USGIN
U.S. Geoscience Information Network

Use of ISO metadata specifications to describe geoscience information resources

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Use of ISO metadata specifications to describe geoscience information resources

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This document describes recommended practices for using ISO19139 xml encoding of ISO 19115 and ISO 19119 metadata to describe a broad spectrum of geoscience resources. The document provides guidance for the population of ISO19139 encoded metadata documents to enable interoperability of catalog service clients with multiple servers conforming to this profile.

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Revision History

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0.7	2009-10-28	Revisions, addition of material, re-title, focus on use of ISO 19139. Revising adding material done, circulate for review, comment. No discussion of serviceIdentification section as yet; this will have to be added, at which point the file title will be revised.	Stephen Richard
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1 Introduction

A key component of a distributed information network is a catalog system, a collection of resources that allow data and service providers to register resources, and data consumers to locate and use those resources. Currently, many online catalogs are web pages with collections of URLs for services, or services are discovered accidently or by word of mouth. The vision is to enable a web client (portal) to search across one or more metadata registries without having to configure the client individually for each of the registries that will be searched. Thus, metadata providers can focus on data development, without having to also develop web clients to enable search of that metadata.

The Open Geospatial Consortium (OGC) Catalog Service for the Web (CSW) specification defines a collection of basic operations for searching catalogs of metadata via the web. Engineering the desired interoperability requires adding additional constraints on CSW operation; one of the major constraints is selection of the xml schema that will be used to encode metadata for the service. The core CSW specification requires use of a basic xml schema that includes content defined by the Dublin Core Metadata specification [Dublin Core, 2008-01-14]. This document concerns use of the ISO19115 and ISO19119 content models implemented using the ISO19139 xml schema for encoding of metadata content. Some more specific constraints on use of this implementation may be included in a separate document (planned) describing metadata constraints for different kinds of resources.

A set of other USGIN resource registry and discovery service profile documents discuss the other constraints and best practices to enable catalog interoperability. These include a profile for use of the CSW specification, providing details on how requests and search criteria should be encoded. A profile that describes metadata content required for different resources adds additional detail for specific resources. Finally vocabularies for categorizing resources and specifying other metadata properties are documented in a separate document; these vocabularies will need to be published in a web accessible registry to make them accessible.

1.1 Normative References

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

ISO 19115 designates these two normative references:

- ISO 19115:2005, *Geographic information - Metadata*
- ISO 19115/Cor.1:2006, *Geographic information – Metadata, Technical Corrigendum*

ISO 19119 designates these normative references:

- ISO 19119:2005, *Geographic information - Services*
- ISO 19119:2005/Amd 1:2008, *Extensions of the service metadata model ISO 19108 designates*:
- ISO 19108:2005, *Geographic information – Temporal Schema*

ISO 639-2, Codes for the representation of names of languages - Part 2: Alpha-3 code control ISO 8601, Data elements and interchange formats - Information interchange - Representation of dates and times

32 **ISO/TS 19139:2007**, Geographic information - Metadata – XML Schema Implementation

33 **OGC 07-006r1**¸ OpenGIS Catalog Services Specification version 2.0.2, Corrigendum 2 release, 2007

34 **OGC 07-045**, OpenGIS Catalogue Services Specification 2.0.2 - ISO Metadata Application Profile, Version 1.0.0, 2007

35 **INCITS 453-2009**, North American Profile of ISO 19115:2003 – Geographic Information – Metadata (NAP-Metadata), 2009, American National Stand-
36 ards Institute, Inc.

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

38 **RFC 2119,** Key words for use in RFCs to Indicate Requirement Levels, Network Working Group, 1997.

1.2 Purpose

40 The USGIN development team is proposing to use ISO 19115/19119 metadata as the content model, and the ISO 19139 xml schema for encoding
41 this content in xml documents that will be provided by USGIN CSW services. This profile conforms to most of the provisions of the North American
42 Profile of ISO metadata (INCITS 453-2009, referred to as NAP), except it allows multiple distributor-format-transferOptions bindings for resource dis-
43 tribution, and recommends use of ISO19115 codelist values. This USGIN document is meant to provide guidance on the use of the ISO19139 XML
44 schema to encode metadata for geoscience resources, with sufficient detail that developers of client or server applications can produce interoperable
45 implementations of the OGC Catalog Service for the Web (CSW). The focus of the profile is to enable interoperable catalog services for discovery,
46 evaluation, and access to information resource of interest to geoscientists.

1.3 Terminology

48 The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OP-
49 TIONAL" in this document are to be interpreted as described in Internet RFC 2119.

50

51 **Application profile**: a schema that consists of data elements drawn from one or more namespaces, combined together by implementers, and opti-
52 mized for a particular local application. (Rachel Heery and Manjula Patel, 2000, http://www.ariadne.ac.uk/issue25/app-profiles/)

53 **Catalog application**: Software that implements a searchable metadata registry. The application must support the ability to register information re-
54 sources, to search the registered metadata, to support the discovery and binding to registered information resources within an information community.

55 **Codelist (also as Code list)**: a controlled vocabulary that is used to populate values for an xml element.

56 **Data product specification**: a definition of the data schema and value domains for a dataset. The data schema specifies entities (features), proper-
57 ties associated with each entity, the data type used to specify property values, cardinality for property values, and if applicable, other logical con-
58 straints that determine data validity. Value domains are specified for simple data types—strings or numbers, and may include controlled vocabularies
59 for terminology required to specify some properties.

60 **Dataset series**: collection of datasets sharing the same product specification (ISO 19115). ISO 19115 does not define product specification. For the
61 purposes of USGIN, a product specification defines a data schema, any required controlled vocabularies, and recommended practices for use of
62 schema (see Data product specification).

63 **Dataset**: an identifiable collection of data (ISO19115). USGIN refines this concept to represent a collection of data items in which individual data items
64 are identified and accessible. USGIN extends the concept of data items to include physical artifacts like books, printed maps and diagrams, photo-

65 graphs, and material samples--any identifiable resource of interest. DCMI definition is "Data encoded in a defined structure" with additional comment
66 "Examples include lists, tables, and databases. A dataset may be useful for direct machine processing." Metadata for the collection is a different type
67 than metadata for individual items in the collection (dataset vs. features). Criteria for what unifies the collection are variable (topic, area, author...). Da-
68 ta items may represent intellectual content -- information content and organization (data schema) -- or may represent particular manifestations (for-
69 mats) of an intellectual artifact.

70 **Interoperability**: "The capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the us-
71 er to have little or no knowledge of the unique characteristics of those units." ISO/IEC 2382-01 (SC36 Secretariat, 2003)

72 **Metadata element**: a discrete unit of metadata (ISO 19115), an attribute of a metadata entity. A metadata element contains some content specifying
73 the value of the element; this content may be simple—a number or string, or may be another metadata entity.

74 **Metadata entity**: a named set of metadata elements describing some aspect of a resource.

75 **Metadata register**: an information store that contains a collection of registered metadata records, maintained by a metadata registry. (ISO 11179)

76 **Metadata registry**: an information system for assignment of unambiguous identifiers to administered metadata records. (ISO 11179)

77 **Metadata section**: Part of a metadata document consisting of a collection of related metadata entities and metadata elements (ISO 191115).

78 **Metadata**: data about a resource in some context. Generalize from ISO 11179 definition of metadata, which constrains the scope to data about data.
79 For USGIN purposes, metadata may describe any resource—including electronic, intellectual, and physical artifacts. Metadata represent resource
80 characteristics that can be queried and presented for evaluation and further processing by both humans and software.

81 **Profile**: set of one or more base standards and - where applicable - the identification of chosen clauses, classes, subsets, options and parameters of
82 those base standards that are necessary for accomplishing a particular function [ISO 19101, ISO 19106]

83 **Resource**: An identifiable thing that fulfills a requirement. Usage here is closer to definition used in RDF (www.w3.org/TR/REC-rdf-syntax), general-
84 ized from ISO19115, which defines resource as an 'asset or means that fulfills a requirement' without defining asset or means. "An object or artifact
85 that is described by a record in the information model of a catalogue" (OGC 07-006r1)

86 **Service metadata**: metadata describing the operations and information available from a server.

87 **Source Specification**: The specification or standard that is being profiled.

88 **User Community**: A group of users, e.g. within a supply-chain industry, the members of which decide to make a similar usage of the source specifica-
89 tion in order to be able to interoperate.

90

91 Note that throughout this document, the names of xml elements are shown in `this typecase`. Long X-paths have been broken with non-breaking hy-
92 phen characters. Note that hyphens are not used in any xml attribute or element name, so if they appear in the text, they are strictly for better text
93 wrapping. In Xpath expressions `/../` indicates that some elements have been omitted from the path.

1.4 ISO Schemas Location

95 ISO I9139 xml schemas are in an online repository at http://schemas.opengis.net/iso/19139/. Two versions are posted: 20060504 and 20070417. Un-
96 fortunately, these two directories both contain schema with the same target namespace, so there is no clear way to distinguish applications that are
97 based on one or the other. The medatadaEntity.xsd in the two directories is identical; other schema have not been compared (but see discussion pa-
98 per gin2009-005 at http://lab.usgin.org/node/269). The 20070417 directory contains schema implementing ISO Technical Specification 19139:2007

99   (dated 2007 Apr 17), which appear to include the changes from ISO 19115:2003 Cor 1;2006(E), but this is not declared in any included documentation
100   (need metadata on the metadata schema!).

101   The 20070417 version of the ISO 19139 schemas references GML 3.2.1. However, there is no mention of the SRV namespace
102   (http://www.isotc211.org/2005/srv) anywhere in this ISO 19139 version. The SRV namespace is where, in our metadata documents using the 2006
103   version, we specified all our information about dynamic, online services such as WFS and WMS, so the 20070417 version is not useful for metadata
104   catalogs that register services.

105   In order to create metadata for both static datasets and dynamic, online services and for use with CSW, the OGC created an xml schema that merges
106   the schema for ISO19115 (dataset metadata) and ISO19119 (service metadata) (see section D.1.5, page 105 in OGC 07-045). The way that was ac-
107   complished was by creating a schema located at http://schemas.opengis.net/csw/2.0.2/profiles/apiso/1.0.0/apiso.xsd. This schema simply imports ..
108   iso/19139/20060504/gmd/gmd.xsd and .. iso/19139/20060504/srv/srv.xsd. Thus for CSW 2.0.2 implementations, the 20060504 versions of the
109   ISO19139 schema must be used.

2 Overview of the Profile

2.1 General Objectives

The Profile defines:

- mandatory and conditional metadata sections, metadata entities, and metadata elements
- the minimum set of metadata elements for any resource in order to conform to the Profile
- the core metadata for geographic datasets
- optional metadata elements that allow for a more extensive standard description of resources
- some recommended practices to increase the utility and interoperability of metadata.

2.2 Requirements

M (mandatory). Metadata element must have a valid value.

C (conditional). Metadata element is mandatory based on values of other metadata elements in the metadata record.

O (optional). Metadata element may be null in a valid document.

X (not used). Metadata element is not used by a Profile. The element may be included where it is schema valid, but may be ignored by applications implementing the profile.

2.3 Use cases to be supported

This section includes a number of user scenarios for how we intend USGIN metadata to be used, and discussion of several basic approach requirements that guide metadata content recommendations. At its heart, the problem is to find resources of interest via the internet, based on criteria of topic, place, or time, evaluate resources for an intended purpose, and learn how to access those resources. Detailed metadata describing a resource data schema, describing service or application operation, or providing detailed descriptions of analytical techniques and parameter are outside the scope intended for USGIN metadata. Our contention is that this more domain/resource specific type information is better accounted for with linked documents utilizing schema appropriate to those specific resource. Some examples include OGC getCapabilities, WSDL, and ISO 19110 feature catalogs. For more in depth discussion of use cases, scenarios, and requirements, see Metadata Recommendations for Geoscience Resources (Richard and Grunberg, 2010).

- A user specifies a geographic bounding box or one or more text keywords to constrain the resources of interest, and searches a metadata catalog using these criteria. The user is presented with a web page containing a list of resources that meet the criteria, with links for each resource that provide additional detailed metadata, and direct access to the resource if an online version is accessible, e.g. as a web page, Adobe Acrobat document, or online application (see Accessing Resources, below).

- A client application provides user with a map window that contains some simple base map information (political boundaries, major roads and rivers). User wishes to assemble a variety of other data layers for a particular area for some analysis or data exploration, e.g. slope steepness, geologic units, bedding orientation, and vegetation type for a hazard assessment. User centers map view on area of interest, then using an 'add data' tab, accesses a catalog application that allows them to search for web services that provide the desired datasets. After obtaining the results and reviewing the metadata for the located services, user selects one or more to add to the table of contents for the client application. Response from catalog has sufficient information to enable the client application to load and use the resource (e.g. serviceType, OnlineResourceLinkage). More concrete instances of this case would be finding Web Map services to add as layers in an ESRI ArcMap project, borehole Web Feature Services to post borehole logs in a 3-D mapping application, or water chemistry data Web Feature Service to bring data into a spreadsheet or database.
- User searches for boreholes in an area. Returned metadata records have links to metadata for related resources, like logs of different types, core, water quality data, etc. that the user can follow to browse metadata for these resources.
- A catalog operator wishes to import and cache catalog records from a collaborating catalog that have been inserted or updated during the last month (harvest). This operation requires knowledge of the metadata standard and version used for the returned records.
- A user discovers an error in a metadata record for a resource that they have authored, and wishes to contact the metadata producer to request correction.
- A search returns several results that appear to contain the desired content, and user must select the most likely to meet their needs. Metadata should provide sufficient information to guide this decision.
- A project geologist at Company X is searching for data relevant to a new exploration target, and wishes to restrict the search to resources that are publicly available.
- Complex search examples (see further discussion in the **Error! Reference source not found.** section, below):
  - Search based on related resources, for example a search for boreholes that have core.
  - Boreholes that penetrate the Escabrosa formation.
  - Sample locations for samples with uranium-lead geochronologic data.
  - Find links to pdfs of publications by Harold Drewes on southeast Arizona.
  - Find geologic maps at scale < 100,000 in the Iron Mountains.
  - Who has a physical copy of USGS I-427?

2.4 Resources of interest

Table 1 summarizes the geoscience information resources of interest to the community that can be registered and discovered using this metadata profile. Note that this collection of resource types includes several kinds of resources that are not typically associated with ISO19115/ISO19119, which were created specifically for geospatial resources.

167 *Table 1. Summary of resource types described by metadata for US Geoscience Information Network catalogs. Resource type **names in bold** have*
168 *been prioritized for implementation in version one catalogs. The Resource type names include the type hierarchy encoded with the broader (parent)*
169 *resource type indicated in the Broader Resource Type column.*

Resource Type hierarchy	Broader Resource Type	Source	Definition
Collection		DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	An aggregation of resources. A collection is described as a group; its parts may also be separately described. (from http://www.ukoln.ac.uk/metadata/dcmi/collection-application-profile/): The term "collection" can be applied to any aggregation of physical or digital items. Those items may be of any type, so examples might include aggregations of natural objects, created objects, "born-digital" items, digital surrogates of physical items, and the catalogs of such collections (as aggregations of metadata records). The criteria for aggregation may vary: e.g. by location, by type or form of the items, by provenance of the items, by source or ownership, and so on. Collections may contain any number of items and may have varying levels of permanence. A "collection-level description" provides a description of the collection as a unit: the resource described by a collection-level description is the collection, rather than the individual items within that collection. Collection-level descriptions are referred to in Michael Heaney's *An Analytical Model of Collections and their Catalogues* as "unitary finding-aids".
Dataset	Collection	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A collection of data items in which individual data items are identified and accessible. DCMI definition is "Data encoded in a defined structure." with additional comment "Examples include lists, tables, and databases. A dataset may be useful for direct machine processing." The container may be a stand-alone digital file (mdb, spreadsheet, table in a Word document), a web service, or an enterprise database. Metadata for the collection is a different type than metadata for individual items in the collection. Criteria for what unifies the collection are variable (topic, area, author...). Synonym: structured data collection. This resource type represents the intellectual artifact -- the information content and organization; the dataset may have more than one manifestation (format) -- as a list, a table, databases, using different software implementations.
Catalog	Dataset	USGIN	A collection of data items that index resources, as in metadata records; a metadata registry. The resource represents the information content and organization. Catalogs are accessed using other resources, like an interactiveResource or Service, and may have different formats.

Physical arti-fact collec-tion	Collection	USGIN	A collection of identifiable physical objects, unified based on some criteria. Criteria for defining a collection may be who collected, where curated, why collected, kind of material…
Document		USGIN	A packaged body of intellectual work; has an author, title, some status with respect to Review/authority/quality. USGS peer reviewed would be a 'status property'. Have to account for gray literature, unpublished documents, etc. A document may have a variety of physical manifestations (pdf file, hard-bound book, tiff scan, Word processor document...), and versions may exist as the document is traced through some publication process. May be map, vector graphics, text. Sound, moving images are included as document types.
Image	Document	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A visual representation other than text. Comment: Examples include images and photographs of physical objects, paintings, prints, drawings, other images and graphics, animations and moving pictures, film, diagrams, maps, musical notation. Note that Image may include both electronic and physical representations.
StillImage	Image	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A static visual representation. Comment: Examples include paintings, drawings, graphic designs, plans and maps. Recommended best practice is to assign the type Text to images of textual materials if the intent of the image is to capture the textual content as opposed to the appearance of the medium containing the text. Instances of the type Still Image must also be describable as instances of the broader type Image. Subtype of Image.
Human-generated im-age	StillImage	USGIN	Image produced by human drawing or painting, using any media. May be entirely product of human imagination, human perception of the world, or a human-modified photographic image.
Photograph	StillImage	USGIN	Image produced by optical device with chemical or electronic image capture; represents things in the field of view directly as captured by the device. Photographs may be modified by human processing; there is a continuum between photographs and human-generated image. Distinction between the two is largely based on intention
Remote sens-ing Earth im-age	StillImage	USGIN	Image of earth surface acquired by an air born or earth-orbiting sensor. May be georeferenced such that location in the image directly corresponds to location on the earth.
Map	Human-generated im-age	USGIN	Human-generated depiction of some part of the earth using a mathematical system of correspondence between geometry in the image and location on the earth.
MovingImage	Image	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A series of visual representations imparting an impression of motion when shown in succession. Comment: Examples include animations, movies, television programs, videos, zoetropes, or visual output from a simulation. Instances of the type Moving Image must also be describable as instances of the broader type Image. Subtype of Image. Commonly include sound

Sound	Document	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A resource primarily intended to be heard. Comment: Examples include a music playback file format, an audio compact disc, and recorded speech or sounds.
Text	Document	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A resource consisting primarily of words for reading. Comment: Examples include books, letters, dissertations, poems, newspapers, articles, archives of mailing lists. Note that facsimiles or images of texts are still of the genre Text.
Hypertext document collection	Text	USGIN	A collection of files that contains http hyperlinks between them. Links to documents or other resources outside of the collection are possible. The criteria for determining membership in the collection are somewhat arbitrary, but in general the 'site' should contain related documents authored and managed by the same agent.
Event		DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A non-persistent, time-based occurrence. Metadata for an event provides descriptive information that is the basis for discovery of the purpose, location, duration, and responsible agents associated with an event. Examples include an exhibition, webcast, conference, workshop, open day, performance, battle, trial, wedding, tea party, and conflagration.
Project	Event	USGIN	Project represents a funded activity that has some purpose; projects have associated extents, which represent the area of interest for the project. This extent serves as a mechanism to filter descriptions and concepts in the information system for those that may be related to the project based on spatial relationships. Projects in a large organization will likely have hierarchical (part-whole) relationships.
Model		USGIN	Algorithm, workflow; an abstract representation of a collection of related processes, objects and relationships. A model resource may be related to various kinds of document that portray the model, or to software that implements the model, or with datasets as input or output. Not clear that there is a compelling use case for cataloging models separately from the software or documents that are manifestations of the model.
Physical artifact		DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	General category for physical resources that are indexed by metadata records; also root of an artifact type hierarchy. An identifiable physical object. Identification is always a function of some human intention, thus differentiating an artifact from other 'natural' things. Note that digital representations of, or surrogates for, these objects should use Image, Text or one of the other types.

Service		DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A system that provides one or more functions via a network interface designed for machine interaction. An implementation of an interface to some sort of digital resource, using either a 'pull' model in which client requests some content from the service, and receives that content in a single 'response' package, or a 'push' model in which client establishes connection and monitors for change events (update, new data…) from service. Difficult to draw line on when a service provides 'files' and when it provides 'data', because responses are always in a form that could be considered a file. Also includes interfaces to digital resources that provide a continuous (with some sampling interval?) feed of some sort of data.
Software		USGIN	A computer program in source or compiled form. Comment: Examples include a C source file, MS-Windows .exe executable, or Perl script.
Stand-Alone-Application	Software	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	Identifiable stand alone software application. Identity of resource is based on function performed, input and output requirements, and authorship. The same application may be packaged in different file formats to run in different software environments; thus an application will have one or more associated digital files. For the purposes of this catalog scheme, stand alone applications are software that can be packaged in a single file that can be transferred between machines, unpackaged and compiled or installed on a computer meeting specified hardware and software environment conditions, to execute the described function on that computer, independent of any network connection.
Interactive-Resource	Software	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A resource requiring interaction from the user to be understood, executed, or experienced. Comment: Examples include forms on Web pages, applets, multimedia learning objects, chat services, or virtual reality environments. Interactive resources are software driven. From the point of view of the catalog, they are accessed by a URL to a web site that is the interface for operating the application. The application operates by interaction with one or more human participants. The application requires network connection to operate, is accessible via the internet, and requires human interaction.
Structured digital data item		USGIN	An individually identifiable item in a structured digital data collection. Characterized by a schema, and some particular values. In ISO11179 terms, this is an instance of a data element. Tagging, commenting, reviewing, rating community interaction with catalog will probably require metadata records about particular data items in cataloged datasets (including metadata items in catalogs.)
Sampling point, site, station	Structured digital data item	From ScienceBase item types, SMR redux	A resource that is a location-based container/base for observation data. Should this be generalized to OGC O&M samplingFrame to include other sampling geometry (borehole, image footprint)... Analogous in function to a keyword, but carries metadata on who located, when, why, how...

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3 USGIN Usage of Metadata Elements

3.1 Core spatial dataset, dataset series, and service elements

Table 2 is a listing of ISO19115 metadata elements used to describe any resource. Tables 3 and 4 provide specifics for describing datasets and services. Note that in the USGIN context, dataset is construed quite broadly to include any kind of georeferenced information resource, including physical samples and hard copy documents. The service metadata elements are defined by ISO19119. The root element of ISO xml-encoded metadata is MD_Metadata. Elements are discussed in this table in the order that they appear in the metadata document. Not all elements are discussed in detail. In a number of places where USGIN makes no specific provisions, we defer to recommendations in the North American Profile for ISO metadata (IN-CITS 453, referred to as NAP). Note that throughout this and the subsequent tables, the names of xml elements are shown in `this typecase`. Long X-paths have been broken with non-breaking hyphen characters. Hyphens are not used in any xml attribute or element name, so if they appear in the text, they are strictly for text wrapping.

Table 2. Description best practices for ISO19139 metadata elements in USGIN profile. This table includes base elements. Elements are in the order that they appear in a metadata instance.

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
Metadata file identifier (O) `fileIdentifier`	M-M	This identifies this metadata record, as opposed to `DatasetURI`, which identifies the described resource. A unique metadata record identifier must be included to allow CSW operations such as GetRecordById or harvest transactions. This identifier should be copied during harvest operations. Ideally there is one metadata record describing each resource, such that there should be a one-to-one mapping between metadata fileIdentifiers and DatasetURIs. However, not all described resources will have a DatasetURI, and the metadata record is a different resource from the resource it describes, and thus should not have the same identifier. The protocol used to generate the identifier does not matter, as long as it generates globally unique identifier strings. Services that rely on natural keys (e.g. serviceURL and layerID) are expected to put the key values in this field. Although there is technically no limit on the length of the identifier string, suggested best practice is to keep the string length less than 255 so the string will fit in legacy database string value fields. USGIN, ANZLIC, and the OGC CSW profiles for ISO metadata (OGC 07-045) recommend the use of the UUID (Universally Unique Identifier) for the `fileIdentifier`. The `fileIdentifier` is used to identify duplicate copies of metadata records, to reference one metadata record from another (via `MD_Data-Identification/aggregationInfo`), or to reference metadata from a described resource (e.g. `DS_Dataset/has/MD_Metadata`). If there is a difference between the two metadata records then one can determine the appropriate version by the content of other elements in the metadata record. The authoritative metadata record should be the only one made publicly available in metadata search systems such as a catalog service. The *OpenGIS® Catalogue Services Specification 2.0.2 - ISO Metadata Application Profile* (OGC 07-

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
		045) mandates that "To simplify catalogue mining each `MD_DataIdentification` instance being part of a `MD_Metadata` instance must have an identifier having a code value that is equal to the `fileIdentifier` of the owning `MD_Metadata` instance." USGIN is attempting to make the semantics of identifiers clear, with the provision (see Unique resource identifier in Table 3, below) that the identifier in `MD_DataIdentification/citation/CI_Citation/identifier/MD_Identifier` identifies the cited resource. This may be identical with the resource described by the metadata, in which case its value is `MD_Metadata/dataSetURI`, or it may be a publication that is the intellectual source of the described resource, in which case it is a different identifier. This USGIN provision, the OGC 07-045 recommendation is rejected because it obfuscates what the citation identifier refers to.
Metadata language (M) `language`	M-M	NAP specifies that language string is composed of a language code (ISO639-2/T) and an alpha3 country code (ISO3166-1). The syntax is "<ISO639-2/T three letter language code><;><blank space><ISO3166-1 three letter country code>" Language code is given in lowercase. Country code is given in uppercase, e.g. fra; CAN Currently, it appears that most CSW client and server applications only support the three letter language code; if testing reveals that this provision causes too much difficulty it will be changed. In the mean time, filtering for metadata in a particular language without a country localization may be done using a wildcard search for the three letter language code.
Metadata character set (C) `characterSet`	M-M	NAP specifies default name is "`utf8`", with codeListValue = "RI_458", codelist = "http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_95". However, due to interoperability problems, USGIN recommends use of ISO codelists: codeListValue="utf8" codelist= "http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/-Codelist/ML_gmxCodelists.xml#CI_CharacterSetCode. See 4.17.3 Codelists for discussion of codelist usage. USGIN requires that a character set code is defined to facilitate CSW servers (deegree, GeoNetwork, etc.).
Parent metadata record (O) `parentIdentifier`	O-X	Not used in USGIN profile. Used in ISO19115 to inherit metadata properties from parent to child records; USGIN CSW service implementations do not require clients to be able to navigate parent links to obtain inherited metadata properties, or to process filters using parent links, so this element is not used. To represent relationships between described resources use `MD_Identification/aggregationInfo`.

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments

Resource type (C)
`hierarchyLevel`
	M-M	Cardinality is 1...*. NAP and ISO codelists are equivalent. See 4.17.3 *Codelists* for discussion of encoding of codelist values. Due to interoperability problems, USGIN mandates use of ISO codelists. At least one MD_ScopeCode codelist value is required. Codelist is {`attribute, attributeType, collectionHardware, collectionSession, dataset, series, nonGeographicDataset, dimensionGroup, feature, featureType, propertyType, fieldSession, software, service, model, tile`}. The European INSPIRE Implementing Rules (MD_IR_and_ISO_20090218) proscribes the code list for the first hierarchyLevel xml element in an MD_Metadata document to be one of {`dataset, service, series`}, or the metadata set will be considered out of scope for the directive (see section 4.6 Resource Type).
		This property essentially categorizes the indexed resource with types that determine the metadata content and the required behavior to access the indexed resource. ISO Example – dataset metadata:
		<gmd:hierarchyLevel>
		  <gmd:MD_ScopeCode
		    codeList="**http://standards.iso.org/ittf/PubliclyAvailableStandards/ ISO_19139_Schemas/resources/Codelist/gmxCodelists.xml#MD_ScopeCode**"
		    codeListValue="**dataset**">dataset</gmd:MD_ScopeCode>
		</gmd:hierarchyLevel>

Resource hierarchy level name (C) `hierarchyLevelName`	O-M	ISO 19115 assumes that the metadata hierarchy level name defaults to "dataset" if it is not documented. NAP does not use it, recognizing that it is redundant. USGIN makes this property mandatory to identify the USGIN resource type from Table 1 (above). Default USGIN `hierarchyLevelName.CharacterString` is "Dataset". Encode hierarchy by including `hierarchyLevelName` elements for all broader resource categories. E.g. default should also include a `hierarchyLevelName`="Collection" element. For services USGIN `hierarchyLevelName.CharacterString` is "Service". As use cases develop that provide rationale for definition of sub-categories of service, the resource category list will be expanded. Example – dataset metadata: <gmd:hierarchyLevelName> <gco:CharacterString>Dataset</gco:CharacterString> </gmd:hierarchyLevelName> <gmd:hierarchyLevelName> <gco:CharacterString>Collection</gco:CharacterString> </gmd:hierarchyLevelName>

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
Metadata point of contact (M) `Contact/CI_ResponsibleParty`	M-M	Cardinality on contact is 1..*. USGIN requires at least one `CI_ResponsibleParty` with `role.CI_RoleCode@codeListValue` = "originator" (CI_RoleCode element value = "`originator`") that identifies the original source of the metadata record. If the point of contact for users to report errors, updates to metadata, etc. is different than the originator, an additional `contact/CI_ResponsibleParty` element may be included with `role.CI_RoleCode@codeListValue` = "pointOfContact" (CI_RoleCode element value="`pointOfContact`"). See 4.17.3 *Codelists* for discussion of encoding of codelist values. ISO Role codes applicable in this context include: {`custodian, owner, distributor, originator, pointOfContact`}. NAP adds {`editor`}. Due to interoperability problems with NAP identifiers different from ISO identifiers for the same codelist elements, USGIN recommends use of ISO codelists.
		The point of contact information (either `originator` or `pointOfContact`) must include a contact e-mail address (`electronicMailAddress`). This is in addition to the NAP rule that count of (individualName + organisationName + positionName) > 0 for any `CI_ResponsibleParty` element. The `contactInfo/CI_Contact/onlineResource/CI_OnlineResource` element for the `CI_ResponsibleParty` with `role.CI_RoleCode@codeListValue` = "`originator`" has `CI_OnlineResource/name` = "icon", the `CI_OnlineResource/linkage/URL` will be assumed to points to an icon image file (e.g. tif, png, jpg) for the metadata originator. This Icon will be displayed in search results to credit the metadata originator. Metadata harvesters must harvest and maintain all metadata originator information so that the origin of metadata records can be credited, and should harvest the point of contact information if it is different.
		If the service providing the metadata records wishes to identify itself in result records, this information should be included in an additional `MD_Metadata/contact/CI_ResponsibleParty` element, with `role.CI_RoleCode@codeListValue` = "`distributor`". Other responsible party roles applying to the metadata record (not the described resource) may also be specified here.
Metadata date stamp (M) `dateStamp`	M-M	USGIN profile requires use of `dateStamp/gco:DateTime` (Note this contrasts with INSPIRE mandate to use `dateStamp/gco:Date`). This is the date and time when the metadata record was created or updated (following NAP). The `dateStamp` is assumed to be updated to reflect any change in the metadata record that the metadata publisher wishes to propagate through the USGIN catalog system. This is the time stamp that will be used by harvesters to determine if a metadata needs to be updated in a harvesting catalog.
Metadata standard name (O) `metadataStandardName`	M-M	NAP specifies "NAP - Metadata". USGIN profile conformant metadata is indicated by using "ISO-USGIN" Use is mandatory to indicate that the metadata record conforms to this profile.
Metadata standard version (O) `metadataStandardVersion`	O-M	For this version of the USGIN profile, use "1.0" Use is mandatory to specify the version of the profile used

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
DataSet Identifier (O) `dataSetURI`	O-C	For USGIN, this is a string that uniquely identifies the described resource. If the resource has an identifier, it should be included here; if the resource will be referenced from other metadata, it must have an identifier here. Any kind of resource (not only datasets) may have an identifier. The protocol for the identifier is not specified, but some sort of documented scheme to assure uniqueness should be used (UUID, URN…). Some implementations place a URL for online access in the dataSetURI; for USGIN profile, the `MD_Distribution/transferOptions/MD_DigitalTransferOptions/online/CI_OnlineResource` is used to specify URLs for access to the resource. The dataSetURI should be considered an opaque identifier. This will avoid ambiguity about where to find URLs for online access to a described resource. If the dataset is coupled to a service, the value of the `MD_Metadata/dataSetURI` attribute is the unique resource identifier used by srv:coupledResource to link the service with the dataset. The *OpenGIS® Catalogue Services Specification 2.0.2 - ISO Metadata Application Profile* (OGC 07-045) Annex F recommends that `MD_DataIdentification/citation/CI_Citation/identifier/- MD_Identifier/code` match the identifiers specified by `SV_ServiceIdentification/operatesOn` and `SV_ServiceIdentification/coupledResource` for linking a described service to datasets that the service operates on. As discussed for `fileIdentifier` (above), this requires that a `MD_DataIdentification/citation/CI_Citation/identifier` explicitly for the dataset is included in the metadata record, in which case its value is the same as `MD_Metadata/dataSetURI`.
Other languages (C) `locale`	C-C	Other languages used in metadata free text description. If description in more than one language is provided, this property should indicate what those languages are. The primary language used for metadata description is identified with `MD_Metadata/language` and `characterSet` and any additional languages are identified by `MD_Metadata/locale/PT_locale` elements, in which the language is provided according to ISO 639-2/T three-letter terminology codes in lowercase, and an optional country is provided according to ISO 3166-1 three-letter codes in uppercase, and mandatory characterEncoding. See 4.17.3 *Codelists* for discussion of encoding of codelist values. NAP has a LanguageNameCodes codelist in their registry (http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_116), but this only points to ISO639-2. The a listing of codes in this codelist is available at http://www.loc.gov/standards/iso639-2/php/code_list.php. However, due to interoperability problems, USGIN prefers ISO over NAP codelists. The ISO code list catalog at http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codelist/ML_gmxCodelists.xml includes a LanguageCode codelist that includes the ISO 639-2 codes, in which the three letter codes are identifiers, and a gml:name, which is the English language name of the language is included. Unfortunately, only eng and fra are included in this codelist catalog. Go figure. Alternate names in other languages are also included in this catalogue. This catalogue should be referenced as the codeList for USGIN language elements as follows: NAP Example – dataset metadata:

