbed dose are the rad and gray (Gy).

3.1.4 alarm: An audible, visual, or other signal activated when the instrument reading or response exceeds a preset value or falls outside of a preset range.

3.1.5 attribute: An XML (eXtensible Markup Language) "name-value" construct contained in an XML element start tag.

NOTE—See W3C Recommendation, Extensible Markup Language (XML) 1.0.

3.1.6 calibrate: To adjust and/or determine the response or reading of a device relative to a series of conventionally true values.

3.1.7 calibration: A set of operations under specified conditions that establishes the relationship between values indicated by a measuring instrument or measuring system and the conventionally true values of the quantity or variable being measured.

3.1.8 confidence indication: A measure provided by the instrument of the reliability assigned to the radiation source identification; higher values indicate a higher likelihood of the presence of the nuclide.

---

[7] The ANSI N42.42 schema can be obtained from http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/xml.html.

[8] The W3C RFC documents referred to in this clause are copyright of the World Wide Web Consortium (W3C®). This particular document is available from the W3C Web site at http://www.w3.org/TR/2004/REC-xml-20040204. More information about W3C can be found at http://www.w3.org.

[9] Available at http://www.w3.org/TR/2004/REC-xmlschema-2-20041028.

3.1.9 covariance: A statistical measure used in computing the correlation coefficient between two variables; the covariance is the mean of $(x-\bar{x})\cdot(y-\bar{y})$ over all pairs of values for the variables *x* and *y,* where $\bar{x}$ and $\bar{y}$ are the mean values of *x* and *y*.

3.1.10 data: A formalized representation of facts or concepts suitable for communication, interpretation, or processing by people or automated means.

NOTE—The term "data" is often used to refer to the information stored in the computer.

3.1.11 default: A computer setting or preference that a program designer or user can set, showing what he or she wants to have happen automatically in the event that no other action is deliberately chosen.

3.1.12 detector: A device or component designed to produce a quantifiable response to ionizing radiation normally measured electronically.

3.1.13 dose equivalent: The energy absorbed by tissue from ionizing radiation.

NOTE—The Sievert (Sv) and rem are the units of dose equivalent.

3.1.14 element: An XML construct consisting of a start tag contained in angle brackets, optional data, and an optional end tag. All XML documents must contain a single, unique tag pair to define the root element.

NOTE 1—All other elements (or parent elements) must be nested within the root element. All parent elements can have sub elements (or child elements). The child elements must be in pairs and correctly nested within their parent element.

NOTE 2—A detailed definition can be found in W3C Recommendation, Extensible Markup Language (XML) 1.0.

3.1.15 exposure rate: The measure of ionization produced in air by x- and gamma-ray radiation.

NOTE 1—The special unit of exposure rate is the Roentgen per hour, abbreviated in this standard as R/h.

NOTE 2—In this standard, the International System (SI) units Sievert (Sv) or Gray (Gy) follow in parentheses the Roentgen value R, though the two units are not physically equivalent.

3.1.16 gross counts: The total number of events detected by the instrument.

3.1.17 instrument: A complete system consisting of one or more assemblies designed to quantify one or more characteristics of ionizing radiation or radioactive material.

3.1.18 intrinsic full-energy peak efficiency: The ratio of gamma- or x-rays recorded in the full energy peak to those striking the detector.

3.1.19 intrinsic total efficiency: The ratio of gamma- or x-rays recorded to those striking the detector.

3.1.20 live time: The total time during a measurement that the system is available for the acquisition of events.

3.1.21 location: The geographic coordinates where a measurement is performed.

3.1.22 manufacturer: A person or company that manufactures hardware or software.

3.1.23 MIME type: Identifies the format of data; MIME types are maintained by the Internet Assigned Numbers Authority.[10]

3.1.24 monitoring: Means provided to continuously indicate the state or condition of a system or assembly.

NOTE—May also be used for the real time measurement of radioactivity or radiation levels.

3.1.25 multichannel analyzer (MCA): A device designed to measure the differential pulse height spectrum from a radiation detector.

3.1.26 multichannel scaler (MCS): A device designed to count pulses from a radiation detector without amplitude discrimination.

3.1.27: multipurpose Internet mail extension (MIME): Defines the encoding of non-text data, such as images and sound, in text format.

NOTE—MIME is a standard, RFC 1590 [see IETF RFC 1590].

3.1.28 precision: Degree of agreement of repeated measurements of the same parameter.

3.1.29 pulse height analyzer (PHA): A device designed to sort successive signal pulses from a radiation detector into parallel amplitude channels.

3.1.30: radiological dispersal device (RDD): An improvised device used to disperse radioactive material.

3.1.31 range: All values lying between the lower and upper detection limits.

3.1.32 reading: The indicated or displayed value of the instrument readout.

3.1.33 readout: The portion of the instrument that provides a visual display of the response of the instrument or the displayed value, with units, displayed and/or recorded by the instrument as a result of the instrument's response to some influence quantity.

3.1.34 real time: The duration (i.e., elapsed clock time) of the measurement.

3.1.35 response: Ratio of the instrument reading to the conventionally true value of the measured quantity.

3.1.36 response time: The time interval required for the instrument reading to change from 10% to 90% of the final reading or vice versa, following a step change in the radiation field at the detector.

3.1.37 software: Sets of instructions or data that tell a computer what to do.

NOTE—Software is often divided into two categories: system software, which includes the operating system (e.g., Windows 95[11], MacOS[12]) and all utilities that enable the computer to function; and applications software, which includes programs that perform specific tasks (e.g., word processors, spreadsheets, and databases).

---

[10] See www.iana.org/assignments/media-types.

[11] Windows 95 is a registered trademark of Microsoft Corporation. This information is given for the convenience of users of this standard and does not constitute an endorsement of these products. Similar products may be used if they can be shown to lead to the same results.

[12] MacOS is a registered trademark of Apple Computer, Inc. This information is given for the convenience of users of this standard and does not constitute and endorsement of these products. Similar products may be used if they can be shown to lead to the same results.

3.1.38 tag: A piece of text that describes a unit of data, or element, in XML.

NOTE—The tag is distinguishable as markup, as opposed to data, because it is surrounded by angle brackets (< and >). For example, the element <name>My Name</name> has the start tag <name>, the end tag </name>, which enclose the data "My Name". Tags are case sensitive; i.e., <Start> is not the same as <start>.

3.1.39 uncertainty: The estimated bounds of the deviation from the conventionally true value, generally expressed as a percent of the mean, ordinarily taken as the square root of the sum of the square of two components: 1) random errors that are evaluated by statistical means; and 2) systematic errors that are evaluated by other means.

3.1.40 UTF-8: UCS Transformation Format 8, which encodes a character in the repertoire of ISO/IEC 10646 using between 1 and 6 octets.

NOTE—See ISO/IEC 10646-1.

3.1.41 variance (σ^2): A measure of dispersion, which is the sum of the squared deviation of observations from their mean divided by one less than the number of observations.

$$\sigma^2 = \frac{1}{n-1}\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2$$

3.1.42 XML (eXtensible Markup Language): XML is a system and hardware-independent language for expressing data and its structure within an XML document.

NOTE 1—An XML document is a text object that contains the data together with markup that defines the structure of the data.

NOTE 2—See W3C Recommendation, Extensible Markup Language (XML) 1.0.

3.1.43 XML schema: Provides a means for defining the structure, content, and semantics of XML documents through XML itself.

NOTE—See W3C Recommendation, XML Schema Part 2: Datatypes, Second Edition.

3.2 Acronyms

IANA: Internet Assigned Numbers Authority

NOTE—IANA is responsible for the registration of globally unique internet domain names and namespaces.[13]

MCA: Multichannel Analyzer

MCS: Multichannel Scaler

MIME: Multipurpose Internet Mail Extension

NIST: National Institute of Standards and Technology

OSI: Open Systems Interconnection

NOTE—Defined by ITU-TS Recommendation X.200.

[13] For more information on IANA, see http://www.iana.org.

PC: Personal computer

URI: Uniform Resource Identifier

NOTE—Defined by IETF RFC 2732.

URL: Uniform Resource Locator

NOTE—Defined by IETF RFC 2396.

UUID: Universally Unique Identifier

NOTE—The format of a UUID is described by ISO/IEC 11578.

W3C: World Wide Web Consortium

NOTE—Maintains the definition for XML and associated standards.

3.3 Standard word usage

In this document, the following word usage applies:

- The word “shall” signifies a mandatory requirement (where appropriate a qualifying statement is included to indicate that there may be an allowable exception).
- The word “should” signifies a recommended specification or method.
- The word “may” signifies an acceptable method or an example of good practice.

4. General

4.1 Goals for this standard

It is the intent of this standard to facilitate the use of radiation data with particular regard to homeland security, emergency response, and common data-sharing needs by achieving the following goals:

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 instrumentation.

d) Impartiality. The data format should not favor any particular commercial interest by adopting a particular manufacturer’s practices.

4.2 Characteristics of the data format

With these goals in mind, the data format defined by this standard, henceforth referred to as the "ANSI N42.42 data format," is based upon the XML specification (see W3C Recommendation, Extensible Markup Language (XML) 1.0). Specifically, this standard requires that all radiation data instruments shall comply with the data formats discussed in the following list:

a) The data shall be rendered in an XML document in conformance to the W3C XML V1.0 standard [see W3C Recommendation, Extensible Markup Language (XML) 1.0 and W3C Recommendation, XML Schema Part 2, Datatypes, Second Edition]. In this standard, an XML document is considered identical to an XML file and the terms will be used synonymously.

b) The data format is to be compatible with the master ANSI N42.42 schema maintained by NIST (see ANSI N42 schema and Annex A).

c) Data authentication, when required, shall be provided via XML-Signature (see IETF RFC 3275).

NOTE—Data encryption is not addressed in this standard.

This standard has the general characteristics discussed in the following list:

a) Radiation instrumentation information is expressed as a hierarchical structure of data items.

b) These data items are formatted as XML elements and attributes [see W3C Recommendation, Extensible Markup Language (XML) 1.0].

c) In order to allow the data to be accessed using simple text editors, only the UTF-8 (see ISO/IEC 10646-1) character encoding shall be used.

d) The structure of the data is described by an XML Schema document (see ANSI N42.42 schema and Annex A). This schema defines the standard names for data elements and attributes, whether or not they are optional or required for each class of instrument, and the hierarchical relationships between them. The schema document will be updated in concert with a revision to this standard.

e) For new types of radiation instruments, or radiation instruments not specifically addressed in this standard, the ANSI N42.42 data format shall be used to the extent possible. If additional data for those instruments is required, these shall be defined in the performance standard for that type of instrument via a namespace extending the ANSI N42.42 data format. A schema describing the new data in the new namespace shall be created and made available along with the ANSI N42.42 schema, found at the location defined in the ANSI N42.42 schema.

f) If data elements or attributes are needed by a particular instrument that have not been defined in the ANSI N42.42 data format schema, then the manufacturer of the instrument shall use a unique namespace prefix for the elements and attributes not defined in the ANSI N42.42 data format schema; see the example fragment in Annex G. Custom elements and attributes shall not supplant use of standard elements and attributes.

g) When data in this format is recorded in a file, the data filename extension shall be "N42," either uppercase or lowercase, to allow for automated recognition.

h) The standard allows values to be expressed in a variety of units. Use of SI units is encouraged.

i) The standard gives implementers a great deal of flexibility in deciding what information is to be included or omitted. Implementers should be sensitive to the needs of the users of this information; in particular, providing sufficient raw measurement data to substantiate analysis results.

4.3 General description of the ANSI N42.42 data format

ANSI N42.42 supports several different types of 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 annotated data files can be found in Annex B, Annex C, Annex D, Annex E, and Annex F:

Annex B A "spectrometer"; the file contains only a spectrum and energy calibration and demonstrates the minimum required information.

Annex C A "spectrometer"; more complex than the example in Annex B, the file contains a spectrum, its calibration, and the results of the analysis of that spectrum.

Annex D A "gross count portal monitor"; the data is a series of seven count values representing a small monitor with two gamma and two neutron detectors.

Annex E A "spectroscopic portal monitor."

Annex F A "radiation pager"; the data is a series of four count and dose rate readings.

Note that annotation (given in the form of XML comments) is not required in real instrument data files. Also, the examples are indented for readability; this is desirable in real files but not required.

These examples can be downloaded from the ANSI N42.42 Web site, which is found online at: http://physics.nist.gov/N4242schema.

4.3.1 General organization

The <N42InstrumentData> element is the parent element for all data in the file. It shall contain one or more <Measurement> elements, each of which represents a "measurement"; the definition of a "measurement" depends on the type of instrument. The <Measurement> element contains various child elements that describe the instrument, the data collected, and the results of the instrument's analysis of the data:

— <InstrumentInformation> element: describes the instrument that performed the measurement.

— <MeasuredItemInformation> element: describes the item being measured.

— <Spectrum> element: produced by spectrometers, this element contains a PHA or MCS spectrum, the acquisition start and elapsed times, and calibration information. Multiple <Spectrum> elements may be used in a single parent <Measurement> element to represent multiple detectors or background spectra.

— <DetectorData> element: typically produced by portal monitors, this element contains a series of gross count and/or spectroscopic "samples" from one or more detectors, along with other information associated with each sample, such as sampling duration and monitor occupancy status. A series of monitor occupancies could be represented by multiple <DetectorData> elements in a single <Measurement> element; alternatively, each occupancy could be represented by a <Measurement> element containing a single <DetectorData> element.

— <CountDoseData> element: produced by radiation pagers or survey meters, this element contains a series of count rate, exposure, exposure rate, dose, and/or dose rate values.

— <AnalysisResults> element: this element represents the information presented to the operator by the instrument as a result of its analysis of the data. For spectrometers, this consists of the nuclides identified by the instrument and an indication of the confidence that they are present.

Figure 1 shows the organization of a simple spectrometer file, containing a single spectrum measurement, and all the information associated with that measurement:

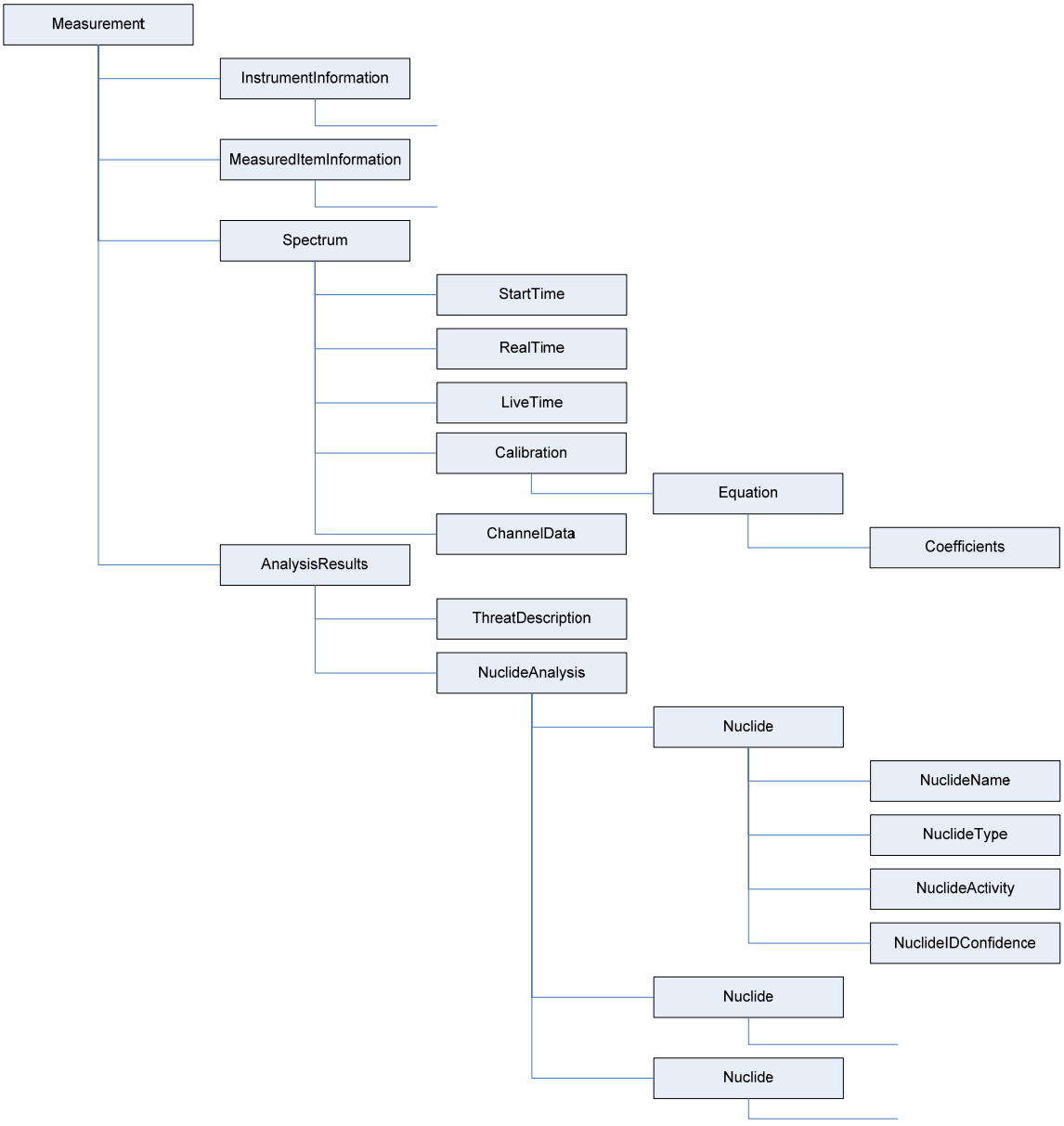

Figure 1—Organization of an N42 file containing a spectrum and analysis results

In Figure 1, <N42InstrumentData> (not shown) is the parent element; it contains a single <Measurement> element, which in turn contains:

- <InstrumentInformation>, which contains child elements (not shown) describing the instrument.
  - <MeasuredItemInformation>, which contains child elements (not shown) describing the item being measured.
  - <Spectrum>, which contains child elements describing the acquisition start and elapsed times, the spectrum (<ChannelData>), and the energy calibration (<Calibration>). Note that if there are multiple spectra in the file that share the same calibration, these spectra may reference a single <Calibration> element via the CalibrationIDs attribute; an example of this usage is given in the example file in Annex C.
  - <AnalysisResults>, which contains the results of the analysis of the spectrum:
    - <ThreatDescription>, which is the instrument's "human-readable" conclusion as to the nature of the item; for example, "Possible RDD".
    - <NuclideAnalysis>, which contains a series of <Nuclide> elements, each containing elements describing the analysis results for a nuclide of interest.

Multiple measurements are permitted in a single file, via multiple <Measurement> elements, and can be measurements for different classes of instruments.

5. Requirements

5.1 Data types and enumerations

5.1.1 Standard data types

Data type names, shown in italics, are taken from the XML Schema specification (see W3C Recommendation, XML Schema Part 2: Datatypes, Second Edition) and are summarized here for convenience. Note that case of literal values is significant.

- *boolean*: a true or false value (i.e., "0" or "false", "1" or "true").
- *dateTime*: a date and time, in ISO 8601 format; see ISO 8601. For example, November 3, 2004 8:36:04.3 AM CST is represented by "2004-11-03T14:36:04.3-06:00". The seconds value can be represented to arbitrary precision; the precision used should be appropriate for the value being represented. If the time zone is known, then the time zone field ("-06:00") shall be present. If the time zone is not known, then time zone field shall be omitted. If the time zone is not present, then it cannot be determined whether the value is UTC or local time.
- *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.
- *double*: a double-precision 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; see ISO 8601. For example, a 1 hour, 15 minute, 5.2 second time interval could be represented by "PT1H15M05.2S", "PT75M5.2S", or "PT4505.2S". The precision of the seconds part of the value can be represented to arbitrary precision; the precision used should be appropriate for the value being represented.

— *enumeration*: a list of specific strings allowed for an element or attribute. Each enumeration is named and described in 5.1.3.

— *ID*: a string containing no whitespace or carriage control characters. An *ID* is used to uniquely identify elements in the XML file via the ID attribute. For example:

<Example ID=”Example1”>example element value</Example>

— *IDREF*: identical to the *ID* data type, an IDREF is a reference to a particular element identified by an *ID*. For example,

<Ref Examples=”Element1”/>

— *IDREFS*: a *list* of IDREF values

— *list*: a finite-length series of space-separated values of an atomic 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

5.1.2 Derived data types

Data types specific to the ANSI N42.42 Schema are:

— *doubleUnc*: a *list* of *double* with length of 2, where the first item in the list is the value and the second is the 1-sigma absolute total uncertainty (i.e., including all sources of uncertainty) in the value. For example, an <Activity> element whose value is 1.2 ± 0.45 would be represented by

<Activity>1.2 0.45</Activity>

An uncertainty of 0 indicates that the uncertainty is unknown.

— *durationUnc*: a *list* of *duration* with length of 2, where the first item is the time interval value and the second is the 1-sigma total uncertainty in that value. For example, an <Elapsed> element whose value is 5 seconds ± 0.5 seconds would be represented by

<Elapsed>PT5.0S PT0.5S</Elapsed>

— *coordinates*: used to represent a geographic location; is a *list* of *decimal* with length of 2 or 3, where the first item is the latitude, the second is the longitude, and the optional third item is the height in meters relative to the applicable datum’s ellipsoid. For latitudes, positive values correspond to Northern latitudes, and negative values to Southern; for longitudes, positive values are Eastern longitudes and negative Western. For example, a point 5.2 meters above the ellipsoid at “N42.123 W22.456” would be expressed as “42.123 -22.456 5.2”.

5.1.3 Enumerations

Where the value of a *string* data type element or attribute has a restricted range of values, an enumeration data type is defined. All enumeration values are case sensitive.

- *enumInstrumentMode*: describes the operating mode of the instrument.
  - Used by: <InstrumentInformation> <Mode> element
  - Values:
    - "Measure": normal measurement mode
    - "Calibrate": calibration mode
    - "Test": test or diagnostics mode
    - "Other"
- *enumSpectrumType*: indicates the collection mode of the spectrum.
  - Used by: <Spectrum> Type attribute
  - Values:
    - "PHA": Pulse Height Analysis
    - "MCS": Multi-Channel Scaling
    - "Other"
- *enumSourceType*: indicates the type of spectrum measurement.
  - Used by: <Spectrum> <SourceType> element
  - Values:
    - "Item": measurement of an item
    - "Background": measurement of environmental background
    - "Calibration": measurement of a calibration source
    - "Other"
- *enumCalibrationType*: indicates the type of calibration represented by this <Calibration> element.
  - Used by: <Calibration> element
  - Values (see 5.2.35 for a description of each type of calibration):
    - "Energy"
    - "AbsoluteEfficiency"
    - "IntrinsicFullEnergyPeakEfficiency"
    - "IntrinsicTotalEfficiency"
    - "FWHM"
    - "CountstoDose"
    - "CountstoAbsorbedDose"
    - "CountstoExposure"
    - "Other"
- *enumEnergyUnits*: indicates the units in which energy is represented
  - Used by: various elements and attributes
  - Values:
    - "eV"
    - "keV"
    - "MeV"
- *enumFWHMUnits*: indicates the units in which FWHM is represented.
  - Used by: <Calibration> FWHMUnits attribute
  - Values:
    - "Energy"
    - "Channels"

— *enumEquationType*: indicates the functional form of the equation.

- Used by: <Equation> Model attribute
- Values (see 5.2.38 for a description of Equation models):
  - "Polynomial"
  - "Exponential"
  - "Pade"
  - "PolyLogarithmic"
  - "FullRangeFraction"
  - "Other"

— *enumActivityUnits*: indicates the units in which activity is represented.

- Used by: various elements
- Values:
  - "mBq": milliBequerels
  - "Bq": Becquerels
  - "kBq": kiloBequerels
  - "MBq": megaBequerels
  - "GBq": gigaBequerels
  - "pCi": picoCuries
  - "nCi:" nanoCuries
  - "uCi": microCuries
  - "mCi": milliCuries
  - "Ci": Curies
  - "kCi": kilocuries
  - "MCi": megaCuries

— *enumGrossCountDetectorType*: used to indicate the general type of detector.

- Used by: <GrossCountMeasurement> and <CountDoseData> DetectorType attribute
- Values:
  - "Gamma"
  - "Neutron"
  - "Alpha"
  - "Beta"
  - "Other"

— *enumQualityStatus*: used to indicate data quality.

- Used by: Quality attribute
- Values:
  - "Good": data quality is believed to be acceptable
  - "Bad": data quality is known to be unacceptable
  - "Suspect": data quality is unknown
  - "Missing": data is missing

— *enumInstrumentTypes*: indicates the type of instrument.

- Used by: <InstrumentType> element
- Values:
  - "PortalMonitor": instruments covered by ANSI N42.35
  - "SpecPortal": instruments covered by ANSI N42.38
  - "RadionuclideIdentifier": instruments covered by ANSI N42.34
  - "PersonalRadiationDetector": instruments covered by ANSI N42.32
  - "SurveyMeter": instruments covered by ANSI N42.33
  - "Spectrometer": other instruments that produce spectra
  - "Other"

— *enumCountRateUnits*: the units in which a count rate may be expressed.

- Used by: <CountRate> Units attribute
- Values:
  - "CPS": counts per second
  - "CPM": counts per minute

— *EnumDoseUnits*: the units in which dose equivalent may be expressed.

- Used by: <DoseRate> and <TotalDose>
- Values:
  - "rem"
  - "mrem"
  - "urem": µrem
  - "Sv": Sievert
  - "mSv"
  - "uSv": µSv

— *enumAbsorbedDoseUnits*: the units in which absorbed dose may be expressed.

- Used by: <AbsorbedDoseRate> and <TotalAbsorbedDose>
- Values:
  - "Gy": Gray
  - "mGy"
  - "uGy": µGy
  - "rad"

— *enumExposureUnits*: the units in which exposure may be expressed.

- Used by: <ExposureRate> and <TotalExposure>
- Values:
  - "C/kg": coulomb per kilogram
  - "R": Roentgen
  - "mR"
  - "uR": µR

— *enumSpeedUnits*: the units in which speed may be expressed.

- Used by <Speed> Units attribute
- Values:
  - "mph": miles per hour
  - "kph": kilometers per hour
  - "m/s": meters per second
  - "fps": feet per second

— *enumDistanceUnits*: the units in which distance may be expressed.

- Used by <ItemToDetectorDistance> Units attribute
- Values:
  - "mm": millimeters
  - "cm": centimeters
  - "m": meters
  - "km": kilometers
  - "in": inches
  - "ft": feet
  - "mi": miles

— *enumSpectrumCompressionType*: the algorithm with which spectrum channel data has been compressed.

- Used by <ChannelData> Compression attribute
- Values:
  - "None": no compression
  - "CountedZeroes": the data is compressed using the "CountedZeroes" algorithm

5.1.4 Nuclide name format recommendation

Radionuclide identifiers will create the <NuclideAnalysis> <Nuclide> <NuclideName> element, which is the name of a radioisotope or other radiation source. This section provides a format for these names; note that this standard permits the names of non-standard radiation sources to be defined by the XML file creator. Examples of standard nuclide names are "Ag-110m", "Cs-137", and "I-131" (per *Nomenclature of Inorganic Chemistry*); examples of non-standard nuclides or radiation sources are "Thorium", "U-natural", and "Attenuated Co-60".

Element-Nucleons[Isomer]

where

Element	is the IUPAC chemical element name (see *Nomenclature of Inorganic Chemistry*; note that the case of the IUPAC names shall be preserved)
Nucleons	is the number of protons and neutrons for this isotope
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*,...

5.2 ANSI N42.42 schema elements and attributes

The following sections describe the elements defined in the ANSI N42.42 schema. The following items are described for each element:

a) Parent element(s)

b) Possible child elements, given in the order in which they shall appear. Elements whose "Occurrences" (see below) includes "zero" can be omitted; however, when they are included they shall appear in the order given. Note that with the use of a custom namespace, arbitrary elements can be included after any standard elements; see the example in Annex G.

c) Description of the meaning and use of the element.

d) Data type of the element's contents, if any.

e) Element attributes. Attributes are required to be present unless noted as optional. Arbitrary attributes may be included with the use of a custom namespace.

f) Number of times the element can occur in its parent. Options are:

   1) One: the element shall be present, and can occur only once.

   2) Zero or one: the element may or not be present; if it is present, it can occur only once.

   3) Zero or more: the element may or not be present; if it is present, it can occur any number of times.

   4) One or more: the element shall be present and may occur any number of times.

Refer to the examples in Annex B, Annex C, Annex D, Annex E, and Annex F for sample usage.

5.2.1 <N42InstrumentData>

- Parent: none
- Children: <Remark>, <Measurement>, <Calibration>
- Description: the top level entity in each file
- Element data type: none
- Attributes: none. Note that the XML file cannot be validated against the ANSI N42.42 schema unless namespaces are defined as shown in the examples in Annex C, Annex D, Annex E, and Annex F.
- Occurrences: one

5.2.2 <Remark>

- Parent: <N42InstrumentData>, <Measurement>, <Calibration>, <Spectrum>, <DetectorData>, <MeasuredItemInformation>, <CountDoseData>, <InstrumentInformation>, <QualityControl>, <MeasurementLocation>, <Equation>, <ArrayXY>, <PointXY>, <DetectorMeasurement>, <GrossCountMeasurement>, <SpectrumMeasurement>, <NuclideAnalysis>, <Nuclide>
- Children: none
- Description: general comments regarding the dataset
- Element data type: *string*
- Attributes: none
- Occurrences: zero or more

5.2.3 <Measurement>

- Parent: <N42InstrumentData>
- Children: <Remark>, <InstrumentInformation>, <MeasuredItemInformation>, <Spectrum>, <DetectorData>, <CountDoseData>, <AnalysisResults>
- Description: contains the data resulting from a measurement from a single instrument
- Element data type: none
- Attributes:
  - UUID (optional): data type *string*, a unique identifier for the measurement. The format of the UUID is defined in ISO/IEC 11578.
- Occurrences: one or more

5.2.4 <InstrumentInformation>

- Parent: <Measurement>
- Children: <Remark>, <InstrumentType>, <Manufacturer>, <InstrumentModel>, <InstrumentVersion>, <InstrumentID>, <ProbeType>, <InstrumentMode>, <QualityControl>
- Description: describes the instrument that collected the data
- Element data type: none

- Attributes: none
- Occurrences: zero or one

5.2.5 <InstrumentType>

- Parent: <InstrumentInformation>
- Children: none
- Description: the type of instrument
- Element data type: *enumInstrumentType*
- Attributes: none
- Occurrences: zero or one

5.2.6 <Manufacturer>

- Parent: <InstrumentInformation>
- Children: none
- Description: the name of the manufacturer of the instrument
- Element data type: *string*
- Attributes: none
- Occurrences: zero or one

5.2.7 <InstrumentModel>

- Parent: <InstrumentInformation>
- Children: none
- Description: the manufacturer's model number of the instrument. The information may include hardware and software version information.
- Element data type: *string*
- Attributes: none
- Occurrences: zero or one

5.2.8 <InstrumentVersion>

- Parent: <InstrumentInformation>
- Children: none
- Description: version information for the instrument. This information may include both hardware and software version information.
- Element data type: *string*
- Attributes: none
- Occurrences: zero or one

5.2.9 InstrumentID>

- Parent: <InstrumentInformation>
- Children: none
- Description: identification information for the specific instrument; i.e., serial number, asset tag number. The identification information shall be unique for a given manufacturer and model of instrument; if an instrument cannot generate a unique ID, then this field shall be omitted.
- Element data type: *string*
- Attributes: none
- Occurrences: zero or one

5.2.10 <ProbeType>

- Parent: <InstrumentInformation>
- Children: none
- Description: the description of the probe used to make the measurement
- Element data type: *string*
- Attributes: none
- Occurrences: zero or one

5.2.11 <InstrumentMode>

- Parent: <InstrumentInformation>
- Children: none
- Description: the operating mode of the instrument
- Element data type: enumeration *enumInstrumentMode*
- Attributes: none
- Occurrences: zero or one

5.2.12 <QualityControl>

- Parent: <InstrumentInformation>
- Children: <InspectionDate>, <InService>, <Remark>
- Description: describes the quality control status of the instrument; see child elements <InspectionDate> and <InService>.
- Element data type: none
- Attributes: none
- Occurrences: zero or one

5.2.13 <InspectionDate>

- Parent: <QualityControl>
- Children: none
- Description: the date at which the instrument was most recently inspected and verified as being available for use
- Element data type: *dateTime*
- Attributes: none
- Occurrences: zero or one

5.2.14 <InService>

- Parent: <QualityControl>
- Children: none
- Description: indicates whether the instrument is currently certified as being properly calibrated and considered in service
- Element data type: *boolean*
- Attributes: none
- Occurrences: zero or one

5.2.15 <MeasuredItemInformation>

- Parent: <Measurement>
- Children: <ItemDescription>, <ItemQuantity>, <MeasurementLocation>, <ItemReferenceDate>, <MultimediaData>, <MeasurementGeometryDescription>, <ItemToDetectorDistance>, <MeasurementOperator>, <Remark>
- Description: this is the parent element for information describing the item being measured and the environment in which it is measured
- Element data type: none
- Attributes: none
- Occurrences: zero or one

5.2.16 <ItemDescription>

- Parent: <MeasuredItemInformation>
- Children: none
- Description: free-form text describing the item being measured
- Element data type: *string*
- Attributes: none
- Occurrences: zero or one

5.2.17 <ItemQuantity>

- Parent: <MeasuredItemInformation>
- Children: none
- Description: the 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 item, used in the calculation of item activity concentration.
- Element data type: *doubleUnc*
- Attributes:
  - Units: data type *string*, the units of the quantity value
- Occurrences: zero or one

5.2.18 <MeasurementLocation>

- Parent: <MeasuredItemInformation>
- Children: <Remark>, <MeasurementLocationName>, <Coordinates>
- Description: where the measurement was performed; see child elements <MeasurementLocationName> and <Coordinates>.
- Element data type: none
- Attributes: none
- Occurrences: zero or one

5.2.19 <MeasurementLocationName>

- Parent: <MeasurementLocation>
- Children: none
- Description: a description of the location where the measurement was performed
- Element data type: *string*
- Attributes: none
- Occurrences: zero or one

5.2.20 <Coordinates>

- Parent: <MeasurementLocation>
- Children: none
- Description: the geographic coordinates of the location where the measurement was performed. A series of <Coordinates> elements may be provided if the instrument or item moved over the course of the measurement; the time corresponding with each location is provided by the Time attribute value.
- Element data type: *coordinates*

— Attributes:

  - Time (optional): data type *dateTime*, the time at which the location was determined.
  - Datum (optional): data type *positiveInteger*, the EPSG map datum reference for coordinates; see EPSG Map Datum Codes for EPSG codes. If not specified, the map datum is WGS-84 (EPSG code 4326).

— Occurrences: zero or more

5.2.21 <ItemReferenceDate>

— Parent: <MeasuredItemInformation>

— Children: none

— Description: establishes a target date for decay correction—radionuclide activities shall be decay-corrected from the measurement date to this date.

— Element data type: *dateTime*

— Attributes: none

— Occurrences: zero or one

5.2.22 <MultimediaData>

— Parent: <MeasuredItemInformation>

— Children: none

— Description: multi-media data—i.e., images, sound clips, movies—regarding the measured item or the measurement environment.

— Element data type: *string* if the data is encapsulated as the element's contents; if the data location is provided via the URI attribute, then the element has no content.

— Attributes:

  - DataMIMEType: data type *string*, indicates the format of the data as a MIME type (for example, "image/jpeg" for a JPEG image). MIME types are maintained by the IANA.
  - EncodingMIMEType: data type *string*, indicates how the data is encoded (for example, "application/octet-stream" or "application/zip").
  - Remark (optional): data type *string*, free-form text describing the data.
  - SequenceNumber (optional): data type *positiveInteger*, allows the processing order of multiple <MultimediaData> elements to be determined; the elements should be processed in increasing order of this value.
  - Time (optional): data type *dateTime*, the time at which capture of the data was started.
  - URI (optional): data type *anyURI*, is used to indicate the location of the data should the data not be included as the contents of the element.

— Occurrences: zero or more

5.2.23 <MeasurementGeometryDescription>

— Parent: <MeasuredItemInformation>

— Children: none

— Description: a free-form description of the measurement geometry: the effective item-detector distance, the geometry of the item, attenuators between the item and detector, etc.

- Element data type: *string*
- Attributes: none
- Occurrences: zero or one

5.2.24 <ItemToDetectorDistance>

- Parent: <MeasuredItemInformation>
- Children: none
- Description: the effective distance between the item being measured and the detector(s)
- Element data type: *double*
- Attributes:
  - Units: data type *enumDistanceUnits*, the units in which the distance is expressed
- Occurrences: zero or one

5.2.25 <MeasurementOperator>

- Parent: <MeasuredItemInformation>
- Children: none
- Description: free-form text that identifies the operator of the instrument when the measurement was made
- Element data type: *string*
- Attributes: none
- Occurrences: zero or one

5.2.26 <Spectrum>

- Parent: <Measurement> or <SpectrumMeasurement>
- Children: <Remark>, <StartTime>, <RealTime>, <LiveTime>, <DwellDuration>, <ElapsedSweeps>, <SourceType>, <DetectorType>, <Calibration>, <ChannelData>
- Description: contains a PHA or MCS spectrum and supporting information, such as collection start time, real, and live time. Calibration information for the spectrum is contained in <Calibration> elements; these can be children of <Spectrum>, or can be accessed via the <CalibrationID> element.
- Element data type: none
- Attributes:
  - Type: (optional) data type enumeration *enumSpectrumType*; if "MCS" then the <DwellDuration> and <ElapsedSweeps> elements are required. If omitted, the type is "PHA".
  - Detector (optional): data type *string*, identifies the particular detector which generated this data.
  - Quality (optional): data type *enumQualityStatus*; indicates if the data is trustworthy.
  - ID (optional): data type ID, uniquely identifies the instance of this element within the XML file. The value of this attribute can be used in the BackgroundSpectrumID or CalibrationSpectrumID attributes to indicate the spectrum of interest.