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
		``
<gmd:locale>
  <gmd:PT_Locale id="FR">
    <gmd:languageCode>
      <gmd:LanguageCode
        codeList="http://www.loc.gov/standards/iso639-2/php/code_list.php"
        codeListValue="fra">French</gmd:LanguageCode>
    </gmd:languageCode>
    <gmd:characterEncoding>
      <gmd:MD_CharacterSetCode
        codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_95"
        codeListValue="RI_458">utf8</gmd:MD_CharacterSetCode>
    </gmd:characterEncoding>
  </gmd:PT_Locale>
</gmd:locale>
```
ISO Example – dataset metadata:
```
<gmd:locale>
  <gmd:PT_Locale id="FR">
    <gmd:languageCode>
      <gmd:LanguageCode
        codeList="http://www.loc.gov/standards/iso639-2/php/code_list.php"
        codeListValue="fra">French</gmd:LanguageCode>
    </gmd:languageCode>
    <gmd:characterEncoding>
      <gmd:MD_CharacterSetCode
        codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/
ISO_19139_Schemas/resources/Codelist/gmxCodelists.xml#MD_CharacterSetCode"
        codeListValue="utf8">UTF-8</gmd:MD_CharacterSetCode>
    </gmd:characterEncoding>
  </gmd:PT_Locale>
</gmd:locale>
```

The INSPIRE 19115/19 2009-02-18 guidelines use this codeList for language codes, but use the three letter abbreviation as the element value, not the gml:name from the codelist catalog. NAP examples (INCITES 453, 2009) reference the NAP codelist (IC_116), use the three letter code as the codeListValue, and the languageCode element value is the name of the language apparently using that language, e.g. codeListValue = 'fra', element value Français. Given these variations, it is recommended that search for a particular languageCode use the codeListValue as the criteria, with the three letter codes as the search value. |

| ISO 19115 (M/C/O)<br>xPath from MD_Metadata | NAP-USGIN M/C/O | Comments |
|---|---|---|
| [role] Resource spatial representation (O)<br><br>`spatialRepresentationInfo` | O-O | Best practice is to include metadata for spatial representation if the described resource is a georeferenced dataset. Metadata for Spatial data representation are derived from ISO 19107. Metadata is instantiated as one or more of `MD_GridSpatialRepresentation`, `MD_VectorSpatialRepresentation`, `MD_Georectified`, or `MD_Georeferenceable` classes. USGIN profile follows NAP for spatial representation metadata. Vector Spatial Representation is required if point or vector objects exist in the dataset. If `MD_VectorSpatialRepresentation` is used, either `spatialRepresentationInfo/MD_VectorSpatial-Representation/topologyLevel` or `spatialRepresentationInfo/MD_VectorSpatialRepresentation/-geometricObjects` shall be provided, or both." (NAP) `MD_GridSpatialRepresentation` or one of its subtypes (`MD_Georectified`, or `MD_Georeferenceable` ) is required if dataset objects are gridded. `MD_Georectified` should be used if the grid (image) is georeferenced, and `MD_Georeferenceable` is used if the grid (image) can be georeferenced. Follow NAP optionality if these elements are used. |
| Resource spatial representation vector topology (O)<br><br>`spatialRepresentationInfo/-MD_VectorSpatialRepresentation/topologyLevel` | C-C | Code that specifies the degree of complexity of spatial relationships between features in a dataset. Value is from ISO codelist `MD_TopologyLevelCode`. (Code names in this list include {`geometryOnly`, `topology1D`, `planarGraph`, `fullPlanarGraph`, `surfaceGraph`, `fullSurfaceGraph`, `topology3D`, `fullTopology3D`, `abstract`}. Due to interoperability problems with NAP identifiers different from ISO identifiers for the same codelist elements, USGIN mandates use of ISO codelists. See 4.17.3 *Codelists* for discussion of encoding of codelist values. It is unclear precisely what these values mean in terms of the topology encoding. To be useful, assertion that topology is present should indicate that topological relationships that may be implicit in the encoded vector geometry are explicitly represented (e.g. by correlation tables—left poly, right poly for a polyline) in the data. |
| Resource spatial representation vector geometric objects (O)<br><br>`spatialRepresentationInfo/-MD_VectorSpatialRepresentation/geometricObjects` | C-C | "Identification of the objects used to represent features in the dataset." (NAP) Provides a geometry type and count for the number of objects of each type. Use the ISO `MD_GeometricObjectTypeCode` codelist. Code names in this list are: {`complex`, `composite`, `curve`, `point`, `solid`, `surface`}. The ISO and NAP codelists are equivalent. Due to interoperability problems with NAP identifiers different from ISO identifiers for the same codelist elements, USGIN mandates use of ISO codelists. See 4.17.3 *Codelists* for discussion of encoding of codelist values. |
| [role] Resource's spatial reference system (O)<br><br>`referenceSystemInfo` | O-O? | Description of the spatial and/or temporal reference systems used in the dataset. NAP specifies { (`identificationInfo/spatialRepresentationType/MD_SpatialRepresentationTypeCode`= "`vector`") or (`../MD_SpatialRepresentationTypeCode` = "`grid`") or (`../MD_SpatialRepresentationTypeCode` = "`tin`") implies count `referenceSystemInfo` >= 1) }. See 4.17.3 Codelists for discussion of encoding of codelist values. NAP and ISO codelists are equivalent; USGIN mandates use of ISO codelist. |

| ISO 19115 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments |
|---|---|---|
| Reference System identifier code (O) `referenceSystemInfo/- MD_ReferenceSystem/- referenceSystemIdentifier/- RS_Identifier/code` | C-C | If `referenceSystemInfo` is included, then the `RS_Identifier` element must include at least a code value. For USGIN the code should be a value from the EPSG Geodetic Parameter Dataset register (http://www.epsg-registry.org/) in the form "EPSG:nnnn" where nnnn is the EPSG code number for the CRS. If the CRS is not defined in the EPSG registry, then the procedure specified in the NAP profile should be followed, e.g. the CRS shall be described according to ISO 19111 and ISO/TS 19127, assigned an identifier, and registered with an authority such that it may be referenced here. The `RS_Identifier/codespace` in this case should identify the registry authority where the CRS definition is registered, such that the definition can be located. Best Practice for USGIN purposes is to provide georeferenced data using one of the EPSG defined coordinate reference systems if this is possible. |
| Metadata extension information (O) `metadataExtensionInfo` | X-X | Not used in this profile. |
| Resource identification information (M) `identificationInfo` | M-M | Cardinality 1..*. The content of this element identifies the described resource. For resources that are not services, use `MD_DataIdentification` (**see Table 3**), otherwise `SV_ServiceIdentification` is required (**see Table 4)**. |
| [role] Content information (O) `contentInfo` | O-O | Characteristics describing the feature catalog, coverage, or image data. `MD_ContentInformation` is an abstract class. One or more of `MD_FeatureCatalogueDescription` or `MD_CoverageDescription` or `MD_ImageDescription` elements may be used to specify this content. `MD_FeatureCatalogueDescription` describes content in a feature service or dataset like an ESRI geodatabase that may have more than one feature, e.g. geologic unit outcrop polygons, fault line features, and point observation locations for strike and dip data. The `MD_FeatureCatalogueDescription` only provides a `CI_Citation` link to the full feature catalog, which may use ISO19110 or ISO11179. `MD_CoverageDescription` is for datasets that are one of the types listed in napMD_CoverageContentTypeCode: image, thematicClassification, physicalMeasurement. A coverage is a data structure that acts as a function to return values from its range for any direct position within its spatiotemporal domain (OGC 07-067r5). Image coverages return values for light intensity in a given wavelength range, thematicClassification coverages return codes corresponding to some domain concept, and physicalMeasurement coverages return values representing some physical quantity like magnetic susceptibility, density, resistivity. USGIN currently makes no recommendation for use of contentInfo; follow NAP recommendations (see INCITS 453). |

| ISO 19115 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments |
|---|---|---|
| [role] Resource distribution information (O)<br><br>`distributionInfo` | O-O | This element provides information to inform users how to obtain or access the described resource. Cardinality is 0..1. US GIN profile specifies that if distribution information is included (`MD_Distribution` is not null), then at least one `MD_Distribution/distributionFormat` and one `MD_Distribution/transferOptions` element is required, and the specified format is available via the specified transfer options. See section 4.13 '*Use of MD_Distribution and MD_Distributor*' for instructions for more complicated combinations of distributor, format, transfer options, and ordering instructions. |
| Resource distribution format (O)<br><br>`distributionInfo/-MD_Distribution/-distributionFormat` | O-O | Information on the format or physical manifestation of the resource. If distribution information is included (`MD_Distribution` is not null), then at least one `MD_Distribution/distributionFormat` element is required.<br>• If the resource is a physical resource, like a book, rock sample, paper document, the `distributionFormat/MD_Format/name` is mandatory, and must be from the USGIN distribution format codelist.<br>• For digital resources, the format specifies the file type, either using a MIME type, or formatted string. Pattern for digital resources: `[vendor:applicationName]/fileExtension`. The vendor and application names may not be applicable, and could be omitted, but the '/' and file extension should always be present.<br>• If the format consists of a single file, the file extension is a three letter file-type abbreviation assigned by the vendor.<br>• For services, list the output formats offered by the service in `distributioninfo` as a collection of `distributionFormat/MD_Format` elements if all formats are applicable to all service requests, or if the mapping between requests and formats is obvious. Encoding of the format name should use whatever convention is used by the service to specify that output format in requests made to the service. (see 4.14 Distribution Format). |
| Resource distributor information (O)<br><br>`distributionInfo/-MD_Distribution/distributor/-MD_Distributor/` | O-C | *USGIN differs from NAP* in this case (but not with ISO19115) by allowing multiple distributors, and binding between distributors, transfer options, and formats. For USGIN profile, each `distributor/MD_Distributor` is a binding between one or more transfer options and the distributor formats that are available through that/those transfer options (`MD_DigitalTransferOptions/onLine/CI_OnlineResource` in particular). If different formats are available from the same distributor, or have different transfer options, these should be represented as different `distributor/MD_Distributor` instances. See section 4.13 '*Use of MD_Distribution and MD_Distributor*' for instructions on use of these elements. |

| ISO 19115 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments |
|---|---|---|
| Resource distributor responsible party (O)<br><br>`distributionInfo/-`<br>`MD_Distribution/-`<br>`distributor/MD_Distributor/-`<br>`distributorContact/-`<br>`CI_ResponsibleParty` | C-C | If `distributionInfo` is not null, `MD_Distributor` is required, which requires one `CI_ResponsibleParty`. For responsible party, count of (`individualName` + `organisationName` + `positionName`) > 0, and CI_RoleCode is required. ISO Role codes applicable in this context include: {`resourceProvider`, `custodian`, `owner`, `distributor`, `pointOfContact`, `publisher`, `author`}. NAP adds some potentially useful values. Due to interoperability problems with NAP identifiers different from ISO identifiers for the same codelist elements, USGIN recommends use of ISO codelists. See section 4.17.3 '*Codelists'* for details on codelist encoding. |
| Resource distributor order process (O)<br><br>`distributionInfo/-`<br>`MD_Distribution/distributor/-`<br>`MD_Distributor/-`<br>`distributionOrderProcess/-`<br>`MD_StandardOrderProcess` | O-O | Information on the availability of the resource including at least one of fees, available date and time, ordering instructions, or turnaround. For physical resources, ordering instructions are mandatory as these will typically indicate the method of accessing the resource. |
| Resource distributor format (O)<br><br>`distributionInfo/-`<br>`MD_Distribution/distributor/-`<br>`MD_Distributor/-`<br>`distributorFormat/MD_Format` | (O-C) | See section 4.14 Distribution Format ' for instructions on use of these elements. |
| Resource distributor online distribution linkage (O)<br><br>`distributionInfo/-`<br>`MD_Distribution/distributor/-`<br>`MD_Distributor/-`<br>`distributorTransferOptions/-`<br>`MD_DigitalTransferOptions/-`<br>`online/-`<br>`CI_OnlineResource/linkage` | M-M | Digital transfer options are "Technical means and media by which a dataset is obtained from the distributor." NAP requires `CI_OnlineResource/linkage` and `CI_OnlineResource/protocol` in `CI_OnlineResource`. The `CI_OnlineResource/linkage` element should contain the complete URL to access the resource directly (see section 4.13). `CI_OnlineResource` requires a `Linkage` element that is a `gmd:URL`. |

| ISO 19115 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments |
|---|---|---|
| Resource distributor online distribution linkage (O)<br>`distributionInfo/-`<br>`MD_Distribution/-`<br>`distributor/MD_Distributor/-`<br>`distributorTransferOptions/-`<br>`MD_DigitalTransferOptions/-`<br>`online/-`<br>`CI_OnlineResource/protocol` | M-M | The `CI_OnlineResource/protocol` element defines a valid internet protocol used to access the resource. USGIN mandates use of protocol mnemonics from the Official Internet Protocol Standards registry published on the Web at http://www.rfc-editor.org/rfcxx00.html.  'ftp' or 'http' are common values.  If no mnemonic has been assigned, use the rfc number. |
| Resource distributor online distribution linkage (O)<br>`distributionInfo/-`<br>`MD_Distribution/distributor/-`<br>`MD_Distributor/-`<br>`distributorTransferOptions/-`<br>`MD_DigitalTransfer-`<br>`Options/online/-`<br>`CI_OnlineResource/name` | O-O | The `CI_OnlineResource/name` element may duplicate the file name if the URL is a link to a file, but it is recommended to provide a user-friendly label for the file that could be presented in a user interface. |
| Resource distributor online distribution application profile (O)<br>`distributionInfo/-`<br>`MD_Distribution/distributor/-`<br>`MD_Distributor/-`<br>`distributorTransferOptions/-`<br>`MD_DigitalTransferOptions/-`<br>`online/CI_OnlineResource/-`<br>`applicationProfile` | C-C | `applicationProfile` is required if the `CI_OnlineResource/linkage` does not connect to a web page, and another software application is needed to use the indicated file resource. The `application-Profile` character string should specify the software using the following recommended syntax: "vendor:application name/application version", e.g. "Microsoft:Word/2007", or "ESRI:ArcGIS/9.3" |
| Resource distributor online distribution function (O)<br>`distributionInfo/-`<br>`MD_Distribution/distributor/-`<br>`MD_Distributor/-`<br>`distributorTransferOptions/-`<br>`MD_DigitalTransferOptions/-`<br>`online/CI_OnlineResource/-`<br>`function` | O-C | `CI_OnlineResource/function` is required by USGIN to indicate how linkage is to be used. Valid values for CI_OnlineFunctionCode in this role are summarized in Table 7. If the resource is accessible as a web service, the metadata for the service should be separate metadata record with the dataset(s) exposed through the service identified in the service metadata record as coupledResources. The NAP function code vocabulary extends the ISO codelist, and this list will likely need to be customized further. |

| ISO 19115 (M/C/O)<br>xPath from MD_Metadata | NAP-USGIN M/C/O | Comments |
|---|---|---|
| Resource distribution transfer options (O)<br><br>`distributionInfo/-MD_Distribution/-transferOptions/-MD_DigitalTransferOptions` | C-C | `MD_DigitalTransferOptions` provides information on digital distribution of resource. See section 4.13 '*Use of MD_Distribution and MD_Distributor*' for instructions on use of this element. Details on encoding for MD_DigitalTransferOptions are above in the distributorTransferOptions elements description. If distribution information is included (MD_Distribution is not null), then at least one one MD_Distribution/transferOptions element is required. |
| [role] Data quality information (O)<br>`dataQualityInfo` | C-C | Either `dataQualityInfo/DQ_DataQuality/report` or `dataQualityInfo/DQ_DataQuality/lineage` is mandatory if a dataQualityInfo element is present. `dataQualityInfo/DQ_DataQuality/scope` is required, with value from MD_ScopeCode: {`attribute, attributeType, collectionHardware, collectionSession, dataset, series, nonGeographicDataset, dimensionGroup, feature, featureType, propertyType, fieldSession, software, service, model, tile`}. The ISO and NAP codelists are identical, so USGIN mandates use of ISO codelists. See 4.17.3 *Codelists* for discussion of encoding of codelist values. `dataQualityInfo` has cardinality 0..*. See section 4.19 *Data Quality*<br>*Simple quality statement*<br>*For most resource evaluation purposes (is the described resource* good enough for my purposes?) most users would find a free text statement more useful that a detailed xml document. What would be useful for many cases is the ability to state something like "These data were compiled by the authors from field sheets and notes by scanning paper copies, georeferencing and digitizing on screen. Station locations are based on Garmin 12 GPS readings, except locally where they have been adjusted for consistency with the base map. Original GPS coordinates are reported in the station table. These data have been reviewed for completeness of description and internal consistency, but have not been independently field checked." This is the kind of quality information that is all that is available for many resources; it is neither a quantitative measure nor technically a conformance result. A simple qualityStatement would suffice and provide significant value.<br><br>To implement this simple case, the proposed solution is to use `DQ_DataQuality[1]/report[1]/-AbstractDQ_Element/result[1]/DQ_ConformanceResult/explanation` as a place to put this text explanation. The use of any of the concrete data quality elements (e.g. DQ_QuantitativeAttributeAccuracy, DQ_RelativeInternalPositionalAccuracy..) is arbitrary; the mechanism proposed here is that the xpath `DQ_DataQuality[1]//report[1]//explanation/CharacterString` (the first data quality report conformance explanation in the metadata document) would contain a free text discussion/description of data quality considerations for the indicated scope. The use of any specific data quality element to contain this explanation is arbitrary and would not be considered meaningful in this context.<br><br>Data quality for individual parts of a resource  for discussion of data quality with resource parts. |

| ISO 19115 (M/C/O)<br>xPath from MD_Metadata | NAP-USGIN M/C/O | Comments |
|---|---|---|
| Data quality scope (O)<br>`dataQualityIn-fo/DQ_DataQuality/scope` | C-C | Mandatory if `DQ_DataQuality` is not null.  Specifies the extent of characteristics for which data quality information is reported. Value is from MD_ScopeCode: {`attribute, attributeType, collectionHardware, collectionSession, dataset, series, nonGeographicDataset, dimensionGroup, feature, featureType, propertyType, fieldSession, software, service, model, tile`}. The ISO and NAP codelists are identical, so USGIN mandates use of ISO codelists. See 4.17.3 *Codelists* for discussion of encoding of codelist values. |
| Data quality scope level description (O)<br>`dataQualityInfo/-DQ_DataQuality/-scope/levelDescription` | C-C | `DQ_DataQuality/scope/levelDescription` is mandatory if `../scope/DQ_Scope/level/MD_ScopeCode` = "`attributeType`" or "`featureType`". `levelDescription` specifies the aspect of the larger resource described by the containing `dataQualityInfo/DQ_DataQuality` element. The data type for the `levelDescription` child elements are reference only; the documentation in ISO19115 (2003, section B.4.4, p. 91) indicates that these are references to ISO19109 (Application Schema) elements describing attributes or features in the application scheme. For USGIN these will be xlink:href or uuidref URIs. Only the `features` and `attributes` child elements are used by the USGIN profile. See section 4.19 *Data Quality*<br>*Simple quality statement*<br>*For most resource evaluation purposes (is the described resource* good enough for my purposes?) most users would find a free text statement more useful that a detailed xml document. What would be useful for many cases is the ability to state something like "These data were compiled by the authors from field sheets and notes by scanning paper copies, georeferencing and digitizing on screen. Station locations are based on Garmin 12 GPS readings, except locally where they have been adjusted for consistency with the base map. Original GPS coordinates are reported in the station table. These data have been reviewed for completeness of description and internal consistency, but have not been independently field checked." This is the kind of quality information that is all that is available for many resources; it is neither a quantitative measure nor technically a conformance result. A simple qualityStatement would suffice and provide significant value.<br><br>To implement this simple case, the proposed solution is to use `DQ_DataQuality[1]/report[1]/-AbstractDQ_Element/result[1]/DQ_ConformanceResult/explanation` as a place to put this text explanation. The use of any of the concrete data quality elements (e.g. DQ_QuantitativeAttributeAccuracy, DQ_RelativeInternalPositionalAccuracy..) is arbitrary; the mechanism proposed here is that the xpath `DQ_DataQuality[1]//report[1]//explanation/CharacterString` (the first data quality report conformance explanation in the metadata document) would contain a free text discussion/description of data quality considerations for the indicated scope. The use of any specific data quality element to contain this explanation is arbitrary and would not be considered meaningful in this context.<br><br>Data quality for individual parts of a resource  for more discussion of levelDescription. |

| ISO 19115 (M/C/O)<br>xPath from MD_Metadata | NAP-USGIN M/C/O | Comments |
|---|---|---|
| Data quality report (O)<br>`dataQualityInfo/-`<br>`DQ_DataQuality/report` | C-C | If a `DQ_DataQuality/report` element is included, at least one of the 15 possible data quality elements must be present, and multiple report elements are allowed within each `DQ_DataQuality` element. Each of these *AbstractDQ_element* subtypes has optional `nameOfMeasure`, `measureIdentification`, `measureDescription`, `evaluationMethodType`, `evaluationMethodDescription`, `evaluationProcedure`, and `dateTime` elements, and one or two required result elements. The *AbstractDQ_element* /result is either a `DQ_ConformanceResult` or a `DQ_QuantitativeResult`, each of which has required and optional sub-elements. Inclusion of this report metadata should follow recommendations in NAP.<br>In this profile, the requirement is to implement a simple case where a text explanation of data quality considerations is desired. The proposed implementation is to use The use of one of the specific data quality elements (e.g. DQ_QuantitativeAttributeAccuracy, DQ_RelativeInternalPositionalAccuracy..) is arbitrary; the mechanism proposed here is `DQ_DataQuality[1]//report[1]// explanation/ Charac-terString` to contain a free text discussion/description of data quality considerations for the indicated scope. The use of any specific data quality element to contain this explanation is arbitrary and should not be considered meaningful in this context. |
| Data quality lineage (O)<br>`dataQualityInfo/-`<br>`DQ_DataQuality/lineage` | C-C | USGIN follows NAP rule that count(`lineage/LI_Lineage/source` + `lineage/LI_Lineage/sourceStep` + `lineage/LI_Lineage/statement` ) >0  for spatial dataset and spatial dataset series. Not applicable to services. USGIN recommended practice is described in section 4.19. |
| Data quality lineage statement (O)<br>`dataQualityInfo/-`<br>`DQ_DataQuality/lineage/-`<br>`LI_Lineage/statement` | C-C | INSPIRE makes general `lineage/LI_Lineage/statement` mandatory. "General explanation of the data producer's knowledge of the dataset lineage" NAP. USGIN recommended practice is described in section 4.19. |
| Data quality lineage source (O)<br>`dataQualityInfo/-`<br>`DQ_DataQuality/lineage/-`<br>`LI_Lineage/source` | C-C | Each `source/LI_Source` element describes a source data resource that is input into a processStep. NAP provision is that `LI_Source/description` is mandatory if `LI_Source/sourceCitation` and `LI_Source/sourceExtent`  are not provided. If used, the `LI_Source/description` includes the source medium name from the CodeList napMD_MediumNameCode, followed by <;><blank space> and a free text description, e.g. "dvd; source satellite image."<br>If the source is part of a processing chain, the `LI_Source/processStep/LI_ProcessStep` provides "Information about an event related to the creation process for the source data." (INCITS 453). This is interpreted to mean that the link from a source to a process step is to a process step for which the described source is an output. USGIN recommended practice is described in section 4.19. |

| ISO 19115 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments |
|---|---|---|
| Data quality lineage process step (O)<br><br>`dataQualityInfo/-DQ_DataQuality/lineage/-LI_Lineage/processStep` | C-C | An event in the development of the dataset. Each step requires a free text description, and may have a free text `rationale`, `dateTime` stamp when process was complete, 0 to many `CI_ResponsibleParty` elements identifying parties involved in the process, and finally 0 to many `source/LI_Source` associations to identify data that is input into the process step. Best practice recommended for USGIN is that source association from a process step is to inputs to a process, and `processStep` associations from a source element link an output resource to a process step that produced it. See USGIN recommended practice is described in section 4.19. |
| [role] Portrayal catalog information (O)<br><br>`portrayalCatalogueInfo` | O-O | `portrayalCatalogueInfo/MD_PortrayalCatalogReference/portrayalCatalogueCitation/CI_Citation` element identifying a catalogue that contains symbols and rules to depict a resource. A portrayal catalog is a collection of defined symbols used to depict, to humans, features on a map. No documentation in ISO19115 about how this is supposed to work. ISO 19117 defines the structure of a Portrayal Catalogue. No USGIN recommended practices here yet. |
| [role] Metadata constraint information (O)<br><br>`metadataConstraints` | O-O | This element specifies use constraints for access to the metadata record. Use constraints for accessing the describe resource are in `resourceConstraint/MD_Constraint` in `MD_DatasetIdentification` or `MD_ServiceIdentification`. Follow NAP for specification of access constraints.<br>NAP provision is that `metadataConstraints/MD_Constraints/useLimitation` is mandatory when `MD_Constraints` is used to specify `metadataConstraints`. When one of the subtypes `MD_LegalConstraints` or `MD_SecurityConstraints` is used, `useLimitation` is optional. `MD_LegalConstraints` are specified by MD_RestrictionCode. ISO codelist values are {`copyright, patent, patentPending, trademark, license, intellectualPropertyRights, restricted, otherRestrictions`}. NAP codelist adds {`licenseUnrestricted, licenseEndUser, licenseDistributor, privacy, statutory, confidential, sensitivity`}. See 4.17.3 *Codelists* for discussion of encoding of codelist values. `otherConstraints` is a free text element required by NAP if `accessConstraints` or `useConstraints` is set to "otherRestrictions." For an example: "Data only to be used for the purposes for which they were collected." `MD_SecurityConstraints` has various optional free text values, and a required `MD_SecurityConstraints/classification` from ISO MD_ClassificationCode: {`unclassified, restricted, confidential, secret, topSecret`}. NAP adds {`sensitive, forOfficialUseOnly`}. See 4.17.3 *Codelists* for discussion of encoding of codelist values. |
| [role] Application schema information (O)<br><br>`applicationSchemaInfo` | O-O | Information about the information schema of the resource `applicationSchemaInfo/MD_ApplicationSchemaInformation` element has mandatory `name/CI_Citation`, `schemaLanguage` free text, and `constraintLanguage` free text. The `MD_ApplicationSchemaInformation` element also allows inclusion of an actual schema document as ASCII, or a binary `graphicsFile` or `softwareDevelopmentFile`. Multiple applicationSchemaInfo elements may be used for different presentations of a single schema, or for different kinds of schema (e.g. physical, logical, conceptual). |

| ISO 19115 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments |
|---|---|---|
| [role] Metadata maintenance information (O) `metadataMaintenance` | O-O | This element provides information about the maintenance schedule or history of the metadata record. Only one `MD_MaintenanceInformation` element may be included, with a required MD_MaintenanceFrequencyCode. The ISO codelist is {`continual`, `daily`, `weekly`, `fortnightly`, `monthly`, `quarterly`, `biannually`, `annually`, `asNeeded`, `irregular`, `notPlanned`, `unknown`}. NAP adds {`semimonthly`}. See 4.17.3 *Codelists* for discussion of encoding of codelist values. |
| [role] Series information (O) `series` | X-X | The `MD_Metadata/series` element that appears in the ISO19139 schema appears to implement the metadata application model in ISO19115:2003 Figure 3, which is a UML class diagram defining the classes of geographic information to which metadata applies. The series role appears to allow modeling aggregation of datasets into various kinds of aggregation classes like DS_Series, DS_StereoMate, DS_Initiave … NAP does not mention it. Use case appears for bundling collections of related metadata records to allow simpler cross referencing and resolution of inherited property values. … Not Used by USGIN. |
| [role] Described resource (O) `describes` | X-X | The `MD_Metadata/describes` element that appears in the ISO19139 schema appears to implement the metadata application model in ISO19115:2003 Figure 3, which is a UML class diagram defining the classes of geographic information to which metadata applies. The `describes` association models the link from a metadata record to the described resource. … Not used by USGIN. |
| [role] Property type description (O) `propertyType` | X-X | The `MD_Metadata/propertyType` element that appears in the ISO19139 schema appears to implement the metadata application model in ISO19115:2003 Figure 3, which is a UML class diagram defining the classes of geographic information to which metadata applies. The `propertyType` association apparently models the fact that a metadata record might be attribute-level metadata—that is describing an individual property value assignment. … Not used by USGIN. |
| [role] Feature type description (O) `featureType` | X-X | Although an `MD_Metadata/featureType` element that appears in the ISO19139 schema appears to implement the metadata application model in ISO19115:2003 Figure 3, which is a UML class diagram defining the classes of geographic information to which metadata applies. The `featureType` association apparently models the fact that a metadata record might describe an individual feature. … Not used by USGIN. |
| [role] Feature attributes (O) `featureAttribute` | X-X | Although an `MD_Metadata/featureAttribute` element that appears in the ISO19139 schema appears to implement the metadata application model in ISO19115:2003 Figure 3, which is a UML class diagram defining the classes of geographic information to which metadata applies. The `featureAttribute` association apparently models the fact that a metadata record might be attribute-level metadata—that is describing an individual property value assignment; distinction between propertyType and featureAttribute is not explained. … Not used by USGIN. |

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## 3.2 Dataset Identification properties (MD_DataIdentification)

The difference between metadata for services, and metadata for other resources is in the `identificationInfo` part of the ISO19139 xml schema. Service metadata utilizes the `SV_ServiceIdentification` element to provide a description and identification of a service (see 3.3 Service identification elements (SV_ServiceIdentification). This section documents use of `MD_DataIdentification` for metadata describing other resources of interest in the geoscience information network.

*Table 3. Dataset Identification properties (MD_DataIdentification)*

| ISO 19115 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on MD_DataIdentification |
|---|---|---|
| Resource citation (M) `identificationInfo[1]/- MD_DataIdentification/- citation/CI_Citation` | M-M | The citation attribute provides information for citing the described resource. Citation is defined by Webster as "an act of quoting". The precise semantics of what an identification/citation is supposed to be are not very well articulated in ISO19115. For USGIN purposes, this should be viewed as information to identify the intellectual origin of the content in the described resource, along the lines of a citation in a scientific journal. Required content for a `CI_Citation` element are `title`, `date`, and `responsibleParty`. |
| Resource title (M) `identificationInfo[1]/- MD_DataIdentification/- citation/CI_Citation/title` | M-M | USGIN recommends using titles that inform the human reader about the dataset's content as well as its context. |
| Resource reference date (M) `identificationInfo/- MD_DataIdentification/- citation/CI_Citation/date/- CI_Date/date/` | M-M | Best practice is to include at least the date of publication or creation of the resource. The date of the resource reported in the citation corresponds to the resource's last update version according to its update frequency. `CI_Date` content includes a `date` and `dateType`. Date for USGIN profile uses xs:date data type, defined thus "date uses the date/timeSevenPropertyModel, with hour, minute, and second required to be *absent*. `timezoneOffset`· remains optional" (http://www.w3.org/TR/xmlschema11-2). Example date encoding: 2000-12-12+13:00, 2006-10-01. If the month or day is not known, encode as '00', for example '2006-00-00'. `DateType` is from napCI_DateTypeCode which identifies the event used for the temporal aspect of the resource. This date is distinct from the `dateStamp` for the metadata record, or the `EX_Extent/temporalElement` that specifies the time period to which the resource content is applicable. |

| ISO 19115 (M/C/O)<br>xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on MD_DataIdentification |
|---|---|---|
| Unique resource identifier (O)<br><br>`identificationInfo/-`<br>`MD_DataIdentification/-`<br>`citation/CI_Citation/-`<br>`identifier/MD_Identifier` | C-C | NAP makes `MD_Identifier` mandatory for dataset and dataset series. For USGIN, if the Citation has an identifier that is different from the identifier for the described resource (`MD_Metadata/dataSetURI`), it must be included here.<br>For USGIN purposes, this element content value should be only considered an identifier for the citation, without any assumption that it will use http protocol. The identifier may be resolvable to a URL, if a protocol prefix specifies an identifier scheme that is resolvable (e.g. http, urn…), but this is not necessary for a valid document, and should not be assumed when processing metadata documents. The USGIN profile requires the use of MD_Identifier element to identify resources. RS_Identifier may substitute for MD_Identifier in the ISO19139 schema, but the USGIN profile requires use of MD_Identifer. If additional codespace and version content is associated with the identifier, it should be encoded as `MD_Identifier/authority/CI_Citation/alternateTitle` and `MD_Identifier/authority/-`<br>`CI_Citation/edition` |
| Resource responsible party (O)<br><br>`identificationInfo/-`<br>`MD_DataIdentification/-`<br>`citation/CI_Citation/-`<br>`citedResponsibleParty` | M-M | CI_Citation cardinality exactly one required. USGIN requires at least one `CI_ResponsibleParty` following the NAP rule that count of (individualName + organisationName + positionName) > 0. The `CI_ResponsibleParty/role/CI_RoleCode@codeListValue` is from CI_RoleCode. See 4.17.3 *Codelists* for discussion of encoding of codelist values. For most intellectual content, the responsible party is what would normally be considered the author of a work. Best practice is to include point of contact information for the resource in `MD_DataIdentification/pointOfContact/ CI_ResponsibleParty`. Guidance on use of role codes would be helpful for consistency, but has not been developed as yet. |
| Resource presentation form (O)<br><br>`identificationInfo/-`<br>`MD_DataIdentification/-`<br>`citation/CI_Citation/-`<br>`presentationForm` | O-C | The form in which the cited resource is available. Note that the citation is to the original source of intellectual content in the described resource, and its presentation may be different from the format for distribution described in the metadata. USGIN recommends that this element is required if there is a difference between the cited resource presentation format and the distribution format(s) listed in the `distributionInfo/MD_Distribution` section of the metadata record.<br>`presentationForm` uses CodeList = CI_PresentationFormCode, with ISO code names {`docu-mentDigital, documentHardcopy, imageDigital, imageHardcopy, mapDigital, mapHardcopy, modelDigital, modelHardcopy, profileDigital, profileHardcopy, tableDigital, tableHardcopy, videoDigital, videoHardcopy, audioDigital`}. NAP adds {`audioHardcopy, multimediaDigital, multimediaHardcopy, diagramDigital, diagramHardcopy`}. Due to interoperability problems with NAP identifiers different from ISO identifiers for the same codelist elements, USGIN recommends use of ISO codelists. See section 4.17.3 *Codelists* for details on codelist encoding. |
| Resource series (O)<br><br>`identificationInfo/-`<br>`MD_DataIdentification/-`<br>`citation/CI_Citation/series` | O-O | Information about the (publication) series or collection of which the resource is a part. NAP rule: (name + issueIdentification) > 0. |

| ISO 19115 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on MD_DataIdentification |
|---|---|---|
| Resource other citation details (O)<br><br>`identificationInfo/-MD_DataIdentification/-citation/CI_Citation/-otherCitationDetails` | O-O | "Other information to complete a citation." NAP |
| Resource collective title (O)<br><br>`identificationInfo/-MD_DataIdentification/-citation/CI_Citation/-collectiveTitle` | O-C | Title of the combined resource that the cited resource is part of, for example the cited resource may be a paper in an anthology, in which case the anthology title would be the collective title. Required if the cited resource is part of such a collective work. |
| Resource abstract (M)<br><br>`identificationInfo/-MD_DataIdentification/abstract` | M-M | A free text summary of the content, significance, purpose, scope, etc. of the resource. Exactly one value. |
| Resource purpose (O)<br><br>`identificationInfo/-MD_DataIdentification/purpose` | O-O | "Summary of the intentions for which the dataset was developed. Purpose includes objectives for creating the dataset and what the dataset is to support." NAP |
| Resource status (O)<br><br>`identificationInfo/-MD_DataIdentification/status` | M-M | Value is from MD_ProgressCode codelist. ISO values are {`completed`, `historicalArchive`, `obsolete`, `onGoing`, `planned`, `required`, `underdevelopment`}. NAP adds {`proposed`}. Obsolete is synonymous with deprecated. Due to interoperability problems with NAP identifiers different from ISO identifiers for the same codelist elements, USGIN recommends use of ISO codelists. See section 4.17.3 *Codelists* for details on codelist usage. |
| Resource point of contact (O)<br><br>`identificationInfo/-MD_DataIdentification/-pointOfContact` | O-C | CI_ResponsibleParty element here would contain information for point of contact to access the resource. This information is mandatory for physical resources such as core, cuttings, samples, manuscripts. USGIN rule that count of (individualName + organisationName + positionName) > 0. The `CI_ResponsibleParty/role/CI_RoleCode` is from CI_RoleCode codelist. ISO role codes for physical resource point of contact are {`custodian`, `owner`, `pointOfContact`}; other point of contact role codes may apply for other resources. Due to interoperability problems with NAP identifiers different from ISO identifiers for the same codelist elements, USGIN recommends use of ISO codelists. See section 4.17.3 *Codelists* for details on codelist usage. |

| ISO 19115 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on MD_DataIdentification |
|---|---|---|
| Resource maintenance (O) `identificationInfo/-MD_DataIdentification/-resourceMaintenance` | O-O | This element provides information about the maintenance schedule or history of the resource (or some subset/part of the resource specified by the scope and scope description) described by the metadata record. 0 to many `MD_MaintenanceInformation` elements may be included. Different `MD_MaintenanceInformation` elements are required to have different napMD_ScopeCode or `MD_ScopeDescription`. Usage of `MD_ScopeDescription` is poorly described, and no actual examples of usage could be found; it would appear to allow identification of a set of attribute or features (by name?), or feature instances or attribute instances (identified how?), or a dataset, to which the maintenance information applies. Use MD_MaintenanceFrequencyCode codelist. ISO values are {`continual, daily, weekly, fortnightly, monthly, quarterly, biannually, annually, asNeeded, irregular, notPlanned, unknown`}. NAP adds {`semimonthly`}. Due to interoperability problems with NAP identifiers different from ISO identifiers for the same codelist elements, USGIN recommends use of ISO codelists. See section 4.17.3 *Codelists* for details on codelist usage. |
| Graphic overview of resource (O) `identificationInfo/-MD_DataIdentification/-graphicOverview` | O-O | Highly recommended to include a URL providing a web-accessible visual representation of the resource if it is applicable to the described resource, particularly for geographic datasets that may be represented by maps. If `MD_BrowseGraphic` is included, `MD_BrowseGraphic/filename` character string is mandatory. USGIN Recommended practice is to provide a complete URL as a gco:characterString value for the `filename` property. Use napMD_FileFormatCode code values (http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_115) in `fileType/CharacterString`, but because of schema problems, encoding the xsi:Type for the codelist extension is not recommended. See section 4.17.3 *Codelists* for details on codelist usage. Repeatable element; multiple values may present different resolutions, or different parts of resource. Names associated with overview should provide sufficient information for user to distinguish these. |
| Resource format (O) `identificationInfo/-MD_DataIdentification/-resourceFormat` | X-X | This element is not used by NAP or USGIN; this information is encoded in `MD_Metadata/distributionInfo/MD_Distribution/` in USGIN metadata (see 4.13 *Use of MD_Distribution and MD_Distributor*). |

| ISO 19115 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on MD_DataIdentification |
|---|---|---|
| Resource keywords (O) `identificationInfo/- MD_DataIdentification/- descriptiveKey- words/MD_Keyword` | O-O | Best Practice for USGIN profile metadata is to supply keywords to facilitate the discovery of metadata records relevant to the user. **USGIN Keywords**: USGIN keyword vocabularies are in development. Future versions of this profile may include required keyword vocabularies. **Other Keywords**: Keyword Type - allowed values from MD_KeywordTypeCode. ISO codelist includes {`discipline, place, stratum, temporal, theme`}. NAP adds {`product, sub-TopicCategory`}. Due to interoperability problems with NAP identifiers different from ISO identifiers for the same codelist elements, USGIN recommends use of ISO codelists. See section 4.17.3 Codelists for details on codelist usage. USGIN requires that `MD_Keyword/keyword` contain a `CharacterString` (see section 4.16). USGIN best practice is to include keywords in English. |
| Condition applying to access and use of resource (O) `identificationInfo/- MD_DataIdentification/- resourceConstraints/` | O-O | Restrictions on the access and use of a resource or metadata. Follow NAP for specification of `resourceConstraints`. This attribute provides information for access control to the described resource itself. In some situations, the `metadataConstraints` may allow a user to learn of the existence of a resource that they may not actually be able to access without further clearance. Constraints may be represented by `MD_Constraint`, `MD_LegalConstraint`, or `MD_SecurityConstraint`. |
| Aggregation information (O) `identificationInfo/- MD_DataIdentification/- aggregationInfo/- MD_AggregateInformation` | O-O | This element includes either a citation for or identifier of an associated dataset, along with the type of association between the datasets, and optionally the activity that produced the dataset. `MD_AggregateInformation` requires either `aggregateDataSetName/CI_Citation` or `aggregateDataSetIdentifier/MD_Identifier`. `MD_AggregateInformation/associationType` is mandatory, from DS_AssociationTypeCode. ISO codelist includes {`crossReference, largerWorkCitation, partOfSeamlessDatabase, source, stereoMate`}. NAP adds {`isComposedOf`}. Due to interoperability problems with NAP identifiers different from ISO identifiers for the same codelist elements, USGIN recommends use of ISO codelists. See section 4.17.3 *Codelists* for details on codelist usage. If the related resource has an associated metadata record, USGIN recommended practice is to include the identifier for that metadata record in `aggregateDataSetIdentifier/MD_Identifier`. For related resources that do not have a metadata record, `aggregateDataSetName/CI_Citation` may be used; this element is optional if `aggregateDataSetIdentifier` has a value. For USGIN profile, this property, rather than `MD_Metadata/parentIdentifier`, should be used to indicate relationships between described resources. |
| Spatial Representation Type (O) `MD_DataIdentification/spatial RepresentationType/` | O-O | value from MD_SpatialRepresentationTypeCode list. ISO codelist includes {`vector, grid, textTable, tin, stereoModel, video`}. ISO and NAP codelists have the same terms, USGIN mandates use of ISO codelists. See section 4.17.3 *Codelists* for details on codelist usage. |

| ISO 19115 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on MD_DataIdentification |
|---|---|---|
| Resource spatial resolution (O) `MD_DataIdentification/-spatialResolution/-MD_resolution/equivalentScale /MD_RepresentativeFraction/-denominator` | C-C | USGIN requires use of `equivalentScale/../denominator` to express spatial resolution, in order to be more easily interoperable. ISO19139 schema requires `MD_resolution` to be specified by an `equiva-lentScale/MD_RepresentativeFraction/denominator` or a `distance` (or both), so if a `distance` is available, that should be supplied as well. The resolution distance represents the smallest length between two resolvable points in the dataset. To calculate `equivalentScale` given a resolution distance, recommended practice is to divide the resolution distance in meters by 0.0005. This assumes that the smallest distance resolvable in a map display for human usage is 0.5 mm. |
| Resource language (O) `identificationInfo/-MD_DataIdentification/languag e` | M-M | Language for content of described resource. The mandatory optionality is inherited from NAP, although it does not make sense for non-language based content like images or physical samples. Default value is 'eng'. If language is not applicable to the described resource use 'zxx'. Multiple instances of this element indicate that the linguistic content of the resource is available in multiple languages. Three-letter language code followed by an optional three-letter country code: {ISO 639-2/T three letter language code}{<;><blank space><ISO 3166-1 three letter country code} Language code is given in lowercase. Country code is given in uppercase. ISO 639 codelists are available at http://www.loc.gov/standards/iso639-2/php/code_list.php. ISO 3166-1 codelists are at http://www.iso.org/iso/english_country_names_and_code_elements. |
| Topic category `identificationInfo/-MD_DataIdentification/-topicCategory` | C-C | NAP specifies that topicCategory code shall be provided when hierarchyLevel is set to "dataset" or "dataset series". Codes are from MD_TopicCategoryCode, the ISO codelist includes {`farming, bi-ota, boundaries, climatologyMeterologyAtmosphere, economy, elevation, envi-ronment, geoscientificInformation, health, imageryBaseMapsEarthCover, in-telligenceMilitary, inlandWater, location, oceans, planningCadastre, socie-ty, structure, transportation, utilitiesCommunication`}. The NAP and ISO codelists are the same, USGIN mandates use of ISO codelists. See section 4.17.3 *Codelists* for details on codelist usage. Most USGIN resources will have MD_TopicCategoryCode = "`geoscientificIn-formation`", which is the default value for this profile. More specific topic categorization should be done using keywords. |
| Resource content extent `identificationInfo/-MD_DataIdentification/extent/ -EX_Extent` | C-C | Defines the spatial (horizontal and vertical) and temporal region to which the content of the resource applies. For USGIN, the spatial extent is a rectangle that bounds the geographic extent to which resource content applies. NAP specifies required when `hierarchyLevel` is set to 'dataset'. Best Practice for USGIN is to include an extent for any resource with content related to some geographic or temporal location. For geoscience resources, the temporal extent may be expressed using time ordinal eras from a geologic time scale if the resource is related to some particular geologic time. USGIN specifies count(`description` + `geographicElement` + `temporalElement`) >0 |

| ISO 19115 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on MD_DataIdentification |
|---|---|---|
| Resource content extent description `identificationInfo/-MD_DataIdentification/extent/-EX_Extent/description` | C-C | Free text that describes the spatial and temporal extent of the dataset. USGIN specifies that `description` is mandatory if a `geographicElement` or `temporalElement` is not provided. Note that if geographic place names are used to express the geographic extent, USGIN profile specifies that these should be encoded using keyword with keyword type code = 'place.' Geographic names may be duplicated in the `EX_Extent/description`. |
| Resource content extent bounding box `identificationInfo/-MD_DataIdentification/extent/-EX_Extent/geographicElement/-EX_GeographicBoundingBox` | O-C | USGIN profile requires that if an `EX_Extent/geographicElement` is supplied, it include a geographic bounding box with bounding latitude and longitude expressed using World Geodesic System WGS 84 decimal degrees. The corner coordinates for the geographic bounding box must not coincide in one point, because this may result in fatal errors with some CSW implementations. Point locations must thus be represented as tiny rectangles. USGIN recommended practice is to place the actual point location in the lower left corner of the rectangle. |
| Resource content extent geographic description `identificationInfo/-MD_DataIdentification/extent/-EX_Extent/geographicElement/-EX_GeographicDescription` | C-X | Not used by USGIN profile, use keyword with type code = 'place'. This ISO19115 element provides an `MD_Identifier` element that identifies a geographic location by name. `MD_Identifier` provides an `authority/CI_Citation` that specifies the `authority` for a location name, and a `code`, which is a text string identifying the location. For the purposes of USGIN metadata, this information should be encoded using keywords, for which the napMD_KeywordTypeCode = 'place'; the `thesaurus/CI_Citation` has the same content as `EX_GeographicDescription/authority/CI_Citation`, and the keyword is the same as the `EX_GeographicDescription/code`. |
| Resource content extent bounding polygon `identificationInfo/-MD_DataIdentification/extent/-EX_Extent/geographicElement/-EX_BoundingPolygon` | C-X | Not used by USGIN profile. To improve interoperability, USGIN mandates the use of Geographic Bounding Box instead of bounding polygon. "An element which describes inclusions or exclusions in a resource. The enclosed boundary of the dataset expressed in x-y coordinates." |

| ISO 19115 (M/C/O)<br>xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on MD_DataIdentification |
|---|---|---|
| Resource temporal extent (O)<br><br>`identificationInfo/-`<br>`MD_DataIdentification/extent/`<br>`-EX_Extent/temporalElement/-`<br>`EX_TemporalExtent/extent/-`<br>`TimePeriod` | O-O | Property contains information about temporal extent to which resource is applicable. For many geo-science resources, this would be the geologic time period(s) to which the resource applies. USGIN mandates use of `TimePeriod` for all temporal extents. The default time extent for `beginPosition@frame` and `endPosition@frame` attributes are #ISO-8601. For geologic time extents, USGIN requires the values for `beginPosition@frame` and `endPosition@frame` to be populated using numeric time coordinates in Ma, measured positive increasing older with an origin at 1950 CE (see Temporal extents). The default frame attribute value for geologic time coordinates is "urn:cgi:trs:CGI:StandardGeologicTimeMa"<br>ISO 8601 Default Example:<br>`<gml:TimePeriod gml:id="IdModern">`<br>`  <gml:name>Y2kX</gml:name>`<br>`  <gml:beginPosition`<br>`     frame="#ISO-8601">2010-01-00T00:00:00</gml:beginPosition>`<br>`  <gml:endPosition`<br>`     frame="#ISO-8601">2010-12-31T24:00:00</gml:endPosition>`<br>`</gml:TimePeriod>`<br>Geologic Time Example:<br>`<gml:TimePeriod gml:id="IdJurassic">`<br>`  <gml:name>Jurassic</gml:name>`<br>`  <gml:beginPosition`<br>`     frame="urn:cgi:trs:CGI:StandardGeologicTimeMa">203</gml:beginPosition>`<br>`  <gml:endPosition`<br>`     frame="urn:cgi:trs:CGI:StandardGeologicTimeMa ">135</gml:endPosition>`<br>`</gml:TimePeriod>` |
| Resource spatio-temporal extent (O)<br><br>`identificationInfo/-`<br>`MD_DataIdentification/extent/`<br>`-EX_Extent/temporalElement/-`<br>`EX_SpatialTemporalExtent/` | O-X | Not used. Although use of `EX_SpatialTemporalExtent` is allowed by ISO19139 and NAP, USGIN mandates encoding space time location with `EX_TemporalExtent` and `EX_GeographicBoundingBox`. |

| ISO 19115 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on MD_DataIdentification |
|---|---|---|
| Resource vertical extent (O)<br><br>`identificationInfo/-MD_DataIdentification/extent/-EX_Extent/verticalElement/-EX_VerticalExtent` | O-O | Vertical extent is used to provide elevation location for resources that have an explicit vertical location. Most common example will be samples related to vertical location in a borehole. The borehole trace is the vertical CRS within which the sample will be located, typically using coordinates measured in linear distance from the collar (or ground level, or Kelly bushing) of the borehole. `EX_VerticalExtent` has `minimumValue`, `maximumValue` that are real numbers, and a `verticalCRS` `verticalCRS` has (minimally) an xlink:href attribute which references an EPSG registry code (http://www.epsg-registry.org/). For interoperability, USGIN mandates use of a VerticalCRS with origin at World mean sea level (MSL), with elevations measured up positive in meters; the URI for this VerticalCRS is "urn:ogc:def:crs:EPSG::5714" |

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## 3.3 Service identification elements (SV_ServiceIdentification)

196    *Table 4. Service Identification properties (SV_ServiceIdentification)*

| ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on SV_ServiceIdentification |
|---|---|---|
| Resource service citation (M) `identificationInfo[1]/- SV_ServiceIdentification/- citation/CI_Citation` | M-M | The citation attribute provides information for citing the described service. Note that for scientific citation purposes, a citation for the intellectual content of the information presented by the service would be found in the `MD_DataIdentification/citation/CI_Citation` for datasets identified in the `operatesOn` section of `SV_ServiceIdentification`. Citation is defined by Webster as "an act of quoting". For USGIN purposes, this should be viewed as information to identify the intellectual origin or authority for the content in the described resource, along the lines of a citation in a scientific journal. The purpose of the citation for the service is to identify a particular service instance as a unique entity. Required content for a `CI_Citation` element are `title`, `date`, and `responsibleParty`. |
| Resource title (M) `identificationInfo[1]/- SV_ServiceIdentification/- citation/CI_Citation/title` | M-M | USGIN recommends that the title in a service identification citation should uniquely identify the particular service instance, and inform the human reader about the service content, function, and context. |
| Resource reference date (M) `identificationInfo/- SV_ServiceIdentification/- citation/CI_Citation/date/- CI_Date/date/` | M-M | The citation date for a service may indicate the creation date, when the service first became operational, the publication date, when the service first became public, or the revision date, which specifies the date of most recent update. If the service is no longer online, a notAvailable or superseded date may be specified. These are differentiated by the `DateType`. `CI_Date` content includes a `date` and `dateType`. Date for USGIN profile uses xs:date data type, defined thus "date uses the date/timeSevenPropertyModel, with *·hour·*, *·minute·*, and *·second·* required to be **sent**. *·timezoneOffset·* remains *·optional*" (http://www.w3.org/TR/xmlschema11-2).<br><br>Example date encoding: 2000-12-12+13:00, 2006-10-01. If the month or day is not known, encode as '01', for example '2006-01-01'. `DateType` is from napCI_DateTypeCode which identifies the event used for the temporal aspect of the resource. This date is distinct from the `dateStamp` for the metadata record, or the `EX_Extent/temporalElement` that specifies the time period to which the resource content is applicable. ISO CI_DateTypeCode names that apply to services include {`creation, publication, revision`}. NAP adds {`notAvailable, superseded`}. Due to interoperability problems with NAP identifiers different from ISO identifiers for the same codelist elements, USGIN recommends use of ISO codelists. See section 4.17.3 *Codelists* for details on codelist usage. |

| ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on SV_ServiceIdentification |
|---|---|---|
| Unique resource identifier (O) `identificationInfo/-SV_ServiceIdentification/-citation/CI_Citation/-identifier/MD_Identifier` | C-O | For USGIN, because the Citation is for the service, this identifier should be identical to `MD_Metadta/dataSetURI`, and is therefore optional.<br><br>For USGIN purposes, this element content value is only an identifier for the citation; it is not a URL for accessing the service. The USGIN profile requires the use of MD_Identifier element to identify re-sources. RS_Identifier may substitute for MD_Identifier in the ISO19139 schema, but the USGIN pro-file requires use of MD_Identifer. If additional codespace and version content is associated with the identifier, it should be encoded as `MD_Identifier/authority/CI_Citation/alternateTitle` and `MD_Identifier/authority/CI_Citation/edition` |
| Resource responsible party (O) `identificationInfo/-SV_ServiceIdentification/-citation/CI_Citation/-citedResponsibleParty` | M-M | USGIN requires at least one `CI_ResponsibleParty` following the NAP rule that count of (individual-Name + organisationName + positionName) > 0. The `CI_ResponsibleParty/role/CI_RoleCode` is from napCI_RoleCode. For a service, the point of contact information for questions or reporting problems should be in `SV_ServiceIdentification/pointOfContact/CI_ResponsibleParty`. The service citation responsible party would logically identify the parties responsible for creating (implementing) and pub-lishing the service. ISO Role code names applicable to a service citation include {`originator, principalInvestigator, processor, author, publisher`}, and NAP adds {`collabora-tor`}. Other codelist values ISO {`resourceProvider, custodian, owner`}, and NAP {`rightsHolder, mediator`} would logically be specified in the `SV_ServiceIdentification/pointOfContact` element. Due to interoperability problems with NAP iden-tifiers different from ISO identifiers for the same codelist elements, USGIN recommends use of ISO codelists. See section 4.17.3 *Codelists* for details on codelist usage. |
| Resource presentation form (O) `identificationInfo/-SV_ServiceIdentification/-citation/CI_Citation/-presentationForm` | O-O | The form in which the service is available, which in the case of a service is only through the service implementation described by the metadata record, so the information here is not generally very use-ful. Note that the citation is to the original source of intellectual content in the described resource should be in `MD_DataIdentification/citation/CI_Citation` that describes the datasets operated on by the service.<br><br>`presentationForm` uses the CI_PresentationFormCode codelist; ISO code names that are applicable to a service citation include {`documentDigital, imageDigital, mapDigital, modelDig-ital, profileDigital, tableDigital, videoDigital, audioDigital`}. NAP adds {`multimediaDigital, diagramDigital`}. Due to interoperability problems with NAP identifiers different from ISO identifiers for the same codelist elements, USGIN recommends use of ISO codel-ists. See section 4.17.3 *Codelists* for details on codelist usage. |

| ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on SV_ServiceIdentification |
|---|---|---|
| Resource series (O)<br>`identificationInfo/-SV_ServiceIdentification/-citation/CI_Citation/series` | O-O | Information about the series or collection of which the cited service is a part. NAP rule: (name + issueIdentification) > 0. At this point there is not much precedent for aggregating services into a formal series, so in general this element is probably not applicable to services. |
| Resource other citation details (O)<br>`identificationInfo/-SV_ServiceIdentification/-citation/CI_Citation/-otherCitationDetails` | O-O | Free text information useful to identify and cite the described service instance, usage is not specified by this profile. |
| Resource collective title (O)<br>`identificationInfo/-SV_ServiceIdentification/-citation/CI_Citation/-collectiveTitle` | O-O | Free text title of a "combined resource of which the service is a part." At this point there is not much precedent for aggregating services into a collections, so in general this element is probably not applicable to services.  Use aggregation info to link layer-specific service metadata records to a metadata record for the aggregate service that serves the layer. |
| Resource abstract (M)<br>`identificationInfo/-SV_ServiceIdentification/-abstract` | M-M | A free text summary of the content, significance, purpose, scope, etc. of the service described by this metadata. Exactly one value. |
| Resource purpose (O)<br>`identificationInfo/-SV_ServiceIdentification/-purpose` | O-O | Text summary of the intentions for which the service was developed, including objectives for creating the service and use cases it is designed to support. One value optional. |
| Resource status (O)<br>`identificationInfo/-SV_ServiceIdentification/-status` | M-M | Value is from MD_ProgressCode codelist. ISO Code names applicable to services include {`completed, obsolete, onGoing, planned, required, underDevelopment`}. NAP adds {`proposed`}. Obsolete is synonymous with deprecated. Due to interoperability problems with NAP identifiers different from ISO identifiers for the same codelist elements, USGIN recommends use of ISO codelists.  See section 4.17.3 *Codelists* for details on codelist usage. |

| ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on SV_ServiceIdentification |
|---|---|---|
| Resource point of contact (O)<br>`identificationInfo/-SV_ServiceIdentification/-pointOfContact` | O-O | `pointOfContact/CI_ResponsibleParty` element for service metadata should contain information for a point of contact to report problems with the service. Element is optional but highly recommended! USGIN rule that count of (individualName + organisationName + positionName) > 0. The `CI_ResponsibleParty/role/CI_RoleCode@codeListValue` is from CI_RoleCode; applicable name for the point of contact party are from the ISO codelist {`resourceProvider`, `custodian`, `owner`}. Due to interoperability problems with NAP identifiers different from ISO identifiers for the same codelist elements, USGIN mandates use of ISO codelists. See section 4.17.3 *Codelists* for details on codelist usage. |
| Resource maintenance (O)<br>`identificationInfo/-SV_ServiceIdentification/-resourceMaintenance` | O-O | This element provides information about the maintenance schedule or history of the service described by the metadata record. For a service, only one `MD_MaintenanceInformation` elements may be included; for which the `MD_ScopeDescription` MD_ScopeCode will be 'service'. If `MD_MaintenanceInformation` is present, then `maintenanceAndUpdateFrequency` is mandatatory, populated by a MantenanceFrequencyCode; ISO names in this code list are {`continual, daily, weekly, fortnightly, monthly, quarterly, biannually, annually, asNeeded, irregular, notPlanned, unknown`}. NAP adds {`semimonthly`}. Due to interoperability problems with NAP identifiers different from ISO identifiers for the same codelist elements, USGIN recommends use of ISO codelists. See section 4.17.3 *Codelists* for details on codelist usage. NAP specified best practice is that when `SV_ServiceIdentification/status` is set to "onGoing," either the attribute `MD_MaintenanceInformation/dateOfNextUpdate` or `MD_MaintenanceInformation/userDefined-MaintenanceFrequency` must be provided.<br><br>Maintenance information for data the service presents should be included in the dataset metadata for coupleResources associated with the service. |
| Graphic overview of resource (O)<br>`identificationInfo/-SV_ServiceIdentification/-graphicOverview` | O-O | Highly recommended to include a small image visual representation of the resource provided by a map or image service. For geographic feature or data services, a graphic overview might show the geographic distribution of available data. If `MD_BrowseGraphic` is included, `MD_BrowseGraphic/filename` character string is mandatory. USGIN Recommended practice is to provide a complete URL as a gco:characterString value for the `filename` property. Use napMD_FileFormatCode code values (http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_115) in `fileType/CharacterString`. Although USGIN mandates use of napMD_FileFormatCode for specifying file type, the full encoding of the xsi:type= "napm:napMD_FileFormatCode_PropertyType" in the CharacterString element causes validation problems, and is not recommended. See section 4.17.3 *Codelists* for details on encoding of the file format code, which is special because this is a NAP extension to the ISO base specification.<br><br>Repeatable element; multiple values may present different resolutions, or different parts of resource. Names associated with overview should provide sufficient information for user to distinguish these. |

| ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on SV_ServiceIdentification |
|---|---|---|
| Resource format (O) `identificationInfo/-SV_ServiceIdentification/-resourceFormat` | O-X | The format of service response documents varies at the operation level, and for a particular operation, different output formats may be requested. A listing of all possible options here without bindings to the operations that respond with that format is not useful. NAP does not include this role in the list of properties associated with `SV_ServiceIdentification` |
| Resource keywords (O) `identificationInfo/-SV_ServiceIdentification/-descriptiveKey-words/MD_Keyword` | O-O | Best Practice for USGIN profile metadata is to supply keywords to facilitate the discovery of metadata records relevant to the user.<br><br>**USGIN Keywords**: USGIN keyword vocabularies are in development. Future versions of this profile may include required keyword vocabularies.<br><br>**Other Keywords**: Keyword Type - allowed ISO values from MD_KeywordTypeCode: {`discipline`, `place`, `stratum`, `temporal`, `theme`}. NAP adds {`product`, `subTopicCategory`}. Due to interoperability problems with NAP identifiers different from ISO identifiers for the same codelist elements, USGIN recommends use of ISO codelists.  See section 4.17.3 Codelists for details on codelist usage.<br><br>USGIN requires that `MD_Keyword/keyword` contain a `CharacterString` (see section 4.16). USGIN best practice is to include keywords in English. |
| Resource specific usage (O) `identificationInfo/-SV_ServiceIdentification/-resourceSpecificUsage/` | O-X | NAP excludes this property in INCITS 453, figure 64 p.175, but it is schema valid under http://schemas.opengis.net/iso/19139/20060504/serviceMetadata.xsd, which is the service metadata schema imported by apiso.xsd for the OGC CSW profile for ISO19115/19 metadata. Property not used by USGIN. |
| Condition applying to access and use of resource (O) `identificationInfo/-SV_ServiceIdentification/-resourceConstraints/` | O-O | Restrictions on the access and use of a service. Follow NAP for specification of `resourceConstraints`. This attribute provides information for access control to the described service. In some situations, the `metadataConstraints` may allow a user to learn of the existence of a resource that they may not actually be able to access without further clearance. Follow NAP for specification of resourceConstraints. Constraints may be represented by `MD_Constraint`, `MD_LegalConstraint`, or `MD_SecurityConstraint`. The attribute `MD_Constraint/useLimitation` is mandatory unless `MD_LegalConstraint` or `MD_SecurityConstraint` is provided.  Condition applying to access and use of resource - ISO19119 duplicates this property as `SV_ServiceIdentification/restrictions`. NAP specifies that `SV_ServiceIdentification/resourceConstraints` is to be used, and `SV_ServiceIdentification/restrictions` is not to be used; USGIN profile follows this provision. |

| ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on SV_ServiceIdentification |
|---|---|---|
| Aggregation information (O)<br>`identificationInfo/-`<br>`SV_ServiceIdentification/-`<br>`aggregationInfo/-`<br>`MD_AggregateInformation` | O-O | This element includes either a citation for or identifier of an associated service or dataset, along with the type of association, and optionally the activity that produced the dataset.<br><br>`MD_AggregateInformation` requires either `aggregateDataSetName/CI_Citation` or `aggregateDataSet-Identifier/MD_Identifier`. `associationType` is mandatory, from DS_AssociationTypeCode. ISO code names in this list include {`crossReference, largerWorkCitation, partOfSeamless-Database, source, stereoMate`}. NAP adds {`isComposedOf`}. Due to interoperability problems with NAP identifiers different from ISO identifiers for the same codelist elements, USGIN recommends use of ISO codelists. See section 4.17.3 *Codelists* for details on codelist usage. The only currently recognized use for this aggregation would be to associate metadata for individual layers with metadata for a service that provides a collection of layers.<br><br>If the related resource has an associated metadata record, USGIN recommended practice is to include the identifier for that metadata record in `aggregateDataSetIdentifier/MD_Identifier`. For related resources that do not have a metadata record, `aggregateDataSetName/CI_Citation` may be used; this element is optional if `aggregateDataSetIdentifier` has a value.<br><br>For USGIN profile, this property, rather than `MD_Metadata/parentIdentifier`, should be used to indicate relationships between described resources. |
| Resource service type (M)<br>`identificationInfo/-`<br>`SV_ServiceIdentification/-`<br>`serviceType` | M-M | Exactly one value required. USGIN mandates use of a `LocalName` value (http://schemas.opengis.net/iso/19139/20060504/srv/serviceMetadata.xsd allows either localName or ScopedName). There is not as yet a standard registry of service types and identifiers that can serve as an authority for serviceTypes. An interim list of service types and identifiers is included in section 7.1 ServiceType (with the ad hoc codespace URI 'http://resources.usgin.org/registry/serviceType201001'). Valid values for OGC services are {`WMS, WFS, WCS, CSW, …`}<br><br>Example:<br>`<srv:serviceType>`<br>`  <gco:LocalName codeSpace=`<br>`"http://resources.usgin.org/registry/serviceType201001">WMS</gco:LocalName>`<br>`</srv:serviceType>` |
| Resource service type version (O)<br>`identificationInfo/-`<br>`SV_ServiceIdentification/-`<br>`serviceTypeVersion` | O-C | Multiple serviceTypeVersion tags may not be implemented in some harvesting server applications - USGIN recommends a reverse chronological order for supported versions. Constraint: if various versions are available, it is mandatory to list versions that are supported. Default is oldest version of service. |

    

| ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on SV_ServiceIdentification |
|---|---|---|
| Resource service access properties (O)<br>`identificationInfo/-SV_ServiceIdentification/-accessProperties` | O-O | Optional MD_StandardOrderProcess element to provide information on the availability of the service which include: fees, available date and time, ordering instructions, turnaround. Ordering instructions and turnaround are not applicable to web services. |
| Resource service restrictions (O)<br>`identificationInfo/-SV_ServiceIdentification/-restrictions` | O-X | Not used by USGIN; use `resourceConstraints` as per NAP. |
| Keywords (O)<br>`identificationInfo/-SV_ServiceIdentification/-keywords` | O-X | Not used by USGIN; use `descriptiveKeywords` as per NAP |
| Resource service content extent (O)<br>`identificationInfo/-SV_ServiceIdentification/-extent/EX_Extent` | C-C | Defines the spatial (horizontal and vertical) and temporal region to which the content of the resource applies. For USGIN, the spatial extent is a rectangle that bounds the geographic extent to which resource content applies. Best Practice for USGIN is to include an extent for any resource with content related to some geographic or temporal location. For geoscience resources, the temporal extent may be expressed using time ordinal eras from a geologic time scale if the resource is related to some particular geologic time.<br>USGIN specifies count(`description` + `geographicElement` + `temporalElement`) >0 |
| Resource service content extent description ( )<br>`identificationInfo/-SV_ServiceIdentification/-extent/EX_Extent/description` | C-C | Free text that describes the spatial and temporal extent of the dataset. USGIN specifies that `description` is mandatory if a `geographicElement` or `temporalElement` is not provided. Note that if geographic place names are used to express the geographic extent, USGIN profile specifies that these should be encoded using keyword with keyword type code = `'place'`. Geographic names may be duplicated in the `EX_Extent/description`. |
| Resource service content extent bounding box ( )<br>`identificationInfo/-SV_ServiceIdentification/-extent/EX_Extent/-geographicElement/-EX_GeographicBoundingBox` | O-C | USGIN profile requires that if an `EX_Extent/geographicElement` is supplied, it include a geographic bounding box with bounding latitude and longitude expressed using WGS 84 decimal degrees.<br>The corner coordinates for the geographic bounding box must not coincide in one point, because this may result in fatal errors with some CSW implementations. Point locations must thus be represented as tiny rectangles. USGIN recommended practice is to place the actual point location in the lower left corner of the rectangle. |

| ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on SV_ServiceIdentification |
|---|---|---|
| Resource service content extent geographic description ( )<br><br>`identificationInfo/- SV_ServiceIdentification/- extent/EX_Extent/geographic- Element/EX_Geographic- Description` | C-X | Not used by USGIN profile, use keyword with type code = '`place`'. This ISO19115 element provides an `MD_Identifier` element that identifies a geographic location by name. `MD_Identifier` provides an `authority/CI_Citation` that specifies the `authority` for a location name, and a `code`, which is a text string identifying the location. For the purposes of USGIN metadata, this information should be encoded using keywords, for which the MD_KeywordTypeCode = '`place`'; the `thesaurus/CI_Citation` has the same content as `EX_GeographicDescription/authority/CI_Citation`, and the keyword is the same as the `EX_GeographicDescription/code`. |
| Resource service content extent bounding polygon ( )<br><br>`identificationInfo/- SV_ServiceIdentification/- extent/EX_Extent/- geographicElement/- EX_BoundingPolygon` | C-X | To improve interoperability, USGIN mandates use of Geographic Bounding Box; bounding polygons may be present, but may be ignored by harvesters. |
| Resource service temporal extent (O)<br><br>`identificationInfo/- SV_ServiceIdentification/- extent/EX_Extent/temporal- Element/EX_TemporalExtent/- extent/TimePeriod` | O-O | Property contains information about temporal extent to which resource is applicable. For many geoscience resources, this would be the geologic time period(s) to which the resource applies. Although the ISO19139 xml schema allows temporal extents to be instants, intervals, or ordered eras, USGIN mandates use of only `TimePeriod` for temporal extent in order to make metadata interoperable. USGIN mandates that values for `beginPosition@frame` and `endPosition@frame` must be populated. The default frame property value is "#ISO-8601", for standard calendar date and time. For geologic time extents, USGIN requires the values for `beginPosition@frame` and `endPosition@frame` to be populated using numeric time coordinates in Ma, measured positive increasing older with an origin at 1950 CE (see *Temporal extents*). The default frame attribute value for geologic time coordinates is "urn:cgi:trs:CGI:StandardGeologicTimeMa". See section 4.21, below. |
| Resource service spatio-temporal extent (O)<br><br>`identificationInfo/- SV_ServiceIdentification/- extent/EX_Extent/- temporalElement/- EX_SpatialTemporalExtent/` | O-X | Although use of `EX_SpatialTemporalExtent` is allowed by ISO19139 and NAP, USGIN best practice is to encode space time location with `EX_TemporalExtent` and `EX_GeographicBoundingBox`. Other optional extent elements may be included, but they may be ignored by client implementations processing the metadata document. |

| ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on SV_ServiceIdentification |
|---|---|---|
| Resource service vertical extent (O)<br><br>`identificationInfo/-SV_ServiceIdentification/-extent/EX_Extent/-verticalElement/-EX_VerticalExtent` | O-O | Vertical extent is used to provide elevation location for resources that have an explicit vertical location. Most common example will be samples related to vertical location in a borehole. The borehole trace is the vertical CRS within which the sample will be located, typically using coordinates measured in linear distance from the collar (or ground level, or Kelly bushing) of the borehole.<br><br>`EX_VerticalExtent` has `minimumValue`, `maximumValue` that are real numbers, and a `verticalCRS` `verticalCRS` has (minimally) an xlink:href attribute which references an EPSG registry code (http://www.epsg-registry.org/). The default VerticalCRS code is for the World mean sea level (MSL) in meters: "urn:ogc:def:crs:EPSG::5714" |
| Coupled Resource ( )<br><br>`identificationInfo/-SV_ServiceIdentification/-coupledResource` | O-O | This element correlates operations (identified by `operationName`) with datasets (identified by `identifier`). For logical consistenty, and `SV_coupledResource/identifier` values should be equal to `MD_DataIdentification/citation/CI_Citation/identifier/MD_Identifier/code` for a dataset that is the target of a `SV_ServiceIdentification/operatesOn` element (either in an inline `MD_DataIdentification/citation../code` element, or a `@uuidref` attribute). This element is necessary to implement the many-to-many relationship between data sources and operations in a single service. |
| Coupled Resource operation name (M)<br><br>`identificationInfo/-SV_ServiceIdentification/-coupledResource/-SV_CoupledResource/-operationName` | M-M | String, the name of the service operation: GetMap, GetFeature, etc. There is no internal check in the metadata record that the given operation name is valid. |
| Coupled Resource identifier (M)<br><br>`identificationInfo/-SV_ServiceIdentification/-coupledResource/-SV_CoupledResource/identifier` | M-M | Identifier of a given tightly coupled dataset. Equal to `MD_DataIdentification/citation/CI_Citation/identifier/MD_Identifier/code` for a dataset that is the target of a `SV_ServiceIdentification/-operatesOn` element (either in an inline `MD_DataIdentification/citation../code` element, or a `@uuidref` attribute). |
| Coupled Resource scoped name (X)<br><br>`identificationInfo/-SV_ServiceIdentification/-coupledResource/-SV_CoupledResource/ScopedName` | X-O | OGC 07-045 application profile for ISO metadata using CSW 2.0.2 extends SV_CoupledResource with a ScopedName, defined as a scoped identifier of the resource in the context of the given service instance (e.g. layer name or featureTypeName). This is necessary for users to generate service requests (like GetMap or GetFeature) based on ISO service metadata. |

| ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on SV_ServiceIdentification |
|---|---|---|
| Service coupling type (M)<br><br>`identificationInfo/-SV_ServiceIdentification/-couplingType` | M-M | Type of coupling between service and associated data (if exists) - "Qualitative information on the tightness with which the service and the associated data are coupled." NAP. NAP uses the napSV_CouplingType codelist.<br><br>According to ISO:<br><br>• loose - service instance is loosely coupled with a data instance, i.e. no MD_DataIdentification class has to be described (ISO 19119).<br><br>• mixed - service instance is mixed coupled with a data instance, i.e. MD_DataIdentification describes the associated data instance and additionally the service instance might work with other external data instances (ISO 19119 / ISO 19115).<br><br>• tight - service instance is tightly coupled with a data instance, i.e. MD_DataIdentification class MUST be described. (ISO 19119 / ISO 19115)<br><br>According to OGC:<br><br>• loose - A service instance that is not associated with a specific dataset or datasetcollection. Looselycoupled services may have an association with data types through the service type definition. Dataset metadata need not be provided in the service metadata.<br><br>• mixed - A service that is associated with a specific dataset or datasetcollection. Service metadata shall describe both the service and the geographic dataset, the latter being defined in accordance with ISO 19115. But this service instance can also be used with external data (i.e. data that is not described by the operatesOn association).<br><br>• tight - An information resource that is hosted on a specific set of hardware and accessible over a network. |
| Service operations (M)<br><br>`identificationInfo/-SV_ServiceIdentification/-containsOperations` | M-M | "This element is intended for use to describe the operations performed by the service". However, the ISO19119 model includes insufficient detail to completely describe all parameters necessary to auto-mate connection to a service. Widely used xml formats exist to describe service function, including OGC getCapabilities.xml and W3C Web Service Description Language (WSDL). Following INSPIRE guidelines, USGIN does not use the srv:containsOperations. It is a required element in the ISO19139 (20060504) srv.xsd xml schema, so it should be populated with the attribute gco:nilReason='Missing'. Although this is xml schema valid, it may break some existing client implementations; we need to work with developers to correct these problems.<br><br>For information describing function of the service see distributionIn-fo/../transferOptions/../online/../linkage where online/../name = 'serviceDescription'; this should provide a URL for getCapabilities or a WSDL document, depending on the service type. |

| ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on SV_ServiceIdentification |
|---|---|---|
| Service operation name (M) `identificationInfo/-SV_ServiceIdentification/-containsOperations/-SV_OperationMetadata/-operationName` | M-X | not used by this profile |
| Service operation distributed computing platforms (M) `identificationInfo/-SV_ServiceIdentification/-containsOperations/-SV_OperationMetadata/DCP` | M-X | not used by this profile |
| Service operation description (O) `identificationInfo/-SV_ServiceIdentification/-containsOperations/-SV_OperationMetadata/-operationDescription` | O-X | not used by this profile |
| Service operation invocation name (O) `identificationInfo/-SV_ServiceIdentification/-containsOperations/-SV_OperationMetadata/-invocationName` | O-X | not used by this profile |
| Service operation online re-source (M) `identificationInfo/-SV_ServiceIdentification/-containsOperations/-SV_OperationMetadata/-connectpoint` | M-X | not used by this profile; see `distributionInfo/../transferOptions/../onLine` |

| ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata | NAP-USGIN M/C/O | Comments on SV_ServiceIdentification |
|---|---|---|
| Service operates on (O)<br><br>`identificationInfo/-SV_ServiceIdentification/-operatesOn` | O-C | "Provides information on the datasets that the service operates on." ISO 19119.<br><br>With tightly coupled references, `operatesOn` must include a map or feature layer's valid `MD_DataIdentification` element inline or a `@uuidref` attribute value that explicitly links to an existing dataset metadata record that describes the same layer.<br><br>Mandatory if metadata for datasets on which the service operates are available. The value of `SV_ServiceIdentification/operatesOn@uuidref` or `SV_ServiceIdentification/operatesOn/MD_Data-Identification/citation/CI_Citation/identifier/MD_Identifier/code` must correspond to one of the `SV_ServiceIdentification/coupledResource/MD_CoupledResource/identifier` values. If the metadata record for the coupled dataset is a separate gmd:MD_Metadata record, the service de-scribed in the service metadata record should be identified as a distribution for the dataset.<br><br>Explicitly linked reference example:<br><br>`<srv:operatesOn`<br>`  uuidref="13ce1e84-c887-4fd8-b888-8d021b1fa4c2"`<br>`  xlink:href="http://resources.azgs.org/geonetwork/srv/en/metadata.show?id=8717"`<br><br>`  xlink:title="azgs:azgeochron"/>` |

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## 3.4 USGIN specification constraints and recommendations

Summary of constraints to ISO19115, ISO119, ISO19139, and NAP (INCITS 453) introduced by USGIN profile.

- Require fileIdentifier
- Require hierarchyLevelName
- Require metadataStandardName and metadataStandardVersion
- Require DatasetURI if there is one
- Allow multiple distributor-format-transfer option combinations for a single resource.
- Representation of aggregated resources done using `identificationInfo/MD_DataIdentification/aggregationInfo/MD_AggregateInformation`, not `MD_Metadata/parentIdentifier`
- Geographic extent must be represented by bounding box in WGS 84 decimal degrees
- Vertical resource extend uses CRS referenced to mean sea level, meters, measured positive up.
- Resolution is expressed using `equivalentScale/MD_RepresentativeFraction/denominator`
- Language for resource must be specified
- Introduces recommended distribution format codes (Table 6) for `distributionFormat/name` introduced for categorization of physical resources, like a book, rock sample, paper document. USGIN recommends use of MIME types if they are registered for the format, and provides a recommended syntax for file formats that do not have corresponding MIME types.
- Introduces a ServiceType codelist recommended for use population the `srv:ServiceType` (Table 11)
- Introduces recommended `CI_OnlineResource/name` strings (Table 12) to identify special online resources link icons for branding.

As a convention for using controlled vocabularies on characterString elements without the overhead of a new namespace and xml schema, USGIN proposes that use a controlled vocabulary be indicated by using xsi:type on the gco:characterString element to make the type gml:CodeType, which then requires a codeSpace attribute (see 4.14.2-Non digital resources and 7.2-Linkage name conventions). This codeSpace should be the URI for the vocabulary used, with the implication that the CharacterString element value will then be an identifier from that vocabulary. This essentially turns the CharacterString into a GML scoped name or gco:LocalName element.

## 3.5 USGIN specification extensions

Summary of extensions to ISO19115, ISO119, ISO19139, and NAP (INCITS 453) introduced by USGIN profile.

Allow use of `identificationInfo/SV_ServiceIdentification/coupledResource/-SV_CoupledResource/ScopedName` defined by OGC 07-045 ISO profile for CSW 2.0.2, use to provide WMS layer names or WFS feature names for service requests.

# 4 Usage notes for Metadata Elements

This section presents additional information and discussion to supplement that in Table 1.

## 4.1 Metadata file identifier

`MD_Metadata/fileIdentifier` is unique identifier for the metadata file. Some metadata profiles suggest that the metadata field UUID should be the same as the UUID for the described resource. This seems problematic. In the USGIN scheme, the metadata record is considered an independently identified resource from the resource it describes. The described resource identifier is the Unique resource identifier (`DatasetURI`, 4.8, below).

## 4.2 Metadata hierarchy

The ISO19115 specification (especially Annex H) discusses the use of metadata hierarchy, in which a resource may inherit metadata properties from parent metadata records in the hierarchy. For example a `dataset` in a dataset series might inherit all of the metadata content from the parent dataset series metadata record, except for dataset-specific data quality metadata. The linkage would be made through `MD_Metadata/parentIdentifier`. This kind of nesting seems problematic in a CSW environment in terms of how queries could be constructed, and the kind of client behavior that would be required to navigate the parent links to acquire 'inherited' properties from 'parent' records. For catalog service purposes, USGIN mandates that in metadata records returned by services, all inherited properties in such a hierarchy should be included explicitly in the metadata document, as opposed to implicitly through the `parentIdentifier` link. Internal document links may be used where allowed by the xml schema for identified elements repeated in a single response document.

## 4.3 Metadata Contact vs. Resource Citation vs. Resource Contact

There are various locations to store contact information within an ISO 19139 metadata record. Here is a summary of the required contact properties and their significance as it pertains to the USGIN Profile.

- `MD_Metadata/contact/CI_ResponsibleParty` or "metadata point of contact" describes how to contact the party responsible for the **metadata** record to allow users to report errors, updates to metadata etc. The mandatory `CI_RoleCode` is set to "`pointOfContact`".

- `MD_Metadata/identificationInfo/[MD_DataIdentification || SV_ServiceIdentification]/citation/CI_Citation/citedResponsibleParty/CI_ResponsiblerParty` provides information to identify the **intellectual origin** of the content in the described resource. This is straight forward when citing library resources (books, journals, etc.) but less clear when defining the intellectual origin of, for example, physical samples. The mandatory `CI_RoleCode` is set to one of the ISO codelist values {`custodian, owner, distributor, originator, pointOfContact, principalInvestigator, publisher, author`}. NAP codelist values {`collaborator, editor, rights holder`} may also apply.

- `MD_Metadata/identificationInfo/[MD_DataIdentification || SV_ServiceIdentification]/pointOfContact/CI_ResponsibleParty` or "resource point of contact" contains information on who to contact to **access** the described resource. The mandatory `CI_RoleCode` is set to one of the ISO codelist values {`resourceProvider, custodian, owner, user, distributor, originator, pointOfContact, principalInvestigator, processor, publisher, author`}. NAP codelist values {`collaborator, editor, mediator, rights holder`} may also apply.

Optional contact information in the distribution section of the metadata provides point of contact for individual distribution processes.

## 4.4 Resource Title

Resource titles should provide sufficient information to distinguish the resource for other similar resources. They are not required to be globally unique, but users will be presented only with the resource title in CSW brief response documents. It is thus a disservice to have significant duplication of title strings.

## 4.5 Resource Abstract

Ideally the resource abstract provides a succinct summary of the content of the resource, the purpose for which it was originally created, some indication of important quality parameters to help evaluate fitness for other purposes, any significant constraints on use of the resource, and a list of distribution options.

## 4.6 Resource Type

The ISO 19115 `MD_Metadata/hierarchyLevel` property provides a high level categorization of resource types. The European INSPIRE Implementing Rules (MD_IR_and_ISO_20090218) proscribes the code list for the first hierarchyLevel xml element in an MD_Metadata document to be one of {`dataset`, `service`, `series`}, or the metadata set will be considered out of scope for the directive. Thus, metadata meant to be utilized by INSPIRE catalogs must follow this rule. The full ISO MD_ScopeCode list has a wider (and more useful) variety of resource categories; one or more hierarchyLevel elements using these codes could follow the first one with an INSPIRE-valid code in the first element to maintain INSPIRE compliance.

Table 1 in this document includes a more geoscience-domain-specific list of resource types, and values from this list should be used in one or more `hierarchyLevelName` elements. To enable resource-category-type searches to find narrower subcategories without complex query processing, `hierarchyLevelName` elements for the resource type and all broader/more general resource type categories should be included. The hierarchical categorization of the resources is encoded with the most specific category first, and progressively broader categories listed subsequently. Thus, harvesters that only take the first `hierarchyLevelName` element will get the most specific value. For example, if the resource is a photograph:

```xml
<gmd:hierarchyLevelName>
     <gco:CharacterString>Photograph</gco:CharacterString>
</gmd:hierarchyLevelName>
<gmd:hierarchyLevelName>
     <gco:CharacterString>StillImage</gco:CharacterString>
</gmd:hierarchyLevelName>
<gmd:hierarchyLevelName>
     <gco:CharacterString>Image</gco:CharacterString>
</gmd:hierarchyLevelName>
<gmd:hierarchyLevelName>
     <gco:CharacterString>Document</gco:CharacterString>
</gmd:hierarchyLevelName>
```

Note that the distinction of resource type and format is not always clear. Table 1 attempts to define resource types that are not specifically bound to a particular format, but are defined based on the kind of content. Format is interpreted as relating to specific approaches to encoding content and committing it to some sort of media.

4.7 Resource Locator

URL's for online access to resources are encoded in USGIN ISO 19139 metadata documents in the element `MD_Distribution/transferOptions/MD_DigitalTransferOptions/online/CI_OnlineResource`. Consistent use of this rule eliminates ambiguity on where to locate the URL to access a resource. Work still remains to develop conventions for use of the `CI_OnlineResource` subelements `protocol`, `applicationProfile`, `name`, `description`, and `function` to enable metadata clients to reliably access referenced resources.

4.8 Unique Resource Identifier

The `MD_Metadata/DataSetURI` property should be a globally unique identifier for the described resource. The protocol used for this identifier is not proscribed by the USGIN Profile, but if it does not have a know resolution service, the capabilities document for a CSW service providing the metadata should have at least a text explanation of how to resolve URI's used by the service. Protocols with available resolvers include http (use the WWW DNS system) and doi (http://dx.doi.org/). Some authorities using urn: protocols are also implementing or have resolver services in place.

4.9 Browse Graphics

NAP profile (INCITS 453-2009) defines **napMD_FileFormatCode_PropertyType** using the ISO19139 extension procedure; including this as an xsi:Type attribute on gmd:fileType adds codespace and codeListValue to the gmd:fileType element, but this causes validation problems with imported xml schema in the schema defining the new property type. USGIN mandates use of napMD_FileFormatCode list (http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_115) simply by using the format name strings in that codelist as the characterString values in gmd:FileType.

```
<gmd:MD_BrowseGraphic>
   <gmd:fileName>
      <gco:CharacterString>http://publicdocs.mnr.gov.on.ca/View.asp?-
             Document_ID=9632&Attachment_ID=18204</gco:CharacterString>
   </gmd:fileName>
   <gmd:fileDescription>
       <gco:CharacterString>Base Map from OMNR</gco:CharacterString>
   </gmd:fileDescription>
   <gmd:fileType>
    <!-- this is a napMD_FileFormatCode_PropertyType codelist value -->
       <gco:CharacterString>jpg</gco:CharacterString>
   </gmd:fileType>
</gmd:MD_BrowseGraphic>
```

Code example 1. Encoding url, display name and file type for browse graphic.

4.10 Resolution and equivalentScale

For spatial datasets, some indication of the resolution of the data is very useful for evaluating fitness for use. From a data perspective, resolution is specified by a distance that represents the smallest length between two resolvable points in the dataset. For a grid or coverage, this would be the average distance between sample points. From data portrayal perspective, an `equivalentScale` is reported, representing the scale at which the portrayal was intended to be viewed. To calculate `equivalentScale` given a resolution distance, recommended practice is to divide the resolution distance in meters by 0.0005. This assumes that the smallest distance resolvable in a map display for human usage is 0.5 mm.

4.11 Resource Language

USGIN metadata is assumed to use American English and by default documents should be returned. Other localizations may be implemented, but in order to avoid complexity with `PT_Text` and `Localized-CharacterString`, USGIN recommended practice is to implement services for different languages as different services, each of which serves `CharacterStrings` in the language specified by the `MD_Metadata/language` element.

4.12 Encoding of Vertical Extents

A vertical extent must specify the vertical coordinate reference system (CRS). In many cases this will be reference to Earth mean sea level or some similar datum, but for boreholes, vertical referencing is defined relative to a borehole trace, with the datum at the ground surface (borehole collar, or Kelly bushing). For interoperability, vertical extents should be converted to meters measured vertically positive from mean

371 sea level. This puts the onus to convert down hole coordinates for deviated holes on the metadata pro-
372 vider. Users searching for resources specific to some depth below the surface will have to convert this to
373 an elevation relative to sea level in order to query the CSW providing this metadata.

374 `EX_VerticalElement` has `minimumValue`, `maximumValue` that are real numbers, and a `verticalCRS`, which
375 has (minimally) an xlink:href attribute which references an EPSG registry code (http://www.epsg-
376 registry.org/). For interoperability, USGIN mandates use of a `VerticalCRS` with origin at World mean sea
377 level (MSL), with elevations measured up positive in meters; the URI for this VerticalCRS is
378 "urn:ogc:def:crs:EPSG::5714"

379 Other vertical extent elements may be included referenced to ground surface, Kelly bushing or other ref-
380 erence systems. These will be useful only is as far as they are understood by client software. The vertical
381 CRS must be specified by an `SC_VerticalCRS` element, which has (minimally):

- a `name/RS_Identifier`,

- a `scope` characterString,

- exactly one `datum/CD_VerticalDatum`, which requires a `scope` CharacterString, and for USGIN an `anchorDefinition` character string

- exactly one `coordinateSystem/CS_VerticalCS`, which has a `name/RS_Identifier`, and one axis with `axisAbbrev`, `axisDirection/CS_AxisDirection`, and `axisUnitID/UnitOfMeasure`.

4.13 Use of MD_Distribution and MD_Distributor

389 The ISO19115 model provides two possible paths for specifying information about how a resource is dis-
390 tributed, i.e. how a user can access the resource. The `MD_Distribution` element may have 0 to many
391 `distributionFormat`, `distributor`, and `transferOptions` child elements (see Figure 1). On the other
392 hand, each of the `distributor` child elements may have 0 to many `distributorFormat` and `distributor-`
393 `TransferOption` elements. Several major existing applications that consume ISO19139 xml metadata files
394 (ESRI GeoPortal Toolkit and GeoNetwork) are configured out of the box to expect format and transfer op-
395 tion information to be at the `MD_Distribution/distributionFormat` and `MD_Distribution/transferOptions`
396 path. This works fine as long as there are not different format or transfer options from different distribu-
397 tors, or different transferOptions for different formats. In these cases, a binding between distributor, for-
398 mat, and transfer options necessitates use of the `MD_Distribution/distributor/MD_Distributor` path to
399 `distributorFormat` and `distributorTransferOptions` (and `distributionOrderProcess`) information that
400 works together.

401 In order to accommodate both existing applications that utilize content in the `MD_Distribution/dis-`
402 `tributionFormat` and `MD_Distribution/transferOptions` elements, and situations that require binding be-
403 tween distributor, order process, format, and transfer options, the USGIN profile mandates that if multiple
404 `MD_Distribution/distributionFormat` or `MD_Distribution/transferOptions` elements are included in a
405 document, all formats must be available via all the specified transfer options, and the content of these el-
406 ements should be included in line. If multiple `MD_Distribution/distributor` elements are present, without
407 child `MD_Distributor/distributorFormat` or `MD_Distributor/distributorTransferOptions` elements, then
408 all formats and transfer options are available from all distributors.

409 To specify different bindings between distributor, order process, format, and transfer options, a separate
410 `MD_Distribution/distributor/MD_Distributor` instance is included for each binding. One
411 `MD_Distributor/distributorFormat` and one `MD_Distributor/distributorTransferOptions` element
412 should be included for applications that expect content in these elements, and the format and transfer op-
413 tions specified by these elements should apply to the first `distributor/MD_Distributor` element. Repeat-
414 ed `CI_ResponsibleParty`, `MD_StandardOrderProcess`, `MD_Format` or MD_DigitalTransferOption elements
415 in the `distributor/MD_Distributor` elements should be specified by reference (xlink:href to gml:id of first
416 occurrence of the element within the document). The implication is that the `distributionOrderProcess/`
417 `MD_StandardOrderProcess`, `distributorFormat/MD_Format`, and `distributorTransferOptions/MD_Digital-`
418 `TransferOptions` child elements of a single `MD_Distributor` are all compatible with each other.

419 USGIN differs from NAP by allowing multiple `distributor` elements, but since this is schema valid under
420 ISO19139 xml schema, and the extra elements can be ignored by applications expecting only a single
421 `distributor` element, this should not cause incompatibility.

422
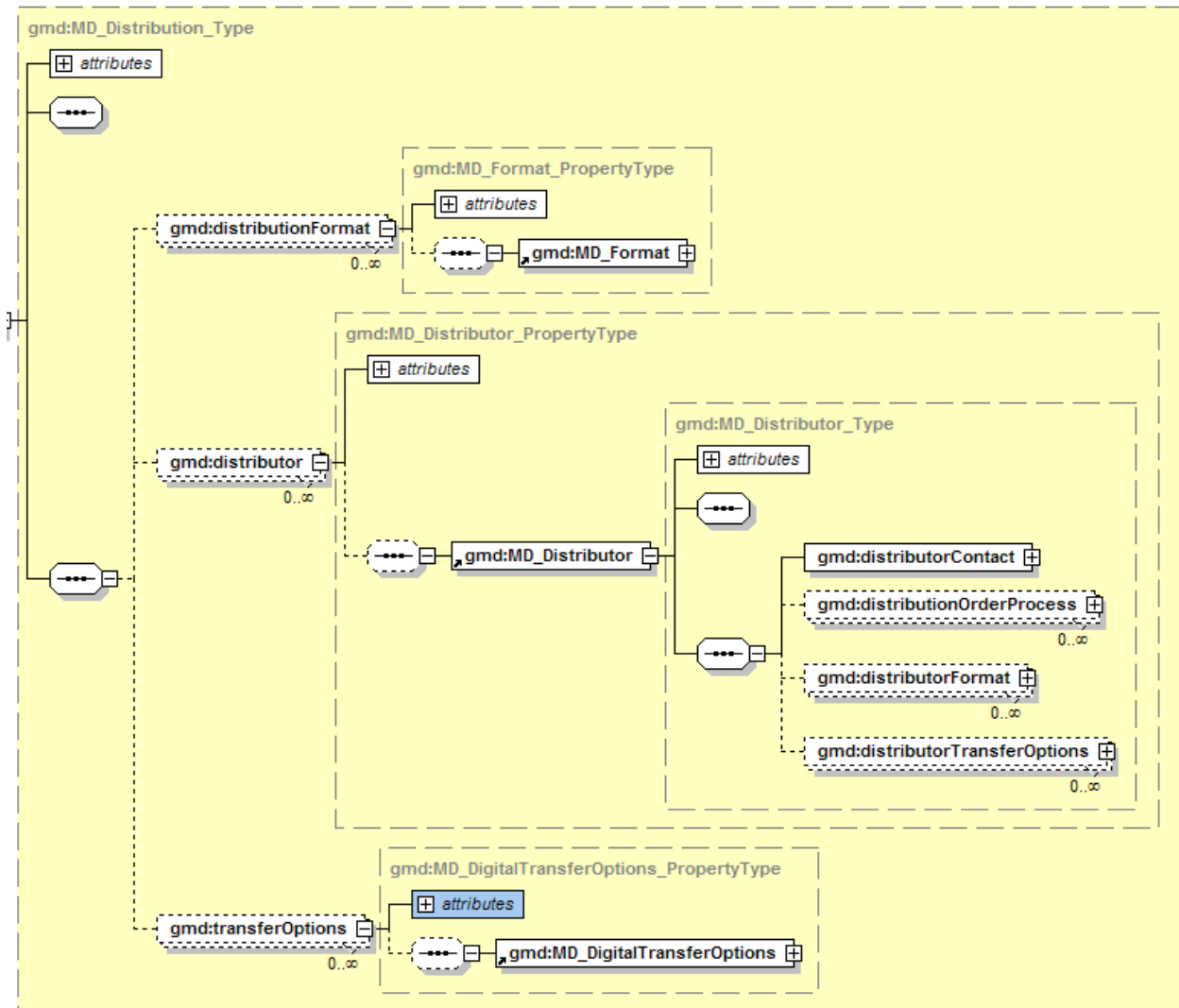
423   *Figure 1. gmd:MD_Distribution_Type diagram*

424

4.14 Distribution Format

426   If the resource is a physical resource, like a book, rock sample, paper document, USGIN recommends the
427   `distribution/../MD_Format/name` is a term from distribution format codelist (see Table 6). Note that for-
428   mat is partially orthogonal from resource type (Table 1). A document may be available in various digital
429   (pdf, tiff, doc, txt) or non-digital (book, loose sheets) formats.

4.14.1 Digital resources

431   The format vocabulary needs to be designed to work in the framework of the `distribution/../-`
432   `MD_DigitalTransferOptions`, which provides protocol, applicationProfile, name, and function subelements
433   for online resources (CI_OnlineResource), and MD_MediumNameCode and MD_MediumFormatCode for
434   offline resources (MD_Medium). For digital resources it provides terms to specify file-format information
435   that does not have any other obvious home. Examples in INCITS 453, INSPIRE 19115/19, and ANZLIC
436   2007 populate `MD_Format/name` with values like 'ESRI ARC/INFO Coverage', 'ESRI shapefile', 'ESRI
437   ARC/INFO Export e00', and 'MapInfo MID/MIF' all pertain to digital resources. If a MIME format
438   (http://www.iana.org/assignments/media-types/) is defined for a digital file format, the MIME media-type
439   code should be used. If no appropriate MIME type is registered with IANA, USGIN mandates that the dis-

440 tribution format for digital resources should specify the file format using a pattern that includes vendor,
441 application name, and file extension.

442 Pattern for digital resources: `[vendor:applicationName]/fileExtension`. The vendor and appli-
443 cation names may not be applicable, and could be omitted, but the '/' and file extension should always be
444 present. If the format consists of a single file, the file extension is a three letter file-type abbreviation as-
445 signed by the vendor. If the format consists of a package of files (e.g. an ArcGIS file geodatabase), the
446 file extension is a name that in most cases should be obvious from vendor usage. The accompanying
447 `MD_Format/version` value should indicate the version of application software if the format is specific to
448 some version.

449 Service metadata includes distribution information as well as dataset metadata. OGC services commonly
450 allow specification of different output formats, and the formats offered are listed in the OGC capabilities
451 document. It is tempting to list the output formats offered by the service in `distributioninfo` as a collec-
452 tion of `distributionFormat/MD_Format` elements, but this is only useful if all formats are applicable to all
453 service requests, or if the mapping between requests and formats is obvious. Version 2.4 of GeoNetwork
454 harvests OGC getCapabilities documents, and puts the format information in a collection of
455 `srv:connectPoint/CI_OnlineResource/protocol` elements, with `connectPoint` elements for each format
456 available on each request. ISO 19119 defines `connectPoint` as 'handle for accessing the service inter-
457 face'. Using this to encode different available output formats seems a bit of a stretch. Because of the
458 USGIN decision that operation metadata is best conveyed to metadata consumers by providing a link to a
459 service-specific description file (getCapabilities or WSDL), the `SV_OperationMetadata` element is not used
460 by the USGIN profile. Thus the recommendation is to list the output formats offered by the service in `dis-`
461 `tributioninfo` as a collection of `distributionFormat/MD_Format` elements if all formats are applicable to
462 all service requests, or if the mapping between requests and formats is obvious. Encoding of the format
463 name should use whatever convention is used by the service to specify that output format in requests
464 made to the service.

465 *Table 5. Example format strings for digital files. These are to be used only if an appropriate MIME type is*
466 *not defined.*

ESRI:ARCINFO/Coverage
/shapefile
ESRI:ARCINFO/e00
PitneyBowes:MapInfo/mid
ESRI:ArcGIS/mdb
ESRI:ArcGIS/fileGeodatabase
Microsoft:Access/mdb

467 ## 4.14.2 Non digital resources

468 The `MD_Format` element is the only format information for resources that do not have digital transfer op-
469 tions, and USGIN proposes Table 6 as a vocabulary for use to specify format of non-digital resources.
470 Although this codelist could be implemented as a schema extension, for the time being we propose to use
471 it as a controlled vocabulary specified by profile and practice, rather than schema. Use of such controlled
472 vocabulary can be indicated by using xsi:type on the gco:characterString element to make the type
473 gml:CodeType, which then requires a codeSpace attribute. The distribution format Identifier from Table 6
474 should be used as the element value. Example encoding:

475 `<gco:CharacterString xsi:type="gml:CodeType"`
476 `codeSpace="http://resources.usgin.org/registry/distributionFormatNames201001">sample:core</gco:`
477 `CharacterString>`
478
479

480   *Table 6. USGIN Distribution formats for non digital resources. URI for this codelist is*
481   *http://resources.usgin.org/registry/distributionFormatNames201001*

Identifier	Name	Parent format	Scope
physicalArtifact	Physical artifact		described resource is a physical object
sample	Sample	physicalArtifact	Use for uncategorized sample. A
sample:core	Core	sample	Cylindrical rock sample extracted from Earth with a coring drill
sample:cuttings	Cuttings	sample	Small rock fragments recovered from drilling process as sample of material being drilled
sample:fluid	Fluid	sample	Sample of a fluid
sample:handSample	Hand sample	sample	Single piece or pieces of material.
hardCopy	Hard copy manuscript	physicalArtifact	A physical copy of a document on paper, film, or other similar material.
hardCopy:book	Book	hardcopy	Manuscript printed on paper, bound into a single volume
hardCopy:manuscript	Manuscript	hardCopy	Other printed or written representation on physical media, usually paper or mylar, includes unbound books, index cards, loose notes, file folders of papers
hardCopy:printedImage	Printed image	hardCopy	Image on paper or other opaque or semi-opaque media.
printedImage:paperMap	Paper map	printedImage	Map image on a single sheet
hardCopy:filmImage	Film image	hardCopy	Image on film, viewed by passing light through the film. Includes single still images and collections of connected images for a movie.
fieldSite	Field site		resource is a station located on or in the Earth, generally of interest as a sampling site at which other resources were collected or originated.
tapeRecording	Tape recording		use for sound resources that are recorded on magnetic tape.

482

483   **4.15 CI_OnlineResource**

484   For USGIN profile, each `distributor/MD_Distributor` is a binding between one or more transfer options
485   and the distributor formats that are available through that/those transfer options (`MD_DigitalTransfer-`
486   `Options/onLine/CI_OnlineResource` in particular). If different formats are available from the same distribu-
487   tor, but have different transfer options, these should be represented as different `distributor/-`
488   `MD_Distributor` instances.

489   In order to enable client applications to determine how to directly connect to a resource, there needs to be
490   agreement on what content is required in the `CI_OnlineResource` element, and how it will be encoded.

491 The linkage property provides a URL for accessing the resource. The role of the `protocol`, `application-`
492 `Profile`, `name` and `function` properties is to provide sufficient additional information for a client application
493 to automatically connect a user with the online resource. The description property may be used to pro-
494 vide information about the online resource, and more usefully, to provide an explanation of how the other
495 content of the `CI_OnlineResource` element is to be used to access the resource.

496 The ESRI GeoPortal toolkit looks for the presence of `MD_Metadata/distributionInfo/MD_Distribution/`
497 `transferOptions/MD_DigitalTransferOptions/online/CI_OnlineResource/function/`
498 `CI_OnlineFunctionCode/@codeListValue` attribute with a non-null value. Only one content type is allowed
499 for each resource. The values must either be an integer between 1 and 10, or a string from the codelist
500 (see Table 7). The value is made lower case, stripped of white space, and then converted to a numeric
501 value ranging from 001 to 010 if its numeric, or compared to see if it starts with a value from the codelist.
502 Thus 'live data', 'lIVe data', 'livE DataAnd maps ArcIMS image service' are all valid and would match
503 'livedata'. Note that this use of the codeListValue attribute is not consistent with its definition as an identi-
504 fier for the codelist entry (see section 4.17.3 *Codelists*).

505 *Table 7. OnlineFunctionCode values from NAP (INCITS 453) and ESRI Geoportal toolkit v. 3.1. ISO*
506 *codelist terms are indicated by '(ISO)' after the code in column 1. ESRI content types and codes are from*
507 *the GeoPortal Toolkit v3.1 User Guide (2007); correlation of these with NAP OnlineFunctionCodes is*
508 *based on the user guide and interpretation by this profile.*

OnLine-FunctionCode	USGIN profile usage	ESRI resource types	ESRI code
browsing	`CI_OnlineResource/linkage` is a valid URL for a web application that enables user to explore and seek information about the resource from a Web browser		
browsing	Use case not documented by ESRI	application	006
browsing	Use case not documented by ESRI	geographicactivity	010
download	Use case not documented by ESRI. Infer that URL provides an ArcGIS layer file (or functionally similar file) with links to data and portrayal instructions.	mapfile	009
download (ISO)	`CI_OnlineResource/linkage` is a valid URL that will initiate transfer of data to the local system. ESRI GPT requires that file extension for file is one of .zip, .e00, .gz, .tgz, .dbf, .tar, .shp, .rar, .xls, .txt, .dwg, .dxf, .dgn	download, down-loadabledata	002
download (ISO)	ESRI GPT requires one of following file extensions: .gif, .jpg, .jpeg, .bmp, .pdf, .pmf, .tif, .tiff, .cal, .pct, .pict, .eps, .mxd, .av, .mpg, .mpeg, .wmv, .img, .rm.	staticmapimage	004
emailService (NAP)	USGIN not used; functionally equivalent to ISO 'information'. `CI_OnlineResource/linkage` is a valid URL that accesses instructions for connection to an email service providing the described resource content via emails		
fileAccess (NAP)	USGIN not used; functionally equivalent to ISO 'information'. `CI_OnlineResource/linkage` is a valid URL for direct retrieval of a file containing the described resource, typically through the use of http or ftp protocol (or their secure variants)		

OnLine-FunctionCode	USGIN profile usage	ESRI resource types	ESRI code
information (ISO)	`CI_OnlineResource/linkage` is a valid URL that will access a web page providing information about the resource content.	Information, otherdocument, document	005
offlineAccess (ISO)	`CI_OnlineResource/linkage` is a valid URL that will access a web page providing instructions for requesting the resource from the provider.	offlinedata, offline-Access	003
order (ISO)	`CI_OnlineResource/linkage` is a valid URL that will access a web page to initiate an ordering process for obtaining the resource.	order, geographicservice	007
search (ISO)	`CI_OnlineResource/linkage` is a valid URL that will access a search interface for seeking out specific information content contained by resource, e.g. the metadata describes a database, and this linkage accesses a search interface to search the database	search, clearinghouse	008
upload (NAP)	`CI_OnlineResource/linkage` is a valid URL for a web interface to transfer data from a local storage device or system to be included in the described resource.		
webMapService (NAP)	`CI_OnlineResource/linkage` is a valid URL for Web -based map request service, which may return custom georeferenced map images, streamed features, raster data, or surface data to a mapping client, e.g. ArcIMS, OCG WMS, WFS, WCS service	livedata	001
webService (NAP)	`CI_OnlineResource/linkage` is a valid URL that accesses a standard web service description document with instructions for the connection to a Web service (other than a Web map service) providing direct online access to the described resource. Example description document may be a Web Services Description Language (WSDL) file or OGC getCapabilities file.		001

509

510 4.16 Responsible parties and logos

511 Metadata should include a URL that locates a thumbnail logo for organizations related to the metadata
512 origination, the organization hosting the catalog that returned the metadata, the organization that originat-
513 ed the data, and the organization hosting online services that provide access to the data. The standard
514 place to put URL's in ISO19139 metadata is in the `CI_Contact/onlineResource/CI_OnlineResource/-`
515 `linkage` attribute. For URL's that indicate icon thumbnails, the `CI_OnlineResource/name` should be 'icon'.

516 The metadata originator information should be in a `MD_Metadata/contact/CI_ResponsibleParty` element
517 with role code 'originator' to identify the original source of the metadata record, for which the
518 CI_Contact/../CI_OnlineResource/linkage is a URL that points to an Icon for the metadata originator. This
519 Icon will be displayed in search results to credit the metadata originator. Metadata harvesters should har-
520 vest and maintain this information so that the origin of metadata records can be credited.

The organization hosting the catalog that returned the metadata record should specified in a `MD_Metadata/contact/CI_ResponsibleParty` element with role code 'distributor', for which the `CI_Contact/` `/CI_OnlineResource/linkage` is a URL that points to an Icon for the metadata server hosting organization. This information need not be harvested, because it will be replaced by information describing the harvesting catalog service.

The organization that originated the data is specified by `MD_Metadata/identificationInfo/MD_Data-` `Identification/citation/../CI_ResponsibleParty` with RoleCode ='originator', and `/CI_OnlineResource/name`='icon'. This will distinguish the citation responsible party element containing the icon linkage from `CI_ResponsibleParty` elements with RoleCode='author' or 'editor', which would provide an online linkage directly to the responsible party as specified by `CI_OnlineResource` `protocol`, `applica-` `tionProfile`, `name`, `function`, and `description` elements.

The organization hosting a service providing online access to described data is specified by `MD_Metadata/distributionInfo/MD_Distribution/distributor/MD_Distributor/distributorContact/-` `CI_ResponsibleParty` with RoleCode ='resourceProvider' or 'distributor', and `../CI_OnlineResource/name`='icon'. Because the cardinality of distributorContact responsible party and online resources is 1, only one linkage can be provided for a distributor, and the metadata author must decide whether that will be a link to an icon, or a link to a web site or other resource related to the distributor.

```
<gmd:contact>
  <gmd:CI_ResponsibleParty>
    <gmd:organisationName>
      <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
    </gmd:organisationName>
    <gmd:contactInfo>
      <gmd:CI_Contact>
        <gmd:onlineResource>
          <gmd:CI_OnlineResource>
            <gmd:linkage>
              <gmd:URL>http://www.azgs.az.gov/logo/metadata/azgs.png</gmd:URL>
            </gmd:linkage>
            <gmd:name>
              <gco:CharacterString>icon</gco:CharacterString>
            </gmd:name>
          </gmd:CI_OnlineResource>
        </gmd:onlineResource>
      </gmd:CI_Contact>
    </gmd:contactInfo>
    <gmd:role>
      <gmd:CI_RoleCode codeL-
ist="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codeli
st/gmxCodelists.xml#CI_RoleCode"
        codeListValue="originator">originator</gmd:CI_RoleCode>
    </gmd:role>
  </gmd:CI_ResponsibleParty>
</gmd:contact>
```

4.17 Extensions to CharacterString

4.17.1 Web extensions

ISO 19139 defines several extensions to `gco:CharacterString` in the gmx namespace. These are defined as members of an xml substitution group for `gco:CharacterString`, and include `gmx:Anchor`, `gmx:FileName`, and `gmx:MimeFileType`. `gmx:Anchor` is used for URL's linking to online web resources, and include a URI attribute associated with the character string that is the human-readable label for the link. `gmx:FileName` adds a filename URI attribute that specifies a machine-readable absolute path to the loca-

573 tion of the file, the human readable file name specified by the character string. `gmx:MimeFileType` adds a
574 MIME type/subtype attribute to a character string that specifies a human readable file type. The gmx
575 namespace is not imported into other ISO19139 schema in the normative schema. In order to create
576 schema-valid documents that use these extensions, explicit namespace-declaration must be made to the
577 gmx schema in instance documents. At the present time, use of these elements does not seem wide-
578 spread. The current version of GeoNetwork, a commonly used catalog service implementation, does not
579 support use of `gmx:Anchor`. Thus, in this version of the USGIN profile, these extension classes are not
580 used.

581   4.17.2 Language localization

582 Another extension to `gco:CharacterString` allows substitution by `PT_FreeText` or `LocalisedCharacter-`
583 `String`. `LocalisedCharacterString` adds a `locale/PT_Locale` property to the `CharacterSTring` element
584 that can specify the language, country, and character encoding for the string. `PT_FreeText` allow substitu-
585 tion of a collection of `LocalisedCharacterString` elements for any `CharacterString`, each localized to a
586 different language/country.

587 These various possibilities create potential to break interoperability. To avoid this problem, Other localiza-
588 tions may be implemented, but in order to avoid complexity with PT_Text and LocalizedCharacterString,
589 USGIN recommended practice is to implement services for different languages as different services, each
590 of which serves CharacterStrings in the language specified by the `MD_Metadata/language` element.

591   4.17.3 Codelists

592 ISO 19139 defines a "CodeListValue_Type" XML Class Type with three attributes:

```
593 <xs:complexType name="CodeListValue_Type">
594   <xs:simpleContent>
595     <xs:extension base="xs:string">
596       <xs:attribute name="codeList" type="xs:anyURI" use="required"/>
597       <xs:attribute name="codeListValue" type="xs:anyURI" use="required"/>
598       <xs:attribute name="codeSpace" type="xs:anyURI"/>
599     </xs:extension>
600   </xs:simpleContent>
601 </xs:complexType>
```

602 The `codeList` attribute contains a URL that references a codeList definition within a registry or a codelist
603 catalogue. As currently used in the metadata services we have studied, the codeList is not used to identi-
604 fy a vocabulary; rather it provides a locator (functionally equivalent to xlink:href) for an online resource,
605 typically a web page or xml file, that contains a listing of the codelist with the code values and scope
606 notes. Different services provide different URL's, possibly linking to different kinds of resources (e.g. web
607 page or xml file), for the same codelist. Thus, the values in this attribute can not be used for automated
608 determination of the code list in use in a metadata document.

609 The `codeListValue` attribute carries the identifier of the codelist value definition. This identifier is the
610 value expressed in the name column of the tables in ISO 19115, Annex B. The codelist catalogue (or reg-
611 istry) located by the `codeList` attribute is expected to contain an explicit name and definition of the value
612 in the default language of the metadata, as well as alternate expressions in different code spaces, some
613 of them corresponding to the different locales supported by the metadata.

614 The `codeSpace` attribute is an optional identifier (URI); when present it refers to an alternative expres-
615 sion of the codelist value definition.. In the example in ISO19139, section 8.5.5.1 (p. 30), the codeSpace
616 URI for the domain code is the string "domainCode", and the value from the domainCode column in a
617 codelist definition table in ISO 19115, Annex B is included as the value of the xml CodeList element in
618 this case.

619 Codelist elements in the ISO19139 XML schema are assigned to type CodeListValue_Type, and also in-
620 cluded in a substitution group for gco:CharacterString. These codeList elements are thus substitutable for
621 elements typed gco:CharacterString. Consequently, any CodeList instance is an XML element that takes
622 a string value and has three XML attributes defined by the CodeListValue_Type XML Class Type. A cor-

623 responding XML Class Property Type is defined for each of these CodeList elements, and this property
624 type is used to restrict the values in XML CharacterString attributes to the code list.

625 The ISO specification uses an unfortunate choice of name for the 'codeListValue' attribute that is defined
626 to be a identifier, apparently with the intention that it is a language-neutral concept identifier that might be
627 associated with various language-localized labels for the concept. NAP CodeList registries
628 (http://www.fgdc.gov/nap/metadata/register) contrast with the codelists defined in the tables in ISO 19115
629 Annex B in that the identifier (the 'name' column the ISO19115 Annex B tables) is an integer identifier
630 with the prefix 'RI_'. This would appear to correspond functionally to the 'domainCode' values in the
631 ISO19115 Annex B tables, which ISO19139 indicates should be the codeListValue when the `code-`
632 `Space`="domainCode".

633 NAP and INSPIRE usage is consistent with the ISO19139 definition of codeListValue as an identifier, with
634 the name or label for the codeList concept included as the value of the CodeList element. The 'name' col-
635 umn in ISO 19115, Annex B tables, which is described as the content for the codeListValue by ISO19139,
636 contains English words that are the same as the labels one would use in English. In the
637 CT_CodeListCatalogues in the ISO publicly available standards registry for ISO 19139
638 (http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources), which one
639 would think are normative, the CodeListDictionary/codeEntry/CodeDefinition elements only include
640 gml:description and gml:identifier elements, but no gml:name elements. So based on this ISO guidance, it
641 appears that one would have to encode CodeList element thus:

```
642 <gmd:CI_DateTypeCode
643         codeList="http://asdd.ga.gov.au/asdd/profileInfo/gmxCodelists.xml#CI_DateTypeCode"
644         codeListValue="creation"/>
```
645 or
```
646 <MD_CharacterSetCode
647         codeList="http://wis.wmo.int/2006/catalogues/gmxCodelists.xml#MD_CharacterSetCode"
648         codeListValue="utf8"/>.
```

649 Extensions to ISO codelists are implemented in two ways. If new values are added to an ISO codelist, the
650 CodeListProperty_Type still points at the ISO CodeList_Type, but the codeList attribute on instances of
651 this element points to the extended codelist. The following example shows use of a DateTypeCode added
652 to the ISO19115 date type code list in the North American Profile:

```
653 <gmd:CI_DateTypeCode
654         codeList="http://www.fgdc.gov/nap/metadata/register/registerItemClasses.html#IC_87"
655         codeListValue="RI_373">superseded</gmd:CI_DateTypeCode>
```

656 Note that the ISO codelists use the codeListValue name as the codeList identifier, creating ambiguity be-
657 tween the human-readable label/name for the codeListValue concept, and its opaque/language-neutral
658 identifier. USGIN NAP codeList usage follows the example metadata encoding in Appendix E of NAP pro-
659 file document (INCITS 453, 2009). In these examples the codeListValue is the identifier from the NAP
660 registry specified by the codeList, with the prefix 'RI_' added, and the code name/label is the value of the
661 codeList xml element. NAP provides names and identifiers for codes.

662 INSPIRE guidelines (INSPIRE ISO19115/119, 2009-02-18) recommend a similar approach, using the ISO
663 identifier string for the code list element value, which appears to match the intention of ISO19139.

```
664 <gmd:CI_DateTypeCode
665         codeList=
666         "http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Cod
667         elist/ML_gmxCodelists.xml#CI_DateTypeCode"
668         codeListValue="publication">publication</gmd:CI_DateTypeCode>
```

669 The unfortunate situation is that NAP and ISO define different identifiers for the same codelist values, and
670 because the 'codeList' attribute is defined as a locator for a codelist resource (not a vocabulary identifi-
671 er) and is used differently by different metadata providers, there is no reliable automated test one can
672 make to determine if NAP or ISO identifiers are being used. In order to avoid interoperability problems,
673 USGIN profile mandates that elements with a data type that is a CodeList_PropertyType use the following
674 encoding, following the NAP and INSPIRE pattern:

675 For elements that use ISO codelists:

```
676  <gmd:CI_DateTypeCode
677        codeList=
678        "http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Code
679        list/gmxCodelists.xml#CI_DateTypeCode"
680        codeListValue="creation">creation</gmd:CI_DateTypeCode>
```

681 For elements that use NAP codelists:

```
682  <gmd:CI_DateTypeCode
683        codeList="http://www.fgdc.gov/nap/metadata/register/registerItemClasses.html#IC_87"
684        codeListValue="RI_366">creation</gmd:CI_DateTypeCode>
```

685 Note that in these encodings, the codeList attribute value functions as an identifier; thus the exact strings
686 in the examples should be used (with the #localAnchor at the end modified as appropriate for the identi-
687 fied codelist). The ISO codelists are in much wider use at this time than the NAP codelists (as far as we
688 can tell from surveying existing services), but we recognize that some of the terms added in the NAP
689 codelists may be required for metadata describing some of the resources in the USGIN scope (Table 1).
690 Table 8 summarizes differences between the ISO and NAP codelists. The recommended practice is to
691 use ISO codelists wherever possible, encoded as in the examples above. NAP codes may be used where
692 necessary, but if the above convention is followed, and the NAP name is equivalent to the ISO identifier
693 for codelists that are the same, which is generally the case, then the two approaches are interoperable if
694 search criteria for a particular value look for the element value (e.g. 'creation' in the example above), not
695 the codeListValue attribute value (e.g. 'creation' or 'RI_366').

696 If a new codelist is created to restrict text in an ISO element whose type is simply CharacterString (e.g.
697 HierarchyLevelName), then characterString values are encoded by soft-typing the element that takes the
698 character string using the xsi:type attribute. The following example uses the FileFormatCodeList, which is
699 the only code list vocabulary added to the collection of codelists defined by ISO 19115 by the North
700 American Profile.

```
701  <gmd:fileType xsi:type="napm:napMD_FileFormatCode_PropertyType"
702        codeList="http://www.fgdc.gov/nap/metadata/register/registerItemClasses.html#IC_115"
703        codeListValue="RI_711">
704    <gco:CharacterString>jpg</gco:CharacterString>
705  </gmd:fileType>
```

706 A NAP-defined codelist property type is defined in a NAP-defined namespace (URI = http://www.cits.-
707 rncan.gc.ca/html/brodeurj/.protege/.napMetadata/napMetadataWebsite/napMetadataTools/napXsd/-
708 napm), defined in an xml schema made available by the profile developers, and this namespace must be
709 defined in xml documents using the xsi:type. In order for the document to validate, the namespace must
710 provide a schema location in the xml document root element as well. Schema fragment from the XML
711 schema defining the napm namespace
712 (http://www.cits.rncan.gc.ca/html/brodeurj/.protege/.napMetadata/tools/napXsd/napm/napm.xsd). Unfor-
713 tunately, because of conflicting element definitions in imported and included schema from other
714 namespaces, this schema may not validate with some validation tools. The following fragment defines
715 the property type used to restrict a value domain to the new code list in the xml fragment above:

```
716  <xs:complexType name="napMD_FileFormatCode_PropertyType">
717    <xs:complexContent>
718      <xs:extension base="gco:CharacterString_PropertyType">
719        <xs:attribute name="codeList" type="xs:anyURI" use="required"/>
720        <xs:attribute name="codeSpace" type="xs:anyURI" use="optional"/>
721        <xs:attribute name="codeListValue" type="xs:anyURI" use="required"/>
722      </xs:extension>
723    </xs:complexContent>
724  </xs:complexType>
```

725 As a convention for using controlled vocabularies on characterString elements without the overhead of a
726 new namespace and xml schema, USGIN proposes that use a controlled vocabulary be indicated by us-
727 ing xsi:type on the gco:characterString element to make the type gml:CodeType, which then requires a
728 codeSpace attribute (see 4.14.2 Non digital resources and 7.2 Linkage name conventions). This
729 codeSpace should be the URI for the vocabulary used, with the implication that the CharacterString ele-

730 ment value will then be an identifier from that vocabulary. This essentially turns the CharacterString into a
731 GML scoped name or gco:LocalName element.

732 *Table 8. Codelist crosswalk between ISO, NAP and USGIN.*

Codelist (ISO / NAP)	Coded Values/Names	Comments
`CI_DateTypeCode`	`creation, publication, revision`	ISO 19115 (B.5.2)
`napCI_DateTypeCode`	`…, notAvailable, inForce, adopted, deprecated, superseded`	NAP expansion
`CI_OnLineFunction-Code`	`download, information, offlineAccess, order, search`	ISO 19115 (B.5.3)
`nap-CI_OnLineFunction-Code`	`…, upload, webService, emailService, browsing, fileAccess, webMapService`	NAP expansion
`CI_PresentationForm-Code` `nap-CI_PresentationForm-Code`	`documentDigital, documentHardcopy, im-ageDigital, imageHardcopy, mapDigital, mapHardcopy, modelDigital, modelHard-copy, profileDigital, profileHardcopy, tableDigital, tableHardcopy, video-Digital, videoHardcopy, audioDigital`	ISO 19115 (B.5.4)
	`…, audioHardcopy, multimediaDigital, multimediaHardcopy, diagramDigital, diagramHardcopy`	NAP expansion
`CI_RoleCode` `napCI_RoleCode`	`resourceProvider, custodian, owner, user, distributor, originator, poin-tOfContact, principalInvestigator, processor, publisher, author`	ISO 19115 (B.5.5)
	`…, collaborator, editor, mediator, rightsHolder`	NAP expansion
`DQ_EvaluationMethod-TypeCode` `napDQ_Evaluation-MethodTypeCode`	`directInternal, directExternal, indi-rect`	ISO 19115 (B.5.6)
`DS_AssociationType-Code` `napDS_Association-TypeCode`	`crossReference, largerWorkCitation, partOfSeamlessDatabase, source, stere-oMate`	ISO 19115 (B.5.7)
	`…, isComposedOf`	NAP expansion
`DS_InitiativeType-Code` `napDS_Initiative-TypeCode`	`campaign, collection, exercise, exper-iment, investigation, mission, sensor, operation, platform, process, program, project, study, task, trial`	ISO 19115 (B.5.8)
`MD_CellGeometryCode`	`point, area`	ISO 19115 (B.5.9)
`napMD_CellGeometry-Code`	`…, voxel`	NAP expansion

Codelist (ISO / NAP)	Coded Values/Names	Comments

`MD_CharacterSetCode`
`napMD_CharacterSet-Code`
	`ucs2, ucs4, utf7, utf8, utf16,`
	`8859part1, 8859part2, 8859part3,`
	`8859part4, 8859part5, 8859part6,`
	`8859part7, 8859part8, 8859part9,`
	`8859part10, 8859part11, 8859part13,`
	`8859part14, 8859part15, 8859part16,`
	`jis, shiftJIS, eucJP, usAscii, ebcdic,`
	`eucKR, big5, GB2312`
		ISO 19115 (B.5.10)

`MD_Classification-Code`	`unclassified, restricted, confiden-` `tial, secret, topSecret`	ISO 19115 (B.5.11)
`napMD_Classification Code`	`…, sensitive, forOfficialUseOnly`	NAP expansion
`MD_CoverageContent-TypeCode` `napMD_Coverage-ContentTypeCode`	`image, thematicClassification, physi-` `calMeasurement`	ISO 19115 (B.5.12)

`MD_DataTypeCode`
not used by NAP and USGIN
	`class, codelist, enumeration, codel-`
	`istElement, abstractClass, aggregate-`
	`Class, specifiedClass, datatypeClass,`
	`interfaceClass, unionClass, metaClass,`
	`typeClass, characterString, integer,`
	`association`
		ISO 19115 (B.5.13) –
		The
		`MD_MetadataExtension Information` element
		and its codelists are
		not used by NAP and
		USGIN.

`MD_DimensionName-TypeCode` `napMD_DimensionName-TypeCode`	`row, column, vertical, track, cross-` `Track, line, sample, time`	ISO 19115 (B.5.14)
`MD_GeometricObject-TypeCode` `napMD_Geometric-ObjectTypeCode`	`complex, composite, curve, point, sol-` `id, surface`	ISO 19115 (B.5.15)

`MD_ImagingCondition-Code`
`napMD_Imaging-ConditionCode`
	`blurredImage, cloud, degrad-`
	`ingObliquitty, fog, heavySmokeOrDust,`
	`night, rain, semiDarkness, shadow,`
	`snow, terrainMasking`
		ISO 19115 (B.5.16)

`MD_KeywordTypeCode` `napMD_KeywordType-Code`	`discipline, place, stratum, temporal,` `theme`	ISO 19115 (B.5.17)
	`…, product, subTopicCategory`	NAP expansion

`MD_Maintenance-FrequencyCode`
`napMD_Maintenance-FrequencyCode`
	`continual, daily, weekly, fortnightly,`
	`monthly, quarterly, biannually, annu-`
	`ally, asNeeded, irregular, notPlanned,`
	`unknown`
		ISO 19115 (B.5.18)

	`…, semimonthly`	NAP expansion
`MD_MediumFormatCode` `napMD_MediumFormat-Code`	`cpio, tar, highSierra, iso9660,` `iso9660RockRidge, iso9660AppleHFS`	ISO 19115 (B.5.19)
	`…, UDF`	NAP expansion

Codelist (ISO / NAP)	Coded Values/Names	Comments
MD_MediumNameCode napMD_MediumNameCode	cdRom, dvd, dvdRom, 3halfinchFloppy, 5quarterInchFloppy, 7trackTape, 9trackTape, 3480Cartridge, 3490Cartridge, 3580Cartridge, 4mmCartridgeTape, 8mmCartridgeTape, digitalLinearTape, onLine, satellite, telephoneLink, hardcopy, hardcopyDi-azoPolyester08, hardcopyCardMicrofilm, hardcopyMicrofilm240, hardcopyMicro-film35, hardcopyMicrofilm70, hard-copyMicrofilmGeneral, hardcopyMicro-filmMicrofiche, hardcopyNegativePhoto, hardcopyPaper	ISO 19115 (B.5.20)
	…, hardcopyDiazo, hardcopyPhoto, hard-copyTracedPaper, hardDisk, USBFlash-Drive, 1quarterInchCartridgeTape	NAP expansion
MD_ObligationCode not used by NAP and USGIN	mandatory, optional, conditional	ISO 19115 (B.5.21) - The MD_MetadataExtension Information element and its codelists are not used by NAP and USGIN.
MD_PixelOrientation-Code napMD_Pixel-OrientationCode	center, lowerLeft, lowerRight, upper-Right, upperLeft	ISO 19115 (B.5.22)
MD_ProgressCode napMD_ProgressCode	completed, historicalArchive, obso-lete, onGoing, planned, required, un-derDevelopment	ISO 19115 (B.5.23)
	…, proposed	NAP expansion
MD_RestrictionCode napMD_Restriction-Code	copyright, patent, patentPending, trademark, license, intellectualProp-ertyRights, restricted, otherRe-strictions	ISO 19115 (B.5.24)
	…, licenseUnrestricted, licenseEndUs-er, licenseDistributor, privacy, stat-utory, confidential, sensitivity	NAP expansion
MD_ScopeCode napMD_ScopeCode	attribute, attributeType, collection-Hardware, collectionSession, dataset, series, nonGeographicDataset, dimen-sionGroup, feature, featureType, prop-ertyType, fieldSession, software, ser-vice, model, tile	ISO 19115 (B.5.25)

Codelist (ISO / NAP)	Coded Values/Names	Comments

`MD_Spatial-RepresentationType-Code`
 	
`napMD_Spatial-RepresentationType-Code`
	`vector, grid, textTable, tin, stereo-Model, video`	ISO 19115 (B.5.26)

`MD_TopicCategoryCode`
 	
`napMD_TopicCategory-Code`
	`farming, biota, boundaries, climatolo-gyMeterologyAtmosphere, economy, ele-vation, environment, geoscientificIn-formation, health, imageryBase-MapsEarthCover, intelligenceMilitary, inlandWater, location, oceans, plan-ningCadastre, society, structure, transportation, utilitiesCommunication`	ISO 19115 (B.5.27)

`MD_TopologyLevelCode`
 	
`napMD_TopologyLevel-Code`
	`geometryOnly, topology1D, planarGraph, fullPlanarGraph, surfaceGraph, fullSurfaceGraph, topology3D, fullTo-pology3D, abstract`	ISO 19115 (B.5.28)

`SV_CouplingType` `napSV_CouplingType`	`loose, mixed, tight`	ISO 19119 (Amend-ment 1; C.2.8)

`SV_Parameter-Direction`
 	
`napSV_Parameter-Direction`
	`in, out, in/out`	ISO 19119 (Amend-ment 1; C.2.9)

LanguageCode	see http://www.loc.gov/standards/iso639-2/php/code_list.php	no complete NAP or ISO registry found
not used by ISO `nap_DCPList`	`XML, CORBA, JAVA, COM, SQL, Web-Services`	NAP specific codelist – not used by USGIN due to poorly defined semantics and use.
not used by ISO `napMD_FileFormatCode`	`bil, bmp, bsq, bzip2, cdr, cgm, cover, csv, dbf, dgn, doc, dwg, dxf, e00, ecw, eps, ers, gdb, geotiff, gif, gml, grid, gzip, html, jpg, mdb, mif, pbm, pdf, png, ps, rtf, sdc, shp, sid, svg, tab, tar, tiff, txt, xhtml, xls, xml, xwd, zip, wpd`	NAP specific codelist – not formally used by USGIN, but these character strings should are to be used to populate fileType elements.

4.18 Geographic bounding box

USGIN profile requires that if an `EX_Extent/geographicElement` is supplied, it include a geographic bounding box with bounding latitude and longitude expressed using WGS 84 decimal degrees.

The corner coordinates for the geographic bounding box must not coincide in one point, because this may result in fatal errors with some CSW implementations. Point locations must thus be represented as tiny rectangles. USGIN recommended practice is to place the actual point location in the lower left corner of the rectangle.

4.19 Data Quality

4.19.1 Simple quality statement

For most resource evaluation purposes (is the described resource good enough for my purposes?) most users would find a free text statement more useful that a detailed xml document. What would be useful for many cases is the ability to state something like "These data were compiled by the authors from field sheets and notes by scanning paper copies, georeferencing and digitizing on screen. Station locations are based on Garmin 12 GPS readings, except locally where they have been adjusted for consistency with the base map. Original GPS coordinates are reported in the station table. These data have been reviewed for completeness of description and internal consistency, but have not been independently field checked." This is the kind of quality information that is all that is available for many resources; it is neither a quantitative measure nor technically a conformance result. A simple qualityStatement would suffice and provide significant value.

To implement this simple case, the proposed solution is to use `DQ_DataQuality[1]/report[1]/Abstract-DQ_Element/result[1]/DQ_ConformanceResult/explanation` as a place to put this text explanation. The use of any of the concrete data quality elements (e.g. DQ_QuantitativeAttributeAccuracy, DQ_RelativeInternalPositionalAccuracy..) is arbitrary; the mechanism proposed here is that the xpath `DQ_DataQuality[1]//report[1]//explanation/CharacterString` (the first data quality report conformance explanation in the metadata document) would contain a free text discussion/description of data quality considerations for the indicated scope. The use of any specific data quality element to contain this explanation is arbitrary and would not be considered meaningful in this context.

4.19.2 Data quality for individual parts of a resource

The use of `dataQualityInfo/DQ_DataQuality/scope` presents challenges for determining how to represent metadata with finer granularity about particular feature or attribute instances, some attribute in the scope of a single dataset, some particular dataset within a series.

Determining best practices for finer-granularity metadata requires consideration of likely use cases. Note that data quality statements may provide information on lineage, completeness, logical consistency, thematic accuracy, temporal accuracy, or positional accuracy. Note also that the USGIN profile is designed for use in a geoscience domain-wide resource catalog meant to enable discovery, evaluation, and access to information resources. Use cases involve filtering metadata records based on data quality statements, or using those statement to evaluate datasets or feature instances for fitness to a user's purpose. These might include:

1) data quality statements for individual datasets in a series, to determine if a dataset in the series might be appropriate for the desired use.

2) data quality statements associated with different attributes of a feature on the dataset series level, e.g. all structure orientations (the attribute) have some standard quantitative attribute accuracy for all features in all datasets in a series, to determine if any data in the series might be appropriate for the desired use.

3) data quality statements associated with different attributes of a feature on the dataset level, e.g. all structure orientations have some standard quantitative attribute accuracy for all features in a particularly subset of datasets in a series. This may be assigned on an individual dataset level, or to subsets, e.g. a measurement procedure changed at some point during development of the series that

781   changes the attribute accuracy for all subsequently acquired data. These quality statements might be
782   used to determine which dataset in a series might be appropriate for the desired use, or if a particular
783   dataset is useful.

784   4) data quality statements for one or more particular features that are contained in a dataset. These
785   statements might be used to select particular feature instances to download or use for an analysis.

786   5) data quality statements for particular attribute value assignments on particular features in a dataset.
787   These statements might be used to select particular feature instances to download or use for an
788   analysis.

789   In a dataspace environment of the sort envisioned for a community data network (Franklin et al, 2005),
790   the ISO19115 hierarchy level 'series' is useful for high-level data discovery and evaluation, but actual da-
791   ta acquisition and usage occur at the dataset level. Attribute- and feature-scoped data quality information
792   would be useful in dataset and series level metadata for discovery and evaluation, but featureInstance
793   and attributeInstance data quality information only come in to play for the data acquisition and usage in
794   the context of a dataset.

795   In the architecture of the system as currently envisioned, only the lineage and accuracy aspects (not the
796   completeness and logical consistency, which apply at a dataset level) of data quality make sense for fea-
797   ture and attribute instance level metadata, and this information is better accounted for by an observation
798   and measurement view of the data (e.g. ISO 19156) through a feature service, not a metadata service.
799   Inclusion of instance level dataQuality statements might make sense in metadata that is bundled with a
800   data collection in a data delivery package, but this is out of scope for this profile. In the CSW environ-
801   ment, if a data provider wishes to enable search using feature- or attribute-instance data quality criteria,
802   these should be exposed by presentation metadata records for each feature- or attribute-instance.

803   The ISO19115 content model provides several possible approaches to fine-granularity metadata:

804   1) using `MD_Metadata/hierarchyLevel` and `MD_Metadata/parentIdentifier`

805   2) using `MD_Metadata/identificationInfo/MD_DataIdentification/aggregationInfo` associations

806   3) using `MD_Metadata/ dataQualityInfo/DQ_DataQuality/scope/levelDescription` elements to bind da-
807   ta quality assertions to parts of the larger resource that are identified by object references from the
808   metadata document.

809   The USGIN profile does not use approach 1, with parentIdentifier links associating MD_Metadata records
810   with parent metadata. This approach is useful for metadata that is packaged with data collections in order
811   to reduce duplication of metadata information that is inherited from series to datasets in that series, and
812   perhaps to individual features and attributes in the application schema for the series, or feature and at-
813   tribute instances in particular datasets. In the context of resource discovery using a CSW service, queries
814   cannot be posed in terms of these kinds of inheritance relationships, and result sets should be complete
815   metadata records for the resources located by a search.

816   The USGIN profile uses approach 2, aggregationInfo associations between metadata records for related
817   resources. In a data discovery environment, links to related resources may be very useful to lead users to
818   other resources that their search criteria did not directly uncover. The `associationType` property on these
819   links provides additional useful information for assessing whether the related resources might be useful.
820   Given this approach, data quality information for datasets in a series would not be accessed through
821   `DQ_DataQuality` elements in the series metadata, with `levelDescription/MD_ScopeDescription/Dataset`
822   elements providing DataSetURI's for each described component dataset. Under the USGIN profile, identi-
823   fication of datasets in a series that meet some data quality criteria would search for datasets that have
824   `MD_Metadata/identificationInfo/MD_DataIdentification/aggregationInfo/MD_AggregateInformation/-`
825   `aggregateDataSetIdentifier` equal to the dataSetURI for the series, with `../AggregateInformation/-`
826   `associationType/DS_AssociationTypeCode` equal to 'largerWorkCitation', along with whatever quality crite-
827   ria were required.

828   USGIN profile uses multiple `dataQualityInfo/DQ_DataQuality` elements to provide optional data quality
829   statements for individual attributes and features in a dataset, with one `dataQualityInfo` element for each
830   attribute on each feature about which the data quality is described. According to the ISO19139
831   (20060504) schema implementing ISO19115, each of these `dataQualityInfo` elements has exactly one
832   `../DQ_Scope`, which in turn may have 0 to many `levelDescription/MD_ScopeDescription` elements. Each
833   `levelDescription/MD_ScopeDescription` contain only one of `attributes`, `features`, `featureInstances`,

834 `attributeInstances`, `dataset` or `other` elements. An individual `MD_ScopeDescription` may specify multiple
835 `attributes`, `features`, `featureInstances`, or `attributeInstances`. `MD_ScopeDescription/other` is not
836 used in the USGIN profile at this time. `MD_ScopeDescription/dataset` is not used because data quality
837 statements about a dataset are indicated by `dataQualityInfo/../DQ_Scope/level/MD_ScopeCode` = 'da-
838 taset', in which case `DQ_Scope/levelDescription/MD_ScopeDescription` elements will be ignored; data
839 quality statements about a dataset in a series are included in a metadata record for the dataset that is as-
840 sociated with the series through `MD_Metadata/MD_DataIdentification../MD_AggregateInformation/-`
841 `aggregateDataSetIdentifier`.

842 `DQ_Scope/levelDescription/MD_ScopeDescription/attributes` and `../features` are specified using ob-
843 ject references to GF_AttributeType and GF_FeatureType elements according to section B.4.4 of
844 ISO19115(2003). These are metaclasses defined in ISO19109, and their implementation is out of scope
845 for this profile. Table 9 presents recommendations for use of `../DQ_DataQuality/scope/-`
846 `levelDescription/MD_ScopeDescription` child elements based on consideration of the above use cases,
847 interpretation of the UML diagrams for ISO19109 and the sketchy text in section B.4.4 of
848 ISO19115(2003).

849 *Table 9. Usage of data quality scope description elements*

scopeDescription type (and cardinality)	Reference target	USGIN profile provisions
`attributes` (1..*)	Identifier for an attribute type defined in the application schema identified by `MD_Metadata/application-SchemaInfo/../CI_Citation`	Use for specifying attribute level data quality for all attributes of a particular type in a particular feature in a dataset or series. `levelDescription/MD_ScopeDescription/attributes` elements are allowed only when `DQ_Scope/-level/MD_ScopeCode` = 'attributeType'. The element value is an xlink:href or uuidref to an attribute defined in the application schema for the dataset. The xlink:title may be used to give the name of the attribute as it appears in the dataset if this is useful. To be useful, the `MD_Metadata/-applicationSchemaInfo` element must provide sufficient information to resolve the attribute identifier.
`features` (1..*)	Identifier for an feature type defined in the application schema identified by `MD_Metadata/application-SchemaInfo/../CI_Citation`	Use for specifying feature level data quality for all features of a particular type in a dataset or series. `levelDescription/MD_ScopeDescription/-attributes` elements are allowed only when `DQ_Scope/level/MD_ScopeCode` = 'featureType' or 'attributeType'. The identified feature type is the target of the data quality statement if `MD_ScopeCode` is 'featureType', else it identifies the feature that contains the described attribute. The element value is an xlink:href or uuidref to a feature defined in the application schema for the dataset. The xlink:title may be used to give the name of the feature as it appears in the dataset if this is useful. To be useful, the `MD_Metadata/-applicationSchemaInfo` element must provide sufficient information to resolve the featureType identifier.
`featureInstances` (1..*)	A resolvable identifier for a particular featureInstance within the scope of the re-	Out of scope, not used by USGIN. Instance level quality statements are provided via a feature service.

scopeDescription type (and cardinality)	Reference target	USGIN profile provisions
	source identified by `MD_Metadata/DataSetURI`	
`attributeInstaces` (1..*)	A resolvable identifier for a particular attributeInstance within the scope of the resource identified by `MD_Metadata/DataSetURI`	Out of scope, not used by USGIN. Instance level quality statements are provided via a feature service.
`dataset` (1)	A resolvable identifier for a particular dataset within the scope of the resource identified by `MD_Metadata/-DataSetURI`	Not used by USGIN. Dataset data quality is described in records with `DQ_Scope/-level/MD_ScopeCode` = 'dataset', and metadata for datasets in a series is represented by separate dataset records for CSW purposes.
`other` (1)	A resolvable identifier for some other resource within the scope of the resource identified by `MD_Metadata/-DataSetURI`	Not used by USGIN, undefined semantics.

850

4.20 Lineage

Lineage in data quality section has to do with processing steps that have altered the resource in some fashion. Each step has some input resources, identified by source citations associated with the process step. The LI_ProcessStep element does not directly identify its output resource, so in a lineage that involves a chain of steps with intermediate resources, the sourceStep association from LI_Source links a resource to a processing step that it is output from.

If a resource has simply been downloaded from some online repository, or copied from some physical media (CD, DVD), with no modification, then it is considered an identical resource, and no lineage is implied. The `MD_DataIdentification/citation/CI_Citation` should identify this source; the `MD_Metadata/distributionInfo` should report information on how the data were obtained. Based on this approach, a LI_Lineage that reports no processSteps, only a source link, does not make sense. `LI_Lineage/source/LI_Source` is thus not used by USGIN metadata.

A GIS dataset originally digitized from a published geologic map, put online, obtained by an online download, and reprojected would report one processStep (reprojection) with `source/LI_Source` that has a CI_Citation for the downloaded data. This LI_Source would have a sourceStep pointing to an LI_ProcessStep for the original digital conversion from the paper map, and the `LI_ProcessStep/source/LI_Source` would contain the citation for the original paper map.

In order to enable xpath queries for any of the sources or processSteps in a processing chain, all related LI_Source and LI_ProcessStep elements should be directly nested within the LI_Lineage element, and the `processStep/source` and `LI_Source/sourceStep` associations should be by reference.

Code example 1: Simplified example of a complex processing and source history using LI_Lineage.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<LI_Lineage
   xmlns="http://www.isotc211.org/2005/gmd"
   xmlns:gco="http://www.isotc211.org/2005/gco"
   xmlns:xlink="http://www.w3.org/1999/xlink"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
```

```
879      xsi:schemaLocation="http://www.isotc211.org/2005/gmd
880  http://schemas.opengis.net/iso/19139/20070417/gmd/dataQuality.xsd">
881    <statement>
882      <LocalisedCharacterString>The digital data described by this metadata was
883  originally compiled digitally from two published maps; this digital dataset
884  was then reprojected to produce the described re-
885  source.</LocalisedCharacterString>
886    </statement>
887    <processStep>
888      <LI_ProcessStep id="1">
889        <description>
890          <LocalisedCharacterString>digital compilation of 2
891  maps</LocalisedCharacterString>
892        </description>
893        <source xlink:href="#10"/>
894        <source xlink:href="#20"/>
895      </LI_ProcessStep>
896    </processStep>
897    <processStep>
898      <LI_ProcessStep id="2">
899        <description>
900          <LocalisedCharacterString>digital map compilation reprojected, should
901  have some way to specify projection parameters?, output is LI_Source id=70
902  </LocalisedCharacterString>
903        </description>
904        <source xlink:href="#40"/>
905      </LI_ProcessStep>
906    </processStep>
907    <source>
908      <LI_Source id="40">
909        <description>
910          <LocalisedCharacterString>a digital compilation of 2 maps, output of
911  processStep ID=1, input into reprojection process</LocalisedCharacterString>
912        description>
913        <sourceStep xlink:href="1"/>
914      </LI_Source>
915    </source>
916    <source>
917      <LI_Source id="10">
918        <description>
919          <LocalisedCharacterString>ultimate source--some published
920  map</LocalisedCharacterString>
921        </description>
922  <!--no source processing recorded for production of paper map so no
923  sourceStep-->
924      </LI_Source>
925    </source>
926    <source>
927      <LI_Source id="20">
928        <description>
929          <LocalisedCharacterString>another published
930  map</LocalisedCharacterString>
931        </description>
932      </LI_Source>
933    </source>
934    <source>
935      <LI_Source id="70">
936        <description>
```

```
937        <LocalisedCharacterString>a reprojected version of the digital compi-
938 lation</LocalisedCharacterString>
939        </description>
940        <sourceStep xlink:href="2"/>
941     </LI_Source>
942   </source>
943 </LI_Lineage>
```

944 An `LI_Lineage` may be constructed that involves a number or resources and processing steps, and this
945 lineage may be referenced by metadata for all the resources involved in the processing. The
946 `LI_Lineage/source/LI_Source/sourceCitation/CI_Citation/identifier/MD_Identifier` is a reference to
947 the `MD_Metadata/fileIdentifier` for the metadata for each resource in the chain. This approach allows
948 the metadata record to record relationships through process steps between resources.

4.21 Temporal extents

950 Resource temporal extent (`identificationInfo/MD_DataIdentification/extent/EX_Extent/-`
951 `temporalElement/EX_TemporalExtent/extent/ TimePeriod`) is used to specify the temporal interval to
952 which the content of a resource applies. Default reference frame for time is calendar date and time en-
953 coded using ISO-8601:

```
954 <gml:TimePeriod gml:id="Id2010">
955   <!-- USGIN requires the beginPosition and endPosition's frame property
956   to be defined. The default value is #ISO-8601. -->
957        <gml:beginPosition frame="#ISO-8601">2010-01-00T00:00:00</gml:beginPosition>
958        <gml:endPosition frame="#ISO-8601">2010-12-31T24:00:00</gml:endPosition>
959 </gml:TimePeriod>
```

960 `<gml:endPosition indeterminatePosition="now"/>` is the correct way to represent "Present" in ISO or
961 GML as one of the boundaries of a timePeriod.

962 The ISO 19139 xml schema allows TM_PeriodTimePeriod to be quantified by a gml:TimeInstant or
963 gml:TimePeriod element. In order to promote interoperability, the USGIN profile mandates use of
964 gml:TimePeriod for specifying temporal extent for a resource.

965 For geologic time extents, the time coordinates for the beginPosition and endPosition should be ex-
966 pressed numerically in Ma. This convention allows search for resources pertinent to intervals of geologic
967 time using simple numeric comparisons instead of the complex hierarchical concept expansions that
968 would be necessary to use named eras from a stratigraphic time scale. Encoding example:

```
969 <EX_TemporalExtent>
970   <extent>
971     <gml:TimePeriod gml:id="y34096">
972       <gml:beginPosition
973         frame="urn:CGI:TemporalCRS:cgi:standardGeologyMa">220
974       </gml:beginPosition>
975       <gml:endPosition
976         frame="urn:CGI:TemporalCRS:cgi:standardGeologyMa">140
977       </gml:endPosition>
978     </gml:TimePeriod>
979   </extent>
980 </EX_TemporalExtent>
```

981 The frame for the beginPosition and endPosition is a URI for standard geologic time, measured positive
982 getting older, with an origin at 1950 CE, in units of millions of years.

4.22 Operation metadata

984 The srv namespace elements based on ISO 19119 are inadequate to provide the content necessary to
985 automate connection to a generic service. This is due in part to poorly defined semantics and use cases
986 for the elements that are there (DCP, applicationProfile, protocol, MD_Format, serviceType, operation-

987   Name vs. invocationName, connectPoint), and partly due to incomplete content model (where to put al-
988   lowed outputFormat parameter values or supported query operations for CSW or WMS). The ISO 19119
989   model for service metadata does not include a mechanism to specify valid values for operation parame-
990   ters. For instance, OGC WMS and CSW services both support an output format parameter, and OGC ca-
991   pabilities documents provide a listing of the supported output formats, but where do these go in ISO19139
992   xml documents? Does the described service support http POST or GET method? This information is nec-
993   essary in order to compose valid service requests.