- CalibrationIDs (optional): data type *IDREFS*, specifies a list of IDs of the calibrations that apply to this spectrum; see Annex C and Annex E for example files that use this attribute. The ID of each calibration is specified via the ID attribute of the calibration's <Calibration> element. If CalibrationIDs is not specified, then any calibrations for this spectrum shall be included in the parent <Spectrum> element; see Annex B for an example of this usage.
- BackgroundSpectrumID (optional): data type *IDREF*, specifies the ID of the <Spectrum> element that is the background for this spectrum; the ID of the background spectrum is specified via the ID attribute of the background spectrum's <Spectrum> element. See Annex E for an example of this usage.

If BackgroundSpectrumID is not specified, then the background spectrum may be associated with the spectrum by being included in the same <Measurement> element; background spectra have a <SourceType> value of "Background". This technique shall be used only when there can be no ambiguity in the association of the background spectrum with the measurement spectra to which they apply; i.e., it shall not be used when there are spectra from multiple detectors present in the same <Measurement> element. See Annex C for an example of this usage.

- CalibrationSpectrumID (optional): data type *IDREF*, specifies the ID of the <Spectrum> element that is to be used to energy calibrate this spectrum; the ID of the calibration spectrum is specified via the ID attribute of the calibration spectrum's <Spectrum> element.

If CalibrationSpectrumID is not specified, then the calibration spectrum may be associated with the spectrum by being included in the same <Measurement> element; background spectra have a <SourceType> value of "Calibration". This technique shall be used only when there can be no ambiguity in the association of the calibration spectrum with the measurement spectra to which they apply; i.e., it shall not be used when there are spectra from multiple detectors present in the same <Measurement> element.

- SampleNumber (optional): data type *positiveInteger*, is used when the <Spectrum> element is contained in a <SpectrumMeasurement> parent element and indicates which sample this spectrum corresponds to; the first sample is number 1.

— Occurrences: zero or more

5.2.27 <StartTime>

— Parent: <Spectrum>, <DetectorData>, <CountDoseData>

— Children: none

— Description: the time corresponding to the start of the collection of the data contained in the parent element

— Element data type: *dateTime*

— Attributes: none

— Occurrences: zero or one

5.2.28 <RealTime>

— Parent: <Spectrum>

— Children: none

— Description: spectrum collection real time

- Element data type: *duration*
- Attributes: none
- Occurrences: Zero or one. This element is optional only in order to support legacy devices that do not supply the real time; if a device does have real time, then this information shall be included in the file.

5.2.29 <LiveTime>

- Parent: <Spectrum>
- Children: none
- Description: spectrum collection live time.
- Element data type: *duration*
- Attributes: none
- Occurrences: Zero or one. This element is optional only in order to support legacy devices that do not supply the live time; if a device does have live time, then this information shall be included in the file.

5.2.30 <DwellDuration>

- Parent: <Spectrum>
- Children: none
- Description: MCS channel collection time
- Element data type: *duration*
- Attributes: none
- Occurrences: zero (if <Spectrum> Type attribute is “PHA”) or one (if the attribute is “MCS”)

5.2.31 <ElapsedSweeps>

- Parent: <Spectrum>
- Children: none
- Description: the number of MCS spectrum sweeps
- Element data type: *nonNegativeInteger*
- Attributes: none
- Occurrences: zero (if <Spectrum> Type attribute is “PHA”) or one (if the attribute is “MCS”)

5.2.32 <SourceType>

- Parent: <Spectrum>
- Children: none
- Description: indicates whether the spectrum is a measurement of an item (“Item”), an environmental background (“Background”), or a calibration source (“Calibration”)

- Element data type: enumeration *enumSourceType*
- Attributes: none
- Occurrences: zero or one

5.2.33 <DetectorType>

- Parent: <Spectrum>
- Children: none
- Description: a free-form description of the type of detector; for example, “HPGe” or “Ne213”
- Element data type: *string*
- Attributes: none
- Occurrences: zero or one

5.2.34 <ChannelData>

- Parent: <Spectrum>
- Children: none
- Description: contains one or more channels of data. A <Spectrum> element shall contain one or more <ChannelData> elements. A single <ChannelData> element may contain the entire spectrum; alternatively, multiple <ChannelData> elements may be used to represent ROIs.

  Note that:

  - Instruments with multiple detectors shall use a <Spectrum> element for each detector.
  - Instruments that periodically produce spectra—for example, multi-spectrum scalers – may create a <Measurement> element for each spectrum; alternatively, they may create a <Spectrum> element for each spectrum within a single <Measurement> element.
- Element data type: *list* of *double*
- Attributes:

  - Compression (optional): data type *enumSpectrumCompressionType*, indicates the algorithm, if any, by which the channel data has been compressed. If this attribute is omitted, the data has not been compressed. The types of data compression are:
- None: the data is 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 has 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.

- Start (optional): data type *positiveInteger*, indicating the starting channel number of the element data, where the first channel is number 1. If omitted, the element data starts with channel 1.

— Occurrences: one or more

5.2.35 <Calibration>

— Parent: <N42InstrumentData>, <Spectrum>, <CountDoseData>

— Children: <Remark>, <CalibrationCreationDate>, <CalibrationMeasurementUUID>, <Equation>, <ArrayXY>

— Description: contains calibration information relating to the data in the parent element, or the element (<Spectrum> or <CountDoseData>) referencing the calibration using the CalibrationIDs attribute. The calibration information may be in the form of one or more <Equation> elements (see 5.2.38) and/or a <ArrayXY> element (a list of X vs. Y data points; see 5.2.41). For spectal calibrations, the value of X shall be referenced such that the value of X at the left-most boundary of the first channel in the spectrum is 0.

— Element data type: none

— Attributes:

- ID (optional): data type *ID*, uniquely identifies the instance of this element within the XML file. The value of this attribute is used in the <CalibrationID> element to indicate the calibration element to be used.
- Type: data type enumeration *enumCalibrationType*, the type of calibration:
  - "Energy": the relationship between energy to channels; Energy = *f*(Channel)
  - "AbsoluteEfficiency": the relationship between the absolute detection efficiency of the system and energy; Absolute Efficiency = *f*(Energy). Absolute efficiency is expressed as a ratio.
- "IntrinsicFullEnergyPeakEfficiency" and "IntrinsicTotalEfficiency": the relationship between the intrinsic full energy peak or total detection efficiency of the gamma detector and energy; Intrinsic Efficiency = *f*(Energy). Intrinsic efficiency is expressed as a ratio.
- "FWHM": the relationship between detector peak shape (FWHM) and energy; FWHM = *f*(Energy)
- "CountstoDose": the relationship of observed counts (or count rate) to dose; Dose = *f*(Counts)
- "CountstoAbsorbedDose": the relationship of observed counts to absorbed dose; Absorbed Dose = *f*(Counts)
- "CountstoExposure": the relationship of observed counts to exposure; Exposure = *f*(Counts)

The units of the types of calibrations listed above shall be indicated via the appropriate attribute:

- EnergyUnits (required if applicable): data type enumeration *enumEnergyUnits*, the units in which energy is expressed.
- FWHMUnits (required if applicable): data type enumeration *enumFWHMUnits*, the units in which FWHM is expressed.
- CountRateUnits (required if applicable): data type enumeration *enumCountRateUnits*, the units in which count rate is expressed.
- DoseUnits (required if applicable): data type enumeration *enumDoseUnits*, the units in which dose or dose rate is expressed.
- AbsorbedDoseUnits (required if applicable): data type enumeration *enumAbsorbedDoseUnits*, the units in which absorbed dose is expressed.
- ExposureUnits (required if applicable): data type enumeration *enumExposureUnits*, the units in which exposure is expressed.

— Occurrences: Zero or more

5.2.36 <CalibrationMeasurementUUID>

- Parent: <Calibration>
- Children: none
- Description: the UUID of the measurement(s) from which this calibration was derived. The format of the UUID is defined in ISO/IEC 11578.
- Element data type: *string*
- Attributes: none
- Occurrences: zero or more

5.2.37 <CalibrationCreationDate>

- Parent: <Calibration>
- Children: none
- Description: the date at which this calibration was created
- Element data type: *dateTime*
- Attributes: none
- Occurrences: zero or one

5.2.38 <Equation>

- Parent: <Calibration>
- Children: <Remark>, <Coefficients>, <CoVarianceMatrix>
- Description: describes an equation (used in a calibration) and its coefficients. The type of the equation is given by the Model attribute. The coefficients of the equation are supplied by the Coefficients element; the values of the covariance matrix may be supplied by <CoVarianceMatrix> element. It is recommended that the data from which the equation coefficients were derived be made available as an <ArrayXY> element so that the coefficients for a different model could be derived.

  An Equation may apply only over a certain range of "X"; if so, the range is specified via the LowerLimit and UpperLimit attributes. In this case, multiple Equation elements may be specified in the parent element; if the ranges of the equations overlap, or if the ranges specified are not comprehensive, the behavior of the system is application-dependent.
- Element data type: none
- Attributes:
  - Model: data type enumeration *enumEquationType*, the type of equation. Equation types are:
    - "Polynomial": an equation of the form

      $$a + bX + cX^2 + \ldots$$

      The order of the polynomial is indicated by the number of terms specified in the <Coefficients> child element.

- "Pade": an equation of the form

$$\frac{\sum_{i=0}^{N} a_i \cdot X^i}{\sum_{i=0}^{M} b_i \cdot X^i}$$

The order of the numerator polynomial (*N*) is the number of terms specified in the <Coefficients> child element whose Subequation attribute value is 1. Similarly, the order of the denominator polynomial (M) is the number of terms specified in the <Coefficients> child element whose Subequation attribute value is 2. It is recommended that coefficient b_0 have the value 1.

- "Exponential": an equation of the form

$$a + be^{cX}$$

"a" is term 0, "b" term 1, and "c" term 2. The values of terms unspecified in the <Coefficients> child element are zero.

- "PolyLogarithmic": an equation of the form

$$e^{\sum_{i=1}^{N} a_i \cdot \left(\ln\left(\frac{a_0}{X}\right)\right)^{i-1}}$$

N is the number of coefficients specified in the <Coefficients> child element minus one.

- "FullRangeFraction": an equation of the form

$$a + bX + cX^2 + ... + e/(1 + \alpha X)$$

The order of the polynomial is the number of terms in the <Coefficients> child element, minus one. The last coefficient in <Coefficients> is the scaling factor α.

- "Other": the model is not one of the types described above. The Form attribute shall be used to describe the model.

  - Form (optional): data type *string*, is a free-form description of Model; it is intended for documentation purposes only. If Model is Other, then Form shall be specified.
  - LowerLimit (optional): data type double, is the lowest value of X for which this equation is valid.
  - UpperLimit (optional): data type double, is the highest value of X for which this equation is valid.

— Occurrences: Zero or more

5.2.39 <Coefficients>

— Parent: <Equation>

— Children: none

— Description: the value of the coefficients of an <Equation>. The first value is term 0, the second term 1, and so forth.

— Element data type: *list of double*

- Attributes:
  - Subequation: data type *positiveInteger*, is used for models which are composed of multiple equations (Pade, for example) and indicates to which of those equations the values in this element applied. Subequation numbers start with one.
- Occurrences: one or more

5.2.40 <CovarianceMatrix>

- Parent: <Equation>
- Children: none
- Description: the lower triangular half of the Equation covariance matrix. The number of values in the list is determined by the number of coefficients in the equation; i.e., $\sum_{i=0}^{N} i$ where *N* is the total number of values specified in all <Coefficients> elements. The elements of the matrix appear in the list in the order $\sigma_{i,j}$, where *i* is varied first, from 0 to N; i.e., $\sigma_{0,0}$, $\sigma_{0,1}$, $\sigma_{1,1}$, $\sigma_{0,2}$, $\sigma_{1,2}$, $\sigma_{2,2}$, $\sigma_{0,3}$, … If the model is composed of multiple equations (Pade, for example), the terms corresponding to the first subequation are first, followed by the higher number subequations, in numerical order. For example, a Pade equation with coefficients a0, a1, and a2 for the numerator equation and b0, b1, and b2 for the denominator equation will have a covariance matrix with 21 elements, appearing in the value list in the order $\sigma_{a0,a0}$, $\sigma_{a0,a1}$, $\sigma_{a0,a2}$, $\sigma_{a0,b0}$, $\sigma_{a0,b1}$, $\sigma_{a0,b2}$, $\sigma_{a1,a1}$, ...
- Element data type: *list* of *double*
- Attributes: none
- Occurrences: zero to one

5.2.41 <ArrayXY>

- Parent: <Calibration>
- Children: <Remark>, <PointXY>
- Description: contains a two dimensional array of data points and (optionally) the uncertainties in those values
- Element data type: none
- Attributes:
  - X: data type *string*, describes the first dimension's data
  - Y: data type *string*, describes the second dimension's data
- Occurrences: zero or one

5.2.42 <PointXY>

- Parent: <ArrayXY>
- Children: <Remark>, <X>, <Y>
- Description: a single two dimensional; i.e., (X,Y) - data point
- Element data type: none

- Attributes: none
- Occurrences: one or more

5.2.43 <X>

- Parent: <PointXY>
- Children: none
- Description: the value and uncertainty of the first dimension of a <PointXY> data point
- Element data type: *doubleUnc*
- Attributes: none
- Occurrences: one

5.2.44 <Y>

- Parent: <PointXY>
- Children: none
- Description: the value and uncertainty of the second dimension of a <PointXY> data point
- Element data type: *doubleUnc*
- Attributes: none
- Occurrences: one

5.2.45 <DetectorData>

- Parent: <Measurement>
- Children: <Remark>, <StartTime>, <SampleRealTime>, <Occupied>, <Speed>, <AlarmSummary>, <AlarmDescription>, <DetectorMeasurement>
- Description: contains data from a gross counting or spectroscopic portal monitor; this type of instrument collects gross count and/or spectroscopic "samples" from one or more detectors synchronously. The data is contained in one or more <DetectorMeasurement> child elements, each of which contains a series of samples from a single detector in <GrossCountMeasurement> or <SpectrumMeasurement> elements. The number of samples in the <GrossCounts> and <SpectrumAvailable> elements in all of the <GrossCountMeasurement> and <SpectrumMeasurement> elements shall be identical.

The <StartTime> element indicates the time at which data integration was started for this series of samples.

- Element data type: none
- Attributes: none
- Occurrences: zero or one

5.2.46 <DetectorMeasurement>

- Parent: <DetectorData>
- Children: <Remark>, <GrossCountMeasurement>, <SpectrumMeasurement>
- Description: the data from a single detector. The data is contained in one or more <GrossCountMeasurement> or <SpectrumMeasurement> child elements, each of which contains a series of gross count or spectrum samples from the detector. The number of samples in the <GrossCounts> and <SpectrumAvailable> elements in all of the <GrossCountMeasurement> and <SpectrumMeasurement> elements shall be identical.
- Element data type: none
- Attributes:
  - Detector: data type *string*, a description of the detector. If there is more than one detector, then this attribute should be used to uniquely describe the relationship of the data to the detector configuration; for example, "Left Gamma Detector" or "Sum of Top and Bottom Detectors".
  - DetectorType: data type enumeration *enumGrossCountDetectorType*, the type of the detector.
- Occurrences: one or more

5.2.47 <SampleRealTime>

- Parent: <DetectorData>, <CountDoseData>
- Children: none
- Description: the data collection time (i.e., clock) for each sample. The number of items in the list shall be either 1, in which case the value applies to all samples, or shall be identical to the number of items in each <GrossCountMeasurement> <GrossCounts> and <BackgroundCounts> element, or in each <CountDoseData> <CountRate>, <Counts>, <DoseRate>, <TotalDose>, <AbsorbedDoseRate>, <TotalAbsorbedDose>, <ExposureRate>, and <TotalExposure> element.
- Element data type: *list* of *duration*
- Attributes: none
- Occurrences: one

5.2.48 <SampleLiveTime>

- Parent: <GrossCountMeasurement>, <CountDoseData>
- Children: none
- Description: the data collection time, corrected for dead time (i.e., live time), for each sample. The number of items in the list shall be either 1, in which case the value applies to all samples, or shall be identical to the number of items in each <GrossCountMeasurement> <GrossCounts> and <BackgroundCounts> element, or in each <CountDoseData> <CountRate>, <Counts>, <DoseRate>, <TotalDose>, <AbsorbedDoseRate>, <TotalAbsorbedDose>, <ExposureRate>, and <TotalExposure> element.
- Element data type: *list* of *duration*
- Attributes: none
- Occurrences: zero or one

5.2.49 <Occupied>

- Parent: <DetectorData>
- Children: none
- Description: indicates if the monitor is occupied during a sample. The number of items in the list shall be identical to the number of items in each <GrossCountMeasurement> <GrossCounts> element and each <SpectrumMeasurement> <SpectrumAvailable> element.
- Element data type: *list* of *boolean*
- Attributes: none
- Occurrences: zero or one

5.2.50 <Speed>

- Parent: <DetectorData>
- Children: none
- Description: indicates the speed of any item moving through a portal monitor. If there is one value in the list, it represents the average speed of the item over the course of the entire measurement. If there are two values in the list, the first represents the entrance speed of the item, and the second the exit speed. If there are more than two values, the number of values shall be identical to the number of items in each <GrossCountMeasurement> <GrossCounts> element and each <SpectrumMeasurement> <SpectrumAvailable> element; these values correspond to the speed profile of the item as it moves through the monitor.
- Element data type: *list* of *double*
- Attributes:
  - Units: data type *enumSpeedUnits*, the units in which speed is expressed.
- Occurrences: zero or one

5.2.51 <AlarmSummary>

- Parent: <DetectorData>, <CountDoseData>
- Children: none
- Description: indicates if an alarm occurred for any sample for any detector; if provided, (purely for the convenience of document readers) this field should be the logical “or” of all child <Alarmed> element values.
- Element data type: *boolean*
- Attributes: none
- Occurrences: zero or one

5.2.52 <AlarmDescription>

- Parent: <DetectorData>, <CountDoseData>
- Children: none
- Description: free-form text describing the alarm or alarms (if any) that occurred

— Element data type: *string*

— Attributes: none

— Occurrences: zero or more

5.2.53 <GrossCountMeasurement>

— Parent: <DetectorMeasurement>

— Children: <Remark>, <SampleLiveTime>, <Alarmed>, <GrossCounts>, <BackgroundCounts>

— Description: a series of samples from a single gross counting detector energy window. Each <GrossCountsMeasurement> element contains a <GrossCounts> element, which is a list of N values, each representing a sample from the detector, and optionally a <BackgroundCounts> element and an <Alarmed> element.

— Element data type: none

— Attributes:

- WindowStart (optional): the starting energy of the window which the data represents. If omitted, the window starts at the lowest energy which can be collected by the detector.
- WindowEnd (optional): the ending energy of the window which the data represents. If omitted, the window ends at the highest energy which can be collected by the detector.
- EnergyUnits (required if either WindowStart or WindowEnd are specified): data type *enumEnergyUnits*, the units of WindowStart and WindowEnd.
- Quality (optional): data type *enumQualityStatus*, indicates if the data is trustworthy.

— Occurrences: Zero or more

5.2.54 <SpectrumMeasurement>

— Parent: <DetectorMeasurement>

— Children: <Remark>, <SpectrumAvailable>, <Alarmed>, <Spectrum>

— Description: contains a series of samples from a single spectroscopic detector. Each <SpectrumMeasurement> element contains a <SpectrumAvailable> element, which is a list of values, one for each sample, each of which indicates if a spectrum saved by the instrument for that sample, and optionally an <Alarmed> element.

— Element data type: none

— Attributes: none

— Occurrences: zero to one

— Attributes: none

5.2.55 <GrossCounts>

— Parent: <GrossCountMeasurement>

— Children: none

— Description: the gross counts from the detector.

— Element data type: list of nonNegativeInteger

- Attributes: none
- Occurrences: one

5.2.56 <BackgroundCounts>

- Parent: <GrossCountMeasurement>
- Children: none
- Description: the background counts appropriate for the detector for each sample, as determined by the instrument. The number of elements in the list shall be either 1, in which case the background value applies to all the samples in the <GrossCounts> element, or shall be equal to the number of samples in the <GrossCounts> element.
- Element data type: *list* of *double*
- Attributes: none
- Occurrences: one

5.2.57 <Alarmed>

- Parent: <GrossCountMeasurement>, <CountDoseData>, <SpectrumMeasurement>
- Children: none
- Description: indicates whether the data triggered an alarm for that sample. The number of items in the list shall be equal to that in the <GrossCounts>, <SpectrumAvailable>, <CountRate>, <ExposureRate>, <DoseRate>, <AbsorbedDoseRate>, <TotalDose>, <TotalExposure>, or <TotalAbsorbedDose> elements.
- Element data type: *list* of *boolean*
- Attributes: none
- Occurrences: zero or one

5.2.58 <SpectrumAvailable>

- Parent: <SpectrumMeasurement>
- Children: none
- Description: a list of boolean values indicating if a spectrum was saved for the corresponding sample. If the value is false, then no spectrum was saved; otherwise, a spectrum was saved for that sample and can be found via the SampleNumber attribute of the <Spectrum> element. Samples are numbered starting from 1..

  The number of values in the <SpectrumAvailable> list shall be equal to that in the <Alarmed> and <GrossCounts> elements.
- Element data type: *list* of *boolean*
- Attributes: none
- Occurrences: one

5.2.59 <AnalysisResults>

- Parent: <Measurement>
- Children: <Remark>, <ThreatDescription>, <NuclideAnalysis>
- Description: contains the results of the analysis of the data in the parent <Measurement> element. These results are those reported to the instrument's operator at the time of the measurement.
- Element data type: none
- Attributes: none
- Occurrences: zero or one

5.2.60 <ThreatDescription>

- Parent: <AnalysisResults>
- Children: none
- Description: free-form text describing the overall conclusion of the analysis; for example, "Possible RDD" or "Probable NORM".
- Element data type: *string*
- Attributes: none
- Occurrences: zero or one

5.2.61 <NuclideAnalysis>

- Parent: <AnalysisResults>
- Children: <Remark>, <Nuclide>
- Description: contains radionuclide analysis results information; each nuclide is described by a <Nuclide> element.
- Element data type: none
- Attributes:
  - ActivityUnits: data type enumeration *enumActivityUnits*, the units in which activity is expressed.
  - AlgorithmDescription (optional): data type *string*, free-form text describing the name or type of algorithm that produced the analysis.
  - AlgorithmVersion (optional): data type *string*, free-form text indicating the version of the algorithm that produced the analysis.
- Occurrences: zero or one

5.2.62 <Nuclide>

- Parent: <NuclideAnalysis>
- Children: <Remark>, <NuclideName>, <NuclideType>, <NuclideActivity>, <NuclideIDConfidenceIndication>, <NuclideIDConfidenceDescription>
- Description: contains the analysis results for a single nuclide

- Element data type: none
- Attributes: none
- Occurrences: zero or more

5.2.63 <NuclideName>

- Parent: <Nuclide>
- Children: none
- Description: the name of the nuclide. The name should follow the recommendation described in 5.1.4.
- Element data type: *string*
- Attributes: none
- Occurrences: one

5.2.64 <NuclideType>

- Parent: <Nuclide>
- Children: none
- Description: the type of this nuclide, as free-form text. Examples are “SNM”, “Industrial”, “Fission Product”, “Medical”, and “NORM”.
- Element data type: *string*
- Attributes: none
- Occurrences: one

5.2.65 <NuclideActivity>

- Parent: <Nuclide>
- Children: none
- Description: the calculated activity and uncertainty in activity of the nuclide. The units of the value are set by the <NuclideAnalysis> ActivityUnits attribute. If the <MeasuredItemInformation> <ItemReferenceDate> element is present, then the activity is decay-corrected to that date.
- Element data type: *doubleUnc*
- Attributes: none
- Occurrences: zero or one

5.2.66 <NuclideIDConfidenceIndication>

- Parent: <Nuclide>
- Children: none

— Description: indication of confidence in the identification status of this 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.

— Element data type: *double*

— Attributes: none

— Occurrences: zero or one

5.2.67 <NuclideIDConfidenceDescription>

— Parent: <Nuclide>

— Children: none

— Description: a text description of the confidence in the identification status of this nuclide; for example, “Not Present”, “Low”, “Medium”, “High”.

— Element data type: *string*

— Attributes: none

— Occurrences: zero or one

5.2.68 <CountDoseData>

— Parent: <Measurement>

— Children: <Remark>, <StartTime>, <SampleRealTime>, <SampleLiveTime>, <Alarmed>, <AlarmSummary>, <AlarmDescription>, <Calibration>, <CountRate>, <Counts>, <DoseRate>, <TotalDose>, <AbsorbedDoseRate>, <TotalAbsorbedDose>, <ExposureRate>, <TotalExposure>

— Description: contains count, count rate, dose, or exposure data, such as would be collected from a personal radiation detector or survey meter. The data is contained in a series of values in <Counts>, <CountRate>, <ExposureRate>, <DoseRate>, <AbsorbedDoseRate>, <TotalDose>, <TotalExposure>, and/or <TotalAbsorbedDose> elements; the interval at which the data was taken is given by the <SampleRealTime> element. The <SampleRealTime> element and one of more of the elements <CountRate>, <ExposureRate>, <DoseRate>, <AbsorbedDoseRate>, <TotalDose>, <TotalExposure>, or <TotalAbsorbedDose> shall be present; the <SampleLiveTime> and <Alarmed> elements may also be present. If more than one of these elements is present, then the number of values in each element shall be identical, with the exception of <SampleRealTime> and <SampleLiveTime>, which may have one value or the same number as the other elements.

  Calibration information (for example, count rate to dose) is provided via a child <Calibration> element, or a <Calibration> element whose ID is contained in a child <CalibrationID> element.

— Element data type: none

— Attributes:

  - CalibrationIDs (optional): data type *IDREFS*, specifies a list of IDs of the calibrations that apply to this data. The ID of each calibration is specified via the ID attribute of the calibration’s <Calibration> element. If CalibrationIDs is not specified, then any calibrations for this data shall be included in the parent <CountDoseData> element.
  - Detector (optional): data type *string*, a description of the detector.

- DetectorType (optional): data type enumeration *enumGrossCountDetectorType*, the type of the detector.
- Quality (optional): data type *enumQualityStatus*, indicates if the data is trustworthy. The default value is "Good".

— Occurrences: zero or more

5.2.69 <CountRate>

— Parent: <CountDoseData>

— Children: none

— Description: a list of count rate values

— Element data type: *list* of *double*

— Attributes:

- Units: data type *enumCountRateUnits*, indicates the units in which the count rate is expressed.

— Occurrences: zero or one

5.2.70 <ExposureRate>

— Parent: <CountDoseData>

— Children: none

— Description: a list of exposure rate values.

— Element data type: *list* of *double*

— Attributes:

- Units: data type *enumExposureUnits*, indicates the units in which exposure rate is expressed, per hour

— Occurrences: zero or one

5.2.71 <DoseRate>

— Parent: <CountDoseData>

— Children: none

— Description: a list of dose rate values

— Element data type: *list* of *double*

— Attributes:

- Units: data type *enumDoseUnits*, indicates the units in which the dose rate is expressed, per hour

— Occurrences: zero or one

5.2.72 <AbsorbedDoseRate>

- Parent: <CountDoseData>
- Children: none
- Description: a list of absorbed dose rate values
- Element data type: *list* of *double*
- Attributes:
  - Units: data type *enumAbsorbedDoseUnits*, indicates the units in which the absorbed dose rate is expressed, per hour
- Occurrences: zero or one

5.2.73 <TotalDose>

- Parent: <CountDoseData>
- Children: none
- Description: a list of total (accumulated) dose values
- Element data type: *list* of *double*
- Attributes:
  - Units: data type *enumDoseUnits*, indicates the units in which the dose is expressed
- Occurrences: zero or one

5.2.74 <TotalExposure>

- Parent: <CountDoseData>
- Children: none
- Description: a list of total (accumulated) exposure values
- Element data type: *list* of *double*
- Attributes:
  - Units: data type *enumExposureUnits*, indicates the units in which the exposure is expressed
- Occurrences: zero or one

5.2.75 <TotalAbsorbedDose>

- Parent: <CountDoseData>
- Children: none
- Description: a list of total (accumulated) absorbed dose values.
- Element data type: *list* of *double*
- Attributes:

- Units: data type *enumAbsorbedDoseUnits*, indicates the units in which the absorbed dose is expressed.

— Occurrences: zero or one

5.3 Possible data elements by class of instrument

The elements that will be typically present for each class of instrument are given below. All instruments shall use the <N42InstrumentData> and <Measurement> elements, and may include <InstrumentInformation>, <MeasuredItemInformation>, and <Calibration>.

— Personal Radiation Detector and Personal Electronic Dosimeter: <CountDoseData>

— Survey meter: <CountDoseData>

— Portable radionuclide identifier: <Spectrum>, <CountDoseData>

— Portal Monitor: <DetectorData>

— Spectroscopic Portal Monitor: <DetectorData>

Annex A

(normative)