994   USGIN proposes to follow the INSPIRE (INSPIRE 19115/119, 2009) guideline to use a `distribution-`
995   `Info/../transferOptions/../online/../linkage` element point to a WSDL or OGC getCapabilities doc-
996   ument (see xml files at http://www.webservice-energy.org/metadata/), and make `srv:SV_Operation-`
997   `Metadata` nil. WSDL and getCapabilities were designed to describe service operation, and it seems coun-
998   terproductive to invent another scheme to do the same thing. Because of the difficulty in creating usable
999   abstract model that accounts for any and all possible services, it makes more sense to allow service de-
1000   scription documents specific to different service frameworks.

1001   In order to identify the linkage element that locates the service description document, USGIN mandates
1002   using `CI_OnlineResource/name` = "serviceDescription" (from the table in section 7.2 Linkage name con-
1003   ventions) as the in the `CI_OnlineResource` element with the linkage to the service description. It may also
1004   be useful to provide a mapping between ServiceType and a guidance for the kind of document the
1005   `CI_OnlineResource/linkage` URL locates.

5 Abbreviations

CSW	Metadata Catalog for the Web. Also abbreviated as CS-W and CS/W
GeoSciML	Geoscience Markup Language
GML	Geographic Markup Language
GUID	Global Unique Identifier
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
UML	Unified Modeling Language
URI	Universal Resource Identifier
USGIN	U.S. Geoscience Information Network
WCS	Web coverage Service
WFS	Web Feature Service
XML	eXtensible Markup Language
XSD	XML Schema Definition
XSL	eXtensible Stylesheet Language
XSLT	XSL Transformations
XLink	XML Linking Language

1007

6 References

6.1 Cited literature

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[INSPIRE ISO19115/119] Drafting Team Metadata and European Commision Joint Research Centre, 2009-02-18, INSPIRE Metadata Implementing Rules: Technical Guidelines based on EN ISO 19115 and EN ISO 19119,v. 1.1: European Commission Joint Research Centre, MD_IR_and_ISO_20090218, available at http://inspire.jrc.ec.europa.eu/index.cfm/pageid/101 (accessed 2010-11-18).

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Richard, S. M., and Grunberg, Wolfgang, editors, 2010, Metadata Recommendataions for Geoscience Resources: U.S. Geoscience Information Network Best Practices Document, Doc ID gin2010-11, v. 1.0.3, available at http://lab.usgin.org/profiles/doc/metadata-content-recommendations (accessed 2010-11-18).

7 Codelists

7.1 ServiceType

1030 INSPIRE metadata Implementing Rules (*OJ L 326, 4.12.2008)* section D3 mandate the use of the value
1031 domain listed in Table 10 to categorize spatial data service types. These values are better suited for
1032 CI_OnlineFunctionCode used to specify CI_OnlineResource/online/Function. The USGIN team interprets
1033 the ISO scope notes to allow more useful content for service type, specifying an actual service specifica-
1034 tion like OGC WMS. USGIN draft ServiceType vocabulary is reported in Table 11.

1035

1036 *Table 10. INSPIRE SPATIAL DATA SERVICE TYPE (for information only, not used by USGIN)*

Type	Description
discovery	Discovery Service
view	View Service
download	Download Service
transformation	Transformation Service
invoke	Invoke Spatial Data Service
other	Other Services

1037 *Table 11. USGIN service type vocabulary. This is an interim listing of serviceTypes. The code list URI for*
1038 *this registry is http://resources.usgin.org/registry/serviceType201001. See also*
1039 *http://dclite4g.xmlns.com/ws.rdf for another rdf-based vocabulary. These should probably be merged.*

Identifier	Name	Description
WMS	OGC Web Map service	provides a simple HTTP interface for requesting geo-registered map imag-es from one or more distributed geospatial databases. A WMS request de-fines the geographic layer(s) and area of interest to be processed. The re-sponse to the request is one or more geo-registered map images (returned as JPEG, PNG, etc) that can be displayed in a browser application. The in-terface also supports the ability to specify whether the returned images should be transparent so that layers from multiple servers can be com-bined or not. (http://www.opengeospatial.org/standards/wms)
WFS	OGC Web Fea-ture service	http://www.opengeospatial.org/standards/wfs
WCS	OGC Web coverage ser-vice	defines a standard interface and operations that enables interoperable ac-cess to geospatial "coverages" [http://www.opengeospatial.org/ogc/glossary/c]. The term "grid coverages" typically refers to content such as satellite images, digital aerial photos, digital elevation data, and other phenomena represented by values at each measurement point.
CSW	OGC Web cat-alog service	supports the ability to publish and search collections of descriptive infor-mation (metadata) about geospatial data, services and related resources. Providers of resources use catalogues to register metadata that conform to the provider's choice of an information model; such models include de-scriptions of spatial references and thematic information. (http://www.opengeospatial.org/standards/cat)

Identifier	Name	Description
SOS	OGC Sensor observation service	provides an API for managing deployed sensors and retrieving sensor data and specifically "observation" data. Whether from in-situ sensors (e.g., water monitoring) or dynamic sensors (e.g., satellite imaging), measurements made from sensor systems contribute most of the geospatial data by volume used in geospatial systems today. (http://www.opengeospatial.org/standards/sos)
WPS	OGC Web Processing service	provides rules for standardizing how inputs and outputs (requests and responses) for geospatial processing services, such as polygon overlay. The standard also defines how a client can request the execution of a process, and how the output from the process is handled. It defines an interface that facilitates the publishing of geospatial processes and clients' discovery of and binding to those processes. The data required by the WPS can be delivered across a network or they can be available at the server. (http://www.opengeospatial.org/standards/wps)
SPS	OGC Sensor planning service	defines interfaces for queries that provide information about the capabilities of a sensor and how to task the sensor. The standard is designed to support queries that have the following purposes: to determine the feasibility of a sensor planning request; to submit such a request; to inquire about the status of such a request; to update or cancel such a request; and to request information about other OGC Web services that provide access to the data collected by the requested task.
OpenDAP	Open source data access protocol	(http://opendap.org/)
OAI-PMH	Open Archives Initiative Protocol for Metadata Harvesting	provides an application-independent interoperability framework based on metadata harvesting.

1040   Example usage:

```
1041        <srv:serviceType>
1042          <gco:LocalName
1043   codeSpace="http://resources.usgin.org/registry/serviceType201001">WMS</gco:LocalName>
1044        </srv:serviceType>
```

1045

1046   7.2 Linkage name conventions

1047   The cardinality of the `online` element in DigitalTransferOptions is 0..*. In order to distinguish the nature of
1048   various linkages that might be provided, above and beyond function, protocol, and applicationProfile,
1049   USGIN profile mandates use of the following names to associate with links to identify important linkages.

1050   *Table 12. USGIN Names to identify special linkage URL's for CI_Online Resource. CodeList URI =*
1051   *http://resources.usgin.org/registry/linkageName201001*

Identifier	Name (eng)	Usage
icon	icon	linkage url is link to a thumbnail icon. Icon pixel height and width range?
serviceDescription	Service Description	linkage url is link to getCapabilities or WSDL that describes a service using a formal syntax such that computer programs can automate connection to the

		service.
baseURL	Base URL	Base url for service. Assumes that ServiceType specifies a well know service type such that requests can be constructed without significant additional information.
serviceClient	Service Client	URL is linkage to a web application that allows the user to access the service
webpage	Web page	URL locates a web page with instructions for accessing the service. This provides the user with information to implement a connection to the service, but does not enable automated service access.

1052 Example usage:

```
1053   </gmd:CI_OnlineResource>
1054       <gmd:linkage>
1055   <gmd:URL>http://75.101.143.247:8080/gsvr/wms?SERVICE=WMS&amp;REQUEST=getCapabilities</gmd:URL>
1056       </gmd:linkage>
1057       <gmd:protocol>
1058           <gco:CharacterString>http</gco:CharacterString>
1059       </gmd:protocol>
1060       <gmd:name>
1061           <gco:CharacterString xsi:type="gml:CodeType"
1062               codeSpace="http://resources.usgin.org/registry/linkageName201001">
1063                   serviceDescription</gco:CharacterString>
1064       </gmd:name>
1065   </gmd:CI_OnlineResource>
```

1066 Use of such controlled vocabulary can be indicated by using xsi:type on the gco:characterString element
1067 to make the type gml:CodeType, which then requires a codeSpace attribute. The distribution format Iden-
1068 tifier from Table 6 should be used as the element value. For compatibility with systems that can not pro-
1069 cess this encoding, the code identifier should be included as the element value as well as the codeList-
1070 Value.

8 Examples

8.1 USGIN ISO 19139 Minimum Dataset Metadata

In the following listing, text in green is comments; XML elements are in blue, XML attributes are in black, and attribute values are in **purple**.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<!--
*********************************************************************************************
*** Minimum example of a ISO 19139 Geospatial Dataset Metadata
*** based on the USGIN v1.1 Profile
*** by USGIN Standards and Protocols Drafting Team
*** U.S. Geoscience Information System (USGIN) - http://lab.usgin.org
*** Contributors: Wolfgang Grunberg, Stephen M Richard
*** 01/20/2010
***
*** DISCLAIMER: this is not an authoritative metadata example but an aide to get started.
*** Scope notes are mostly from NAP or ISO documentation; refer to
*** the USGIN profile document for more specific and reliable guidelines.
***
*** Validated against http://www.isotc211.org/2005/gmd (ISO 19115, CSW 2.0.2 AP ISO 1.0).
*** Follows the USGIN ISO 19139 Dataset Metadata Profile v1.1.
*** a derivative of the North American Profile (NAP)
***
*** NOTES:
*** - Codelists:
*** Most ISO metadata profiles and applications use ISO codelists or codelists that use ISO's
codelist names. NAP does not use ISO codelist names. USGIN recommends using ISO over NAP
codelists to ensure interoperability. Remember, the codeList attribute points to a Uniform
Resource Identifier (URI) which defines an item's identity. It can be a URN or a URL.
*** - napm schema extension:
***
http://www.cits.rncan.gc.ca/html/brodeurj/.protege/.napMetadata/napMetadataWebsite/napMetadataToo
ls/napXsd/napm is the namespace for NAP extensions in xmlns:napm. Its schema is located at
http://www.cits.rncan.gc.ca/html/brodeurj/.protege/.napMetadata/tools/napXsd/napm/napm.xsd.
However, that schema does not resolve properly because it also refernces a local copy of gmd.
USGIN does not follow this NAP requirement because it constitutes a barier to interoperability.
*** - Language code:
*** NAP demands <ISO639-2/T three letter language code - lower case><;><blank space><ISO3166-1
three letter country code - upper case>. However, NAP's requirement is not interoperable and
USGIN prefers ISO's <ISO639-2/T three letter language code - lower case> formatting.
***
*** KEY: (NAP-USGIN) - M/C/O/X (Mandatory, Conditional, Optional, Not Used)
***
*********************************************************************************************-->

<!-- USGIN ISO 19139 geospatial dataset metadata record -->
<gmd:MD_Metadata
  xmlns:gmd="http://www.isotc211.org/2005/gmd"
  xmlns:gco="http://www.isotc211.org/2005/gco"
  xmlns:gml="http://www.opengis.net/gml"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.isotc211.org/2005/gmd
http://schemas.opengis.net/csw/2.0.2/profiles/apiso/1.0.0/apiso.xsd">
  <!-- (M-M) Metadata file identifier - A unique File Identifier (GUID) - USGIN recommends using
a valid Universally Unique Identifier (UUID) -->
  <gmd:fileIdentifier>
    <gco:CharacterString>08fb00c8-0882-4bf7-b07f-fd37050c5efc</gco:CharacterString>
  </gmd:fileIdentifier>
  <!-- (M-M) Metadata language - NAP demands <ISO639-2/T three letter language code - lower
case><;><blank space><ISO3166-1 three letter country code - upper case>. However, NAP's
requirement is not interoperable and USGIN prefers ISO's <ISO639-2/T three letter language code -
lower case> formatting. -->
```

```
1134    <!-- NAP Example -->
1135    <!--
1136    <gmd:language>
1137      <gco:CharacterString>eng; USA</gco:CharacterString>
1138    </gmd:language>
1139    -->
1140    <!-- ISO Example -->
1141    <gmd:language>
1142      <gco:CharacterString>eng</gco:CharacterString>
1143    </gmd:language>
1144    <!-- (M-M) Metadata character set  - NAP specifies default is "utf8", codelist =
1145    napMD_CharacterSetCode. USGIN requires that a character set code is defined to facilitate CSW
1146    servers (deegree, GeoNetwork, etc.).  -->
1147    <gmd:characterSet>
1148      <!-- MD CharacterSetCode names: {ucs2, ucs4, utf7, utf8, utf16, 8859part1, 8859part2,
1149    8859part3, 8859part4, 8859part5, 8859part6, 8859part7, 8859part8, 8859part9, 8859part10,
1150    8859part11, 8859part13, 8859part14, 8859part15, 8859part16, jis, shiftJIS, eucJP, usAscii,
1151    ebcdic, eucKR, big5, GB2312} -->
1152      <!-- NAP example -->
1153      <!--
1154      <gmd:MD CharacterSetCode
1155        codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_95"
1156        codeListValue="RI_458">utf8</gmd:MD_CharacterSetCode>
1157      -->
1158      <!-- ISO example -->
1159      <gmd:MD_CharacterSetCode
1160
1161    codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
1162    Codelist/gmxCodelists.xml#MD_CharacterSetCode"
1163        codeListValue="utf8">UTF-8</gmd:MD_CharacterSetCode>
1164    </gmd:characterSet>
1165    <!-- (M-M) Resource type - Define if this record is a: dataset (default), service, feature,
1166    software, etc. -->
1167    <gmd:hierarchyLevel>
1168      <!-- MD_ScopeCode code names: {attribute, attributeType, collectionHardware,
1169    collectionSession, dataset, series, nonGeographicDataset, dimensionGroup, feature, featureType,
1170    propertyType, fieldSession, software, service, model, tile}. -->
1171      <!-- NAP example -->
1172      <!--
1173      <gmd:MD ScopeCode
1174        codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_108"
1175        codeListValue="RI_622">dataset</gmd:MD_ScopeCode>
1176      -->
1177      <!-- ISO example -->
1178      <gmd:MD_ScopeCode
1179
1180    codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
1181    Codelist/gmxCodelists.xml#MD_ScopeCode"
1182        codeListValue="dataset">dataset</gmd:MD_ScopeCode>
1183    </gmd:hierarchyLevel>
1184    <!-- (O-M) Resource hierarchy level name - ISO 19115 assumes that the metadata hierarchy level
1185    name defaults to "dataset" if it is not documented. NAP does not use it, recognizing that it is
1186    redundant. USGIN makes this property mandatory to identify the USGIN resource type (see USGIN
1187    Profile, "Resources of Interest"). Default USGIN hierarchyLevelName.CharacterString is "Dataset."
1188    Encode hierarchy by including hierarchyLevelName elements for all broader resource categories.
1189    E.g. default should also include a hierarchyLevelName="Collection" element. For services USGIN
1190    hierarchyLevelName.CharacterString is "Service". As use cases develop that provide rationale for
1191    definition of sub-categories of service, the resource category list will be expanded. -->
1192    <gmd:hierarchyLevelName>
1193      <gco:CharacterString>Dataset</gco:CharacterString>
1194    </gmd:hierarchyLevelName>
1195    <!-- (M-M) Metadata point of contact - Point of contact for the metadata record, e.g. for users
1196    to report errors, updates to metadata, etc. -->
1197    <gmd:contact>
1198      <gmd:CI_ResponsibleParty>
1199        <!-- (M-M) (individualName + organisationName + positionName) > 0 -->
1200        <!--
1201        <gmd:individualName>
1202          <gco:CharacterString>Stephen Richard</gco:CharacterString>
1203        </gmd:individualName>
1204        -->
1205        <gmd:organisationName>
```

```
1206          <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
1207        </gmd:organisationName>
1208        <!--
1209        <gmd:positionName>
1210          <gco:CharacterString>Metadata Czar</gco:CharacterString>
1211        </gmd:positionName>
1212        -->
1213        <gmd:contactInfo>
1214          <gmd:CI_Contact>
1215            <!-- Phone -->
1216            <!--
1217            <gmd:phone>
1218              <gmd:CI_Telephone>
1219                <gmd:voice>
1220                  <gco:CharacterString>520.770.3500</gco:CharacterString>
1221                </gmd:voice>
1222                <gmd:facsimile>
1223                  <gco:CharacterString>520.770.3505</gco:CharacterString>
1224                </gmd:facsimile>
1225              </gmd:CI_Telephone>
1226            </gmd:phone>
1227            -->
1228            <!-- Address -->
1229            <gmd:address>
1230              <gmd:CI_Address>
1231                <!--
1232                <gmd:deliveryPoint>
1233                  <gco:CharacterString>416 W. Congress St., Suite 100</gco:CharacterString>
1234                </gmd:deliveryPoint>
1235                <gmd:city>
1236                  <gco:CharacterString>Tucson</gco:CharacterString>
1237                </gmd:city>
1238                <gmd:administrativeArea>
1239                  <gco:CharacterString>Arizona</gco:CharacterString>
1240                </gmd:administrativeArea>
1241                <gmd:postalCode>
1242                  <gco:CharacterString>85701-1381</gco:CharacterString>
1243                </gmd:postalCode>
1244                <gmd:country>
1245                  <gco:CharacterString>USA</gco:CharacterString>
1246                </gmd:country>
1247                -->
1248                <!-- (O-M) Metadata point of contact e-mail address - mandatory in USGIN  -->
1249                <gmd:electronicMailAddress>
1250                  <gco:CharacterString>metadata@azgs.az.gov</gco:CharacterString>
1251                </gmd:electronicMailAddress>
1252              </gmd:CI_Address>
1253            </gmd:address>
1254          </gmd:CI_Contact>
1255        </gmd:contactInfo>
1256        <!-- (M-M) ISO 19139 Mandatory: contact role -->
1257        <gmd:role>
1258          <!-- CI_RoleCode names: {resourceProvider, custodian, owner, user, distributor,
1259     originator, pointOfContact, principalInvestigator, processor, publisher, author} - NAP expands
1260     with {collaborator, editor, mediator, rightsHolder}. -->
1261          <!-- NAP example -->
1262          <!--
1263          <gmd:CI_RoleCode
1264            codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
1265            codeListValue="RI_414">pointOfContact</gmd:CI_RoleCode>
1266          -->
1267          <!-- ISO example -->
1268          <gmd:CI_RoleCode

1270    codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
1271    Codelist/gmxCodelists.xml#CI_RoleCode"
1272            codeListValue="pointOfContact">point of contact</gmd:CI_RoleCode>
1273        </gmd:role>
1274      </gmd:CI_ResponsibleParty>
1275    </gmd:contact>
```

```
1276      <!-- (M-M) Metadata date stamp - USGIN profile requires use of dateStamp/gco:DateTime (Note
1277   this contrasts with INSPIRE mandate to use dateStamp/gco:Date). This is the date and time when
1278   the metadata record was created or updated (following NAP). -->
1279    <gmd:dateStamp>
1280      <!-- Requires an extended ISO 8601 formatted combined UTC date and time string (2009-11-
1281   17T10:00:00) -->
1282        <gco:DateTime>2010-01-14T10:00:00</gco:DateTime>
1283    </gmd:dateStamp>
1284    <!-- (M-M) metadata standard - NAP specifies "NAP - Metadata". USGIN profile conformant
1285   metadata is indicated by using "ISO-NAP-USGIN" -->
1286    <gmd:metadataStandardName>
1287        <gco:CharacterString>ISO-USGIN</gco:CharacterString>
1288    </gmd:metadataStandardName>
1289    <!-- (O-M) USGIN profile version -->
1290    <gmd:metadataStandardVersion>
1291        <gco:CharacterString>1.2</gco:CharacterString>
1292    </gmd:metadataStandardVersion>
1293    <!-- **************** -->
1294    <!-- (M-M) Resource identification information - At least one of MD_DataIdentification
1295   (dataset, dataset series) or SV_ServiceIdentification (service) is required.  -->
1296    <gmd:identificationInfo>
1297       <!-- Resource Dataset or Dataset Series Identification -->
1298       <gmd:MD DataIdentification>
1299         <gmd:citation>
1300           <!-- (M-M) Resource citation - For USGIN purposes, this should be viewed as information
1301   to identify the intellectual origin of the content in the described resource, along the lines of
1302   a citation in a scientific journal. Required content for a CI_Citation element are title, date,
1303   and responsibleParty -->
1304           <gmd:CI_Citation>
1305             <!-- (M-M) Resource title - USGIN recommends using titles that inform the human reader
1306   about the dataset's content as well as its context. -->
1307             <gmd:title>
1308               <gco:CharacterString>USGIN minimum metadata example XML file. Note that this example
1309   includes conditional minimum elements that may or may not apply to a specific resource and its
1310   metadata.</gco:CharacterString>
1311             </gmd:title>
1312             <!-- (M-M) Resource reference date - Best practice is to include at least the date of
1313   publication or creation of the resource. The date of the resource reported in the citation
1314   corresponds to the resource's last update version according to its update frequency. CI Date
1315   content includes a date and dateType. Date for USGIN profile uses xs:date data type, defined thus
1316   "date uses the date/timeSevenPropertyModel, with hour, minute, and second  required to be absent.
1317   timezoneOffset• remains optional" (http://www.w3.org/TR/xmlschema11-2). -->
1318             <gmd:date>
1319               <gmd:CI Date>
1320                 <gmd:date>
1321                   <!-- Requires an extended ISO 8601 formatted combined UTC date and time string
1322   (2001-12-17T09:30:47) -->
1323                   <gco:DateTime>2010-01-14T09:30:47</gco:DateTime>
1324                 </gmd:date>
1325                 <gmd:dateType>
1326                   <!-- CI DateTypeCode names: {creation, publication, revision} - NAP expands with
1327   {notAvailable, inForce, adopted, deprecated, superseded}. -->
1328                   <!-- NAP example -->
1329                   <!--
1330                   <gmd:CI DateTypeCode
1331                     codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_87"
1332                     codeListValue="RI_367">publication</gmd:CI_DateTypeCode>
1333                   -->
1334                   <!-- ISO example -->
1335                   <gmd:CI DateTypeCode

1337     codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
1338   Codelist/gmxCodelists.xml#CI_DateTypeCode"
1339                     codeListValue="publication">publication</gmd:CI_DateTypeCode>
1340                 </gmd:dateType>
1341               </gmd:CI_Date>
1342             </gmd:date>
1343             <!-- (C-C) Unique resource identifier  - NAP makes MD_Identifier mandatory for dataset
1344   and dataset series.
1345             For USGIN purposes, this element content value should be only considered an identifier
1346   for the citation, without any assumption that it will use http protocol. The identifier may be
1347   resolvable to a URL, if a protocol prefix specifies an identifier scheme that is resolvable (e.g.
```

```
1348   http, urn…), but this is not necessary for a valid document, and should not be assumed when
1349   processing metadata documents.
1350           For USGIN, IF the Citation has an identifier that is different from the identifier for
1351   the described resource (MD Metadata/dataSetURI), it must be included here. RS Identifier may
1352   substitute for MD_Identifier in the ISO19139 schema, but the USGIN profile requires use of
1353   MD_Identifer. If additional codespace and version content is associated with the identifier, it
1354   should be encoded as MD_Identifier/authority/ CI_Citation/ alternateTitle and MD_Identifier/
1355   authority/ CI_Citation/ edition  -->
1356           <gmd:identifier>
1357             <gmd:MD_Identifier>
1358               <gmd:code>
1359                 <!-- 13 digit ISBN example -->
1360                 <gco:CharacterString>isbn:000-0-000-00000-0</gco:CharacterString>
1361               </gmd:code>
1362             </gmd:MD_Identifier>
1363           </gmd:identifier>
1364           <!-- (M-M) Resource responsible party - The citation attribute provides information for
1365   citing the described resource. Citation is defined by Webster as "an act of quoting". The precise
1366   semantics of what an identification/citation is supposed to be are not very well articulated in
1367   ISO19115. For USGIN purposes, this should be viewed as information to identify the intellectual
1368   origin (or property) of the content in the described resource, along the lines of a citation in a
1369   scientific journal. Required content for a CI_Citation element are title, date, and
1370   'responsibleParty'.  -->
1371           <gmd:citedResponsibleParty>
1372             <gmd:CI_ResponsibleParty>
1373               <!-- (C-C) (individualName + organisationName + positionName) > 0 -->
1374               <!--
1375               <gmd:individualName>
1376                 <gco:CharacterString>Wolfgang Grunberg</gco:CharacterString>
1377               </gmd:individualName>
1378               -->
1379               <gmd:organisationName>
1380                 <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
1381               </gmd:organisationName>
1382               <!--
1383               <gmd:positionName>
1384                 <gco:CharacterString>IT Specialist</gco:CharacterString>
1385               </gmd:positionName>
1386               -->
1387               <!-- (O-C) Contact Information - (phone + deliveryPoint + electronicMailAddress ) >
1388   0 -->
1389               <gmd:contactInfo>
1390                 <gmd:CI_Contact>
1391                   <gmd:phone>
1392                     <gmd:CI_Telephone>
1393                       <gmd:voice>
1394                         <gco:CharacterString>520-770-3500</gco:CharacterString>
1395                       </gmd:voice>
1396                       <gmd:facsimile>
1397                         <gco:CharacterString>520-770-3505</gco:CharacterString>
1398                       </gmd:facsimile>
1399                     </gmd:CI_Telephone>
1400                   </gmd:phone>
1401                   <!--
1402                   <gmd:address>
1403                     <gmd:CI_Address>
1404                       <gmd:deliveryPoint>
1405                         <gco:CharacterString>416 W. Congress St., Suite 100</gco:CharacterString>
1406                       </gmd:deliveryPoint>
1407                       <gmd:city>
1408                         <gco:CharacterString>Tucson</gco:CharacterString>
1409                       </gmd:city>
1410                       <gmd:administrativeArea>
1411                         <gco:CharacterString>Arizona</gco:CharacterString>
1412                       </gmd:administrativeArea>
1413                       <gmd:postalCode>
1414                         <gco:CharacterString>85701</gco:CharacterString>
1415                       </gmd:postalCode>
1416                       <gmd:country>
1417                         <gco:CharacterString>USA</gco:CharacterString>
1418                       </gmd:country>
1419                       <gmd:electronicMailAddress>
```

```
1420                        <gco:CharacterString>metadata@azgs.az.go</gco:CharacterString>
1421                      </gmd:electronicMailAddress>
1422                    </gmd:CI_Address>
1423                  </gmd:address>
1424                  -->
1425                </gmd:CI_Contact>
1426              </gmd:contactInfo>
1427              <!-- (M-M) ISO 19139 Mandatory: contact role - Guidance on use of role codes would
1428        be helpful for consistency, but has not been developed as yet.. -->
1429              <gmd:role>
1430                <!-- CI_RoleCode names: {resourceProvider, custodian, owner, user, distributor,
1431        originator, pointOfContact, principalInvestigator, processor, publisher, author} - NAP expands
1432        with {collaborator, editor, mediator, rightsHolder}. -->
1433                <!-- NAP example -->
1434                <!--
1435                <gmd:CI_RoleCode
1436                  codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
1437                  codeListValue="RI_414">pointOfContact</gmd:CI_RoleCode>
1438                  -->
1439                <!-- ISO example -->
1440                <gmd:CI_RoleCode
1441
1442        codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
1443        Codelist/gmxCodelists.xml#CI_RoleCode"
1444                  codeListValue="pointOfContact">point of contact</gmd:CI_RoleCode>
1445              </gmd:role>
1446            </gmd:CI_ResponsibleParty>
1447          </gmd:citedResponsibleParty>
1448        </gmd:CI_Citation>
1449      </gmd:citation>
1450      <!-- (M-M) Resource Abstract - A free text summary of the content, significance, purpose,
1451      scope, etc. of the resource. Exactly one value. -->
1452      <gmd:abstract>
1453        <gco:CharacterString>Example for the minimum required elements in a USGIN dataset
1454      metadata record.</gco:CharacterString>
1455      </gmd:abstract>
1456      <!-- (M-M) Resource Status -  -->
1457      <gmd:status>
1458        <!-- Value is from MD_ProgressCode names: {completed, historicalArchive, obsolete,
1459      onGoing, planned, required, underDevelopment} - NAP expands with {proposed}. Obsolete is
1460      synonymous with deprecated. -->
1461        <!-- NAP example -->
1462        <!--
1463        <gmd:MD_ProgressCode
1464          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_106"
1465          codeListValue="RI_593">completed</gmd:MD_ProgressCode>
1466        -->
1467        <!-- ISO Example -->
1468        <gmd:MD_ProgressCode
1469
1470        codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
1471        Codelist/gmxCodelists.xml#MD_ProgressCode"
1472          codeListValue="completed">completed</gmd:MD_ProgressCode>
1473      </gmd:status>
1474      <!-- (O-C) Resource point of contact (access contact) - CI_ResponsibleParty element here
1475      would contain information for point of contact to access the resource. This information is
1476      mandatory for physical resources such as core, cuttings, samples, manuscripts. -->
1477      <gmd:pointOfContact>
1478        <gmd:CI_ResponsibleParty>
1479          <!-- (M-M) (individualName + organisationName + positionName) > 0 -->
1480          <!--
1481          <gmd:individualName>
1482            <gco:CharacterString>Steve Rauzi</gco:CharacterString>
1483          </gmd:individualName>
1484          -->
1485          <gmd:organisationName>
1486            <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
1487          </gmd:organisationName>
1488          <!--
1489          <gmd:positionName>
1490            <gco:CharacterString>Oil and Gas Administrator</gco:CharacterString>
1491          </gmd:positionName>
```

```xml
                    -->
            <!-- (O-C) Contact Information - If a resource point of contact is required then (phone
+ deliveryPoint + electronicMailAddress) > 0 -->
            <gmd:contactInfo>
              <gmd:CI_Contact>
                <!--
                <gmd:phone>
                  <gmd:CI_Telephone>
                    <gmd:voice>
                      <gco:CharacterString>520-770-3500</gco:CharacterString>
                    </gmd:voice>
                    <gmd:facsimile>
                      <gco:CharacterString>520-770-3505</gco:CharacterString>
                    </gmd:facsimile>
                  </gmd:CI_Telephone>
                </gmd:phone>
                -->
                <gmd:address>
                  <gmd:CI_Address>
                    <!--
                    <gmd:deliveryPoint>
                      <gco:CharacterString>416 W. Congress St., Suite 100</gco:CharacterString>
                    </gmd:deliveryPoint>
                    <gmd:city>
                      <gco:CharacterString>Tucson</gco:CharacterString>
                    </gmd:city>
                    <gmd:administrativeArea>
                      <gco:CharacterString>Arizona</gco:CharacterString>
                    </gmd:administrativeArea>
                    <gmd:postalCode>
                      <gco:CharacterString>85701</gco:CharacterString>
                    </gmd:postalCode>
                    <gmd:country>
                      <gco:CharacterString>USA</gco:CharacterString>
                    </gmd:country>
                    -->
                    <gmd:electronicMailAddress>
                      <gco:CharacterString>Steve.rauzi@azgs.az.go</gco:CharacterString>
                    </gmd:electronicMailAddress>
                  </gmd:CI_Address>
                </gmd:address>
              </gmd:CI_Contact>
            </gmd:contactInfo>
            <!-- (M-M) ISO 19139 Mandatory: contact role - Guidance on use of role codes would be
helpful for consistency, but has not been developed as yet. -->
            <gmd:role>
              <!-- The CI_ResponsibleParty/role/CI_RoleCode is from CI_RoleCode names:
{resourceProvider, custodian, owner, user, distributor, originator, pointOfContact,
principalInvestigator, processor, publisher, author} - NAP expands with {collaborator, editor,
mediator, rightsHolder}. -->
              <!-- NAP example -->
              <!--
              <gmd:CI_RoleCode
                codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
                codeListValue="RI_414">pointOfContact</gmd:CI_RoleCode>
              -->
              <!-- ISO example -->
              <gmd:CI_RoleCode

  codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
Codelist/gmxCodelists.xml#CI_RoleCode"
                codeListValue="pointOfContact">point of contact</gmd:CI_RoleCode>
            </gmd:role>
          </gmd:CI_ResponsibleParty>
        </gmd:pointOfContact>
        <!-- (M-M) Resource language - Multiple instances of this element indicate that the
linguistic content of the resource is available in multiple languages -->
        <gmd:language>
          <!-- ISO 639-2/T three-letter language code in lowercase
(http://www.loc.gov/standards/iso639-2/). -->
          <gco:CharacterString>eng</gco:CharacterString>
        </gmd:language>
```

```
1564        <!-- (C-C) Topic category - NAP specifies that topicCategory code shall be provided when
1565   hierarchyLevel is set to "dataset" or "dataset series". Most USGIN resources will have
1566   topicCategory="geoscientificInformation", which is the default value for this profile.  More
1567   specific topic categorization should be done using keywords. NAP declares not applicable to
1568   services. -->
1569        <gmd:topicCategory>
1570        <!-- MD_TopicCategoryCode names: {farming, biota, boundaries,
1571   climatologyMeterologyAtmosphere, economy, elevation, environment, geoscientificInformation,
1572   health, imageryBaseMapsEarthCover, intelligenceMilitary, inlandWater, location, oceans,
1573   planningCadastre, society, structure, transportation, utilitiesCommunication} -->
1574          <gmd:MD_TopicCategoryCode>geoscientificInformation</gmd:MD_TopicCategoryCode>
1575        </gmd:topicCategory>
1576        <!-- (C-C) Resource content extent - Defines the spatial (horizontal and vertical) and
1577   temporal region to which the content of the resource applies. For USGIN, the spatial extent is a
1578   rectangle that bounds the geographic extent to which resource content applies. NAP specifies
1579   required when hierarchyLevel is set to 'dataset'. USGIN specifies (description +
1580   geographicElement + temporalElement) > 0. -->
1581        <gmd:extent>
1582         <gmd:EX_Extent>
1583        <!-- (C-C) Resource Content extent description - Free text that describes the spatial
1584   and temporal extent of the dataset. USGIN specifies that description is mandatory if a
1585   geographicElement or temporalElement is not provided. Note that if geographic place names are
1586   used to express the geographic extent, USGIN profile specifies that these should be encoded using
1587   keyword with keyword type code = 'place.' Geographic names may be duplicated in the
1588   EX_Extent/description. -->
1589            <!--
1590            <gmd:description>
1591              <gco:CharacterString>Some spatio-temporal description.</gco:CharacterString>
1592            </gmd:description>
1593            -->
1594        <!-- (O-C) Resource content extent bounding box -USGIN profile requires that if an
1595   EX_Extent/geographicElement is supplied, it include a geographic bounding box with bounding
1596   latitude and longitude expressed using WGS 84 decimal degrees. The corner coordinates for the
1597   geographic bounding box must not coincide in one point, because this may result in fatal errors
1598   with some CSW implementations. Point locations must thus be represented as tiny rectangles. USGIN
1599   recommended practice is to place the actual point location in the lower left corner of the
1600   rectangle. -->
1601            <gmd:geographicElement>
1602             <gmd:EX_GeographicBoundingBox>
1603               <gmd:extentTypeCode>
1604                 <gco:Boolean>1</gco:Boolean>
1605               </gmd:extentTypeCode>
1606               <gmd:westBoundLongitude>
1607                 <gco:Decimal>-109.911001</gco:Decimal>
1608               </gmd:westBoundLongitude>
1609               <gmd:eastBoundLongitude>
1610                 <gco:Decimal>-109.910999</gco:Decimal>
1611               </gmd:eastBoundLongitude>
1612               <gmd:southBoundLatitude>
1613                 <gco:Decimal>34.772899</gco:Decimal>
1614               </gmd:southBoundLatitude>
1615               <gmd:northBoundLatitude>
1616                 <gco:Decimal>34.772901</gco:Decimal>
1617               </gmd:northBoundLatitude>
1618             </gmd:EX_GeographicBoundingBox>
1619            </gmd:geographicElement>
1620         </gmd:EX_Extent>
1621        </gmd:extent>
1622        <!-- (O-O) Resource temporal extent -  -->
1623        <!--
1624        <gmd:extent>
1625         <gmd:EX_Extent>
1626          <gmd:temporalElement>
1627           <gmd:EX_TemporalExtent>
1628            <gmd:extent>
1629             --><!-- Default ISO time frame example --><!--
1630             <gml:TimePeriod gml:id="IdModern">
1631               <gml:name>Y2KX</gml:name>
1632               --><!-- USGIN requires the beginPosition and endPosition's frame property to be
1633   defined. The default value is #ISO-8601. --><!--
1634               <gml:beginPosition frame="#ISO-8601">2010-01-00T00:00:00</gml:beginPosition>
1635               <gml:endPosition frame="#ISO-8601">2010-12-31T24:00:00</gml:endPosition>
```

```
1636                    </gml:TimePeriod>
1637                    --><!-- Geologic time frame example --><!--
1638                    <gml:TimePeriod gml:id="IdJurassic">
1639                      <gml:name>Jurassic</gml:name>
1640                      --><!-- USGIN requires the beginPosition and endPosition's frame property to be
1641    defined. The default value is #ISO-8601. --><!--
1642                      <gml:beginPosition
1643    frame="urn:cgi:trs:CGI:StandardGeologicTimeMa">203</gml:beginPosition>
1644                      <gml:endPosition frame="urn:cgi:trs:CGI:StandardGeologicTimeMa
1645    ">135</gml:endPosition>
1646                    </gml:TimePeriod>
1647                  </gmd:extent>
1648                </gmd:EX_TemporalExtent>
1649              </gmd:temporalElement>
1650            </gmd:EX Extent>
1651          </gmd:extent>
1652          -->
1653        </gmd:MD_DataIdentification>
1654      </gmd:identificationInfo>
1655      <!-- **************** -->
1656    </gmd:MD_Metadata>
1657
```

1658

8.2 USGIN ISO 19139 Dataset Metadata

1659

1660 In the following listing, text in green is comments; XML elements are in blue, XML attributes are in black,
1661 and attribute values are in **purple**.

1662

```
1663  <?xml version="1.0" encoding="UTF-8"?>
1664  <!--
1665  ************************************************************************************************
1666  *** Example ISO 19139 Geospatial Dataset Metadata based on the USGIN v1.1 Profile
1667  *** by USGIN Standards and Protocols Drafting Team
1668  *** U.S. Geoscience Information System (USGIN) - http://lab.usgin.org
1669  *** Contributors: Wolfgang Grunberg, Stephen M Richard
1670  *** 01/20/2010
1671  ***
1672  *** DISCLAIMER: this is not an authoritative metadata example but an aide to get started.
1673  *** Scope notes are mostly from NAP or ISO documentation; refer to
1674  *** the USGIN profile document for more specific and reliable guidelines.
1675  ***
1676  *** Validated against http://www.isotc211.org/2005/gmd (ISO 19115, CSW 2.0.2 AP ISO 1.0).
1677  *** Follows the USGIN ISO 19139 Dataset Metadata Profile v1.1.
1678  *** a derivative of the North American Profile (NAP)
1679  ***
1680  *** NOTES:
1681  *** - Codelists:
1682  *** Most ISO metadata profiles and applications use ISO codelists or codelists that use ISO's
1683  codelist names. NAP does not use ISO codelist names. USGIN recommends using ISO over NAP
1684  codelists to ensure interoperability. Remember, the codeList attribute points to a Uniform
1685  Resource Identifier (URI) which defines an item's identity. It can be a URN or a URL.
1686  *** - napm schema extension:
1687  ***
1688  http://www.cits.rncan.gc.ca/html/brodeurj/.protege/.napMetadata/napMetadataWebsite/napMetadataToo
1689  ls/napXsd/napm is the namespace for NAP extensions in xmlns:napm. Its schema is located at
1690  http://www.cits.rncan.gc.ca/html/brodeurj/.protege/.napMetadata/tools/napXsd/napm/napm.xsd.
1691  However, that schema does not resolve properly because it also refernces a local copy of gmd.
1692  USGIN does not follow this NAP requirement because it constitutes a barier to interoperability.
1693  *** - Language code:
1694  *** NAP demands <ISO639-2/T three letter language code - lower case><;><blank space><ISO3166-1
1695  three letter country code - upper case>. However, NAP's requirement is not interoperable and
1696  USGIN prefers ISO's <ISO639-2/T three letter language code - lower case> formatting.
1697  ***
1698  *** KEY: (NAP-USGIN) - M/C/O/X (Mandatory, Conditional, Optional, Not Used)
1699  ***
1700  ************************************************************************************************-->
1701
1702  <!-- USGIN ISO 19139 geospatial dataset metadata record -->
1703  <gmd:MD_Metadata
1704   xmlns:gmd="http://www.isotc211.org/2005/gmd"
1705   xmlns:gco="http://www.isotc211.org/2005/gco"
1706   xmlns:gml="http://www.opengis.net/gml"
1707   xmlns:xlink="http://www.w3.org/1999/xlink"
1708   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
1709   xsi:schemaLocation="http://www.isotc211.org/2005/gmd
1710  http://schemas.opengis.net/csw/2.0.2/profiles/apiso/1.0.0/apiso.xsd">
1711   <!-- (M-M) Metadata file identifier - A unique File Identifier (GUID) - USGIN recommends using
1712  a valid Universally Unique Identifier (UUID) -->
1713   <gmd:fileIdentifier>
1714     <gco:CharacterString>00C02E67-F1ED-473D-A240-068CCB041A73</gco:CharacterString>
1715   </gmd:fileIdentifier>
1716   <!-- (M-M) Metadata language - NAP demands <ISO639-2/T three letter language code - lower
1717  case><;><blank space><ISO3166-1 three letter country code - upper case>. However, NAP's
1718  requirement is not interoperable and USGIN prefers ISO's <ISO639-2/T three letter language code -
1719  lower case> formatting. -->
1720   <!-- NAP Example -->
1721   <!--
1722   <gmd:language>
1723     <gco:CharacterString>eng; USA</gco:CharacterString>
1724   </gmd:language>
```

```
1725        -->
1726        <!-- ISO Example -->
1727        <gmd:language>
1728          <gco:CharacterString>eng</gco:CharacterString>
1729        </gmd:language>
1730        <!-- (M-M) Metadata character set  - NAP specifies default is "utf8", codelist =
1731    napMD_CharacterSetCode. USGIN requires that a character set code is defined to facilitate CSW
1732    servers (deegree, GeoNetwork, etc.). -->
1733        <gmd:characterSet>
1734          <!-- MD_CharacterSetCode names: {ucs2, ucs4, utf7, utf8, utf16, 8859part1, 8859part2,
1735    8859part3, 8859part4, 8859part5, 8859part6, 8859part7, 8859part8, 8859part9, 8859part10,
1736    8859part11, 8859part13, 8859part14, 8859part15, 8859part16, jis, shiftJIS, eucJP, usAscii,
1737    ebcdic, eucKR, big5, GB2312}.  -->
1738          <!-- NAP example -->
1739          <!--
1740          <gmd:MD_CharacterSetCode
1741            codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_95"
1742            codeListValue="RI_458">utf8</gmd:MD_CharacterSetCode>
1743          -->
1744          <!-- ISO example -->
1745          <gmd:MD_CharacterSetCode
1746
1747      codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
1748      Codelist/gmxCodelists.xml#MD_CharacterSetCode"
1749            codeListValue="utf8">UTF-8</gmd:MD_CharacterSetCode>
1750        </gmd:characterSet>
1751        <!-- (M-M) Resource type - Define if this record is a: dataset (default), service, feature,
1752    software, etc. -->
1753        <gmd:hierarchyLevel>
1754          <!-- MD_ScopeCode code names: {attribute, attributeType, collectionHardware,
1755    collectionSession, dataset, series, nonGeographicDataset, dimensionGroup, feature, featureType,
1756    propertyType, fieldSession, software, service, model, tile}. -->
1757          <!-- NAP example -->
1758          <!--
1759          <gmd:MD_ScopeCode
1760            codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_108"
1761            codeListValue="RI_622">dataset</gmd:MD_ScopeCode>
1762          -->
1763          <!-- ISO example -->
1764          <gmd:MD_ScopeCode
1765
1766      codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
1767      Codelist/gmxCodelists.xml#MD_ScopeCode"
1768            codeListValue="dataset">dataset</gmd:MD_ScopeCode>
1769        </gmd:hierarchyLevel>
1770        <!-- (O-M) Resource hierarchy level name - ISO 19115 assumes that the metadata hierarchy level
1771    name defaults to "dataset" if it is not documented. NAP does not use it, recognizing that it is
1772    redundant. USGIN makes this property mandatory to identify the USGIN resource type (see USGIN
1773    Profile, "Resources of Interest"). Default USGIN hierarchyLevelName.CharacterString is "Dataset."
1774    Encode hierarchy by including hierarchyLevelName elements for all broader resource categories.
1775    E.g. default should also include a hierarchyLevelName="Collection" element. For services USGIN
1776    hierarchyLevelName.CharacterString is "Service". As use cases develop that provide rationale for
1777    definition of sub-categories of service, the resource category list will be expanded. -->
1778        <gmd:hierarchyLevelName>
1779          <gco:CharacterString>Dataset</gco:CharacterString>
1780        </gmd:hierarchyLevelName>
1781        <!-- (M-M) Metadata point of contact - Point of contact for the metadata record, e.g. for users
1782    to report errors, updates to metadata, etc. -->
1783        <gmd:contact>
1784          <gmd:CI_ResponsibleParty>
1785            <!-- (M-M) (individualName + organisationName + positionName) > 0 -->
1786            <gmd:individualName>
1787              <gco:CharacterString>Stephen Richard</gco:CharacterString>
1788            </gmd:individualName>
1789            <gmd:organisationName>
1790              <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
1791            </gmd:organisationName>
1792            <gmd:positionName>
1793              <gco:CharacterString>Metadata Czar</gco:CharacterString>
1794            </gmd:positionName>
1795            <gmd:contactInfo>
1796              <gmd:CI_Contact>
```