ANSI N42.42 XML schema

The schema file can be found at the URL defined in [R11].


```
<?xml version="1.0" encoding="utf-8"?>
<xs:schema xmlns="http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/2005/ANSIN4242"
xmlns:n42ns="http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/2005/ANSIN4242" xmlns:xs="http://www.w3.org/2001/XMLSchema"
targetNamespace="http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/2005/ANSIN4242" elementFormDefault="qualified" id="n42">
    <xs:element name="N42InstrumentData" type="N42InstrumentData">
        <xs:annotation>
            <xs:documentation>root element</xs:documentation>
        </xs:annotation>
    </xs:element>
    <xs:element name="Remark" type="xs:string">
        <xs:annotation>
            <xs:documentation>Remark (i.e., comment)</xs:documentation>
        </xs:annotation>
    </xs:element>
    <xs:complexType name="N42InstrumentData">
        <xs:annotation>
            <xs:documentation>Contains instrument data in the form of Measurement elements</xs:documentation>
        </xs:annotation>
        <xs:sequence>
            <xs:element ref="Remark" minOccurs="0"/>
            <xs:element name="Measurement" type="Measurement" maxOccurs="unbounded">
                <xs:annotation>
                    <xs:documentation>A "measurement" from an instrument</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:element name="Calibration" type="Calibration" minOccurs="0" maxOccurs="unbounded">
                <xs:annotation>
                    <xs:documentation>Calibration data</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
        </xs:sequence>
    </xs:complexType>
    <xs:complexType name="Measurement">
        <xs:annotation>
            <xs:documentation>A "measurement" from an instrument</xs:documentation>
        </xs:annotation>
        <xs:sequence>
            <xs:element ref="Remark" minOccurs="0"/>
            <xs:element name="InstrumentInformation" type="InstrumentInformation" minOccurs="0">
                <xs:annotation>
```

```xml
                <xs:documentation>Description of the instrument</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="MeasuredItemInformation" type="MeasuredItemInformation" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Description of measured item: what it is and where the measurement was done</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="Spectrum" type="Spectrum" minOccurs="0" maxOccurs="unbounded">
            <xs:annotation>
                <xs:documentation>A single spectrum collected by a spectroscopic instrument</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="DetectorData" type="DetectorData" minOccurs="0" maxOccurs="unbounded">
            <xs:annotation>
                <xs:documentation>Data measured by a gross count or spectroscopic portal monitor</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="CountDoseData" type="CountDoseData" minOccurs="0" maxOccurs="unbounded">
            <xs:annotation>
                <xs:documentation>Data measured by a survey meter or personal radiation detector</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="AnalysisResults" type="AnalysisResults" minOccurs="0" maxOccurs="unbounded">
            <xs:annotation>
                <xs:documentation>Results of the analysis of the measurement</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
    </xs:sequence>
    <xs:attribute name="UUID" type="xs:string">
        <xs:annotation>
            <xs:documentation>Unique identifier for this measurement</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:anyAttribute namespace="##other" processContents="lax"/>
</xs:complexType>
<xs:complexType name="CountDoseData">
    <xs:annotation>
        <xs:documentation>Data measured by a survey meter or personal radiation detector</xs:documentation>
    </xs:annotation>
    <xs:sequence>
        <xs:element ref="Remark" minOccurs="0"/>
        <xs:element name="StartTime" type="xs:dateTime" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Measurement start date/time</xs:documentation>
            </xs:annotation>
```

```xml
</xs:element>
<xs:element name="SampleRealTime" type="xs:duration">
     <xs:annotation>
          <xs:documentation>Duration of each sample measurement/interval at which samples are taken</xs:documentation>
     </xs:annotation>
</xs:element>
<xs:element name="SampleLiveTime" type="xs:duration" minOccurs="0">
     <xs:annotation>
          <xs:documentation>Effective duration (i.e., live time) of each sample measurement</xs:documentation>
     </xs:annotation>
</xs:element>
<xs:element name="Alarmed" type="booleanList" minOccurs="0">
     <xs:annotation>
          <xs:documentation>Did the instrument alarm (one boolean per sample)?</xs:documentation>
     </xs:annotation>
</xs:element>
<xs:element name="AlarmSummary" type="xs:boolean" minOccurs="0">
     <xs:annotation>
          <xs:documentation>Did instrument alarm during this measurement?</xs:documentation>
     </xs:annotation>
</xs:element>
<xs:element name="AlarmDescription" type="xs:string" minOccurs="0" maxOccurs=”unbounded”>
     <xs:annotation>
          <xs:documentation>Description of the alarm, if any</xs:documentation>
     </xs:annotation>
</xs:element>
<xs:element name="Calibration" type="Calibration" minOccurs="0" maxOccurs="unbounded">
     <xs:annotation>
          <xs:documentation>Calibration data</xs:documentation>
     </xs:annotation>
</xs:element>
<xs:element name="CountRate" type="Count" minOccurs="0">
     <xs:annotation>
          <xs:documentation>Count rate</xs:documentation>
     </xs:annotation>
</xs:element>
<xs:element name="Counts" type="nonNegativeIntegerList" minOccurs="0">
     <xs:annotation>
          <xs:documentation>Counts</xs:documentation>
     </xs:annotation>
</xs:element>
<xs:element name="DoseRate" type="Dose" minOccurs="0">
     <xs:annotation>
          <xs:documentation>Dose rate</xs:documentation>
     </xs:annotation>
</xs:element>
<xs:element name="TotalDose" type="Dose" minOccurs="0">
```

```xml
                <xs:annotation>
                    <xs:documentation>Total accumulated dose</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:element name="AbsorbedDoseRate" type="AbsorbedDose" minOccurs="0">
                <xs:annotation>
                    <xs:documentation>Absorbed dose rate</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:element name="TotalAbsorbedDose" type="AbsorbedDose" minOccurs="0">
                <xs:annotation>
                    <xs:documentation>Total accumulated absorbed dose</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:element name="ExposureRate" type="Exposure" minOccurs="0">
                <xs:annotation>
                    <xs:documentation>Exposure rate</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:element name="TotalExposure" type="Exposure" minOccurs="0">
                <xs:annotation>
                    <xs:documentation>Total accumulated exposure</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
        </xs:sequence>
        <xs:attribute name="CalibrationIDs" type="xs:IDREFS">
            <xs:annotation>
                <xs:documentation>Identifies the calibrations that apply to this data</xs:documentation>
            </xs:annotation>
        </xs:attribute>
        <xs:attribute name="Detector" type="xs:string">
            <xs:annotation>
                <xs:documentation>Detector identification/description</xs:documentation>
            </xs:annotation>
        </xs:attribute>
        <xs:attribute name="DetectorType" type="enumGrossCountDetectorType">
            <xs:annotation>
                <xs:documentation>detector type</xs:documentation>
            </xs:annotation>
        </xs:attribute>
        <xs:attribute name="Quality" type="enumQualityStatus">
            <xs:annotation>
                <xs:documentation>Quality of data</xs:documentation>
            </xs:annotation>
        </xs:attribute>
        <xs:anyAttribute namespace="##other" processContents="lax"/>
```

```xml
</xs:complexType>
<xs:complexType name="Count">
     <xs:annotation>
          <xs:documentation>Count rate</xs:documentation>
     </xs:annotation>
     <xs:simpleContent>
          <xs:extension base="doubleList">
               <xs:attribute name="Units" type="enumCountRateUnits" use="required">
                    <xs:annotation>
                         <xs:documentation>Units of count rate</xs:documentation>
                    </xs:annotation>
               </xs:attribute>
               <xs:anyAttribute namespace="##other" processContents="lax"/>
          </xs:extension>
     </xs:simpleContent>
</xs:complexType>
<xs:complexType name="Dose">
     <xs:annotation>
          <xs:documentation>dose rate</xs:documentation>
     </xs:annotation>
     <xs:simpleContent>
          <xs:extension base="doubleList">
               <xs:attribute name="Units" type="enumDoseUnits" use="required">
                    <xs:annotation>
                         <xs:documentation>Units of dose</xs:documentation>
                    </xs:annotation>
               </xs:attribute>
               <xs:anyAttribute namespace="##other" processContents="lax"/>
          </xs:extension>
     </xs:simpleContent>
</xs:complexType>
<xs:complexType name="AbsorbedDose">
     <xs:annotation>
          <xs:documentation>Absorbed dose rate</xs:documentation>
     </xs:annotation>
     <xs:simpleContent>
          <xs:extension base="doubleList">
               <xs:attribute name="Units" type="enumAbsorbedDoseUnits" use="required">
                    <xs:annotation>
                         <xs:documentation>Units of absorbed dose</xs:documentation>
                    </xs:annotation>
               </xs:attribute>
               <xs:anyAttribute namespace="##other" processContents="lax"/>
          </xs:extension>
     </xs:simpleContent>
</xs:complexType>
<xs:complexType name="Exposure">
```

```
    <xs:annotation>
        <xs:documentation>Exposure rate</xs:documentation>
    </xs:annotation>
    <xs:simpleContent>
        <xs:extension base="doubleList">
            <xs:attribute name="Units" type="enumExposureUnits" use="required">
                <xs:annotation>
                    <xs:documentation>Units of exposure</xs:documentation>
                </xs:annotation>
            </xs:attribute>
            <xs:anyAttribute namespace="##other" processContents="lax"/>
        </xs:extension>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="InstrumentInformation">
    <xs:annotation>
        <xs:documentation>Description of the instrument</xs:documentation>
    </xs:annotation>
    <xs:sequence>
        <xs:element ref="Remark" minOccurs="0"/>
        <xs:element name="InstrumentType" type="enumInstrumentType" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Instrument type (e.g., spectrometer, personal radiation detector, ...)</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="Manufacturer" type="xs:string" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Instrument manufacturer</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="InstrumentModel" type="xs:string" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Instrument model</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="InstrumentVersion" type="xs:string" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Instrument version</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="InstrumentID" type="xs:string" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Instrument identification (e.g., serial number)</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="ProbeType" type="xs:string" minOccurs="0">
            <xs:annotation>
```

```
                    <xs:documentation>Description of intrument's probe (i.e., detector)</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:element name="InstrumentMode" type="enumInstrumentMode" minOccurs="0">
                <xs:annotation>
                    <xs:documentation>Instrument mode (measure, calibrate, test, ...)</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:element name="QualityControl" type="QualityControl" minOccurs="0">
                <xs:annotation>
                    <xs:documentation>Instrument quality control information</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
        </xs:sequence>
        <xs:anyAttribute namespace="##other" processContents="lax"/>
    </xs:complexType>
    <xs:complexType name="QualityControl">
        <xs:annotation>
            <xs:documentation>Quality control information</xs:documentation>
        </xs:annotation>
        <xs:sequence>
            <xs:element ref="Remark" minOccurs="0"/>
            <xs:element name="InspectionDate" type="xs:dateTime" minOccurs="0">
                <xs:annotation>
                    <xs:documentation>Date of most recent instrument inspection</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:element name="InService" type="xs:boolean" minOccurs="0">
                <xs:annotation>
                    <xs:documentation>Is the instrument in service?</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
        </xs:sequence>
        <xs:anyAttribute namespace="##other" processContents="lax"/>
    </xs:complexType>
    <xs:complexType name="MeasuredItemInformation">
        <xs:annotation>
            <xs:documentation>Description of measured item and where the measurement was done</xs:documentation>
        </xs:annotation>
        <xs:sequence>
            <xs:element ref="Remark" minOccurs="0"/>
            <xs:element name="ItemDescription" type="xs:string" minOccurs="0">
                <xs:annotation>
                    <xs:documentation>Description of measured item</xs:documentation>
                </xs:annotation>
```

```xml
                </xs:element>
                <xs:element name="ItemQuantity" type="ItemQuantity" minOccurs="0">
                    <xs:annotation>
                        <xs:documentation>Quantity or size of item and the uncertainty in that value</xs:documentation>
                    </xs:annotation>
                </xs:element>
                <xs:element name="MeasurementLocation" type="MeasurementLocation" minOccurs="0">
                    <xs:annotation>
                        <xs:documentation>Location of the measurement</xs:documentation>
                    </xs:annotation>
                </xs:element>
                <xs:element name="ItemReferenceDate" type="xs:dateTime" minOccurs="0">
                    <xs:annotation>
                        <xs:documentation>Reference date for activity calculations (i.e., activities decay-corrected to this
date)</xs:documentation>
                    </xs:annotation>
                </xs:element>
                <xs:element name="MultimediaData" type="MultimediaData" minOccurs="0">
                    <xs:annotation>
                        <xs:documentation>An image or other visual/audio information relating to the item or measurement</xs:documentation>
                    </xs:annotation>
                </xs:element>
                <xs:element name="MeasurementGeometryDescription" type="xs:string" minOccurs="0">
                    <xs:annotation>
                        <xs:documentation>Description of the measurement geometry</xs:documentation>
                    </xs:annotation>
                </xs:element>
                <xs:element name="ItemToDetectorDistance" type="ItemToDetectorDistance" minOccurs="0">
                    <xs:annotation>
                        <xs:documentation>Effective item-to-detector distance</xs:documentation>
                    </xs:annotation>
                </xs:element>
                <xs:element name="MeasurementOperator" type="xs:string" minOccurs="0">
                    <xs:annotation>
                        <xs:documentation>Identifies the instrument's operator</xs:documentation>
                    </xs:annotation>
                </xs:element>
                <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
            </xs:sequence>
            <xs:anyAttribute namespace="##other" processContents="lax"/>
        </xs:complexType>
        <xs:complexType name="ItemToDetectorDistance">
            <xs:annotation>
                <xs:documentation>Effective item-to-detector distance</xs:documentation>
            </xs:annotation>
            <xs:simpleContent>
                <xs:extension base="xs:double">
```

```
                <xs:attribute name="Units" type="enumDistanceUnits" use="required">
                    <xs:annotation>
                        <xs:documentation>Units of the item-to-detector distance</xs:documentation>
                    </xs:annotation>
                </xs:attribute>
                <xs:anyAttribute namespace="##other" processContents="lax"/>
            </xs:extension>
        </xs:simpleContent>
    </xs:complexType>
    <xs:complexType name="ItemQuantity">
        <xs:annotation>
            <xs:documentation>Quantity or size of item and the uncertainty in that value</xs:documentation>
        </xs:annotation>
        <xs:simpleContent>
            <xs:extension base="doubleUnc">
                <xs:attribute name="Units" type="xs:string" use="required">
                    <xs:annotation>
                        <xs:documentation>Units of "quantity"</xs:documentation>
                    </xs:annotation>
                </xs:attribute>
                <xs:anyAttribute namespace="##other" processContents="lax"/>
            </xs:extension>
        </xs:simpleContent>
    </xs:complexType>
    <xs:complexType name="MeasurementLocation">
        <xs:annotation>
            <xs:documentation>The physical location where the measurement was performed</xs:documentation>
        </xs:annotation>
        <xs:sequence>
            <xs:element ref="Remark" minOccurs="0"/>
            <xs:element name="MeasurementLocationName" type="xs:string" minOccurs="0">
                <xs:annotation>
                    <xs:documentation>Name or description(e.g., address) of the measurement location</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:element name="Coordinates" type="Coordinates" minOccurs="0" maxOccurs="unbounded">
                <xs:annotation>
                    <xs:documentation>Geographical coordinates (latitude, longitude, optional elevation)</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
        </xs:sequence>
        <xs:anyAttribute namespace="##other" processContents="lax"/>
    </xs:complexType>
    <xs:complexType name="Coordinates">
        <xs:annotation>
            <xs:documentation>Geographical coordinates (latitude, longitude, optional elevation)</xs:documentation>
```

```xml
    </xs:annotation>
    <xs:simpleContent>
        <xs:extension base="coordinateList">
            <xs:attribute name="Datum" type="xs:positiveInteger">
                <xs:annotation>
                    <xs:documentation>EPSG map datum reference identification number (see www.epsg.org)</xs:documentation>
                </xs:annotation>
            </xs:attribute>
            <xs:attribute name="Time" type="xs:dateTime">
                <xs:annotation>
                    <xs:documentation>Date/time of coordinates measurement</xs:documentation>
                </xs:annotation>
            </xs:attribute>
            <xs:anyAttribute namespace="##other" processContents="lax"/>
        </xs:extension>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="MultimediaData">
    <xs:annotation>
        <xs:documentation>Multimedia (image, sound, etc.) data</xs:documentation>
    </xs:annotation>
    <xs:simpleContent>
        <xs:extension base="xs:string">
            <xs:attribute name="DataMIMEType" type="xs:string" use="required">
                <xs:annotation>
                    <xs:documentation>Format of multimedia data</xs:documentation>
                </xs:annotation>
            </xs:attribute>
            <xs:attribute name="EncodingMIMEType" type="xs:string" use="required">
                <xs:annotation>
                    <xs:documentation>Multimedia data encoding type</xs:documentation>
                </xs:annotation>
            </xs:attribute>
            <xs:attribute name="Remark" type="xs:string">
                <xs:annotation>
                    <xs:documentation>Remarks describing the multimedia data</xs:documentation>
                </xs:annotation>
            </xs:attribute>
            <xs:attribute name="SequenceNumber" type="xs:positiveInteger">
                <xs:annotation>
                    <xs:documentation>Multimedia data sequence number</xs:documentation>
                </xs:annotation>
            </xs:attribute>
            <xs:attribute name="Time" type="xs:dateTime">
                <xs:annotation>
                    <xs:documentation>Date/time of multimedia data collection</xs:documentation>
                </xs:annotation>
```

```
            </xs:attribute>
            <xs:attribute name="URI" type="xs:anyURI">
                <xs:annotation>
                    <xs:documentation>URI of multimedia data if not present as element contents</xs:documentation>
                </xs:annotation>
            </xs:attribute>
            <xs:anyAttribute namespace="##other" processContents="lax"/>
        </xs:extension>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="NuclideAnalysis">
    <xs:annotation>
        <xs:documentation>Results of nuclide analysis</xs:documentation>
    </xs:annotation>
    <xs:sequence>
        <xs:element ref="Remark" minOccurs="0"/>
        <xs:element name="Nuclide" type="Nuclide" minOccurs="0" maxOccurs="unbounded">
            <xs:annotation>
                <xs:documentation>Individual nuclide results</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
    </xs:sequence>
    <xs:attribute name="ActivityUnits" type="enumActivityUnits" use="required">
        <xs:annotation>
            <xs:documentation>Activity units used</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:attribute name="AlgorithmDescription" type="xs:string">
        <xs:annotation>
            <xs:documentation>Name/description of nuclide analysis algorithm</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:attribute name="AlgorithmVersion" type="xs:string">
        <xs:annotation>
            <xs:documentation>Name/version of nuclide analysis algorithm</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:anyAttribute namespace="##other" processContents="lax"/>
</xs:complexType>
<xs:complexType name="Nuclide">
    <xs:annotation>
        <xs:documentation>individual nuclide</xs:documentation>
    </xs:annotation>
    <xs:sequence>
        <xs:element ref="Remark" minOccurs="0"/>
        <xs:element name="NuclideName" type="xs:string">
```

```
            <xs:annotation>
                <xs:documentation>Nuclide name (e.g., Co-60)</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="NuclideType" type="xs:string">
            <xs:annotation>
                <xs:documentation>Description of the type of the nuclide (e.g., Industrial, Medical, SNM, ...)</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="NuclideActivity" type="doubleUnc" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Nuclide activity and its uncertainty</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="NuclideIDConfidenceIndication" type="xs:double" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Confidence in nuclide identification/presence</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="NuclideIDConfidenceDescription" type="xs:string" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Description of confidence in nuclide identification/presence</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##other" processContents="lax"/>
</xs:complexType>
<xs:complexType name="DetectorData">
    <xs:annotation>
        <xs:documentation>Data measured by gross count or spectroscopic portal monitor</xs:documentation>
    </xs:annotation>
    <xs:sequence>
        <xs:element ref="Remark" minOccurs="0"/>
        <xs:element name="StartTime" type="xs:dateTime" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Date/time of first sample measurement</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="SampleRealTime" type="xs:duration">
            <xs:annotation>
                <xs:documentation>Duration of each sample measurement (i.e., interval at which samples are taken)</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="Occupied" type="booleanList" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Was the RPM occupied?</xs:documentation>
```

```
            </xs:annotation>
        </xs:element>
        <xs:element name="Speed" type="Speed" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Speed of RPM occupant (vehicle, train, etc.)</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="AlarmSummary" type="xs:boolean" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Did the instrument alarm (summary)?</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="AlarmDescription" type="xs:string" minOccurs="0" maxOccurs="unbounded">
            <xs:annotation>
                <xs:documentation>Description of the alarm, if any</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="DetectorMeasurement" type="DetectorMeasurement" minOccurs="1" maxOccurs="unbounded">
            <xs:annotation>
                <xs:documentation>RPM measurements from one detector</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##other" processContents="lax"/>
</xs:complexType>
<xs:complexType name="Speed">
    <xs:annotation>
        <xs:documentation>Speed of vehicle (can be the average, an entrance/exit speed pair, or per sample)</xs:documentation>
    </xs:annotation>
    <xs:simpleContent>
        <xs:extension base="doubleList">
            <xs:attribute name="Units" type="enumSpeedUnits" use="required">
                <xs:annotation>
                    <xs:documentation>Units of speed</xs:documentation>
                </xs:annotation>
            </xs:attribute>
            <xs:anyAttribute namespace="##other" processContents="lax"/>
        </xs:extension>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="DetectorMeasurement">
    <xs:annotation>
        <xs:documentation>RPM measurements from one detector</xs:documentation>
    </xs:annotation>
    <xs:sequence>
        <xs:element ref="Remark" minOccurs="0"/>
```

```
            <xs:element name="GrossCountMeasurement" type="GrossCountMeasurement" minOccurs="0" maxOccurs="unbounded">
                <xs:annotation>
                    <xs:documentation>Gross count portal monitor measurements</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:element name="SpectrumMeasurement" type="SpectrumMeasurement" minOccurs="0">
                <xs:annotation>
                    <xs:documentation>Spectroscopic portal monitor measurements</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
        </xs:sequence>
        <xs:attribute name="Detector" type="xs:string" use="required">
            <xs:annotation>
                <xs:documentation>Detector identification/description</xs:documentation>
            </xs:annotation>
        </xs:attribute>
        <xs:attribute name="DetectorType" type="enumGrossCountDetectorType" use="required">
            <xs:annotation>
                <xs:documentation>detector type</xs:documentation>
            </xs:annotation>
        </xs:attribute>
        <xs:anyAttribute namespace="##other" processContents="lax"/>
    </xs:complexType>
    <xs:complexType name="GrossCountMeasurement">
        <xs:annotation>
            <xs:documentation>Gross count portal monitor measurements</xs:documentation>
        </xs:annotation>
        <xs:sequence>
            <xs:element ref="Remark" minOccurs="0"/>
            <xs:element name="SampleLiveTime" type="xs:duration" minOccurs="0">
                <xs:annotation>
                    <xs:documentation>Effective duration (i.e., live time) of each sample measurement</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:element name="Alarmed" type="booleanList" minOccurs="0">
                <xs:annotation>
                    <xs:documentation>Did the detector alarm (one value per sample)?</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:element name="GrossCounts" type="nonNegativeIntegerList">
                <xs:annotation>
                    <xs:documentation>Gross count data, one value per sample</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:element name="BackgroundCounts" type="doubleList">
                <xs:annotation>
```

```
                        <xs:documentation>Background count data; can be one value for all samples, or a unique value for each
sample</xs:documentation>
                    </xs:annotation>
                </xs:element>
                <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
            </xs:sequence>
            <xs:attribute name="WindowStart" type="xs:double">
                <xs:annotation>
                    <xs:documentation>Gamma detector window start energy</xs:documentation>
                </xs:annotation>
            </xs:attribute>
            <xs:attribute name="WindowEnd" type="xs:double">
                <xs:annotation>
                    <xs:documentation>Gamma detector window end energy</xs:documentation>
                </xs:annotation>
            </xs:attribute>
            <xs:attribute name="EnergyUnits" type="enumEnergyUnits">
                <xs:annotation>
                    <xs:documentation>Energy units</xs:documentation>
                </xs:annotation>
            </xs:attribute>
            <xs:attribute name="Quality" type="enumQualityStatus">
                <xs:annotation>
                    <xs:documentation>Data quality status</xs:documentation>
                </xs:annotation>
            </xs:attribute>
            <xs:anyAttribute namespace="##other" processContents="lax"/>
        </xs:complexType>
        <xs:complexType name="SpectrumMeasurement">
            <xs:annotation>
                <xs:documentation>Spectroscopic portal monitor measurements</xs:documentation>
            </xs:annotation>
            <xs:sequence>
                <xs:element ref="Remark" minOccurs="0"/>
                <xs:element name="SpectrumAvailable" type="booleanList">
                    <xs:annotation>
                        <xs:documentation>Indicates which samples have spectra available</xs:documentation>
                    </xs:annotation>
                </xs:element>
                <xs:element name="Alarmed" type="booleanList" minOccurs="0">
                    <xs:annotation>
                        <xs:documentation>Did the RPM alarm (one value for each sample)?</xs:documentation>
                    </xs:annotation>
                </xs:element>
                <xs:element name="Spectrum" type="Spectrum" minOccurs="0" maxOccurs="unbounded">
                    <xs:annotation>
                        <xs:documentation>Spectral data</xs:documentation>
```

```
            </xs:annotation>
        </xs:element>
        <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##other" processContents="lax"/>
</xs:complexType>
<xs:complexType name="Spectrum">
    <xs:annotation>
        <xs:documentation>Spectral data</xs:documentation>
    </xs:annotation>
    <xs:sequence>
        <xs:element ref="Remark" minOccurs="0"/>
        <xs:element name="StartTime" type="xs:dateTime" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Date/time spectrum data collection was initiated</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="RealTime" type="xs:duration" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Spectrum measurement real (clock) time</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="LiveTime" type="xs:duration" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Spectrum measurement live (true) time</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="DwellDuration" type="xs:duration" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Dwell time per sweep (used only for an MCS spectrum)</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="ElapsedSweeps" type="xs:nonNegativeInteger" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Number of sweeps (used only for an MCS spectrum)</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="SourceType" type="enumSourceType" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Type of spectrum measurement (item measurement, background, calibration...)</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="DetectorType" type="xs:string" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Description of the type of detector</xs:documentation>
            </xs:annotation>
        </xs:element>
```

```
            <xs:element name="Calibration" type="Calibration" minOccurs="0" maxOccurs="unbounded">
                <xs:annotation>
                    <xs:documentation>Calibration data</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:element name="ChannelData" type="ChannelData" maxOccurs="unbounded">
                <xs:annotation>
                    <xs:documentation>The spectrum: counts vs. channel for the entire spectrum or a region of
interest</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
        </xs:sequence>
        <xs:attribute name="Type" type="enumSpectrumType">
            <xs:annotation>
                <xs:documentation>Spectrum type: PHA or MCS</xs:documentation>
            </xs:annotation>
        </xs:attribute>
        <xs:attribute name="Detector" type="xs:string">
            <xs:annotation>
                <xs:documentation>Identification/description of the detector that collected the spectrum</xs:documentation>
            </xs:annotation>
        </xs:attribute>
        <xs:attribute name="Quality" type="enumQualityStatus">
            <xs:annotation>
                <xs:documentation>Quality of data</xs:documentation>
            </xs:annotation>
        </xs:attribute>
        <xs:attribute name="ID" type="xs:ID">
            <xs:annotation>
                <xs:documentation>Spectrum element identifier</xs:documentation>
            </xs:annotation>
        </xs:attribute>
        <xs:attribute name="CalibrationIDs" type="xs:IDREFS">
            <xs:annotation>
                <xs:documentation>Identifies calibrations that apply to this spectrum</xs:documentation>
            </xs:annotation>
        </xs:attribute>
        <xs:attribute name="BackgroundSpectrumID" type="xs:IDREF">
            <xs:annotation>
                <xs:documentation>Identifies the background spectrum that applies to this spectrum</xs:documentation>
            </xs:annotation>
        </xs:attribute>
        <xs:attribute name="CalibrationSpectrumID" type="xs:IDREF">
            <xs:annotation>
                <xs:documentation>Identifies the calibration spectrum that applies (or is to be applied) to this
spectrum</xs:documentation>
```

```
            </xs:annotation>
        </xs:attribute>
        <xs:attribute name="SampleNumber" type="xs:positiveInteger">
            <xs:annotation>
                <xs:documentation>The sample number (starting from 1) of this spectrum (used only when the spectrum is contained within
a SpectrumMeasurement element)</xs:documentation>
            </xs:annotation>
        </xs:attribute>
        <xs:anyAttribute namespace="##other" processContents="lax"/>
    </xs:complexType>
    <xs:complexType name="ChannelData">
        <xs:annotation>
            <xs:documentation>The spectrum: counts vs. channel for the entire spectrum or a region of interest</xs:documentation>
        </xs:annotation>
        <xs:simpleContent>
            <xs:extension base="doubleList">
                <xs:attribute name="Start" type="xs:positiveInteger">
                    <xs:annotation>
                        <xs:documentation>The channel number (one-based) of the first value in this element</xs:documentation>
                    </xs:annotation>
                </xs:attribute>
                <xs:attribute name="Compression" type="enumSpectrumCompressionType">
                    <xs:annotation>
                        <xs:documentation>The algorithm used to compress the channel data</xs:documentation>
                    </xs:annotation>
                </xs:attribute>
                <xs:anyAttribute namespace="##other" processContents="lax"/>
            </xs:extension>
        </xs:simpleContent>
    </xs:complexType>
    <xs:complexType name="Calibration">
        <xs:annotation>
            <xs:documentation>Calibration data</xs:documentation>
        </xs:annotation>
        <xs:sequence>
            <xs:element ref="Remark" minOccurs="0"/>
            <xs:element name="CalibrationCreationDate" type="xs:dateTime" minOccurs="0">
                <xs:annotation>
                    <xs:documentation>Date/time of calibration's creation</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:element name="CalibrationMeasurementUUID" type="xs:string" minOccurs="0" maxOccurs="unbounded">
                <xs:annotation>
                    <xs:documentation>Unique identifier of the measurement(s) used to develop this calibration</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:element name="Equation" type="Equation" minOccurs="0" maxOccurs="unbounded">
```

```
            <xs:annotation>
                <xs:documentation>The equation governing this calibration</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="ArrayXY" type="ArrayXY" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Calibration data as ordinal pairs</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
    </xs:sequence>
    <xs:attribute name="Type" type="enumCalibrationType" use="required">
        <xs:annotation>
            <xs:documentation>Calibration type (e.g., Energy, FWHM, ...)</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:attribute name="EnergyUnits" type="enumEnergyUnits">
        <xs:annotation>
            <xs:documentation>Energy units</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:attribute name="FWHMUnits" type="enumFWHMUnits">
        <xs:annotation>
            <xs:documentation>Detector resolution units</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:attribute name="CountRateUnits" type="enumCountRateUnits">
        <xs:annotation>
            <xs:documentation>Count rate units</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:attribute name="DoseUnits" type="enumDoseUnits">
        <xs:annotation>
            <xs:documentation>Dose units</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:attribute name="AbsorbedDoseUnits" type="enumAbsorbedDoseUnits">
        <xs:annotation>
            <xs:documentation>Absorbed dose units</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:attribute name="ExposureUnits" type="enumExposureUnits">
        <xs:annotation>
            <xs:documentation>Exposure units</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:attribute name="ID" type="xs:ID"/>
```

```
    <xs:anyAttribute namespace="##other" processContents="lax"/>
</xs:complexType>
<xs:complexType name="Equation">
    <xs:annotation>
        <xs:documentation>Encapsulates an equation and its coefficients</xs:documentation>
    </xs:annotation>
    <xs:sequence>
        <xs:element ref="Remark" minOccurs="0"/>
        <xs:element name="Coefficients" type="Coefficients" maxOccurs="unbounded">
            <xs:annotation>
                <xs:documentation>The coefficients of the equation</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="CovarianceMatrix" type="doubleList" minOccurs="0">
            <xs:annotation>
                <xs:documentation>The covariance matrix for the equation coefficients</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
    </xs:sequence>
    <xs:attribute name="Model" type="enumEquationType" use="required">
        <xs:annotation>
            <xs:documentation>Type of equation (polynomial, etc.)</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:attribute name="Form" type="xs:string">
        <xs:annotation>
            <xs:documentation>Description of the form of the equation</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:attribute name="LowerLimit" type="xs:double">
        <xs:annotation>
            <xs:documentation>Lower bound of validity of the abscissa</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:attribute name="UpperLimit" type="xs:double">
        <xs:annotation>
            <xs:documentation>Upper bound of validity of the abscissa</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:anyAttribute namespace="##other" processContents="lax"/>
</xs:complexType>
<xs:complexType name="Coefficients">
    <xs:annotation>
        <xs:documentation>Equation coefficients</xs:documentation>
    </xs:annotation>
    <xs:simpleContent>
```

```
        <xs:extension base="doubleList">
            <xs:attribute name="Subequation" type="xs:positiveInteger">
                <xs:annotation>
                    <xs:documentation>Index of the subequation to which this set of coefficients applies</xs:documentation>
                </xs:annotation>
            </xs:attribute>
            <xs:anyAttribute namespace="##other" processContents="lax"/>
        </xs:extension>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="ArrayXY">
    <xs:annotation>
        <xs:documentation>Array of ordinal pairs</xs:documentation>
    </xs:annotation>
    <xs:sequence>
        <xs:element ref="Remark" minOccurs="0"/>
        <xs:element name="PointXY" type="PointXY" minOccurs="1" maxOccurs="unbounded">
            <xs:annotation>
                <xs:documentation>An (abcsissa, ordinate) pair</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
    </xs:sequence>
    <xs:attribute name="X" type="xs:string">
        <xs:annotation>
            <xs:documentation>Abscissa data description</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:attribute name="Y" type="xs:string">
        <xs:annotation>
            <xs:documentation>Ordinate data description</xs:documentation>
        </xs:annotation>
    </xs:attribute>
    <xs:anyAttribute namespace="##other" processContents="lax"/>
</xs:complexType>
<xs:complexType name="PointXY">
    <xs:annotation>
        <xs:documentation>An (abscissa, ordinate) pair</xs:documentation>
    </xs:annotation>
    <xs:sequence>
        <xs:element ref="Remark" minOccurs="0"/>
        <xs:element name="X" type="doubleUnc">
            <xs:annotation>
                <xs:documentation>Abscissa value</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="Y" type="doubleUnc">
```

```
                <xs:annotation>
                    <xs:documentation>Ordinate value</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
        </xs:sequence>
        <xs:anyAttribute namespace="##other" processContents="lax"/>
    </xs:complexType>
    <xs:complexType name="AnalysisResults">
        <xs:annotation>
            <xs:documentation>Results of data analysis of a measurement</xs:documentation>
        </xs:annotation>
        <xs:sequence>
            <xs:element ref="Remark" minOccurs="0"/>
            <xs:element name="ThreatDescription" type="xs:string" minOccurs="0">
                <xs:annotation>
                    <xs:documentation>Overall conclusion of the data analysis</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:element name="NuclideAnalysis" type="NuclideAnalysis" minOccurs="0">
                <xs:annotation>
                    <xs:documentation>Results of nuclide analysis</xs:documentation>
                </xs:annotation>
            </xs:element>
            <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded" processContents="lax"/>
        </xs:sequence>
        <xs:anyAttribute namespace="##other" processContents="lax"/>
    </xs:complexType>
    <xs:simpleType name="doubleUnc">
        <xs:annotation>
            <xs:documentation>Double value with uncertainty: first entry is value, second entry is uncertainty (absolute error, one
standard deviation)</xs:documentation>
        </xs:annotation>
        <xs:restriction base="doubleList">
            <xs:length value="2"/>
        </xs:restriction>
    </xs:simpleType>
    <xs:simpleType name="durationUnc">
        <xs:annotation>
            <xs:documentation>Duration (time) value with uncertainty: first entry is value, second entry is uncertainty (absolute error,
one standard deviation)</xs:documentation>
        </xs:annotation>
        <xs:restriction base="durationList">
            <xs:length value="2"/>
        </xs:restriction>
    </xs:simpleType>
    <xs:simpleType name="coordinateList">
```

```
        <xs:annotation>
            <xs:documentation>Geographic coordinates: first two entries are latitude and longitude; third entry (optional) is elevation
in meters relative to ellipsoid</xs:documentation>
        </xs:annotation>
        <xs:restriction base="decimalList">
            <xs:minLength value="2"/>
            <xs:maxLength value="3"/>
        </xs:restriction>
    </xs:simpleType>
    <xs:simpleType name="booleanList">
        <xs:annotation>
            <xs:documentation>List of booleans</xs:documentation>
        </xs:annotation>
        <xs:list itemType="xs:boolean"/>
    </xs:simpleType>
    <xs:simpleType name="decimalList">
        <xs:annotation>
            <xs:documentation>List of decimals</xs:documentation>
        </xs:annotation>
        <xs:list itemType="xs:decimal"/>
    </xs:simpleType>
    <xs:simpleType name="doubleList">
        <xs:annotation>
            <xs:documentation>List of doubles</xs:documentation>
        </xs:annotation>
        <xs:list itemType="xs:double"/>
    </xs:simpleType>
    <xs:simpleType name="durationList">
        <xs:annotation>
            <xs:documentation>List of durations</xs:documentation>
        </xs:annotation>
        <xs:list itemType="xs:duration"/>
    </xs:simpleType>
    <xs:simpleType name="nonNegativeIntegerList">
        <xs:annotation>
            <xs:documentation>List of nonNegativeIntegers</xs:documentation>
        </xs:annotation>
        <xs:list itemType="xs:nonNegativeInteger"/>
    </xs:simpleType>
    <xs:simpleType name="enumEnergyUnits">
        <xs:annotation>
            <xs:documentation>Energy units</xs:documentation>
        </xs:annotation>
        <xs:restriction base="xs:string">
            <xs:enumeration value="eV"/>
            <xs:enumeration value="keV"/>
            <xs:enumeration value="MeV"/>
```

```
        </xs:restriction>
    </xs:simpleType>
    <xs:simpleType name="enumActivityUnits">
        <xs:annotation>
            <xs:documentation>Activity units</xs:documentation>
        </xs:annotation>
        <xs:restriction base="xs:string">
            <xs:enumeration value="mBq"/>
            <xs:enumeration value="Bq"/>
            <xs:enumeration value="kBq"/>
            <xs:enumeration value="MBq"/>
            <xs:enumeration value="nCi"/>
            <xs:enumeration value="uCi"/>
            <xs:enumeration value="mCi"/>
            <xs:enumeration value="Ci"/>
            <xs:enumeration value="kCi"/>
            <xs:enumeration value="MCi"/>
        </xs:restriction>
    </xs:simpleType>
    <xs:simpleType name="enumFWHMUnits">
        <xs:annotation>
            <xs:documentation>FWHM (Full Width at Half-Maximum) (i.e., resolution) units</xs:documentation>
        </xs:annotation>
        <xs:restriction base="xs:string">
            <xs:enumeration value="Energy"/>
            <xs:enumeration value="Channels"/>
        </xs:restriction>
    </xs:simpleType>
    <xs:simpleType name="enumCountRateUnits">
        <xs:annotation>
            <xs:documentation>Count rate units</xs:documentation>
        </xs:annotation>
        <xs:restriction base="xs:string">
            <xs:enumeration value="CPS"/>
            <xs:enumeration value="CPM"/>
        </xs:restriction>
    </xs:simpleType>
    <xs:simpleType name="enumDoseUnits">
        <xs:annotation>
            <xs:documentation>Dose units</xs:documentation>
        </xs:annotation>
        <xs:restriction base="xs:string">
            <xs:enumeration value="urem"/>
            <xs:enumeration value="mrem"/>
            <xs:enumeration value="rem"/>
            <xs:enumeration value="uSv"/>
            <xs:enumeration value="mSv"/>
```

```
        <xs:enumeration value="Sv"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="enumAbsorbedDoseUnits">
    <xs:annotation>
        <xs:documentation>Absorbed dose units</xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:string">
        <xs:enumeration value="uGy"/>
        <xs:enumeration value="mGy"/>
        <xs:enumeration value="Gy"/>
        <xs:enumeration value="rad"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="enumExposureUnits">
    <xs:annotation>
        <xs:documentation>Exposure units</xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:string">
        <xs:enumeration value="C/kg"/>
        <xs:enumeration value="uR"/>
        <xs:enumeration value="mR"/>
        <xs:enumeration value="R"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="enumSpeedUnits">
    <xs:annotation>
        <xs:documentation>Speed units</xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:string">
        <xs:enumeration value="kph"/>
        <xs:enumeration value="m/s"/>
        <xs:enumeration value="mph"/>
        <xs:enumeration value="fps"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="enumDistanceUnits">
    <xs:annotation>
        <xs:documentation>Distance units</xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:string">
        <xs:enumeration value="mm"/>
        <xs:enumeration value="cm"/>
        <xs:enumeration value="m"/>
        <xs:enumeration value="km"/>
        <xs:enumeration value="in"/>
        <xs:enumeration value="ft"/>
```

```
        <xs:enumeration value="mi"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="enumGrossCountDetectorType">
    <xs:annotation>
        <xs:documentation>Gross counting detector type</xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:string">
        <xs:enumeration value="Alpha"/>
        <xs:enumeration value="Beta"/>
        <xs:enumeration value="Gamma"/>
        <xs:enumeration value="Neutron"/>
        <xs:enumeration value="Other"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="enumEquationType">
    <xs:annotation>
        <xs:documentation>Equation type</xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:string">
        <xs:enumeration value="Polynomial"/>
        <xs:enumeration value="Pade"/>
        <xs:enumeration value="Exponential"/>
        <xs:enumeration value="PolyLogarithmic"/>
        <xs:enumeration value="FullRangeFraction"/>
        <xs:enumeration value="Other"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="enumCalibrationType">
    <xs:annotation>
        <xs:documentation>Calibration type</xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:string">
        <xs:enumeration value="Energy"/>
        <xs:enumeration value="AbsoluteEfficiency"/>
        <xs:enumeration value="IntrinsicFullEnergyPeakEfficiency"/>
        <xs:enumeration value="IntrinsicTotalEfficiency"/>
        <xs:enumeration value="FWHM"/>
        <xs:enumeration value="CountsToDose"/>
        <xs:enumeration value="CountsToAbsorbedDose"/>
        <xs:enumeration value="CountsToExposure"/>
        <xs:enumeration value="Other"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="enumInstrumentType">
    <xs:annotation>
        <xs:documentation>Instrument type</xs:documentation>
```

```
    </xs:annotation>
    <xs:restriction base="xs:string">
        <xs:enumeration value="PortalMonitor"/>
        <xs:enumeration value="SpecPortal"/>
        <xs:enumeration value="RadionuclideIdentifier"/>
        <xs:enumeration value="PersonalRadiationDetector"/>
        <xs:enumeration value="SurveyMeter"/>
        <xs:enumeration value="Spectrometer"/>
        <xs:enumeration value="Other"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="enumInstrumentMode">
    <xs:annotation>
        <xs:documentation>Instrument mode</xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:string">
        <xs:enumeration value="Measure"/>
        <xs:enumeration value="Calibrate"/>
        <xs:enumeration value="Test"/>
        <xs:enumeration value="Other"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="enumQualityStatus">
    <xs:annotation>
        <xs:documentation>Data quality</xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:string">
        <xs:enumeration value="Good"/>
        <xs:enumeration value="Bad"/>
        <xs:enumeration value="Suspect"/>
        <xs:enumeration value="Missing"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="enumSourceType">
    <xs:annotation>
        <xs:documentation>Measurement type</xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:string">
        <xs:enumeration value="Item"/>
        <xs:enumeration value="Background"/>
        <xs:enumeration value="Calibration"/>
        <xs:enumeration value="Other"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="enumSpectrumType">
    <xs:annotation>
        <xs:documentation>Spectrum type</xs:documentation>
```

```
            </xs:annotation>
            <xs:restriction base="xs:string">
                <xs:enumeration value="PHA"/>
                <xs:enumeration value="MCS"/>
                <xs:enumeration value="Other"/>
            </xs:restriction>
        </xs:simpleType>
        <xs:simpleType name="enumSpectrumCompressionType">
            <xs:annotation>
                <xs:documentation>The algorithm (if any) by which the spectrum has been compressed</xs:documentation>
            </xs:annotation>
            <xs:restriction base="xs:string">
                <xs:enumeration value="None"/>
                <xs:enumeration value="CountedZeroes"/>
            </xs:restriction>
        </xs:simpleType>
    </xs:schema>
```