```
1797            <!-- Phone -->
1798            <gmd:phone>
1799              <gmd:CI_Telephone>
1800                <gmd:voice>
1801                  <gco:CharacterString>520.770.3500</gco:CharacterString>
1802                </gmd:voice>
1803                <gmd:facsimile>
1804                  <gco:CharacterString>520.770.3505</gco:CharacterString>
1805                </gmd:facsimile>
1806              </gmd:CI_Telephone>
1807            </gmd:phone>
1808            <!-- Address -->
1809            <gmd:address>
1810              <gmd:CI_Address>
1811                <gmd:deliveryPoint>
1812                  <gco:CharacterString>416 W. Congress St., Suite 100</gco:CharacterString>
1813                </gmd:deliveryPoint>
1814                <gmd:city>
1815                  <gco:CharacterString>Tucson</gco:CharacterString>
1816                </gmd:city>
1817                <gmd:administrativeArea>
1818                  <gco:CharacterString>Arizona</gco:CharacterString>
1819                </gmd:administrativeArea>
1820                <gmd:postalCode>
1821                  <gco:CharacterString>85701-1381</gco:CharacterString>
1822                </gmd:postalCode>
1823                <gmd:country>
1824                  <gco:CharacterString>USA</gco:CharacterString>
1825                </gmd:country>
1826                <!-- (O-M) Metadata point of contact e-mail address - mandatory in USGIN -->
1827                <gmd:electronicMailAddress>
1828                  <gco:CharacterString>metadata@azgs.az.gov</gco:CharacterString>
1829                </gmd:electronicMailAddress>
1830              </gmd:CI_Address>
1831            </gmd:address>
1832            <!-- (O-O) online resources - this is the online resource to contact the metadata
1833    person-->
1834            <gmd:onlineResource>
1835              <gmd:CI_OnlineResource>
1836                <gmd:linkage>
1837                  <gmd:URL>http://www.azgs.az.gov</gmd:URL>
1838                </gmd:linkage>
1839                <gmd:protocol>
1840                  <gco:CharacterString>http</gco:CharacterString>
1841                </gmd:protocol>
1842                <gmd:description>
1843                  <gco:CharacterString>Arizona Geological Survey Web Site</gco:CharacterString>
1844                </gmd:description>
1845              </gmd:CI_OnlineResource>
1846            </gmd:onlineResource>
1847            <!-- (O-O) hours of service -->
1848            <gmd:hoursOfService>
1849              <gco:CharacterString>8 AM to 5 PM Mountain Standard time (no daylight
1850    savings)</gco:CharacterString>
1851            </gmd:hoursOfService>
1852            <!-- (O-O) contact instructions -->
1853            <gmd:contactInstructions>
1854              <gco:CharacterString>Contact Steve Rauzi [Steve.Rauzi@azgs.az.gov] or call Oil and Gas
1855    Commission Staff at Arizona Geological Survey, 520-770-3500.</gco:CharacterString>
1856            </gmd:contactInstructions>
1857          </gmd:CI_Contact>
1858        </gmd:contactInfo>
1859        <!-- (M-M) ISO 19139 Mandatory: contact role -->
1860        <gmd:role>
1861          <!-- CI_RoleCode names: {resourceProvider, custodian, owner, user, distributor,
1862    originator, pointOfContact, principalInvestigator, processor, publisher, author} - NAP expands
1863    with {collaborator, editor, mediator, rightsHolder}.  -->
1864          <!-- NAP example -->
1865          <!--
1866          <gmd:CI_RoleCode
1867            codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
1868            codeListValue="RI_414">pointOfContact</gmd:CI_RoleCode>
```

```
1869            -->
1870            <!-- ISO example -->
1871            <gmd:CI_RoleCode
1872
1873      codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
1874      Codelist/gmxCodelists.xml#CI_RoleCode"
1875            codeListValue="pointOfContact">point of contact</gmd:CI_RoleCode>
1876          </gmd:role>
1877        </gmd:CI_ResponsibleParty>
1878      </gmd:contact>
1879      <!-- (X-O) Metadata should include a URL that locates a thumbnail logo for organizations
1880    related to the metadata origination, the organization hosting the catalog that returned the
1881    metadata, the organization that originated the data, and the organization hosting online services
1882    that provide access to the data. -->
1883      <gmd:contact>
1884        <gmd:CI_ResponsibleParty>
1885          <gmd:organisationName>
1886            <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
1887          </gmd:organisationName>
1888          <gmd:contactInfo>
1889            <gmd:CI_Contact>
1890              <gmd:onlineResource>
1891                <gmd:CI_OnlineResource>
1892                  <!-- Icon image file (e.g. tif, png, jpg, gif) for the metadata originator. This
1893    Icon will be displayed in search results to credit the metadata originator. -->
1894                  <gmd:linkage>
1895                    <gmd:URL>http://www.azgs.az.gov/logo/metadata/azgs.png</gmd:URL>
1896                  </gmd:linkage>
1897                  <!-- (X-C) For URL's that indicate icon thumbnails, the CI_OnlineResource/name
1898    should be 'icon'. -->
1899                  <gmd:name>
1900                    <gco:CharacterString>icon</gco:CharacterString>
1901                  </gmd:name>
1902                </gmd:CI_OnlineResource>
1903              </gmd:onlineResource>
1904            </gmd:CI_Contact>
1905          </gmd:contactInfo>
1906          <gmd:role>
1907            <!-- CI_RoleCode names: {resourceProvider, custodian, owner, user, distributor,
1908    originator, pointOfContact, principalInvestigator, processor, publisher, author} - NAP expands
1909    with {collaborator, editor, mediator, rightsHolder}.  -->
1910            <!-- NAP example -->
1911            <!--
1912            <gmd:CI_RoleCode
1913              codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
1914              codeListValue="RI_413">originator</gmd:CI_RoleCode>
1915            -->
1916            <!-- ISO example -->
1917            <gmd:CI_RoleCode
1918
1919      codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
1920      Codelist/gmxCodelists.xml#CI_RoleCode"
1921            codeListValue="originator">originator</gmd:CI_RoleCode>
1922          </gmd:role>
1923        </gmd:CI_ResponsibleParty>
1924      </gmd:contact>
1925      <!-- (M-M) Metadata date stamp - USGIN profile requires use of dateStamp/gco:DateTime (Note
1926    this contrasts with INSPIRE mandate to use dateStamp/gco:Date). This is the date and time when
1927    the metadata record was created or updated (following NAP). -->
1928      <gmd:dateStamp>
1929        <!-- Requires an extended ISO 8601 formatted combined UTC date and time string (2009-11-
1930    17T10:00:00) -->
1931        <gco:DateTime>2009-11-17T10:00:00</gco:DateTime>
1932      </gmd:dateStamp>
1933      <!-- (M-M) metadata standard - NAP specifies "NAP - Metadata". USGIN profile conformant
1934    metadata is indicated by using "ISO-NAP-USGIN" -->
1935      <gmd:metadataStandardName>
1936        <gco:CharacterString>ISO-USGIN</gco:CharacterString>
1937      </gmd:metadataStandardName>
1938      <!-- (O-M) USGIN profile version -->
1939      <gmd:metadataStandardVersion>
1940        <gco:CharacterString>1.2</gco:CharacterString>
```

```xml
      </gmd:metadataStandardVersion>
    <!-- (O-C) Dataset Identifier - For USGIN, this is a string that uniquely identifies the
described resource. If the resource has an identifier, it should be included here; if the
resource will be referenced from other metadata, it must have an identifier here. If the dataset
is coupled to a service, the value of the MD_Metadata/dataSetURI attribute is the unique resource
identifier used by srv:coupledResource to link the service with the dataset. For the USGIN
profile, the MD_Distribution/transferOptions/MD_DigitalTransferOptions/ online/CI_OnlineResource
is used to specify URLs for access to the resource. -->
    <gmd:dataSetURI>
      <!-- Uniform Resource Identifier (URI) -->
      <gco:CharacterString>http://azgs.az.gov/resource/00C02E67-F1ED-473D-A240-
068CCB041A73</gco:CharacterString>
    </gmd:dataSetURI>
    <!-- (C-C) Other Languages - If description in more than one language is provided, this
property should indicate what those languages are. The primary language used for metadata
description is identified with MD_Metadata/language and characterSet and any additional languages
are identified by MD Metadata/locale/PT locale elements, in which the language is provided
according to ISO 639-2/T three-letter terminology codes in lowercase, and an optional country is
provided according to ISO 3166-1 three-letter codes in uppercase, and mandatory
characterEncoding. -->
    <!-- This locale element example implies that all character string elements are available in
English (from the MD_Metadata/language element), and in French. -->
    <!--
    <gmd:locale>
      <gmd:PT_Locale id="FR">
        <gmd:languageCode>
          <gmd:LanguageCode

  codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
Codelist/ML_gmxCodelists.xml#LanguageCode"
          codeListValue="fra">Français</gmd:LanguageCode>
        </gmd:languageCode>
        <gmd:characterEncoding>
          --><!-- ISO example --><!--
          <gmd:MD_CharacterSetCode

  codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
Codelist/gmxCodelists.xml#MD CharacterSetCode"
          codeListValue="utf8">UTF-8</gmd:MD_CharacterSetCode>
        </gmd:characterEncoding>
      </gmd:PT_Locale>
    </gmd:locale>
    -->
    <!-- (O-O) Resource spatial representation - Spatial representation information for the dataset
(resource). Best practice is to include metadata for spatial representation if the described
resource is a georeferenced dataset. -->
    <gmd:spatialRepresentationInfo>
      <gmd:MD_VectorSpatialRepresentation>
        <gmd:topologyLevel>
          <!-- MD_TopologyLevelCode names: {geometryOnly, topology1D, planarGraph, fullPlanarGraph,
surfaceGraph, fullSurfaceGraph, topology3D, fullTopology3D, abstract} -->
          <!-- NAP Example -->
          <!--
          <gmd:MD_TopologyLevelCode
            codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_111"
            codeListValue="RI_510">geometryOnly</gmd:MD_TopologyLevelCode>
          -->
          <!-- ISO Example -->
          <gmd:MD_TopologyLevelCode

  codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
Codelist/gmxCodelists.xml#MD_TopologyLevelCode"
          codeListValue="geometryOnly">geometry only</gmd:MD_TopologyLevelCode>
        </gmd:topologyLevel>
        <!-- (C-C) Identification of the objects used to represent features in the dataset -  -->
        <gmd:geometricObjects>
          <gmd:MD GeometricObjects>
            <gmd:geometricObjectType>
              <!-- MD_GeometricObjectTypeCode names: {complex, composite, curve, point, solid,
surface} -->
              <!-- NAP Example -->
              <!--
```

```
2013            <gmd:MD_GeometricObjectTypeCode
2014              codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_99"
2015              codeListValue="RI_510">surface</gmd:MD_GeometricObjectTypeCode>
2016            -->
2017            <!-- ISO Example -->
2018            <gmd:MD_GeometricObjectTypeCode
2019
2020     codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
2021     Codelist/gmxCodelists.xml#MD_GeometricObjectTypeCode"
2022              codeListValue="surface">surface</gmd:MD_GeometricObjectTypeCode>
2023          </gmd:geometricObjectType>
2024        </gmd:MD_GeometricObjects>
2025      </gmd:geometricObjects>
2026    </gmd:MD_VectorSpatialRepresentation>
2027  </gmd:spatialRepresentationInfo>
2028  <!-- (O-O) Resource's spatial reference system - Description of the spatial and/or temporal
2029  reference systems used in the dataset. NAP specifies
2030  {identificationInfo/spatialRepresentationType/MD_SpatialRepresentationTypeCode = "vector") or
2031  (../MD_SpatialRepresentationTypeCode = ""grid"") or (../MD_SpatialRepresentationTypeCode =
2032  ""tin"") implies count referenceSystemInfo >= 1) } -->
2033  <gmd:referenceSystemInfo>
2034    <gmd:MD_ReferenceSystem>
2035      <!-- ISO 19115:2003 Corrigendum 1:2006 removes CRS and projection parameter information,
2036  and uses ISO 19111 instead  -->
2037      <gmd:referenceSystemIdentifier>
2038        <gmd:RS_Identifier>
2039          <!-- (C-C) Reference System identifier code - For USGIN the code should be a value from
2040  the EPSG Geodetic Parameter Dataset register (http://www.epsg-registry.org/) in the form
2041  "EPSG:nnnn" where nnnn is the EPSG code number for the CRS. -->
2042          <gmd:code>
2043            <gco:CharacterString>EPSG:5701</gco:CharacterString>
2044          </gmd:code>
2045          <gmd:codeSpace>
2046            <gco:CharacterString>urn:ogc:def:crs</gco:CharacterString>
2047          </gmd:codeSpace>
2048        </gmd:RS_Identifier>
2049      </gmd:referenceSystemIdentifier>
2050    </gmd:MD_ReferenceSystem>
2051  </gmd:referenceSystemInfo>
2052  <!-- (X-X) Metadata extension information - not used in USGIN -->
2053  <!--
2054  <gmd:metadataExtensionInfo/>
2055  -->
2056  <!-- **************** -->
2057  <!-- (M-M) Resource identification information - At least one of MD_DataIdentification
2058  (dataset, dataset series) or SV_ServiceIdentification (service) is required.  -->
2059  <gmd:identificationInfo>
2060    <!-- Resource Dataset or Dataset Series Identification -->
2061    <gmd:MD_DataIdentification>
2062      <gmd:citation>
2063        <!-- (M-M) Resource citation - For USGIN purposes, this should be viewed as information
2064  to identify the intellectual origin of the content in the described resource, along the lines of
2065  a citation in a scientific journal. Required content for a CI_Citation element are title, date,
2066  and responsibleParty -->
2067        <gmd:CI_Citation>
2068          <!-- (M-M) Resource title - USGIN recommends using titles that inform the human reader
2069  about the dataset's content as well as its context. -->
2070          <gmd:title>
2071            <gco:CharacterString>Scanned Borehole Compensated Sonic Log for 0391, Kerr-McGee08
2072  Navajo</gco:CharacterString>
2073          </gmd:title>
2074          <!-- (O-O) Alternate title -->
2075          <!--
2076          <gmd:alternateTitle>
2077            <gco:CharacterString>some alternate title</gco:CharacterString>
2078          </gmd:alternateTitle>
2079          -->
2080          <!-- (M-M) Resource reference date - Best practice is to include at least the date of
2081  publication or creation of the resource. The date of the resource reported in the citation
2082  corresponds to the resource's last update version according to its update frequency. CI_Date
2083  content includes a date and dateType. Date for USGIN profile uses xs:date data type, defined thus
```

```
2084    "date uses the date/timeSevenPropertyModel, with hour, minute, and second  required to be absent.
2085    timezoneOffset• remains optional" (http://www.w3.org/TR/xmlschema11-2). -->
2086           <gmd:date>
2087             <gmd:CI Date>
2088               <gmd:date>
2089                 <!-- Requires an extended ISO 8601 formatted combined UTC date and time string
2090    (2001-12-17T09:30:47) -->
2091                   <gco:DateTime>2001-12-17T09:30:47</gco:DateTime>
2092               </gmd:date>
2093               <gmd:dateType>
2094                 <!-- CI_DateTypeCode names: {creation, publication, revision} _ NAP expands with
2095    {notAvailable, inForce, adopted, deprecated, superseded}.-->
2096                 <!-- NAP Example -->
2097                 <!--
2098                 <gmd:CI_DateTypeCode
2099                   codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_87"
2100                   codeListValue="RI_367">publication</gmd:CI_DateTypeCode>
2101                   -->
2102                 <!-- ISO Example -->
2103                 <gmd:CI_DateTypeCode

2105      codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
2106    Codelist/gmxCodelists.xml#CI_DateTypeCode"
2107                   codeListValue="publication">publication</gmd:CI_DateTypeCode>
2108               </gmd:dateType>
2109             </gmd:CI_Date>
2110           </gmd:date>
2111           <!-- (C-C) Unique resource identifier  - NAP makes MD_Identifier mandatory for dataset
2112    and dataset series.
2113                 For USGIN purposes, this element content value should be only considered an identifier
2114    for the citation, without any assumption that it will use http protocol. The identifier may be
2115    resolvable to a URL, if a protocol prefix specifies an identifier scheme that is resolvable (e.g.
2116    http, urn…), but this is not necessary for a valid document, and should not be assumed when
2117    processing metadata documents.
2118                 For USGIN, IF the Citation has an identifier that is different from the identifier for
2119    the described resource (MD_Metadata/dataSetURI), it must be included here. RS_Identifier may
2120    substitute for MD_Identifier in the ISO19139 schema, but the USGIN profile requires use of
2121    MD_Identifer. If additional codespace and version content is associated with the identifier, it
2122    should be encoded as MD_Identifier/authority/ CI_Citation/ alternateTitle and MD_Identifier/
2123    authority/ CI_Citation/ edition  -->
2124           <!--
2125           <gmd:identifier>
2126             <gmd:MD_Identifier>
2127               <gmd:code>
2128                 --><!-- 13 digit ISBN example --><!--
2129                 <gco:CharacterString>urn:isbn:000-0-000-00000-0</gco:CharacterString>
2130               </gmd:code>
2131             </gmd:MD_Identifier>
2132           </gmd:identifier>
2133           -->
2134           <!-- (M-M) Resource responsible party - USGIN requires at least one CI_ResponsibleParty
2135    following the NAP rule. Best practice is to include point of contact information for the resource
2136    in MD_DataIdentification/pointOfContact/CI_ResponsibleParty.  -->
2137           <gmd:citedResponsibleParty>
2138             <gmd:CI_ResponsibleParty>
2139               <!-- (C-C) (individualName + organisationName + positionName) > 0 -->
2140               <gmd:individualName>
2141                 <gco:CharacterString>Steve Rauzi</gco:CharacterString>
2142               </gmd:individualName>
2143               <gmd:organisationName>
2144                 <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
2145               </gmd:organisationName>
2146               <gmd:positionName>
2147                 <gco:CharacterString>Oil and Gas Administrator</gco:CharacterString>
2148               </gmd:positionName>
2149               <!-- (O-C) Contact Information - (phone + deliveryPoint + electronicMailAddress ) >
2150    0. -->
2151               <gmd:contactInfo>
2152                 <gmd:CI_Contact>
2153                   <gmd:phone>
2154                     <gmd:CI_Telephone>
2155                       <gmd:voice>
```

```
2156                            <gco:CharacterString>520-770-3500</gco:CharacterString>
2157                          </gmd:voice>
2158                          <gmd:facsimile>
2159                            <gco:CharacterString>520-770-3505</gco:CharacterString>
2160                          </gmd:facsimile>
2161                        </gmd:CI_Telephone>
2162                      </gmd:phone>
2163                      <gmd:address>
2164                        <gmd:CI_Address>
2165                          <gmd:deliveryPoint>
2166                            <gco:CharacterString>416 W. Congress St., Suite 100</gco:CharacterString>
2167                          </gmd:deliveryPoint>
2168                          <gmd:city>
2169                            <gco:CharacterString>Tucson</gco:CharacterString>
2170                          </gmd:city>
2171                          <gmd:administrativeArea>
2172                            <gco:CharacterString>Arizona</gco:CharacterString>
2173                          </gmd:administrativeArea>
2174                          <gmd:postalCode>
2175                            <gco:CharacterString>85701</gco:CharacterString>
2176                          </gmd:postalCode>
2177                          <gmd:country>
2178                            <gco:CharacterString>USA</gco:CharacterString>
2179                          </gmd:country>
2180                          <gmd:electronicMailAddress>
2181                            <gco:CharacterString>Steve.rauzi@azgs.az.go</gco:CharacterString>
2182                          </gmd:electronicMailAddress>
2183                        </gmd:CI_Address>
2184                      </gmd:address>
2185                    </gmd:CI_Contact>
2186                  </gmd:contactInfo>
2187                  <!-- (M-M) ISO 19139 Mandatory: contact role - Guidance on use of role codes would
2188     be helpful for consistency, but has not been developed as yet.. -->
2189                  <gmd:role>
2190                    <!-- CI_RoleCode names: {resourceProvider, custodian, owner, user, distributor,
2191     originator, pointOfContact, principalInvestigator, processor, publisher, author} - NAP expands
2192     with {collaborator, editor, mediator, rightsHolder}.  -->
2193                    <!-- NAP example -->
2194                    <!--
2195                    <gmd:CI_RoleCode
2196                      codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
2197                      codeListValue="RI_414">pointOfContact</gmd:CI_RoleCode>
2198                    -->
2199                    <!-- ISO example -->
2200                    <gmd:CI_RoleCode
2201
2202       codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
2203     Codelist/gmxCodelists.xml#CI_RoleCode"
2204                      codeListValue="pointOfContact">point of contact</gmd:CI_RoleCode>
2205                  </gmd:role>
2206                </gmd:CI_ResponsibleParty>
2207              </gmd:citedResponsibleParty>
2208              <!-- (O-C) Dataset Presentation Form - USGIN mandates required if there is a significant
2209     difference between the resource's presentation format and distribution format. -->
2210              <!--
2211              <gmd:presentationForm>
2212              --><!-- CI_PresentationFormCode names: {documentDigital, documentHardcopy, imageDigital,
2213     image-Hardcopy, mapDigital, mapHardcopy, modelDigital, model-Hardcopy, profileDigital,
2214     profileHardcopy, tableDigital, tableHardcopy, videoDigital, videoHardcopy, audioDigital} - NAP
2215     expands with {audioHardcopy, multimediaDigital, multimediaHardcopy, diagramDigital,
2216     diagramHardcopy}.-->
2217                  <!-- NAP Example -->
2218                  <!--
2219                  <gmd:CI_PresentationFormCode
2220                    codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_89"
2221                    codeListValue="RI_391">mapDigital</gmd:CI_PresentationFormCode>
2222                  -->
2223                  <!-- ISO Example -->
2224                  <!--
2225                  <gmd:CI_PresentationFormCode
```

```
     codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
Codelist/gmxCodelists.xml#CI_PresentationFormCode"
                    codeListValue="mapDigital">digital map</gmd:CI_PresentationFormCode>
          </gmd:presentationForm>
            -->
          <!-- (O-O) Resource series - Information about the series or collection of which the
cited resource is a part. Follow NAP rule (name + issueIdentification) > 0. -->
          <!--
          <gmd:series>
            <gmd:CI_Series>
              <gmd:name>
                --><!-- Name of the publication series or aggregate dataset of which the
referenced dataset is a part. --><!--
                  <gco:CharacterString>Borehole Collection</gco:CharacterString>
              </gmd:name>
              <gmd:issueIdentification>
                --><!-- Identification of the series' issue information. --><!--
                  <gco:CharacterString>Volume 10</gco:CharacterString>
              </gmd:issueIdentification>
              <gmd:page>
                --><!-- Identification of the articles' page number(s). --><!--
                  <gco:CharacterString>100-110</gco:CharacterString>
              </gmd:page>
            </gmd:CI_Series>
          </gmd:series>
          -->
          <!-- (O-O) Resource other citation details -->
          <!--
          <gmd:otherCitationDetails/>
          -->
          <!-- (O-C) Resource collective title - Title of the combined resource that the cited
resource is part of, for example the cited resource may be a paper in an anthology, in which case
the anthology title would be the collective title. Required if the cited resource is part of such
a collective work. -->
          <!--
          <gmd:collectiveTitle/>
          -->
        </gmd:CI_Citation>
      </gmd:citation>
      <!-- (M-M) Resource Abstract - A free text summary of the content, significance, purpose,
scope, etc. of the resource. Exactly one value. -->
      <gmd:abstract>
        <gco:CharacterString>Digital files containing Tiff images of scanned logs. Scanned using
Neutra scanner hardware.</gco:CharacterString>
      </gmd:abstract>
      <!-- (O-O) Resource purpose - Summary of the intentions for which the dataset was
developed. Purpose includes objectives for creating the dataset and what the dataset is to
support. -->
      <!--
      <gmd:purpose/>
      -->
      <!-- (M-M) Resource Status -  -->
      <gmd:status>
        <!-- MD_ProgressCode names: {completed, historicalArchive, obsolete, onGoing, planned,
required, underDevelopment} - NAP expands with {proposed}. Obsolete is synonymous with
deprecated. -->
        <!-- NAP Example -->
        <!--
        <gmd:MD_ProgressCode
          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_106"
          codeListValue="RI_593">completed</gmd:MD_ProgressCode>
        -->
        <!-- ISO Example -->
        <gmd:MD_ProgressCode

  codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
Codelist/gmxCodelists.xml#MD_ProgressCode"
              codeListValue="completed">completed</gmd:MD_ProgressCode>
      </gmd:status>
```

```xml
      <!-- (O-C) Resource point of contact - CI_ResponsibleParty element here would contain
information for point of contact to access the resource. This information is mandatory for
physical resources such as core, cuttings, samples, manuscripts. -->
      <gmd:pointOfContact>
        <gmd:CI_ResponsibleParty>
          <!-- (M-M) (individualName + organisationName + positionName) > 0 -->
          <gmd:individualName>
            <gco:CharacterString>Steve Rauzi</gco:CharacterString>
          </gmd:individualName>
          <gmd:organisationName>
            <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
          </gmd:organisationName>
          <gmd:positionName>
            <gco:CharacterString>Oil and Gas Administrator</gco:CharacterString>
          </gmd:positionName>
          <!-- (O-C) Contact Information - If a resource point of contact is required then (phone
+ deliveryPoint + electronicMailAddress) > 0. -->
          <gmd:contactInfo>
            <gmd:CI_Contact>
              <gmd:phone>
                <gmd:CI_Telephone>
                  <gmd:voice>
                    <gco:CharacterString>520-770-3500</gco:CharacterString>
                  </gmd:voice>
                  <gmd:facsimile>
                    <gco:CharacterString>520-770-3505</gco:CharacterString>
                  </gmd:facsimile>
                </gmd:CI_Telephone>
              </gmd:phone>
              <gmd:address>
                <gmd:CI_Address>
                  <gmd:deliveryPoint>
                    <gco:CharacterString>416 W. Congress St., Suite 100</gco:CharacterString>
                  </gmd:deliveryPoint>
                  <gmd:city>
                    <gco:CharacterString>Tucson</gco:CharacterString>
                  </gmd:city>
                  <gmd:administrativeArea>
                    <gco:CharacterString>Arizona</gco:CharacterString>
                  </gmd:administrativeArea>
                  <gmd:postalCode>
                    <gco:CharacterString>85701</gco:CharacterString>
                  </gmd:postalCode>
                  <gmd:country>
                    <gco:CharacterString>USA</gco:CharacterString>
                  </gmd:country>
                  <gmd:electronicMailAddress>
                    <gco:CharacterString>Steve.rauzi@azgs.az.go</gco:CharacterString>
                  </gmd:electronicMailAddress>
                </gmd:CI_Address>
              </gmd:address>
            </gmd:CI_Contact>
          </gmd:contactInfo>
          <!-- (M-M) ISO 19139 Mandatory: contact role - Guidance on use of role codes would be
helpful for consistency, but has not been developed as yet. -->
          <gmd:role>
            <!-- CI RoleCode names: {resourceProvider, custodian, owner, user, distributor,
originator, pointOfContact, principalInvestigator, processor, publisher, author} - NAP expands
with {collaborator, editor, mediator, rightsHolder}.  -->
            <!-- NAP example -->
            <!--
            <gmd:CI_RoleCode
              codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
              codeListValue="RI_414">pointOfContact</gmd:CI_RoleCode>
            -->
            <!-- ISO example -->
            <gmd:CI_RoleCode

  codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
Codelist/gmxCodelists.xml#CI_RoleCode"
              codeListValue="pointOfContact">point of contact</gmd:CI_RoleCode>
          </gmd:role>
```

```
2368              </gmd:CI_ResponsibleParty>
2369          </gmd:pointOfContact>
2370          <!-- (O-O) Resource Maintenance - This element provides information about the maintenance
2371   schedule or history of the resource (or some subset/part of the resource specified by the scope
2372   and scope description) described by the metadata record. 0 to many MD_MaintenanceInformation
2373   elements may be included.    -->
2374          <gmd:resourceMaintenance>
2375            <gmd:MD_MaintenanceInformation>
2376              <gmd:maintenanceAndUpdateFrequency>
2377                <!-- MD_MaintenanceFrequencyCode names: {continual, daily, weekly, fortnightly,
2378   monthly, quarterly, biannually, annually, asNeeded, irregular, not-Planned, unknown} - NAP
2379   expands with {semimonthly}. -->
2380                <!-- NAP Example -->
2381                <!--
2382                <gmd:MD_MaintenanceFrequencyCode
2383                  codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_102"
2384                  codeListValue="RI_540">asNeeded</gmd:MD_MaintenanceFrequencyCode>
2385                -->
2386                <!-- ISO Example -->
2387                <gmd:MD_MaintenanceFrequencyCode

2389     codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
2390     Codelist/gmxCodelists.xml#MD_MaintenanceFrequencyCode"
2391                  codeListValue="asNeeded">as needed</gmd:MD_MaintenanceFrequencyCode>
2392              </gmd:maintenanceAndUpdateFrequency>
2393            </gmd:MD_MaintenanceInformation>
2394          </gmd:resourceMaintenance>
2395          <!-- (O-O) Graphic overview of resource - USGIN best practice is to provide xlink:href URL
2396   to file if it is available online, as an attribute of the MD_BrowseGraphic element. If
2397   MD_BrowseGraphic is included, MD_BrowseGraphic/filename character string is mandatory.
2398   Recommended practice is to use the Anchor extension of CharacterString xml element from ISO19139,
2399   which provides a url as an attribute and a text string as a label for the link.  -->
2400          <gmd:graphicOverview>
2401            <gmd:MD_BrowseGraphic>
2402              <gmd:fileName>
2403                <gco:CharacterString>http://azgs.az.gov/resource/00C02E67-F1ED-473D-A240-
2404   068CCB041A73/preview.jpg</gco:CharacterString>
2405              </gmd:fileName>
2406              <gmd:fileDescription>
2407                <gco:CharacterString>preview map</gco:CharacterString>
2408              </gmd:fileDescription>
2409              <!-- Use napMD_FileFormatCode code list
2410   (http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_115). List names are {bil, bmp, bsq,
2411   bzip2, cdr, cgm, cover, csv, dbf, dgn, doc, dwg, dxf, e00, ecw, eps, ers, gdb, geotiff, gif, gml,
2412   grid, gzip, html, jpg, mdb, mif, pbm, pdf, png, ps, rtf, sdc, shp, sid, svg, tab, tar, tiff, txt,
2413   xhtml, xls, xml, xwd, zip, wpd} See Codelists section for discussion of encoding of codelist
2414   values. Note that to use this napm namespace extension in a valid xml document, the namespace
2415   declaration
2416   xmlns:napm=http://www.cits.rncan.gc.ca/html/brodeurj/.protege/.napMetadata/napMetadataWebsite/nap
2417   MetadataTools/napXsd/napm must be included in the root element of the document. -->
2418              <!-- The current napm.xsd schema conflicts with gmd because it refernces a local copy of
2419   the OGC gmd schema at
2420   http://www.cits.rncan.gc.ca/html/brodeurj/.protege/.napMetadata/tools/napXsd/gmd/ Until this is
2421   resolved, the gmd:fileType attributes can be omitted. However, USGIN requires the use of
2422   napMD_FileFormatCode names. -->
2423              <!-- NAP Example -->
2424              <!--
2425              <gmd:fileType
2426                xsi:type="napm:napMD_FileFormatCode_PropertyType"
2427                codeList="http://www.fgdc.gov/nap/metadata/register/registerItemClasses.html#IC_115"
2428                codeListValue="RI_711">
2429                <gco:CharacterString>jpg</gco:CharacterString>
2430              </gmd:fileType>
2431              -->
2432              <!-- ISO Example -->
2433              <gmd:fileType>
2434                <gco:CharacterString>jpg</gco:CharacterString>
2435              </gmd:fileType>
2436            </gmd:MD_BrowseGraphic>
2437          </gmd:graphicOverview>
2438          <!-- (X-X) Resource Format - This element is not used by NAP or USGIN; this information is
2439   encoded in MD_Metadata/distributionInfo/MD_Distribution/ in USGIN metadata. -->
```

```
2440        <!--
2441        <gmd:resourceForma/>
2442        -->
2443        <!-- (O-O) Resource keywords - Best Practice for USGIN profile metadata is to supply
2444   keywords to facilitate the discovery of metadata records relevant to the user. USGIN requires
2445   that MD_Keyword/keyword contain a CharacterString. USGIN best practice is to include keywords in
2446   English -->
2447        <!-- Theme keywords -->
2448        <gmd:descriptiveKeywords>
2449          <gmd:MD_Keywords>
2450            <gmd:keyword>
2451              <gco:CharacterString>Scanned Gamma Ray Neutron</gco:CharacterString>
2452            </gmd:keyword>
2453            <gmd:keyword>
2454              <gco:CharacterString>NMAL</gco:CharacterString>
2455            </gmd:keyword>
2456            <gmd:keyword>
2457              <gco:CharacterString>borehole</gco:CharacterString>
2458            </gmd:keyword>
2459            <!-- Keyword Type - allowed values from MD_KeywordTypeCode names: {discipline, place,
2460   stratum, temporal, theme} - NAP expands with {product, subTopicCategory}. -->
2461            <gmd:type>
2462              <!-- NAP Example -->
2463              <!--
2464              <gmd:MD_KeywordTypeCode
2465                codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_101"
2466                codeListValue="RI_528">theme</gmd:MD_KeywordTypeCode>
2467              -->
2468              <!-- ISO Example -->
2469              <gmd:MD_KeywordTypeCode
2470
2471   codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
2472   Codelist/gmxCodelists.xml#MD_KeywordTypeCode"
2473                codeListValue="theme">theme</gmd:MD_KeywordTypeCode>
2474            </gmd:type>
2475          </gmd:MD_Keywords>
2476        </gmd:descriptiveKeywords>
2477        <!-- Temporal keywords -->
2478        <gmd:descriptiveKeywords>
2479          <gmd:MD_Keywords>
2480            <gmd:keyword>
2481              <gco:CharacterString>Frasian</gco:CharacterString>
2482            </gmd:keyword>
2483            <gmd:keyword>
2484              <gco:CharacterString>Upper Devonian</gco:CharacterString>
2485            </gmd:keyword>
2486            <gmd:keyword>
2487              <gco:CharacterString>Devonian</gco:CharacterString>
2488            </gmd:keyword>
2489            <gmd:keyword>
2490              <gco:CharacterString>Paleozoic</gco:CharacterString>
2491            </gmd:keyword>
2492            <!-- Keyword Type - allowed values from MD_KeywordTypeCode names: {discipline, place,
2493   stratum, temporal, theme} - NAP expands with {product, subTopicCategory}. -->
2494            <gmd:type>
2495              <!-- NAP Example -->
2496              <!--
2497              <gmd:MD KeywordTypeCode
2498                codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_101"
2499                codeListValue="RI_527">temporal</gmd:MD_KeywordTypeCode>
2500              -->
2501              <!-- ISO Example -->
2502              <gmd:MD_KeywordTypeCode
2503
2504   codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
2505   Codelist/gmxCodelists.xml#MD_KeywordTypeCode"
2506                codeListValue="temporal">temporal</gmd:MD_KeywordTypeCode>
2507            </gmd:type>
2508          </gmd:MD Keywords>
2509        </gmd:descriptiveKeywords>
2510        <!-- Place keywords -->
2511        <gmd:descriptiveKeywords>
```

```
2512          <gmd:MD_Keywords>
2513            <gmd:keyword>
2514              <gco:CharacterString>Arizona</gco:CharacterString>
2515            </gmd:keyword>
2516            <gmd:keyword>
2517              <gco:CharacterString>T41N R27E S22 NE NE</gco:CharacterString>
2518            </gmd:keyword>
2519            <!-- Keyword Type - allowed values from MD_KeywordTypeCode names: {discipline, place,
2520      stratum, temporal, theme} - NAP expands with {product, subTopicCategory}. -->
2521            <gmd:type>
2522              <!-- NAP Example -->
2523              <!--
2524              <gmd:MD_KeywordTypeCode
2525                codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_101"
2526                codeListValue="RI_525">place</gmd:MD_KeywordTypeCode>
2527              -->
2528              <!-- ISO Example -->
2529              <gmd:MD_KeywordTypeCode
2530
2531    codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
2532    Codelist/gmxCodelists.xml#MD_KeywordTypeCode"
2533                codeListValue="place">place</gmd:MD_KeywordTypeCode>
2534            </gmd:type>
2535          </gmd:MD_Keywords>
2536        </gmd:descriptiveKeywords>
2537        <!-- (O-O) Condition applying to access and use of resource - Follow NAP for specification
2538    of resourceConstraints. This attribute provides information for access control to the described
2539    resource itself. In some situations, the metadataConstraints may allow a user to learn of the
2540    existence of a resource that they may not actually be able to access without further clearance.
2541    Constraints may be represented by MD_Constraint, MD_LegalConstraint, or MD_SecurityConstraint. --
2542    >
2543        <gmd:resourceConstraints>
2544          <gmd:MD_LegalConstraints>
2545            <gmd:useLimitation>
2546              <gco:CharacterString>none</gco:CharacterString>
2547            </gmd:useLimitation>
2548          </gmd:MD_LegalConstraints>
2549        </gmd:resourceConstraints>
2550        <!-- (O-O) Aggregation information - The citation for or name of an aggregate dataset, the
2551    type of aggregate dataset, and optionally the activity which produced the dataset. -->
2552        <gmd:aggregationInfo>
2553          <!-- MD_AggregateInformation requires either aggregateDataSetName/CI_Citation or
2554    aggregateDataSetIdentifier/MD_Identifier.   -->
2555          <gmd:MD_AggregateInformation>
2556            <!-- Related dataset name -->
2557            <gmd:aggregateDataSetName>
2558              <gmd:CI_Citation>
2559                <gmd:title>
2560                  <gco:CharacterString>Related Resource's Title</gco:CharacterString>
2561                </gmd:title>
2562                <gmd:date>
2563                  <gmd:CI_Date>
2564                    <gmd:date>
2565                      <gco:DateTime>2001-12-17T09:30:47</gco:DateTime>
2566                    </gmd:date>
2567                    <gmd:dateType>
2568                      <!-- NAP Example -->
2569                      <!--
2570                      <gmd:CI_DateTypeCode
2571                        codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_87"
2572                        codeListValue="RI_367">publication</gmd:CI_DateTypeCode>
2573                      -->
2574                      <!-- ISO Example -->
2575                      <gmd:CI_DateTypeCode
2576
2577    codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
2578    Codelist/gmxCodelists.xml#CI_DateTypeCode"
2579                        codeListValue="publication">publication</gmd:CI_DateTypeCode>
2580                    </gmd:dateType>
2581                  </gmd:CI_Date>
2582                </gmd:date>
2583              </gmd:CI_Citation>
```

```
2584              </gmd:aggregateDataSetName>
2585              <!-- Data Set Identifier -->
2586              <gmd:aggregateDataSetIdentifier>
2587                <gmd:MD_Identifier>
2588                  <gmd:code>
2589                    <gco:CharacterString>00000000-0000-0000-0000-000000000000</gco:CharacterString>
2590                  </gmd:code>
2591                </gmd:MD_Identifier>
2592              </gmd:aggregateDataSetIdentifier>
2593              <!-- (M-M) Association Type is mandatory.. -->
2594              <gmd:associationType>
2595                <!-- Use DS_AssociationTypeCode names: {crossReference, largerWorkCitation,
2596      partOfSeamlessDatabase, source, stereoMate} - NAP expands with {isComposedOf}. -->
2597                <!-- NAP Example -->
2598                <!--
2599                <gmd:DS_AssociationTypeCode
2600                  codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_92"
2601                  codeListValue="RI_428">crossReference</gmd:DS_AssociationTypeCode>
2602                -->
2603                <!-- ISO Example -->
2604                <gmd:DS_AssociationTypeCode
2605
2606        codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
2607        Codelist/gmxCodelists.xml#DS_AssociationTypeCode"
2608                  codeListValue="crossReference">cross reference</gmd:DS_AssociationTypeCode>
2609              </gmd:associationType>
2610            </gmd:MD_AggregateInformation>
2611          </gmd:aggregationInfo>
2612          <!-- (O-O) Spatial Representation Type - napMD_SpatialRepresentationTypeCode names {vector,
2613      grid, textTable, tin, stereoModel, video} -->
2614          <!--
2615          <gmd:spatialRepresentationType/>
2616          -->
2617          <!-- (C-C) Resource spatial resolution - USGIN requires use of
2618      equivalentScale/../denominator to express spatial resolution, in order to be more easily
2619      interoperable.  -->
2620          <gmd:spatialResolution>
2621            <gmd:MD_Resolution>
2622              <gmd:equivalentScale>
2623                <gmd:MD_RepresentativeFraction>
2624                  <gmd:denominator>
2625                    <gco:Integer>100000</gco:Integer>
2626                  </gmd:denominator>
2627                </gmd:MD_RepresentativeFraction>
2628              </gmd:equivalentScale>
2629            </gmd:MD_Resolution>
2630          </gmd:spatialResolution>
2631          <!-- (M-M) Resource language - Multiple instances of this element indicate that the
2632      linguistic content of the resource is available in multiple languages -->
2633          <gmd:language>
2634            <!-- (M-M) Metadata language - use the ISO639-2/T three letter language code in lower
2635      case. -->
2636            <gco:CharacterString>eng</gco:CharacterString>
2637          </gmd:language>
2638          <!-- (C-C) Topic category - NAP specifies that topicCategory code shall be provided when
2639      hierarchyLevel is set to "dataset" or "dataset series". Most USGIN resources will have
2640      topicCategory="geoscientificInformation", which is the default value for this profile.  More
2641      specific topic categorization should be done using keywords. NAP declares not applicable to
2642      services. -->
2643          <gmd:topicCategory>
2644            <!-- MD_TopicCategoryCode names: {farming, biota, boundaries,
2645      climatologyMeterologyAtmosphere, economy, elevation, environment, geoscientificInformation,
2646      health, imageryBaseMapsEarthCover, intelligenceMilitary, inlandWater, location, oceans,
2647      planningCadastre, society, structure, transportation, utilitiesCommunication} -->
2648            <gmd:MD_TopicCategoryCode>geoscientificInformation</gmd:MD_TopicCategoryCode>
2649          </gmd:topicCategory>
2650          <!-- (C-C) Resource content extent - Defines the spatial (horizontal and vertical) and
2651      temporal region to which the content of the resource applies. For USGIN, the spatial extent is a
2652      rectangle that bounds the geographic extent to which resource content applies. NAP specifies
2653      required when hierarchyLevel is set to 'dataset'. USGIN specifies (description +
2654      geographicElement + temporalElement) > 0. -->
2655          <gmd:extent>
```

```
2656          <gmd:EX_Extent>
2657            <!-- (C-C) Resource Content extent description - Free text that describes the spatial
2658      and temporal extent of the dataset. USGIN specifies that description is mandatory if a
2659      geographicElement or temporalElement is not provided. Note that if geographic place names are
2660      used to express the geographic extent, USGIN profile specifies that these should be encoded using
2661      keyword with keyword type code = 'place.' Geographic names may be duplicated in the
2662      EX_Extent/description. -->
2663            <gmd:description>
2664              <gco:CharacterString>Some spatio-temporal description.</gco:CharacterString>
2665            </gmd:description>
2666            <!-- (O-C) Resource content extent bounding box -USGIN profile requires that if an
2667      EX_Extent/geographicElement is supplied, it include a geographic bounding box with bounding
2668      latitude and longitude expressed using WGS 84 decimal degrees. The corner coordinates for the
2669      geographic bounding box must not coincide in one point, because this may result in fatal errors
2670      with some CSW implementations. Point locations must thus be represented as tiny rectangles. USGIN
2671      recommended practice is to place the actual point location in the lower left corner of the
2672      rectangle. -->
2673            <gmd:geographicElement>
2674              <gmd:EX_GeographicBoundingBox>
2675                <gmd:extentTypeCode>
2676                  <gco:Boolean>1</gco:Boolean>
2677                </gmd:extentTypeCode>
2678                <gmd:westBoundLongitude>
2679                  <gco:Decimal>-109.911001</gco:Decimal>
2680                </gmd:westBoundLongitude>
2681                <gmd:eastBoundLongitude>
2682                  <gco:Decimal>-109.910999</gco:Decimal>
2683                </gmd:eastBoundLongitude>
2684                <gmd:southBoundLatitude>
2685                  <gco:Decimal>34.772899</gco:Decimal>
2686                </gmd:southBoundLatitude>
2687                <gmd:northBoundLatitude>
2688                  <gco:Decimal>34.772901</gco:Decimal>
2689                </gmd:northBoundLatitude>
2690              </gmd:EX_GeographicBoundingBox>
2691            </gmd:geographicElement>
2692            <!-- (C-X) Resource content extent geographic description - Not used by USGIN profile,
2693      use keyword with type code = 'place' (with thesaurus if necessary). -->
2694            <!--
2695            <gmd:geographicElement>
2696              <gmd:EX_GeographicDescription/>
2697            </gmd:geographicElement>
2698            -->
2699            <!-- (C-X) Resource content extent bounding polygon - Not used by USGIN profile. To
2700      improve interoperability, USGIN mandates the use of Geographic Bounding Box instead of bounding
2701      polygon. "An element which describes inclusions or exclusions in a resource. The enclosed
2702      boundary of the dataset expressed in x-y coordinates." NAP mandates this element if no other
2703      Geographic Bounding Box, Geographic Description, Temporal Element, or Vertical Element are
2704      provided. -->
2705            <!--
2706            <gmd:geographicElement>
2707              <gmd:EX_BoundingPolygon/>
2708            </gmd:geographicElement>
2709            -->
2710          </gmd:EX_Extent>
2711        </gmd:extent>
2712        <!-- (O-O) Resource temporal extent -  -->
2713        <gmd:extent>
2714          <gmd:EX_Extent>
2715            <gmd:temporalElement>
2716              <gmd:EX_TemporalExtent>
2717                <gmd:extent>
2718                  <!-- Default ISO time frame example -->
2719                  <!--
2720                  <gml:TimePeriod gml:id="IdModern">
2721                    <gml:name>Y2KX</gml:name>
2722                    --><!-- USGIN requires the beginPosition and endPosition's frame property to be
2723      defined. The default value is #ISO-8601. --><!--
2724                    <gml:beginPosition frame="#ISO-8601">2010-01-00T00:00:00</gml:beginPosition>
2725                    <gml:endPosition frame="#ISO-8601">2010-12-31T24:00:00</gml:endPosition>
2726                  </gml:TimePeriod>
2727                  -->
```