Annex B

(informative)

Example simple spectrometer file

This is a very simple file from a 256-channel spectroscopic analyzer (MCA). Note that:

- All comments are present to annotate this example and are not required.
- The leading <? xml ?> element and namespace information present in the other examples is not present. These items are strongly recommended but are not absolutely required; the file cannot be validated without this information.
- There is some optional information in this example: all the time information (<StartTime>, <LiveTime>, and <RealTime> elements) and the energy calibration (the <Calibration> element and everything in it) could be omitted if the data was not available. These data are required if available.
- 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 file could be represented on a single line.
- All numeric values, including channel data, can be in either integer or floating point representation.
- The data were acquired beginning November 10, 2003, at 11:45:19 P.M. The real time is 60 seconds, and the live time is 59.61 seconds. If time zone information is known, it is required. For example, if the zone is Mountain Standard Time, the start time would be written as 2003-11-22T23:45:19-07:00 instead.
- The energy calibration is quadratic. Only the first two coefficients would appear for a linear calibration having an offset of -21.84 keV and a gain of 12.105214 keV/channel.

```
<N42InstrumentData>
  <Measurement>
    <Spectrum>
      <StartTime>2003-11-22T23:45:19</StartTime>
      <RealTime>PT60S</RealTime>
      <LiveTime>PT59.61S</LiveTime>
      <Calibration Type="Energy" EnergyUnits="keV">
        <Equation Model="Polynomial">
          <Coefficients>-21.84 12.105214 0.0065533164771609</Coefficients>
        </Equation>
      </Calibration>
      <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>
  </Measurement>
</N42InstrumentData>
```

Annex C

(informative)

Example radionuclide identifier file

```
<?xml version="1.0" encoding="UTF-8"?>
<N42InstrumentData xmlns="http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/2005/ANSIN4242"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/2005/ANSIN4242
http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/2005/ANSIN4242.xsd">

<!-- A sample document from a spectroscopic analyzer (aka radionuclide identifier), containing the spectrum of the measured item, the -->
<!-- background spectrum, calibration data for that spectrum, and the results of the analysis of the measured item spectrum. -->

    <Measurement UUID="54531d28-402b-11d8-af12-0002a5094c23">
        <InstrumentInformation>                               <!-- Information about the instrument; (optional) -->
            <InstrumentType>Spectrometer</InstrumentType>
            <Manufacturer>Spectrometers R Us</Manufacturer>
            <InstrumentModel>model #1</InstrumentModel>
            <InstrumentID>serial #1</InstrumentID>
        </InstrumentInformation>

        <MeasuredItemInformation>                             <!-- Info on what was measured & where the measurement was done (optional) -->
            <ItemDescription>Cal standard 1</ItemDescription>   <!-- Identification information for the "thing" -->
            <ItemQuantity Units="kg">1.0 0</ItemQuantity>       <!-- How much of the thing there is, in kg (see "Units=") -->
            <MeasurementLocation>                             <!-- Where the measurement was made -->
                <MeasurementLocationName>NYC MTA Line 7 111 Street Station</MeasurementLocationName>
                <Coordinates>40.12 10.67</Coordinates>
            </MeasurementLocation>
            <ItemReferenceDate>2004-11-03T14:36:04.3-05:00</ItemReferenceDate> <!-- The date to which activities will be decay corrected -->
        </MeasuredItemInformation>

        <Spectrum CalibrationIDs="en ef fw">                  <!-- The spectrum, and what calibrations are available for it -->
            <StartTime>2004-11-03T14:36:04.3-05:00</StartTime>  <!-- StartTime element is when acquisition started -->
            <RealTime>PT1013.4S</RealTime>                    <!-- The real (i.e., clock) time that the spectrum was acquired for -->
            <LiveTime>PT1000.46S</LiveTime>                   <!-- the live (i.e., true) time that the spectrum was acquired for -->
            <SourceType>Item</SourceType>                     <!-- SourceType indicates unknown item (vs. background vs. cal source) -->
            <ChannelData>                                     <!-- The spectrum data (256 channels) -->
                0 0 0 0 0 0 0 0 0 0 0 0 3 9 5 12 4 6 5 4 3 4 3 3 <!-- note that the formatting is purely for readability and is not required -->
                6 2 4 6 1 5 2 2 5 3 8 5 6 5 2 6 2 2 3 6 6 3 6 2
                2 8 4 2 3 4 4 3 1 4 4 3 4 4 1 2 5 5 4 7 6 4 4 3
                4 2 3 4 4 1 6 6 4 9 1 3 5 1 2 3 3 4 1 2 2 4 1 3
                2 5 3 3 3 3 3 2 2 1 4 3 3 0 0 3 1 2 1 1 4 0 1 2
                2 1 1 2 0 0 2 0 2 1 1 0 4 3 1 1 0 3 3 4 5 4 2 2
                3 4 3 4 4 4 4 1 5 5 6 7 6 4 5 4 9 6 3 8 5 9 8 7
                7 6 3 4 4 4 2 5 2 2 3 1 1 0 1 2 4 1 3 2 2 1 1 3
                3 2 0 2 0 0 1 1 2 0 1 0 2 0 2 1 2 1 1 0 1 1 2 2
                3 2 0 2 0 0 1 1 2 0 1 0 2 0 2 1 2 1 1 0 1 1 2 2
```

```
        0 2 1 1 0 1 1 0 0 2 1 1 0 1 1 0
    </ChannelData>
</Spectrum>

<Spectrum CalibrationIDs="en ef fw">                   <!-- The background spectrum (see <SourceType>) -->
    <StartTime>2004-11-03T14:00:00-05:00</StartTime>
    <RealTime>PT1013.4S</RealTime>
    <LiveTime>PT1000.46S</LiveTime>
    <SourceType>Background</SourceType>                <!-- SourceType indicates that this is a background -->
    <ChannelData>                                      <!-- The background spectrum data (256 channels) -->
        0 0 0 0 0 0 0 0 0 0 0 0 0 3 9 5 12 4 6 5 4 3 4 3 3
        6 2 4 6 1 5 2 2 5 3 8 5 6 5 2 6 2 2 3 6 6 3 6 2
        2 8 4 2 3 4 4 3 1 4 4 3 4 4 1 2 5 5 4 7 6 4 4 3
        4 2 3 4 4 1 6 6 4 9 1 3 5 1 2 3 3 4 1 2 2 4 1 3
        2 5 3 3 3 3 3 2 2 1 4 3 3 0 0 3 1 2 1 1 4 0 1 2
        2 1 1 2 0 0 2 0 2 1 1 0 4 3 1 1 0 3 3 4 5 4 2 2
        3 4 3 4 4 4 4 1 5 5 6 7 6 4 5 4 9 6 3 8 5 9 8 7
        7 6 3 4 4 4 2 5 2 2 3 1 1 0 1 2 4 1 3 2 2 1 1 3
        3 2 0 2 0 0 1 1 2 0 1 0 2 0 2 1 2 1 1 0 1 1 2 2
        3 2 0 2 0 0 1 1 2 0 1 0 2 0 2 1 2 1 1 0 1 1 2 2
        0 2 1 1 0 1 1 0 0 2 1 1 0 1 1 0
    </ChannelData>
</Spectrum>

<AnalysisResults>                                      <!-- Analysis results for this measurement -->
    <ThreatDescription>None</ThreatDescription>        <!-- Description of the instrument's overall assessment of the measurement -->
    <NuclideAnalysis ActivityUnits="Bq">               <!-- Source analysis results -->
        <Nuclide>                                      <!-- Results for Co-60 -->
            <NuclideName>Co-60</NuclideName>           <!-- Name of the nuclide -->
            <NuclideType>Industrial</NuclideType>      <!-- The type of this nuclide: Industrial, SNM, Medical, NORM, etc. -->
            <NuclideActivity>0.5 0.05</NuclideActivity>  <!-- The decay-corrected activity (in Bq; see Units) calculated for Co-60 -->
            <NuclideIDConfidenceIndication>70.0</NuclideIDConfidenceIndication>     <!-- Indication of confidence in the presence -->
                                                                                     <!-- of this nuclide: higher numbers mean it is -->
                                                                                     <!-- more likely to be really present. -->
            <NuclideIDConfidenceDescription>Medium</NuclideIDConfidenceDescription> <!-- ConfidenceIndication translated into words -->
        </Nuclide>
        <Nuclide>                                      <!-- Results for Am-241 -->
            <NuclideName>Am-241</NuclideName>
            <NuclideType>Suspicious</NuclideType>
            <NuclideActivity>100000.0 1000.0</NuclideActivity>
            <NuclideIDConfidenceIndication>98.0</NuclideIDConfidenceIndication>
            <NuclideIDConfidenceDescription>High</NuclideIDConfidenceDescription>
        </Nuclide>
        <Nuclide>                                      <!-- Results for Cs-137 -->
            <NuclideName>Cs-137</NuclideName>
            <NuclideType>Industrial</NuclideType>
            <NuclideActivity>1000000.0 10000.0</NuclideActivity>
```

```
                    <NuclideIDConfidenceIndication>99.0</NuclideIDConfidenceIndication>
                    <NuclideIDConfidenceDescription>High</NuclideIDConfidenceDescription>
                </Nuclide>
            </NuclideAnalysis>
        </AnalysisResults>
    </Measurement>

    <Calibration Type="Energy" ID="en" EnergyUnits="keV">         <!-- Energy calibration for this spectrum -->
        <Equation Model="Polynomial" Form="E = Term0 + Term1*Ch"> <!-- "Model" is the type of equation; "Form" is for documentation -->
            <Coefficients>0 0.5</Coefficients>
            <CovarianceMatrix>0 0.05 0.01</CovarianceMatrix>
        </Equation>
    </Calibration>

    <Calibration Type="AbsoluteEfficiency" EnergyUnits="keV" ID="ef">  <!-- Efficiency calibration for this spectrum -->
        <ArrayXY X="Energy" Y="Efficiency">                    <!-- This calibration is given in terms of (energy,efficiency) pairs -->
            <PointXY>
                <X>88.01 0</X>
                <Y>1.23E-02 1.23E-03</Y>
            </PointXY>
            <PointXY>
                <X>661.65 0</X>
                <Y>1.23E-02 1.23E-03</Y>
            </PointXY>
        </ArrayXY>
    </Calibration>

    <Calibration Type="FWHM" EnergyUnits="keV" ID="fw">           <!-- FWHM calibration for this spectrum -->
        <Equation Model="Polynomial" Form="FWHM = Term0 + Term1*E">
            <Coefficients>1.0 0.03</Coefficients>
        </Equation>
    </Calibration>

</N42InstrumentData>
```

Annex D

(informative)

Example gross counting portal monitor


```xml
<?xml version="1.0" encoding="UTF-8"?>

<!-- An example gross counting portal monitor data file. The monitor has two gamma and two neutron detectors; -->
<!-- the gamma detectors collect gross count data in two energy windows (100-200 and 200-1000 keV). -->
<!-- This example shows an occupancy: there are three samples during the occupancy, with two pre-occ samples and two post-occupancy samples. -->
<!-- There was no alarm. -->

<N42InstrumentData xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/2005/ANSIN4242"
xsi:schemaLocation="http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/2005/ANSIN4242
http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/2005/ANSIN4242.xsd">

<Measurement UUID="54531f3c-402b-11d8-af12-0002a5094c23">
        <InstrumentInformation>                             <!-- Information about the instrument; all of this is optional -->
            <InstrumentType>PortalMonitor</InstrumentType>
            <Manufacturer>Portals R Us</Manufacturer>
            <InstrumentModel>model #1</InstrumentModel>
            <InstrumentID>serial #1</InstrumentID>
        </InstrumentInformation>

        <MeasuredItemInformation>                           <!-- Info on what's measured (optional): here, just the measurement location. -->
            <MeasurementLocation>
                <MeasurementLocationName>DCA Cargo East</MeasurementLocationName>
                <Coordinates>40.12 10.67</Coordinates>
            </MeasurementLocation>
        </MeasuredItemInformation>

        <DetectorData>                                      <!-- DetectorData contains the occupancy data: 7 samples in all -->
            <StartTime>2004-11-03T14:36:05.5-05:00</StartTime><!-- The time when measurement was started; i.e., the time of the first sample -->
            <SampleRealTime>PT0.1S</SampleRealTime>         <!-- Integration time of each sample; i.e., interval at which samples are taken -->
            <Occupied>0 0 1 1 1 0 0</Occupied>              <!-- Occupied indicates if the monitor was occupied for each of the 7 samples -->
            <Speed Units="mph">5.0</Speed>                  <!-- The average speed of the item through the monitor (this is optional) -->

            <DetectorMeasurement DetectorType="Gamma" Detector="Left Gamma"><!-- Measurement data for the gamma detector on the left side -->
                <GrossCountMeasurement WindowStart="100" WindowEnd="200"> <!-- Count data from the left gamma detector, 100 to 200 keV -->
                    <Alarmed>0 0 0 0 0 0 0</Alarmed>                      <!-- 1 if an alarm was generated for the corresponding sample -->
                    <GrossCounts>100 110 100 98 99 102 100</GrossCounts>  <!-- The raw gross counts from the detector for each sample -->
                    <BackgroundCounts>100.5</BackgroundCounts>            <!-- The background counts value to be applied to each sample -->
                </GrossCountMeasurement>

                <GrossCountMeasurement WindowStart="200" WindowEnd="1000"><!-- Gross count data from left gamma detector, 200 to 1000 keV -->
```

```
                <Alarmed>0 0 0 0 0 0 0</Alarmed>
                <GrossCounts>100 110 100 98 99 102 100</GrossCounts>
                <BackgroundCounts>101.25</BackgroundCounts>
            </GrossCountMeasurement>
        </DetectorMeasurement>

        <DetectorMeasurement DetectorType="Gamma" Detector="Right Gamma">  <!-- Measurement data from gamma detector on the right side -->
            <GrossCountMeasurement WindowStart="100" WindowEnd="200">
                <Alarmed>0 0 0 0 0 0 0</Alarmed>
                <GrossCounts>100 110 100 98 99 102 100</GrossCounts>
                <BackgroundCounts>101.25</BackgroundCounts>
            </GrossCountMeasurement>

            <GrossCountMeasurement WindowStart="200" WindowEnd="1000">
                <Alarmed>0 0 0 0 0 0 0</Alarmed>
                <GrossCounts>100 110 100 98 99 102 100</GrossCounts>
                <BackgroundCounts>101.25</BackgroundCounts>
            </GrossCountMeasurement>

        </DetectorMeasurement>

        <DetectorMeasurement DetectorType="Neutron" Detector="Left Neutron">    <!-- Measurement data from neutron detector on left side -->
            <GrossCountMeasurement>
                <Alarmed>0 0 0 0 0 0 0</Alarmed>
                <GrossCounts>3 4 2 4 1 2 3</GrossCounts>
                <BackgroundCounts>3.4 3.6 3.5 3.5 3.5 3.5 3.5</BackgroundCounts>
            </GrossCountMeasurement>
        </DetectorMeasurement>

        <DetectorMeasurement DetectorType="Neutron" Detector="Right Neutron">   <!-- Measurement data from neutron detector on right side -->
            <GrossCountMeasurement>
                <Alarmed>0 0 0 0 0 0 0</Alarmed>
                <GrossCounts>3 4 2 4 1 2 3</GrossCounts>
                <BackgroundCounts>3.4 3.6 3.5 3.5 3.5 3.5 3.5</BackgroundCounts>
            </GrossCountMeasurement>
        </DetectorMeasurement>

    </DetectorData>
  </Measurement>
</N42InstrumentData>
```

Annex E

(informative)