```
2728            <!-- Geologic time frame example -->
2729            <gml:TimePeriod gml:id="IdJurassic">
2730              <gml:name>Jurassic</gml:name>
2731              <!-- USGIN requires the beginPosition and endPosition's frame property to be
2732    defined. The default value is #ISO-8601. -->
2733              <gml:beginPosition
2734    frame="urn:cgi:trs:CGI:StandardGeologicTimeMa">203</gml:beginPosition>
2735              <gml:endPosition frame="urn:cgi:trs:CGI:StandardGeologicTimeMa
2736    ">135</gml:endPosition>
2737            </gml:TimePeriod>
2738          </gmd:extent>
2739        </gmd:EX_TemporalExtent>
2740      </gmd:temporalElement>
2741    </gmd:EX_Extent>
2742  </gmd:extent>
2743  <!-- (O-X) Resource spatio-temporal extent - Not used. Although use of
2744  EX_SpatialTemporalExtent is allowed by ISO19139 and NAP, USGIN mandates encoding space time
2745  location with EX_TemporalExtent and EX_GeographicBoundingBox. -->
2746  <!--
2747  <gmd:extent>
2748    <gmd:EX_Extent>
2749      <gmd:temporalElement>
2750        <gmd:EX_SpatialTemporalExtent/>
2751      </gmd:temporalElement>
2752    </gmd:EX_Extent>
2753  </gmd:extent>
2754  -->
2755  <!-- (O-O) Resource vertical extent  -->
2756  <gmd:extent>
2757    <gmd:EX_Extent>
2758      <gmd:verticalElement>
2759        <gmd:EX_VerticalExtent>
2760          <gmd:minimumValue>
2761            <gco:Real>-100</gco:Real>
2762          </gmd:minimumValue>
2763          <gmd:maximumValue>
2764            <gco:Real>200</gco:Real>
2765          </gmd:maximumValue>
2766          <!-- Use EPSG register of geodetic parameters such as at http://www.epsg-
2767  registry.org/. The default VerticalCRS is World mean sea level (MSL): urn:ogc:def:crs:EPSG::5714
2768  -->
2769          <gmd:verticalCRS xlink:href="urn:ogc:def:crs:EPSG::5714 "/>
2770        </gmd:EX_VerticalExtent>
2771      </gmd:verticalElement>
2772    </gmd:EX_Extent>
2773  </gmd:extent>
2774    </gmd:MD_DataIdentification>
2775  </gmd:identificationInfo>
2776  <!-- **************** -->
2777  <!-- (O-O) Content information - Characteristics describing the feature cataloguecatalog,
2778  coverage, or image data. USGIN currently makes no recommendation for use of contentInfo; follow
2779  NAP recommendations (see INCITS 453). -->
2780  <!--
2781  <gmd:contentInfo/>
2782  -->
2783  <!-- (O-O) Resource distribution information - This element provides information to inform
2784  users how to obtain or access the described resource.  NOTE: there are several ways elements can
2785  be nested within MD_Distribution  -->
2786  <gmd:distributionInfo>
2787    <gmd:MD_Distribution>
2788      <!-- (O-O)  Resource distribution format - Information on the format or physical
2789  manifestation of the resource. If the resource is a physical resource, like a book, rock sample,
2790  paper document, the distributionFormat/MD_Format/name is mandatory, and must be from the USGIN
2791  distribution format codelist. -->
2792      <!--
2793      <gmd:distributionFormat/>
2794      -->
2795      <!-- (O-C) Resource distributor information - USGIN differs from NAP in this case (but not
2796  with ISO19115) by allowing multiple distributors, and binding between distributors, transfer
2797  options, and formats.  -->
2798      <gmd:distributor>
```

```
2799        <!-- For USGIN profile, each distributor/MD_Distributor is a binding between one or more
2800   transfer options and the distributor formats that are available through that/those transfer
2801   options (MD DigitalTransferOptions/onLine/CI OnlineResource in particular). If different formats
2802   are available from the same distributor, or have different transfer options, these should be
2803   represented as different distributor/MD_Distributor instances. See the USGIN Profile section 'Use
2804   of MD_Distribution and MD_Distributor' for instructions on use of these elements. -->
2805        <gmd:MD_Distributor>
2806          <gmd:distributorContact>
2807            <!-- (C-C) Distribution responsible party - For CI_ResponsibleParty, count of
2808   (individualName + organisationName + positionName) > 0 -->
2809            <gmd:CI_ResponsibleParty>
2810              <gmd:organisationName>
2811                <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
2812              </gmd:organisationName>
2813              <!-- (C-C) If CI_ResponsibleParty exists, the role element is required -->
2814              <gmd:role>
2815                <!-- Use CI RoleCode names {resourceProvider, custodian, owner, user, distributor,
2816   originator, pointOfContact, principalInvestigator, processor, publisher, author} - NAP expands
2817   with {collaborator, editor, mediator, rightsHolder}. -->
2818                <!-- NAP Example -->
2819                <!--
2820                <gmd:CI_RoleCode
2821                  codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
2822                  codeListValue="RI_412">distributor</gmd:CI_RoleCode>
2823                -->
2824                <!-- ISO Example -->
2825                <gmd:CI_RoleCode

2827     codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
2828     Codelist/gmxCodelists.xml#CI_RoleCode"
2829                  codeListValue="distributor">distributor</gmd:CI_RoleCode>
2830              </gmd:role>
2831            </gmd:CI_ResponsibleParty>
2832          </gmd:distributorContact>
2833          <!-- (O-O) Resource distributor order process - Information on the availability of the
2834   service which includes at least one of fees, available date and time, ordering instructions, or
2835   turnaround. -->
2836          <gmd:distributionOrderProcess>
2837            <gmd:MD_StandardOrderProcess>
2838              <gmd:fees>
2839                <gco:CharacterString>variable fees</gco:CharacterString>
2840              </gmd:fees>
2841              <gmd:orderingInstructions>
2842                <gco:CharacterString>ordering instructions</gco:CharacterString>
2843              </gmd:orderingInstructions>
2844              <gmd:turnaround>
2845                <gco:CharacterString>one to two weeks.</gco:CharacterString>
2846              </gmd:turnaround>
2847            </gmd:MD_StandardOrderProcess>
2848          </gmd:distributionOrderProcess>
2849          <!-- (O-C) Resource distributor format - USGIN profile specifies that the
2850   distributionInfo/MD_Distribution/distributionFormat may be included in the document (its schema
2851   valid...), but distribution format information must be duplicated in a
2852   distributionInfo/distributor/MD_Distributor/distributorFormat element or the content can be lost
2853   -->
2854          <gmd:distributorFormat>
2855            <gmd:MD_Format>
2856              <!-- Use USGIN distribution format code values. See the "Online resource format
2857   names" section of the USGIN Profile -->
2858              <gmd:name>
2859                <gco:CharacterString>Adobe:Acrobat/pdf</gco:CharacterString>
2860              </gmd:name>
2861              <gmd:version>
2862                <gco:CharacterString>8.0</gco:CharacterString>
2863              </gmd:version>
2864            </gmd:MD_Format>
2865          </gmd:distributorFormat>
2866          <!-- Resource distributor transfer options - Provides information about the technical
2867   means and media used by the distributor. -->
2868          <gmd:distributorTransferOptions>
2869            <gmd:MD_DigitalTransferOptions>
2870              <gmd:onLine>
```

```
2871                    <gmd:CI_OnlineResource>
2872                        <!-- (M-M) Resource distributor on-line distribution linkage - Digital transfer
2873    options are "technical means and media by which a dataset is obtained from the distributor." NAP
2874    requires CI_OnlineResource/linkage and CI_OnlineResource/protocol in CI_OnlineResource. -->
2875                        <gmd:linkage>
2876                            <!-- The linkage element should contain the complete URL to access the
2877    resource directly. CI_Online-Resource requires a Linkage element that is a gmd:URL. -->
2878                            <gmd:URL>http://azgs.az.gov/resource/00C02E67-F1ED-473D-A240-
2879    068CCB041A73/borehole_report.pdf</gmd:URL>
2880                        </gmd:linkage>
2881                        <gmd:protocol>
2882                            <!-- The protocol element defines a valid internet protocol used to access the
2883    resource. NAP recommended best practice is that the protocol should be taken from an official
2884    controlled list such as the Official Internet Protocol Standards published on the Web at
2885    http://www.rfc-editor.org/rfcxx00.html or the Internet Assigned Numbers Authority (IANA) at
2886    http://www.iana.org/numbers.html.  'ftp' or 'http' are common values. -->
2887                            <gco:CharacterString>http</gco:CharacterString>
2888                        </gmd:protocol>
2889                        <!-- (C-C) Resource distributor online distribution application profile -
2890    applicationProfile is required if the CI_OnlineResource/linkage does not connect to a web page,
2891    and another software application is needed to use the indicated file resource. The
2892    applicationProfile character string should specify the software using the following recommended
2893    syntax: "vendor:application name/application version", e.g. "Microsoft:Word/2007", or
2894    "ESRI:ArcGIS/9.3" -->
2895                        <gmd:applicationProfile>
2896                            <gco:CharacterString>Adobe:Acrobat/8.0</gco:CharacterString>
2897                        </gmd:applicationProfile>
2898                        <gmd:name>
2899                            <!-- The CI_OnlineResource/name element may duplicate the file name if the URL
2900    is a link to a file, but it is recommended to provide a user-friendly label for the file that
2901    could be presented in a user interface.  -->
2902                            <gco:CharacterString>borehole_report.pdf</gco:CharacterString>
2903                        </gmd:name>
2904                        <gmd:description>
2905                            <gco:CharacterString>Downloadable PDF document</gco:CharacterString>
2906                        </gmd:description>
2907                        <!-- (O-C) Resource distributor online distribution function -
2908    CI_OnlineResource/function is required by USGIN to indicate how linkage is to be used. If the
2909    resource is accessible as a web service, the metadata for the service should be separate metadata
2910    record with the dataset(s) exposed through the service identified in the service metadata record
2911    as coupledResources. -->
2912                        <gmd:function>
2913                            <!-- CI_OnlineFunctionCode names: {download, information, offlineAccess,
2914    order, search} - NAP expands with {upload, webService, emailService, browsing, fileAccess,
2915    webMapService}. -->
2916                            <!-- NAP Example -->
2917                            <!--
2918                            <gmd:CI_OnLineFunctionCode
2919                              codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_88"
2920                              codeListValue="RI_375">download</gmd:CI_OnLineFunctionCode>
2921                            -->
2922                            <!-- ISO Example -->
2923                            <gmd:CI_OnLineFunctionCode

2925      codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
2926      Codelist/gmxCodelists.xml#CI_OnLineFunctionCode"
2927                            codeListValue="download">download</gmd:CI_OnLineFunctionCode>
2928                        </gmd:function>
2929                    </gmd:CI_OnlineResource>
2930                </gmd:onLine>
2931            </gmd:MD_DigitalTransferOptions>
2932          </gmd:distributorTransferOptions>
2933        </gmd:MD_Distributor>
2934      </gmd:distributor>
2935      <!-- (C-C) Resource distribution transfer options - MD_DigitalTransferOptions provides
2936    information on digital distribution of resource. See USGIN Profile 'Use of MD_Distribution and
2937    MD_Distributor' for instructions on use of this element. Details on encoding for
2938    MD_DigitalTransferOptions are above in the distributorTransferOptions elements description. -->
2939        <!--
2940        <gmd:transferOptions/>
2941        -->
2942      </gmd:MD_Distribution>
```

```xml
      </gmd:distributionInfo>
  <!-- (C-C) Data quality Information - NAP requires either dataQualityInfo/DQ_DataQuality/report
or dataQualityInfo/ DQ DataQuality/lineage   if
dataQualityInfo/DQ_DataQuality/scope/DQ_Scope/level = 'dataset'.   -->
    <gmd:dataQualityInfo>
       <gmd:DQ_DataQuality>
        <!-- (C-C) Data quality scope - Mandatory if DQ_DataQuality is not null.   Specifies the
extent of characteristics for which data quality information is reported. -->
          <gmd:scope>
           <gmd:DQ_Scope>
             <gmd:level>
               <!-- MD_ScopeCode names: {attribute, attributeType, collectionHardware,
collectionSession, dataset, series, nonGeographicDataset, dimensionGroup, feature, featureType,
propertyType, fieldSession, software, service, model, tile}. -->
               <!-- NAP Example -->
               <!--
               <gmd:MD ScopeCode
                 codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_108"
                 codeListValue="RI_622">dataset</gmd:MD_ScopeCode>
               -->
               <!-- ISO Example -->
               <gmd:MD_ScopeCode

   codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
   Codelist/gmxCodelists.xml#MD_ScopeCode"
               codeListValue="dataset">dataset</gmd:MD_ScopeCode>
             </gmd:level>
               <!-- (C-C) Data quality scope level description - NAP provision is that
DQ_DataQuality/scope/levelDescription is mandatory if scope/DQ_Scope/level is not equal to
'dataset' or 'series'. USGIN adds requirement that DataQuality/scope/levelDescription is
mandatory if DQ_DataQuality/scope/DQ_Scope/level/MD_ScopeCode.codeListValue is not equal to
MD_MetadataHierarchy/hierarchyLevel/MD_ScopeCode.codelistvalue level. -->
               <!--
               <gmd:levelDescription>
                 <gmd:MD_ScopeDescription>
                   --><!-- NAP BP: One and only one of the following must be entered: attributes,
features, featureInstances, attributeInstances, dataset, or other as appropriate. Encoding of the
values for the levelDescription element is unclear from the ISO or INCITs documentation. --><!--
                   <gmd:attributes></gmd:attributes>
                 </gmd:MD ScopeDescription>
               </gmd:levelDescription>
               -->
           </gmd:DQ_Scope>
          </gmd:scope>
          <!-- (C-C) Data quality report - If a DQ_DataQuality/report element is included, at least
one of the 15 possible data quality elements must be present, and multiple report elements are
allowed within each DQ_DataQuality element.   -->
          <!--
          <gmd:report>
            <gmd:DQ_CompletenessCommission>
              <gmd:nameOfMeasure>
                <gco:CharacterString>Name of Measure</gco:CharacterString>
              </gmd:nameOfMeasure>
              <gmd:result>
                <gmd:DQ QuantitativeResult>
                <gmd:valueUnit>a unit</gmd:valueUnit>
                  <gmd:value>
                    <gco:Record>a value</gco:Record>
                  </gmd:value>
                </gmd:DQ_QuantitativeResult>
              </gmd:result>
            </gmd:DQ_CompletenessCommission>
          </gmd:report>
          -->
          <!-- (C-C) Data quality lineage - INSPIRE makes general lineage/LI_Lineage/statement
mandatory. USGIN follows NAP rule that count(lineage/LI_Lineage/source +
lineage/LI Lineage/sourceStep + lineage/LI Lineage/statement ) >0  for spatial dataset and
spatial dataset series. Not applicable to services. -->
          <gmd:lineage>
            <gmd:LI_Lineage>
              <!-- (C-C) Data quality lineage statement - General explanation of the data producer's
knowledge of the dataset lineage. -->
```

```
3015              <gmd:statement>
3016                <gco:CharacterString>This dataset is maintained by the Arizona Geological
3017  Survey.</gco:CharacterString>
3018              </gmd:statement>
3019              <!-- (C-C) Data quality lineage source - Each source/LI_Source element describes a
3020  source data resource that is input into a processStep. NAP provision is that
3021  LI_Source/description is mandatory if LI_Source/sourceCitation and LI_Source/sourceExtent  are
3022  not provided. The attribute description includes the source medium name code (CodeList
3023  napMD_MediumNameCode) followed by <;><blank space> and a free text description, e.g. "dvd; source
3024  satellite image."  -->
3025              <!--
3026              <gmd:source/>
3027              -->
3028              <!-- (C-C) Data quality lineage process step - An event in the development of the
3029  dataset. Best practice recommended for USGIN is that source association from a process step is to
3030  inputs to a process, and processStep associations from a source element link an output resource
3031  to a process step that produced it.  -->
3032              <!--
3033              <gmd:processStep>
3034                <gmd:LI_ProcessStep>
3035                  <gmd:description>
3036                    <gco:CharacterString></gco:CharacterString>
3037                  </gmd:description>
3038                </gmd:LI_ProcessStep>
3039              </gmd:processStep>
3040              -->
3041          </gmd:LI_Lineage>
3042        </gmd:lineage>
3043      </gmd:DQ_DataQuality>
3044    </gmd:dataQualityInfo>
3045    <!-- (O-O) Portrayal catalog information - A portrayal cataloguecatalog is a collection of
3046  defined symbols used to depict, to humans, features on a map. No documentation in ISO 19115 about
3047  how this is supposed to work. ISO 19117 defines the structure of a Portrayal Catalogue. No USGIN
3048  recommended practices here yet. -->
3049    <!--
3050    <gmd:portrayalCatalogueInfo/>
3051    -->
3052    <!-- (O-O) Metadata constraint information - This element specifies use constraints for access
3053  to the metadata record.  -->
3054    <gmd:metadataConstraints>
3055      <!-- Constraints -->
3056      <gmd:MD_Constraints>
3057        <!-- NAP provision is that metadataConstraints/MD_Constraints/useLimitation is mandatory
3058  when MD_Constraints is used to specify metadataConstraints.  -->
3059        <gmd:useLimitation>
3060          <gco:CharacterString>fair use</gco:CharacterString>
3061        </gmd:useLimitation>
3062      </gmd:MD_Constraints>
3063    </gmd:metadataConstraints>
3064    <gmd:metadataConstraints>
3065      <!-- Legal constraint -->
3066      <gmd:MD_LegalConstraints>
3067        <!-- When one of the subtypes MD_LegalConstraints or MD_SecurityConstraints is used,
3068  useLimitation is optional. -->
3069        <gmd:useLimitation>
3070          <gco:CharacterString>one</gco:CharacterString>
3071        </gmd:useLimitation>
3072        <gmd:accessConstraints>
3073          <!-- MD_RestrictionCode names: {copyright, patent, patentPending, trademark, license,
3074  intellectualPropertyRights, restricted, otherRestrictions} - NAP expands with
3075  {licenseUnrestricted, licenseEndUser, licenseDistributor, privacy, statutory, confidential,
3076  sensitivity}. -->
3077          <!-- NAP Example -->
3078          <!--
3079          <gmd:MD_RestrictionCode
3080            codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_107"
3081            codeListValue="RI_609">otherRestrictions</gmd:MD_RestrictionCode>
3082          -->
3083          <!-- ISO Example -->
3084          <gmd:MD_RestrictionCode
```

```
     codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
  Codelist/gmxCodelists.xml#MD_RestrictionCode"
           codeListValue="otherRestrictions">other restrictions</gmd:MD_RestrictionCode>
       </gmd:accessConstraints>
       <gmd:useConstraints>
         <!-- MD_RestrictionCode names: {copyright, patent, patentPending, trademark, license,
  intellectualPropertyRights, restricted, otherRestrictions} - NAP expands with
  {licenseUnrestricted, licenseEndUser, licenseDistributor, privacy, statutory, confidential,
  sensitivity}. -->
         <!-- NAP Example -->
         <!--
         <gmd:MD_RestrictionCode
           codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_107"
           codeListValue="RI_609">otherRestrictions</gmd:MD_RestrictionCode>
         -->
         <!-- ISO Example -->
         <gmd:MD_RestrictionCode

     codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
  Codelist/gmxCodelists.xml#MD_RestrictionCode"
           codeListValue="otherRestrictions">other restrictions</gmd:MD_RestrictionCode>
       </gmd:useConstraints>
       <!-- (C-C) otherConstraints is a free text element required by NAP if accessConstraints or
  useConstraints is set to "otherRestrictions." -->
       <gmd:otherConstraints>
         <gco:CharacterString>Data only to be used for the purposes for which they were
  collected.</gco:CharacterString>
       </gmd:otherConstraints>
     </gmd:MD_LegalConstraints>
   </gmd:metadataConstraints>
   <gmd:metadataConstraints>
     <!-- Security constraints -->
     <gmd:MD_SecurityConstraints>
       <gmd:classification>
         <!-- MD_SecurtyConstraints has various optional free text values, and a required
  MD_SecurityConstraints/classification from MD_ClassificationCode names: {unclassified,
  restricted, confidential, secret, topSecret} - NAP expands with {sensitive, forOfficialUseOnly}.
  -->
         <!-- NAP Example -->
         <!--
         <gmd:MD_ClassificationCode
           codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_96"
           codeListValue="RI_484">unclassified</gmd:MD_ClassificationCode>
         -->
         <!-- ISO Example-->
         <gmd:MD_ClassificationCode

     codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
  Codelist/gmxCodelists.xml#MD_ClassificationCode"
           codeListValue="unclassified">unclassified</gmd:MD_ClassificationCode>
       </gmd:classification>
     </gmd:MD_SecurityConstraints>
   </gmd:metadataConstraints>
   <!-- (O-O) Application schema information - Information about the conceptual schema of the
  dataset. -->
   <!--
   <gmd:applicationSchemaInfo>
     --><!-- (M-M) The applicationSchemaInfo/MD_ApplicationSchemaInformation element has mandatory
  name/CI_Citation, schemaLanguage free text, and constraintLanguage free text. --><!--
     <gmd:MD_ApplicationSchemaInformation>
       <gmd:name>
         <gmd:CI_Citation>
           <gmd:title>
             <gco:CharacterString>schema title string</gco:CharacterString>
           </gmd:title>
           <gmd:date>
             <gmd:CI_Date>
               <gmd:date>
                 <gco:DateTime>2001-12-17T09:30:47</gco:DateTime>
               </gmd:date>
               <gmd:dateType>
```

```xml
                  --><!-- NAP Example -->
                  <!--
                  <gmd:CI_DateTypeCode
                    codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_87"
                    codeListValue="RI_367">publication</gmd:CI_DateTypeCode>
                  -->
                  <!-- ISO Example  --><!--
                  <gmd:CI_DateTypeCode

  codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
  Codelist/gmxCodelists.xml#CI_DateTypeCode"
                  codeListValue="publication">publication</gmd:CI_DateTypeCode>
                </gmd:dateType>
              </gmd:CI_Date>
            </gmd:date>
          </gmd:CI_Citation>
        </gmd:name>
        <gmd:schemaLanguage>
          <gco:CharacterString>some schema language</gco:CharacterString>
        </gmd:schemaLanguage>
        <gmd:constraintLanguage>
          <gco:CharacterString>some constraint language</gco:CharacterString>
        </gmd:constraintLanguage>
      </gmd:MD_ApplicationSchemaInformation>
  </gmd:applicationSchemaInfo>
  -->
  <!-- (O-O) Metadata maintenance information - This element provides information about the
  maintenance schedule or history of the metadata record.  -->
  <gmd:metadataMaintenance>
    <gmd:MD_MaintenanceInformation>
      <gmd:maintenanceAndUpdateFrequency>
        <!-- Only one MD_MaintenanceInformation element may be included, with a required
  MD_MaintenanceFrequencyCode names: {continual, daily, weekly, fortnightly, monthly, quarterly,
  biannually, annually, asNeeded, irregular, not-Planned, unknown} - NAP expands with
  {semimonthly}. -->
        <!-- NAP Example -->
        <!--
        <gmd:MD_MaintenanceFrequencyCode
          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_102"
          codeListValue="RI_540">asNeeded</gmd:MD_MaintenanceFrequencyCode>
        -->
        <!-- ISO Example -->
        <gmd:MD_MaintenanceFrequencyCode

  codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
  Codelist/gmxCodelists.xml#MD_MaintenanceFrequencyCode"
          codeListValue="asNeeded">as needed</gmd:MD_MaintenanceFrequencyCode>
      </gmd:maintenanceAndUpdateFrequency>
    </gmd:MD_MaintenanceInformation>
  </gmd:metadataMaintenance>
  <!-- (X-X) Series information - Not used by USGIN. -->
  <!--
  <gmd:series/>
  -->
  <!-- (X-X) Described resource - Not used by USGIN. -->
  <!--
  <gmd:describes/>
  -->
  <!-- (X-X) Property type description - Not used by USGIN. -->
  <!--
  <gmd:propertyType/>
  -->
  <!-- (X-X) Feature type description - Not used by USGIN -->
  <!--
  <gmd:featureType/>
  -->
  <!-- (X-X) Feature attributes - Not used by USGIN -->
  <!--
  <gmd:featureAttribute/>
  -->
</gmd:MD_Metadata>
```

3228

3229

8.3 USGIN ISO 19139 Service Metadata

In the following listing, text in green is comments; XML elements are in blue, XML attributes are in black, and attribute values are in purple.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<!--
*********************************************************************************************
*** Example ISO 19139 Geospatial Service Metadata  based on the USGIN v1.1 Profile
*** with explicitly linked references to coupled resources (map layers) for a WMS service
*** by USGIN Standards and Protocols Drafting Team
*** U.S. Geoscience Information System (USGIN) - http://lab.usgin.org
*** Contributors: Wolfgang Grunberg, Stephen M Richard
*** 01/20/2010
***
*** DISCLAIMER: this is not an authoritative metadata example but an aide to get started.
*** Scope notes are mostly from NAP or ISO documentation; refer to
*** the USGIN profile document for more specific and reliable guidelines.
***
*** Validated against http://www.isotc211.org/2005/gmd (ISO 19115, CSW 2.0.2)
*** and http://www.isotc211.org/2005/srv (ISO 19119, CSW 2.0.2)
*** Follows the USGIN ISO 19139 Dataset Metadata Profile v1.1
*** a derivative of the North American Profile (NAP)
***
*** NOTES:
*** - Codelists:
*** Most ISO metadata profiles and applications use ISO codelists or codelists that use ISO's
codelist names. NAP does not use ISO codelist names. USGIN recommends using ISO over NAP
codelists to ensure interoperability. Remember, the codeList attribute points to a Uniform
Resource Identifier (URI) which defines an item's identity. It can be a URN or a URL.
*** - napm schema extension:
***
http://www.cits.rncan.gc.ca/html/brodeurj/.protege/.napMetadata/napMetadataWebsite/napMetadataToo
ls/napXsd/napm is the namespace for NAP extensions in xmlns:napm. Its schema is located at
http://www.cits.rncan.gc.ca/html/brodeurj/.protege/.napMetadata/tools/napXsd/napm/napm.xsd.
However, that schema does not resolve properly because it also refernces a local copy of gmd.
USGIN does not follow this NAP requirement because it constitutes a barier to interoperability.
*** - Language code:
*** NAP demands <ISO639-2/T three letter language code - lower case><;><blank space><ISO3166-1
three letter country code - upper case>. However, NAP's requirement is not interoperable and
USGIN prefers ISO's <ISO639-2/T three letter language code - lower case> formatting.
***
*** KEY: (NAP-USGIN) - M/C/O/X (Mandatory, Conditional, Optional, Not Used)
***
*********************************************************************************************-->

<!-- USGIN ISO 19139 geospatial service metadata record with explicitly linked references to
coupled resources (map layers) for a WMS service -->
<gmd:MD_Metadata
  xmlns:gmd="http://www.isotc211.org/2005/gmd"
  xmlns:gco="http://www.isotc211.org/2005/gco"
  xmlns:gml="http://www.opengis.net/gml"
  xmlns:srv="http://www.isotc211.org/2005/srv"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="
    http://www.isotc211.org/2005/gmd http://schemas.opengis.net/iso/19139/20060504/gmd/gmd.xsd
    http://www.isotc211.org/2005/srv http://schemas.opengis.net/iso/19139/20060504/srv/srv.xsd
    ">
  <!-- (M-M) Metadata file identifier - A unique File Identifier (GUID) - USGIN recommends using
a valid Universally Unique Identifier (UUID) -->
  <gmd:fileIdentifier>
    <gco:CharacterString>53e3ad439d6043e25d875f3959445c3d7d9a1</gco:CharacterString>
  </gmd:fileIdentifier>
  <!-- (M-M) Metadata language - NAP demands <ISO639-2/T three letter language code - lower
case><;><blank space><ISO3166-1 three letter country code - upper case>. However, NAP's
requirement is not interoperable and USGIN prefers ISO's <ISO639-2/T three letter language code -
lower case> formatting. -->
  <!-- NAP Example -->
```

```
3298      <!--
3299      <gmd:language>
3300        <gco:CharacterString>eng; USA</gco:CharacterString>
3301      </gmd:language>
3302      -->
3303      <!-- ISO Example -->
3304      <gmd:language>
3305        <gco:CharacterString>eng</gco:CharacterString>
3306      </gmd:language>
3307      <!-- (M-M) Metadata character set  - NAP specifies default is "utf8", codelist =
3308      napMD CharacterSetCode. USGIN requires that a character set code is defined to facilitate CSW
3309      servers (deegree, GeoNetwork, etc.). -->
3310      <gmd:characterSet>
3311        <!-- MD_CharacterSetCode names: {ucs2, ucs4, utf7, utf8, utf16, 8859part1, 8859part2,
3312      8859part3, 8859part4, 8859part5, 8859part6, 8859part7, 8859part8, 8859part9, 8859part10,
3313      8859part11, 8859part13, 8859part14, 8859part15, 8859part16, jis, shiftJIS, eucJP, usAscii,
3314      ebcdic, eucKR, big5, GB2312}.  -->
3315        <!-- NAP example -->
3316        <!--
3317        <gmd:MD_CharacterSetCode
3318          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_95"
3319          codeListValue="RI_458">utf8</gmd:MD_CharacterSetCode>
3320        -->
3321        <!-- ISO example -->
3322        <gmd:MD_CharacterSetCode
3323
3324      codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
3325      Codelist/gmxCodelists.xml#MD_CharacterSetCode"
3326          codeListValue="utf8">UTF-8</gmd:MD_CharacterSetCode>
3327      </gmd:characterSet>
3328      <!-- (M-M) Resource type - Define if this record is a: dataset (default), service, feature,
3329      software, etc. -->
3330      <gmd:hierarchyLevel>
3331        <!-- MD ScopeCode code names: {attribute, attributeType, collectionHardware,
3332      collectionSession, dataset, series, nonGeographicDataset, dimensionGroup, feature, featureType,
3333      propertyType, fieldSession, software, service, model, tile}. -->
3334        <!-- NAP example -->
3335        <!--
3336        <gmd:MD ScopeCode
3337          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_108"
3338          codeListValue="RI_631">service</gmd:MD_ScopeCode>
3339        -->
3340        <!-- ISO example -->
3341        <gmd:MD_ScopeCode
3342
3343      codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
3344      Codelist/gmxCodelists.xml#MD_ScopeCode"
3345          codeListValue="service">service</gmd:MD_ScopeCode>
3346      </gmd:hierarchyLevel>
3347      <!-- (O-M) Resource hierarchy level name - ISO 19115 assumes that the metadata hierarchy level
3348      name defaults to "dataset" if it is not documented. NAP does not use it, recognizing that it is
3349      redundant. USGIN makes this property mandatory to identify the USGIN resource type (see USGIN
3350      Profile, "Resources of Interest"). Default USGIN hierarchyLevelName.CharacterString is "Dataset."
3351      Encode hierarchy by including hierarchyLevelName elements for all broader resource categories.
3352      E.g. default should also include a hierarchyLevelName="Collection" element. For services USGIN
3353      hierarchyLevelName.CharacterString is "Service". As use cases develop that provide rationale for
3354      definition of sub-categories of service, the resource category list will be expanded. -->
3355      <gmd:hierarchyLevelName>
3356        <gco:CharacterString>Service</gco:CharacterString>
3357      </gmd:hierarchyLevelName>
3358      <!-- (M-M) Metadata point of contact - Point of contact for the metadata record, e.g. for users
3359      to report errors, updates to metadata, etc. -->
3360      <gmd:contact>
3361        <gmd:CI_ResponsibleParty>
3362          <!-- (M-M) (individualName + organisationName + positionName) > 0 -->
3363          <gmd:individualName>
3364            <gco:CharacterString>Ryan Clark</gco:CharacterString>
3365          </gmd:individualName>
3366          <gmd:organisationName>
3367            <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
3368          </gmd:organisationName>
3369          <gmd:positionName>
```

```
3370            <gco:CharacterString>GIS Manager</gco:CharacterString>
3371          </gmd:positionName>
3372          <gmd:contactInfo>
3373            <gmd:CI_Contact>
3374              <!-- Phone -->
3375              <gmd:phone>
3376                <gmd:CI_Telephone>
3377                  <gmd:voice>
3378                    <gco:CharacterString>520.770.3500</gco:CharacterString>
3379                  </gmd:voice>
3380                  <gmd:facsimile>
3381                    <gco:CharacterString>520.770.3505</gco:CharacterString>
3382                  </gmd:facsimile>
3383                </gmd:CI_Telephone>
3384              </gmd:phone>
3385              <!-- Address -->
3386              <gmd:address>
3387                <gmd:CI_Address>
3388                  <gmd:deliveryPoint>
3389                    <gco:CharacterString>416 W. Congress St., Suite 100</gco:CharacterString>
3390                  </gmd:deliveryPoint>
3391                  <gmd:city>
3392                    <gco:CharacterString>Tucson</gco:CharacterString>
3393                  </gmd:city>
3394                  <gmd:administrativeArea>
3395                    <gco:CharacterString>Arizona</gco:CharacterString>
3396                  </gmd:administrativeArea>
3397                  <gmd:postalCode>
3398                    <gco:CharacterString>85701-1381</gco:CharacterString>
3399                  </gmd:postalCode>
3400                  <gmd:country>
3401                    <gco:CharacterString>USA</gco:CharacterString>
3402                  </gmd:country>
3403                  <!-- (O-M) Metadata point of contact e-mail address - mandatory in USGIN -->
3404                  <gmd:electronicMailAddress>
3405                    <gco:CharacterString>metadata@azgs.az.gov</gco:CharacterString>
3406                  </gmd:electronicMailAddress>
3407                </gmd:CI_Address>
3408              </gmd:address>
3409              <!-- (O-O) online resources - this is the online resource to contact the metadata
3410    person-->
3411              <gmd:onlineResource>
3412                <gmd:CI_OnlineResource>
3413                  <gmd:linkage>
3414                    <gmd:URL>http://www.azgs.az.gov</gmd:URL>
3415                  </gmd:linkage>
3416                  <gmd:protocol>
3417                    <gco:CharacterString>http</gco:CharacterString>
3418                  </gmd:protocol>
3419                  <gmd:description>
3420                    <gco:CharacterString>Arizona Geological Survey Web Site</gco:CharacterString>
3421                  </gmd:description>
3422                </gmd:CI_OnlineResource>
3423              </gmd:onlineResource>
3424              <!-- (O-O) hours of service -->
3425              <gmd:hoursOfService>
3426                <gco:CharacterString>8 AM to 5 PM Mountain Standard time (no daylight
3427    savings)</gco:CharacterString>
3428              </gmd:hoursOfService>
3429              <!-- (O-O) contact instructions -->
3430              <gmd:contactInstructions>
3431                <gco:CharacterString>Fill out contact form at http://www.azgs.az.gov
3432    </gco:CharacterString>
3433              </gmd:contactInstructions>
3434            </gmd:CI_Contact>
3435          </gmd:contactInfo>
3436          <!-- (M-M) ISO 19139 Mandatory: contact role -->
3437          <gmd:role>
3438            <!-- CI RoleCode names: {resourceProvider, custodian, owner, user, distributor,
3439    originator, pointOfContact, principalInvestigator, processor, publisher, author} - NAP expands
3440    with {collaborator, editor, mediator, rightsHolder}.  -->
3441            <!-- NAP example -->
```

```
3442          <!--
3443          <gmd:CI_RoleCode
3444            codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
3445            codeListValue="RI_414">pointOfContact</gmd:CI_RoleCode>
3446          -->
3447          <!-- ISO example -->
3448          <gmd:CI_RoleCode
3449
3450   codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
3451   Codelist/gmxCodelists.xml#CI_RoleCode"
3452          codeListValue="pointOfContact">point of contact</gmd:CI_RoleCode>
3453        </gmd:role>
3454      </gmd:CI_ResponsibleParty>
3455    </gmd:contact>
3456    <!-- (X-O) Metadata should include a URL that locates a thumbnail logo for organizations
3457   related to the metadata origination, the organization hosting the catalog that returned the
3458   metadata, the organization that originated the data, and the organization hosting online services
3459   that provide access to the data. -->
3460    <gmd:contact>
3461      <gmd:CI_ResponsibleParty>
3462        <gmd:organisationName>
3463          <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
3464        </gmd:organisationName>
3465        <gmd:contactInfo>
3466          <gmd:CI_Contact>
3467            <gmd:onlineResource>
3468              <gmd:CI_OnlineResource>
3469                <!-- Icon image file (e.g. tif, png, jpg) for the metadata originator. This Icon
3470   will be displayed in search results to credit the metadata originator. -->
3471                <gmd:linkage>
3472                  <gmd:URL>http://www.azgs.az.gov/logo/metadata/azgs.png</gmd:URL>
3473                </gmd:linkage>
3474                <!-- (X-C) For URL's that indicate icon thumbnails, the CI_OnlineResource/name
3475   should be 'icon'. -->
3476                <gmd:name>
3477                  <gco:CharacterString>icon</gco:CharacterString>
3478                </gmd:name>
3479              </gmd:CI_OnlineResource>
3480            </gmd:onlineResource>
3481          </gmd:CI_Contact>
3482        </gmd:contactInfo>
3483        <gmd:role>
3484          <!-- CI_RoleCode names: {resourceProvider, custodian, owner, user, distributor,
3485   originator, pointOfContact, principalInvestigator, processor, publisher, author} - NAP expands
3486   with {collaborator, editor, mediator, rightsHolder}.  -->
3487          <!-- NAP example -->
3488          <!--
3489          <gmd:CI_RoleCode
3490            codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
3491            codeListValue="RI_413">originator</gmd:CI_RoleCode>
3492          -->
3493          <!-- ISO example -->
3494          <gmd:CI_RoleCode
3495
3496   codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
3497   Codelist/gmxCodelists.xml#CI_RoleCode"
3498          codeListValue="originator">originator</gmd:CI_RoleCode>
3499        </gmd:role>
3500      </gmd:CI_ResponsibleParty>
3501    </gmd:contact>
3502    <!-- (M-M) Metadata date stamp - USGIN profile requires use of dateStamp/gco:DateTime (Note
3503   this contrasts with INSPIRE mandate to use dateStamp/gco:Date). This is the date and time when
3504   the metadata record was created or updated (following NAP). -->
3505    <gmd:dateStamp>
3506      <!-- Requires an extended ISO 8601 formatted combined UTC date and time string (2009-11-
3507   17T10:00:00) -->
3508      <gco:DateTime>2009-11-17T10:00:00</gco:DateTime>
3509    </gmd:dateStamp>
3510    <!-- (M-M) metadata standard - NAP specifies "NAP - Metadata". USGIN profile conformant
3511   metadata is indicated by using "ISO-NAP-USGIN" -->
3512    <gmd:metadataStandardName>
3513      <gco:CharacterString>ISO-USGIN</gco:CharacterString>
```

```
3514      </gmd:metadataStandardName>
3515      <!-- (O-M) USGIN profile version -->
3516      <gmd:metadataStandardVersion>
3517        <gco:CharacterString>1.2</gco:CharacterString>
3518      </gmd:metadataStandardVersion>
3519      <!-- (O-C) Dataset Identifier - For USGIN, this is a string that uniquely identifies the
3520    described resource. If the resource has an identifier, it should be included here; if the
3521    resource will be referenced from other metadata, it must have an identifier here. If the dataset
3522    is coupled to a service, the value of the MD Metadata/dataSetURI attribute is the unique resource
3523    identifier used by srv:coupledResource to link the service with the dataset. For the USGIN
3524    profile, the MD Distribution/transferOptions/MD DigitalTransferOptions/ online/CI_OnlineResource
3525    is used to specify URLs for access to the resource. -->
3526      <!-- This locale element example implies that all character string elements are available in
3527    English (from the MD_Metadata/language element), and in French. -->
3528      <!--
3529      <gmd:locale>
3530        <gmd:PT_Locale id="FR">
3531          <gmd:languageCode>
3532            <gmd:LanguageCode
3533
3534    codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
3535    Codelist/ML_gmxCodelists.xml#LanguageCode"
3536            codeListValue="fra">Français</gmd:LanguageCode>
3537          </gmd:languageCode>
3538          <gmd:characterEncoding>
3539            --><!-- ISO example --><!--
3540            <gmd:MD_CharacterSetCode
3541
3542    codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
3543    Codelist/gmxCodelists.xml#MD_CharacterSetCode"
3544            codeListValue="utf8">UTF-8</gmd:MD_CharacterSetCode>
3545          </gmd:characterEncoding>
3546        </gmd:PT_Locale>
3547      </gmd:locale>
3548      -->
3549      <!-- (C-C) Other Languages - If description in more than one language is provided, this
3550    property should indicate what those languages are. The primary language used for metadata
3551    description is identified with MD Metadata/language and characterSet and any additional languages
3552    are identified by MD Metadata/locale/PT locale elements, in which the language is provided
3553    according to ISO 639-2/T three-letter terminology codes in lowercase, and an optional country is
3554    provided according to ISO 3166-1 three-letter codes in uppercase, and mandatory
3555    characterEncoding. -->
3556        <!--
3557        <gmd:locale/>
3558        -->
3559      <!-- (O-O) Resource spatial representation - Spatial representation Information for the dataset
3560    (resource). Best practice is to include metadata for spatial representation if the described
3561    resource is a georeferenced dataset. -->
3562      <!--
3563      <gmd:spatialRepresentationInfo/>
3564      -->
3565      <!-- (O-O) Resource's spatial reference system - Description of the spatial and/or temporal
3566    reference systems used in the dataset.
3567        NAP specifies {
3568    (identificationInfo/spatialRepresentationType/MD SpatialRepresentationTypeCode= "vector") or
3569    (../MD_SpatialRepresentationTypeCode = "grid"") or (../MD_SpatialRepresentationTypeCode = "tin")
3570    implies count referenceSystemInfo >= 1) } -->
3571      <gmd:referenceSystemInfo>
3572        <gmd:MD_ReferenceSystem>
3573          <!-- ISO 19115:2003 Corrigendum 1:2006 removes CRS and projection parameter information. It
3574    uses the new ISO 19111 instead  -->
3575          <gmd:referenceSystemIdentifier>
3576            <gmd:RS_Identifier>
3577              <!-- (C-C) Reference System identifier code - For USGIN the code should be a value from
3578    the EPSG Geodetic Parameter Dataset register (http://www.epsg-registry.org/) in the form
3579    "EPSG:nnnn" where nnnn is the EPSG code number for the CRS. -->
3580              <gmd:code>
3581                <gco:CharacterString>EPSG:5701</gco:CharacterString>
3582              </gmd:code>
3583              <gmd:codeSpace>
3584                <gco:CharacterString>urn:ogc:def:crs</gco:CharacterString>
3585              </gmd:codeSpace>
```

```
3586            </gmd:RS_Identifier>
3587          </gmd:referenceSystemIdentifier>
3588        </gmd:MD_ReferenceSystem>
3589      </gmd:referenceSystemInfo>
3590      <!-- (X-X) Metadata extension information - not used in USGIN -->
3591      <!--
3592      <gmd:metadataExtensionInfo/>
3593      -->
3594      <!--********************-->
3595      <!-- (M-M) Resource identification information - At least one of MD_DataIdentification
3596    (dataset, dataset series) or SV_ServiceIdentification (service) is required.  -->
3597      <gmd:identificationInfo>
3598        <!-- Resource Service Identification -->
3599        <srv:SV_ServiceIdentification>
3600          <gmd:citation>
3601            <!-- (M-M) Resource citation - For USGIN purposes, this should be viewed as information
3602    to identify the intellectual origin of the content in the described resource, along the lines of
3603    a citation in a scientific journal. Required content for a CI_Citation element are title, date,
3604    and responsibleParty -->
3605            <gmd:CI_Citation>
3606              <!-- (M-M) Resource title - USGIN recommends using titles that inform the human reader
3607    about the dataset's content as well as its context.  -->
3608              <gmd:title>
3609                <gco:CharacterString>Arizona Geological Survey Web Map Service</gco:CharacterString>
3610              </gmd:title>
3611              <!-- (O-O) Alternate title -->
3612              <!--
3613              <gmd:alternateTitle/>
3614              -->
3615              <!-- (M-M) Resource reference date - Best practice is to include at least the date of
3616    publication or creation of the resource. The date of the resource reported in the citation
3617    corresponds to the resource's last update version according to its update frequency. CI Date
3618    content includes a date and dateType. Date for USGIN profile uses xs:date data type, defined thus
3619    "date uses the date/timeSevenPropertyModel, with hour, minute, and second  required to be absent.
3620    timezoneOffset• remains optional" (http://www.w3.org/TR/xmlschema11-2). -->
3621              <gmd:date>
3622                <gmd:CI_Date>
3623                  <gmd:date>
3624                    <!-- Requires an extended ISO 8601 formatted combined UTC date and time string
3625    (2001-12-17T09:30:47) -->
3626                    <gco:DateTime>2009-11-22T23:35:22</gco:DateTime>
3627                  </gmd:date>
3628                  <gmd:dateType>
3629                    <!-- CI DateTypeCode names: {creation, publication, revision} _ NAP expands with
3630    {notAvailable, inForce, adopted, deprecated, superseded}.-->
3631                    <!-- NAP Example -->
3632                    <!--
3633                    <gmd:CI_DateTypeCode
3634                      codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_87"
3635                      codeListValue="RI_368">revision</gmd:CI_DateTypeCode>
3636                    -->
3637                    <!-- ISO Example -->
3638                    <gmd:CI_DateTypeCode
3639
3640      codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
3641    Codelist/gmxCodelists.xml#CI_DateTypeCode"
3642                      codeListValue="revision">revision</gmd:CI_DateTypeCode>
3643                  </gmd:dateType>
3644                </gmd:CI_Date>
3645              </gmd:date>
3646              <!-- (C-O) Unique resource identifier  - For USGIN,  because the Citation is for the
3647    service, this identifier should be identical to MD_Metadta/dataSetURI, and is therefore optional.
3648    For USGIN purposes, this element content value is only an identifier for the citation; it is not
3649    a URL for accessing the service. The USGIN profile requires the use of MD_Identifier element to
3650    identify resources. RS_Identifier may substitute for MD_Identifier in the ISO19139 schema, but
3651    the USGIN profile requires use of MD_Identifer. If additional codespace and version content is
3652    associated with the identifier, it should be encoded as
3653    MD_Identifier/authority/CI_Citation/alternateTitle and
3654    MD_Identifier/authority/CI_Citation/edition  -->
3655              <!--
3656              <gmd:identifier>
3657                <gmd:RS_Identifier>
```

```
3658              <gmd:code>
3659                <gco:CharacterString>0000000000000000000000000000000000000000</gco:CharacterString>
3660              </gmd:code>
3661            </gmd:RS_Identifier>
3662          </gmd:identifier>
3663          -->
3664          <!-- (M-M) Resource responsible party - The citation attribute provides information for
3665     citing the described resource. Citation is defined by Webster as "an act of quoting". The precise
3666     semantics of what an identification/citation is supposed to be are not very well articulated in
3667     ISO19115. For USGIN purposes, this should be viewed as information to identify the intellectual
3668     origin (or property) of the content in the described resource, along the lines of a citation in a
3669     scientific journal. Required content for a CI_Citation element are title, date, and
3670     'responsibleParty'.  -->
3671          <gmd:citedResponsibleParty>
3672            <gmd:CI_ResponsibleParty id="R264537">
3673              <!-- (M-M) (individualName + organisationName + positionName) > 0 -->
3674              <!--
3675              <gmd:individualName/>
3676              -->
3677              <gmd:organisationName>
3678                <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
3679              </gmd:organisationName>
3680              <gmd:positionName>
3681                <gco:CharacterString>GIS Manager</gco:CharacterString>
3682              </gmd:positionName>
3683              <!-- (O-C) Contact Information - (phone + deliveryPoint + electronicMailAddress ) >
3684     0. Best practice is to include at least an e-mail address -->
3685              <gmd:contactInfo>
3686                <gmd:CI_Contact>
3687                  <gmd:address>
3688                    <gmd:CI_Address>
3689                      <gmd:electronicMailAddress>
3690                        <gco:CharacterString>webServices@azgs.az.gov</gco:CharacterString>
3691                      </gmd:electronicMailAddress>
3692                    </gmd:CI_Address>
3693                  </gmd:address>
3694                </gmd:CI_Contact>
3695              </gmd:contactInfo>
3696              <!-- (M-M) ISO 19139 Mandatory: contact role - Guidance on use of role codes would
3697     be helpful for consistency, but has not been developed as yet. -->
3698              <gmd:role>
3699                <!-- CI_RoleCode names: {resourceProvider, custodian, owner, user, distributor,
3700     originator, pointOfContact, principalInvestigator, processor, publisher, author} - NAP expands
3701     with {collaborator, editor, mediator, rightsHolder}.  -->
3702                <!-- NAP example -->
3703                <!--
3704                <gmd:CI_RoleCode
3705                  codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
3706                  codeListValue="RI_408">resourceProvider</gmd:CI_RoleCode>
3707                -->
3708                <!-- ISO example -->
3709                <gmd:CI_RoleCode
3710
3711       codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
3712     Codelist/gmxCodelists.xml#CI_RoleCode"
3713                  codeListValue="resourceProvider">resource provider</gmd:CI_RoleCode>
3714              </gmd:role>
3715            </gmd:CI_ResponsibleParty>
3716          </gmd:citedResponsibleParty>
3717          <!-- (O-O) Resource Presentation Form - The form in which the service is available,
3718     which in the case of a service is only through the service implementation described by the
3719     metadata record, so the information here is not generally very useful. Note that the citation is
3720     to the original source of intellectual content in the described resource should be in
3721     MD_DataIdentification/citation/CI_Citation that describes the datasets operated on by the
3722     service. -->
3723          <!--
3724          <gmd:presentationForm gco:nilReason="not applicable"/>
3725          -->
3726          <!-- (O-O) Resource series - Information about the series or collection of which the
3727     cited service is a part. NAP rule: (name + issueIdentification) > 0. At this point there is not
3728     much precedent for aggregating services into a formal series, so in general this element is
3729     probably not applicable to services. -->
```

```
3730              <!--
3731              <gmd:series/>
3732              -->
3733              <!-- (O-O) Resource other citation details -->
3734              <!--
3735              <gmd:otherCitationDetails/>
3736              -->
3737              <!-- (O-C) Resource collective title - At this point there is not much precedent for
3738       aggregating services into a collections, so in general this element is probably not applicable to
3739       services. -->
3740              <!--
3741              <gmd:collectiveTitle/>
3742              -->
3743           </gmd:CI_Citation>
3744         </gmd:citation>
3745         <!-- (M-M) Resource Abstract - A free text summary of the content, significance, purpose,
3746       scope, etc. of the resource. Exactly one value. -->
3747         <gmd:abstract>
3748           <gco:CharacterString>A collection of Web Map Service (WMS) layers created and maintained
3749       by the Arizona Geological Survey.</gco:CharacterString>
3750         </gmd:abstract>
3751         <!-- (O-O) Resource purpose - Summary of the intentions for which the service was
3752       developed, including objectives for creating the service and use cases it is designed to support.
3753       -->
3754         <gmd:purpose>
3755           <gco:CharacterString>To provide geologic data for the state of Arizona at 1:1,000,000
3756       scale online and free-of-charge.</gco:CharacterString>
3757         </gmd:purpose>
3758         <!-- (M-M) Resource Status -  -->
3759         <gmd:status>
3760           <!-- MD_ProgressCode names: {completed, historicalArchive, obsolete, onGoing, planned,
3761       required, underDevelopment} - NAP expands with {proposed}. Obsolete is synonymous with
3762       deprecated. -->
3763           <!-- NAP Example -->
3764           <!--
3765           <gmd:MD_ProgressCode
3766             codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_106"
3767             codeListValue="RI_593">completed</gmd:MD_ProgressCode>
3768           -->
3769           <!-- ISO Example -->
3770           <gmd:MD_ProgressCode
3771
3772     codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
3773       Codelist/gmxCodelists.xml#MD_ProgressCode"
3774           codeListValue="completed">completed</gmd:MD_ProgressCode>
3775         </gmd:status>
3776         <!-- (O-C) Resource service point of contact (access contact) - CI_ResponsibleParty element
3777       here would contain information for point of contact to access the resource. This information is
3778       mandatory for physical resources such as core, cuttings, samples, manuscripts. -->
3779         <gmd:pointOfContact>
3780           <!-- CI Responsible party has an id in order to allow reuse of this element later in the
3781       document by an internal href; see distributionInfo/../distributor near end of document -->
3782           <gmd:CI_ResponsibleParty>
3783             <!-- (M-M) (individualName + organisationName + positionName) > 0 -->
3784             <gmd:individualName>
3785               <gco:CharacterString>Ryan Clark</gco:CharacterString>
3786             </gmd:individualName>
3787             <gmd:organisationName>
3788               <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
3789             </gmd:organisationName>
3790             <gmd:positionName>
3791               <gco:CharacterString>GIS Manager</gco:CharacterString>
3792             </gmd:positionName>
3793             <!-- (O-C) Contact Information - If a resource point of contact is required then (phone
3794       + deliveryPoint + electronicMailAddress) > 0. Best practice is to include at least an email
3795       address. -->
3796             <gmd:contactInfo>
3797               <gmd:CI_Contact>
3798                 <gmd:phone>
3799                   <gmd:CI_Telephone>
3800                     <gmd:voice>
3801                       <gco:CharacterString>520-770-3500</gco:CharacterString>
```

```
3802              </gmd:voice>
3803              <gmd:facsimile>
3804                <gco:CharacterString>520-770-3505</gco:CharacterString>
3805              </gmd:facsimile>
3806            </gmd:CI_Telephone>
3807          </gmd:phone>
3808          <gmd:address>
3809            <gmd:CI_Address>
3810              <gmd:deliveryPoint>
3811                <gco:CharacterString>416 W. Congress St. Suite 100</gco:CharacterString>
3812              </gmd:deliveryPoint>
3813              <gmd:city>
3814                <gco:CharacterString>Tucson</gco:CharacterString>
3815              </gmd:city>
3816              <gmd:administrativeArea>
3817                <gco:CharacterString>Arizona</gco:CharacterString>
3818              </gmd:administrativeArea>
3819              <gmd:postalCode>
3820                <gco:CharacterString>85701</gco:CharacterString>
3821              </gmd:postalCode>
3822              <gmd:country>
3823                <gco:CharacterString>USA</gco:CharacterString>
3824              </gmd:country>
3825              <gmd:electronicMailAddress>
3826                <gco:CharacterString>ryan.clark@azgs.az.gov</gco:CharacterString>
3827              </gmd:electronicMailAddress>
3828            </gmd:CI_Address>
3829          </gmd:address>
3830          <!--(O-O)  "Information about Internet hosted resources: availability; URL; protocol
3831   used; resource name; resource description, and resource function." NAP -->
3832          <gmd:onlineResource>
3833            <gmd:CI_OnlineResource>
3834              <gmd:linkage>
3835                <gmd:URL>http://75.101.143.247:8080/gsvr/wms</gmd:URL>
3836              </gmd:linkage>
3837              <gmd:protocol>
3838                <gco:CharacterString>http</gco:CharacterString>
3839              </gmd:protocol>
3840            </gmd:CI_OnlineResource>
3841          </gmd:onlineResource>
3842        </gmd:CI_Contact>
3843      </gmd:contactInfo>
3844      <!-- (M-M) ISO 19139 Mandatory: contact role - Guidance on use of role codes would be
3845   helpful for consistency, but has not been developed as yet. -->
3846      <gmd:role>
3847        <!-- CI RoleCode names: {resourceProvider, custodian, owner, user, distributor,
3848   originator, pointOfContact, principalInvestigator, processor, publisher, author} - NAP expands
3849   with {collaborator, editor, mediator, rightsHolder}.  -->
3850        <!-- NAP example -->
3851        <!--
3852        <gmd:CI_RoleCode
3853          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
3854          codeListValue="RI_414">pointOfContact</gmd:CI_RoleCode>
3855        -->
3856        <!-- ISO example -->
3857        <gmd:CI_RoleCode
3858
3859   codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
3860   Codelist/gmxCodelists.xml#CI_RoleCode"
3861          codeListValue="pointOfContact">point of contact</gmd:CI_RoleCode>
3862      </gmd:role>
3863    </gmd:CI_ResponsibleParty>
3864  </gmd:pointOfContact>
3865  <!-- (O-O) Resource Maintenance - This element provides information about the maintenance
3866   schedule or history of the service described by the metadata record. For a service, only one
3867   MD_MaintenanceInformation elements may be included; for which the MD_ScopeDescription
3868   napMD ScopeCode will be 'service'. If MD MaintenanceInformation is present, then
3869   maintenanceAndUpdateFrequency is mandatory.  -->
3870  <gmd:resourceMaintenance>
3871    <gmd:MD_MaintenanceInformation>
3872      <gmd:maintenanceAndUpdateFrequency>
```

```
3873             <!-- MD_MaintenanceFrequencyCode names: {continual, daily, weekly, fortnightly,
3874    monthly, quarterly, biannually, annually, asNeeded, irregular, not-Planned, unknown} - NAP
3875    expands with {semimonthly}. -->
3876             <!-- NAP Example -->
3877             <!--
3878             <gmd:MD_MaintenanceFrequencyCode
3879               codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_102"
3880               codeListValue="RI_540">asNeeded</gmd:MD_MaintenanceFrequencyCode>
3881             -->
3882             <!-- ISO Example -->
3883             <gmd:MD_MaintenanceFrequencyCode
3884
3885      codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
3886    Codelist/gmxCodelists.xml#MD_MaintenanceFrequencyCode"
3887               codeListValue="asNeeded">as needed</gmd:MD_MaintenanceFrequencyCode>
3888           </gmd:maintenanceAndUpdateFrequency>
3889         </gmd:MD_MaintenanceInformation>
3890       </gmd:resourceMaintenance>
3891       <!-- (O-O) Graphic overview of resource - Highly recommended to include a small image
3892    visual representation of the resource provided by a map or image service. For geographic feature
3893    or data services, a graphic overview might show the geographic distribution of available data.
3894    If MD_BrowseGraphic is included, MD_BrowseGraphic/filename character string is mandatory. USGIN
3895    Recommended practice is to provide a complete URL as a gco:characterString value for the filename
3896    property.  -->
3897       <!--
3898       <gmd:graphicOverview/>
3899       -->
3900       <!-- (O-X) Resource Format - This element is not used by USGIN; this information is encoded
3901    in MD_Metadata/distributionInfo/MD_Distribution/ in USGIN metadata. -->
3902       <!--
3903       <gmd:resourceFormat>
3904       -->
3905       <!-- (O-O) Resource keywords - Best Practice for USGIN profile metadata is to supply
3906    keywords to facilitate the discovery of metadata records relevant to the user. USGIN requires
3907    that MD_Keyword/keyword contain a CharacterString. USGIN best practice is to include keywords in
3908    English -->
3909       <!-- Theme keywords -->
3910       <gmd:descriptiveKeywords>
3911         <gmd:MD_Keywords>
3912           <gmd:keyword>
3913             <gco:CharacterString>WMS</gco:CharacterString>
3914           </gmd:keyword>
3915           <gmd:keyword>
3916             <gco:CharacterString>GEOSERVER</gco:CharacterString>
3917           </gmd:keyword>
3918           <gmd:keyword>
3919             <gco:CharacterString>AZGS</gco:CharacterString>
3920           </gmd:keyword>
3921           <gmd:keyword>
3922             <gco:CharacterString>GEOLOGY</gco:CharacterString>
3923           </gmd:keyword>
3924           <!-- Keyword Type - allowed values from MD_KeywordTypeCode names: {discipline, place,
3925    stratum, temporal, theme} - NAP expands with {product, subTopicCategory}. -->
3926           <gmd:type>
3927             <!-- NAP Example -->
3928             <!--
3929             <gmd:MD_KeywordTypeCode
3930               codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_101"
3931               codeListValue="RI_528">theme</gmd:MD_KeywordTypeCode>
3932             -->
3933             <!-- ISO Example -->
3934             <gmd:MD_KeywordTypeCode
3935
3936      codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
3937    Codelist/gmxCodelists.xml#MD_KeywordTypeCode"
3938               codeListValue="theme">theme</gmd:MD_KeywordTypeCode>
3939           </gmd:type>
3940         </gmd:MD_Keywords>
3941       </gmd:descriptiveKeywords>
3942       <!-- Temporal keywords -->
3943       <!--
3944       <gmd:descriptiveKeywords/>
```

```
3945            -->
3946         <!-- Place keywords -->
3947         <gmd:descriptiveKeywords>
3948           <gmd:MD_Keywords>
3949             <gmd:keyword>
3950               <gco:CharacterString>ARIZONA</gco:CharacterString>
3951             </gmd:keyword>
3952             <!-- Keyword Type - allowed values from MD_KeywordTypeCode names: {discipline, place,
3953     stratum, temporal, theme} - NAP expands with {product, subTopicCategory}. -->
3954             <gmd:type>
3955               <!-- NAP Example -->
3956               <!--
3957               <gmd:MD_KeywordTypeCode
3958                 codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_101"
3959                 codeListValue="RI_525">place</gmd:MD_KeywordTypeCode>
3960               -->
3961               <!-- ISO Example -->
3962               <gmd:MD_KeywordTypeCode
3963
3964     codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
3965     Codelist/gmxCodelists.xml#MD_KeywordTypeCode"
3966                 codeListValue="place">place</gmd:MD_KeywordTypeCode>
3967             </gmd:type>
3968           </gmd:MD_Keywords>
3969         </gmd:descriptiveKeywords>
3970         <!-- (O-X) Resource specific usage - NAP excludes this property in INCITS 453, figure 64
3971     p.175, but it is schema valid under
3972     http://schemas.opengis.net/iso/19139/20060504/serviceMetadata.xsd, which is the service metadata
3973     schema imported by apiso.xsd for the OGC CSW profile for ISO19115/19 metadata. Property not USED
3974     by USGIN. -->
3975         <!--
3976         <gmd:resourceSpecificUsage/>
3977         -->
3978         <!-- (O-O) Condition applying to access and use of resource - Restrictions on the access
3979     and use of a service. Follow NAP for specification of resourceConstraints. This attribute
3980     provides information for access control to the described service. In some situations, the
3981     metadataConstraints may allow a user to learn of the existence of a resource that they may not
3982     actually be able to access without further clearance. Follow NAP for specification of
3983     resourceConstraints. -->
3984         <gmd:resourceConstraints>
3985           <gmd:MD_LegalConstraints>
3986             <gmd:useLimitation>
3987               <gco:CharacterString>Read only</gco:CharacterString>
3988             </gmd:useLimitation>
3989             <gmd:accessConstraints>
3990
3991               <!-- MD_RestrictionCode names: {copyright, patent, patentPending, trademark, license,
3992     intellectualPropertyRights, restricted, otherRestrictions} - NAP expands with
3993     {licenseUnrestricted, licenseEndUser, licenseDistributor, privacy, statutory, confidential,
3994     sensitivity}. -->
3995               <!-- NAP Example -->
3996               <!--
3997               <gmd:MD_RestrictionCode
3998                 codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_107"
3999                 codeListValue="RI_602">copyright</gmd:MD_RestrictionCode>
4000               -->
4001               <!-- ISO Example -->
4002               <gmd:MD_RestrictionCode
4003
4004     codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
4005     Codelist/gmxCodelists.xml#MD_RestrictionCode"
4006                 codeListValue="copyright">copyright</gmd:MD_RestrictionCode>
4007             </gmd:accessConstraints>
4008             <gmd:otherConstraints>
4009               <gco:CharacterString>NONE</gco:CharacterString>
4010             </gmd:otherConstraints>
4011           </gmd:MD_LegalConstraints>
4012         </gmd:resourceConstraints>
4013         <!-- (O-X) Aggregation information - The citation for the aggregate service or the name of
4014     the aggregate service, the type of aggregate service, and optionally the activity which produced
4015     the service. The citation for or name of an aggregate dataset, the type of aggregate dataset, and
4016     optionally the activity which produced the dataset. For USGIN profile, this property, rather than
```

```
4017   MD_Metadata/parentIdentifier, should be used to indicate relationships between described
4018   resources. -->
4019        <!--
4020        <gmd:aggregationInfo/>
4021        -->
4022        <!-- (M-M) Service type - Choose a service type name from a registry of services. USGIN
4023   mandates use of a LocalName value from the service type listing in the ServiceType section of the
4024   USGIN ISO19139 profile document, with the codespace http://resources.usgin.org/registry/
4025   serviceType201001  -->
4026        <srv:serviceType>
4027          <!-- Valid values for OGC services would be then {<WMS, WFS, WVS, CSW, …}  -->
4028          <gco:LocalName
4029   codeSpace="http://resources.usgin.org/registry/serviceType201001">WMS</gco:LocalName>
4030
4031        </srv:serviceType>
4032        <!-- (O-C) Resource service type version - Multiple serviceTypeVersion tags may not be
4033   implemented in applications - USGIN recommends a reverse chronological order for supported
4034   versions. Constraint: if various versions are available, mandatory to list versions that are
4035   supported. Default is oldest version of service. -->
4036        <srv:serviceTypeVersion>
4037          <gco:CharacterString>1.3.0</gco:CharacterString>
4038        </srv:serviceTypeVersion>
4039        <srv:serviceTypeVersion>
4040          <gco:CharacterString>1.1.3</gco:CharacterString>
4041        </srv:serviceTypeVersion>
4042        <srv:serviceTypeVersion>
4043          <gco:CharacterString>1.1.1</gco:CharacterString>
4044        </srv:serviceTypeVersion>
4045        <!-- (O-O) Resource service access properties - Information on the availability of the
4046   service which includes attributes from Standard Order Process. Applicable sub elements for
4047   service are: fees, and available date and time. -->
4048        <!--
4049        <srv:accessProperties/>
4050        -->
4051        <!-- (O-X) Resource service restrictions - Not used by USGIN; use resourceConstraints as
4052   per NAP. -->
4053        <!--
4054        <srv:restrictions/>
4055        -->
4056        <!-- (O-X) Keywords - Not used by USGIN; use descriptiveKeywords as per NAP -->
4057        <!--
4058        <srv:keywords/>
4059        -->
4060
4061        <!-- (C-C) Service Extent - Defines the spatial (horizontal and vertical) and temporal
4062   region to which the content of the resource applies. For USGIN, the spatial extent is a rectangle
4063   that bounds the geographic extent to which resource content applies. Best Practice for USGIN is
4064   to include an extent for any resource with content related to some geographic or temporal
4065   location. For geoscience resources, the temporal extent may be expressed using time ordinal eras
4066   from a geologic time scale if the resource is related to some particular geologic time. USGIN
4067   specifies count(description + geographicElement + temporalElement) >0  -->
4068        <srv:extent>
4069          <gmd:EX_Extent>
4070            <!-- (C-C) Resource Content extent description - Free text that describes the spatial
4071   and temporal extent of the dataset. USGIN specifies that description is mandatory if a
4072   geographicElement or temporalElement is not provided. Note that if geographic place names are
4073   used to express the geographic extent, USGIN profile specifies that these should be encoded using
4074   keyword with keyword type code = 'place.' Geographic names may be duplicated in the
4075   EX_Extent/description. -->
4076            <!--
4077            <gmd:description/>
4078            -->
4079            <!-- (O-C) Resource content extent bounding box -USGIN profile requires that if an
4080   EX_Extent/geographicElement is supplied, it include a geographic bounding box with bounding
4081   latitude and longitude expressed using WGS 84 decimal degrees.
4082   The corner coordinates for the geographic bounding box must not coincide in one point, because
4083   this may result in fatal errors with some CSW implementations. Point locations must thus be
4084   represented as tiny rectangles. USGIN recommended practice is to place the actual point location
4085   in the lower left corner of the rectangle. -->
4086            <gmd:geographicElement>
4087              <gmd:EX_GeographicBoundingBox>
4088                <gmd:westBoundLongitude>
```

```
4089                        <gco:Decimal>-114.815</gco:Decimal>
4090                      </gmd:westBoundLongitude>
4091                      <gmd:eastBoundLongitude>
4092                        <gco:Decimal>-108.984</gco:Decimal>
4093                      </gmd:eastBoundLongitude>
4094                      <gmd:southBoundLatitude>
4095                        <gco:Decimal>31.25</gco:Decimal>
4096                      </gmd:southBoundLatitude>
4097                      <gmd:northBoundLatitude>
4098                        <gco:Decimal>37.004</gco:Decimal>
4099                      </gmd:northBoundLatitude>
4100                    </gmd:EX_GeographicBoundingBox>
4101                  </gmd:geographicElement>
4102            <!-- (C-X) Resource content extent geographic description - Not used by USGIN profile,
4103      use keyword with type code = 'place' (with thesaurus if necessary). -->
4104            <!--
4105            <gmd:geographicElement>
4106              <gmd:EX_GeographicDescription/>
4107            </gmd:geographicElement>
4108            -->
4109            <!-- (C-X) Resource content extent bounding polygon - To improve interoperability, USGIN
4110      mandates use of Geographic Bounding Box; bounding polygons may be present, but may be ignored by
4111      harvesters. -->
4112            <!--
4113            <gmd:geographicElement>
4114              <gmd:EX_BoundingPolygon/>
4115            </gmd:geographicElement>
4116            -->
4117            <!-- (O-O) Resource temporal extent  -->
4118            <!--
4119            <gmd:extent>
4120              <gmd:EX_Extent>
4121                <gmd:temporalElement>
4122                  <gmd:EX_TemporalExtent>
4123                    <gmd:extent>
4124                      --><!-- Default ISO time frame example --><!--
4125                      <gml:TimePeriod gml:id="IdModern">
4126                        <gml:name>Y2KX</gml:name>
4127                        --><!-- USGIN requires the beginPosition and endPosition's frame property to
4128      be defined. The default value is #ISO-8601. --><!--
4129                        <gml:beginPosition frame="#ISO-8601">2010-01-00T00:00:00</gml:beginPosition>
4130                        <gml:endPosition frame="#ISO-8601">2010-12-31T24:00:00</gml:endPosition>
4131                      </gml:TimePeriod>
4132                      --><!-- Geologic time frame example --><!--
4133                      <gml:TimePeriod gml:id="IdJurassic">
4134                        <gml:name>Jurassic</gml:name>
4135                        --><!-- USGIN requires the beginPosition and endPosition's frame property to
4136      be defined. The default value is #ISO-8601. --><!--
4137                        <gml:beginPosition
4138      frame="urn:cgi:trs:CGI:StandardGeologicTimeMa">203</gml:beginPosition>
4139                        <gml:endPosition frame="urn:cgi:trs:CGI:StandardGeologicTimeMa
4140      ">135</gml:endPosition>
4141                      </gml:TimePeriod>
4142                    </gmd:extent>
4143                  </gmd:EX_TemporalExtent>
4144                </gmd:temporalElement>
4145              </gmd:EX_Extent>
4146            </gmd:extent>
4147            -->
4148            <!-- (O-X) Resource spatio-temporal extent - Not used. Although use of
4149      EX_SpatialTemporalExtent is allowed by ISO19139 and NAP, USGIN mandates encoding space time
4150      location with EX_TemporalExtent and EX_GeographicBoundingBox. -->
4151            <!--
4152            <gmd:extent>
4153              <gmd:EX_Extent>
4154                <gmd:temporalElement>
4155                  <gmd:EX_SpatialTemporalExtent/>
4156                </gmd:temporalElement>
4157              </gmd:EX_Extent>
4158            </gmd:extent>
4159            -->
4160            <!-- (O-O) Resource service vertical extent  -->
```

```
4161            <!--
4162            <gmd:verticalElement>
4163              <gmd:EX VerticalExtent>
4164                <gmd:minimumValue>
4165                  <gco:Real>-100</gco:Real>
4166                </gmd:minimumValue>
4167                <gmd:maximumValue>
4168                  <gco:Real>200</gco:Real>
4169                </gmd:maximumValue>
4170            --><!-- Use EPSG register of geodetic parameters such as at http://www.epsg-
4171    registry.org/. The default VerticalCRS is World mean sea level (MSL): urn:ogc:def:crs:EPSG::5714
4172    --><!--
4173                <gmd:verticalCRS xlink:href="urn:ogc:def:crs:EPSG::5714 "/>
4174              </gmd:EX_VerticalExtent>
4175            </gmd:verticalElement>
4176            -->
4177          </gmd:EX Extent>
4178        </srv:extent>
4179        <!-- (O-O) Coupled Resources - This element correlates operations (identified by
4180    operationName) with datasets (identified by identifier). For logical consistency
4181    SV coupledResource/identifier values should be equal to
4182    MD_DataIdentification/citation/CI_Citation/identifier/MD_Identifier/code for a dataset that is
4183    the target of a SV ServiceIdentification/operatesOn element (either in an inline
4184    MD_DataIdentification/citation../code element, or a @uuidref attribute). This element is
4185    necessary to implement the many-to-many relationship between data sources and operations in a
4186    single service. -->
4187        <!-- NOTE: This is an example for TIGHTLY coupled resources with EXPLICIT links. This means
4188    that the example resource service's WMS layers are described in existing and separate metadata
4189    records. -->
4190        <srv:coupledResource>
4191          <srv:SV_CoupledResource>
4192            <!-- (M-M) Coupled resource operation name - Name of the service operation: GetMap,
4193    GetFeature, etc. -->
4194            <srv:operationName>
4195              <gco:CharacterString>GetMap</gco:CharacterString>
4196            </srv:operationName>
4197            <!-- (M-M) Coupled Resource identifier  - Identifier of a given tightly coupled dataset.
4198    Equal to MD DataIdentification/citation/CI Citation/identifier/MD Identifier/code for a dataset
4199    that is the target of a SV ServiceIdentification/operatesOn element (either in an inline
4200    MD DataIdentification/citation../code element, or a @uuidref attribute).  -->
4201            <srv:identifier>
4202              <gco:CharacterString>8215ed91-6c92-4ae9-b094-8b58ddd5e7e0</gco:CharacterString>
4203            </srv:identifier>
4204            <!-- (X-O) Coupled Resource scoped name - OGC 07-045 application profile for ISO
4205    metadata using CSW 2.0.2 extends SV_CoupledResource with a ScopedName, defined as a scoped
4206    identifier of the resource in the context of the given service instance (e.g. layer name or
4207    featureTypeName). This is necessary for users to generate service requests (like GetMap
4208    or GetFeature) based on ISO service metadata. Note that if multiple WMS layers are related to a
4209    single dataset, separate coupledResource elements are required for each layer because the
4210    cardinality of ScopedName here is 0 or 1.-->
4211            <gco:ScopedName>azgs:trace_nonmetals_earthchem</gco:ScopedName>
4212          </srv:SV_CoupledResource>
4213        </srv:coupledResource>
4214        <srv:coupledResource>
4215          <srv:SV CoupledResource>
4216            <srv:operationName>
4217              <gco:CharacterString>GetMap</gco:CharacterString>
4218            </srv:operationName>
4219            <srv:identifier>
4220              <gco:CharacterString>55932c11-67d6-4414-8a5f-a45f7dc3ecf6</gco:CharacterString>
4221            </srv:identifier>
4222            <gco:ScopedName>azgs:trace_metals_earthchem</gco:ScopedName>
4223          </srv:SV CoupledResource>
4224        </srv:coupledResource>
4225        <srv:coupledResource>
4226          <srv:SV_CoupledResource>
4227            <srv:operationName>
4228              <gco:CharacterString>GetMap</gco:CharacterString>
4229            </srv:operationName>
4230            <srv:identifier>
4231              <gco:CharacterString>8504f947-39d6-4c1f-a4fa-672534f94856</gco:CharacterString>
4232            </srv:identifier>
```

```
4233          <gco:ScopedName>azgs:trace_alk_alkearth_earthchem</gco:ScopedName>
4234        </srv:SV_CoupledResource>
4235      </srv:coupledResource>
4236      <srv:coupledResource>
4237        <srv:SV_CoupledResource>
4238          <srv:operationName>
4239            <gco:CharacterString>GetMap</gco:CharacterString>
4240          </srv:operationName>
4241          <srv:identifier>
4242            <gco:CharacterString>4dbd380c-7ba4-49d6-b34c-7f9415dde6f0</gco:CharacterString>
4243          </srv:identifier>
4244          <gco:ScopedName>azgs:ree_earthchem</gco:ScopedName>
4245        </srv:SV_CoupledResource>
4246      </srv:coupledResource>
4247      <srv:coupledResource>
4248        <srv:SV_CoupledResource>
4249          <srv:operationName>
4250            <gco:CharacterString>GetMap</gco:CharacterString>
4251          </srv:operationName>
4252          <srv:identifier>
4253            <gco:CharacterString>a3120268-1fb4-496a-84cc-c3a02dd0be16</gco:CharacterString>
4254          </srv:identifier>
4255          <gco:ScopedName>ncgmp:mapunitpolys</gco:ScopedName>
4256        </srv:SV_CoupledResource>
4257      </srv:coupledResource>
4258      <srv:coupledResource>
4259        <srv:SV_CoupledResource>
4260          <srv:operationName>
4261            <gco:CharacterString>GetMap</gco:CharacterString>
4262          </srv:operationName>
4263          <srv:identifier>
4264            <gco:CharacterString>39d94525-b1d6-494f-a739-357088e5a2e9</gco:CharacterString>
4265          </srv:identifier>
4266          <gco:ScopedName>azgs:earthfissures</gco:ScopedName>
4267        </srv:SV_CoupledResource>
4268      </srv:coupledResource>
4269      <srv:coupledResource>
4270        <srv:SV_CoupledResource>
4271          <srv:operationName>
4272            <gco:CharacterString>GetMap</gco:CharacterString>
4273          </srv:operationName>
4274          <srv:identifier>
4275            <gco:CharacterString>13ce1e84-c887-4fd8-b888-8d021b1fa4c2</gco:CharacterString>
4276          </srv:identifier>
4277          <gco:ScopedName>azgs:azgeochron</gco:ScopedName>
4278        </srv:SV_CoupledResource>
4279      </srv:coupledResource>
4280      <!-- (M-M) Service coupling type - Type of coupling between service and associated data (if
4281 exists) - "Qualitative information on the tightness with which the service and the associated
4282 data are coupled." NAP.  -->
4283      <!-- According to ISO: -->
4284      <!--  1) loose - service instance is loosely coupled with a data instance, i.e. no
4285 MD_DataIdentification class has to be described (ISO 19119). -->
4286      <!--  2) mixed - service instance is mixed coupled with a data instance, i.e.
4287 MD_DataIdentification describes the associated data instance and additionally the service
4288 instance might work with other external data instances (ISO 19119 / ISO 19115). -->
4289      <!--  3) tight - service instance is tightly coupled with a data instance, i.e.
4290 MD_DataIdentification class MUST be described. (ISO 19119 / ISO 19115) -->
4291      <!-- According to OGC: -->
4292      <!--  1) loose - A service instance that is not associated with a specific dataset or
4293 dataset collection. Loosely coupled services may have an association with data types through the
4294 service type definition. Dataset metadata need not be provided in the service metadata. -->
4295      <!--  2) mixed - A service that is associated with a specific dataset or dataset collection.
4296 Service metadata shall describe both the service and the geographic dataset, the latter being
4297 defined in accordance with ISO 19115. But this service instance can also be used with external
4298 data (i.e. data that is not described by the operatesOn association). -->
4299      <!--  3) tight - An information resource that is hosted on a specific set of hardware and
4300 accessible over a network. -->
4301      <srv:couplingType>
4302        <!-- SV_CouplingType names: {loose, mixed, tight} -->
4303        <!-- NAP Example -->
4304        <!--
```

```
4305            <srv:SV_CouplingType
4306              codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_114"
4307              codeListValue="RI_685">tight</srv:SV_CouplingType>
4308            -->
4309            <!-- ISO Example -->
4310            <srv:SV_CouplingType
4311
4312    codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
4313    Codelist/gmxCodelists.xml#SV_CouplingType"
4314              codeListValue="tight">tight</srv:SV_CouplingType>
4315        </srv:couplingType>
4316        <!--***-->
4317        <!-- (M-M) Service operation - "Operations performed by the service" NAP. Each
4318    SV_OperationMetadata element describes the signature of one and only one method provided by the
4319    service. -->
4320        <!-- See WMS GetCapabilities for operation metadata -->
4321        <srv:containsOperations gco:nilReason="missing"/>
4322        <!-- (O-C) Service operates on - "Provides information on the datasets that the service
4323    operates on" ISO 19119. With tightly coupled references, operatesOn must  include a map or
4324    feature layer's valid MD_DataIdentification element inline or a @uuidref attribute value that
4325    explicitly links to an existing dataset metadata record that describes the same layer. Mandatory
4326    if linkage to datasets on which the service operates are available. The value of
4327    SV_ServiceIdentification/operatesOn@uuidref or
4328    SV_ServiceIdentification/operatesOn/MD_DataIdentification/citation/CI_Citation/identifier/MD_Iden
4329    tifier/code must correspond to one of the coupledResource/MD_CoupledResource/identifier values.
4330    If the metadata record for the coupled dataset is a separate gmd:MD_Metadata record, the service
4331    described in the service metadata record should be identified as a distribution for the dataset.
4332    -->
4333        <!-- NOTE:  In this explicitly linked reference example, the uuidref property must point to
4334    an existing (already loaded) CSW metadata record! -->
4335        <srv:operatesOn
4336          uuidref="13ce1e84-c887-4fd8-b888-8d021b1fa4c2"
4337          xlink:href="http://resources.azgs.org/geonetwork/srv/en/metadata.show?id=8717"
4338          xlink:title="azgs:azgeochron"/>
4339        <srv:operatesOn
4340          uuidref="39d94525-b1d6-494f-a739-357088e5a2e9"
4341          xlink:href="http://resources.azgs.org/geonetwork/srv/en/metadata.show?id=8718"
4342          xlink:title="azgs:earthfissures"/>
4343        <srv:operatesOn
4344          uuidref="a3120268-1fb4-496a-84cc-c3a02dd0be16"
4345          xlink:href="http://resources.azgs.org/geonetwork/srv/en/metadata.show?id=8719"
4346          xlink:title="ncgmp:mapunitpolys"/>
4347        <srv:operatesOn
4348          uuidref="4dbd380c-7ba4-49d6-b34c-7f9415dde6f0"
4349          xlink:href="http://resources.azgs.org/geonetwork/srv/en/metadata.show?id=8720"
4350          xlink:title="azgs:ree_earthchem"/>
4351        <srv:operatesOn
4352          uuidref="8504f947-39d6-4c1f-a4fa-672534f94856"
4353          xlink:href="http://resources.azgs.org/geonetwork/srv/en/metadata.show?id=8721"
4354          xlink:title="azgs:trace_alk_alkearth_earthchem"/>
4355        <srv:operatesOn
4356          uuidref="55932c11-67d6-4414-8a5f-a45f7dc3ecf6"
4357          xlink:href="http://resources.azgs.org/geonetwork/srv/en/metadata.show?id=8722"
4358          xlink:title="azgs:trace_metals_earthchem"/>
4359        <srv:operatesOn
4360          uuidref="8215ed91-6c92-4ae9-b094-8b58ddd5e7e0"
4361          xlink:href="http://resources.azgs.org/geonetwork/srv/en/metadata.show?id=8723"
4362          xlink:title="azgs:trace_nonmetals_earthchem"/>
4363      </srv:SV_ServiceIdentification>
4364    </gmd:identificationInfo>
4365    <!--*******************-->
4366    <!-- (O-O) Content information - Characteristics describing the feature cataloguecatalog,
4367    coverage, or image data. USGIN currently makes no recommendation for use of contentInfo; follow
4368    NAP recommendations (see INCITS 453). -->
4369      <!--
4370      <gmd:contentInfo gco:nilReason="missing"/>
4371      -->
4372    <!-- (O-O) Resource distribution information - This element provides information to inform
4373    users how to obtain or access the described resource.  For service metadata, the only
4374    distribution is the interface offered by the described service. The distributionFormat is nil
4375    because the format depends on the operation and request. TransferOptions is used to provide the
4376    URL's for accessing the service and a serviceDescription resource (WSDL, getCapabilities, web
```

```
4377   page..). Distributor is used to identify the agent that is responsible for hosting the service. -
4378   ->
4379    <gmd:distributionInfo>
4380     <gmd:MD_Distribution>
4381       <!-- (O-O)  Resource distribution format - Information on the format or physical
4382   manifestation of the resource. If the resource is a physical resource, like a book, rock sample,
4383   paper document, the distributionFormat/MD_Format/name is mandatory, and must be from the USGIN
4384   distribution format codelist. In the case of a service, the format information is operation and
4385   request dependent.-->
4386       <!--
4387       <gmd:distributionFormat gco:nilReason="missing"/>
4388       -->
4389       <!-- (O-C) Resource distributor information - For a service, the distributor element
4390   identifies the agent that is responsible for hosting the service, probably the same as the
4391   CI_ResponsibleParty for the service identification citation. -->
4392       <!-- in this example, the distributor is the same as the metadata point of contact, so the
4393   CI_Responsible party is included by reference to the element earlier in the document -->
4394       <gmd:distributor>
4395         <gmd:MD_Distributor>
4396           <gmd:distributorContact xlink:href="#R264537"/>
4397         </gmd:MD_Distributor>
4398       </gmd:distributor>
4399       <!-- (C-C) Resource distribution transfer options - MD_DigitalTransferOptions provides
4400   information on digital distribution of resource. See USGIN Profile 'Use of MD_Distribution and
4401   MD_Distributor' for instructions on use of this element. Details on encoding for
4402   MD_DigitalTransferOptions are above in the distributorTransferOptions elements description.  -->
4403       <gmd:transferOptions>
4404         <gmd:MD_DigitalTransferOptions>
4405           <!-- Two online elements are included, one for the serviceDescription and one for the
4406   baseURL, which in this case is the full URL for the OGC getCapabilities document -->
4407           <gmd:onLine>
4408             <gmd:CI_OnlineResource>
4409               <!-- (M-M) Resource distributor on-line distribution linkage - Digital transfer
4410   options are "technical means and media by which a dataset is obtained from the distributor." NAP
4411   requires CI_OnlineResource/linkage and CI_OnlineResource/protocol in CI_OnlineResource. -->
4412               <gmd:linkage>
4413                 <!-- This linkage element contains the complete URL to access the getCapabilities
4414   document directly. If the service is described by a WSDL document, this would be a URL for the
4415   WSDL description of service operation. CI_Online-Resource requires a Linkage element that is a
4416   gmd:URL. -->
4417                 <gmd:URL>http://75.101.143.247:8080/gsvr/wms?SERVICE=WMS&amp;
4418   http://75.101.143.247:8080/gsvr/wms?SERVICE=WMS&amp;</gmd:URL>
4419               </gmd:linkage>
4420               <!-- The protocol element defines a valid internet protocol used to access the
4421   resource. NAP recommended best practice is that the protocol should be taken from an official
4422   controlled list such as the Official Internet Protocol Standards published on the Web at
4423   http://www.rfc-editor.org/rfcxx00.html or the Internet Assigned Numbers Authority (IANA) at
4424   http://www.iana.org/numbers.html.  'ftp' or 'http' are common values. -->
4425               <gmd:protocol>
4426                 <gco:CharacterString>http</gco:CharacterString>
4427               </gmd:protocol>
4428               <!-- Linkage names for service URL's are from "Linkage name conventions" section in
4429   the USGIN ISO19139 profile document.  -->
4430               <gmd:name>
4431                 <gco:CharacterString>serviceDescription</gco:CharacterString>
4432               </gmd:name>
4433               <!-- Service Description -->
4434               <gmd:description>
4435                 <gco:CharacterString>Full URL to request the OGC getCapabilities document. This is
4436   the mechanism used to acquire detailed operation description for USGIN
4437   metadata.</gco:CharacterString>
4438               </gmd:description>
4439             </gmd:CI_OnlineResource>
4440           </gmd:onLine>
4441           <gmd:onLine>
4442             <gmd:CI_OnlineResource>
4443               <!-- (M-M) Resource distributor on-line distribution linkage - Digital transfer
4444   options are ""technical means and media by which a dataset is obtained from the distributor.""
4445   NAP requires CI_OnlineResource/linkage and CI_OnlineResource/protocol in CI_OnlineResource. -->
4446               <gmd:linkage>
4447                 <!-- This linkage element contains the base URL to compose requests to the
4448   service. CI_Online-Resource requires a Linkage element that is a gmd:URL. -->
```

```
4449              <gmd:URL>http://75.101.143.247:8080/gsvr/wms?</gmd:URL>
4450            </gmd:linkage>
4451            <!-- The protocol element defines a valid internet protocol used to access the
4452   resource. NAP recommended best practice is that the protocol should be taken from an official
4453   controlled list such as the Official Internet Protocol Standards published on the Web at
4454   http://www.rfc-editor.org/rfcxx00.html or the Internet Assigned Numbers Authority (IANA) at
4455   http://www.iana.org/numbers.html.  'ftp' or 'http' are common values. -->
4456            <gmd:protocol>
4457              <gco:CharacterString>http</gco:CharacterString>
4458            </gmd:protocol>
4459   <!-- Linkage names for service URL's are from "Linkage name conventions" section in the USGIN
4460   ISO19139 profile document  -->
4461            <gmd:name>
4462              <gco:CharacterString>baseURL</gco:CharacterString>
4463            </gmd:name>
4464            <gmd:description>
4465              <gco:CharacterString>Base URL for service access; append standard WMS request
4466   parameters to compose query.</gco:CharacterString>
4467            </gmd:description>
4468          </gmd:CI_OnlineResource>
4469        </gmd:onLine>
4470      </gmd:MD_DigitalTransferOptions>
4471     </gmd:transferOptions>
4472    </gmd:MD_Distribution>
4473   </gmd:distributionInfo>
4474   <!-- (C-C) Data quality Information - NAP requires either dataQualityInfo/DQ DataQuality/report
4475   or dataQualityInfo/DQ_DataQuality/lineage if dataQualityInfo/DQ_DataQuality/scope/DQ_Scope/level
4476   = 'dataset'.  -->
4477   <!--
4478   <gmd:dataQualityInfo/>
4479   -->
4480   <!-- (O-O) Portrayal catalog information - A portrayal cataloguecatalog is a collection of
4481   defined symbols used to depict, to humans, features on a map. No documentation in ISO 19115 about
4482   how this is supposed to work. ISO 19117 defines the structure of a Portrayal Catalogue. No USGIN
4483   recommended practices here yet. -->
4484   <!--
4485   <gmd:portrayalCatalogueInfo/>
4486   -->
4487   <!-- (O-O) Metadata constraint information - This element specifies use constraints for access
4488   to the metadata record.  -->
4489   <!--
4490   <gmd:metadataConstraints/>
4491   -->
4492   <!-- (O-O) Application schema information - Information about the conceptual schema of the
4493   dataset. This would be populated with a citation to a schema, or may have an inline binary file
4494   representing the schema. No USGIN provision for usage of this element. -->
4495   <!--
4496   <gmd:applicationSchemaInfo/>
4497   -->
4498   <!-- (O-O) Metadata maintenance information - This element provides information about the
4499   maintenance schedule or history of the metadata record.  -->
4500   <!--
4501   <gmd:metadataMaintenance/>
4502   -->
4503   <!-- (X-X) Series information - Not used by USGIN. -->
4504   <!--
4505   <gmd:series/>
4506   -->
4507   <!-- (X-X) Described resource - Not used by USGIN. -->
4508   <!--
4509   <gmd:describes/>
4510   -->
4511   <!-- (X-X) Property type description - Not used by USGIN. -->
4512   <!--
4513   <gmd:propertyType/>
4514   -->
4515   <!-- (X-X) Feature type description - Not used by USGIN -->
4516   <!--
4517   <gmd:featureType/>
4518   -->
4519   <!-- (X-X) Feature attributes - Not used by USGIN -->
4520   <!--
```

```
   <gmd:featureAttribute/>
   -->
</gmd:MD_Metadata>
```