Example spectroscopic portal monitor file

```xml
<?xml version="1.0" encoding="UTF-8"?>

<!-- An example spectroscopy portal monitor data document. The monitor has two gamma and two neutron detectors. Spectra are collected from the -->
<!-- gamma detectors; gross counting data is also collected from these detectors in two energy windows (0-100 and 200-1000 keV). -->
<!-- This example shows an occupancy: there are three samples during the occupancy (see the <Occupied> element), with two pre-occupancy samples -->
<!-- and two post-occupancy samples. The monitor is storing the spectra from the fourth and fifth samples (the second and third occupied samples). -->

<N42InstrumentData xmlns="http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/2005/ANSIN4242" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/2005/ANSIN4242
    http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/2005/ANSIN4242.xsd">

<Measurement UUID="54531f3c-402b-11d8-af12-0002a5094c23">
    <InstrumentInformation>                          <!-- Information about the instrument; all of this is optional -->
        <InstrumentType>SpecPortal</InstrumentType>
        <Manufacturer>Portals R Us</Manufacturer>
        <InstrumentModel>model #1</InstrumentModel>
        <InstrumentID>serial #1</InstrumentID>
    </InstrumentInformation>

    <MeasuredItemInformation>                        <!-- Info on what's measured (optional): here, just the measurement location -->
        <MeasurementLocation>
            <MeasurementLocationName>DCA Cargo East</MeasurementLocationName>
            <Coordinates>40.12 10.67</Coordinates>
        </MeasurementLocation>
    </MeasuredItemInformation>

    <DetectorData>                                   <!-- DetectorData contains the occupancy data: 7 samples in all -->
        <StartTime>2004-11-03T14:36:05.5-05:00</StartTime> <!-- Time when the measurement was started (i.e., time of the first sample) -->
        <SampleRealTime>PT0.1S</SampleRealTime>      <!-- Integration time of each sample; i.e., interval at which samples are taken -->
        <Occupied>0 0 1 1 1 0 0</Occupied>           <!-- Occupied indicates if the monitor was occupied for each of the 7 samples -->
        <Speed Units="m/s">2.2 2.3</Speed>           <!-- Entrance & exit speeds of the item as it went through the monitor (optional) -->
        <AlarmSummary>1</AlarmSummary>               <!-- Indicated that an alarm was generated during this occupancy (optional) -->
        <AlarmDescription>Speed Alarm</AlarmDescription>   <!-- What was annunciated for each alarm that occurred (optional): a speed alarm -->
        <AlarmDescription>High Co60 Activity: possible RDD</AlarmDescription> <!-- another alarm: a high level of Co60 was detected -->

        <DetectorMeasurement DetectorType="Gamma" Detector="Left Gamma"> <!-- Measurement data for the gamma detector on the left side -->

            <GrossCountMeasurement WindowStart="0" WindowEnd="100">     <!-- Gross count data from the left gamma detector, from 0 to 100 keV -->
                <Alarmed>0 0 0 0 0 0 0</Alarmed>                      <!-- Will be 1 if an alarm was generated due to the corresponding sample -->
                <GrossCounts>100 110 100 98 99 102 100</GrossCounts>  <!-- The raw gross counts from the detector for each sample -->
                <BackgroundCounts>101.25</BackgroundCounts>           <!-- The background counts value to be appled to each sample -->
            </GrossCountMeasurement>
```

```xml
<GrossCountMeasurement WindowStart="100" WindowEnd="1000">
    <Alarmed>0 0 0 0 0 0 0</Alarmed>
    <GrossCounts>100 110 100 98 99 102 100</GrossCounts>
    <BackgroundCounts>101.25</BackgroundCounts>
</GrossCountMeasurement>

<SpectrumMeasurement>
    <SpectrumAvailable>0 0 0 1 1 0 0</SpectrumAvailable>    <!-- For each sample, the list value is 0 if the spectrum was not saved, -->
                                                             <!-- or is 1 if it was. -->
    <Alarmed>0 0 0 1 0 0 0</Alarmed>                         <!-- Indicates, for each sample, if this detector alarmed.  In this -->
                                                             <!-- example, sample 4 alarmed. -->

    <Spectrum SampleNumber="4" CalibrationIDs="LeftGammaEnergy" BackgroundSpectrumID="LeftGammaBackground">
                                                             <!-- the spectrum for the fourth sample.  One calibration is specified -->
                                                             <!-- (see ID="LeftGammaEnergy" below); the background spectrum has -->
                                                             <!-- ID="LeftGammaBackground". -->
        <StartTime>2004-11-03T14:36:05.8-05:00</StartTime> <!-- Time when this spectrum measurement was started -->
        <RealTime>PT1S</RealTime>
        <LiveTime>PT0.99S</LiveTime>
        <SourceType>Item</SourceType>
        <ChannelData>                                           <!-- The spectrum data (256 channels) -->
            0 0 0 0 0 0 0 0 0 0 0 0 3 9 5 12 4 6 5 4 3 4 3 3   <!-- note that the formatting is purely for readability -->
            6 2 4 6 1 5 2 2 5 3 8 5 6 5 2 6 2 2 3 6 6 3 6 2
            2 8 4 2 3 4 4 3 1 4 4 3 4 4 1 2 5 5 4 7 6 4 4 3
            4 2 3 4 4 1 6 6 4 9 1 3 5 1 2 3 3 4 1 2 2 4 1 3
            2 5 3 3 3 3 3 2 2 1 4 3 3 0 0 3 1 2 1 1 4 0 1 2
            2 1 1 2 0 0 2 0 2 1 1 0 4 3 1 1 0 3 3 4 5 4 2 2
            3 4 3 4 4 4 4 1 5 5 6 7 6 4 5 4 9 6 3 8 5 9 8 7
            7 6 3 4 4 4 2 5 2 2 3 1 1 0 1 2 4 1 3 2 2 1 1 3
            3 2 0 2 0 0 1 1 2 0 1 0 2 0 2 1 2 1 1 0 1 1 2 2
            3 2 0 2 0 0 1 1 2 0 1 0 2 0 2 1 2 1 1 0 1 1 2 2
            0 2 1 1 0 1 1 0 0 2 1 1 0 1 1 0
        </ChannelData>
    </Spectrum>

    <Spectrum SampleNumber="5" CalibrationIDs="LeftGammaEnergy" BackgroundSpectrumID="LeftGammaBackground">
                                                             <!-- the spectrum for the fifth sample -->
        <StartTime>2004-11-03T14:36:05.9-05:00</StartTime>
        <RealTime>PT1S</RealTime>
        <LiveTime>PT0.99S</LiveTime>
        <SourceType>Item</SourceType>
        <ChannelData>                                        <!-- The spectrum data (256 channels) -->
            0 0 0 0 0 0 0 0 0 0 0 0 3 9 5 12 4 6 5 4 3 4 3 3
            6 2 4 6 1 5 2 2 5 3 8 5 6 5 2 6 2 2 3 6 6 3 6 2
            2 8 4 2 3 4 4 3 1 4 4 3 4 4 1 2 5 5 4 7 6 4 4 3
            4 2 3 4 4 1 6 6 4 9 1 3 5 1 2 3 3 4 1 2 2 4 1 3
```

```
            2 5 3 3 3 3 3 2 2 1 4 3 3 0 0 3 1 2 1 1 4 0 1 2
            2 1 1 2 0 0 2 0 2 1 1 0 4 3 1 1 0 3 3 4 5 4 2 2
            3 4 3 4 4 4 4 1 5 5 6 7 6 4 5 4 9 6 3 8 5 9 8 7
            7 6 3 4 4 4 2 5 2 2 3 1 1 0 1 2 4 1 3 2 2 1 1 3
            3 2 0 2 0 0 1 1 2 0 1 0 2 0 2 1 2 1 1 0 1 1 2 2
            3 2 0 2 0 0 1 1 2 0 1 0 2 0 2 1 2 1 1 0 1 1 2 2
            0 2 1 1 0 1 1 0 0 2 1 1 0 1 1 0
        </ChannelData>
    </Spectrum>

    <Spectrum ID="LeftGammaBackground" CalibrationIDs="LeftGammaEnergy">  <!-- the background spectrum for the left gamma detector  -->
        <StartTime>2004-11-03T14:30:00.0-05:00</StartTime>
        <RealTime>PT100S</RealTime>
        <LiveTime>PT99.8S</LiveTime>
        <SourceType>Background</SourceType>
        <ChannelData>                                              <!-- The background spectrum data (256 channels) -->
            0 0 0 0 0 0 0 0 0 0 0 0 3 9 5 12 4 6 5 4 3 4 3 3
            6 2 4 6 1 5 2 2 5 3 8 5 6 5 2 6 2 2 3 6 6 3 6 2
            2 8 4 2 3 4 4 3 1 4 4 3 4 4 1 2 5 5 4 7 6 4 4 3
            4 2 3 4 4 1 6 6 4 9 1 3 5 1 2 3 3 4 1 2 2 4 1 3
            2 5 3 3 3 3 3 2 2 1 4 3 3 0 0 3 1 2 1 1 4 0 1 2
            2 1 1 2 0 0 2 0 2 1 1 0 4 3 1 1 0 3 3 4 5 4 2 2
            3 4 3 4 4 4 4 1 5 5 6 7 6 4 5 4 9 6 3 8 5 9 8 7
            7 6 3 4 4 4 2 5 2 2 3 1 1 0 1 2 4 1 3 2 2 1 1 3
            3 2 0 2 0 0 1 1 2 0 1 0 2 0 2 1 2 1 1 0 1 1 2 2
            3 2 0 2 0 0 1 1 2 0 1 0 2 0 2 1 2 1 1 0 1 1 2 2
            0 2 1 1 0 1 1 0 0 2 1 1 0 1 1 0
        </ChannelData>
    </Spectrum>
  </SpectrumMeasurement>

</DetectorMeasurement>

<DetectorMeasurement DetectorType="Gamma" Detector="Right Gamma"><!-- Measurement data for the gamma detector on the right side -->

    <GrossCountMeasurement WindowStart="0" WindowEnd="100">
        <Alarmed>0 0 0 0 0 0 0</Alarmed>
        <GrossCounts>100 110 100 98 99 102 100</GrossCounts>
        <BackgroundCounts>101.25</BackgroundCounts>
    </GrossCountMeasurement>
    <GrossCountMeasurement WindowStart="100" WindowEnd="1000">
        <Alarmed>0 0 0 0 0 0 0</Alarmed>
        <GrossCounts>100 110 100 98 99 102 100</GrossCounts>
        <BackgroundCounts>101.25</BackgroundCounts>
    </GrossCountMeasurement>

    <SpectrumMeasurement>
```

```
<SpectrumAvailable>0 0 0 1 1 0 0</SpectrumAvailable>
<Alarmed>0 0 0 0 0 0 0</Alarmed>
<Spectrum SampleNumber="4" CalibrationIDs="RightGammaEnergy" BackgroundSpectrumID="RightGammaBackground">
     <StartTime>2004-11-03T14:36:05.8-05:00</StartTime>
     <RealTime>PT1S</RealTime>
     <LiveTime>PT0.99S</LiveTime>
     <SourceType>Item</SourceType>
     <ChannelData>                              <!-- The spectrum data (256 channels) -->
          0 0 0 0 0 0 0 0 0 0 0 0 3 9 5 12 4 6 5 4 3 4 3 3
          6 2 4 6 1 5 2 2 5 3 8 5 6 5 2 6 2 2 3 6 6 3 6 2
          2 8 4 2 3 4 4 3 1 4 4 3 4 4 1 2 5 5 4 7 6 4 4 3
          4 2 3 4 4 1 6 6 4 9 1 3 5 1 2 3 3 4 1 2 2 4 1 3
          2 5 3 3 3 3 3 2 2 1 4 3 3 0 0 3 1 2 1 1 4 0 1 2
          2 1 1 2 0 0 2 0 2 1 1 0 4 3 1 1 0 3 3 4 5 4 2 2
          3 4 3 4 4 4 4 1 5 5 6 7 6 4 5 4 9 6 3 8 5 9 8 7
          7 6 3 4 4 4 2 5 2 2 3 1 1 0 1 2 4 1 3 2 2 1 1 3
          3 2 0 2 0 0 1 1 2 0 1 0 2 0 2 1 2 1 1 0 1 1 2 2
          3 2 0 2 0 0 1 1 2 0 1 0 2 0 2 1 2 1 1 0 1 1 2 2
          0 2 1 1 0 1 1 0 0 2 1 1 0 1 1 0
     </ChannelData>
</Spectrum>

<Spectrum SampleNumber="5" CalibrationIDs="RightGammaEnergy" BackgroundSpectrumID="RightGammaBackground">
     <StartTime>2004-11-03T14:36:05.9-05:00</StartTime>
     <RealTime>PT1S</RealTime>
     <LiveTime>PT0.99S</LiveTime>
     <SourceType>Item</SourceType>
     <ChannelData>                         <!-- The spectrum data (256 channels) -->
          0 0 0 0 0 0 0 0 0 0 0 0 3 9 5 12 4 6 5 4 3 4 3 3
          6 2 4 6 1 5 2 2 5 3 8 5 6 5 2 6 2 2 3 6 6 3 6 2
          2 8 4 2 3 4 4 3 1 4 4 3 4 4 1 2 5 5 4 7 6 4 4 3
          4 2 3 4 4 1 6 6 4 9 1 3 5 1 2 3 3 4 1 2 2 4 1 3
          2 5 3 3 3 3 3 2 2 1 4 3 3 0 0 3 1 2 1 1 4 0 1 2
          2 1 1 2 0 0 2 0 2 1 1 0 4 3 1 1 0 3 3 4 5 4 2 2
          3 4 3 4 4 4 4 1 5 5 6 7 6 4 5 4 9 6 3 8 5 9 8 7
          7 6 3 4 4 4 2 5 2 2 3 1 1 0 1 2 4 1 3 2 2 1 1 3
          3 2 0 2 0 0 1 1 2 0 1 0 2 0 2 1 2 1 1 0 1 1 2 2
          3 2 0 2 0 0 1 1 2 0 1 0 2 0 2 1 2 1 1 0 1 1 2 2
          0 2 1 1 0 1 1 0 0 2 1 1 0 1 1 0
     </ChannelData>
</Spectrum>

<Spectrum ID="RightGammaBackground" CalibrationIDs="RightGammaEnergy"><!-- the background spectrum for the right gamma detector -->
     <StartTime>2004-11-03T14:30:00.0-05:00</StartTime>
     <RealTime>PT100S</RealTime>
     <LiveTime>PT99.8S</LiveTime>
     <SourceType>Background</SourceType>
```

```
                    <ChannelData>                                                   <!-- The background spectrum data (256 channels) -->
                         0 0 0 0 0 0 0 0 0 0 0 0 3 9 5 12 4 6 5 4 3 4 3 3
                         6 2 4 6 1 5 2 2 5 3 8 5 6 5 2 6 2 2 3 6 6 3 6 2
                         2 8 4 2 3 4 4 3 1 4 4 3 4 4 1 2 5 5 4 7 6 4 4 3
                         4 2 3 4 4 1 6 6 4 9 1 3 5 1 2 3 3 4 1 2 2 4 1 3
                         2 5 3 3 3 3 3 2 2 1 4 3 3 0 0 3 1 2 1 1 4 0 1 2
                         2 1 1 2 0 0 2 0 2 1 1 0 4 3 1 1 0 3 3 4 5 4 2 2
                         3 4 3 4 4 4 4 1 5 5 6 7 6 4 5 4 9 6 3 8 5 9 8 7
                         7 6 3 4 4 4 2 5 2 2 3 1 1 0 1 2 4 1 3 2 2 1 1 3
                         3 2 0 2 0 0 1 1 2 0 1 0 2 0 2 1 2 1 1 0 1 1 2 2
                         3 2 0 2 0 0 1 1 2 0 1 0 2 0 2 1 2 1 1 0 1 1 2 2
                         0 2 1 1 0 1 1 0 0 2 1 1 0 1 1 0
                    </ChannelData>
               </Spectrum>
          </SpectrumMeasurement>
     </DetectorMeasurement>

     <DetectorMeasurement DetectorType="Neutron" Detector="Left Neutron">      <!-- Measurement data for the neutron detector on the left side -->
          <GrossCountMeasurement>
               <Alarmed>0 0 0 0 0 0 0</Alarmed>                               <!-- 1 if an alarm was generated due to the corresponding sample -->
               <GrossCounts>3 4 2 4 1 2 3</GrossCounts>                       <!-- The raw gross count data -->
               <BackgroundCounts>3.4 3.6 3.5 3.5 3.5 3.5 3.5</BackgroundCounts> <!-- The background counts appropriate for each sample; -->
                                                                              <!-- only one value needed if they’re all the same -->
          </GrossCountMeasurement>
     </DetectorMeasurement>

     <DetectorMeasurement DetectorType="Neutron" Detector="Right Neutron">     <!-- Measurement data for the neutron detector on the right side -->
          <GrossCountMeasurement>
               <Alarmed>0 0 0 0 0 0 0</Alarmed>
               <GrossCounts>3 4 2 4 1 2 3</GrossCounts>
               <BackgroundCounts>3.4 3.6 3.5 3.5 3.5 3.5 3.5</BackgroundCounts>
          </GrossCountMeasurement>
     </DetectorMeasurement>
</DetectorData>

<AnalysisResults>                                                             <!-- Analysis results for this measurement -->
     <ThreatDescription>Possible RDD</ThreatDescription>                      <!-- Instrument’s overall assessment of the situation -->

     <NuclideAnalysis ActivityUnits="Bq">                                     <!-- Nuclide analysis results -->

          <Nuclide>                                                           <!-- Results for Co-60 -->
               <NuclideName>Co-60</NuclideName>                               <!-- The name of the nuclide -->
               <NuclideType>Industrial</NuclideType>                          <!-- The type of nuclide: Industrial, SNM, NORM, etc. -->
               <NuclideActivity>10000000 10000.0</NuclideActivity>            <!-- Co-60’s decay-corrected activity (in Bq; see Units) -->
               <NuclideIDConfidenceIndication>98.0</NuclideIDConfidenceIndication>  <!-- Confidence in the presence of Co-60: -->
                                                                              <!-- higher values mean more likely to be present -->
               <NuclideIDConfidenceDescription>High</NuclideIDConfidenceDescription> <!-- Confidence indication translated into words -->
```

```xml
        </Nuclide>
        <Nuclide>                                                            <!-- Results for Cs-137 -->
            <NuclideName>Cs-137</NuclideName>
            <NuclideType>Industrial</NuclideType>
            <NuclideActivity>10.0 5.0</NuclideActivity>
            <NuclideIDConfidenceIndication>3</NuclideIDConfidenceIndication>
            <NuclideIDConfidenceDescription>Low</NuclideIDConfidenceDescription>
        </Nuclide>
      </NuclideAnalysis>
  </AnalysisResults>
</Measurement>

<Calibration Type="Energy" ID="LeftGammaEnergy">           <!-- Energy calibration for the left gamma detector -->
  <Equation Model="Polynomial" Form="E = Term0 + Term1*Ch">   <!-- "Model" is the type of equation; "Form" is just for documentation -->
      <Coefficients>0 0.5</Coefficients>                   <!-- the 1st list element is "Term0", the second "Term1" -->
      <CovarianceMatrix>0 0.05 0.01</CovarianceMatrix>
  </Equation>
</Calibration>

<Calibration Type="Energy" ID="RightGammaEnergy">              <!-- Energy calibration for the right gamma detector-->
  <Equation Model="Polynomial" Form="E = Term0 + Term1*Ch">
      <Coefficients>0 0.5</Coefficients>
      <CovarianceMatrix>0 0.05 0.01</CovarianceMatrix>
  </Equation>
</Calibration>

</N42InstrumentData>
```

Annex F

(informative)

Example personal radiation detector/survey meter file

```
<?xml version="1.0" encoding="UTF-8"?>

<!-- This is an example personal radiation detector or survey meter data document.  This instrument generates count and dose rate data -->
<!-- (using units of CPS and uSv, respectively) once per second (see <SampleRealTime>); four rate data samples were written. -->
<!-- The instrument has built-in GPS, and records its position every 10 seconds using the Coordinates element. -->

<N42InstrumentData xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/2005/ANSIN4242"
xsi:schemaLocation="http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/2005/ANSIN4242
http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/2005/ANSIN4242.xsd">

    <Measurement UUID="54531f3b-402b-11d8-af12-0002a5094c23">

        <InstrumentInformation>
            <InstrumentType>PersonalRadiationDetector</InstrumentType>
            <Manufacturer>PRDs R Us</Manufacturer>
            <InstrumentModel>model #1</InstrumentModel>
            <InstrumentID>serial #1</InstrumentID>
        </InstrumentInformation>

        <MeasuredItemInformation>                             <!-- Information about where the measurement was done; also optional -->
            <MeasurementLocation>
                <Coordinates Time="2004-11-03T14:30:00-05:00">40.123 10.670</Coordinates>
                <Coordinates Time="2004-11-03T14:40:00-05:00">40.124 10.669</Coordinates>
                <Coordinates Time="2004-11-03T14:50:00-05:00">40.125 10.669</Coordinates>
            </MeasurementLocation>
        </MeasuredItemInformation>

        <CountDoseData>
            <StartTime>2004-11-03T14:30:00-05:00</StartTime>      <!-- When the measurement sequence was started -->
            <SampleRealTime>PT1.0S</SampleRealTime>               <!-- The interval at which the samples were taken -->
            <Alarmed>0 0 0 0</Alarmed>                            <!-- Whether an alarm occurred or not on each sample -->
            <CountRate Units="CPS">10.5 10 9.75 10.75</CountRate> <!-- Four count rate samples -->
            <DoseRate Units="uSv"> 0.5 0.45 0.4 0.55</DoseRate>   <!-- Four dose rate samples -->
        </CountDoseData>

    </Measurement>
</N42InstrumentData>
```

Annex G

(informative)

Example of an extension to the N42.42 standard

This example file, a modified fragment of the survey meter/PRD example given in Annex F, shows the use of an element not defined in this Standard. In this example, the instrument's HV setting is recorded. Two changes have been made in the <N42InstrumentData> element and are underlined in the example:

1. A custom namespace, "PRDsRUs" is defined; this namespace is used to denote the "HV" element, which is not defined in the Standard.
2. An XML Schema file, PRDSchema.xsd, is associated with that namespace for use in file validation. This is optional.

The custom <PRDsRUs:HV> element (underlined in the example below) is then included at the end of the <InstrumentInformation> child elements.

```
<?xml version="1.0" encoding="UTF-8"?>

<N42InstrumentData xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/2005/ANSIN4242" xmlns:PRDsRUs="http://www.PRDsRUs.com/N42Schema/2006/PRDSchema"
xsi:schemaLocation=
"http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/2005/ANSIN4242 http://physics.nist.gov/Divisions/Div846/Gp4/ANSIN4242/2005/ANSIN4242.xsd
http://www.PRDsRUs.com/N42Schema/2006/PRDSchema http://www.PRDsRUs.com/N42Schema/2006/PRDSchema.xsd">

    <Measurement UUID="54531f3b-402b-11d8-af12-0002a5094c23">
        <InstrumentInformation>
            <InstrumentType>PersonalRadiationDetector</InstrumentType>
            <Manufacturer>PRDs R Us</Manufacturer>
            <InstrumentModel>model #1</InstrumentModel>
            <InstrumentID>serial #1</InstrumentID>
            <PRDsRUs:HV>750</PRDsRUs:HV>
        </InstrumentInformation>
    </Measurement>

</N42InstrumentData>
```

Note that within a parent element, elements not defined in this Standard appear after all elements defined by this Standard; for example, placing the <PRDsRUs:HV> element before the <InstrumentID> element would be invalid.

The following XML Schema file ("PRDSchema.xsd") could be used to validate the custom element.

```
<?xml version="1.0" encoding="utf-8"?>
<xs:schema xmlns="http://http://www.PRDsRUs.com/N42Schema/2006/PRDSchema" xmlns:PRDsRUsns="http://http://www.PRDsRUs.com/N42Schema/2006/PRDSchema"
xmlns:xs="http://www.w3.org/2001/XMLSchema" targetNamespace="http://www.PRDsRUs.com/N42Schema/2006/PRDSchema"
elementFormDefault="qualified" id="PRDsRUsns">
    <xs:element name="HV" type="xs:double">
        <xs:annotation>
```

```
          <xs:documentation>Detector HV</xs:documentation>
        </xs:annotation>
      </xs:element>
    </xs:schema>
```